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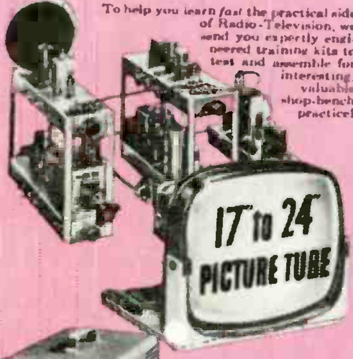

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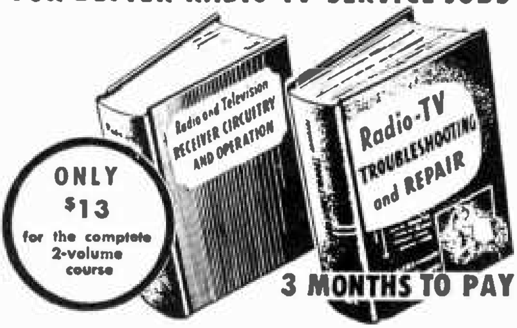

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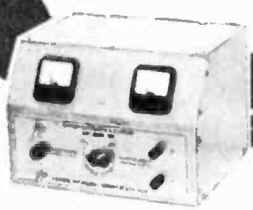

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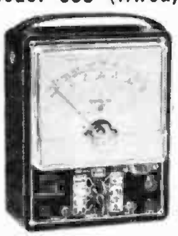

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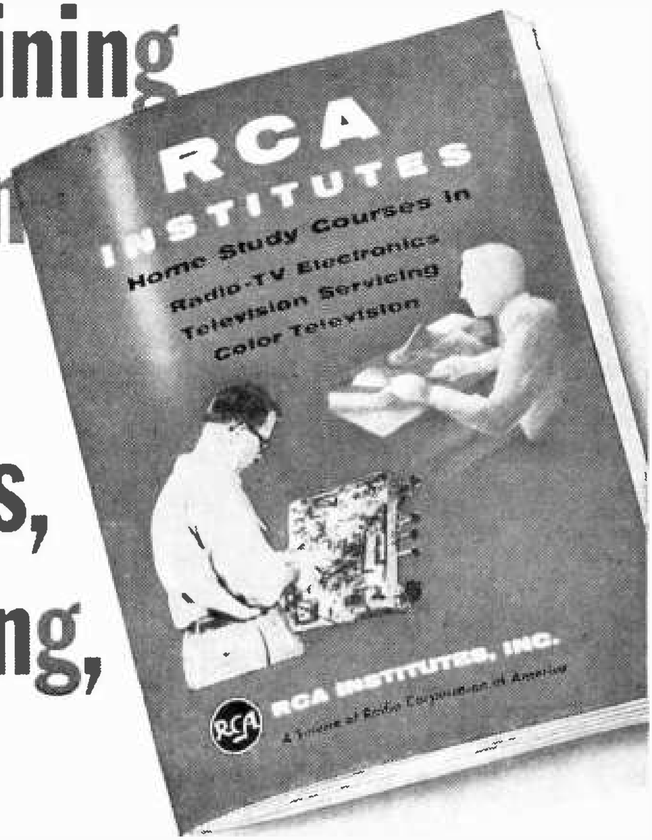

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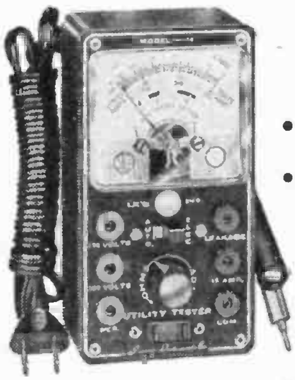

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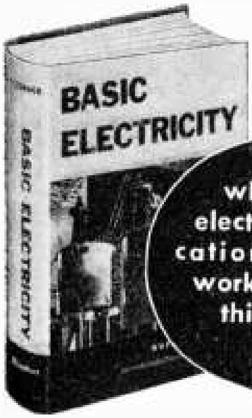

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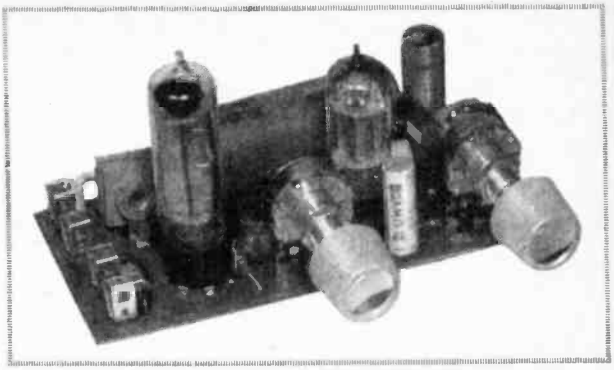


Printed circuit amplifier has reserve power for driving a big speaker. Unit (inset) is so compact, it can be installed inside much smaller speaker cabinets than that shown if desired. Total weight is only 6 oz.

1

Printed Circuit Phono Amplifier

Smaller, cheaper, neater than conventional units —and it can drive a 12-inch speaker!

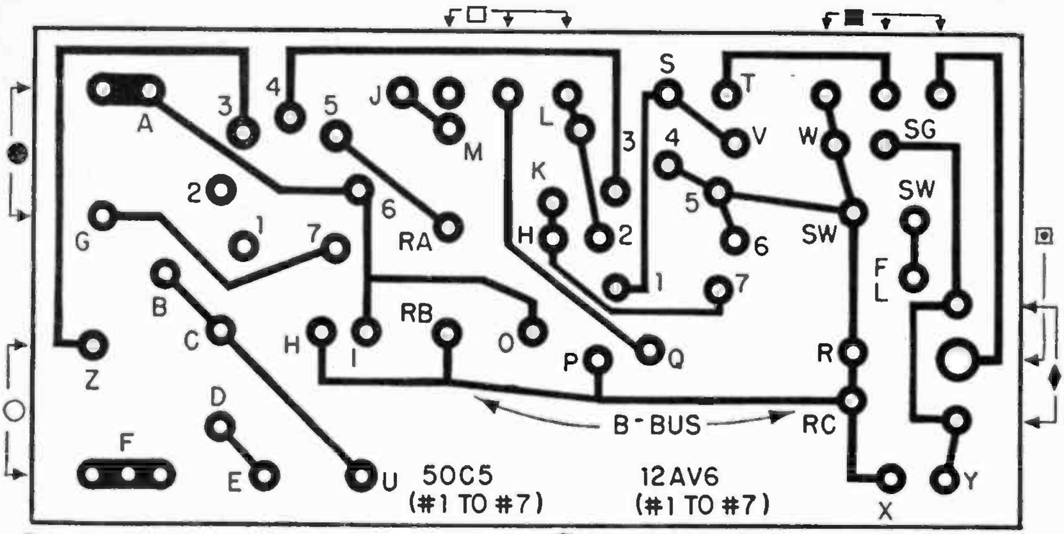
By THOMAS BLANCHARD

MASS producers of electronic equipment have found printed circuitry ideal for their operations. The experimenter, too, will find it worthwhile to utilize printed circuitry —as this project demonstrates. A two-tube, inverse feedback, phono amplifier, it can be assembled on a ready-made #PC-360 copper etched wiring board (available from Photocircuits Corp., see Table A), or etched on a blank board using readily available materials (see Materials List and Table A).

Generally speaking, there are two ways to make a printed circuit: the additive and the subtractive. In the additive, or plating process, a sheet of plain phenolic (Bakelite) is sketched with a conductive ink. The phenolic is then placed in a copper plating tank until a sufficient deposit of copper affixes itself to the inked circuit paths. This method, however, is strictly a commercial process.

In the subtractive, or etched process, a sheet of phenolic to which is bonded on one side a thin layer of copper foil, is used. The techniques employed to etch the circuit are simple enough for the experimenter to handle them in his kitchen or basement, and they are the ones we'll use for this phono amplifier's circuit.

First, remove any traces of grease or dirt from the copper side of the plastic laminate board and then trace the circuit design on the copper (freehand, if desired, but the wiring board shown in Fig. 2 can be transferred to the plastic sheet with ordinary carbon paper). After tracing, ink in the lines with either a commercial acid-resisting varnish (resist) or with ordinary shellac. A small amount of ordinary fountain ink can be added to the shellac to tint it so that the wiring will be clearly visible. Use a camel's hair brush to apply the shellac. (A special type of self-stick tape is also available for forming the wiring pattern, as are self-stick dots for making socket lug and terminal points.)

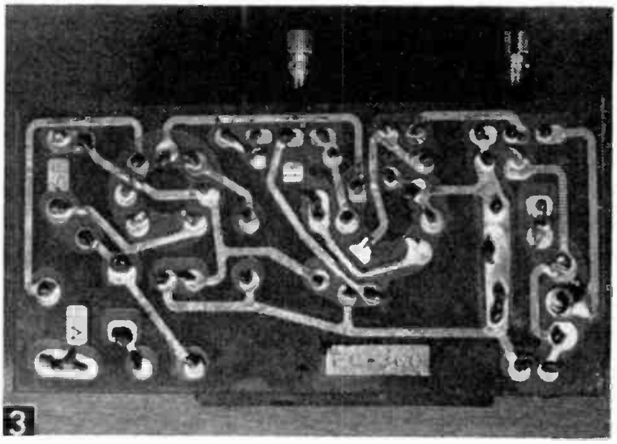


○ - TO 400 OHM, 10 W. RESISTOR ● - TO OUTPUT TRANSFORMER AND SPEAKER □ - 10K TREBLE TONE CONTROL ■ - 500 K VOLUME CONTROL SWITCH ⊡ - PHONO JACK CENTER PIN ♦ - PHONO JACK OUTER SHELL AND EXTERNAL GROUND

2 ETCHED COPPER-PHENOLIC WIRING BOARD SHOWN ACTUAL SIZE

KEY TO WIRING BOARD COMPONENTS INSERTION

A to B —	390 ohm, 1-watt Resistor
C —	Rectifier Plus
D —	Rectifier Anode
E to F —	22 ohms, ½-watt Resistor
H to 50C5	Pin #1—150 ohms, ½-watt
A to G —	Output Transformer
I —	80 mfd. Plus
J to 50C5	Pin #7—470K ohms, ½-watt
K to 50C5	Pin #5—.1 mfd. Midget
L to M —	.0015 Ceramic Disc Cap.
N to O —	220K ohm, ½-watt Resistor
P to 12AV6	Pin #2—3300 ohms, ½-watt
Q to R —	.1 mfd. Ceramic Tubular
S to T —	.05 mfd. Ceramic Tubular
U —	80 mfd. Plus (2nd section)
RC —	80-80 mfd. Common Negative
V and W —	5.6 megohms, ½-watt
X to Y —	.1 mfd. Tubular Capacitor
Z to F —	400 ohm, 10-watt Wirewound Res.
F to FL —	120v. Line Cord
SW to SW —	Line Switch on Volume Control
SG —	Ground to shell of Switch
RA to RB —	470K, ½ watt resistor

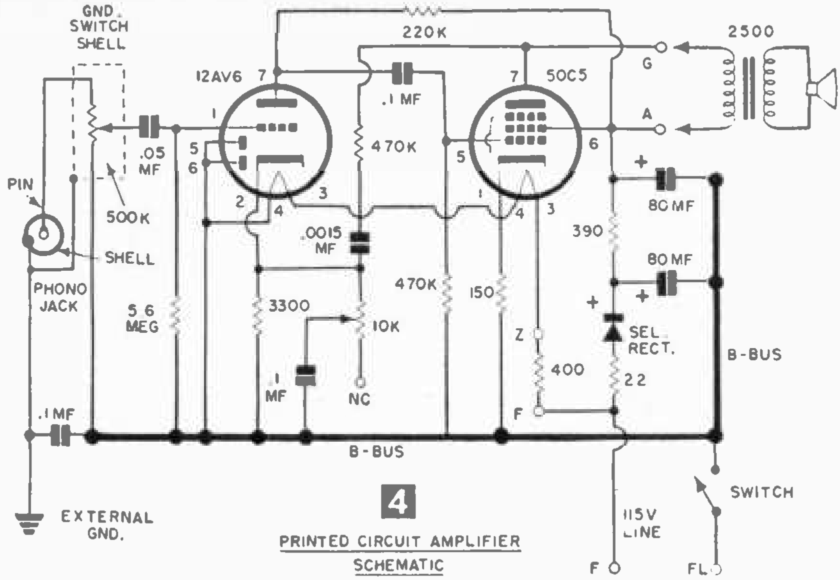


3 Electrical paths are unetched copper protected in acid bath by special masking tape or painted-on 'resist' such as shellac.

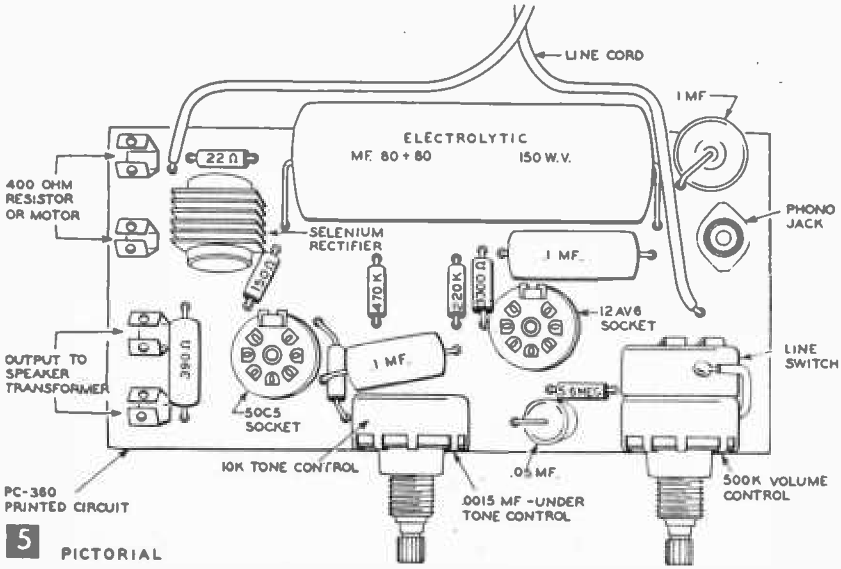
With the wiring layout completed, the next step is to etch the plate. Again, commercial printed circuit etchants are available, but the experimenter can "roll his own." The etchant is nothing more than ferric chloride (also known as perchloride of iron), a chemical you can get at any local photo engraving shop, professional pharmacy, or industrial chemical supply house. Dilute one part of ferric chloride with two parts water and pour just enough of this solution into a glass or plain china dish to cover the wiring board (copper side up). Allow the board to remain in the acid bath until all the unprotected copper has been etched (eaten) away. This process can be hastened by brushing the plate gently while in the solution, and by using warm water.

When the plate is completely etched, remove it from the acid bath and thoroughly wash with household detergent. If tape resist has been used, peeling it off will reveal the bright copper "printed" circuit (see Fig. 3). If shellac resist is used, wash it off with denatured alcohol.

In the case of commercial wiring boards, component insertion holes are die-punched into the board after etching. The experimenter, however, drills the necessary holes, either before or after the etching operation. Holes into which resistor and capacitor pigtail leads are inserted are made with a $\frac{1}{32}$-in. drill. Holes into which socket, po-



4 PRINTED CIRCUIT AMPLIFIER SCHEMATIC



5 PICTORIAL

Components are inserted into predrilled holes in wiring board and secured by forming small loops in pigtail leads on underside.

tentiometer, rectifier and hardware lugs fit are drilled 3/32 in. If holes are drilled in the board before etching, there is less chance of the copper foil tearing. But if a drill press is available, and sharp, high-speed chrome vanadium or similar twist drills are used, the insertion holes can be drilled after the etching operation.

Following the components key (Fig. 2), insert parts into their respective holes from the plain side of the wiring board. Form a small holding loop in the lead and clip off the excess. All pigtail components should be secured before the soldering operation. Usually, sockets and other lugged components will hold in the wiring board by bending the lugs slightly after insertion.

Commercially printed boards are dip-soldered. Portions of the wiring board where solder isn't neces-

MATERIALS LIST—PC PHONO AMPLIFIER

1 type PC-360 printed circuit board
1 2½ x 5¼" pc. copper/phenolic laminate (for homemade printed circuit)
2 Molded, 7-pin, top-mounted printed wiring sockets (Lafayette MS-404)
1 65 ma. selenium rectifier with 1 1/16" sq. plates
1 phono jack (PC type, or modified RCA standard)
4 Stimpson type wire clips, or plain lug tie-points (for spkr. output and drop resistor)
1 line cord and plug
2 push-on knurled shaft knobs
1 audio output transformer with 2500 ohm primary impedance to 3-4 ohm voice coil

Resistors

1 Stackpole 10K tone control #TC-10 for PC (Stackpole Carbon Co., St. Marys, Pa.)
1 Stackpole 500K volume control w/sw. #VC-114 for PC
1 22-ohm, ½-watt composition resistor
1 150-ohm, ½-watt composition resistor
1 390-ohm, 1-watt composition resistor
1 3300-ohm, ½-watt composition resistor
1 220K-ohm, ½-watt resistor
2 470K-ohm, ½-watt resistor
1 5.6 megohm, ½-watt resistor
1 400 ohm, 10 watt wirewound heater voltage drop resistor

Capacitors

3 .1 mfd. ceramic encased paper tubular capacitors: 200 dc wv.
1 .05 mfd. ceramic encased paper tubular capacitor: 200 dc wv.
1 .0015 mfd. disc-type ceramic capacitor 200 dc wv or higher
1 80-80 mfd. cardboard tubular electrolytic dual capacitor, 150 dc wv.

Copper-faced wiring board, etchant, resist, PC sockets, etc., available from Lafayette Radio, 165-08 Liberty Ave., Jamaica 33, N Y.

TABLE A—WHO AND WHERE TO WRITE FOR INFORMATION ON PRINTED CIRCUITS

—Centralab
A Division of Globe-Union, Inc.
900 E. Keefe
Milwaukee 1, Wisc.

—Cornell-Dubilier Electric Corp.
333 Hamilton Blvd.
South Plainfield, N. J.

—Erie Resistor Corp.
Erie, Penna.

—Sprague Products Co.
Marshall St.
North Adams, Mass.

—Photocircuits Corp.
Glen Cove, L. I., N. Y.

sary are silk-screen printed with an epoxy masking varnish. The sole purpose of this operation is that it saves a lot of solder. The experimenter's hand soldering, therefore, will not look unlike a factory job, because solder appears only at tie points.

You may have read that printed circuits should be soldered only with tiny, low-heat irons. Our own experience has been only with quick, high-heat soldering guns. We get sure, quick bonding of components to printed wiring and have never experienced any problems of foil loosening from the laminate. Good printed circuit solder is Kester "Resin Five" with a ratio of 60 parts tin to 40 parts lead. This solder (in the orange, not the red or green, box) is available in 25c packages at most hardware and radio shops.

Generally, components used in printed circuitry are the same as those used in conventional chassis designs with the exception of sockets and potentiometers. Even these items can be of the more conventional type, but those designed expressly for printed circuit boards mount more readily.

This phono amplifier has an output of about 2½ watts. A 12AV6 dual diode-triode detector is used as input amplifier with a 50C5 pentode serving as the power amplifier. These tubes are wired with a 400-ohm, 10-watt, voltage dropping resistor, external from the printed circuit. Instead of the resistor, you can connect a 95*v*. phono motor in the circuit and use it as the voltage drop. (See "Economy Record Player," page 80, for details of how this is done.)

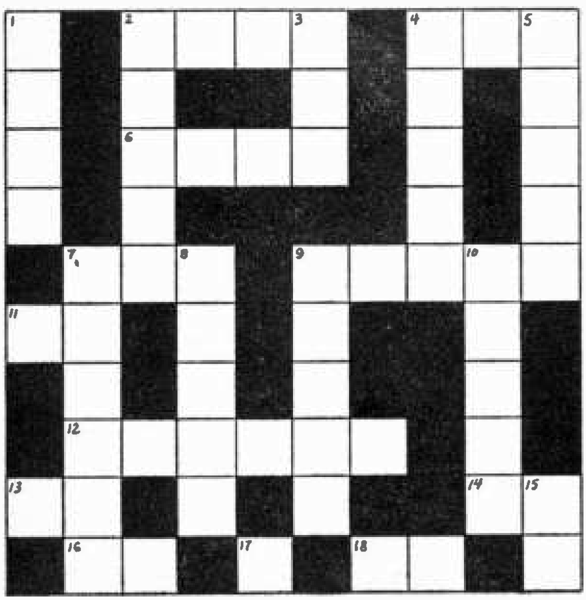
When you test the completed amplifier, *don't* place it on a metal topped table or on a workbench strewn with small tools or bits of wire. The circuitry of this amplifier is exposed and prone to short-circuits from stray articles.

Complete, the amplifier is so light and compact that it will mount directly inside a speaker enclosure simply by drilling two ⅜-in. holes for the volume and tone controls. Space these holes 2$\frac{1}{16}$ in. apart.

Since the chassis is completely unshielded, solder a length of hookup wire from the line-switch shell to the isolated ground connection to prevent stray hum pickup. This external grounding point may also be used to deter possible hum if you connect the phono pickup arm and the frame of the phono motor to it.

ELECTRONIC CROSSWORD PUZZLE

Good at crossword puzzles? Here's one in which all of the words and abbreviations used are common in the field of electronics. On the right are the clues, see how well you do:



DOWN:

1) An element in a vacuum tube.
2) Unit of inductance.
3) An atom or molecule that has fewer or more electrons than normal.
4) A common term denoting a radio receiver.
5) A two-element vacuum tube.
7) The first man to demonstrate that electric current could be passed from a heated filament to a cold plate in a vacuum.
8) That which hypothetically fills space and serves as a medium for the transmission and reception of radio waves.
9) A positive element in a vacuum tube.
10) Radio interference.
15) A system used to address a large group of people.

ACROSS:

2) Abbreviation meaning the faithful reproduction of sound.
4) One of the three primary colors used in color television.
6) An inert gas that glows bright orange-red when ionized.
7) An organ of the body used when viewing television.
9) A common expression meaning telephone.
11) An abbreviation meaning long-distance, spelled backwards.
12) The outside covering of a shielded transmission line.
13) With the addition of one letter, the abbreviation of logarithm.
16) An abbreviation meaning wires are not connected.
17) The letter symbol for current flow.
18) Abbreviation for a type of phonograph record.

For solution, see page 97.

Small enough to slip into your coat pocket, the Red Hot has excellent sensitivity and selectivity and plenty of power.

The RED HOT

A simple economical portable that packs a BIG wallop

By FORREST H. FRANTZ, SR.

Here's that economical, power-packed pocket portable you've been looking for. Measuring only 1¼ x 3¼ x 4 in., this set has loudspeaker power and is extremely sensitive and selective. What's more, no pick-up lead of any kind dangles from the set and its design is simplicity itself.

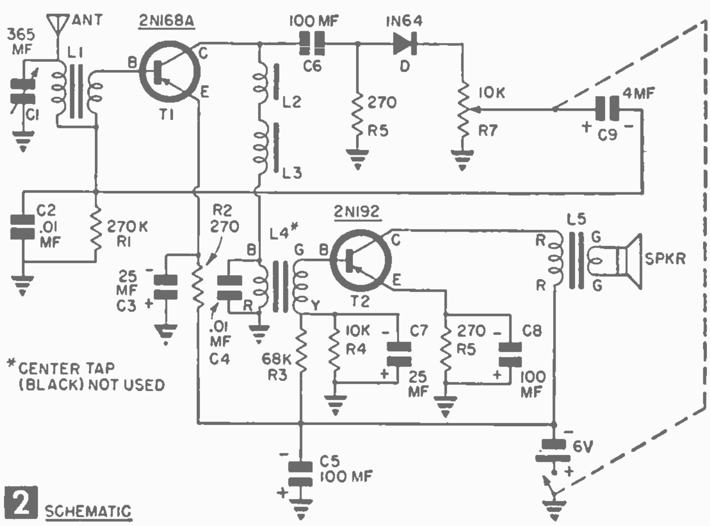
If you're wondering how a two-transistor set can pack the kind of wallop the Red Hot does, here are the reasons. In the first place, it uses entertainment grade transistors. Though better in quality than experimenter grade transistors, entertainment grade transistors cost only a little more. The GE 2N168A transistor, for example, has a much higher cut-off frequency than the experimenter types of the AF and RF varieties, an important consideration when the transistor is to be used as an RF amplifier. And the GE 2N192 transistor, used in the output stage, has a higher beta (current gain or amplifying capacity) than the experimenter grades.

With good transistors as basic ingredients, the design determines how well a piece of transistorized electronic gear will perform. To get plenty of gain in the Red Hot, T1 (see Fig. 2) is used to amplify the signal twice. With this "reflex" technique, T1 amplifies the received signal while it is still in the radio frequency form, and then again when it is in the audio frequency form after detection by diode D. The audio output of T1 is introduced to the base of transistor T2 through the audio driver transformer L4. The better impedance match between T1 and T2 given by L4 provides considerably more gain than you can expect from resistance-capacitance coupling.

Another feature contributing to the gain is that there's positive feedback in the RF stage. It's not apparent from the circuit, and it's not enough feedback to make the set oscillate, but there is feedback, resulting from the relative placement of the components in the case. This feedback feature and the high Q of the antenna coil (L1) make the set quite selective in spite of the fact that it has only one tuned circuit.

Cost of the Red Hot is about $15 (and the four penlite cells used last a long, long time). You can construct the set in six to 20 hours, depending upon your experience. An expert might even do it in less than six hours. To make the construction go smoothly and quickly, obtain all of the parts in advance (see the Materials List), have the required tools handy, and go over the instructions a time or two before you actually begin work.

Construction. You'll need 1) an ice pick; 2) a hand drill; 3) a ⅛ in. dia. drill bit; 4) a hand taper reamer; 5) a measuring scale or tape; 6) a hack saw; 7) needle nose pliers; 8) diagonal (cutting) pliers; 9) small screwdriver



2 SCHEMATIC

(blade about 1/16 in. wide); 10) medium size screwdriver (blade about 3/16 in. wide); 11) small soldering iron; 12) tin snips.

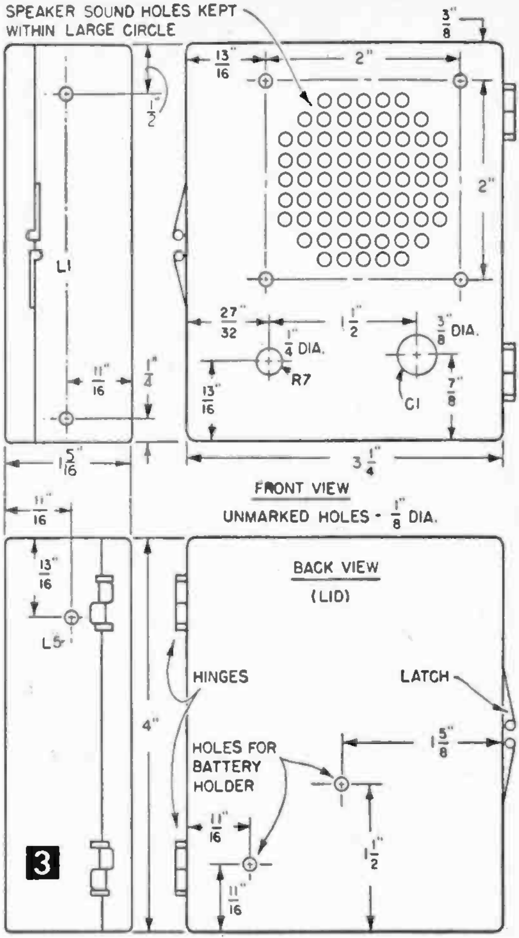
Mounting holes are required in the plastic case for 1) the antenna coil, L1; 2) the output transformer, L5; 3) the tuning capacitor, C1; 4) the volume control, R9; 5) the battery holder; 6) the loudspeaker (Spkr.). Sound holes are also required for the loudspeaker. Figure 3 shows the positions and the dimensions of these holes in the plastic case.

Mark off the hole positions on the case, then heat the ice pick and use it to make holes in the case on the marked centers. Don't get the ice pick red hot or it will melt the plastic too fast and make the work difficult. Make the holes just big enough so that the hand taper reamer can be made to bite in without difficulty. When all pilot holes have been made with the hot ice pick, allow the melted plastic around the holes to harden. To assure yourself that the holes are properly located, place the components over the appropriate holes. If necessary, use the hot ice pick to relocate centers. After you're sure of the hole center locations, enlarge all the holes to size with the taper reamer with the exception of the loudspeaker sound holes. These are closely spaced and you might get into difficulty trying to ream them out smooth, so leave them rough.

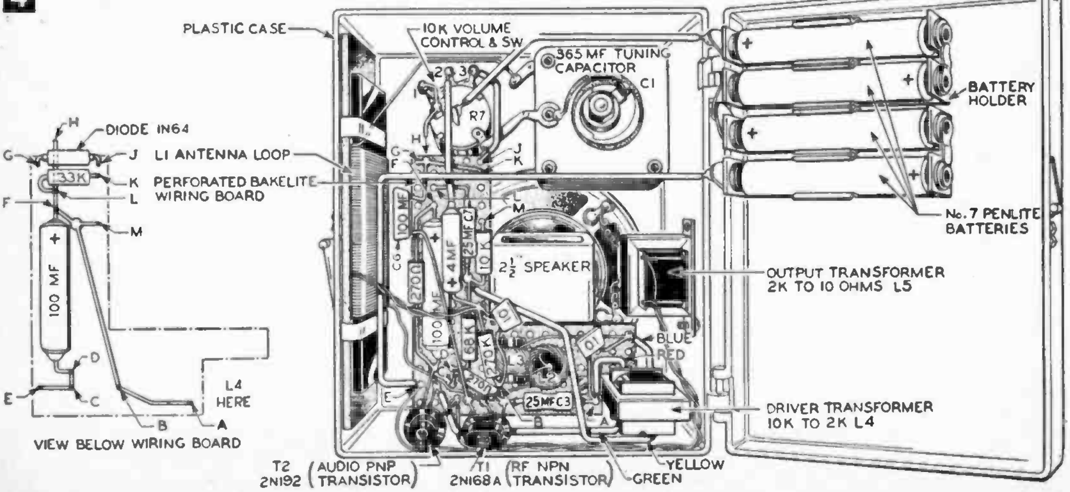
When you've completed this work, wash the case with soap and cold water to remove dirt and finger prints. Rinse in clear cold water and dry.

If you want to paint the interior of the case, do it now. Spraying will be more effective than brushing since the paint may run—particularly around the speaker sound hole openings—if you brush paint.

Now, cut the volume control (R7) shaft to a length of 1/4 in. and the shaft of the tuning capacitor (C1) to a length of 5/8 in. Remove five turns from the tuning coil (the end of L1 with many turns), and one turn from the transistor input coil (the end of L1 with few turns). Remove the coil from the Masonite mounting base to do this. (Simply take off the tape which is wrapped around each end of the coil). When



4 PICTORIAL

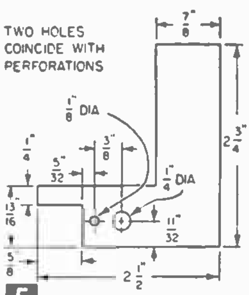


MATERIALS LIST—THE RED HOT

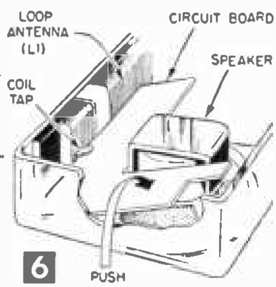
R2, R5	270 ohms ½ watt, carbon resistors, 10% tolerance
R4	10K ohms ½ watt, carbon resistors, 10% tolerance
R6	33K ohms ½ watt, carbon resistors, 10% tolerance
R3	68K ohms ½ watt, carbon resistors, 10% tolerance
R1	270K ohms ½ watt, carbon resistors, 10% tolerance
R7	10K miniature volume control with switch (Lafayette VC-28)
C1	365 mmfd tuning capacitor (Lafayette MS-215)
C6	100 mmfd miniature ceramic capacitor (Centralab DM-101)
C2, C4	.01 mfd 75v miniature ceramic capacitor (Lafayette C-612)
C9	4 mfd 6v miniature electrolytic capacitor (Lafayette CF-101)
C3, C7	25 mfd 6v miniature electrolytic capacitor (Lafayette P6-25)
C5, C8	100 mfd. 6v miniature electrolytic capacitor (Lafayette CF-106)
D	diode (GE 1N64)
T1	RF NPN transistor (GE 2N168A)
T2	audio PNP transistor (GE 2N192)
L1	flat ferrite antenna loop (Miller 2004)
L4	driver transformer 10K to 2K (Lafayette TR-96)
L5	output transformer 2K to 10 ohms (Lafayette TR-93)
SPKR	2½" loudspeaker (Lafayette SK-66)
1	battery holder (Lafayette MS-170)
4	batteries (#7 penlite cells)
1	miniature knob (Lafayette MS-185)
1	small pointer knob (Smith 2220)
1	plastic case 1¼ x 3¼ x 4" (Lafayette MS-298)
1	perforated Bakelite wiring board (Lafayette MS-304)
L2	25' 7/41 litz wire* jumble-wound on ¾" length, ¼" diameter ferrite core
L3	15' 7/41 litz wire* jumble-wound on ½" length, ¼" diameter ferrite core

(Apply a coat of Duco Cement to hold windings of L2 and L3 in place.)

* A 7½" long core (MS-331) and 100' of litz wire (Belden 8817), more than enough for these coils, may be obtained from Lafayette Radio, 165-08 Liberty Avenue, Jamaica 33, N. Y., source for all of the components in this radio.



5 CIRCUIT BOARD LAYOUT



6 SLIP CIRCUIT BOARD UNDER TAP ON L1 AND PUSH ON OTHER SIDE OF BOARD TO SLIP IN PLACE

you've removed the turns, leave about 3 in. lead lengths on each end, providing connections at the lead ends by stripping off about ½ in. of the cotton insulation. Rub the lead ends gently with very fine sandpaper to partially remove the enamel insulation from the individual strands, being careful not to break any of the strands. Then, using a hot iron and rosin core solder, heat up the lead ends and apply solder while rubbing the iron back and forth along the ends. Continue until you've burned off the enamel and the coil ends look shiny and well tinned. Replace the coil on the Masonite mounting strip and fasten in place with the original tape.

Next, make L2 and L3. Both of these coils are wound on short lengths of ferrite core. Dimensions, type of wire and winding data are given in the Materials List. Cut the lengths of ferrite core from the 7½-in. length by notching the core material with a hacksaw or file and then breaking it off. Or you can try to saw it off all the way.

Mounting Coil Components. Fasten the loudspeaker in the case with 4-36 x ¼-in. machine screws and nuts. Terminals should be along the hinge side of the case (see Fig. 4). Then mount the volume control (R7), the tuning capacitor (C1), output transformer (L5), antenna coil (L1), and the battery holder. Place two thicknesses of electrical tape along the edge of C1 that will be behind the edge of the loudspeaker and be sure to slip a lockwasher on the bushing of C1 before you mount it. Otherwise it may short-circuit through the loudspeaker frame.

When you fasten the battery holder to the back of the case, stick the screws through from the battery holder side and fasten the nuts on the outside of the case. If the nuts are fastened against the battery holder, they may puncture the insulating paper cover on the batteries and short circuit them through the holder's frame. The connecting lugs on the holder should be bent down to allow clearance to close the case.

Mount L5 with the 10-ohm winding connections toward the loudspeaker terminals. Don't uncoil these leads; connect them to the terminals of the loudspeaker before you fasten the transformer in place.

Finally, wire these components in the case. Note that the connection between the switch and volume control lugs is also soldered to the volume control frame and that the center lug on the tuning capacitor is soldered to the volume control frame, too.

Wiring the Circuit Board. Cut and drill the perforated circuit board according to the layout of Figure 5. Use a hacksaw to do the cutting, smoothing the edges with a file. Drill the holes with a ⅛-in. drill, and use a taper reamer to enlarge to the ¼-in. hole. Try the board in the case for fit. It should fit between the upper edge of the case and the speaker, and the antenna coil and the speaker with the antenna coil tap above the circuit board. Insert the board as shown in Fig. 6 to check the fit. If it doesn't fit, file the edges of the board as required. The fit should be tight. When you're sure you have a good fit, remove board and mount components.

When you mount the driver transformer (L4) be sure to place the mounting flange of the transformer on the underside of the circuit board or you'll find it impossible to close the lid on the receiver after assembly. The other transformer mounting flange is bent down to allow the circuit board to fit in the case.

Connections are made by pushing lead pigtails through the perforations in the board. The long lead on the bottom of the board that runs around most of the board is the common return and it is formed from the extra length of lead pigtails that remain after the parts are mounted on the board. The short straight lead on the bottom of the circuit board to which the negative end of C5 is connected is the battery negative bus. All parts except the transistors and C6 and C9 are mounted tight against the circuit board. A ⅛ in. space is left between the transistor bottoms and the circuit board to prevent straining the leads and to keep heat transfer to the transistors during the soldering process within reason.

Mount L2 by applying a small amount of Duco cement to the core and inserting it in the ¼-in. hole on the circuit board. Apply a very small amount of Duco cement to L3 and fasten it perpendicular to L2. Don't use too much Duco for this because you'll have to loosen L3 later. Be sure that L2 and the other components do not extend more than ⅝ in. above the top of the circuit board. If they do, you may have trouble closing the lid of the case after assembly. None of the components, with the exception of the output transformer (L5), should protrude beyond the edges of the circuit board because the circuit board will be held in place by the tight fit between it, the loudspeaker, the edge of the case, and the antenna coil.

Final Assembly. There are eight connections which will have to be made from the circuit board to components in the case. They are, in order of connection: 1) collector of T2 to primary of L5; 2) negative bus to primary of L5; 3) base of T1 to end of short winding on L1; 4) junction of C2, R1 and C9 to tap on L1; 5) common return to switch; 6) plus terminal of C9 to center terminal of R7; 7) K terminal of D to upper terminal of R7; 8) negative line to negative terminal of battery.

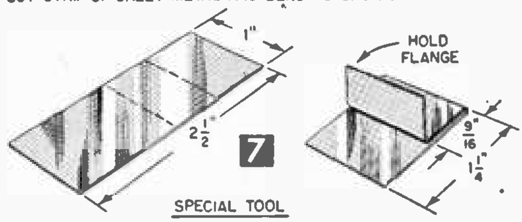
The first three connections must be made before the circuit board is mounted in the case. After they're made, place the edge of the circuit board against L1 but below the coil tap as shown in Fig. 6, and push the board into place in the case. Then, make the other five connections.

Now close the lid, and move parts and leads as required to allow easy closing. You may find that the back of the loudspeaker interferes with complete closure of the lid. If it does, trace the outline of the speaker magnet frame on the lid of the case and make a tool from a piece of sheet metal (which can be cut out of a tin can) as shown in Fig. 7. Grip the hold flange of this tool with a pair of needle nose pliers, heat the tool slightly, and apply it to the inside of the case lid along the magnet frame tracing using a small amount of pressure. This will dent the lid slightly to allow it to close over the speaker magnet frame without interference. It's wise to do this several times if necessary, starting with low temperatures. Otherwise, you may get the tool too hot and damage the case.

Now you're ready to insert the batteries. Do this cautiously with the switch in *Off* position and be sure to position the plus and minus terminals properly. Do not let the clips on the holder cut through the insulating paper cover on the batteries.

If you have a milliameter, connect it across the switch terminals (plus meter terminal to battery side of switch) with the meter on a range of 100 *ma* or more. The meter deflection should be less than 10 *ma*. If it's more than 10 *ma*, start looking for trouble, perhaps an error in wiring, an incorrect resistor, reversal of capacitor polarity, short circuits, or similar mistakes. (Occasionally, you may run into trouble due to bad components; this occurs so rarely if all new components are used, however, that this possibility should be dismissed till the circuit has been checked several times). If the meter reads less than 10 *ma*, switch to the range nearest 10 *ma* (but not less than 10 *ma* on your meter). You should get a reading of 6 *ma* or less. On my set the reading was 4 *ma*, but tolerance variations in transistors and other components might allow variations in current from about 3 to 6 *ma*. You can expect long battery life with such a small current demand.

CUT STRIP OF SHEET METAL AND BEND AS SHOWN



SPECIAL TOOL

Next, turn the set on and try it out. If it squeals at the high frequency end of the dial, move C6 away from L1 a small amount at a time till the squeal is eliminated. Some feedback between C6 and L1 is desirable for maximum sensitivity, but if there's too much feedback, squealing may occur. The feedback is increased by moving C6 closer to L1, decreased by moving C6 away from L1.

The orientation of L3 also affects feedback. The contribution is most noticeable at the low frequency end of the dial. The axis of L3 should be parallel to L1. To find the correct orientation for this coil, tune in a station on the low frequency end of the dial and note the volume level. Then break the Duco cement bond between L2 and L3 and reverse the positions of the ends of L3. Retune the set to the station for maximum volume. If the station comes in louder, fasten L3 in this position with Duco. If the volume decreases, however, return the coil ends to their original positions and re-cement.

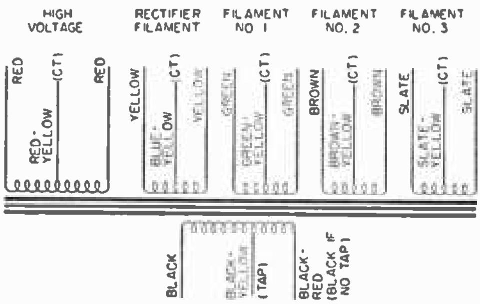
Although this little set is one of the hottest performers I've seen with such a simple circuit configuration, a little additional experimenting with the orientation and positions of L2 and L3, can make it even more sensitive and selective. Since no external pick-up lead is used, this set is highly directional. The antenna coil must be horizontal; rotate the set in a horizontal plane for best pick-up.

Component Color Codes

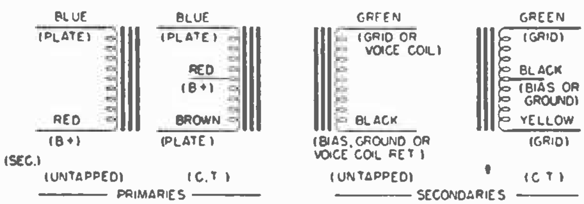
STANDARD RETMA COLOR CODE

Color	1st Digit 2nd Digit	Multiplier	Res. Tol.	Cap. Tol.	Cap. Volts
Black	0	None	....	....	...
Brown	1	0	....	1%	100
Red	2	00	....	2%	200
Orange	3	,000	....	3%	300
Yellow	4	0,000	....	4%	400
Green	5	00,000	....	5%	500
Blue	6	,000,000	....	6%	600
Violet	7	0,000,000	....	7%	700
Grey	8	00,000,000	....	8%	800
White	9	,000,000,000	....	9%	900
Silver	..	....	10%	10%	...
Gold	..	....	5%	....	...

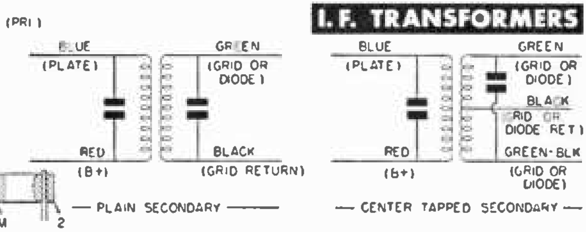
POWER TRANSFORMERS



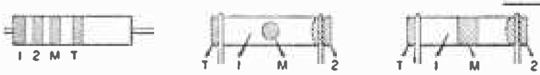
A.F. TRANSFORMERS



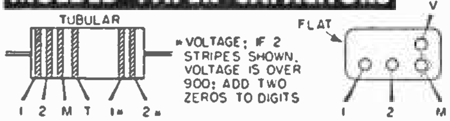
I.F. TRANSFORMERS



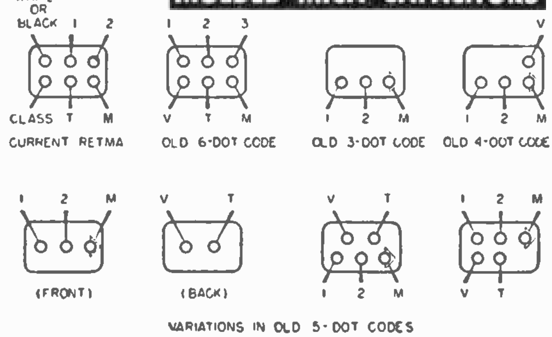
RESISTORS



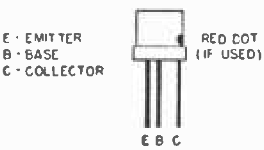
MOLDED PAPER CAPACITORS



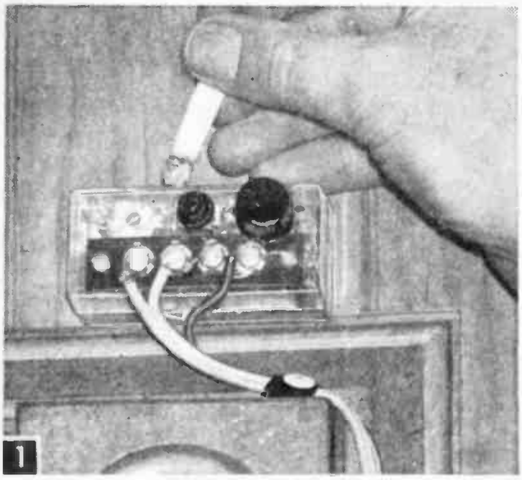
MOLDED MICA CAPACITORS



TRANSISTORS



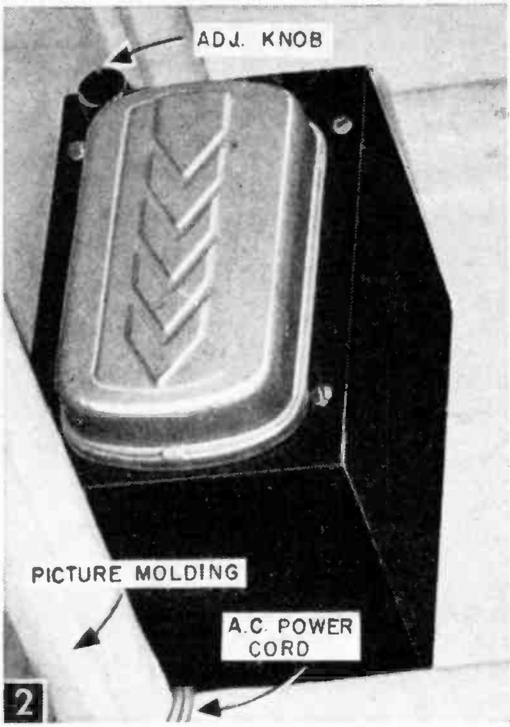
CODES
1 - 1ST DIGIT
2 - 2ND DIGIT
3 - 3RD DIGIT
M - MULTIPLIER
V - VOLTAGE
T - TOLERANCE



1

Midget bell system powered transistorized alarm unit can be set with aid of cigaret to trigger alarm the instant room temperature rises above normal.

Transistorized Fire Alarms



2

Self-powered alarm unit is independent of house bell system, can be wired to operate auxiliary devices such as fire gong or extinguisher.

IF YOUR family members are worth more to you than $10 and a little spare time, you'll be interested in these transistorized fire alarms. The transistor sensing elements in these alarms are more reliable than fusible or link type elements—even with wide fluctuations of line voltage. Moreover, they can be set to react at any range from 68° to 170° F.

In the alarm shown in Fig. 1, the house bell system is used both for power and for the alarm itself. In the other version (Fig. 2), a bell and bell transformer are made part of a self-powered design. The fire alarm sensitive elements in both types of units should be mounted near the ceiling as in Fig. 2 or at the top of an open staircase.

Self-Powered Unit. Since the self-powered unit is a complete system, we'll describe its circuit construction and operation first. In Fig. 3B, plug P1 supplies 110-volt *a-c* to bell transformer TR1; secondary voltage is rectified by diode D1 to furnish *d-c* of about 15 to 18 volts filtered by capacitor C1.

Power supplied to the collector (C) of the transistor passes through the coil of a sensitive relay, factory-adjusted to pull in at a current of about 1.5 *ma*. When the relay pulls in (dotted line position of relay arm, Fig. 3), the circuit is closed to the bell and the bell rings.

In contrast to the transistor, the bell draws considerable current. This reduces the amount available for the relay, causing it to drop out and remove the bell from the circuit, thereby pulling the relay back in. A pulsating alarm signal results then, when the alarm is actuated by heat in excess of its setting.

The current drawn by the transistor collector through its collector-base-emitter circuit is controlled primarily by the resistance in its base circuit and by the room temperature. Base current is limited by resistor R1 and potentiometer R2. Potentiometer R2 is set so that current to the relay has it ready to pull in if room temperature exceeds normal, as in case of fire, when the collector current to the relay would increase; the relay energizes; the alarm bell rings.

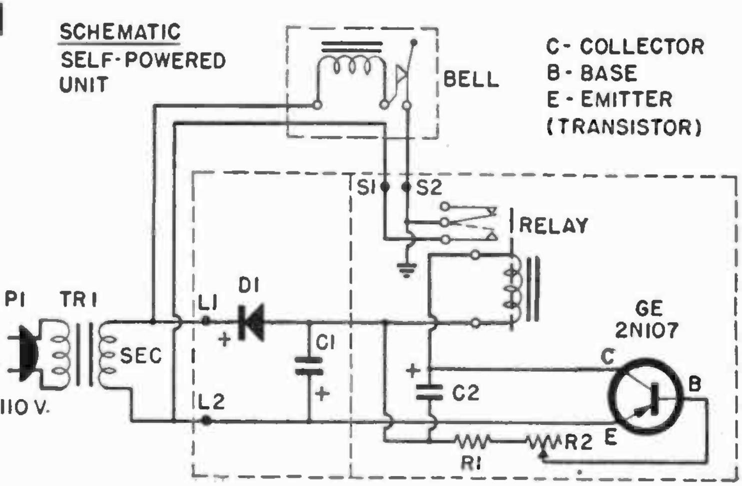
Capacitor C2 helps to hold the relay in longer, once in, and also to prevent premature pull-in. Resistor R1 prevents transistor damage should potentiometer R2 accidentally be turned all out.

The self-powered unit is housed in a standard metal utility cabinet with built-in chassis. Wire as in Figs. 3 and 4. For parts layout simply use the components as templates. Do *not* solder to the transistor socket with the transistor in place. Before pushing the transistor into its socket, cut the long leads to a length of about 3/8 in. and make sure that these are straight.

Bell System Powered Unit. As shown in Fig. 6, only three wires are needed to connect this system to a typical house doorbell and door opener circuit. Two line wires (L1 and L2) furnish input power; S1 and S2 terminals are wired across the pushbutton (one side of the line is also one side of the pushbutton connection). The alarm connections themselves are the same as those for the self-powered system as shown in the boxed area, Fig. 3. Closing of the relay contacts is the same as pushing the doorbell pushbutton. Use heavy wiring (not less than the standard #18 bell wire) to prevent excessive voltage drop in the wiring from the unit to the bell system.

Wire as shown in Figs. 6 and 7. Mount the terminal strip first, close to the edge of the case, then position the relay, and scribe and drill a center for it.

3



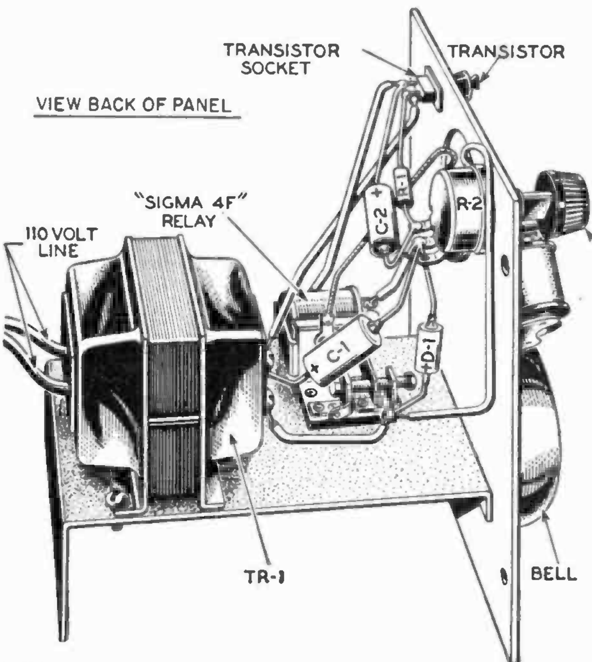
Don't mount the relay at this time, but position and drill holes for the transistor socket, finishing the cutout with a file, and mount the socket with retaining ring. Next drill the hole for potentiometer R2 and mount it, mount a terminal lug under one of the Bakelite terminal mounting screws to serve as a tiepoint for the power supply negative potential.

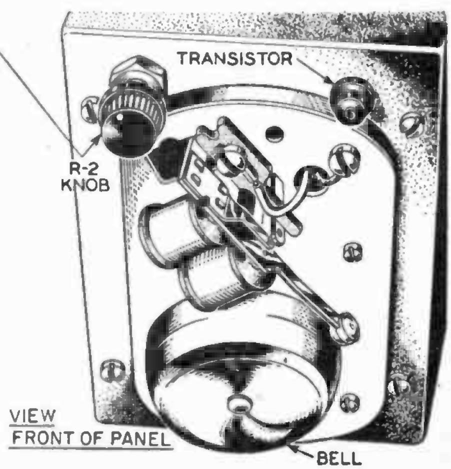
First, wire in resistor R1 and the lead from R2 to the negative tiepoint, then wire the lead from the emitter terminal of the transistor socket to the line terminal L2 and solder in place along with capacitor C1's positive lead. Note that the polarity is marked on the case.

Next, install the germanium diode, once again observing polarity; soldering the + end (also labeled "K" or indicated by a symbol) to the L1 terminal on the Bakelite strip. Run an insulated lead from the nearest relay coil terminal to the minus tiepoint and solder it in place. Use a pencil type iron and make all connections to the capacitors and to diode D1 rapidly. Mount the relay with its screw, and solder the + end lead of capacitor C2 to the remaining relay coil terminal and the collector lug of the transistor socket.

Now insert all leads going to the negative (−) tiepoint into the lug hole and solder them. Run a wire from the normally open contact of the relay to the S1 terminal post and solder both of these points. Then connect a wire from the lug on the frame of the relay (near the retractile spring) to the S2 lug on the terminal strip. Take care to insure that the motion of the spring is not altered and that solder does not get into the armature hinge.

Adjustment of Units: After construction is completed, mount unit as shown in either Fig. 1 or Fig. 2 (depending upon which type you have made) and screw-fasten in place. Plug in the self-contained unit or make connections to the bell sys-





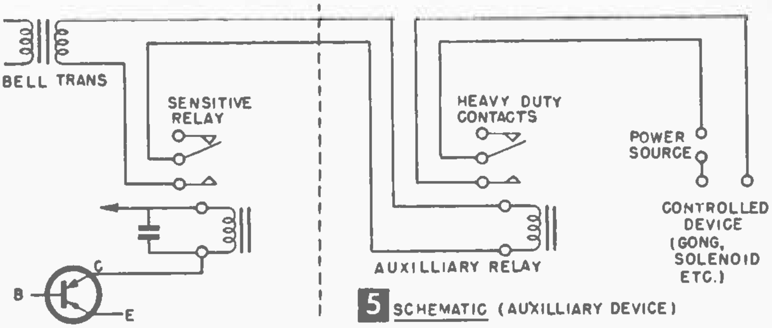
4 SELF-POWERED UNIT PICTORIAL

tem for the bell system powered unit and test for operation by turning the adjustment knob clockwise to the point where the bell rings. Then turn it back. The distance you turn it back will depend upon the room temperature; the adjustment knob must be backed off to prevent false alarms.

Hold a cigaret for one minute about 1 in. from the transistor of the unit (Fig. 1). Adjust the knob so that the alarm will just turn on about 15 seconds after the cigaret is removed if you're using a 2N107 transistor, or a full minute for the CK722 type transistor. Manipulate adjustment knob in this test interval for a fine setting.

A more exact method of adjustment employs a strip of iron to which a thermometer has been strapped. Heat the iron to the desired turn-on temperature plus 10°. Then touch it to the transistor case and adjust the knob to turn on at that temperature.

Auxiliary devices such as a fire gong or fire extinguisher can be operated by a power relay actuated by the sensitive relay of the alarm unit. Connections are made as shown in Fig. 5. The power source is appropriate to the device used.



5 SCHEMATIC (AUXILLIARY DEVICE)

MATERIALS LIST—TRANSISTORIZED FIRE ALARM SYSTEMS

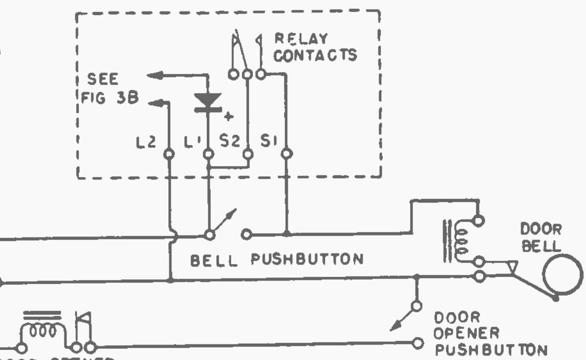
Relay	Jewel or Argonne R/C AR-21 (Lafayette F 260)
D1	1N64 germanium diode (1N34 can be used)
C1	electrolytic capacitor, 50 mfd., 25 v.
C2	electrolytic capacitor, 10 mfd., 15 v.
R1	resistor, 10,000 ohms. 1/2 watt
R2	potentiometer, miniature, 1 megohm with knob (Lafayette VC-38; MS 185 knob)
	2N107 transistor, G. E.; (or CK722) transistor with socket
	4-terminal mounting strip (Lafayette MS 229)
	Plastic case, 1 x 1 3/16 x 2 7/8" (Lafayette MS 167)

Additional parts for Self-powered Unit

Bell transformer, (Snapit Cat. #2302)
Edwards doorbell
Sigma 4F relay (instead of Argonne)
ICA #3819 metal utility cabinet, 4 x 5 x 6", with built-in chassis (instead of plastic case)
electric light cord and plug

Both types of alarm units may be paralleled to operate at different locations. Standby current drain of bell-powered units is so low (about .025 watt from bell transformer) that 20 units draw less than an electric clock. Each alarm unit has the low voltage a-c power supplied to its L1, L2 terminals and its relay terminals paralleled across the pushbutton.

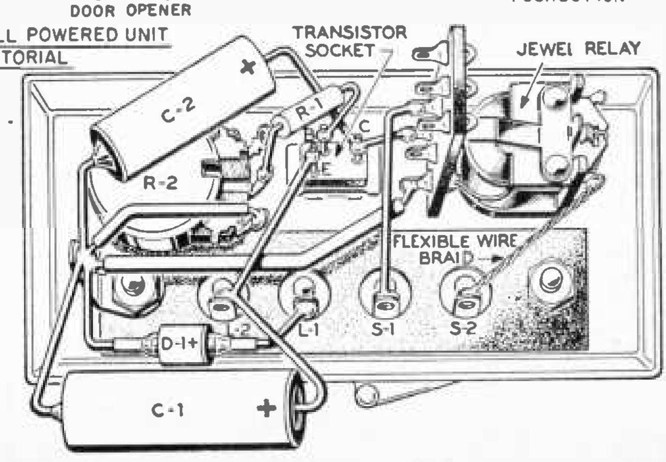
6 BELL SYSTEM POWERED UNIT SCHEMATIC



Self-powered units can have their relay contacts paralleled in the same manner to ring a single bell (bell on each unit is then omitted), or, they too can control another, heavier duty relay as in Fig. 7. As another alternative, several system units can be supplied with input power from one self-powered unit, taking a-c low voltage directly from bell transformer secondary.

—James A. McRoberts.

7 BELL POWERED UNIT PICTORIAL



Listen with a Transducer

By T. A. BLANCHARD

HERE is a neat little transducer that can be applied to any type of headphone, or headset. You will hear everything—even a faint whisper—bell clear, without any earphone over the ear. Moreover, the system can be practically invisible, if for example, you might presently use a hearing aid.

The phone attachments shown here are generally known as *transducers*, coined from transmitter and *reproducer* The sound waves generated by the moving diaphragm of a headphone, instead of going directly into the ear canal, travel through a light and very flexible vinyl plastic tube. This tubing is nothing more than a wire insulation known and sold as *radio spaghetti*. All radio suppliers have it in various diameters and colors including transparent types. Single headphones of all-plastic construction make excellent *transducers*. Remove the phone cap, and diaphragm. Drill a 3/32 in. hole in the back of phone (B). Into this hole insert a suitable length of 3/32 in. vinyl tubing; allow to project inside the receiver about 1/8 in. Secure with several drops of Duco cement. Do not plug up the tube opening.

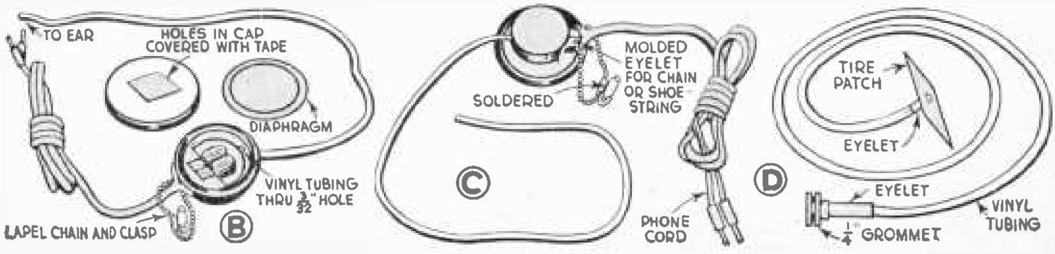
Replace diaphragm and cap on receiver, attaching a piece of Scotch electrical tape over the cap to seal the sound perforations or hole. Sound waves are generated both from the front and back by an earphone diaphragm. The vinyl tubing coming out of the back of the case provides the most convenient method of installation.

The molded eyelet in earphone case (C) provides for attaching the phone to your person. Solder a small safety clasp to a bead key chain so the *transducer* may be pinned to lapel or shirt. Or, thread a shoestring through the eyelet, and wear the reproducer around your neck. Insert end of vinyl tubing just inside the ear, then loop behind the ear where it will remain without falling out. If you prefer an earpiece, make one as shown (D).

A universal *transducer* may be constructed to fit any type headset without altering phones. Cut off a suitable length of radio spaghetti, and obtain 2 eyelet type rivets about 1/2 in. long and with a dia. that will allow tubing to make a tight fit either inside or over the eyelet. In the center of a 1 1/8 sq. in. tire patch, pierce a hole, leaving the starched cloth backing in place. Next step in construction is to force an eyelet into the hole, and then slip on tubing.

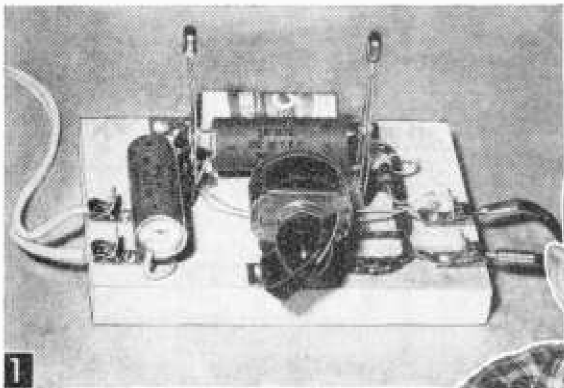
Slip a rubber radio grommet designed for a 1/4 in. hole on the longer earpiece eyelet. Wind a narrow strip of Scotch tape over the flanged end of eyelet so grommet makes a tight fit. Finally attach the remaining end of tubing.

To attach to headphone, apply rubber cement to phone cap and allow it to set. Strip off cloth backing on tire patch and position over opening in earphone. It will remain attached indefinitely. Headphone set may be laid on a table, or hung around neck by headband spring. Rubber grommet makes a perfect little earpiece. A double set of transducers can be made, one for each phone, but volume is usually so good that a single unit is ample. Rubber grommet, eyelets, and vinyl tubing are stocked by all radio suppliers. Eyelets usually come in packages of assorted sizes. Leathercraft supply shops, harness shops



(if you can find one these days) and hardware stores also have them.

Users of hearing aids may adopt this system with ease. Check the diameter of the opening in earpiece. Obtain a piece of clear tubing that will provide a snug fit inside the earpiece. Tubing may be worn with or without rubber earbutton; place earphone in the shirt pocket.



1

Left, closeup showing transistors in place. Amplifier may be used with single or double headphones of 2,000 ohms or more, and it will serve as detectophone or a stationary hearing aid. Below, a 4-in. PM speaker and output transformer mounted in cabinet at left makes a wide range dynamic mike for this tiny but powerful 2-stage transistor amplifier.

Transistor Amplifier

Powered with just a penlite battery, this 2-stage amplifier demonstrates how to use transistors in a sensitive detectophone

By THOMAS A. BLANCHARD

THIS simple *breadboard* layout will show you how you can adapt transistors to audio frequency amplifiers. In fact, the completed setup shown in Fig. 1 will serve you as a very sensitive detectophone and will pick up voice and music with surprising clarity and volume.

While transistor hearing aids use transformer-coupled amplifiers which provide somewhat greater gain and less distortion, we have found that the simple, inexpensive resistance-coupled circuit is excellent for experimental purposes. Moreover, its components are available at all radio parts suppliers, whereas few dealers stock the expensive sub-miniature components employed in hearing aids.

Vacuum tubes have high impedance inputs allowing crystal mikes or pickups to provide the grid signal. Transistors, on the other hand, have low impedance inputs making crystal mikes impractical. Transistor hearing aids, therefore, use a miniature moving coil magnetic mike known as the dynamic type, which is not easy for you to obtain at this writing. But your mike problem is easily solved by using an ordinary 4 or 5-in. PM speaker and a regular 2500-ohm output transformer. In this case, the output transformer is used as a "mike-to-grid" input transformer.

Although this amplifier can be reduced to less than half the size shown in Fig. 3, the 3½ x 5-in. baseboard mounting allows the parts to be 100% salvaged for re-use in other experiments. The two three-lug solder tie strips, mounted on the baseboard with ½-in. *rh* wood screws, serve to tie down resistors and capacitors as well as provide three lug points for terminating the transistor pigtail leads. Input and output amplifier connections are simple Fahnestock clips also secured to the base with ½-in. *rh* (round-head) wood screws. For the volume control mounting, use a window shade bracket with the ⅛-in. pin hole drilled out to ⅜ in. to take the threaded control bushing. Two small tin or copper brackets screwed to the base provide a mounting clip for the penlite battery which powers the amplifier.

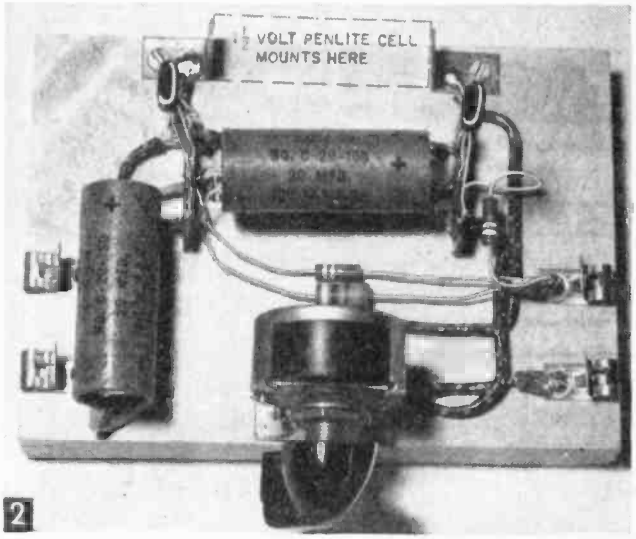
When wiring up the amplifier (Figs. 2 through 4), the transistors are not installed until the unit has been completed. When installing the transistors, hold a tiny wad of damp cotton on each pigtail lead to block transmission of soldering heat up into the transistor elements. Never apply heat to or near the transistor's metal jacket.

The transistor pin arrangement shown applies to units in current production. Some transistors may differ physically, so follow the instruction sheet furnished for the location of C (collector), B (base) and E (emitter). The RR-38 transistors shown here have dual purpose leads allowing direct pigtail connections. Or, with the leads cut short, transistors may be plugged into 4-pin miniature sockets.

MATERIALS LIST—TRANSISTOR AMPLIFIER

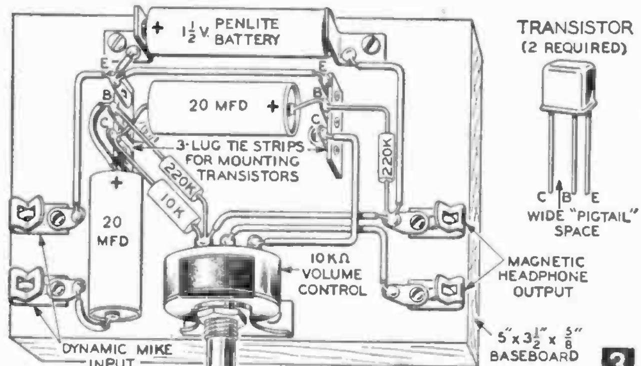
1 pc.	wood about 5 by 3½ by ⅝ in. for breadboard base
1	4 or 5-in. PM speaker
1	2500-ohm output transformer (commonly called 50L6 type)
2	RR-38 or CK-722 transistors or other P-N-P junction type
1	pair magnetic headphones, 2,000 to 4,000-ohms impedance
2	C-D (or equivalent) electrolytic capacitors, 20 mfd, 25 d-c w.v.
2	220K (220,000-ohm) ½-watt composition resistors
1	10K (10,000-ohm) ½-watt composition resistor (see note below)*
1	10K Mallory or IRC linear potentiometer (volume control)
1	bar pointer knob for above
4	Fahnestock clips
	window shade, brackets, wood screws and hook-up wire

*Some transistors may require more collector current. If amplifier fails to work, switch transistors, or change 10K resistor to 3.9 or 4K.



2

Transistor amplifier assembled on 5 x 3½-in. breadboard base. For greater output, extend battery clips and insert two penlite cells in series.



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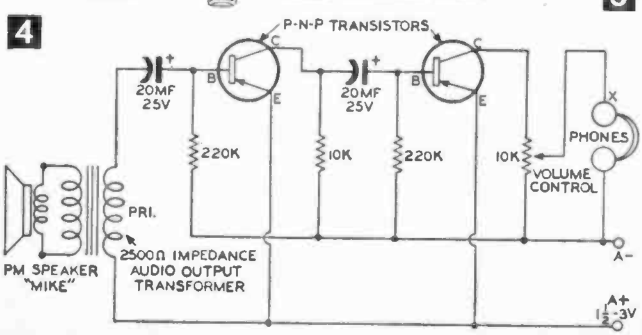


Note that the values of the coupling capacitors are two thousand times as great as those used in vacuum tube amplifiers; this is necessary because of the low impedence characteristics of the transistor.

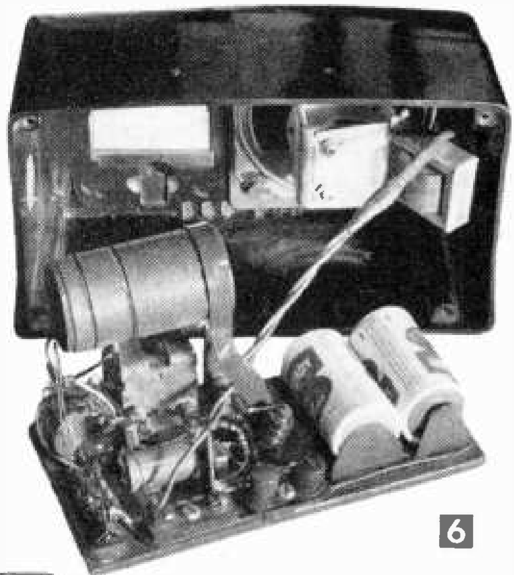
Also note that the capacitors used in the model are of higher voltage rating than required only because we had them handy. Since the maximum voltage applied to this circuit will never exceed 3 volts, any working voltage above six will be sufficient, and the capacity may be as high as 40 *mfd.*

Having attached a pair of magnetic headphones to the output clips, advance the volume control. If all the wiring is okay, the pickup of minute sounds will surprise you. Remember to use headphones of 2,000 to 4,000-ohms resistance for best results; crystal headphones will *not* work!

The 10,000-ohm volume control in the output circuit will slightly reduce the maximum amplifier output. If you prefer to build the unit and leave the volume control out, then connect headphone lead mark X in Fig. 4 directly to C (the collector of the output transistor).

Some magnetic headphones may produce slight distortion when the volume control is retarded. To correct this, insert a 20 mfd. capacitor between the arm of the potentiometer (volume control) and the X phone lead.

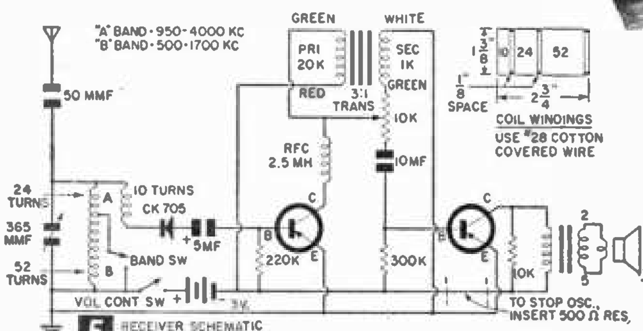
A 50% gain in signal output is possible simply by increasing the voltage from 1½ to 3 volts. Two penlite batteries can be inserted between wide-spaced clips, with two strips of wood attached to the baseboard to form holding-cleats for these additional batteries.



6

Robert Rich's two-band, two-transistor receiver. Actual life of the batteries used is about 1000 hours. For roughly 30¢, that's not bad.

Two-Band, Two-Transistor Receiver



5 RECEIVER SCHEMATIC

Using the transistor amplifier as a starting point, and taking a cue from the last hint given above, Robert B. Rich of Springfield, Mass., designed a compact receiver that will please the most discriminating experimenter. Constructed on a ¼-in. plywood chassis, it will pull in stations over a radius of 1000 miles with loudspeaker performance.

And, although selectivity of the set is not equal to that of a superhet, Mr. Rich reports that his unit separates seven local stations within a radius of five miles, tunes from 500 to 4000 kc.

The completed unit is shown in Fig. 6; its schematic, in Fig. 5. The antenna coil is tuned to a 25-ft. inside antenna against a good ground. The winding of the coil is the critical factor in reception: spacing must not exceed 2½ times the dia. of the coil. If you use a 1-in. coil form, for instance, then you would use No. 30 cotton-covered wire, the insulation spacing the turns for greater selectivity yet still keeping within the scale dimensions of the coil.

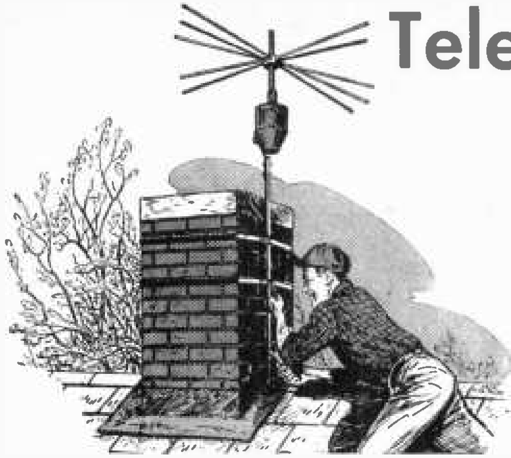
A note to the impatient: Don't build this set. Mr. Rich wound 26 coils before arriving at the correct band coverage.

TWO-BAND RECEIVER-MATERIALS LIST

1 coil, see text and Fig. 5
1 365 mmf. variable capacitor, miniature or regular
1 Raytheon CK705 diode
1 Raytheon CK722 transistor
1 Raytheon 2N138 transistor
1 driver transformer: 20K primary; 1K secondary
1 volume control; audio taper, 10K with switch
1 2.5 mh choke coil
1 5 mf electrolytic, 25 v. capacitor
1 10 mf electrolytic, 25 v. capacitor
2 large flashlite batteries
1 300,000-ohm resistor, ½ watt
1 220,000-ohm resistor, ½ watt
1 10,000-ohm resistor, ½ watt
1 output transformer (Stancor No. A3856; use secondary taps 2 & 5 to speaker terminals
1 Quam 4-A15 PM speaker or equivalent
1 volume control knob
1 variable capacitor knob with pointer
1 plywood base ¼ x 4 x 8"
1 small radio cabinet 4½ x 5 (high) x 9"
Wire, solder, wood screws, phone and speaker jacks, 2 battery holders.

D. Victor

"Dinner is ready. Do you read me? Dinner is ready."



Tele-Tenna Beamer

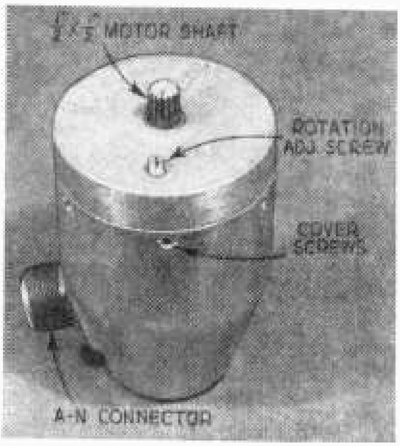
By THOMAS A. BLANCHARD

FOR best TV reception, your antenna must be oriented toward the point of transmission. Where reception is received from several compass points, a series of individual antennae may be required for best reception; this is not only unsightly, but makes a difficult installation problem on the average rooftop. The ideal system is to drive a single television antenna with a low-speed Barber-Colman Aircraft Controller motor, operated from a toggle switch convenient to the television set. Several commercial outfits are on the market, but here is one you can assemble for a couple of dollars.

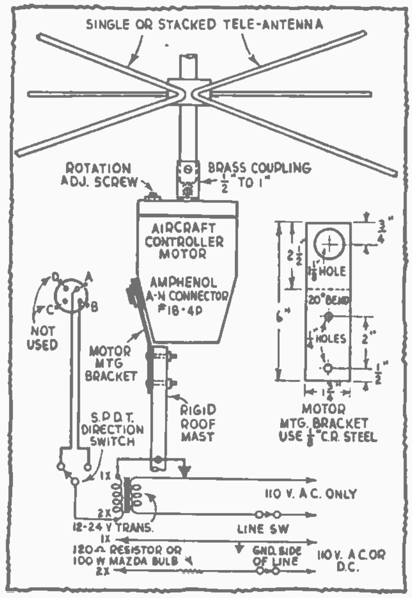
Although the motor used was intended for 24 volt *dc* operation, being a series type it operates equally well on 24 volts *ac*. Like the commercial antenna rotors, this motor requires a 12 to 24 v. step-down transformer for operating on 110 volt house current. Lacking a transformer, you may operate with a 100 watt Mazda lamp bulb, or a resistor in series with the hot side of the power line. This system can be quite practical if a few precautions are observed: One side of your power line is grounded; one side is hot! The grounded side is common with water and sanitary piping that runs through the home. Now, since aluminum housing containing controller motor is grounded and a connection must be made to its frame in order for it to run, plus the fact that a television mast and reflectors should be grounded anyway for lightning protection, the solution is simple and practical.

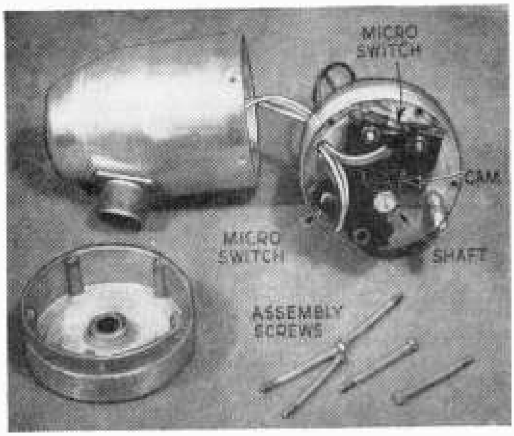
Find "hot" side of your power line by connecting a fixture plug to a single wire *only!* Connect this single lead to one terminal on a light socket. Now connect another wire to the remaining light socket terminal and secure the end of this wire to a water pipe or steam radiator. Insert any 100 watt size Mazda lamp in the socket. If lamp doesn't light, reverse plug. The plug-pin to which wire is connected when bulb lights is the "hot" side. Mark outlet and plug with white paint to indicate correct plug position, or replace outlet with a polarized receptacle which will prevent incorrect plug-in. Having established "hot" side of the line, connect this single wire, through the Mazda lamp or ballast resistor to the arm of the single pole-double throw switch. By grounding the antenna mast on the roof to the sewage vent pipe, the return lead of the motor is automatically established.

When the transformer system is used, one side of the transformer 12 or 24 volt secondary winding should be grounded to a convenient water pipe. Thus when television mast is grounded on the roof to the sewage vent pipe, the return circuit is completed without need for a third wire. Where the home lacks this convenient ground, a third wire will be required, for the TV-mast



This 2½ Barber-Colman Aircraft Controller Motor has a precision gear drive and makes an ideal antenna beamer. It rotates ¾ around horizon in ¾ minute. Rotation adjustment screw permits less rotation.





Motor is easily knocked-down for removal of Formica cam which lifts off drive shaft. Removed, motor runs in clockwise or counter-clockwise direction for other heavy-duty jobs.

should be grounded for lightning protection. Use a piece of iron, copper, or aluminum wire #8 gauge or heavier for the ground.

The aircraft controller motor is housed in a combination drawn and die-cast aluminum housing. An Amphenol *A-N* 4-prong fitting projects out the side. The pins inside fitting are marked A, B, C, D, but only A and B are used. From your radio supply house obtain the female cable connector to fit the Amphenol #18-4P. Connect a length of heavy-duty SJ round rubber fixture cord from pins A and B to toggle switch near your TV receiver. You can make a wooden box containing the direction switch, line switch and transformer (or lamp bulb).

Should the #18-4P connector be unavailable, solder ends of SJ cord directly to pins A and B. Fill up hole with pitch or calking compound for weather protection. Use a 1⅛ x 18 BX nut to mount motor to bracket, which is formed from a 1¾ x 6 in. strip of ⅛ in. cold-rolled steel. Every town boasts at least one general machine and blacksmith shop that can make this bracket if home facilities are not available. Don't attempt to cut the 1⅛ in. bracket hole with a radio socket punch. Drill a ¼ in. pilot hole, then clamp bracket in a vise and ream to size with a pipe reamer inserted in a bit brace.

We show the aircraft motor opened, but it is not necessary to disturb the unit unless you want to use it for continuous rotation as in operating winches, light hoists, etc. In this case, first remove the 6 *fh* screws securing cover. Pry off shell from gear box using, first, jack-knife blade, then a screwdriver. Burrs from the countersinking make removal of shell difficult but if you pry at the cover screw points, the shell will come off nicely. With die-cast section free from shell, cut copper wire loop which secures 5 screws holding the gear-train and limit switch assembly. Also remove locking nut on the "increase" screw. Now lift off motor cover and you'll see the 2 Micro limit switches.

This motor rotates about ¾ revolution in about ¾ minute. If you wish continuous rotation, lift off Formica cam located on motor shaft, being sure tiny metal key is removed with it. Removal of cam prevents actuation of Micro-switches and motor will run continuously either clockwise or counter-clockwise simply by throwing toggle switch in desired direction.

In most cases, the ¾ revolution is ample for beaming your tele-antenna. After a few practice runs, you'll know just when you see the "peak" signal of a given station on your television screen. The built-in Micro-switches make the motor stop automatically at the end of either clockwise or counter-clockwise rotation. Then a mere flip of the D.P.D.T. toggle switch starts the motor travel in the opposite direction of last completed cycle. The small adjustment screw marked "increase" permits as little as ¼ revolution if turned to extreme left, or the maximum of ¾ revolution at extreme right. This is accomplished by one of the Micro-switches being mounted on a gear driven eccentric plate.

Mount the motor as near to the antenna array as possible. Also use as rigid a roof mast as possible. The aircraft controller has a ½-in. dia. splined shaft. Couple this to the stub length of antenna mast with a brass or steel motor coupling or have a local shop make up a suitable coupling if you can't buy one. Drill and tap 2 holes in coupling for 10-32 set screws so antenna may be locked securely to motor shaft.

To protect motor shaft from the elements, a rubber suction cup (often called a "plumber's helper") may be forced over antenna mast. This forms an umbrella keeping water away from the motor shaft. However, since shaft rides in a bronze bearing, there is little chance of corrosion especially if a ribbon of silicone grease is applied around the shaft and bearing junction. If antenna is mounted on the chimney, clean soot from the area near the insulators occasionally.

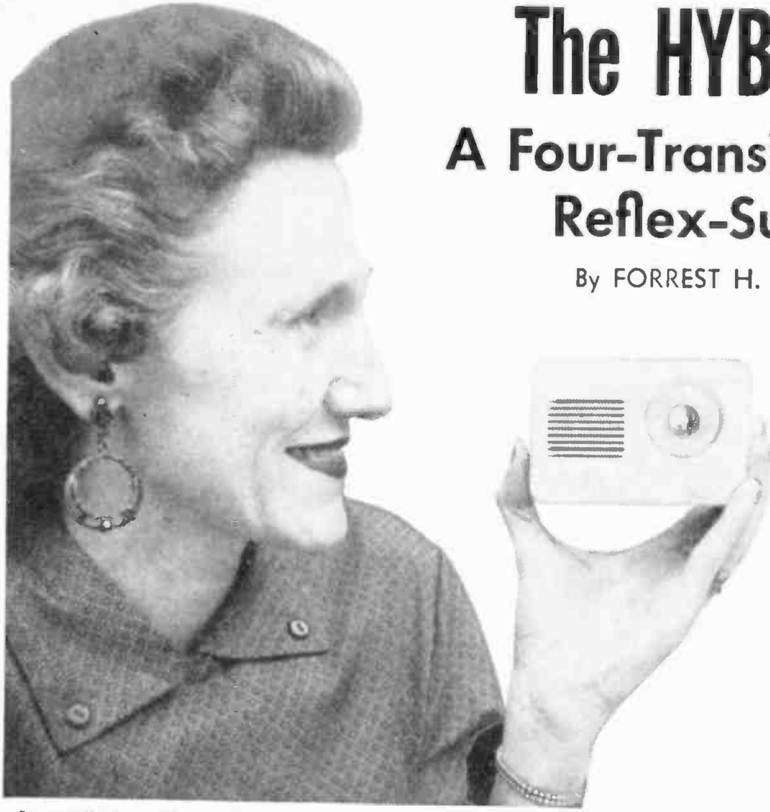
MATERIALS LIST—TELE-TENNA BEAMER

- 1 Barber-Colman Aircraft Controller Motor (available from Instrument Associates, Dept. SM, 351 Great Neck Rd., Great Neck, N. Y.)
- 1 Single pole-double throw toggle switch (S.P.D.T.) (all radio and electrical supply houses)
- 1 Single pole toggle switch (above source & dime stores)
- 1 12 to 24 v. to 110 v. transformer such as used in military battery chargers (available from many radio and surplus dealers). Or use alternate system with a series 100 watt Mazda lamp or 120 ohm-50 watt wire-wound radio type resistor
- 1 Suitable length type SJ heavy-duty rubber fixture cord to extend from rooftop to control box near television set
- 1 Amphenol A-N connector (female) #18-4P
- 1 Mounting bracket (homemade per diagram)
- 1 Shaft coupler (commercial or homemade ½" to 1")

The HYBRO-HET

A Four-Transistor Pocket Reflex-Superhet

By FORREST H. FRANTZ, SR.



Its small size and superior performance make the Hybro-Het rank high as a gift.

WANT a pocket portable radio with loudspeaker volume—one that performs well without antenna? If you do, the Hybro-Het will meet your requirements. Housed in a 1⅗₁₆ x 2⅝ x 4¼ in. cabinet (without protruding knobs), the Hybro-Het utilizes several circuit innovations that pay off in high performance and have the additional pay-off features of low cost, about $20, and construction and tuning simplicity.

Construction is simple because a commercially available cabinet, tuning dial, and coils are used and because the entire circuit is constructed on a miniature, perforated Bakelite board. The cabinet and tuning dial do not require any drilling or modifications, they are ready to use; the Bakelite board requires minimum drilling and cutting. Perforations in the board are anchor and connection points for leads. Component leads that are to connect are pushed through a hole, twisted together and soldered; excess lead length is clipped off. The insulating properties of the Bakelite are exploited to the utmost by mounting parts and wiring on both sides of the board.

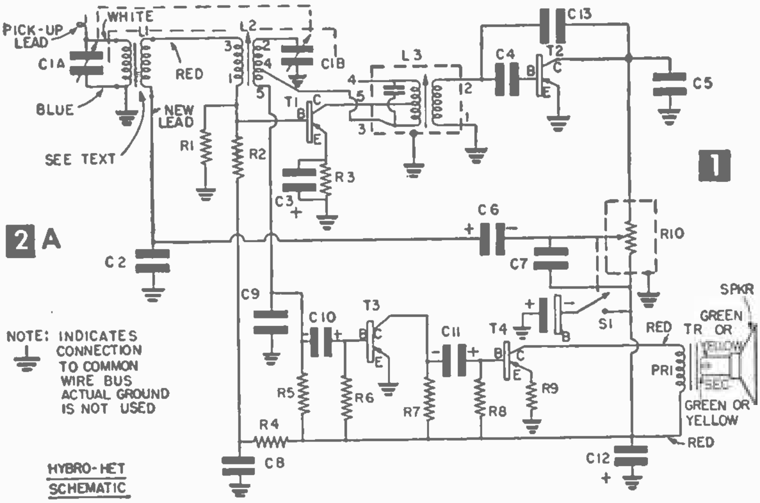
Figure 2B shows the functional arrangement of the circuit. The signal from the antenna coil-tuning capacitor combination is fed into transistor T1 which amplifies it —and does three other jobs. Two of these other jobs are to generate a signal 455 *kc* above the received signal and to mix this signal with the received signal.

The T2 circuit is a 455 *kc* regenerative detector. (The regenerative detector is noted for its sensitivity and selectivity.) The output signal from T2 is, of course, an audio signal. Thus, this versatile circuit does a multiple job.

The output of T2 is fed back to T1. Since the frequencies of the received and the internally-generated oscillator signal in the T1 circuit are much higher than the audio frequency from T2, the audio frequency can be amplified by the same transistor (T1). This little trick of "reflexing" is one that old timers will recall in connection with

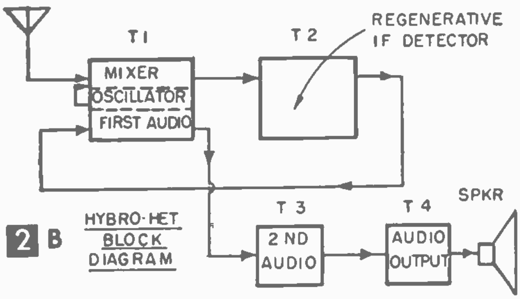
Materials List—HYBRO-HET

R1	27 K, ½ watt
R2	100 K, ½ watt
R3	390 ohms, ½ watt
R4	6.8 K, ½ watt
R5	1 K, ½ watt
R6	270 K, ½ watt
R7	10 K, ½ watt
R8	68 K, ½ watt
R9	47 ohms, ½ watt
R10-S1	5 K Volume Control with Switch (Lafayette VC-48)
C13	500 mmfd, 75 v. capacitor (Lafayette C-608)
C5	.005 mfd, 75 v. capacitor (Lafayette C-611)
C2, C7, C8, C9	.01 mfd. 75 v. capacitor (Lafayette C-612)
C4	.05 mfd. 75 v. capacitor (Lafayette C-614)
C3	6 mfd, 12 v. electrolytic capacitor (Lafayette CF-102)
C6, C10, C11	8 mfd, 6 v. electrolytic capacitor (Lafayette CF-121)
C12	100 mfd. 15 v. electrolytic capacitor (Lafayette CF-126)
$C1_a$	tuning capacitor (Lafayette MS-270)
$C1_b$	tuning capacitor (Lafayette MS-270)
L1	antenna coil (Lafayette MS-272)
L2	oscillator coil (Lafayette MS-265)
L3	IF transformer (Lafayette MS-268)
T1	2N136 transistor (General Electric)
T2	CK768 transistor (Raytheon)
T3, T4	CK722 transistor (Raytheon)
TR & SPKR	1½" loudspeaker & matching transformer (Lafayette SK-62)
B	Battery (See text)
1	Miniature perforated bakelite board 2⅜ x 3¹¹⁄₁₆" cut from Lafayette MS-305
1	Dial knob for tuning capacitor (Lafayette KN-24)
1	Plastic case & volume control knob, ivory (Lafayette AR-190)



1

2A



2B

early vacuum-tube circuits.

The audio signal from the output of T1 is fed into transistor audio amplifier T3, and thence to the output stage T4.

Construction. Tools required are: hacksaw, pocket knife, file, ½-in. taper reamer, hand drill, needle-nose pliers, diagonal pliers, screwdriver and soldering iron or soldering gun. (When you begin to solder connections, remember that the small components and the transistors you're working with can't stand a whole lot of heat. Use rosin core solder only and leave ⅝-in. leads on the transistors, and you won't have any trouble.)

A single cut across the Lafayette MS-305 piece of perforated Bakelite 2⅜ in. from one end will give you the required 2⅜ x 3¹¹⁄₁₆ in. blank for the chassis board. Smooth the edge with a file. Whenever you place the board in a vise for cutting or drilling, clamp it between two pieces of wood to minimize the possibility of breakage.

The lay-out for cutting and drilling the perforated bakelite board is shown in Fig. 3. Drill the ⅛-in. holes and ⅛-in. pilot holes for all other holes. Enlarge the pilot holes to size with taper reamer. All holes except D, K and I are centered on perforations.

Opening A is started by sawing with a hacksaw blade held nearly parallel to the surface of the board. After you've cut through the board near the corners, push the blade through and saw in the usual manner with the blade nearly perpendicular to the surface of the board. (Smooth edges with a file.) Opening G is made by drilling the end holes to ⅛ in. and cutting a joining slot with a hacksaw.

The output transformer (TR) mounting hole on your left as you look at the side of the transformer labeled "2K" must be enlarged to ⁵⁄₃₂ in. to permit mounting with a #6-32 x ¼-in. machine screw and nut. (The transformer frame is held together with rivets through the mounting holes; don't enlarge the second mounting hole, or you may have trouble handling the transformer.) A single screw and nut at the enlarged mounting hole with a drop of Duco cement at the other hole will hold the transformer in place on the chassis board.

The oscillator coil (L2) terminal lugs should be cut with diagonal pliers, bent up and trimmed as shown in Figure 4A. This operation reduces the mounting space required for the oscillator coil.

Shorten the shaft of the tuning capacitor (C1) to ½ in. with a hacksaw and dress the end of the shaft with a file until the shaft is ¹⁵⁄₃₂ in. long. The capacitor's shaft should be fastened in the vise for this operation so that no side stresses are placed on the plastic bearings of the capacitor.

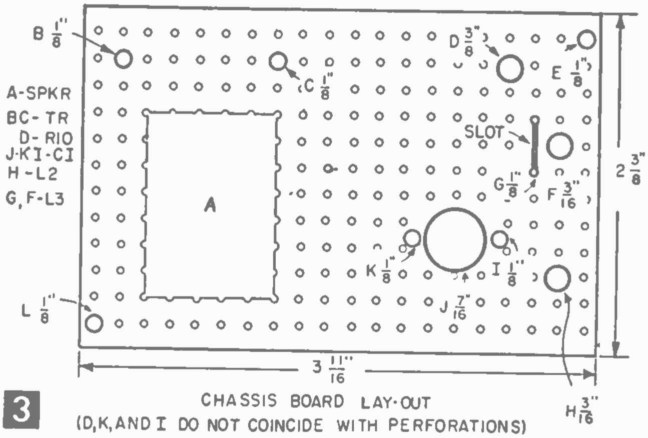
The antenna coil (L1) is manufactured with its two windings fastened together. They must be separated. Remove the tape at the ends of the coil, leave the blue lead on the end of the long winding, but cut the end of the short winding from the blue lead as shown in Fig. 5. Provide a lead for this end of the short winding, insulate with tape and refasten the tape around the end of the coil.

Mount the components TR, R10, L2, L3, C1, C4, C12, T1, T2, T3 and T4 on the back of the chassis board (See Fig. 6A). Transistors and fixed capacitors are mounted simply by pushing their leads through the perforations on the board. The mounting lugs on the L2 shield are bent up and back against the shield. (A short length of #20 wire, about 2 in., should be soldered to each of these lugs before mounting the transformer.)

Mount the IF transformer by passing terminal lugs 2, 3 and 5 through slot G on the terminal board, and bending them over. Terminal lug 1 is bent up over the edge of the board, and lug 4 is cut off to a length of ⅛ in. (no connection will be made to it). Make the bottom of L3 hug the chassis board; file the two plastic protrusions at the top of the shield even with the shield. Oscillator coil (L2) fits in hole H on the chassis board and is held in place with a drop of Duco cement.

Now, place the partially assembled radio in the cabinet to check shaft and cabinet hole alignment. If the shafts don't center in the holes, do some reamer work on the chassis board before you proceed with the wiring.

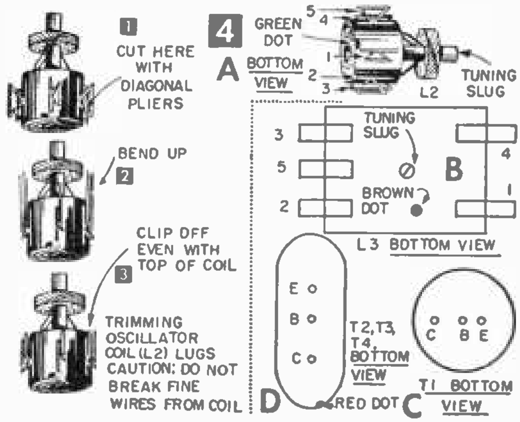
Most of the wiring is completed with component leads. The common ground bus and shield connections are made with #20 wire. Other connections requiring extra wire may be made with #22. The best sequence is to complete the wiring associated with the oscillator coil (L2), transistor T1 and the IF transformer (L3) primary first. (Soldering of most connections can be done after the set has been completed and tested.)



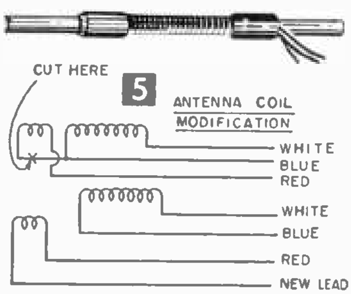
3 CHASSIS BOARD LAY-OUT (D,K,AND I DO NOT COINCIDE WITH PERFORATIONS)

Next, complete the wiring associated with the secondary of the IF transformer, transistor T2, and the volume control (R10). Solder the lead that has been soldered to the bent-back mounting lug of L3 to R10. A lead returns from this point to terminal 1 of L3. The other L3 shield lead goes to the ground bus.

The speaker need not be fastened to the chassis board since it will be held firmly in place by pressure when the chassis board is mounted in the cabinet. However, transparent tape or a rubber band holding it in place will protect it during testing and alignment.



The antenna loop coil (L1) and a short antenna pick-up lead (about a foot of #20 plastic insulated hook-up wire) is connected next. When this is completed, you're ready to hook the Hybro-Het to its batteries and try it out. Two Ray-O-Vac No. 716 miniature batteries (1½ *v.* each) connected in series with a Mallory TR-145R (7.5 *v.*) constituted my power supply. I insulated the terminals with transparent tape. As an alternative power supply, two Mallory T-114R batteries connected in series will supply 10 *v.* and fit nicely, one battery on each side of the loudspeaker.

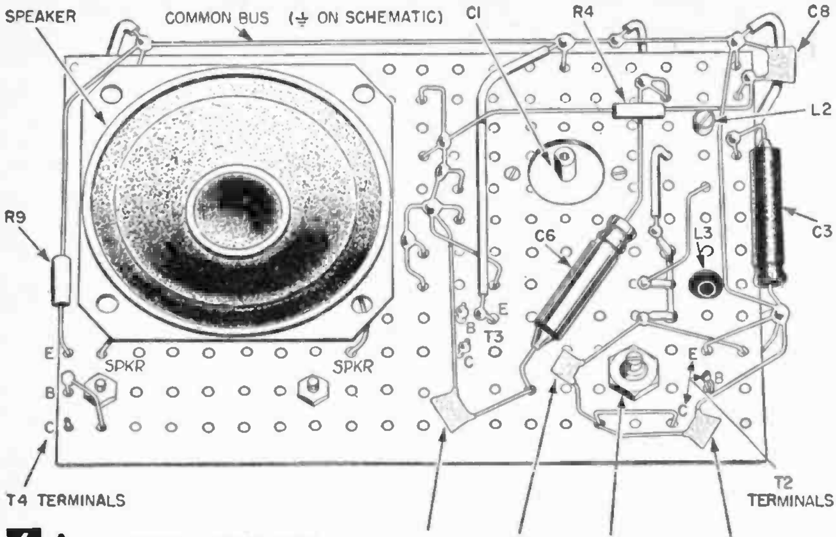


The Hybro-Het will work with a battery voltage between 7.5 and 12 *v.* The lower voltage should be avoided because operation becomes unsatisfactory when the batteries go down the least bit.

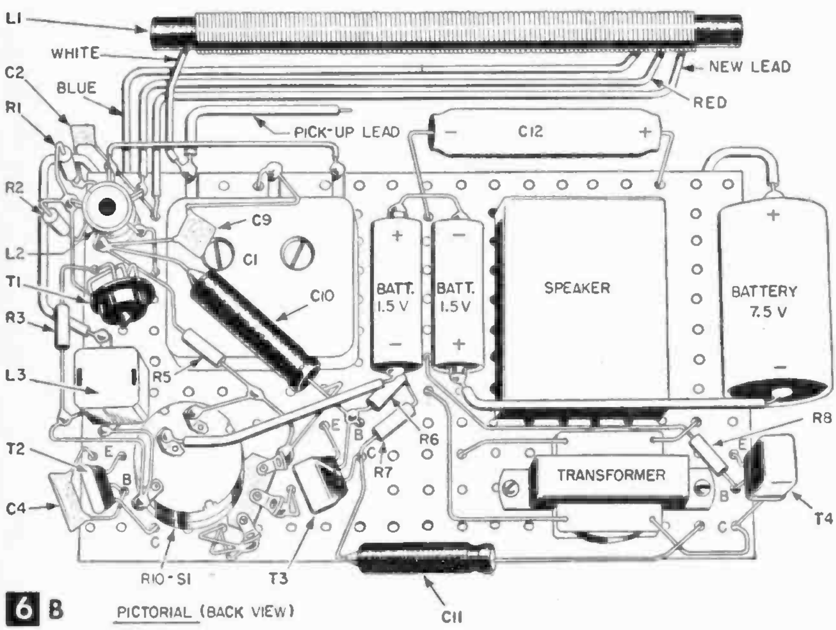
Alignment. The Hybro-Het can be aligned without expensive instruments, using a superhet broadcast radio as the IF signal source. Remove the regular broadcast radio from its case and connect the common ground return in the broadcast set to the common ground return on the Hybro-Het (see Fig. 7). You can readily find this point since the negative terminal of the power supply electrolytic filter capacitor in the regular broadcast radio is tied to common ground. Connect a second lead from the plate of the first IF stage in the regular broadcast radio through a 100-mmfd mica capacitor to the base of T1 (junction of R1 and R2) and turn the Hybro-Het tuning dial capacitor fully closed (530 *kc*), the broadcast radio to a station between 1200 and 1500 kilocycles.

Turn the volume on the regular broadcast set down, and tune the IF transformer (L3) slug with a screwdriver through hole F in the chassis board for maximum output. You'll probably have to reduce the Hybro-Het volume control setting since this control also serves as a regeneration control. When this adjustment is completed, the IF stage is tuned.

Now, disconnect the leads from the regular broadcast set. Set the slug in the oscillator coil (L2) of the Hybro-Het so that the top of it is flush with the upper edge of the L2 coil form as you look at the front of the chassis board. Turn the oscillator trimmer capacitor on C1 three-fourths closed and leave the antenna trimmer on C1 fully open. With the set in the case, tune the C1 dial to a local broadcast station between 1300



6 A PICTORIAL (FRONT VIEW)



6 B PICTORIAL (BACK VIEW)

and 1500 *kc*. Adjust the antenna trimmer for maximum output. Again, you may have to reduce the volume control setting until "squealing" stops. Then tune to a station on the low end of the C1 dial (around 600 *kc*). Move the C1 dial slightly to one side of the station and tune the L2 slug until the station comes in. If it's louder than it was, continue the process until you have maximum output. If you get a weaker output, work in the other direction on the dial.

After you complete this procedure, go back to the high frequency end of the dial and re-trim the antenna. If the loudest signal results with the antenna trimmer (C1A) fully closed, you may have to open the oscillator trimmer (C1B) slightly in order to tune the set. If you get the loudest results with the antenna trimmer full open, you'll have to close the oscillator trimmer slightly. The oscillator coil slug may again require slight adjustment at 600 *kc*, followed by a re-trim of the antenna at the high frequency end of the broadcast band to complete alignment. Place a drop of Duco cement on the L2 slug when alignment is completed.

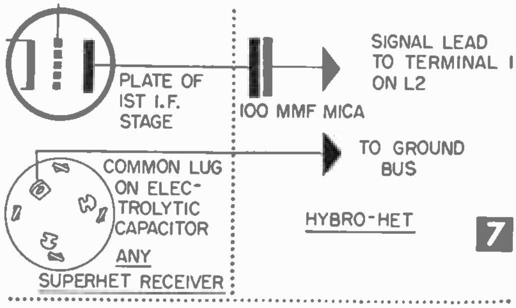
If you have trouble, bear in mind that this is a regenerative radio and it may squeal with the volume control full on. Reduce this setting until the squeal stops; you should not have to reduce it much. At lower volume settings, the control performs as a conventional volume control.

If you can't eliminate squealing by reducing the volume control setting, check to be sure that you've connected the volume control case and IF transformer shields to ground. Check to be sure that you've dressed leads so that they can't short a circuit.

If the set motorboats on you, check the battery voltage. Motorboating will occur when the batteries become weak.

If the set is inoperative, check the audio by touching the junction of C2 and C6 with your finger. If the audio is working, you'll get a faint hum and your trouble is probably associated with the oscillator and IF portions of the circuit. If you don't get a faint hum, check the audio and output stage first, and then the T1 stage.

A ⅛-in. hole should be drilled in the side of the cabinet to permit passage of the pick-up



ARRANGEMENT FOR ALIGNING I.F. STAGE: WITH TOO STRONG A SIGNAL, DISCONNECT LEAD FROM TERMINAL I ON L2 AND WRAP INSULATED PORTION OF SIGNAL LEAD AROUND TERMINAL I OF L2

lead. A knot in the lead will relieve strain on the tuning capacitor to which it connects. You may wish to drill another hole on the other side of the cabinet through which you can pass the other end of this lead. The end of the lead would then be knotted inside of the cabinet. Thus, the pick-up lead can serve as a handle. This would reduce pick-up length to about 5 in., adequate for most localities.

Placing your finger on the metal knurled tuning capacitor screw will increase pick-up in most instances. The set has adequate pick-up for local stations without resorting to this, however.

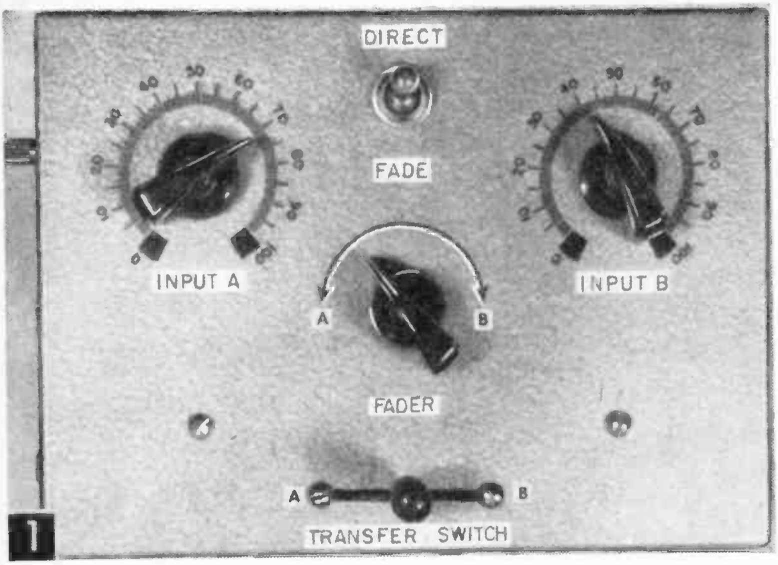
What's Your

Radio-TV Theory Quotient?

By JOHN A. COMSTOCK

Think you know your radio and television theory fairly well? Or are you a bit rusty on some points? Here's a test designed to reveal how much you really do know of the theory behind radio and TV. If you score 18 or more correct, your TQ is excellent; 15 to 18 correct it's good; 12 to 15, fair; 12 or less—you need to brush up on theory! (See page 158 for answers to the test.)

1. A______ and______ make up a resonant circuit (fill in the blanks).
2. A resonant circuit is said to be tuned when:
   a) The inductive reactance equals the capacitive reactance
   b) The inductive reactance is greater than the capacitive reactance
   c) When total resistance is zero
   d) None of the answers given above
3. When a resistor of 10 ohms is placed in parallel with another resistance of _____ ohms, the total resistance in such a circuit is 5 ohms.
4. A resistor of 10 ohms, 10 watts, is in parallel with another of the same resistance and wattage rating. What amount of power can be dissipated by the two?
5. The unit of measurement of impedance is the:
   a) Farad
   b) Ohm
   c) Rel
   d) Henry
6. Disregarding losses, the amount of power in the secondary of a transformer is the same as that in the primary winding.
   a) True
   b) False
7. When a ______ of 15 microfarads is placed in parallel with one of the 10 microfarads, the total ______ equals:
   a) 25 microfarads
   b) 15 microfarads
   c) 30 microhenries
   d) 25 microhenries
8. The device used to convert sound energy into electrical energy is a:
   a) Loudspeaker
   b) Microphone
   c) Antenna
   d) Picture tube
9. A transducer is a:
   a) Microphone
   b) Loudspeaker
   c) Light bulb
   d) All of these devices
10. The ______ element in a transistor serves the same purpose as a cathode in a vacuum tube.
11. The n-p-n and p-n-p transistors are:
    a) Junction type
    b) Point-contact type
12. In television, interlaced scanning is used to:
    a) Widen channel
    b) Reduce flicker
    c) Increase frame rate
    d) ______
13. At what frequency does the horizontal scanning generator operate in a TV speaker?
    a) 30 cps
    b) 60 cps
    c) 6 Mc
    d) 15,750 cps
14. The sound transmitter at a TV station employs ______ modulation.
15. S______ signals are sent in the composite video signal to maintain the correct beam scanning pattern on the receiver screen as at the camera pick-up tube.
16. In the United States, a) negative, b) positive, picture tube phase transmission is used.
17. What is an intercarrier type TV receiver?
18. The blanking signals are transmitted to ______ the electron beam in the picture tube during ______.
19. In color TV, what signal corresponds to the video signal in a black and white system?
20. The video transmitter at a color TV station employs amplitude modulation.
    a) True
    b) False



Front-panel view of two-channel mixer well-suited for use with high-fidelity equipment—and inexpensive!

HIGH-EFFICIENCY Two-Channel Mixer

By W. F. GEPHART

A MIXER to superimpose voice on recorded music, operate one amplifier from two microphones, etc., should have the following characteristics:

1) The input impedance should match the impedances of the devices feeding it and the output should be suitable for high-gain amplifier inputs.

2) The input and output impedance should not vary as the mixer's controls are varied.

3) The variation in gain for each channel should be smooth from zero to maximum.

4) There should be no interaction between controls.

5) The mixer should not affect frequency response of the input signals and should not introduce any hum or noise into the signal being fed into the amplifier.

6) The mixer should be versatile enough to permit either fading or direct switching or a combination of both.

Many mixers do not have all of these characteristics and when used with high-fidelity equipment the results are disappointing. Those that do work well usually have expensive, balanced, pad-type controls—too expensive for most non-professionals. The mixer described in this article, however, can be assembled of inexpensive parts, possesses all of the characteristics mentioned as necessary, and is well-suited for high-fidelity use.

Figure 2, a schematic diagram of the mixer's circuit, shows that the input circuits are designed for high-impedance inputs such as crystal microphones, phono pick-ups, tuners, etc. The two inputs are fed into separate jacks (J1 and J2), through separate "Level" controls (R1 and R2) and into separate amplifiers (V1A and V1B).

Amplified, the signals are then fed through separate sides of the Transfer Switch (SW1), through separate sides of the Function Switch (SW2), and into separate sides of the Fader Control (R7). The signals, still separated, each go to a grid of a dual cathode-follower stage (V2), whose plates and cathodes are common. Here, mixing occurs. The output is fairly low impedance, permitting up to 100 ft. of microphone cable between the mixer and main amplifier.

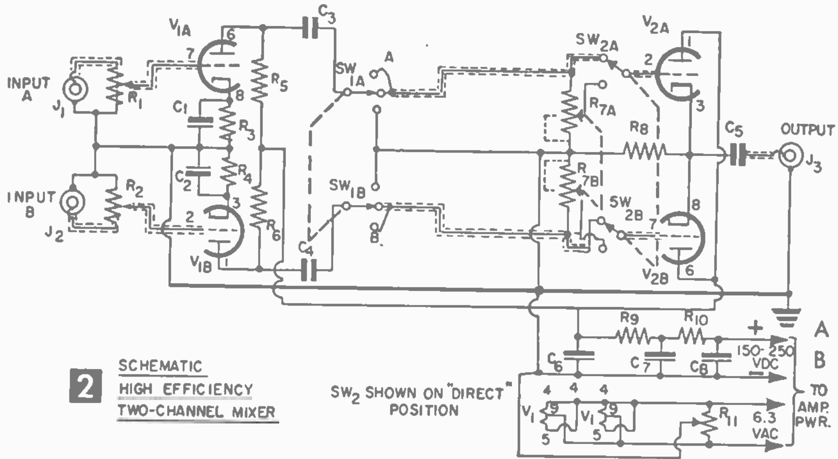
The function of the Level controls (R1 and R2) is to equalize the levels of the two incoming signals, so that no gain adjustment will be required when switching from one signal to another.

The Transfer Switch (SW1) is used to switch directly from one signal to another without fading. When in the center position, both signals are passed. Moving the switch to either side permits only the signal selected to go through, grounds out the other.

The Function Switch (SW2) determines whether the signals are to be switched directly by the Transfer Switch or faded into each other by the Fader Control (R7). When in the "Direct" position (as in Fig. 2), the signals go directly to the grids of V2, bypassing the Fader Control.

The Fader Control (R7) is a dual potentiometer, wired so that the gain of one signal is increased as the other is decreased. It must be a linear taper potentiometer connected so that as the shaft turns, resistance increases in one element as it decreases in the other. As shown in Fig. 2 (ignoring the small dotted lines), a standard dual potentiometer may be used and, at midpoint, an equal amount of each signal will pass. The fading action is therefore (turning clockwise) from full signal A to half signal A plus half signal B to full signal B. If it is desired to have no signal at midpoint (with fading action from full signal A to zero to full signal B), the potentiometer must be modified. This modification will be explained later.

Figure 2 assumes that external power for the mixer can be secured from the main amplifier. Power requirements are 6.3 volts *ac* at .7 *amps* and between 150 and 250 v. dc at 5 *ma*. This power may be brought in by a four-conductor cord wired directly into the mixer or through a power plug.

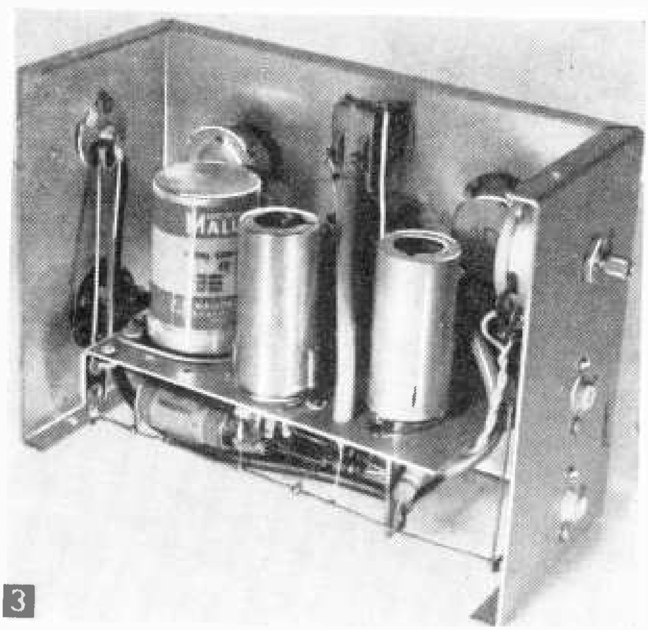


2 SCHEMATIC HIGH EFFICIENCY TWO-CHANNEL MIXER

If power from the main amplifier is not available, a built-in power supply, such as that shown in Fig. 6, can be included. Note that the power line is isolated from the chassis and ground by the two filament transformers. This is necessary not only from a standpoint of safety, but also to prevent interaction between the mixer and main amplifier.

To minimize *ac* hum, a filament balancing control (R11 in Figs. 2 and 6) is provided. If power is secured from a main amplifier with either side of its filament circuit grounded to the chassis, however, this control should not be included. This control should be set after the mixer is connected to the main amplifier and the inputs are plugged in. With no signal (this may require holding your hand over microphone), both Level controls at full gain, and the main amplifier gain turned up until a hum is heard, adjust the Hum Control for minimum hum in the speaker.

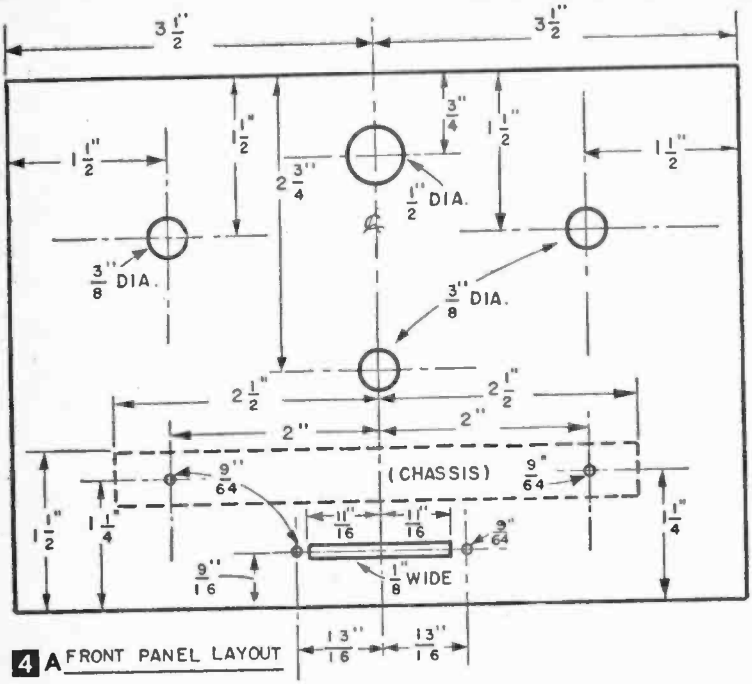
Figure 4 gives the panel and chassis layout for the unit without the power supply. No dimensions are indicated for the mounting of the two Input jacks and Hum Control in one end of the case and the Output jack and power plug at the other end; these can be placed where most convenient. If a power supply is to be built in, a larger box (3½ x 6 x 10 in.) should be used. The same size chassis piece can be used, but it should be mounted to one side, leaving clearance at one end of the box for the two transformers and selenium rectifier. The pilot light and power switch could be placed symmetrically on either side of the Fader Control, on the panel under the Level controls. The Hum Control and both Input and Output jacks would then be on the other end of the case.



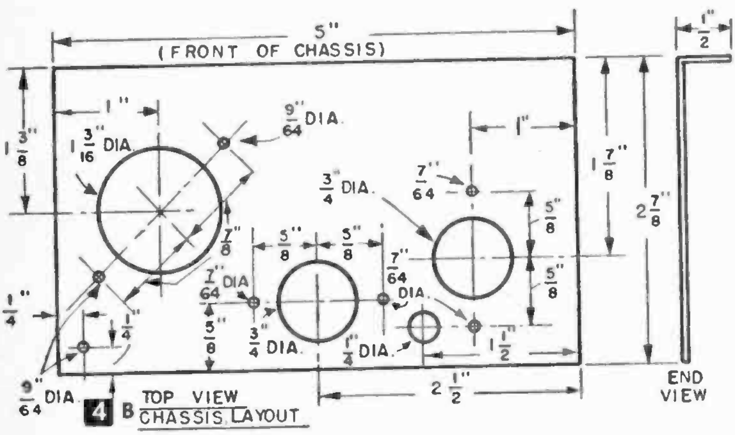
3 Back of panel view of mixer with cover removed. Note Input jacks and Hum Control on end panel at right.

Figure 3, a back view of the mixer, and Figs. 7 and 8 show wiring arrangements. Notice that SW1 (shown in Fig. 8), is mounted with ⅜-in. spacers. This particular switch (Mallory 6243) has a very long arm which tends to protrude too far from the mixer's front panel unless mounted in this manner. Also notice that shielded sockets and tube shields are used to reduce hum and interference.

Run the filament leads first, twisting the wires together and keeping them close to the chassis (chassis is made of scrap aluminum, with a ½-in. bend along one side; a convenient source is the side panel of an old 3-in. deep chassis). Be sure to use shielded wire where shown in the schematic and elsewhere if long (over 2 in.) signal leads are used. Generally, it will be best to use plastic-covered shielded wire to prevent the grounded shielding from shorting out against other wiring. Within reason, the larger the diameter of the shielding, the better, since small-diameter shielding has a higher



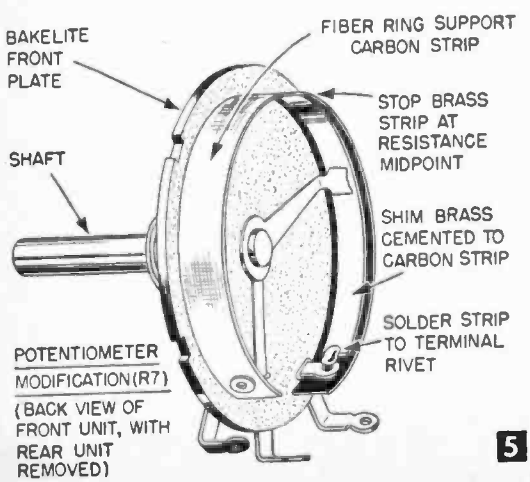
4 A FRONT PANEL LAYOUT



4 B TOP VIEW CHASSIS LAYOUT

capacity which reduces high-frequency response. In some cases, as can be seen in Figs. 7 and 8, two-conductor shielded wire can be used to good advantage. To minimize stray chassis currents, a common ground bus is used and all ground connections are made to it. This bus is grounded to the chassis at the Input and Output jacks.

Modification of Fader Control. The ideal way to provide zero gain on both signals (instead of half-gain) at midpoint would be to have a dual, linear-taper, center-tapped potentiometer of 1 or 2 megohms. But such pots are not normally available. An untapped potentiometer can be "shorted out" as shown in Fig. 5 if it has a removable back, and if the front and rear sections can be separated. The clockwise half of one potentiometer and the counter-clockwise half of the other is shorted out with a small piece of shim brass which results in the potentiometer arms being shorted to ground (see small dotted lines on R7 in Fig. 2) at midpoint. Turning the shaft one way moves one arm toward the grid (with decreasing resistance and therefore increasing signal), while the other arm stays on the shorted-to-ground section. This results in fading action from full signal A to zero to full signal B.



POTENTIOMETER MODIFICATION (R7) (BACK VIEW OF FRONT UNIT, WITH REAR UNIT REMOVED) **5**

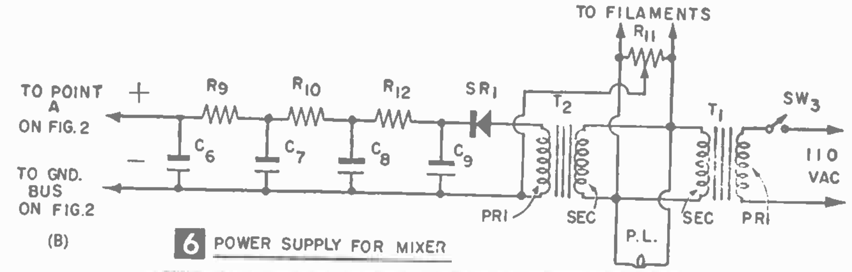
To modify the potentiometer (use a 2-meg. pot.), cut a strip of shim brass (as thin as is available) the width of the potentiometer carbon strip. Using an accurate ohmmeter, adjust pot's arm to the exact midpoint, and mark it carefully. Cut the brass strip to a length slightly in excess of the circumferential distance from the midpoint of the carbon strip to the end terminal, and cement it (using contact cement) to the inner side of the strip (as shown in Fig. 5). Solder one end to the lug rivet at the end of the strip. Do the same to the other half of the dual potentiometer, using the opposite segment of the carbon strip. While every effort should be made to have the unsoldered end of the brass strips at the same point when the potentiometer is re-assembled, a little variation won't hurt since the midpoint is the point of lowest gain.

To use the mixer, connect the input and output cables and balance the hum. Then set both Level controls to midpoint and adjust the main amplifier gain to a satisfactory level for the weaker of the two input signals. The Function Switch should be on "Direct" and the two inputs can be switched with the Transfer Switch to determine which is the weaker signal. After the main amplifier gain has been adjusted, adjust the Level Control for the weaker signal to bring it up to the level of the other signal, switching with the Transfer Switch for comparison. Inputs to the mixer are now balanced.

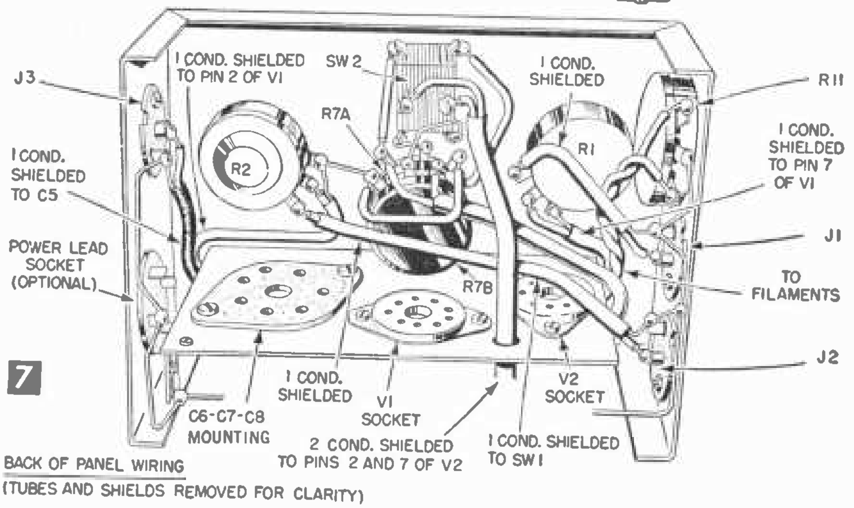
If direct switching is desired, leave the Function Switch on "Direct" and use the Transfer Switch to select either or both inputs as desired.

If fading from one signal to another is desired, leave the Transfer Switch in the center position and switch the Function Switch to "Fade." With the Fader Control at midpoint, both signals (at half volume) will be heard, and turning the control either way will diminish one signal and and increase the other.

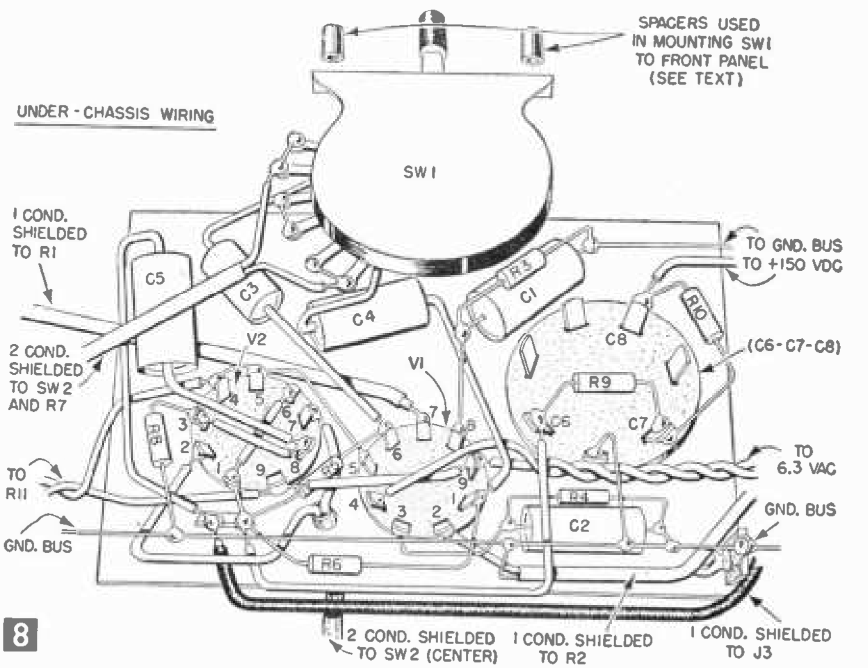
If, after a period of direct switching, it is desired to fade out the last signal instead of making a direct cut-off, first turn the Fader Control to maximum gain for the signal being heard. Leave the Transfer Switch in the proper signal (the one being heard) position, and switch the Function Switch to "Fade." The second signal will still be grounded by the Transfer Switch and the first signal will still be connected directly to the grid of V2—but through the Fader Control at zero resistance. When desired, turn the Fader



6 POWER SUPPLY FOR MIXER



7 BACK OF PANEL WIRING (TUBES AND SHIELDS REMOVED FOR CLARITY)



8 UNDER-CHASSIS WIRING

MATERIALS LIST—TWO-CHANNEL MIXER

R1, R2— .5 meg. potentiometers*
R3, R4—1500 ohm, ½ watt
R5, R6— .1 meg. ½ watt
R7—Dual 1 meg. potentiometers* (See text)
R8—47000 ohm, ½ watt
R9—15000 ohm, 1 watt, wire-wound
R10—10000 ohm, 1 watt, wire-wound
R11—200 ohm, 2 watt potentiometer (Mallory C200P or M200PK)
C1, C2—10mfd, 25 volt
C3, C4— .05 mfd, 300 volt
C5— .2 mfd, 300 volt
C6, C7—20 mfd, 250 volt electrolytic } Mallory FP-320, Sprague TVL 3540
C8—40 mfd, 250 volt electrolytic } Mallory FP-320, Sprague TVL 3540
SW1—DP 3 pos. Lever Switch (Mallory 6243 or Switchcraft 3036L)
SW2—DPDT toggle switch
J1, J2, J3—Phono Jacks #
V1—12AX7
V2—12AU7
Case—Bud "Minibox 3 x 5 x 7"
Tube sockets and shields, knobs, shielded wire, etc.

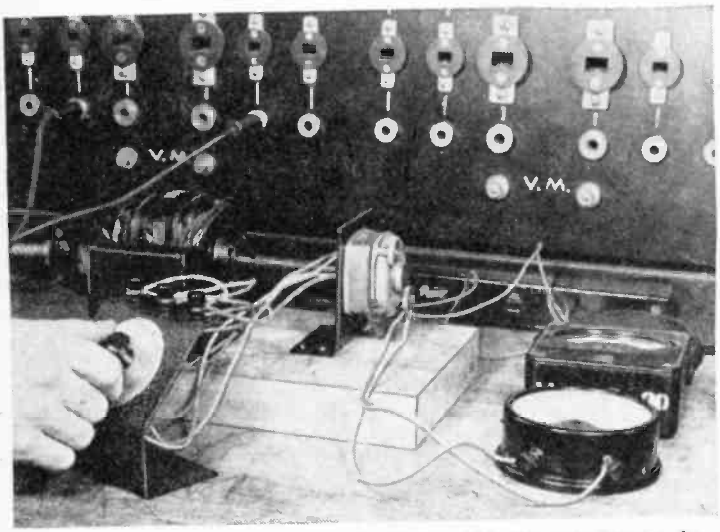
Additional and Substitute Parts Required If Power Supply Is To Be Included. (See Fig. 6)

T1—Filament Transformer: Secondary 6.3 volts @ 1 amp
T2—Filament Transformer: Secondary 6.3 volts @ .5 amp
SR1—20 ma. selenium rectifier
R12—5000-ohm, 1-watt, wire-wound
C9—40 mfd, 150-volt, electrolytic
SW3—SPST toggle switch
PL—6.3-volt pilot light and jeweled socket
If power supply is used, larger, low-voltage quadruple condenser unit can be used to act as C6, C7, C8 & C9; such as Mallory FP 312 (100-80-60-40 mfd @ 150 volts).

* All potentiometers must be linear taper

Jacks may be varied to suit needs; however, adapters made by Switchcraft can be used to adapt various microphone plugs to phono jacks.

Control toward the center position, fading out the signal. The other signal will not fade in since it is grounded out at the Transfer Switch. The same operation could be performed with the Level controls but this would unbalance the input levels.



A setup in a special laboratory experiment in which the potentiometer described in this article is being used in the circuit of a small Alnico type generator to vary the generator's output.

POTENTIOMETER for the Electronics Lab

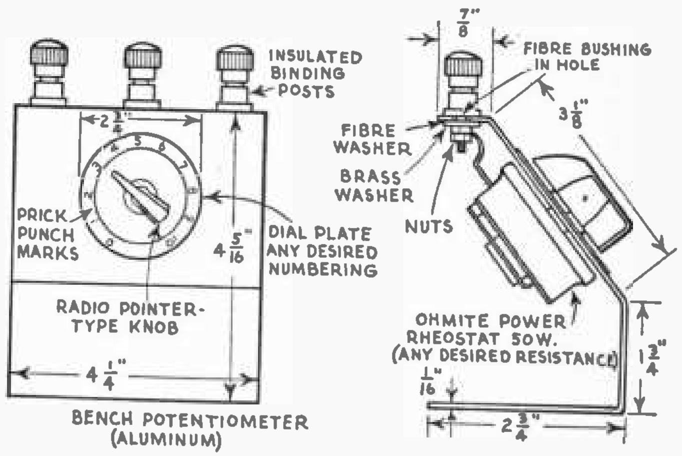
Here's just the thing for your radio and electrical testing work

By HAROLD P. STRAND

ELECTRICAL experimenters and radio technicians have constant need of variable resistors for many purposes. These should be in such form that they are handy to use on the bench and are easily adjusted. One type of home built adjustable slide wire resistor, described in detail on page 153 of *Experimenter,* Vol. 5, was built around a resistance tube commonly sold in radio stores. Another and more versatile type can be built from a power rheostat, a piece of 1/16 in. aluminum sheet, a knob, a dial and three binding posts. This device is shown in use in a circuit of a special piece of electrical apparatus under test, where a certain resistance value is necessary. The handy stand takes but little space on the bench and offers suitable support. The pointer type knob is easily adjusted to give any value within the range of the unit. Insulated binding posts at the back permit easy connections. Several of these units should be made up, using various rheostats, both in respect to resistance and wattage, so as to be able to cover any reasonable condition.

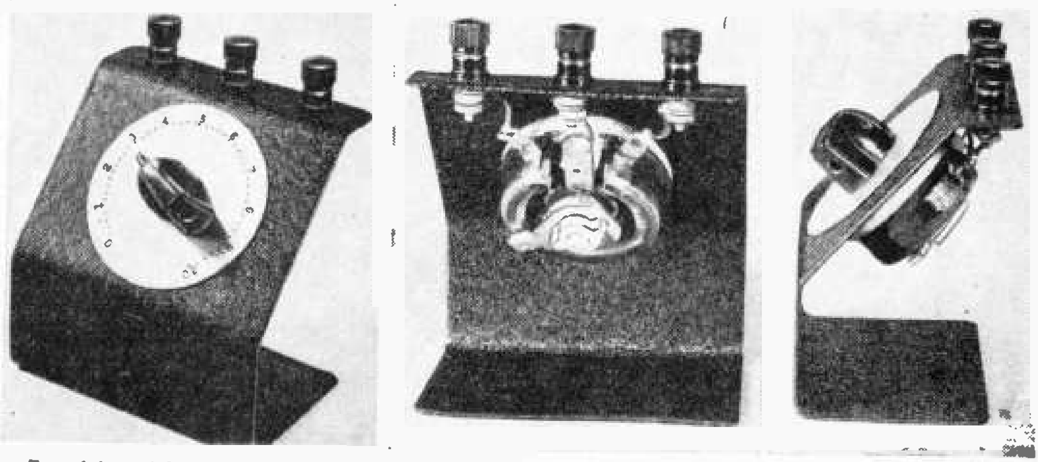
Begin building by bending up the stand from some 1/16 in. sheet aluminum (thinner gage steel can be used). Dimensions given will accommodate 50 watt Ohmite power rheostats, which have three terminals so they can be used as potentiometers or as straight series resistance if desired. These 2 5/16 in. dia. rheostats can be obtained in values ranging from .5 ohm 10 amperes up to 10,000 ohms .070 ampere.

In the center of inclined surface of the stand, drill a hole to clear threaded end of rheostat, so it can be locked in place with the nut provided. Before securing it in place, however, make up a dial from some .015 or .020 thick sheet brass. Cut this out in the form of a 2¾ in. dia. circle. Then scribe a 2³⁄₁₆ in. dia. circle on the disc and lay out your scale on this line. The figures 0 and 10 should be extreme stop positions of the pointer knob, which should be marked first by testing knob for its two positions. Between these two points, lay out 10 even divisions on the circular line. Divide each division into 5 equal parts, which will be the subdivisions. With a set of number stamping dies, stamp numbers from 0 to 10 on the main divisions just above the line. Use a prick punch to make markers for each sub-division. Should stamping the numbers result in warping the disc as it often does, anneal metal by heating over a flame and when cool it can be flattened easily. When completed, clean and polish dial and finish it with a coat of clear lacquer.



Now place dial in position over hole in stand, and push rheostat stud through; locknut holds the assembly in place. Keep numbers 0 and 10 in a level position at the bottom and terminals of rheostat at the top. In addition to hole for rheostat mentioned, drill three additional ¼ in. dia. holes at the back level surface for the Bakelite binding posts. Since metal stand would short-circuit posts if they were placed directly in the holes, provide insulating sleeves and washers in position, to insulate the posts from the stand. Bakelite tubing, ¼ in. O.D. (with a hole to clear the 6-32 threaded studs of the posts) and ¹⁄₁₆ in. long, serves to insulate studs in the holes. A fiber washer, together with a brass washer and a nut complete assembly of the posts. At the back side solder three short pieces of No. 18 lead wire to the three rheostat terminals and connect these to binding posts. If you have the facilities, apply a black crackle finish; put this durable, attractive finish on before any assembly work is done but after all four holes had been drilled. If crackle finish is not available, paint metal with dull black lacquer or any other finish selected.

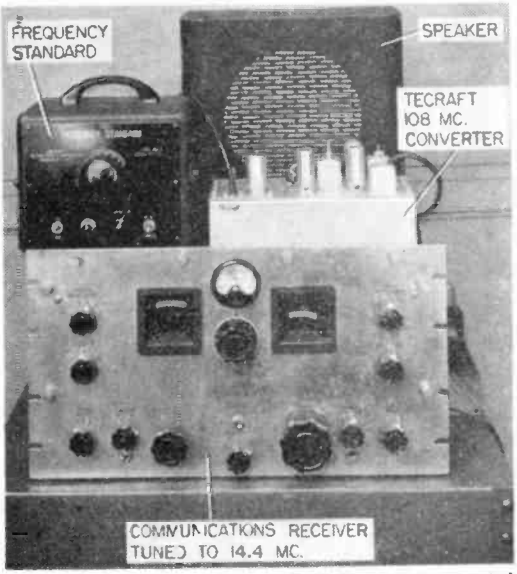
Potentiometers are used in many ways in electrical circuts. They are often connected with the outside terminals across the line, (provided resistance value is suitable) and load is taken from center terminal and one side of the line. Thus a method is provided for getting reduced voltage control. Another use is for voltage dividers in circuits. They can also be used as simple series resistance by using one outside terminal and the center one. When using any form of resistance in circuits make sure that both resistance value and capacity of resistor in amperes are suitable. Otherwise, it is easy to burn out a resistor quickly.



From left to right, front, rear and side views of the versatile potentiometer, which was built from a power rheostat, a knob, a dial, and three binding posts. Note connections on rear view.

Radio Tracking AMERICAN SATELLITES

By JEROME TANNENBAUM



At top of page, electronic consultant Tannenbaum seated in front of equipment he has used for tuning in on American satellite signals. Photo directly above identifies equipment which was used.

SO many new sounds have been coming from space recently that the amateur listener feels almost as if he were tuning in on a satellite "orchestra."

First, there were the familiar "beep-beep" signals from the Russian Sputniks. Then the fainter, varied musical tones of the American Explorer I. Not long after that came the signals from Vanguard I satellite, sounding very much like those from Explorer I (and later Explorer III), but with a little more of a "thrumming" tone.

Compared to the Sputniks the signals from the first American Explorer I and Vanguard I satellites were weaker and more difficult to receive. In Chicago, the 108.030 megacycle signals from Explorer I at their strongest sounded to us like a continuous carrier with a very shallow (about 15%) superimposed modulation. The four telemetering tones we heard were fairly short, none longer than one-third second. These tones followed each other in such rapid succession that they sounded almost like a continuous chord. Explorer I signals came in sharply, were in briefly, only about four minutes, and then went out sharply. We could easily hear a slow, two-second fade resulting from the slow rotation of the satellite.

No Job for Amateurs? Not long ago, many experts were saying that picking up the 108 megacycle signals from the American satellites would be beyond the reach of most amateurs. Receiving equipment, they said, would be in the $1,500 class, and thus even the casual listener would have to be in a high tax bracket!

These experts had a point. The power used by the American satellites, 10 to 50 thousandths of a watt, was but a small fraction of the 1-watt transmitters used in the earliest Sputniks. And such low power imposes a very hard task for receiving tubes and circuits. Also, because the operating frequency of 108 megacycles provides only for line-of-sight reception, there is very little bending of the waves by the ionosphere. Thus reception will occur only when the satellite is near or above the horizon for the receiving station, it will be in only for brief periods, and for many parts of the world it will be in only when its orbit is highest (apogee) near the longitude of the receiving station.

It is also more difficult to get maximum efficiency from receiving tubes and circuits at 108 megacycles than at the 20 megacycles the Russians used. American scientists chose this high frequency and short wave length (each wave is only about 3 meters long) because the lack of bending would permit the more accurate use of radio to fix the orbit and track the satellite's position accurately.

To receive the 108 megacycle satellite channel, a very good antenna, cut to this channel, is required in most locations. The "front end" of the receiving system must be able to handle very weak signals without masking them with internally generated noise.

As the experts knew, these requirements would have called for quite expensive equipment a few months ago. Now, thanks to the ingenuity and energy of three manufacturers, moderately-priced equipment is available which the amateur can use for American satellite tracking. It is detailed for you in Table A.

Hookup. Figure 2 shows the system for receiving weak signals using the Tecraft converter. You may already have a communications receiver which can receive signals at 14.4 megacycles; most communications receivers cover this frequency. The Tecraft converter converts the 108 megacycle satellite frequency to the more easily received intermediate frequency of 14.4 megacycles, where it can be amplified and detected in the normal way by the communications receiver.

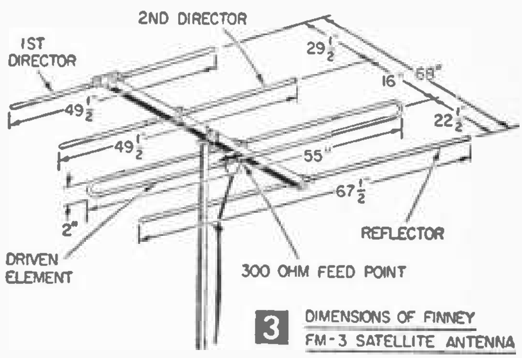
Use Beat Oscillator. The beat oscillator on your communications receiver not only converts the carrier of the satellite into an easily heard tone, but is also useful in measuring the Doppler Shift in frequency due to the satellite's tremendous velocity. You can turn it off when you wish to listen to or tape record the tone modulation which conveys the information from the satellite's instruments.

Don't set the selectivity on your communications receiver too sharp, since there is a considerable Doppler Shift in frequency. Further, the Lyman-alpha satellite uses tone modulation of between 2.5 and 15 kilocycles. To record such information, you'll have to use the receiver in its broadest selectivity position and employ a high fidelity tape recorder, capable of recording 15,000 cycles.

Power Requirements. Power to run the Tecraft converter comes from the communications receiver itself, if its power supply is more than minimal, or from a high fidelity amplifier or separate power supply. The Tecraft converter requires 6.3 volts *ac* at 2 amps and 150 to 250 volts *dc* at 50 *ma*.

If you are serious about trying to catch those satellite signals, you will find (as we did) that it is wise to run receiver, converter, and frequency standard continuously, day and night, to minimize the warm-up drift and various thermal drifts. We used a 250-watt Sola constant voltage transformer to run all units; this minimizes drifts due to changes in line voltage. While you don't have to have a constant voltage transformer, it will reduce the amount of recalibration.

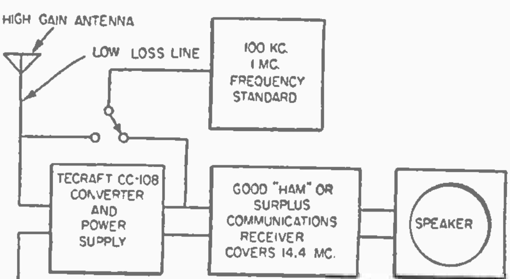
Use Frequency Standard. A frequency standard helps to spot the exact frequency with a minimum amount of tuning and retuning. For the Tecraft converter setup (Fig. 2), use a frequency standard to set the communications receiver at the exact intermediate frequency of 14.400 *mc* to receive satellite signals on 108.000 *mc*, or 14.430 *mc* to receive satellite signals on 108.030 *mc*.



3 DIMENSIONS OF FINNEY FM-3 SATELLITE ANTENNA

Although the older model frequency standard which we used would set the exact frequency of the communications receiver, its harmonic output at 108 megacycles was too low to be useful as a double check on the receiving system. Most newer frequency standards do not have this fault.

To put a strong harmonic on 108 megacycles we



2 BLOCK DIAGRAM OF 108 MC. SATELLITE RECEIVING SYSTEM

How Cold Are You, Van?

ANYONE who can tune in on the broadcasts from the 6 inch test Vanguard satellite (and perhaps some of the later satellites) could learn the temperature where the sphere was at the time.

The test satellite carries two transmitters, each with its own antenna, broadcasting at 108.00 and 108.03 megacycles, or within four kilocycles of these frequencies. The crystal controlling the mercury cell powered broadcasts at the even 108 megacycles is mounted at the satellite's center so its temperature will be as nearly constant as possible.

The crystal controlling the solar-powered broadcasts at 108.03 megacycles is temperature-sensitive, however, and mounted on the satellite's surface.

The difference between the two frequencies thus indicates the skin temperature, each degree centigrade changing the frequency by about 100 cycles. Temperature so measured is expected to be accurate to within 5°.

TABLE A—EQUIPMENT LIST

To receive the 108 megacycle American satellite signals you will want to use:

1. One of the following weak-signal, low-noise, high stability converters:
   - Tecraft CC-108 Converter....................$44.95
   - Tapetone Model TC-108 Converter.............. 95.00
2. Finney FM-3 Yagi, 4-element, high gain antenna (with satellite modification) cut to 108 megacycles.................$7.35 RG11U, RG59U, or tubular twin lead.
3. Almost any good communications receiver designed for amateur or military use that can tune to 14.4 megacycles.
4. A frequency standard.

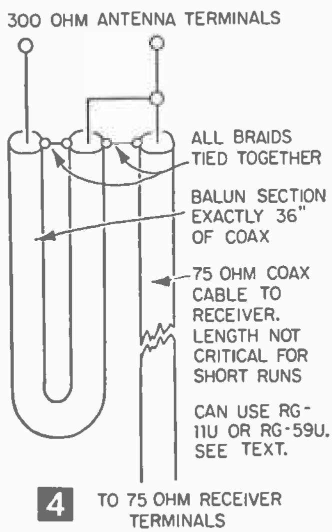
(The above converters and the antenna may be ordered from Allied Radio Corporation, Dept. S, 100 North Western Avenue, Chicago 80, Illinois.)

tried using the 24th harmonic of a 4.5 megacycle crystal normally used for alignment of TV sound channels. These crystals and generators for them are widely used by TV servicemen and labs, and are stock items with most jobbers. A simple circuit sets them into oscillation and their exact frequency can be determined by use of the low frequency standard. The 27th harmonic of a 4 megacycle crystal might also be used. We found that a little ingenuity would put a marker right on 108.000 megacycles to further confirm the receiver calibration.

You'll save a great deal of time and improve your chances of hearing if you can obtain the latest timetable for the satellites' orbit from a local newspaper, press service, or IGY facility.

High-Gain Antenna. The difference between hearing and not hearing the American satellites may well be the difference between a superior and a fair antenna. The antenna used should be cut to 108 megacycles. Figure 3 shows the dimensions of the Finney Model FM-3 antenna as supplied modified to receive 108 megacycle signals; the dimensions of this antenna are critical. For listeners who want to cut down channel 6 TV antennas, all dimensions should be scaled in proportion to the frequency difference.

Use Balun. To prevent losses in signal amplitude, your antenna must be very well matched to the converter input. But both the Tecraft and Tapetone converters have a 52 or 72 ohm unbalanced input, while the impedance at the Finney antenna terminals is 300 ohms balanced. Therefore, you'll need to use an impedance changing and balancing device called a "balun," which is made and hooked up as shown in Fig. 4.

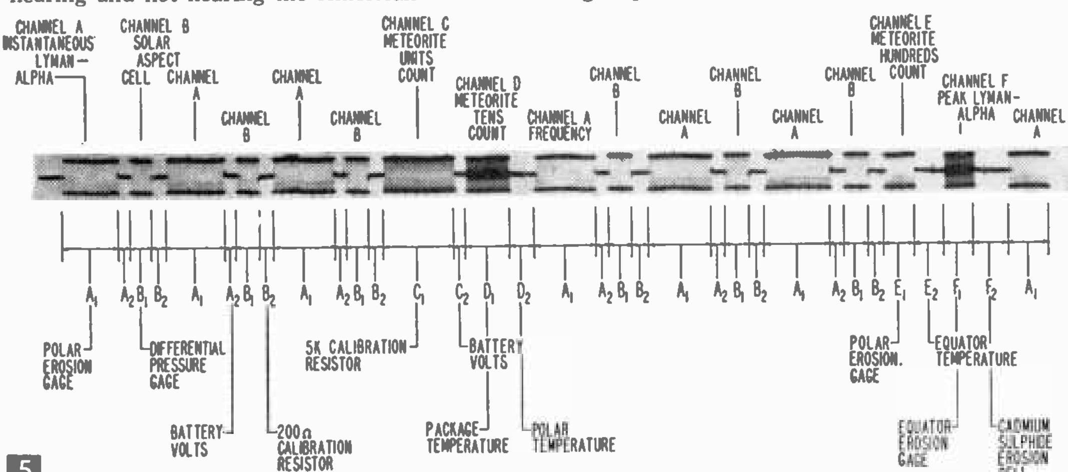


4

Minimize Line Loss. Signal strengths in the northern portion of the U. S. and Canada will be considerably lower than those in the very southernmost states. In weaker signal areas, and if the antenna and the converter are to be separated by more than 100 ft. of transmission lines, to minimize line loss, use tubular (not the ordinary flat type) twin lead for the longest span between receiver and antenna. Also, install the balun close to the converter and run a short length of 75 ohm coax to the converter.

In higher signal areas or where the transmission line will be under 100 feet, you can install the balun right at the antenna terminals and use coaxial cable (RG11U or RG59U) for the long span down to the receiver.

In some city locations where electrical noise is very high there may be a gain in overall signal-to-noise ratio if coaxial cable is used for the longer span since extraneous noise pickup by the



5

Components of typical Layman-alpha satellite telemetry signal. Diagram courtesy U. S. Naval Research Laboratory.

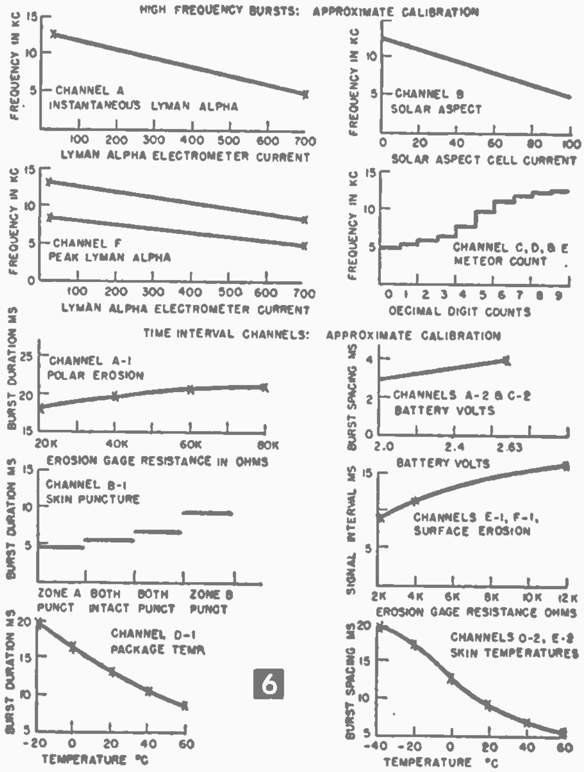
transmission line will be reduced.

The higher the antenna installation the better. Height gives a better chance of receiving the satellite when it is not so high above the listener's horizon. Mount the antenna in the clear, above surrounding objects that would interfere with its directivity and gain.

Antenna Orientation. For observers nearer the equator and up to about 35° North and South latitude, the antenna may point West or West S.W. For more northern or more southern latitudes (up to about 50° latitude) turn the main directivity of the antenna more to the equator. For very northern and very southern latitudes, (in excess of 50°) use a due South direction for the American satellite signals.

Some experimenters prefer to use their arrays mounted vertically since this gives a broader directivity pattern. Others mount their antenna horizontally and use TV type beam rotators, to follow the changing direction of the satellite with respect to the observer.

Coded Messages from Space. The newer American satellites will send back to earth tones which can be decoded as information on the skin temperature, meteorite count and short ultra violet (Lyman-Alpha) radiation from the sun—all these are secrets of space that are now being unlocked for the first time. If you want to be in on discovering what those secrets are, be sure to beg, borrow or buy a hi-fi tape recorder.



Here are some typical Layman-alpha satellite calibration curves, as supplied by the U. S. Naval Research Laboratory.

Figure 5 shows the telemetering code for the Lyman-Alpha satellite. Note that the information is coded either as a burst frequency, burst duration or spacing between adjacent bursts. The start of each telemetering frame may be recognized by the fact that channel A (instantaneous Lyman-Alpha), a long burst; and channel B (solar aspect), a short burst alternate 3 times. Their sequence is A B A B A B, a long short long short long short sequence.

Cracking the Code. Perhaps the best way for an amateur to crack the code is to use, in conjunction with a hi fi tape recorder, an audio generator and oscilloscope. Run a loop of tape containing the signal continuously through the recorder at its very slowest speed. Mix the recorder output and audio generator output through 100 *k* resistors at the oscilloscope input. The audio generator may then be varied in frequency to "beat" with a given tone burst frequency and the burst frequency read off the audio generator dial. Be sure to allow for the difference in recording speed and playback speed. Each burst may then be cracked individually.

You can approximate burst and interval durations in milli-seconds by setting the audio generator to 1,000 cycles per second and counting the number of generator cycles visible during an interval or burst duration. Once again, be mindful of recording and playback tape speed. If the ratio between these two speeds is, say, 4:1, use a 250 cycle timing signal from the audio generator to give a duration of 1 milli-second per cycle on the oscilloscope.

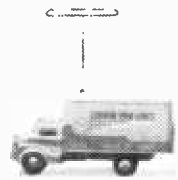
Reporting. Your tape recordings may actually help the American satellite tracking program. For one thing, when a new satellite is launched, amateur observers can aid in plotting its orbit in the first two days of its flight. Your reports, giving your latitude and longitude and the exact time and date and other details on the observation, should be wired to Project Vanguard, Naval Research Laboratory, Washington 25, D. C.

The amateur observer who is able to make good tape recordings can help in another way. While official observing stations will make their own tape recordings, there may be times and locations where an official recording cannot be made, perhaps during a very short solar disturbance.

When such recordings are needed they will be asked for within two days after the event has occurred. So save your recordings for at least two days, and if you are lucky enough to have a recording for one of the periods that will be requested, send this recording, or a copy of it, to the Naval Research Laboratory. Include with it data on the tape speed and type of tape recorder you used, the exact time and date of observation, and the latitude and longitude of the observer.

Radio Remote Controls

Weighing less than 4 lbs. complete with batteries and antenna, this compact radio control transmitter, when used with its companion receiver, will operate models, open doors or perform other tasks you designate.



1

Operate this ultra-simple crystal-controlled unit in the license-free 27.255 megacycle Citizens' Band to open your garage doors or guide a model plane

By THOMAS A. BLANCHARD

Pulse-Type Transmitter. A remote radio control outfit need not be complicated or expensive in order to perform a number of useful, entertaining functions such as operating garage doors or controlling model power boats, wheeled models or model planes in flight. While there are four Citizens' Bands provided by the FCC in which remote radio control transmitters may be operated without a license (the only requirements are that the apparatus be a crystal-controlled device and FCC Form #505 be filed by a U.S. citizen who is at least 18 years of age), the control shown here operates on the lower 27.255 megacycle band rather than in the UHF 460 megacycle range. Ultra-high frequency controls pose exacting mechanical and electrical design requirements not always accomplished with standard components. Other than the use of a piezoelectric crystal ground to 27.255 mc., the parts used here are conventional. Both the transmitter (Fig. 1) and its receiver mate (see page 57), can be built for less than the cost of a frequency-type relay alone.

The circuit employed here is a basic crystal-controlled oscillator of the continuous wave type. When the control is energized by depressing the push switch, an RF signal is picked up by the receiving unit in the model. The signal to receiver circuit sends a flow of current through the plate circuit, causing the coil of a sensitive relay to become energized. The relay armature carrying the switch contacts is pulled down to close some particular operating circuit in the model.

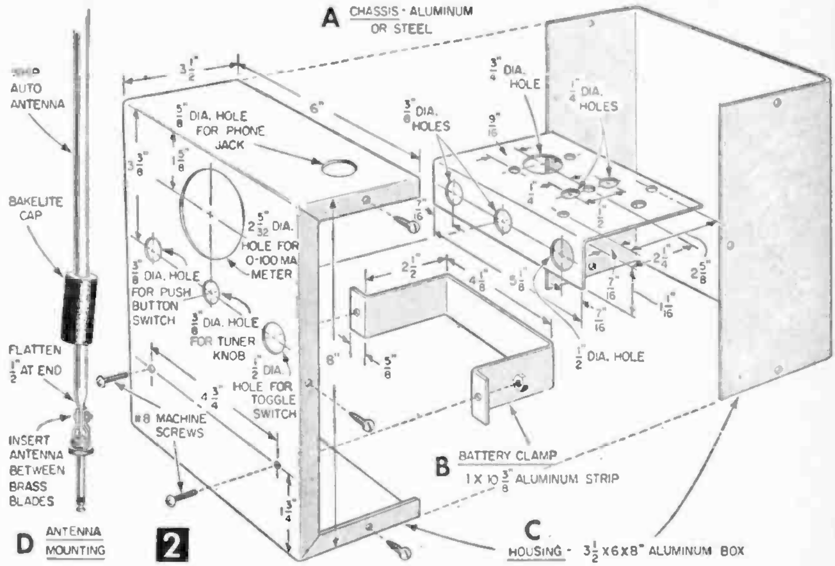
Make chassis for transmitter of aluminum or steel (Fig. 2A), bending to form a shelf arrangement inside box. Also cut and bend an aluminum or steel strap to serve as a clamp to secure A and B batteries in lower part of utility box.

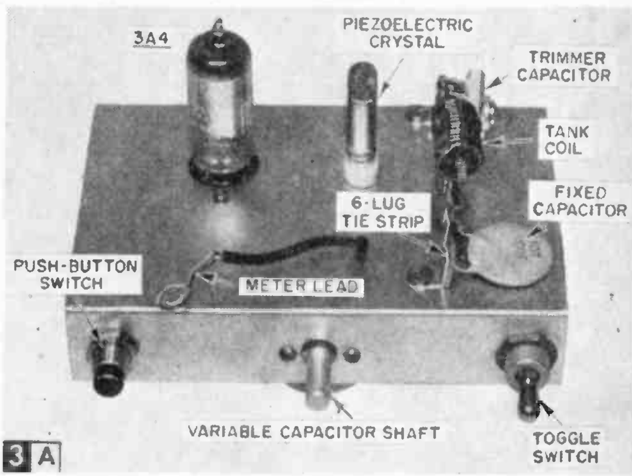
Transfer switch and tuner holes to front of utility box from chassis, locating them 3⅜ in. from top of box, and cut or drill. Center 2 5/32 in. dia. meter hole 1⅝ in. from top of box. Drill battery clamp mounting holes to pass a ½ in. #8 machine screw; space 4¾ in. apart, 1¾ in. from bottom of utility box.

Connecting all ground leads to the chassis will keep the number of leads on the underside of the control chassis at a minimum (Fig. 3B). Terminate one side of toggle switch on a soldering lug under the same nut used to secure one end of the 6-lug tie strip located on top of chassis (Fig. 3A). Back up the opposite end of the 6-lug tie strip with the 2-lug tie strip on the chassis underside (Fig. 3B). Attach one end of the 3.3 uH RF choke and one terminal of the crystal socket to the grounded lug of the 2-lug tie strip, then solder the remaining end of the choke and one end of the 47K resistor to the tie-strip's remaining insulated lug (Fig. 4). Place a soldering lug under one of the tube socket's mounting nuts, nearest tube pins 1 and 7. A short piece of wire connects pins 1 and 7 to the ground lugs (Fig. 3B).

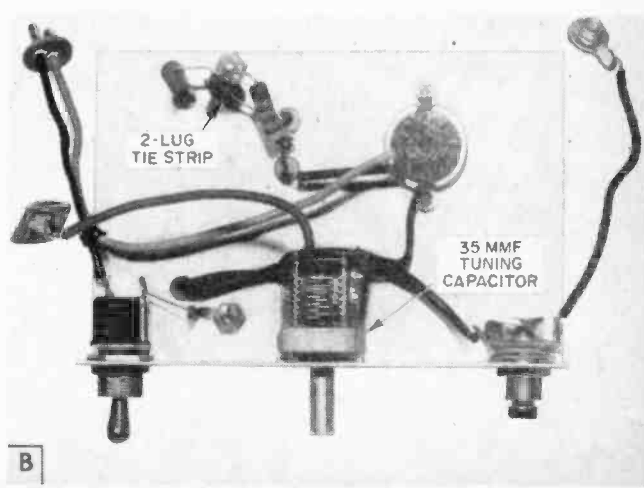
The switches and variable 35 *mmf* capacitor are permanently mounted to the chassis. Mount toggle and push-button switches so as to allow enough shank to pass through the aluminum box, and tighten in place with an open-end wrench. Purchase an extra nut with each switch for neatly and firmly securing the chassis later in the cabinet by the threaded switch shanks.

While ordinarily variable capacitors have their rotor shafts grounded, not so here as the capacitor is used to tune the tank coil in the B-plus plate circuit. Both rotor and stator plates must be insulated. Before mounting the 35 *mmf* capacitor, check to be sure the rotor lug was not grounded at the factory to one of the 4-36 or 4-40 threaded mounting studs. If it was, unsolder and rotate the spring lug so that it rests on the ceramic portion of the capacitor. Mount the unit so that its ¼-in. shaft will be centered in its ⅜ in. chassis hole (see Figs. 2 and 3A).

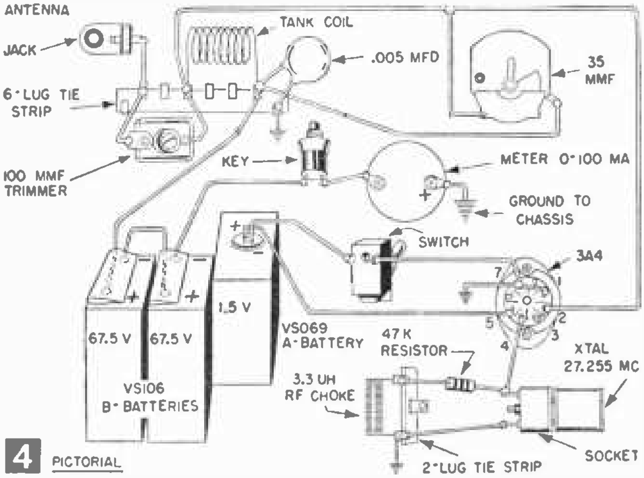




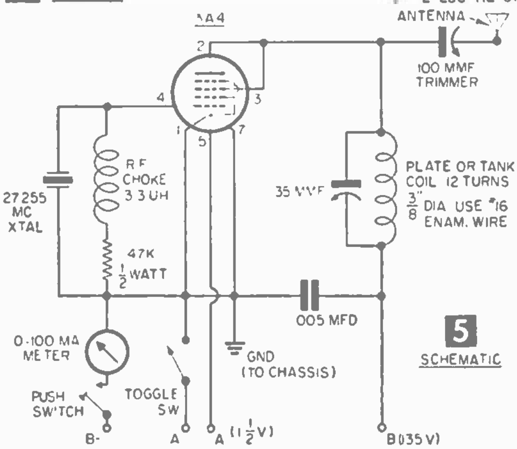
Top view of chassis. The two 4-36 mounting screws for 35 *mmf* tuner shaft are on 11/16-in. centers. Tuner shaft, push-button switch and toggle switch serve as means of mounting chassis in box.



Underside of chassis. Grounding lugs keep wiring at a minimum.



4 PICTORIAL



5 SCHEMATIC

The top side of the chassis (Fig. 3A) requires only wiring in tank coil, screwdriver-adjusted trimmer capacitor and the .005 *mfd* fixed ceramic capacitor. These components are terminated on the first, third and sixth lugs of the 6-lug tie strip. To make a plate coil that will tune 27.255 mc., wind an 18-in. length of #16 enameled magnet wire in a tight spiral around a piece of 3/8-in. dia. wood dowel or metal tubing. When you remove the form, you will have a self-supporting coil. With flat-nose pliers, bend about 3/4 in. at one end of coil wire at right angles. Calling the next turn of wire "one," count off 12 spirals and unwind any excess turns, making another right-angle bend at the 12th turn. Scrape off the enamel insulation from both ends of the coil and mount to tie strip as shown in Figs. 3A and 4.

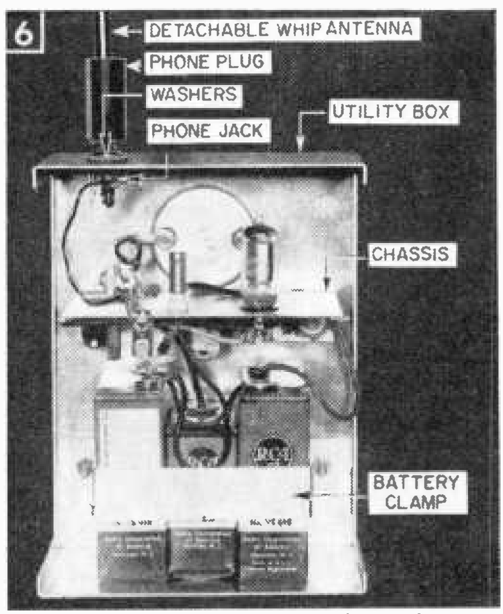
The trimmer lugs may be soldered directly to the tie-strip lugs without use of hook-up wire which is shown in Fig. 4 for convenience of illustration. Solder the .005 *mfd* ceramic capacitor from the hot side of the tank coil to the grounded mounting ear of the tie strip. Bring a single lead up from the underside of the chassis and fit the end to a soldering lug which attaches to the minus terminal of the 0-100 ma. panel meter. Ground the meter's plus terminal by placing a soldering lug under one of the meter mounting screws. Thus only one meter wire is involved when removing chassis from cabinet. Install batteries, securing with aluminum clamp (Figs. 4 and 6).

The plug-in whip antenna can be obtained at the nearest auto junk yard, since none of the original mounting hardware is required. Cut off with a hacksaw near the body mount. Be sure antenna is extended before sawing, or you will saw through one of the telescoped sections, making antenna inoperative.

Place about 1/2-in. of the sawed-off end of the antenna tubing in a vise and compress until nearly flat. Remove the screw-on *Bakelite* cap from the phone plug and take out the terminal screws intended to secure the phone cord tips. Place the flattened whip antenna between the brass blades of the plug and drill a hole through blades and antenna (Fig. 2). Insert a short 6/32 machine screw (after first sliding Bakelite cap on whip antenna) and tighten securely. Then screw cap back to metal plug.

Mount a matching phone jack on top of utility box, centering it over the toggle switch. The jack has a 3/8-in. shank, but should be centered in a 5/8-in. hole and backed on each side with a fiber or Bakelite washer so as to be completely insulated from the cabinet (Figs. 2 and 6). Connect a short length of hook-up wire to both soldering lugs on the jack. Terminate the other

6



Inside view of utility box shows chassis, batteries and antenna installed, and wiring completed. Shelf-like chassis and plug-in antenna can be easily removed from box.

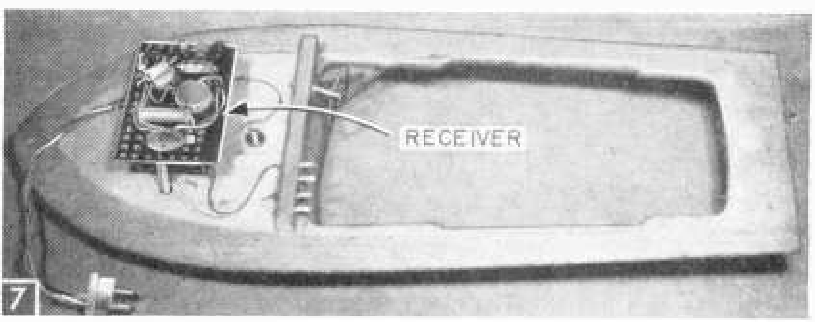
MATERIALS LIST—TRANSMITTER FOR RADIO CONTROL
All parts available from Lafayette Radio, Dept. SM, 165-08 Liberty Ave., Jamaica 33, N. Y.

1	3½ x 6 x 8" aluminum radio utility box hammertone gray enamel (housing)
1	Shurite #950 panel meter. Range: 0-100 d-c milliamperes
1	27.255 megacycle piezoelectric crystal in mount
1	ceramic crystal holder
1	miniature pentode tube Type 3A4
1	7-pin miniature molded tube socket
1	S.P.S.T. toggle switch
1	momentary push-button switch (key switch)
1	standard-size phone plug
1	standard-size phone jack (single or closed-circuit type)
1	2-pin A-battery plug
2	male B-battery Dot snap-fastener type connectors
2	female B-battery Dot snap-fastener type connectors
1	6-lug tie strip with end mounting ears
1	2-lug tie strip with center mounting ear
1 pc	#14-gage aluminum 4¼ x 5⅛" (chassis)
1 pc	#14-gage aluminum battery clamp 1 x 10⅜"
1	1½ volt A-battery, RCA Type VS069 or equiv.
2	67½ volt B-battery, RCA Type VS016 or equiv. (connected in series for 135v.)
1	18-in. length #16 enameled magnet wire for tank coil
1	IRC 3.3 microhenry RF choke, Type CLA
1	47K chm (47,000) ½-watt composition resistor
1	35 mmf. miniature tuning capacitor
1	4-80 or 100 mmf. trimmer capacitor
1	.005 mfd. ceramic capacitor
1	auto whip-type antenna, extending to 6 ft.

Misc. hardware, chrome handle, hook-up wire, ⅝" knurled knob.

end of the lead to lug #1 of the 6-lug tie strip where the trimmer capacitor is located (Figs. 4 and 6.) For carrying convenience, attach a chrome metal handle to side of the utility box.

Your radio control transmitter is now ready for testing. Because it includes a built-in meter, you always know if the signal is getting out by the extent of the needle swing. With batteries connected, toggle switch at *on* and push switch depressed, rotate the 35 *mmf* capacitor knob until the meter dips to the lowest reading (about 20 ma. without antenna). The circuit is then in resonance and sending out a signal.



Occupying only a 2x 3½-in. area this tiny receiver easily fits on underside of model boat decking.

To transmit the maximum signal possible with this control, the 80 or 100 *mmf* trimmer allows the antenna coupling to be adjusted for maximum loading. Plug-in the fully-extended whip antenna; then, with a plastic-blade screwdriver close the plates of the trimmer by turning the screw clockwise. Watch the meter for any sudden swing of the needle. If the needle shoots up to 60 ma., try to bring the circuit back into resonance by turning the front control knob. If this proves ineffective, loosen the trimmer screw until the meter can again be dropped by rotation of the 35 *mmf* knob to about 20 ma. The trimmer screw need be adjusted only once. Thereafter, whether the antenna is used partially telescoped or fully extended, you only need rotate the knurled knob until the lowest reading is obtained with push switch closed.

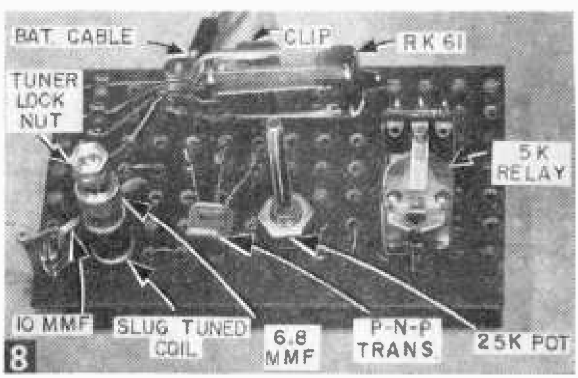
Because the rise of current is quite sudden when circuit resonance ceases, the sharp needle swing provides the operator with a continuous check on the control. Should there be any influence on the circuit through body capacitance, making it difficult to maintain the lowest meter reading, change the value of the 47K grid leak resistor to a lower value such as 39K.

Exposing set-screw of ⅝-in. knurled tuner knob to body contact may affect meter reading during circuit adjustment. In this case, coat head with nail polish, or cover with tape.

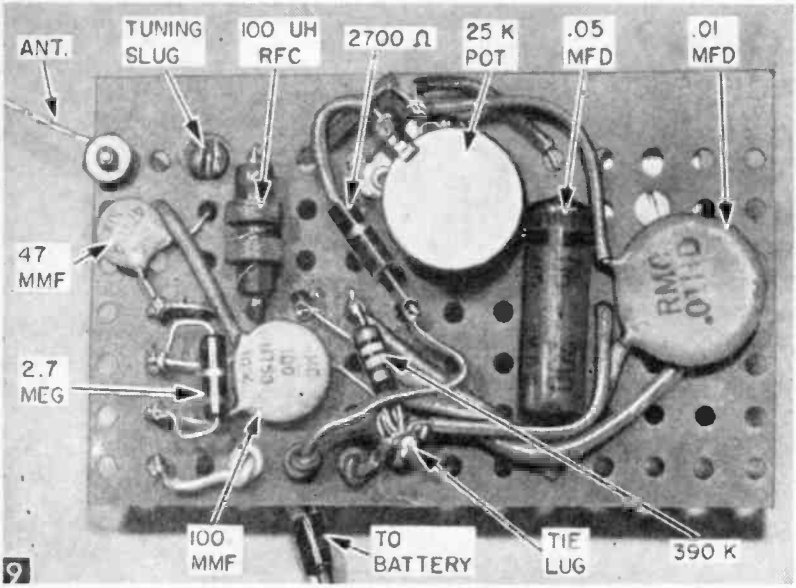
Receiver. The circuit board on which the receiver is constructed is available in panels of various sizes, or larger pieces may be cut to size. Holes, 3⁄32 in. dia. are located ¼ in. apart. The holes are arranged geometrically.

Small phosphor bronze connectors known as "Flea" clips may be inserted into the 3⁄32 in. holes. Flatten spade end of clip with pliers, allowing transistor or tube leads to clip firmly in place. Pigtailed components such as capacitors and resistors may have their leads threaded through the holes, thus providing a secure mounting.

The relay is a minute s.p.d.t. type with a 5K ohm coil. Either the Lafayette 5K "Gem" or "Jewel" types may be used. The function of the



Top side of receiver showing how parts are mounted on panel of perforated Bakelite. Geometric arrangement of holes provides a versatile wiring board.



9 Underside of receiver. Wiring board holes allow set to be mounted with two or more small metal studs in whatever position best fits the particular model.

of clip used to mount electrical cartridge fuses in many home and factory wiring systems. Both clips must be "sprung" because too much clip tension may break the tube. The clip gap should be about ½ in. which is the diameter of the RK61 triode.

While the CTC-LSM coil form is provided with a threaded ferrule for panel or chassis mounting, it is mounted in the lower right hand corner of the wiring board (Fig. 12) in reverse fashion by enlarging one of the 3/32-in. holes to ¼ in. Cement the Bakelite tube, not the ferrule, into this hole with *Duco* or *Pliobond* cement. Both the .05 *mfd* tubular paper capacitor and the 100 uH R. F. choke are threaded to the panel board to make them secure. One end of the choke and one end of the .05 *mfd* terminate on Lug #1 of the 25K potentiometer. This is a subminiature type mounted in a ¼ in. hole. Opposite ends of choke and capacitor terminate on tube and transistor "Flea" clips as shown in Fig. 11.

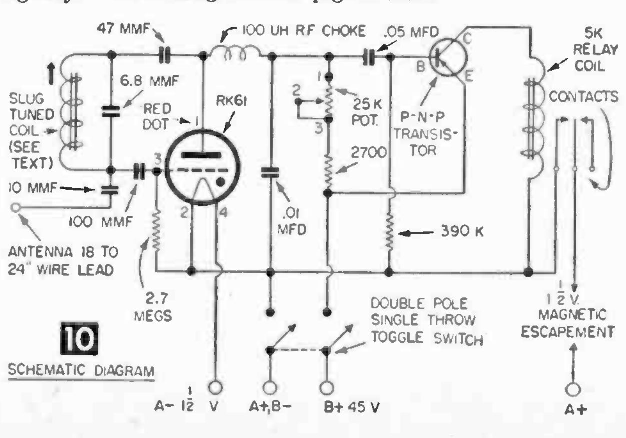
With all wiring completed, the receiver is ready for testing and adjusting to 27.255 mc. Install tube in clip and attach pigtail leads to respective "Flea" clips. Cut off excess pigtail leads on tube. Observe that tube lead #1 is identified by a red dot on the glass with other leads following in sequence (Fig. 10). The transistor (C) collector pigtail lead (Figs. 10 and 11) is identified by a red dot on the side of the unit, or by the fact that a wide space separates it from Base (B), the center lead, and Emitter (E), the remaining outside pigtail lead.

relay is similar to that of a speaker. A relay, however, converts the signal into motion, whereas the speaker converts the signal into sound. Motion in this case is to cause the relay contacts to open or close and control other circuits which in turn provide the necessary animation—banking, looping, starting, stopping, forward, reverse or turning.

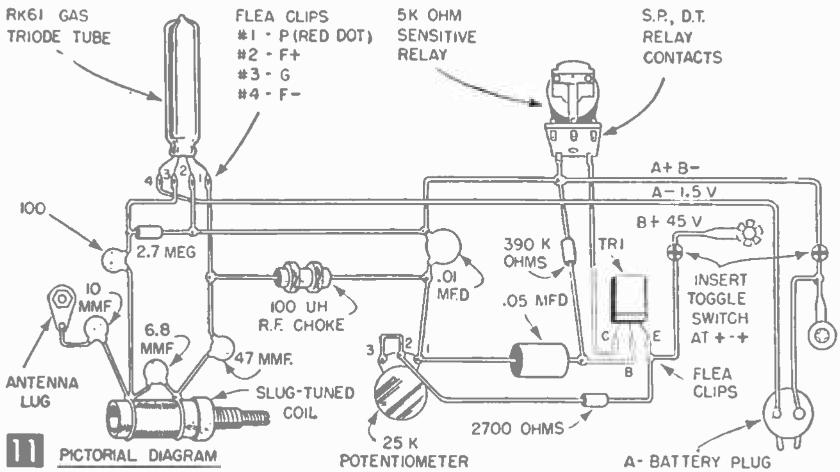
Tuning the receiver to the 27.255 mc. signal sent out by the transmitter is accomplished by a special slug-tuned coil. Lafayette Radio will provide a ¼-in. coil form, ¾ in. long fitted with aluminum threaded ferrule and slug. Two silver rings are pressed over the coil form to provide termination for each end of the coil winding. The winding consists of 22 turns of #30 enameled magnet wire close wound in the center of the form. Each end of the winding is scraped clean of enamel, then soldered to the silver terminals. A thin coat of *Duco* cement may be flowed on the finished coil to give it some rigidity.

While the cement is drying, the parts may be installed on the wiring board as in Fig. 12. Dimensions are not needed because the board holes will automatically provide for suitable parts locations. Mount the relay with a single jeweler's type screw (provided) and the antenna lug and tube clip with 4-40 x ¼-in. binding head machine screws and nuts. When mounting the tube clip, place another soldering lug on the underside of the same screw. This lug serves as a tie point for all the leads and components in the A/B-circuit.

The tube clip can be either of two things: A catch as used to secure the doors on kitchen cabinets, or the type



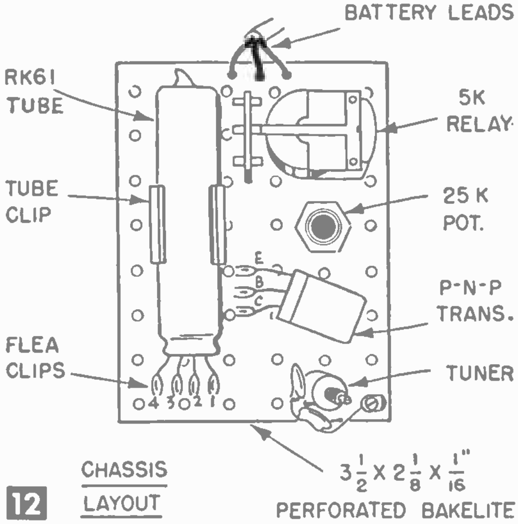
10 SCHEMATIC DIAGRAM



11 PICTORIAL DIAGRAM

The pictorial wiring layout (Fig. 11) does not show any connections to the relay inasmuch as the contacts may be connected independently of the receiver operating voltages where motors, auxiliary relays, escapements, etc. require operating voltages in excess of 1½ volt as used for the RK61 thyratron tube's filament.

The Fig. 10 sche-



12 CHASSIS LAYOUT

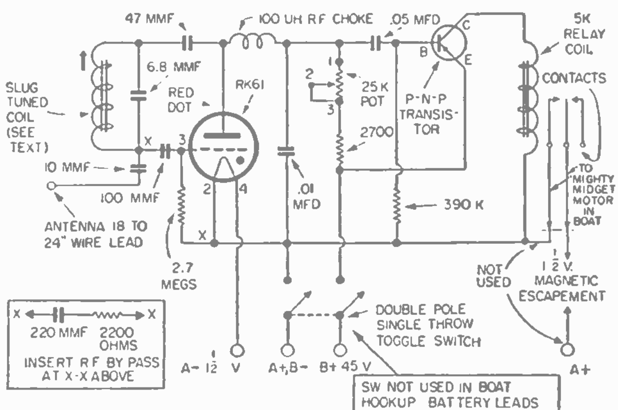
MATERIALS LIST—REMOTE CONTROL RECEIVER

1	1/16" x 2 1/8" x 3 1/2" perforated Bakelite for chassis
7	"Flea" clips for mounting tube and transistor
1	Raytheon type RK61 gas triode tube
1	P-N-P transistor any low frequency .200 mw type (such as Ck-722, etc.)
1	5K ohm (5,000) sensitive relay with single pole, double throw contacts (Lafayette Gem or Jewel)
1	slug-tuned coil form (Lafayette CTC-LSM Red Core) 1/4" dia. x 3/4" long
2	Ft #30 enameled magnet wire for winding coil
1	100 uH (microhenry) R. F. choke
1	1/2-inch fuse clip for mounting RK61 tube
2	#6 or #4 soldering lugs
2	binding head machine screws with nuts. Size: 4-40 or 4-36
1	double pole, single throw toggle switch
	Optional battery connectors (see text)
	RESISTORS
1	25K ohm (25,000) sub-miniature potentiometer
1	2700 ohm, 1/2-watt composition resistor
1	390K ohm, 1/2-watt composition resistor
1	2.7 meg., 1/2-watt composition resistor
	CAPACITORS
1	6.8 mmf midget disc ceramic capacitor
1	10 mmf midget disc ceramic capacitor
1	47 mmf midget disc ceramic capacitor
1	100 mmf midget disc ceramic capacitor
1	.01 mfd midget disc ceramic capacitor
1	.05 mfd 150 v tubular paper capacitor

The above components are available either individually or as a kit from Lafayette Radio Div., R-W-T Inc., 165-08 Liberty Ave., Jamaica 33, Long Island, N. Y.

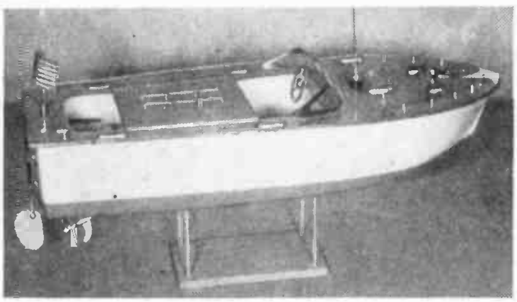
With a 1½-volt flashlight battery or larger RCA VSO69 connected into circuit along with a 45-volt pack, rotate the potentiometer shaft to maximum resistance so lug #2 arm is swung to lug #3. Have a friend close the transmitter key or push-switch. Now with plastic blade screwdriver, slowly turn in the tuning coil slug. A point should be reached where the relay is heard to click in. If not, slightly advance the 25K subminiature potentiometer and retune.

When the correct lock-in point is found, release the transmitter key. The receiver relay should also release. Repeat to see if the relay pulls in each time the transmitter key is depressed. Once coil has been tuned "on the button", run a 4-40 nut on the slug screw, turn up the ferrule screw on coil form and lock both securely. The receiver needs no further adjustment other than an occasional adjustment of the potentiometer as the B battery voltage drops off.



13 SCHEMATIC DIAGRAM

matic plan, however, shows relay wired into 1½-volt filament circuit for triggering rubber-band powered escapements used to control flight of model planes. To test your receiver at distances, insert a 1½-volt penlight bulb at arrows. Then after dark, you can determine just how effective your little radio control transmitter-receiver rig is. For receiver antenna any sort of insulated wire may be used. Length may vary from 18 to 24 inches.



Model boat can be maneuvered remotely in a tight loop, sweeping circle, zig-zag course or follow a straight line. Insert photo shows close-up of factory-built model boat which comes equipped with battery-powered, electric motor propeller drive.

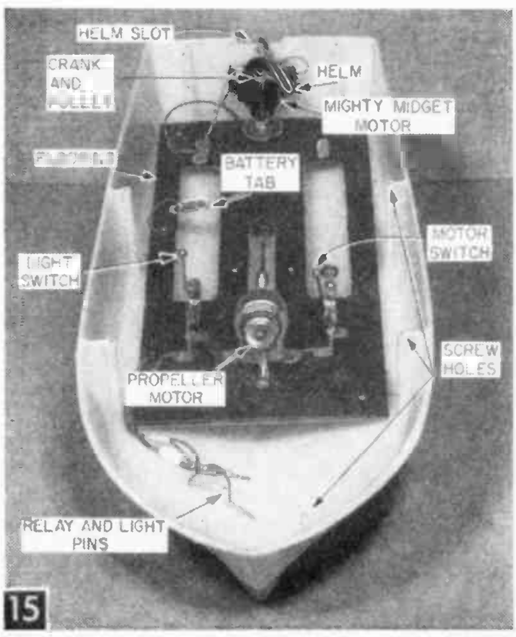
In tests following the construction and installation of the receiver in the model boat (Fig. 7), we found that the receiver acted in an erratic fashion at times. The probable cause for this is due to the circuit employing a gas-filled triode (thyratron) as detector. At the same time, the circuit employed is a super-regenerative type. This circuit is oscillating all the time and may well be creating a feedback effect so as to keep the relay energized unless the antenna is loaded up excessively.

After trying loading coils in the antenna circuit as well as varying grid bias, the solution to erratic operation and *really* stable receiver performance was obtained with a capacitor-resistor by-pass connected from the input (grid) end of the R. F. tuning coil to ground (A, B), Fig. 13.

Model Boat Control. Use an inexpensive, ready-made 16-in. model boat (see Fig. 1 and materials list), which may be purchased at your local toy store.

The boat is propelled by a single screw propeller driven by a miniature PM motor. Power is supplied by four standard D-size flashlight cells. Two hand-thrown switches turn on motor and/or running lights. Hull is plastic.

To install your radio control system, first remove the wooden deck. The hull is molded of an acetate that melts at about 350° F, and will release the drive screws if they are heated sufficiently. Place the tip of a soldering gun or heavy-duty iron on the head of each screw, and at the same time, lift up on the deck; each drive screw will spring loose from the bulkhead as it is

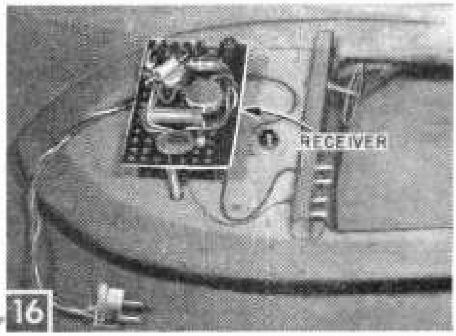


View of hull with deck removed to show location of parts and deck screw holes.

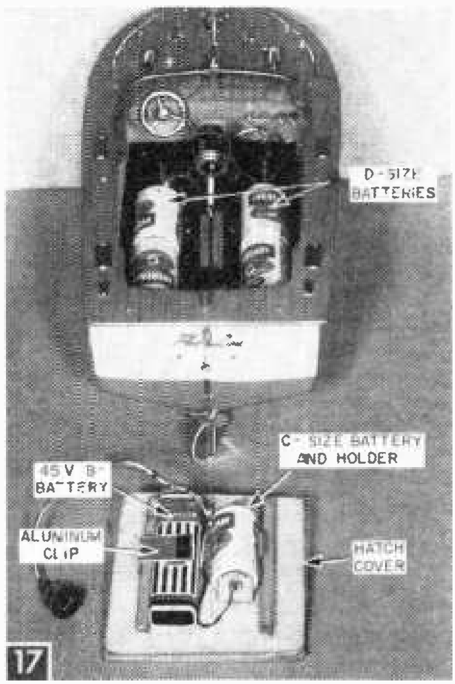
heated. Repeat the operation for all eight screws and the deck is off!

Then with a 5/64 in. twist drill inserted in a pin vise (hand chuck) clean out the bulkhead screw holes (Fig. 15), turning the pin vise by hand—do not use a power drill. The drill will go down about 3/8 in.—drill no deeper than original holes. With holes thus reamed out, the deck can be replaced with conventional #2 x 3/8 in. *rh* brass wood screws. The screws will cut their own threads into the plastic and may be inserted or removed as often as necessary. The boat flooring which carries the battery holders, and the PM motor (Fig. 15) are also secured with drive screws. Replace them with #2 *rh* wood screws in the same manner.

Now mount the radio control receiver on two 1 in. spacers with 4-40 x 1 1/8 in. *rh* machine screws to the underside of the bow deck (Fig. 16). Drill a 1/4 in. hole in the deck to clear the tuning coil adjustment screw and a 1/8 in. hole to pass the shaft of the potentiometer sensitivity control. Then drill another 1/4 in. hole just forward of the windshield for the antenna jack connector.



Remote-control radio-receiver is mounted to underside of forward deck.



Stern view of boat with inverted hatch cover in foreground to show location of batteries.

Connect the receiver battery leads (shown in Fig. 13) to the male side of a 3-pin, Amphenol miniature connector. A minus connects to Pin 1. A plus B minus connects to Pin 3 and B plus to Pin 2. Connect the female socket to the batteries which are located on the underside of the boat hatch cover (Fig. 17). The receiver A battery is the medium C size flash cell which snaps into a battery holder as used in transistor radios. The B battery is a 45 v. Burgess U-30 hearing-aid type cell. A simple clip was fashioned from a strip of aluminum to hold the B battery to the hatch cover.

The original wiring for the boat running lights was cleaned up, covered with strips of *Scotch* masking tape, and the leads terminated to clips mounted on the dash. The two normally open relay contacts were then connected to another pair of clips on the dash. The connectors used here were contacts salvaged from an old octal wafer tube socket. By drilling four 1/8 in. holes in the dash, the contacts make a press fit. Contact pins are nothing more than brass shade bracket nails to which leads are soldered. If the builder desires, the separate dash connectors may be eliminated by using a 7-pin miniature male and female connector in place of the 3-pin type shown.

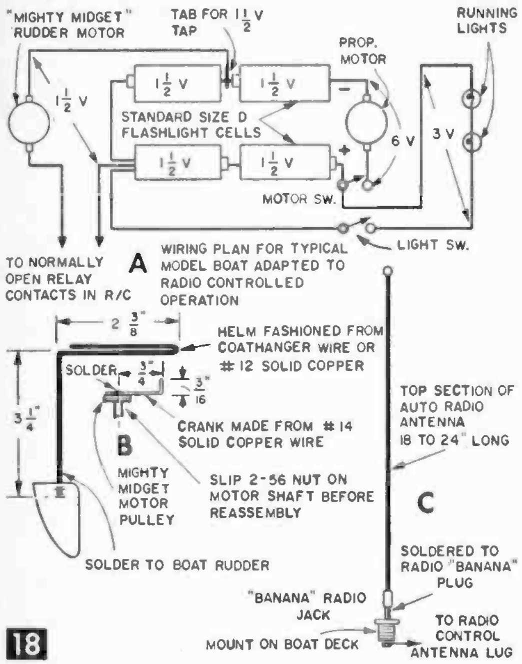
Pilot Control. While we have limited the radio control here to steer the boat, the same mechanism may be expanded to stop the motor midstream, turn on the lights. These no-cost additions can be made by the experimenter.

A conventional escapement would (if space permitted) allow the boat to be operated forward, 90° right, and 90° left. With the system used here, the turn is not fixed. The boat can operate in a tight loop, or sweeping circle, it will respond to zig-zag course, or follow a straight line. All this is accomplished by a miniature geared-down PM motor with a simple homemade eccentric helm drive.

The *Mighty Midget* motor is a British import selling for under $3. It includes a 6:1 gear reduction with a small brass pulley for normal power take-off. First loosen the set-screw securing the large gear, so that the drive shaft carrying the swaged-on pulley can be removed. Then fashion a small crank from a piece of solid bare copper wire and solder to the pulley as in Fig. 18B. Place a 2-56 machine nut on the motor shaft before reassembly so that the nut acts as a bearing and allows the pulley to clear the motor housing when operated in a vertical position.

Mount the *Mighty Midget* to the hull transom (Fig. 15) with two 2-56 x 3/8 in. brass *rh* machine screws. Drill mounting holes 1 5/16 in. apart and 1 3/32 in. from the top edge of the hull. With a file, make a slot in the transom, 1/8 in. deep and 1 in. wide to clear the helm. Before permanently mounting the motor to the transom, however, make up the helm.

The rudder on the original boat, made a snap



18

MATERIALS LIST—REMOTE CONTROL MODEL BOAT

1—Pre-built model Sports Cruiser, the "Sea Wolf" by K & O Models, Inc., 14720 Keswick St., Van Nuys, Calif. Sold by dept. and toy stores. Boat is 16" long with 7" beam. Price $9.95.

1—"Mighty Midget" 6:1 gear drive motor by Victory Industries (Surrey) Ltd., Guildford, England. Sold by Lafayette Radio, Jamaica 22, L. I., N. Y. Price $2.95.

1—45 V. hearing aid battery (Burgess U-30), B-battery connectors, 3-pin plug set, "C" flashlight battery holder also from Lafayette Radio.

2—doz. #2 x 3/8" rh brass wood screws.
Misc. electronic items as needed available from either Lafayette Radio, or Allied Radio Corp., Chicago.

fit into a socket-hole in the keel. The rudder was set to the desired angle by hand and remained so fixed until changed. For our remote control boat, the original rudder still is used but altered slightly.

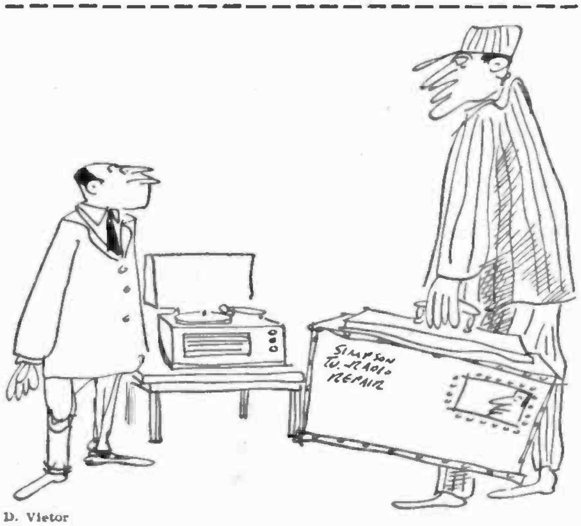
First remove it by pulling it out of the keel socket, then unsolder the short brass pin. Make the helm from a length of solid copper wire, or light coathanger wire approx. #12 gage or the diameter of a #46 twist drill. Bend the wire to the shape shown in Fig. 18B with special care given to the hairpin bend. Attach the helm to the stern with a pair of radio lugs of the type used on tie-strips. Bend the lugs at right angles so that the eyelet portion forms a bearing for the wire helm. Fasten the lugs to the stern with #2-56 x 1/4 in. *rh* machine screws. Drop the helm through the bearings, fit the rudder in place and resolder. When soldering the rudder, apply a wad of wet cleansing tissue to the helm and lower bearing to act as a heat sink so that no harm comes to the plastic hull.

The helm motor operates on voltages from 1½ to 6. However, since it is desired to have it rotate slowly, only 1½ volts are applied to it as against the full 6 volts applied to the screw motor. To accomplish this, make up a battery tap from a bit of thin brass or tin-can stock. With a 1/4 in. bolt dimple one end of the strip of metal by placing it on a block of soft wood and striking the bolt a sharp blow with a hammer. Then, with a tinsnips, cut the strip to the shape of a large soldering lug or tab. Insert it between two of the flashlight cells as shown in Fig. 18A, fitting the dimple over the brass battery cap where it will not be dislodged.

Before replacing the deck, check to see that the brass flag holder does not extend below deck and thus foul the helm action. If this little boat fitting isn't flush with the underside, file or grind off any excess. Then fasten the deck.

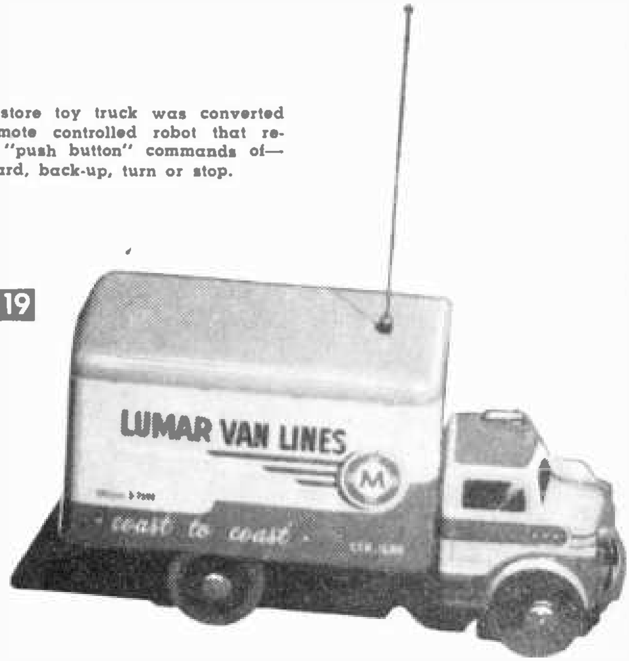
With the radio control receiver adjusted as explained earlier, and all wiring in place, your boat is ready for a dry run. Press down the operating key on the transmitter and note that the rudder runs back and forth. With a little practice, you'll be able to key the transmitter so as to swing the rudder to any position you desire. Rotate the receiver control left to right. This will allow the helm motor to run. Slowly turn the control to the point where the helm motor just stops. The receiver is now adjusted at maximum sensitivity.

Do not operate the screw motor out of water and expect the radio controlled helm motor to act normally. The full 6 volts is applied to the screw motor because of the resistance offered when



"I brought Harry along—he's our expert on portables."

This dime-store toy truck was converted into a remote controlled robot that responds to "push button" commands of— forward, back-up, turn or stop.



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the propeller is submerged in water. Out of water, the screw motor runs wild, and sets up so much vibration that it jars closed the sensitive relay contacts which start and stop the helm motor. These false pulses can make it appear that the radio control is "on the blink" when it actually is working perfectly.

To make the boat tamper-proof, no toggle switch was included in the wiring circuit. To shut off power to the receiver, disconnect the 3-pin plug. To increase the range, the A plus B minus lead from batteries may be grounded to the metal motor housing. This takes the connection directly to the water via the prop shaft.

The antenna for the radio remote controlled model boat can be any piece of stiff wire 18 to 24 in. long. Solder the end of the wire to a "banana" plug which fits the jack mounted on the deck (Fig. 18C). An excellent antenna will be found in the top wire section of an au' › radio antenna which can be picked up at any junk yard.

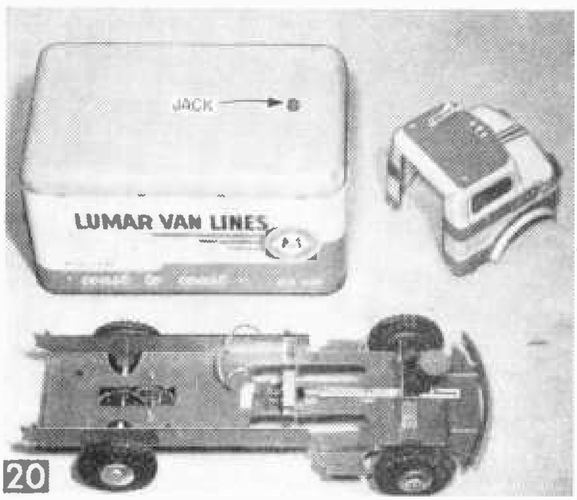
The radio control does not affect manual operation of the boat as it can always be operated manually without alterations. Set helm by turning the large helm motor gear with the fingers to whatever fixed course is desired.

Motorized Robot Truck. While we do not claim that this little radio controlled truck shown in Fig. 19 can do everything a real car can do, it comes darn close to it.

The foundation of the project is a pressed-steel toy moving van made by Louis Marx & Co., and sells for $2.95. The same chassis with a stake body is $1.95, and although we used the moving van model, we would advise the latter be used since it is lighter, thus requiring a smaller traction motor. The various mechanical motions are home-made from #16 gage aluminum or brass, while the "tricky" drive gear problem is solved by A. C. Gilbert Co., makers of *Erector*.

After obtaining the truck, remove the body and cab from the chassis (Fig. 20). As with most metal toys, these parts are secured with bent-over tabs which must be straightened out to disengage the parts. After removing the parts, press the tabs flat in a vise so that they will serve to register the location of the cab and body on the chassis for reassembly. The tabs will not be used for fastening since the cab and body will be secured with 6-32 machine screws so the parts can be removed as often as necessary.

Next, remove the wheels and axles from the



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Cab and body of toy truck are removed to permit installation of steering and drive unit on truck chassis. Radio receiver, remote controls and batteries are located in truck body.

truck by filing down the burr on the swaged end of each axle. Then lay out and cut a 2⅝ x ¾ opening in the chassis (Fig. 21) over the rear axle to clear the 9:1 ratio gear train. Cut the opening by drilling a series of holes along the layout and cutting between the holes with a chisel.

One of the truck wheels must be rigidly secured to the rear axle. Fasten by applying *Pliobond* all-purpose cement to the "headed" end of the axle for a distance of ¾ in. Also coat the inside of the wheel "bearing" with cement using a pipe cleaner for an applicator. Allow both parts to set for an hour. Then apply a second coat of Pliobond to the axle and slip the wheel in place. Now set axle and wheel aside and allow 24 hours for drying. The remaining rear wheel is allowed to turn freely for differential action as on a real car.

Fortunately, the truck axles are the same size as the bore in the Erector gears. Slip the #CJ 36-tooth, 1-9/16 in. dia. gear on the rear truck axle and lock in position with the set screw. Place the other wheel on the axle and apply a drop of solder to the hub cap. Next make the two gear brackets (Figs. 21 and 22) to support another #CJ gear and a #P-13, 12-tooth, pinion gear. Use the original front truck axle, which is to be replaced with a modified Erector steering mechanism, for the 2 in. length of shafting that is needed to support the CJ and P-13 gears on the brass brackets.

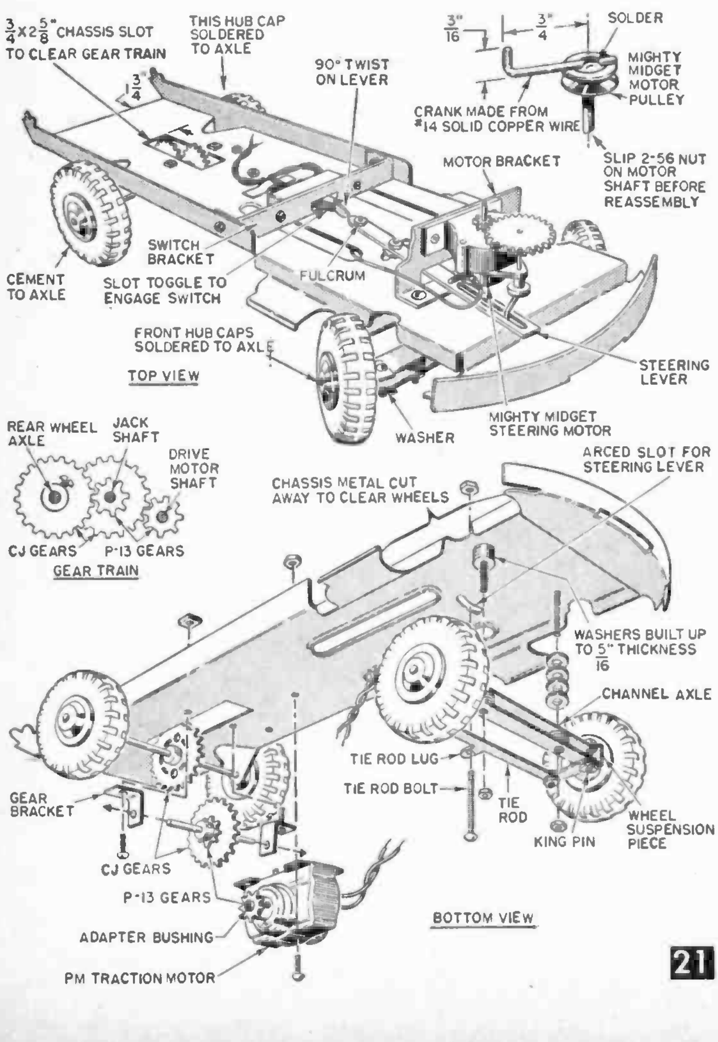
The power take-off gear (Fig. 21) is another P-13 pinion type. However, since the gear is drilled for a 5/32 in. shaft, and as all miniature PM motors come with a 3/32 in. shaft, an adaptor is required. A simple solution was found for this problem by drilling a 5/32 dia. x ⅜ in. long aluminum rivet, through the center. File one end of the rivet half way through as in Fig. 22, and slip it into the hole in the gear with the filed portion under the set screw. When tightened, the set screw will then lock up against the 3/32 in. motor shaft.

Of the several sizes of PM motors available from model supply houses, select a *heavy duty* or *super* type which will provide the necessary torque. A smaller, less powerful motor can only be used by adding an additional CJ and P-13 gear supported on brackets ahead of those that are shown in Fig. 21.

Locate mounting holes on chassis for gear-shaft bracket and motor by trial set up. Do not mesh gears too tightly or they will not turn freely. The distance from center of rear axle to the shaft supporting CJ and P-13 is 1 in. as is the distance from shaft to center of motor shaft. With gear train properly lined up, apply petroleum jelly, a light lubricant, to the gear teeth and shaft bearings. After hooking up the motor to several flashlight batteries a quick check on how your transmission functions should spur you on to the next step — the radio-controlled steering and switching system.

The front wheels of the toy truck, when purchased, do not steer. They are attached to a fixed axle the same as the rear wheels. Your first step is to cut off the fixed axle hangers from the chassis and install a functional steering mechanism. For this purpose, we were able to adapt Erector's #MI Front Axle Unit as included with their #9½ Automotive Set. It can be purchased separately for 25¢.

The axle unit measures 6 in. wide and must be cut down to 4¼ in. to fit the truck chassis used. Because this assembly



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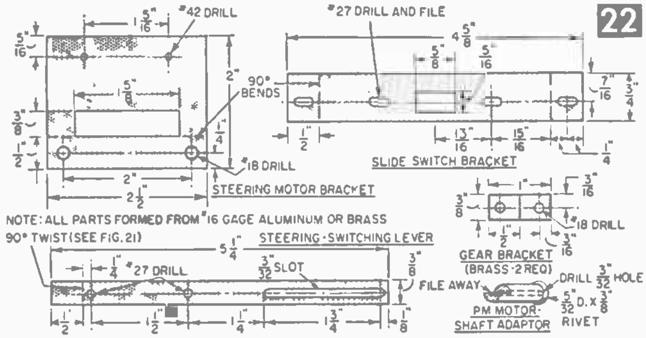

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6-32 x ¾ in. machine screws. Place washers or spacers on the screws under the axle to support it 5/16 in. away from the chassis. Insert washers or spacers ¼ in. thick inside the channel so that when the screws are tightened, the channel is not compressed.

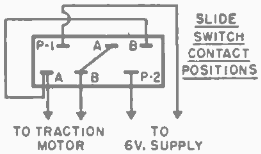
To bring the steering action to the top of the chassis cut a ¼ x ⅞ in. arced slot through the chassis centered with the hole in the tie-rod lug (Fig. 21). Then secure a 6-32 x 1½-in. machine screw to the tie-rod lug with a nut. With wheels pointed straight ahead, drill a #18 hole 1½ in. behind the steering screw in the chassis and insert a 6-32 x ½ in. screw secured with a nut. This rigid screw will serve as fulcrum for the steering lever made from a strip of aluminum as in Fig. 22. To cut the slot, first drill a series of 3/32 in. holes, then file to shape. When assembling the steering lever to the chassis, place washers on both the steering and fulcrum screws so as to support the lever ¼ in. above the chassis. Note in Fig. 21 that the portion of the lever behind the fulcrum screw is twisted 90° so as to engage a slot filed into the Bakelite switch toggle. Make the steering-motor crank as in Fig. 21 and solder to the motor pulley. Place a 2-56 nut on the motor shaft before reassembly so that the nut acts as a bearing and allows the pulley to clear the motor housing when operated in a vertical position. Mount the motor on its bracket so that the crank engages the slot in the steering lever.

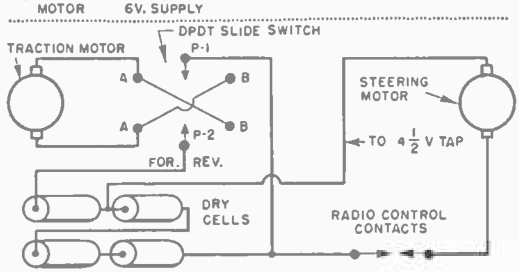
When the steering motor is energized, the crank actuates the lever causing two functions to be performed: (1) The lever moves the screw from the steering mechanism back and forth to

is loosely fitted with rivets, the latter are ground off and later reassembled with machine screws (Fig. 21). As received, the steering gear lug on the tie rod is off center to the left. The distance from the lug to the nearest tie rod end hole is 2 in. By cutting off the longer end of the tie rod and drilling a new hole, we have now placed the tie-rod lug in the exact center of the shortened tie rod. Now cut off the channel-like axle member to which kingpins and wheel suspension are mounted and drill a new kingpin hole 3⅝-in. from the outside hole at the opposite end of the axle. Finally drill a new #18 axle mounting hole ¾ in. from the kingpin hole and 2 in. from the original axle mounting hole. To provide steering clearance for the front wheels, snip off part of the chassis at the front and rear of the wheels as in Fig. 21.

The steering mechanism is now reassembled. Because the axle channel piece makes a very loose fit with the wheel suspension, shim each end with 1/16-in. thick washers to remove excess play. The kingpin screws are 8-32 x ⅝″ *rh* brass. Draw up the nuts as tight as they will go without binding. The tie rod pins are 8-32 x ⅜″ *rh* brass machine screws. After all nuts have been properly adjusted, secure them with a drop of solder so that there is no chance of their working loose from vibration.

To mount the axle assembly on the chassis, drill two #18 holes 2 in. on centers as in Fig. 21. These holes also serve for mounting the steering motor bracket (Fig. 22) which should be made at this time and assembled together with the front axle to the chassis with





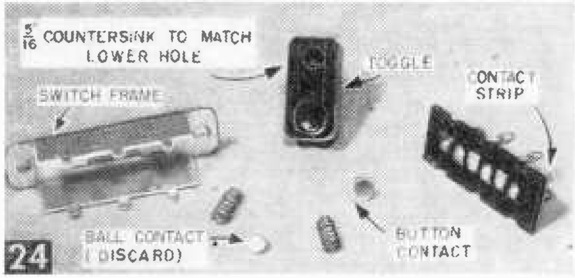
23 SCHEMATIC

MATERIALS LIST—RADIO CONTROLLED TRUCK

- 1 Pressed-steel toy truck with 10″ wheelbase (17″ overall). Made by: Louis Marx & Bro. Co., Toy Center Bldg., 200 5th Ave., New York, N. Y. Sold by toy, variety, and dept. stores everywhere.
- 1 Steering motor. "Mighty Midget" sold by Lafayette Radio, Jamaica 33, N. Y.
- 1 Traction motor. Any PM heavy duty shunt type. Sold by local model shops. Also from L. Barnett, IMP Products, 33 Union Sq., New York 3, N. Y., or Polk Models, Crafts & Hobbies, Inc., 314 5th Ave. (at 32nd St.), New York, N. Y.
- 1 Erector #MI "Front Axle Unit" price 25¢.
- 2 Erector #CJ "36-tooth Gears" price 20¢ each.
- 2 Erector #P-13 12-tooth pinion gears, price 10¢ each. Erector axle rod/shafting also available in following lengths at 1¢ per inch: 1″, 2⅞″, 4″, 5″, 7″, 10″ and 19¾″. Order Erector Parts from: Mrs. M. M. Wool, Consumer Dept. A. C. Gilbert Co., P. O. Box 1610, New Haven, Conn.
- 1 2″ x 8″ x 16 ga. sheet aluminum used for brackets can be obtained from local sheet metal shop. Brass available from local auto parts dealers or hardware store.
- 1 Double Pole—Double Throw Slide Switch from Radio Parts Suppliers. Made by: Stackpole Carbon Co., St. Marys, Penna.
- 1 5/32″ dia. x ⅜″ long aluminum rivet
- 2 8/32 x ¼″ rh brass machine screws for gear bracket
- 2 8/32 x ⅝″ rh brass machne screws for axle king pins
- 2 8/32 x ⅜″ rh brass machine screws for axle tie rod
- 2 6/32 x ¾″ rh machine screws for axle mounting
- 1 6/32 x 1½″ rh machine screw for tie-rod lug
- 2 6/32 x 1½″ rh machine screws for mounting body
- 4 6/32 x ¼″ rh machine screws for switch bracket
- 1 6/[illegible] x [illegible]″ rh machine screw for lever fulcrum
- 4 2/56 x ½″ rh machine screws for mounting motors
- 2 6/32 General Cement Co. spade screws for mounting cab

turn the wheels. This is a 2nd class lever function. (2) At the same time the lever provides 1st class duty by moving a D.P.D.T. slide switch back and forth. This switch causes the traction motor to run forward, stop, and reverse.

There are several makes of slide switches available, all of which require modification. Since some sort of snap action is provided internally, the switch must be made to slide easily. The Stackpole switch shown is probably most simple to convert. However two switches must be purchased. Lift up the tabs on the switch frame so that the contact strip may be removed. Cup your hands while doing this to hold the spring.



Performance of radio controlled truck is accomplished, in part, by modified slide switch. Stackpole D.P.D.T. has been disassembled to show parts.

As shown in Fig. 24, the Bakelite toggle contains two 5/32 in. dia. holes into which the pole tension springs are inserted. The countersunk hole accepts a button-type silver slide contact. The plain hole accepts a silver ball contact. The ball is both contact and detent causing the switch to snap into position. To remove this friction, the ball contact is replaced with another button contact and its spring taken from a similar switch. Countersink the plain hole in the Bakelite toggle, or throw, to match the other hole before replacing with button contact. With springs and button contacts positioned, reposition the contact strip on the frame, and bend down the lugs. Apply petroleum jelly to the inside surface of the switch frame before reassembling so that toggle slides easily.

Make the slide-switch bracket (Fig. 22), mount the switch on it and assemble the bracket to the chassis as in Fig. 21. Note that all bracket holes are elongated with a 1/8 in. dia. file so that when the lever engages the slot filed in the Bakelite toggle, the switch can be positioned correctly both for forward-back, and side-to-side alignment.

The hole in the end of the lever which slips over the fulcrum screw should be a close fit. The hole in which the steering screw is engaged, however, should be elongated slightly. Both the 1/8 in. round file and 1/16 x 7/16 in. flat file are most useful in dressing down any points in the mechanical linkage where binding may occur. Turn the gear on top of the Mighty Midget motor by hand and make necessary adjustments before applying power to the motor. PM motors should never be operated in a stalled or jammed condition as some parts may be ruined.

Once smooth mechanical action is obtained, turn down the 6-32 nuts so they just touch the lever. Now apply a drop of model airplane cement to the threads to lock the nuts in position. Two flashlight cells attached to the steering motor, with front wheels propped up, will allow you to see just what happens. The 6:1 geared down steering motor turns the crank which is soldered to the pulley. As the crank rotates, the lever swings the wheels and the toggle on the switch back and forth. When the wheels are turned partially or completely to the right, the auto runs forward. When the steering motor carries the wheels left, the switch reverses the traction motor causing the car to back up. At a point just off a straight wheel position, the switch disengages power to the traction motor and car stops.

Because of the rapid action of the relay contacts in the receiver, the switch can be made to pass through an undesired function simply by holding down the transmitter key until the desired sequence is reached. After a little practice, the operator can tell by noting the position of the wheels if a long or short pulse from the transmitter is needed.

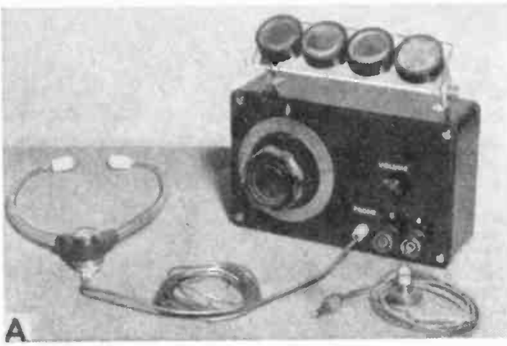
Because the reverse-forward actions take place when the wheels are in a turning position, the effect is most realistic especially when backing up the truck for a turnaround. Anything reduced to the simple workable system employed here just can't have everything. You must be content to have the car steer in tight to sweeping circles in a clock or counterclockwise direction only. The opposite turns being reserved for reverse travel. However, by eliminating the slide switch, and connecting the traction motor directly to the 6v. battery supply, the radio will then control only steering allowing the truck to move in all forward directions.

The radio receiver is installed along with battery clips inside the truck's van body with radio control receiver mounted on spacers as described for the remote controlled model boat. Drill two #18 holes in the van body and chassis (Fig. 21) for 6-32 x 1½-in. machine screws. Position the body over the chassis lugs and fasten in place with the 6-32 screws.

Two 6-32 General Cement Co. "spade screws" are attached to each side of the cab. Position the cab over the chassis so tabs engage the slots, draw up the nuts on the spade screws and the steering motor is concealed but readily accessible for service. If the tires rub against the fender skirts, file or snip away the slight amount of metal at points where tire strikes fender.

The steering-switching designs described in the article can also be used on a model car of your own choosing. Lighter cars will require less power at the steering motor. The right voltage is best determined by experiment. For example, if steering is too rapid at the 4½v. tap, move the lead down to 3v. Or if action is too slow, advance tap lead to full 6v. as used for the traction motor.

This solar powered radio, using four silicon cells, produces about as good a volume as a similar circuit powered by 10 selenium cells. Inset A shows radio with two of the different types of magnetic, 2000 ohm earphones you can use with it. Or you can power radio with a mercury cell and convert it to loud-speaker operation.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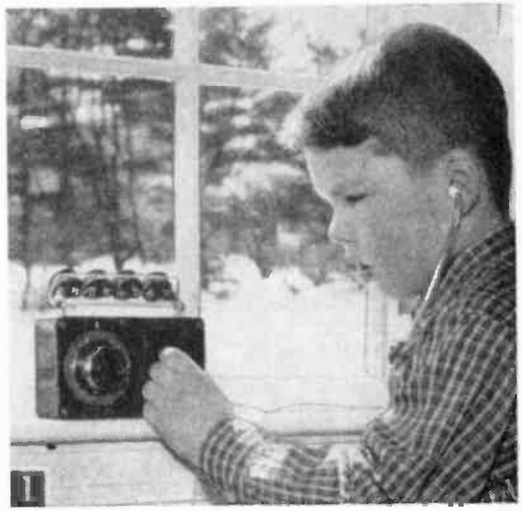

1

Silicon Solar Cells Power Transistorized Radio

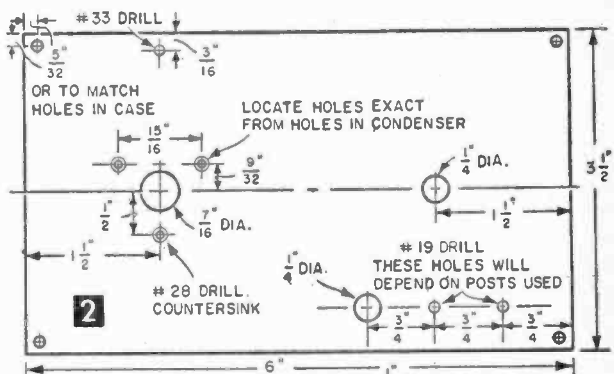
Silicon solar cells are now available at a price many experimenters can afford. And here's a first-class project using them

THE solar-powered 108.03 megacycle transmitter in our orbiting Vanguard satellite is expected to operate long after a companion transmitter, powered by mercury cells, has quit.

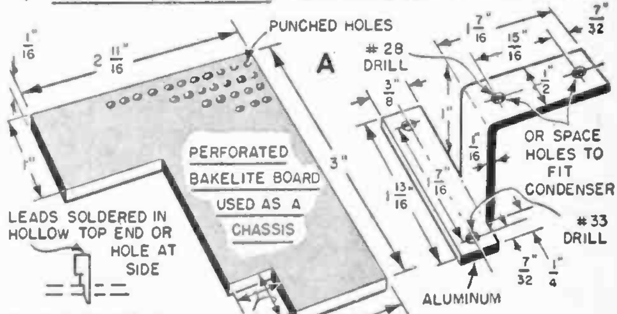
That's the nice thing about tapping the sun's power—not only will your equipment operate cheaply for a long time but you also minimize maintenance and replacement problems.

The solar battery cells used in the Vanguard's 108.03 megacycle transmitter are silicon cells, and this transistorized radio (Fig. 4) uses four silicon cells. As you probably know, these silicon cells are much more efficient than selenium cells. Silicon cells keep their voltage up under load and generally provide greater electrical energy from a given number of cells, so that fewer cells are required to perform a given task. Up until recently, however, the cost of the more efficient *silicon* cells was so high relatively few experimenters could afford to use them to power small radios or motors. Now they can.

For this sun-power radio project, four silicon cells are utilized, connected *in series* to obtain the maximum voltage. Since the current requirement for tran-



FRONT PANEL HOLE LAYOUT - MATERIAL 1/8" BLACK BAKELITE



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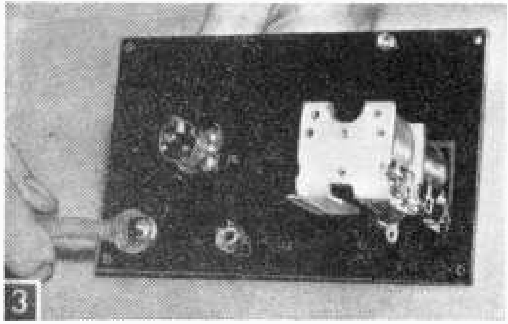
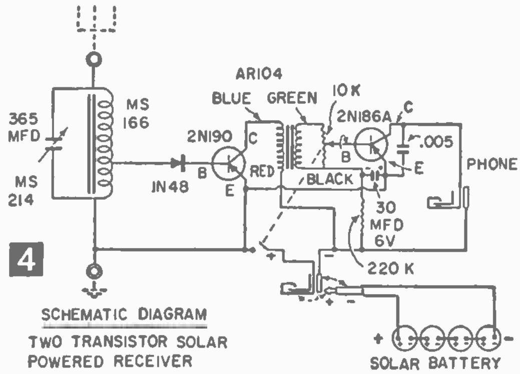
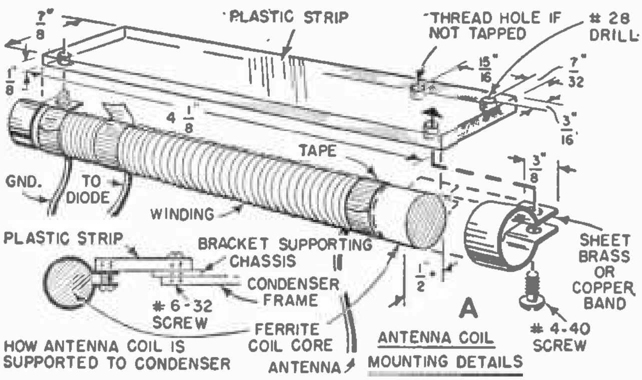
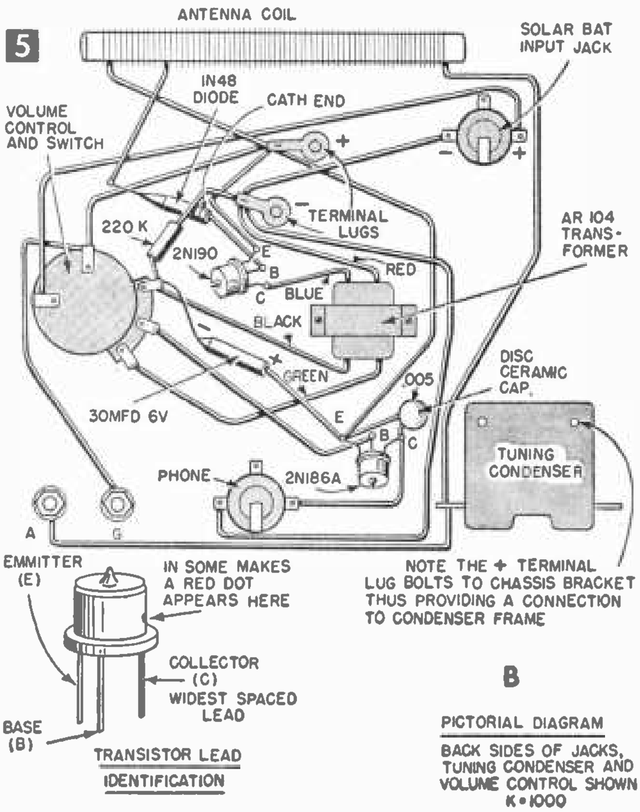


Parts attached to front Bakelite panel.







sistors is small, the current delivered from such a series circuit will be more than enough. Bright sunlight will produce 50 milliamperes or more current, and 1.5 or slightly more volts.

Using sunlight, we obtained good reception from four local (Boston area) stations, with satisfactory selectivity. Playing a 100-150 watt lamp bulb on the solar cells will also operate this radio, though with reduced volume, of course.

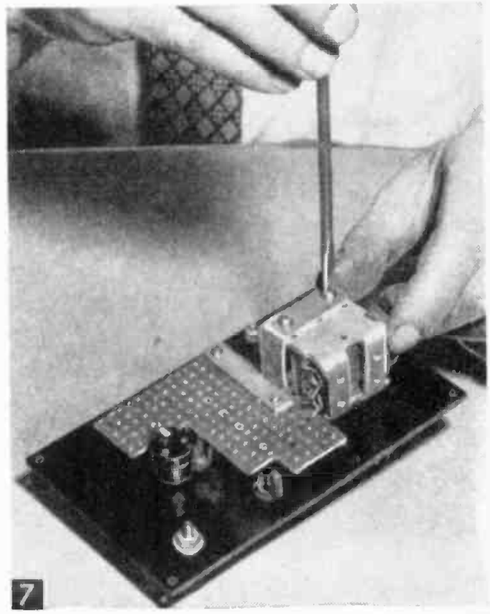
The radio (Figs. 5 and 6) uses two transistors, which is about the maximum number that can be powered with 1.5 volts and still get acceptable earphone volume. The circuit is of the common emitter type and if you do not want to use solar cells, you can use a dry cell (1.5 to 3 volts) and have yourself a useful little earphone radio. For earphones you can use a regular headset of 2,000 ohms or higher rating or single ear or binaural magnetic type of same rating.

You can also use a 4-volt mercury battery and get strong local stations to come in with sufficient volume to operate a loudspeaker. To do this, use an output transformer, plugged into the phone jack with short leads and a speaker with 3-4 ohms voice coil. You can mount the transformer to the speaker frame and house it in a small baffle or enclosure with the speaker. Use a miniature type output transformer which matches the impedances of the output transistor and the voice coil.

A short antenna or perhaps 15 to 25 ft. of wire from the antenna post, with a ground to a radiator or water pipe, gives the best results. But just connecting the antenna post to the finger stop on a dial phone provides excellent reception. You can also connect a clip lead from the antenna post, with no ground, to the wire

MATERIALS LIST—SILICON CELL SOLAR RADIO

No.	Description
1	Bakelite meter case, 6¼ x 3¾ x 2" (MS-216)
1	miniature single-gang 365 mmfd. tuning condenser (MS-214)
1	volume control with switch, miniature type, 10,000 ohms (VC-28)
1	miniature knob for ⅛" shaft (MS-185)
2	subminiature jacks (MS-282)
2	subminiature plugs (MS-281)
2	binding posts for bared wires or banana plugs, Black, Smith PJ21
1	antenna coil with ½" ferrite core (MS-166)
1	transformer for transistor circuits (AR-104)
1	electrolytic capacitor 30 mfd. 6 volt, miniature type (CF-104)
1	G.E. diode 1N48. Can use other types such as 1N34
1	G.E. 2N190 transistor (or try 2N107, CK721, CK722)
1	G.E. transistor 2N186A
1	package of flea clips (MS-263)
2	small solder lugs for #6 screw
1 pc	perforated Bakelite board (MS-304)
1	½ watt resistor, 220,000 ohm
1	ceramic capacitor, .005 disc type
	The above material can be purchased from Lafayette Radio, 165-08 Liberty Avenue, Jamaica 33, N. Y.
1	tuning knob with dial 180 degrees 0-100. ICA 2¾" dia. Type 2171. Could also use at lower cost a pointer knob 1¼" #55H 074 and a Croname dial plate Type 569 0-100 #55H 140.
4	International Rectifier silicon cells Type SA5-M. Could also use lower cost Type SA5-PL (unmounted) and cement (Pliobond) them to plastic mounting strip and make lead connections.
	The above materials can be purchased from Allied Radio, 100 N. Western Avenue, Chicago 80, Ill.
	Miscellaneous
1 pc	clear plastic or Bakelite ⅛ x 4⅛ x ⅞" (antenna coil mounting strip)
1 pc	aluminum about 1/16 thick x 2 x 3" (chassis support bracket)
1 pc	black Bakelite ⅛ x 6 x 3½" (front panel)
1 pc	soft brass or copper about .025 x ⅜ x 4" (antenna coil clamps)
1 pc	clear plastic or Bakelite ⅛ x 1½ x 5" (solar cell strip)
1 pc	aluminum about 1/16 thick x 9/16 x 4" (solar battery brackets)
	Miscellaneous screws, nuts, hook-up wire, solder, etc.



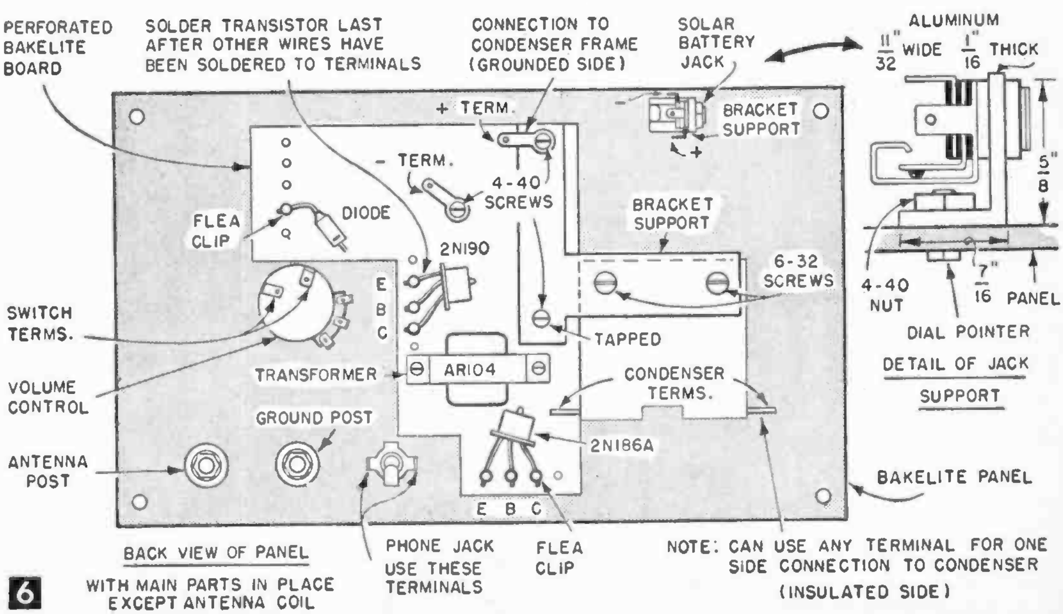
7

Attaching bracket to condenser. Note perforated sheet in foreground, to which bracket has already been attached.

frame of a lampshade, or with about three or four turns of insulated wire around several metal slats of a venetian blind; the radio signals will be picked up inductively from the blind slats. Connecting the antenna post of the radio to a ground sometimes works quite well in picking up signals.

Start construction by drilling holes (Fig. 2) and fitting the components to the front panel (Figs. 3 and 6) which has been cut from ⅛-in. black Bakelite to neatly fit in the recess of the meter case. Attach the tuning condenser with short 6-32 flathead screws, making sure these screws are *not* so long that they project through the condenser frame and strike the movable plates.

Note in Fig. 2A the bracket which is bent up from 1/16-in. or 3/32-in. aluminum; this bracket supports a piece of perforated Bakelite (Fig. 2A) which serves as a "chassis," to the frame of the



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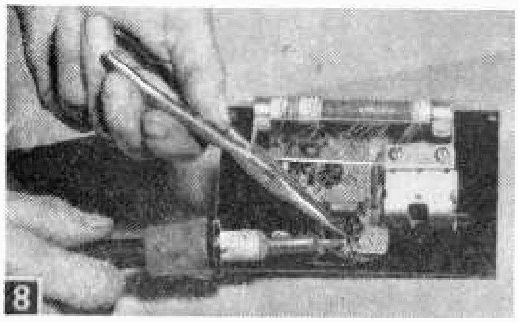
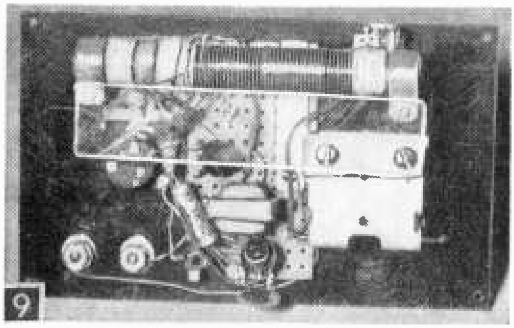


Note mounting of antenna coil at top. At bottom, how to hold transistor leads with long-nose pliers to conduct heat away from transistors when soldering.

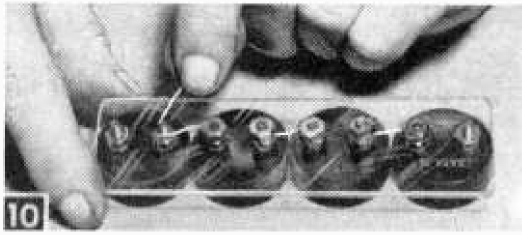


Note ground binding post added at lower left and solar battery jack added just above antenna coil (also see Fig. 6).

condenser. Attach the bracket to the perforated Bakelite with two screws in tapped holes. The other end of the bracket has drilled holes that match up with holes in the condenser (Fig. 7). You can tap the condenser holes for machine screws if they do not come already tapped. Make sure that all screws turning into a condenser frame do not protrude through enough to touch the rotating section.

The antenna coil (Fig. 5) has a large (about ½-in.) diameter ferrite rod, over which the coil comes wound. Of three leads provided, the center one, near one end, is the *tap* and the other two are the *start* and *finish*. To mount the coil, bend up two clamps from thin sheet brass which go around the ends of the core tightly when the ends of the clamp come together (Fig. 5A). Cut a strip of ⅛-in. thick plastic for a base and attach the coil with the clamps to this piece using 4-40 screws and nuts. The coil should come along one edge of the strip as in Fig. 5. Next, secure strip, together with chassis bracket, to the condenser frame with the same screws (Fig. 9). Although this simple method of supporting the perforated Bakelite is rigid enough for use, when applying pressure as you would when you press in the flea clips, place a thin piece of wood under it as a support.

Mount the inter-stage transformer to the Bakelite perforated with two 4-40 screws in tapped holes. Then press the tiny flea clips in the holes at the points indicated in Fig. 6 as wire terminals.



Four silicon cells are mounted to a strip of plastic and connected in series (plus to minus) with bare, tinned copper wire.

Also at the two other points shown, flea clips are used for the connection of the transistor leads. Connect a solder terminal under one of the screws in the condenser bracket as a common plus terminal for a group of wires and attach a second solder terminal to the perforated board with a 4-40 screw for the common minus terminal.

Connect the switch on the end of the volume control in series with the plus side going to the solar battery jack. Use #28 plastic insulated Alpha sub-miniature wire (obtainable in electronic parts stores in a small 30 foot spool) and solder all terminals with rosen-core solder. Cut off the transistor leads to about ½-in. length for convenient connections, and then use long-nosed pliers (Fig. 8) when soldering the connecting wires to the terminals to help conduct damaging heat away from the transistor. Be sure you identify the collector lead at the transistor; this is the one widest spaced from the others (Fig. 5B). Also examine the jacks carefully to locate the two out of the three provided which you will actually use.

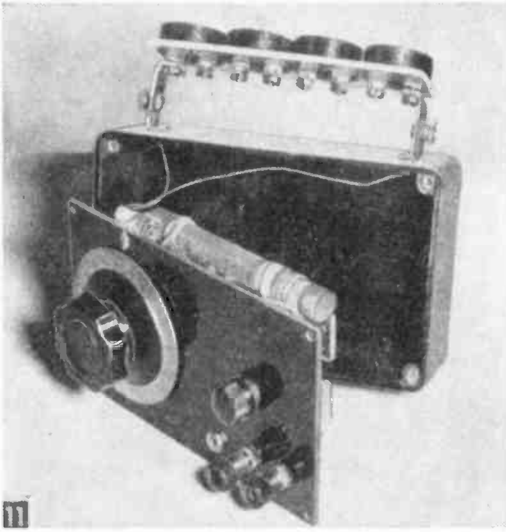
While doing the wiring, remove one screw in the antenna strip and swing the strip away a bit to allow better access to the parts underneath. Note in Fig. 4 that a wire runs from the negative common terminal to the jack where the solar battery connects. A second wire runs from one side of the switch to the jack and a wire connects the other side of the switch to the positive common terminal. Take care to get this polarity correct all the way through to the solar battery.

The jack connecting the solar battery is supported in a small aluminum angle bracket attached under the nut holding the pointer at the top of the tuning dial (Figs. 6 and 9).

Because the drilled and tapped holes provided at the corners of the Bakelite meter case are rather large for good appearance in attaching the panel, I drilled them deeper with a 43 drill and tapped for 4-40 screws.

Testing the Circuit. With a 1½ volt penlight cell plugged into the solar battery jack (take care to get the correct polarity), connect a short antenna to the antenna post and a ground wire to the post which has been added (Fig. 9). Plug in the earphone. You should be able to pick up some stations by rotating the tuning dial and adjusting the volume.

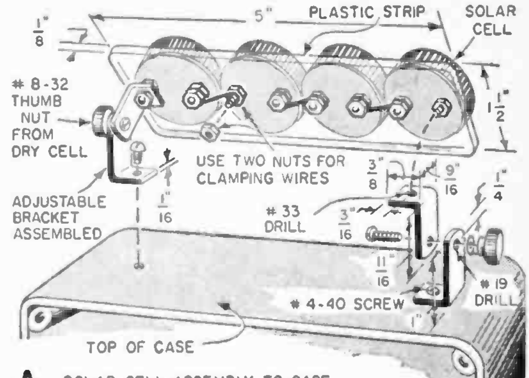
Assembling the Solar Battery. Arrange the four silicon solar cells along a strip of ⅛-in. plas-



11

Solar battery mounted to case with brackets shown in detail A. Short wires connect from bracket attaching nuts to plug which fits into miniature jack shown in Fig. 6 Brackets carry current from solar cells down to circuit.

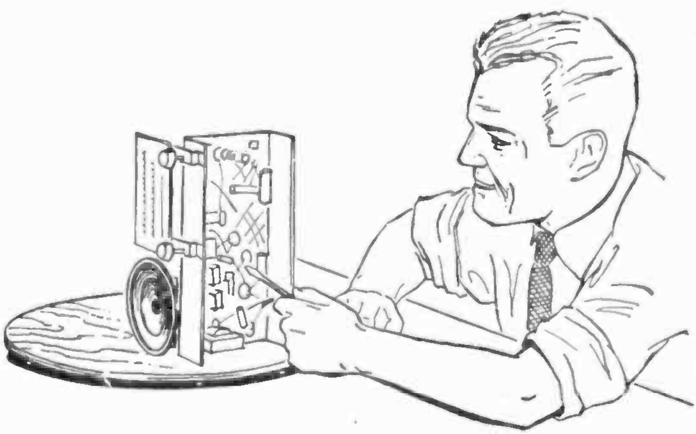
tic, drilling holes as required to clear the mounting studs (Fig. 10). Connect the plus and minus posts as in Fig. 4 to form a series group, using bare, tinned #24 copper wire. There will be a *plus* and a *minus* post left over; attach to the bracket pieces shown in Fig. 11. Then attach the

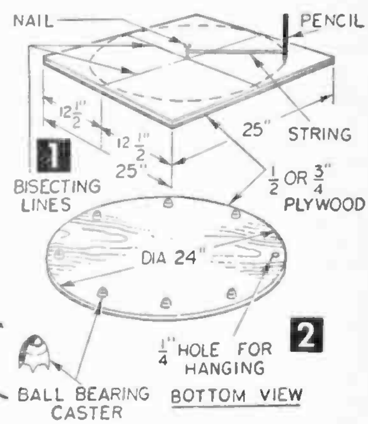


A SOLAR CELL ASSEMBLY TO CASE

shorter pieces of the brackets to the top of the case with 4-40 screws. Use 8-32 screws and thumb nuts (from an old dry cell) at the brackets for adjusting them. Make sure the plus (positive) side of the battery is connected through the proper jack terminal to the *plus* side of the circuit or to one of the switch terminals and the *minus* (negative) side goes to the common negative terminal strip. Once properly connected, the plug will go in the jack and make these connections correctly at all times.

Finally, add some neat lettering to the panel (Fig. 1A) using decals sold by electronic supply houses. Coat lettering with thin lacquer or transparent plastic for protection.—HAROLD P. STRAND.





Workbench Chassis Turntable

YOU can save time when working on radio-TV or electrical appliances by building a turntable that will rotate to keep the work always within easy reach without having to lift and move it. To make such a turntable, take a piece of ½ in. or ¾ in. plywood about 25 in. square and locate the exact center by scribing two bisecting lines in from the edges. With center located, drive a small nail partly in where the lines cross (see Fig. 1), and attach a string to a pencil, tieing the opposite end to the nail. Then, holding the string tight, scribe a circle.

Jigsaw out the disk and drive eight ballbearing casters into the bottom of the disk about 2 in. in from the edge, spaced approximately equidistant from each other (see Fig. 2). Drill a ¼ in. hole near one edge of the turntable so that it can be hung on a nail driven in the shop wall when not in use.—J. A. C.


1

Speaker cabinet is of the free-standing type. It can be used in a corner or against a wall.

Hi-Fi Speaker Cabinet

Engineered to Please the Ear

By R. J. DeCRISTOFORO

IN THEIR search for the ultimate in sound reproduction—a laboratory reference standard reproducer—the Jensen engineering staff designed this speaker cabinet (Fig. 1) to house their own KT-31 Imperial 3-way, speaker system kit. Although the KT-31 kit and the speaker cabinet are a perfect match for true high fidelity that will delight the most exacting audiophile, design of the cabinet is such that any good quality 15-inch co-axial speaker may be installed.

It is well to point out right now, so you'll know before beginning construction, that the cabinet should be inverted if a G-610 Triaxial or a 15-inch co-axial speaker is to be installed. This places the systems closer to ear level. In this case it is recommended that part No. 2 which is now the top of the cabinet, be doubled in thickness to add strength when it is used as a base. This addition will not change the dimensions of other parts except those three trim pieces which border the front and side edges.

Construction is not difficult although it is not as easy to build as a simple bass-reflex. To simplify things we've eliminated confusing dimensions from the drawings and numbered the parts so that you can cut them exactly as called for in the materials list. With a few exceptions, where trimming to fit will mean tighter joints and therefore better appearance, the dimensions called for are exact.


2

Balance controls on side of cabinet permits adjustment of speaker to room in which it is placed.

Use ¾ in. thick fir plywood throughout except where solid material is called for. Remember that the prime requisite of any speaker enclosure is rigidity, so all joints must be tight and firm. Use screws where called for but be sure to drill shank and lead holes. Joints should also be airtight so don't spare the glue and don't wipe off excess as you normally would except where such "squeezings out" would show on the outside of the cabinet. Use a non-drying caulking compound on the inside of the structure to further seal the joints. It's best to do this as you go along before some joints become inaccessible due to added parts.

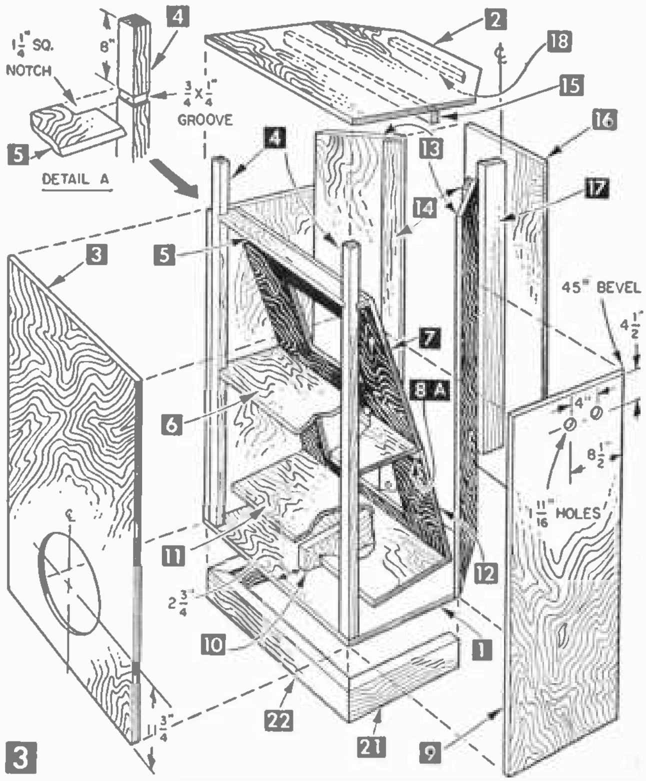
Coat all inside parts with shellac to prevent moisture absorption which could lead to warping and splitting of the wood. No absorption material (specified in some plans) is necessary or desirable in a horn-type enclosure such as this.

Cabinet Construction. Start by laying out and cutting the bottom and top pieces (#1 and #2, Fig. 4) to size and shape. Then cut the front panel (#3) to size and lay out the 13¼ in. dia. speaker opening in the center of the panel 11¾ in. up from the bottom edge.

Since the panel is too large to saw the circular opening for the speaker on a jigsaw, use a compass saw, or portable jigsaw. File the edges evenly and sand smoothly.

Your next step is to make the two posts (#4) from solid material such as a clear piece of 2 x 4 in. stock. Cut grooves in each post on two adjacent sides ¼ in. deep x ¾ in. wide at a point 8 in. down from the top end (A in Fig. 3). The grooves could be cut by hand with saw and chisel but a dado assembly on a table saw will assure uniformity of cuts and go faster. Be sure the 8 in. dimension is exact, because the top of the groove must line up with the top edge of the front panel.

Attach the posts to the back of the front panel with glue and #8 x 1½ in. *fh* screws spaced 5 in. apart. Set each post in ¾ in. from the sides of the panel and ¾ in. up from the bottom edge, so that the sides and bottom of the speaker will be flush with the edges of the front panel.



3

Add the bottom (#1) to the front panel (#3) next, bracing it temporarily so it will be at right angles to the front. Fasten with glue and 8d finishing nails spaced 4 in. apart. Also drive one nail up through the bottom into each post. The base, made up of parts #21 and #22 is optional and may be added at this time if desired. After cutting the compartment top (#5 in Fig. 3), make a 1¼ in. square notch at each front corner (A in Fig. 3), so the board will fit in the grooves cut in the posts, and bevel the rear edge 20°. Apply glue to the grooves in both posts and along the front edge of compartment top and put it in position. Use 8d nails to draw it up tight.

At this point apply caulking compound to the inside corners of the cabinet along each post, in the corner made by the base and front and in the corner formed by the front and compartment top. Follow this procedure as you go along to be sure of air tight construction.

Cut the center shelf (#6), and notch the two front corners as you did for #5. Like #5, the rear edge is also beveled 20°. A cleat (#8, Fig. 4) is cut to size and attached to the front edge of the center shelf with glue and #8 x 1½ *fh* screws. Then drive screws through the cleat into the front panel (Fig. 5) to hold the center shelf in position. The distance between #5 and the center shelf (#6) should be 20¾ in. Use temporary braces to keep the center shelf square to the front. Cut the upper compartment back and bevel both top and bottom edges so it will mate exactly with the bevel cuts on the parts it will attach to. Before adding this to the assembly, cut a 12 in. square opening exactly in its center. Then fasten #7 to the cabinet with glue and 6d finishing nails.

Start assembling the lower speaker compartment by cutting #10 to size. This is 12³⁄₁₆ in. long, 4 in. wide at one end and tapers to 2¾ in. wide at the other. Attach to the bottom as in Figs. 3 and 4, centered and 2¾ in. in from the front panel. Use glue and four #6 x 1½ in. *fh* screws, driven up through the bottom. Part #10 supports the bottom shelf (#11) at the proper angle. Cut a 6° bevel along the back edge of #11 and attach it to the support using glue and three #6 x 1½ in. *fh* screws. Cut the cleat #8A with a 12° bevel along one edge and attach along the rear bottom edge of the center shelf as in Fig. 4.

To add rigidity to the structure at this stage of the assembly, it's best to add the left side. Bevel the back edges of each side (#9) 45° so they will be flush with #13, Fig. 4, which will be added later.

To add the side (#9), lay the cabinet on its side and coat all contacting edges with glue. Then put the side in place and secure with 8d finishing nails spaced 4 in. apart (Fig. 7).

Make the lower compartment back #12 next and cut a 12 x 17 in. access opening in its center. Glue and nail to the back edge of the bottom shelf and to the cleat on the underside of the center shelf.

Now lay the cabinet on the installed side and

MATERIALS LIST—HI-FI SPEAKER CABINET

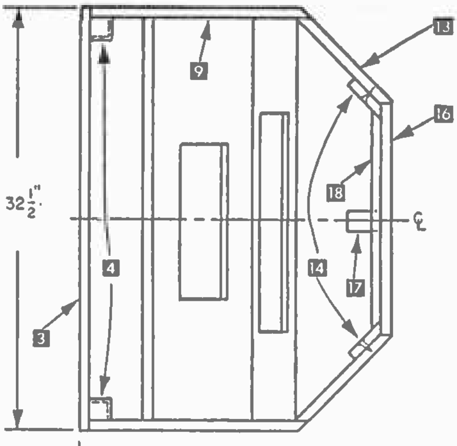
All dimensions in inches

No.	Part	No. Req.	Size	Material
1	bottom	1	¾ x 22½ x 31	fir plywood
2	top	1	¾ x 24 x 32½	fir plywood
3	front	1	¾ x 32½ x 41¼	fir plywood
4	post	2	1½ x 1½ x 48½	straight grain fir
5	compartment top	1	¾ x 4⅜ x 31	fir plywood
6	center shelf	1	¾ x 11¾ x 31	fir plywood
7	compartment back	1	¾ x 23⅛ x 31	fir plywood
8	cleat	1	1 x 1 x 28	straight grain fir
8A	cleat	1	1 x 1 x 31	straight grain fir
9	side	2	¾ x 16¾ x 41¼	fir plywood
10	support	1	¾ x 4 x 12 5/16	fir plywood
11	lower shelf	1	¾ x 12 5/16 x 31	fir plywood
12	lower compartment back	1	¾ x 15½ x 31	fir plywood
13	corner side panels	2	¾ x 11⅝ x 49¼	fir plywood
14	cleats	2	1 x 3 x 48½	straight grain fir
15	stiffener	1	1½ x 2½ x 29	straight grain fir
16	back	1	¾ x 17½ x 49¼	fir plywood
17	stiffener	1	1½ x 2½ x 40	straight grain fir
18	cleat	1	1 x 1 x 19	straight grain fir
19	upper compartment door	1	¾ x 14 x 14	fir plywood
20	lower compartment door	1	¾ x 14 x 19	fir plywood
	upper and lower compartment doors are not shown on construction drawings			
21	base side	2	2 x 4 x 16¾	straight grain fir
22	base front	1	2 x 4 x 31	straight grain fir
	parts #21 and #22 are optional and required only if base is desired			
23	filler	2	¾ x 2¼ x 8	fir plywood
24	filler	2	¾ x 1½ x 8	fir plywood
25	filler	2	¾ x 1 x 8	fir plywood
26	front trim	2	¾ x 2¼ x 50	clear pine
27	front trim	2	¾ x 2¼ x 33	clear pine
28	front trim	1	¾ x ¾ x 33	clear pine
29	side trim	4	¼ x ¾ x 9½	clear pine
30	side trim	4	¼ x ¾ x 17	clear pine
		2	#10 x 2" fh screws	
		63	#8 x 1½" fh screws	
		24	#8 x 1½" rh screws	
		3	#6 x 1½" fh screws	
		2 yds	grille cloth (36" wide)	
		1 pt	polyvinyl resin glue (white glue)	
			small tube caulking compound (M-D is good brand and available in most hardware stores)	
		1 lb.	8d finishing nails (2½")	
		1 lb.	6d finishing nails (2")	
			small box ⅝" x 18 brads	
			¼" tacks or staples for grille cloth	

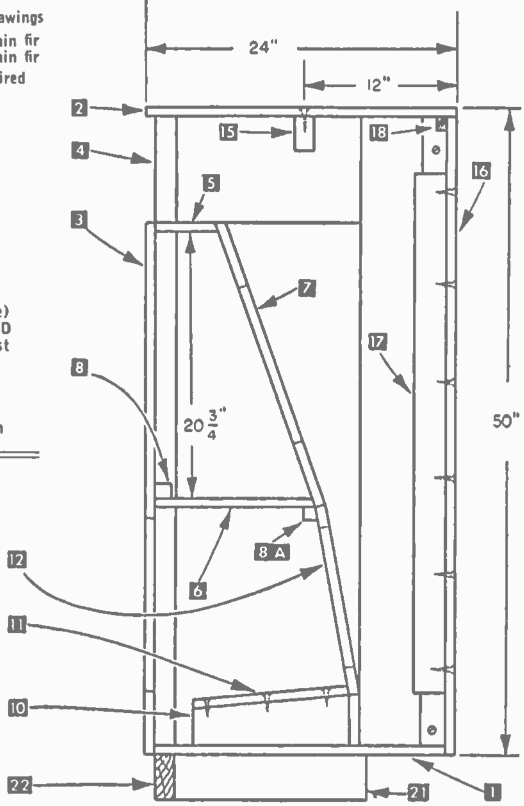
add the second side following the same procedure outlined for the first. If speaker used has H-F and M-F balance controls (Fig. 2), bore the two holes shown in Fig. 3 for H-F and M-F balance controls. Make parts #19 and #20, which cover the access opening in both upper and lower compartments and temporarily attach with #8 x 1¼ in. long screws spaced 4 in. apart (Fig. 6).

Both corner side panels (#13) can be added now. Bevel each one along both vertical edges 45° (Fig. 4), and attach with glue and 8d nails driven through into the base and edge of the sides. Make cleats #14 and #18 and attach parts #14 to the side panels as in Fig. 4 using glue and #8 x 1¼ in. *fh* screws. These cleats form a rabbet into which the back of the cabinet can be recessed.

Before adding the top (#2) attach the stiffening member (#15 in Fig. 3) using five #8 x 1½ in. *fh* screws. Then attach the top by using plenty of glue on all mating surfaces and driving in 8d finishing nails spaced 3 to 4 in. apart. Use one #10 x 2 in. *fh* screw through the top down into each post. Add cleat #18 and the cabinet is ready for the back (#16). After cutting the back to

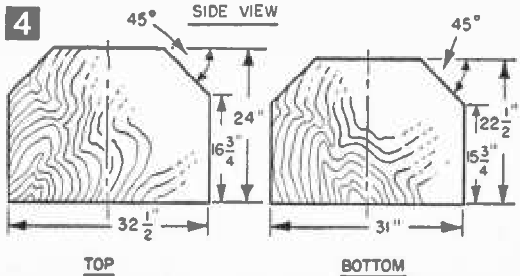


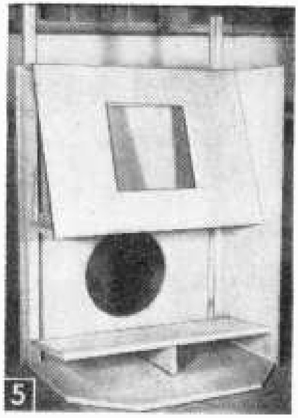
TOP VIEW

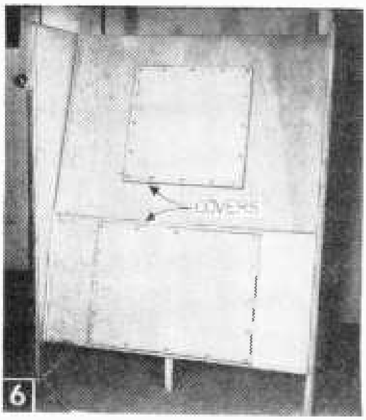


SIDE VIEW

4







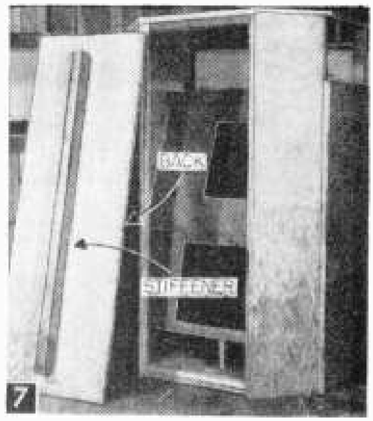
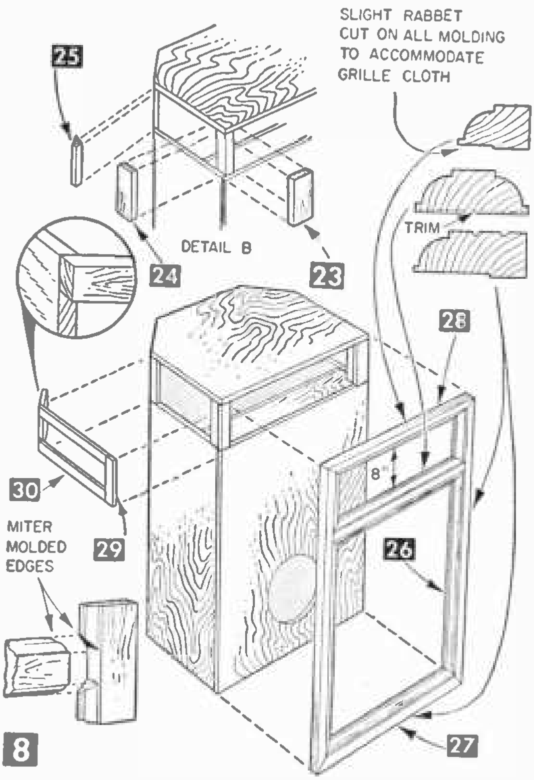


Fig. 5. Rear view of cabinet showing left side in place. Fig. 6. Access openings in upper and lower compartments are covered with pieces of ¾ in. plywood. Fig. 7. Rear view of cabinet with back removed to show stiffener fastened to center of back.

size, stiffen it by fastening part #17 to the center of the back (Fig. 3) with glue and six #8 x 1½ in. *fh* screws. Attach the back, which must be removable, with 24 #8 x 1½ in. *rh* screws and washers.

At this point, basic construction is complete and all permanent nail and screw heads should be sunk below the surface of the wood and puttied over. Examine exposed plywood edges carefully and if any holes show, fill with putty. You can sand now to make the surfaces smooth, but contrary to usual procedure (if you desire the antique white finish shown on the original), you don't have to be extremely careful with sanding because some slight imperfections will actually add to the appearance of the finish.

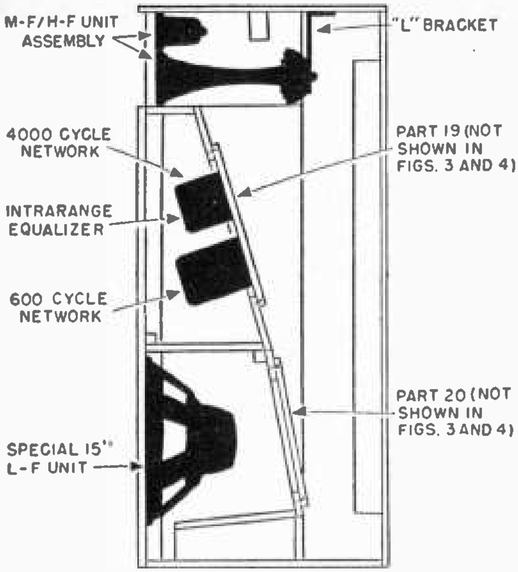


Before attaching the grille cloth to the front panel, add the filler blocks (parts #23, #24, and #25—B in Fig. 8), to bring these recessed areas flush with the surfaces of the cabinet. Attach blocks with glue and 6d finishing nails. Staple the grille cloth so that about 1 in. of bare wood shows around all edges. (Fig. 10) so the molding can be attached. The grille cloth, on the front, runs from top to bottom of the cabinet. Cut smaller pieces to cover the openings on the sides.

Figure 8 shows how the molding is applied. These can be decorative moldings that you can purchase from your lumber dealer or you can make your own with a molding head or shaper. Another method, and one which we used, is to attach blank strips to the cabinet and add the shapes with a portable router. In any case, attach the molding strips on the front with glue and 6d finishing nails, and the strips on the sides with small brads. Sink all nails under the surface of the wood and fill the holes with wood putty.

Finishing. If you prefer the antique finish shown apply a clear resin sealer to all wood surfaces and let dry. Then brush on a full application of flat-finish, white undercoat. After the undercoat dries, make an antique glaze by mixing equal parts of turpentine and glazing liquid and tinting it to the tone desired. Umbers (colors in oil) may be used to tint or you can use a stain. We found that walnut stain gave a good tone. Wipe the glaze on with a cloth, being sure that it piles up in the corners. How you apply the glaze has much to do with the final appearance.

It's best to practice on scrap wood both to establish the best wiping stroke and the most appealing tint. Some leeway is possible by letting the glaze set awhile and then wiping again with a cloth that has been dampened with turpentine. Let the glaze dry thoroughly, then finish with two coats of satin-finish varnish, then wax.

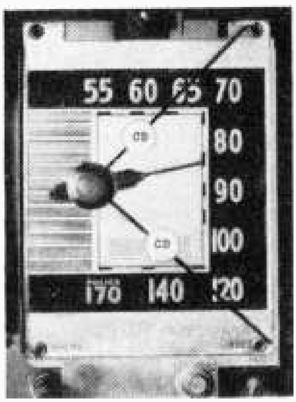


9 INSTALLATION OF JENSEN KT-31 IMPERIAL 3-WAY SPEAKER-SYSTEM KIT

Installing Units. Any speaker you buy will contain specific instructions relating to installation of that particular unit. You'll find the back opening and access openings in the cabinet are ample for installation of any 15 in. speaker. When divided systems such as the Jensen KT-31 Imperial (Fig. 9) are installed, the woofer is placed in the lower compartment, the cross-over networks in the upper compartment and the tweeters behind the opening at the top of the cabinet.

Balance controls (Fig. 2), are set in the holes provided for them and are adjusted following the instructions provided with the speaker system. In general, follow these instructions. Pencil an outlining circle around the speaker cutout which will be visible after the speaker is put in position. This will make centering the speaker a simple matter. When tightening the screws that attach the speaker, take up on each an equal amount to prevent distortion of the speaker frame. When drilling holes in the compartment backs for connecting wires (wires that go from cross-over networks to controls, etc.) make them only as large as needed and caulk all these holes with strips of felt after the wires have been passed through. Connect the speaker to your Hi-Fi amplifier and you're ready for the ultimate in sound reproduction.

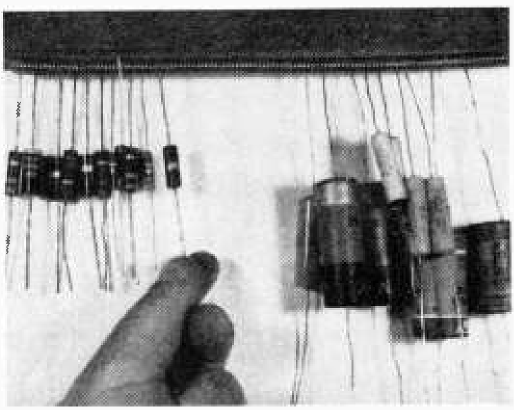
Marking Your Radio for CD Bands



• In the event of an enemy attack on the U. S., the only radio broadcasts will be made by Civil Defense on a frequency of 640 or 1240 kc. To mark your radio now for pinpoint emergency tuning, first remove the knobs and chassis-holding screws and slide chassis out of cabinet, being careful not to ground an *ac-dc* chassis. Using a signal generator, mark the 640 and 1240 kc spots on the dial with a sharp-pointed pencil. Pull the line plug for safety, and draw the lines across the face of the dial with black India ink, or white ink if dial is black, or you can stretch threads secured at each end with *Duco* cement across dial. Type the letters "CD" on white paper, cut out and cement on lines.—A. T.

Components Held by Spring

• If you're tired of digging through boxes and drawers of assorted parts looking for the right value of resistance or capacitance, try this method for easy selection. Hang a long spring about the size of a screen-door spring from a handy place on your test bench, or somewhere handy



to your work area, and insert all your resistors and capacitors between the coils.—PHIL MCCAFFERTY.

Clay Solves Radio Problems

• Modeling clay is the answer to many radio-TV problems. (1) It can be used to hold a dial string on a pulley when restringing an elaborate dial mechanism; (2) It will hold small parts to be soldered or tested on the bench; (3) It is especially handy for removing metal filings from the magnetic pole pieces of speakers or recording heads.—JOHN A. COMSTOCK.

Testing Those Coils for Shorts

By HAROLD P. STRAND

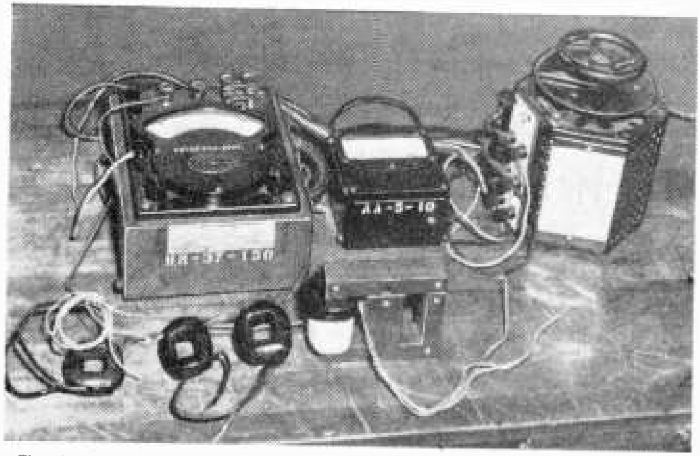
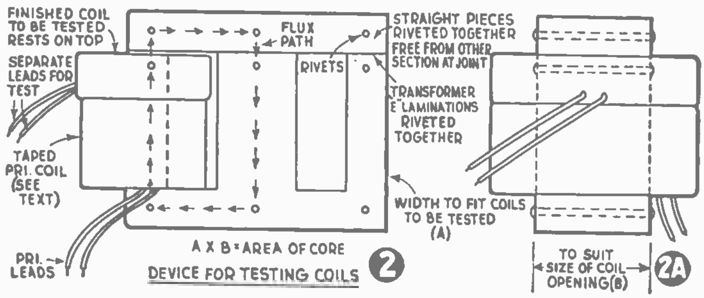


Fig. 1. Using coil tester to test a group of 4 field coils for shorts. One coil in this finished group was found shorted and therefore useless. A considerable saving in time was made by learning of this defect before installing in generator frame.

IN THE winding of coils for motors, generators, transformers and similar equipment, one of the problems is that of avoiding short circuits between turns in the finished coil. The tester shown will detect a short among as few as 4 turns in about 500 total turns in a coil, a feat that is not quite possible to duplicate with a wheatstone bridge, due to slightly varying resistance between normal coils anyhow.

This device works in a similar manner to a transformer. A laminated iron core is made up from transformer E laminations (Fig. 1). The stack, corresponding in width to the particular coils to be tested, is riveted together through drilled holes in the E. The straight pieces are likewise riveted to form a separate bar, which can be laid on top.



DEVICE FOR TESTING COILS 2

A coil is then wound, which forms the primary of the transformer and which is connected to a 115 volt 60 cycle line, through a Variac or variable voltage power transformer. The coil to be tested is placed on the same leg, on top of the primary. This is in effect the secondary of the special transformer. A voltmeter should be used across the leads of the primary and an ammeter and a wattmeter are connected in the circuit, as shown in the diagram, so as to be able to read amperes and watts input to the primary.

The way the tester works is this. A transformer with no load on the secondary draws but very little current and watts, the amount indicated, being the excitation of the core or the iron losses. Now, if the coil on the core leg has no shorted turns, the watts registered on the meter will be the same as when the coil is removed; since the coil leads are open, the secondary is therefore at open circuit or no load. On the other hand, if a coil with some shorted turns is placed on the core, current will flow in the coil through the shorted turns. This will be reflected in higher primary watts and current, as the primary always supplies added current to meet the demands of the secondary. Therefore, by getting increased readings on the meter, we can quickly detect shorted turns in a coil, the value of the increase being in relation to the number of turns and degree of contact at the shorts.

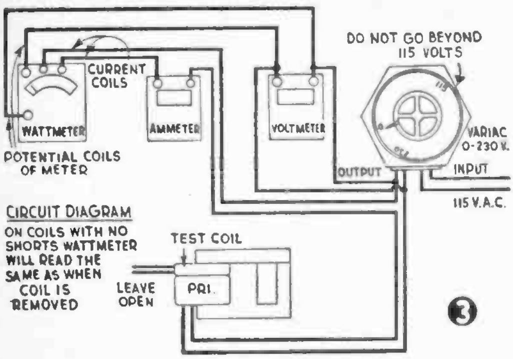
To build the tester, select some transformer laminations on which coils to be tested will fit over one of the outside legs, when stacked to a thickness that will fill the coil space. Clamping the E pieces tightly between clamps, drill holes to pass iron rivets (Figs. 1 and 2). Stack straight pieces to the same thickness, then drill and rivet.

To figure the right number of turns to use for the primary coil, use the transformer formula:

$$\frac{E \times 10^8}{4.44 \times f \times A \times B_M}$$

in which E=primary voltage, 10^8=10 raised to the eighth power, f=frequency of the supply, A=area of the core, B_M=maximum flux density in lines per sq. in., 4.44 a factor=4 times the form factor (1.11).

For this job it is well to make the flux density quite high, so as to get close to saturation. A figure of 100,000 lines was found satisfactory. For example, suppose your core outside leg, which the coil surrounds, measures ¾ in. wide and you are going to stack the core 1½ in. Then, .75 × 1.5 = 1.125 or 1.13 is close enough. This is the area. Substituting figures for symbols in the



formula, we get:

$$\text{Turns} = \frac{115 \times 100{,}000{,}000}{4.44 \times 60 \times 1.13 \times 100{,}000} = 382.$$

Wind the coil on a suitable wooden form, using about 20 Formex wire. The wire size is not critical, since with good coils, there will be but little current flowing in the primary and, if a shorted coil is on the leg, the increased current will last only long enough to get a meter reading. Make the form size such as to leave room on the core leg for the coil to be tested.

A wattmeter should be used with a scale of about 0—75 or 100 watts, in order to be able to read the exciting current easily. Close the switch supplying the 115 volts ac to the Variac, having the dial of the latter at 0. Then gradually bring up the voltage to 115 volts, watching the wattmeter carefully. A sudden jump in current to a high value, indicating a shorted coil, calls for quickly bringing the Variac dial back to 0, to protect the meter. In this manner, coils can be quickly tested. Those showing no increase over the primary watts, from the value when no coil is on the leg, can be passed as good.

"Wireless" Pickup Amplifies Phone Talks

A standard earphone, with cap and metal diaphragm removed, is taped over telephone receiver. Voice comes over the loudspeaker.

A radio earphone makes a simple inductor pickup to send a phone call through your radio speaker

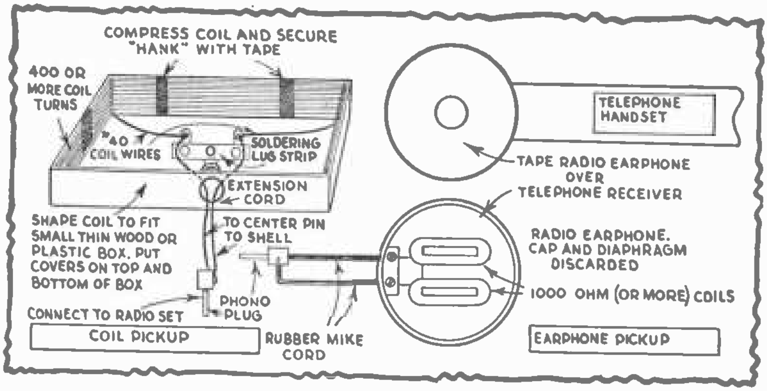
AMPLIFYING a telephone conversation so that the caller's voice can be heard by any number of people is simple. There are several methods of obtaining "wireless" connection to any phone. The two methods described in this article are inductive pick-up systems.

The easiest method requires only a radio receiver provided with a phonograph pickup jack. Many sets have such a connection on the back of the chassis. Otherwise, such a jack may be provided. Plans and instructions for installing such a pickup jack are given in detail in the article, "A Phone Jack for Radio or TV," found on pages 150-151 of this volume.

The telephone pickup consists of a single radio earphone with a resistance of 1000 ohms or more. While even an ancient earphone may be used, much better results will be obtained from one of the newer receivers having an Alnico magnet. Many war surplus headsets are of the Alnico type. Unscrew the plastic earphone cap, lift off the metal diaphragm and disconnect the cord (if earphone is obtained from a double headset). Now connect a new pair of wires, using rubber-covered fixture wire, to the earphone lugs and connect a radio-phono plug to the opposite end of the fixture wires.

Leave earphone cap and diaphragm just as they are and attach the open unit over the telephone's receiver with Scotch tape or heavy elastic band. To obtain proper polarity between telephone receiver and earphone pickup, turn or rotate earphone slowly until loudest dial tone comes in. A drop of red nail polish on phone receiver and earphone edge will identify the proper position for future use.

In some instances, the pickup is more sensitive when phone receiver cap is unscrewed and earphone placed against phone receiver's diaphragm. However, very modern phones have a cartridge type receiver which disconnects when cap is removed. For all practical purposes—unless you know exactly what you are doing—do not remove the receiver cap on telephones as the pickup will work in most cases as first described.

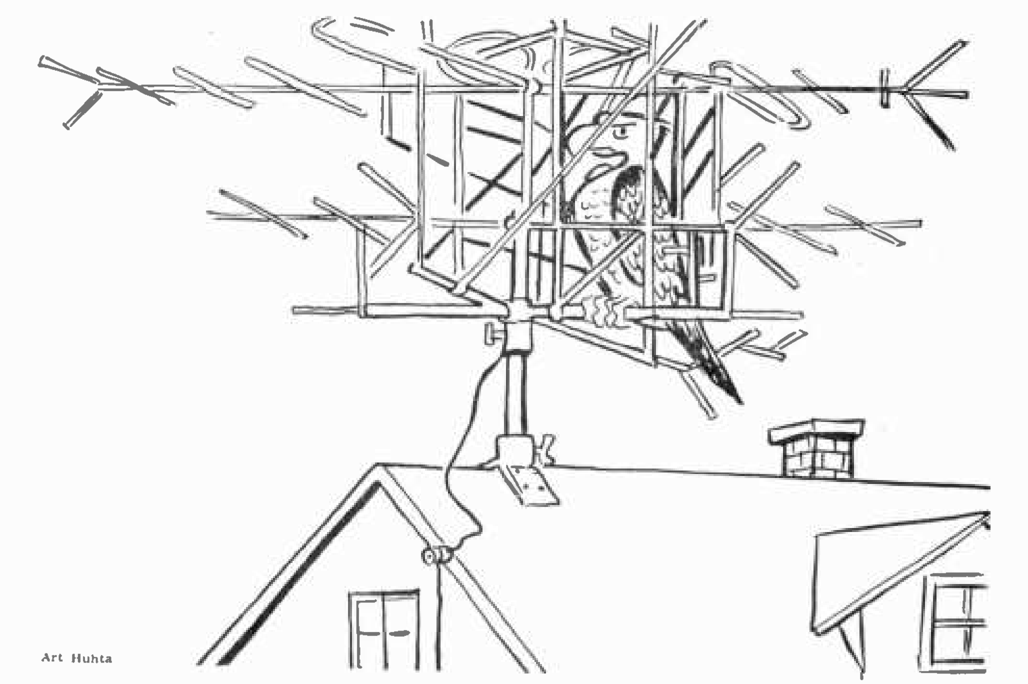


Another pickup which connects to the amplifier or phono-pickup jack in the same manner as the earphone pickup, is a homemade induction coil consisting of several hundred turns of No. 40 gage enameled magnet wire.

Form a cylinder 3 in. in diameter from light cardboard, holding it in shape with Scotch tape. The tube should be long enough to handle since it is removed after coil has been wound. Wind 400 or more turns of magnet wire onto the tube, keeping the turns within a ¾ in. space. Scramble-winding is adequate for our purpose. When finished, secure coil around its circumference with adhesive tape.

The completed coil is too delicate to withstand rough handling and should be placed inside a shallow plastic or wooden box. A two terminal soldering lug fastened inside box permits fine magnet wires to be joined to fixture cord extension connecting to jack on radio or amplifier. Be sure enamel insulation is removed from ends of magnet wire before soldering to lug strip or an open circuit will result. Wireless pickup is obtained by laying telephone receiver on coil box, or by placing box under phone base, depending on type of telephone.

Of the two pickup methods described, induction coil method is best for all around purposes. There are some instances where the simple earphone method may not work to complete satisfaction. For a very sensitive induction pickup, use the secondary winding from an old Model-T Ford spark coil. This eliminates the necessity of winding your own coil.



Record player built largely from spare parts found in the author's workshop. The white disc around turntable spindle is a built-in "spider" for playing 45 rpm records. Disc retracts for 33 and 78 rpm records.

Economy Record Player

Powered with a single tube amplifier, this portable phonograph plays 78, 45 and 33 rpm records. It's got reserve power to fill a big room with music, yet takes no more current than a 15-watt light bulb

HERE is a 3-speed record player that can save you money both in construction and in operation. First, before purchasing any parts, check through your own and your friends' stockpiles for all available parts. For the original record player we salvaged amplifier, components and speaker from a discarded radio; the cabinet was a beat-up relic pock-marked with odd holes. If you have an old 78 crystal pickup in working order, just replace the .003 needle with a .001 sapphire designed for 45 and 33-*rpm* long-play microgroove records. If you want to play old 78-*rpm* records as well, a .002 all-purpose needle can be used, but we don't advise it. We purchased a new turnover phono pickup for playing 78, 45, or 33-*rpm* records and the 3-speed motor and turntable used here.

Economy of operation can be traced to the motor. The conventional motor is designed with a coil for operating on 120-volt 60 cycle current. The motor used here, however, is wound with a 95-volt coil. Connecting the motor in series with the heater of the 25L6GT pentode tube adds up to 120 volts. Thus the tube provides the series voltage drop for the motor, or the motor provides the voltage drop for the tube—however you wish to look at it. A step-down heater transformer or a current-wasting voltage-drop resistor, usually required with single pentode amplifiers, is not needed.

The circuit is extremely efficient and simple. Although the amplifier uses a single tube, it supplies sufficient output to fill a 20 x 20-ft. room. Operated directly off the 120-volt *a-c* line, the player is completely shockproof even if installed in a metal cabinet.

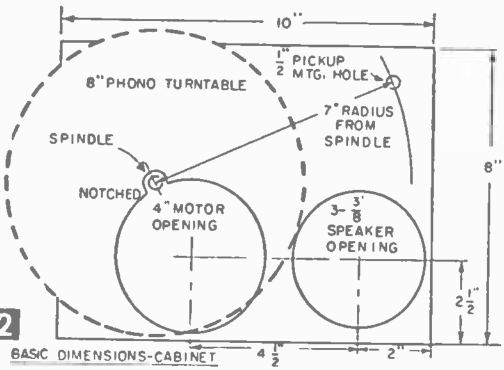
Any discarded record player cabinet, or one made from scrap wood, may be used. It may be as small as 3¼ x 8 x 10 in. I.D., which will leave a turntable overhang (Fig. 2). This, how-

MATERIALS LIST—ECONOMY RECORD PLAYER

No. Req.	Description
1	3 x 5" pc. #14 or #16 aluminum (chassis)
1	.01 mfd. capacitor, 150 w.v. or higher
1	.05 mfd. capacitor, 150 w.v. or higher
1	.1 mfd. capacitor, 150 w.v. or higher
1	50-50 mfd., 150 w.v. electrolytic strap-type capacitor
1	150 ohm, ½-watt composition resistor
1	47 ohm. 1-watt composition resistor
1	10K (10.000) 1-watt composition resistor
1	1 megohm potentiometer, audio taper (volume)
1	500K (½ meg.) potentiometer with S.P.S.T. switch attached
1	50 ma. selenium ½-wave rectifier
1	4-in. PM speaker with 2000 to 2500 ohm audio output transformer
1	3-speed phono motor with 95 v. coil and turntable. Alliance, General Industries, or German import

No. Req.	Description
1	turnover crystal pickup, Astatic Model TMS with #7-CAC-D arm. (Rose Electronics, Inc.—see above)
1	25L6GT pentode output tube
1	octal wafer-type socket
1	4 x 4" plastic or aluminum screening (speaker grille)
2	¼ x ¾" spacers
3	6-32 *fh* screws and nuts, 1" long
3	6-32 *fh* screws and nuts, ¼" long
1	6-32 machine screw and nut, ¾" long
1	1-lug tie-strip
1	2-lug tie strip
1	TV "cheater" cord and male interlock receptor
2	knobs

ever, will have no effect on operation, whether you play a child's 5-in. 78-*rpm* record, or a 12-in. symphonic microgroove running at 33 *rpm*. Our cabinet (see Fig. 1) originally contained a 78-*rpm* motor and pickup. As the motor opening was larger than required for the 3-speed turntable, brass braces from the dime store were cut down and used to support three of the motor's four mounting screws (Fig. 6). A flycutter was used to cut a 3⅜-in. dia. opening for the 4-in. PM speaker.



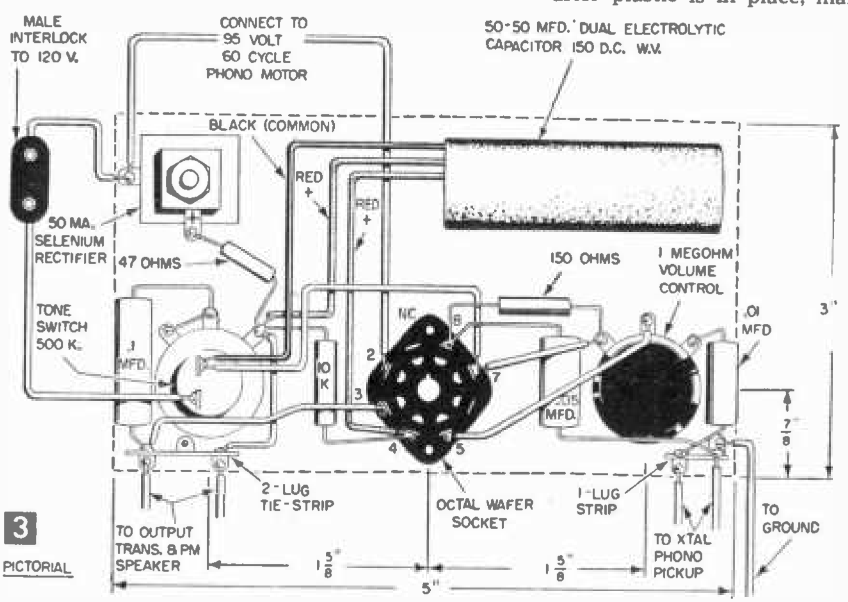
2 BASIC DIMENSIONS-CABINET

Plug any unnecessary small holes in the cabinet you use with wood putty, sanding off smooth when dry. To plug large holes, attach matchbook-weight cardboard securely on underside of each hole with model plane cement, then fill in hole with wood putty.

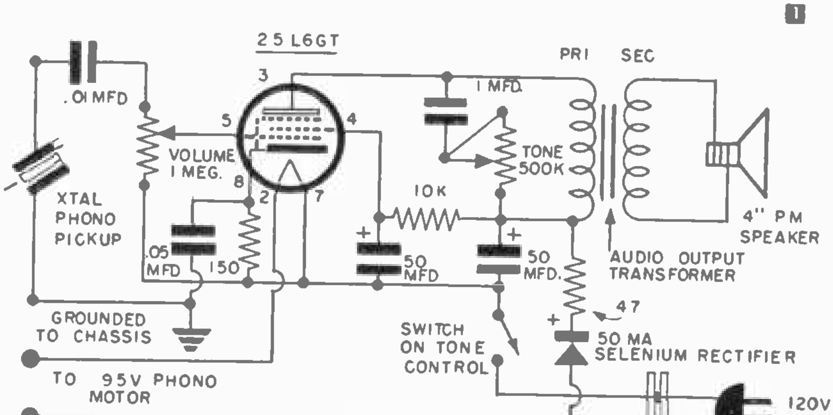
Finish the cabinet with *Con-Tact,* an inexpensive self-stick plastic fabric available in about fifty designs at variety stores. Cut the material about 1-in. wider than the cabinet width and entire front to back measurement, peel off the paper backing and apply the plastic front-to-back (see Fig. 1). Notch the side excess and fold down. Finally, cut end pieces to shape and apply in same manner. Cut speaker opening after plastic is in place, making spoke-like slits while holding cabinet up to light. Fold the slit pieces down smoothly under the speaker opening.

The design of the amplifier is as simple and direct as possible, with the chassis merely a flat piece of #14 or #16 aluminum on which components are mounted as shown in Fig. 3. Mount the 25L6GT tube in an octal wafer-type socket supported on ¼ x ¾-in. long spacers secured with 6-32 *fh* screws (Fig. 5). Also use flathead screws to mount the selenium rectifier, strap of 50-50 *mfd* filter capacitor and tie-strips, countersinking reverse side of panel so screw heads are flush.

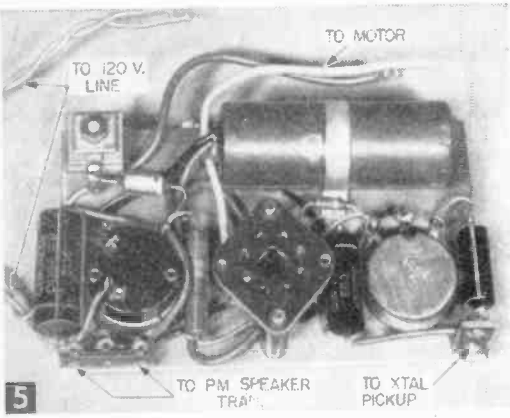
Mount volume and tone controls in ⅜-in. dia. holes. Drill a single hole in the chassis between the tube socket and electrolytic capacitor and a corresponding hole in cabinet for



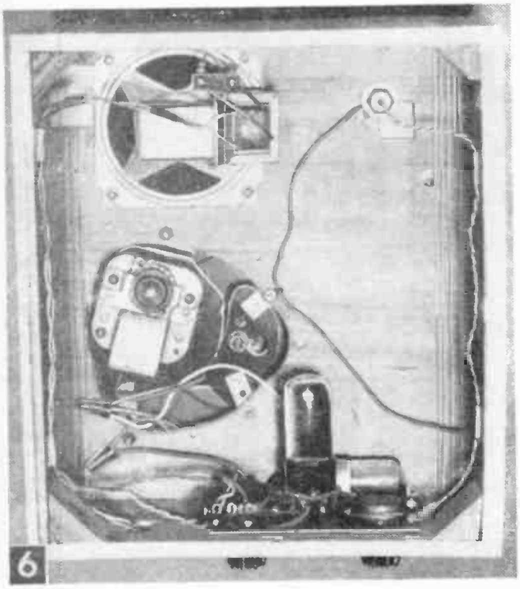
3 PICTORIAL



SCHEMATIC 4



Amplifier chassis is flat aluminum plate smaller than a 2¢ postcard. Note excess metal of 6-32 socket mounting screws has been filed off flush with nuts.

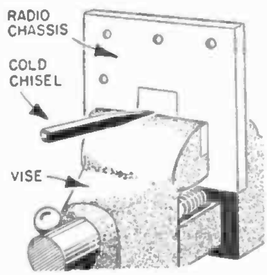


View of underside of record player. Amplifier bolts to side of cabinet with single 6-32 screw. Loose leads are affixed to cabinet with masking tape.

¾-in. 6-32 machine screw which secures chassis to cabinet (see Fig. 1). Control holes in the cabinet are ⅝ in. dia. to allow clearance of potentiometer nuts. Use plastic or aluminum fly screening, loose-woven plastic fabric or a 4 x 4-in. piece of perforated sheet aluminum as speaker grille. Mount pickup clip under lower righthand speaker mounting screw.

Fit cabinet with a TV male interlock and "cheater" cord rather than a plain cord, so cord can be removed from the record player when not in use. To avoid hum pickup, the line switch is not part of the volume control, but is attached to the tone control which is removed from the grid input. Another source of hum pickup can be avoided by connecting wire from amplifier chassis to motor frame to pickup washer on underside of cabinet (Fig. 6).—T. A. BLANCHARD.

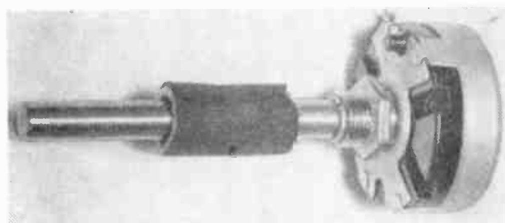
Chassis Punching



• When you need to punch square holes neatly in a metal radio chassis, yet don't have a square punch, a cold chisel and bench vise can be used to punch holes of almost any size. As cutting proceeds, rotate the chassis so that the outline mark is always flush with the vise jaws. You will find that this method is faster and gives an outline almost as smooth as that obtained with a chassis punch.—JOHN A. COMSTOCK.

Radio Shaft Coupler

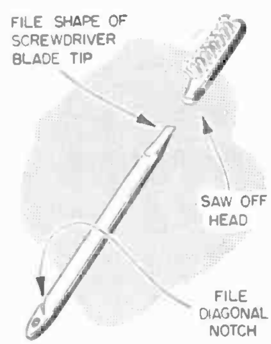
• A 1-in. length of automobile windshield-wiper hose can be used as a quick, inexpensive ¼ in.-to-¼ in. shaft coupler for radio and other electronic components. While not intended to replace conventional couplers which employ setscrews, the hose does grip the shafts with surprising tenacity, making it handy in an emergency or in



an experimental lashup. A 3- to 4-in. length of the hose makes a good flexible coupler for connecting the shaft of a variable component to a knob shaft when the two are out of line with each other. Offset drive up to at least 45 degrees is easily accomplished. Other uses for the hose include couplers for small electric motors, Veeder-Root counters; in fact, anywhere ¼ in. shafts are used and the load requirements are moderate.—FRANK H. TOOKER.

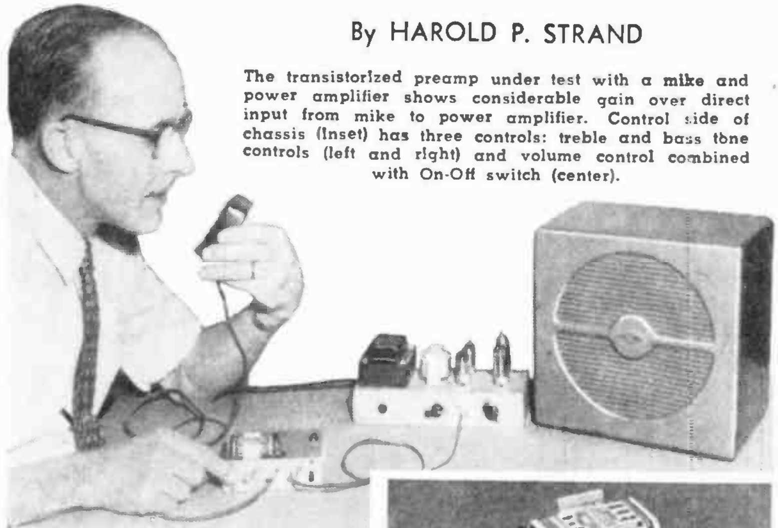
Tooth Brush Becomes Radio Tool

• The plastic handle of that worn toothbrush you're about to throw away will make a useful radio tool. Saw off the bristly head, file the neck thin in the shape of a screwdriver blade tip and use it as an alignment tool. The opposite end makes a handy probe and, with a notch filed in one edge, the tool also can be used for dial stringing.—JOHN A. COMSTOCK.

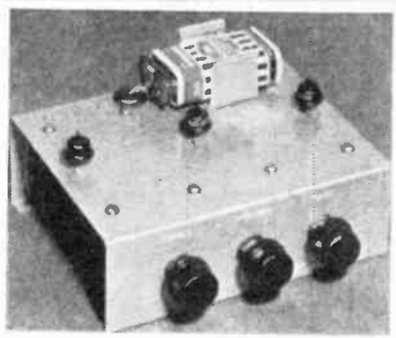


Transistorized Hi-Fi Preamplifier

By HAROLD P. STRAND

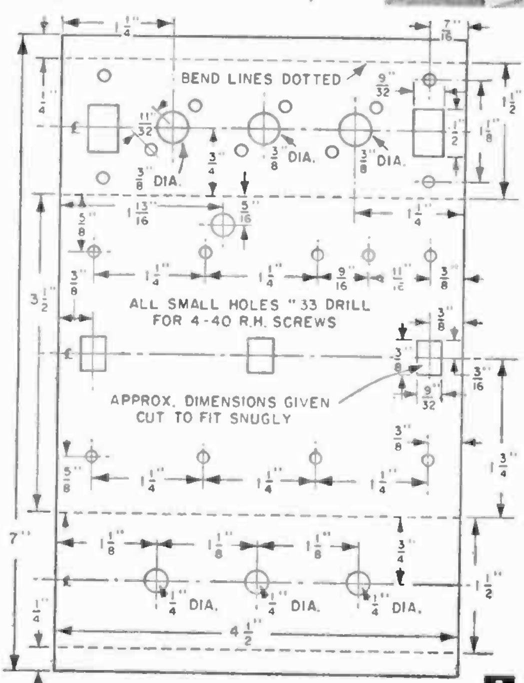


The transistorized preamp under test with a mike and power amplifier shows considerable gain over direct input from mike to power amplifier. Control side of chassis (Inset) has three controls: treble and bass tone controls (left and right) and volume control combined with On-Off switch (center).

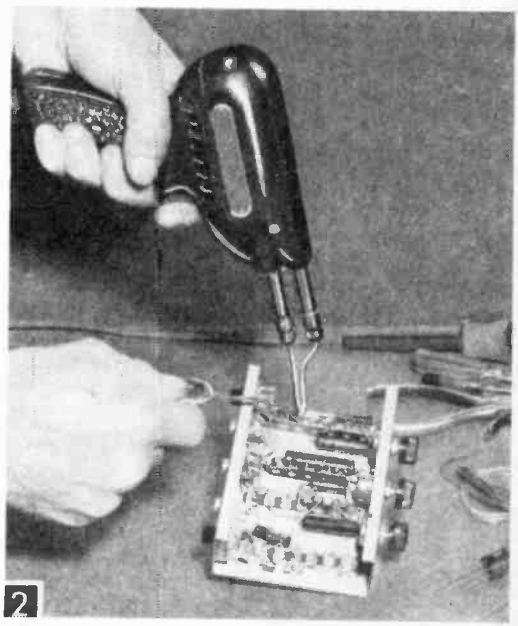


MAGNETIC or variable reluctance phonograph cartridges usually require a boost of their output voltage—5 to 30 millivolts—in order to obtain satisfactory operation from a standard power amplifier. (Crystal cartridges, on the other hand, usually deliver sufficient output voltage—600 to 4000 millivolts, depending on make and type—for such operation.) Because of the low output of magnetic cartridges, a device known as a preamplifier is usually employed with them to effect the desired boost. The preamplifier is connected between the cartridge and the power amplifier in a simple plug-in circuit.

For many years, vacuum-tube preamplifiers have been used for this purpose, but transistorized preamps, such as the unit described in this article, have several advantages over vacuum-tube preamps, including those of zero hum, without the microphonics usually associated with vacuum tubes, a frequency response of from 20 to 20,000 cps, 40 *db* gain (or better than 52 *db* below 2 millivolts) for low impedance cartridges, three phono in-



CHASSIS LAYOUT 1

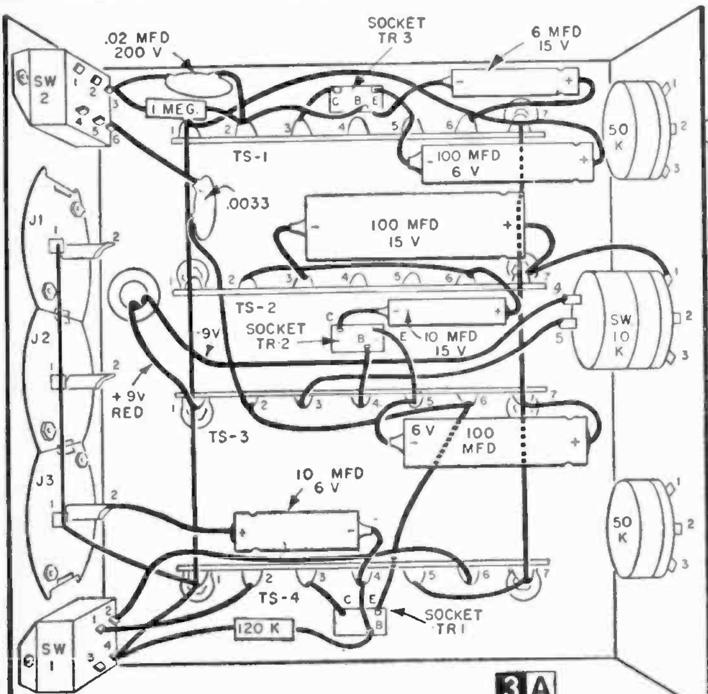


2 When soldering at terminals, apply sufficient heat for the solder to flow completely around leads.

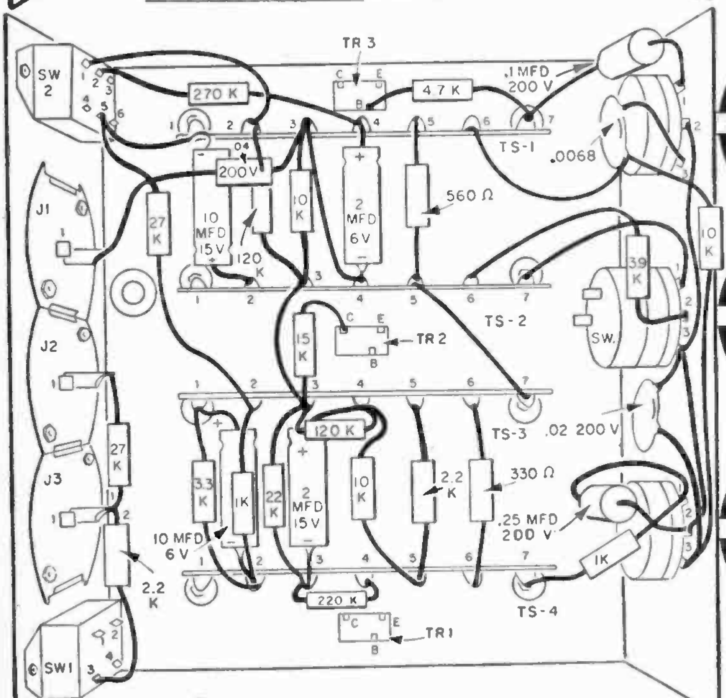
puts and also a microphone input, bass and treble control, as well as a volume control with switch. Since a small self-contained battery is used with this unit, no outside power connections are required and the unit can be placed up to 175 ft. away from its associated equipment if desired.

The transistorized preamplifier can be built from a kit supplied by Lafayette Radio or you can build it entirely from the group of standard parts given in the Materials List. The chassis, however, is not a standard size, so it is bent up from sheet aluminum to the dimensions given in Fig. 1. It can be bent up in a vise over a hardwood block, but a bending brake will make a better job of it. If you don't have a brake, perhaps your local sheet metal shop will do this for you on theirs.

Lay out the rectangular socket holes on the metal and then drill a number of holes within the rectangular area. Break out the metal between the drilled holes and dress to size and shape with a file. Fix the sockets in their openings on the chassis, positioning them so that the terminal with the widest spacing (collector) will be located with respect to the other components as shown in Fig. 3. (A locking ring is forced down on the lower end of each socket, securing them in place.) Now install the jacks and controls, as well as the long terminal strips. Be sure to place as indicated, with the volume control and On-Off switch in the center. Secure the slide switches in their openings, attach the battery holder to the top of the chassis—using for this purpose one of the bolts securing a terminal

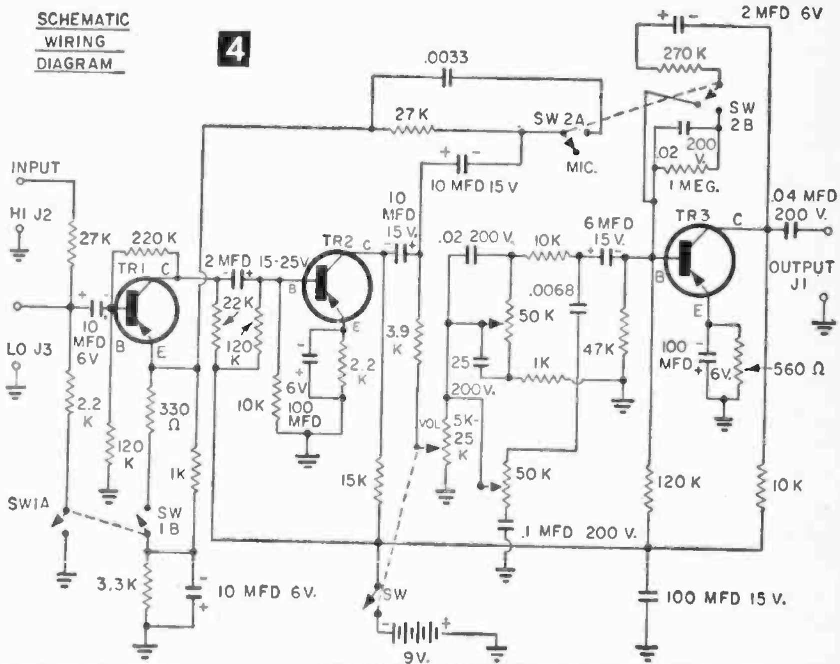


3A PICTORIAL WIRING DIAGRAM - FIRST STEP



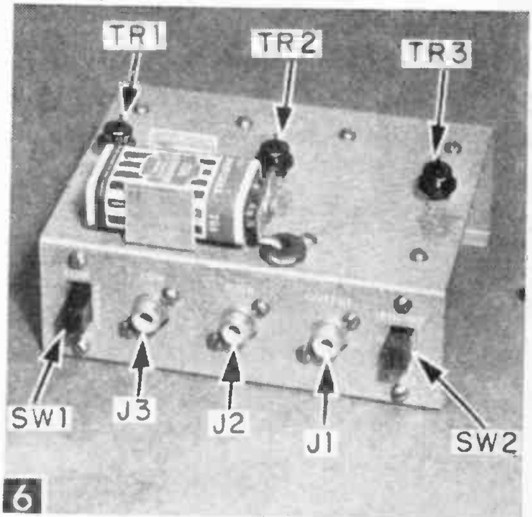
B PICTORIAL WIRING DIAGRAM - SECOND STEP strip, one in a drilled hole 9/16 in. away — and press the rubber grommet in its hole. Cut off the shafts on all three controls to about ½ in. before installing them unless the extra length of shaft is required for mounting in a cabinet.

Although a relatively large number of parts must go on the chassis, good layout and the number of terminals or tie points provided makes a neat job possible.

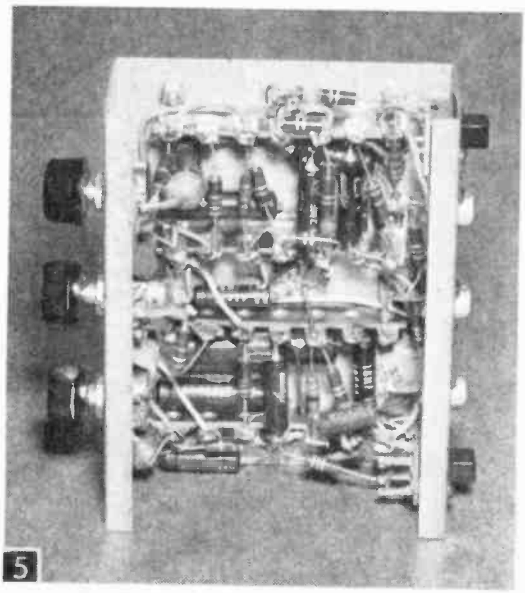


The pictorial and schematic wiring diagrams shown in Figs. 3 and 4 show the wiring. Electrolytic capacitors will be marked plus and minus at their ends and care should be taken to place them in the circuit correctly with respect to polarity. Carry leads to terminals and allow enough extra to bend them over at the terminals when you cut them off. Separate the transistor socket terminals slightly when making connections (see Fig. 7A) to avoid any possibility of shorts. Where more than one lead goes to a terminal, make all of them up and then solder as a group. A Weller soldering gun will be found useful, or a 60 watt iron can be used. At points where bare leads may cross, use small spaghetti tubing on them to avoid shorts—except of course where they go to the same terminal.

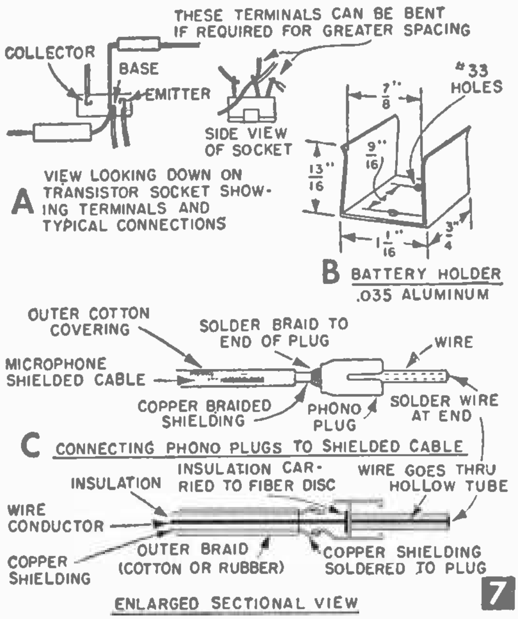
Figure 5 shows the completely wired unit in an underside view where the neat and compact placement of parts and wiring is evident. Check all connections against the diagrams and then install the battery and 2N190 transistors. A battery holder can be made as shown in Fig. 7B; a top view of the unit, ready to be used, is shown in Fig. 6, above.



The designations TR1, TR2 and TR3 indicate the transistors; SW1 is the low or high level switch; J3 is the low impedance input; J2, the high; J1, the output; and SW2 is the phono or mike switch.



Completely wired chassis, bottom view.



MATERIALS LIST—TRANSISTORIZED HI-FI PREAMPLIFIER

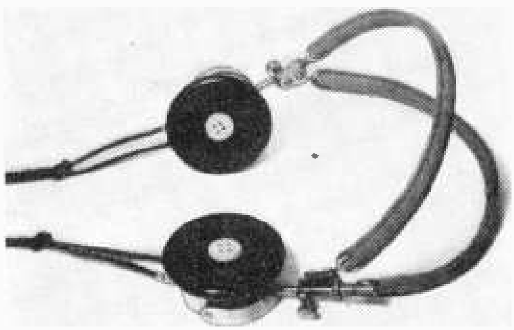
No. Reqd.	Description
3	transistor sockets MS-275
3	G.E. 2N190 transistors
1	9 volt Burgess 2U6 battery
1	male and 1 female battery snap-on clip or snap-on, two-terminal insert
1	D.P.D.T. slide switch (SW17)
1	D.P.S.T. slide switch (SW16)
3	RCA type phono jacks and plugs
1	10-K ohm volume control with switch (K = 1000), miniature type VC-28
2	50-K ohm controls (no switch), miniature type VC-36
3	miniature knobs for 1/8" shaft MS-185
4	solder lug terminal strips each with 2 ground lugs, 5 insulated lugs (7 total) Cinch-Jones 55-A
1	22-K ohm 1/2 watt resistor
2	27-K ohm 1/2 watt resistors
3	10-K ohm 1/2 watt resistors
2	2200 ohm 1/2 watt resistors
1	15-K ohm 1/2 watt resistor
3	120-K ohm 1/2 watt resistors
1	3900 ohm 1/2 watt resistor
1	220-K ohm 1/2 watt resistor
1	4700 ohm 1/2 watt resistor
1	330 ohm 1/2 watt resistor
1	270-K ohm 1/2 watt resistor
1	3300 ohm 1/2 watt resistor
1	1 meg. 1/2 watt resistor
2	1000 ohm 1/2 watt resistors
1	560 ohm 1/2 watt resistor
2	10 mfd. 6 volt Argonne capacitors (electrolytic)
1	2 mfd. 25 volt Argonne capacitor (electrolytic)
2	100 mfd. 6 volt Argonne capacitors (electrolytic)
2	10 mfd. 15 volt Argonne capacitors (electrolytic)
1	100 mfd. 15 volt Argonne capacitor (electrolytic)
1	6 mfd. 15 volt Argonne capacitor (electrolytic)
1	2 mfd. 6 volt Argonne capacitor (electrolytic)
2	.02 mfd. disc ceramic capacitors
1	.25 mfd. 200 volt capacitor (Aerovax Aerolite P82Z)
1	.0033 mfd. disc ceramic capacitor
1	.1 mfd. 200 volt capacitor
1	.0068 mfd. disc ceramic capacitor
1	.04 mfd. 200 volt capacitor (Aerovax micro-miniature P83Z)
1	rubber grommet for 1/4" hole.
1 pc	half-hard alloy sheet aluminum about .040" x 7" x 4 1/2" (bend to make chassis)
1 pc	half-hard alloy sheet aluminum about .030-.035 x 3" x 3/4" (bend to make battery clip)
18	round head 4-40 machine screws 1/4" long
18	4-40 hex nuts
	plastic covered hook-up wire about 24 gage (stranded); small spaghetti tubing

Kit #KT117 for building the Hi-Fi Preamplifier can be obtained from Lafayette Radio, 165-08 Liberty Ave., Jamaica 33, N. Y., for $18.45.

A good first test can be made with a microphone and amplifier, together with a speaker. The unit shows excellent gain over results obtained by plugging the mike directly into the amplifier. For phonograph use, simply plug a magnetic cartridge into the input jack instead of the mike. A selection of either high or low impedance jacks with a high-low switch allows the best matching conditions. Connections between the mike or phono cartridge as well as between the preamplifier and the power amplifier should be made with shielded cable to avoid picking up hum. The method of installing these phono plugs to cable is shown in Fig. 7C.

Buttoning Up Earphones

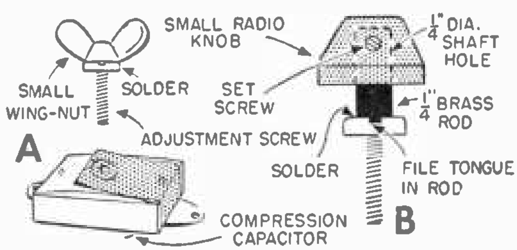
• In order to protect the thin metal diaphragm inside an earphone which has a single large opening in the cap, cement a button over the opening with *Duco* cement. Sound waves readily pass through the small openings in the button but



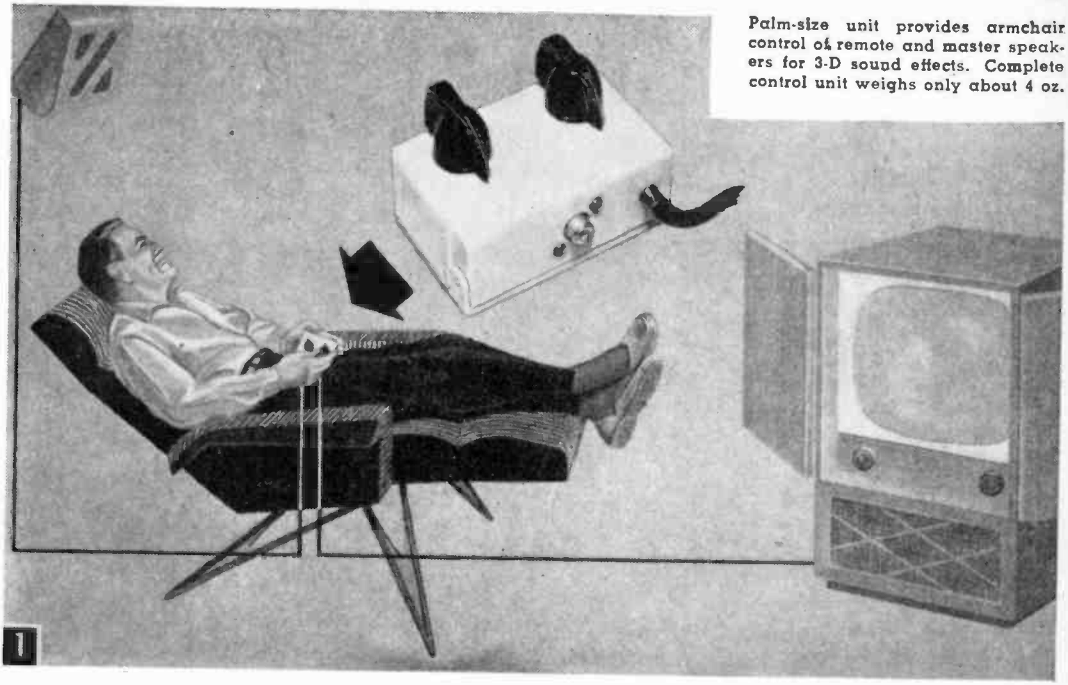
the diaphragm is protected from damage by sharp objects when phones are stored or transported. The button also provides a better ear-seal between the cap opening and the eardrum. —A. TRAUFFER.

Knobs for Compression Capacitors

• Small economical compression-type capacitors up to 380 *mmf* capacity used as tuning capacitors in crystal sets or small tube sets can be adjusted without a screwdriver if you solder a small wing-



nut to the head of the screw (see A). If hand-contact effects are troublesome when using a wing-nut, solder a short length of 1/4 in. dia. brass rod securely to the head of the screw to take a small radio knob (see B). File a tongue in other end of rod to fit slot in screw head.—A. TRAUFFER.



1 Palm-size unit provides armchair control of remote and master speakers for 3-D sound effects. Complete control unit weighs only about 4 oz.

Armchair Speaker Control

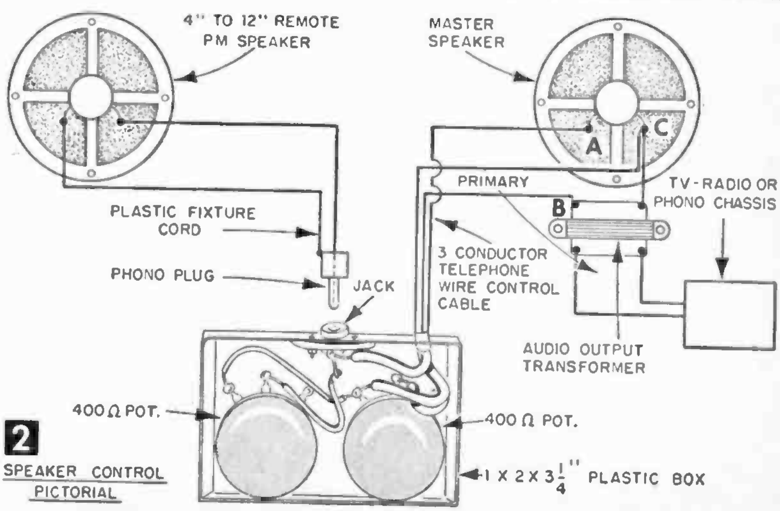
FOR a surprisingly small investment, plus a few simple and safe alterations, your radio, TV or phono amplifier can be given a new sound dimension. From the comfort of an armchair, you can control—separately—the volume of the console speaker and that of an extension speaker located in an opposite corner of the room. Music, adjustable from a whisper to a roar without leaving your seat, literally surrounds you.

An 8-in. PM speaker is the ideal size for the remote unit. It can be mounted in a homemade cabinet, or your parts dealer can furnish inexpensive wall cabinets in a variety of sizes to fit speakers from the 4 to the 12-in. size. Speakers are graded and priced by the ounce-weight of the magnet.

Whatever size of speaker you may select, it is wise to pay a little more—the best speakers are relatively inexpensive—for the model with a heavy Alnico magnet.

Decide where you wish to locate the remote speaker, measure the distance between it and the spot where you want to place the control box, and purchase a suitable length of regular lamp "zip" type plastic fixture cord at any hardware or dime store. Connect one end of the fixture cord to the speaker's two *voice coil* soldering terminals. To the opposite end of the cord, solder an ICA type phono plug. This completes the work on the remote speaker.

The armchair, dual volume control is a palm-sized plastic box (it can be as small as 1 x 2 x 3¼ in.) in which are mounted the volume controls, two 400 ohm, wire-wound potentiometers. Four ⅜



2 SPEAKER CONTROL PICTORIAL

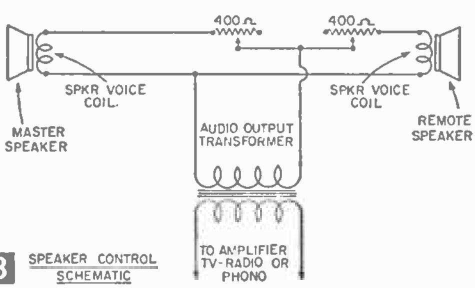
MATERIALS LIST—ARMCHAIR SPEAKER CONTROL

No.	Description
1	plastic or homemade box, 1 x 2 x 3¼" or larger
1	phono plug and jack (ICA)
2	wire-wound potentiometers (IRC #W-400)
1	6 or 8' 3-conductor telephone wire
1	length plastic "zip" fixture cord
1	PM speaker with heavy Alnico magnet, any size from 4" to 12"
1	homemade or commercial cabinet for speaker
2	knobs

in. holes are drilled in the box: two on the top for mounting the potentiometers, and two on the side, one for the ICA type phono jack, and one for a clearance hole for the three-wire control cable to the master console speaker.

Using three-conductor telephone wire, connect the components as shown in Figs. 2 and 3 (note that the potentiometers are wired as rheostats, with no connections to their righthand terminals). The control cable should be long enough to reach from the master speaker to your armchair, coffee table, etc. You can, of course, leave the control on top of the console cabinet if desired. With circuit components connected to the leads of one end of the three-conductor wire, the control box is complete.

The final step is to make connections to the console master speaker. Some receivers and amplifiers have the audio output transformer mounted directly on the speaker frame. Others



3 SPEAKER CONTROL SCHEMATIC

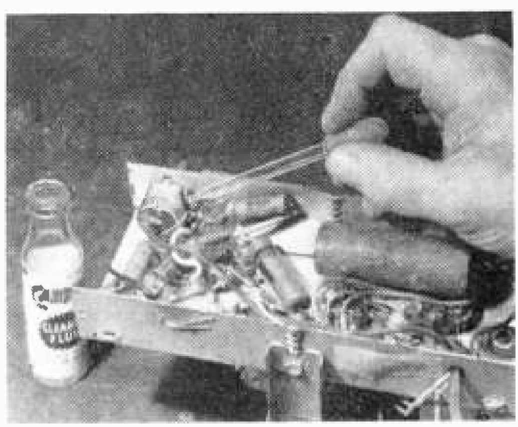
have the output transformer mounted on the chassis. In either case, do *not* disturb any wires on the primary side of this transformer. Instead, connect cable wire C to voice coil lug C on speaker (see Fig. 2; do not remove the wire already connected to C). Next, unsolder the lead on speaker lug A, connect this disconnected wire to cable lead B and tape up the connection. Finally, connect cable lead A to the now vacant speaker lug A and the installation is complete.

Turn on the TV, radio or phono player, advance its volume control all the way, and turn both control knobs on your armchair control to the extreme left. Now, plug the remote speaker into the phono jack and you're ready to go; advancing one knob on the armchair control will bring up the volume of the remote speaker, advancing the other will bring the console speaker into play. A multi-dimensional sound effect results when you place yourself between the two speakers. Adjusting the individual volume controls to different levels furthers the effect, making it seem that the music is coming from all parts of the room. When desired, the master speaker operates *without* the remote cable being plugged in.—T. A. B.

"GOT A CALL HERE TO REPAIR A RADIO. THINK YOU REMEMBER HOW?"

Quick Volume Control Cleanup

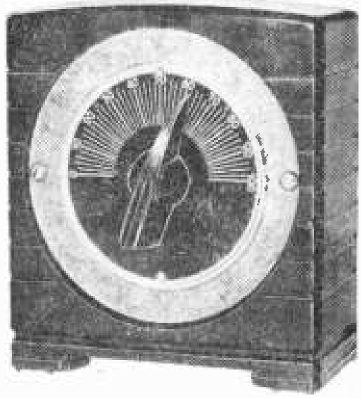
• When the volume or tone control on a radio becomes scratchy and spotty, the reason is usually hardened grease on the contact ring, or glaze on the resistance element. Instead of unsoldering wires and dismantling the control in order to



clean the parts, squirt a small amount of carbon tetrachloride from a medicine dropper onto the control surfaces through the lug openings, and work the shaft back and forth until it dries. This may be done while the set is in operation, so that the results can be judged on the spot.—Herbert Y. Moon.

Air-Powered Tuner

Adds Hi-Fi to Your TV Set or Record Player



This little tuner brings hi-fi radio reception to TV when plugged into the set's "phono jack." Photo above shows how an old alarm clock case provided a neat cabinet for the tuner.

MATERIALS LIST—AIR-POWERED TUNER

1	plastic alarm clock case about 4½ x 4½ x 2" (or homemade cabinet)
1	364 or 374 *mmf* variable tuning capacitor (midget or small size)
1	50 *mmf* fixed mica or ceramic capacitor
1	1N60 or other general purpose crystal (germanium) diode
1	Ferrite slug-tuned antenna coil
1	3-lug soldering tie-strip
1	antenna clip (Mueller Alligator clip #60 or #85)
1	phono pin plug
1	length (3 to 5 ft.) shielded phono cable
1	length insulated hook-up wire for antenna lead
1	small piece Masonite for panel
1	strip #16 copper, aluminum, etc., for coil mtg. bracket (1¼ x 1½ in.)

SINCE radio's early days the high fidelity virtues of the crystal detector have been well known. The modern counterpart of the old catwhisker "tickled" galena, silicon, or iron pyrite detector is the germanium diode . . . a tiny fixed crystal unit that never requires delicate adjustments. So dependable is this little crystal diode that many TV sets use it, instead of a tube, as the Video Detector.

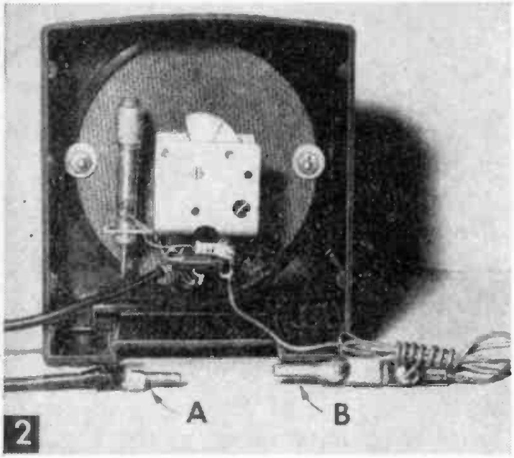
Since many TV receivers have a plug-in connection for record players, a suitable tuner will allow reception of local AM radio stations when connected into the TV set's *phono jack*. For that matter, this "air-powered" tuner may be connected into any amplifier with two or more stages. Why do we call it "air-powered"? Well, the tuner itself costs nothing to operate since power is taken right out of the ether.

This tuner of course is limited to reception of local stations as well as high-powered transmitters within a 50 mile radius. We have, however, used it to receive distant stations late at night using an outdoor antenna. Ordinarily, no elaborate antenna is needed. Crystal detectors are not highly selective and the shorter the antenna, the greater the selectivity (and the lower the sensitivity). In this respect, attaching the antenna lead to one of the *antenna* terminals on the TV set, or to some non-grounded metal object, provides more than ample signal pick-up.

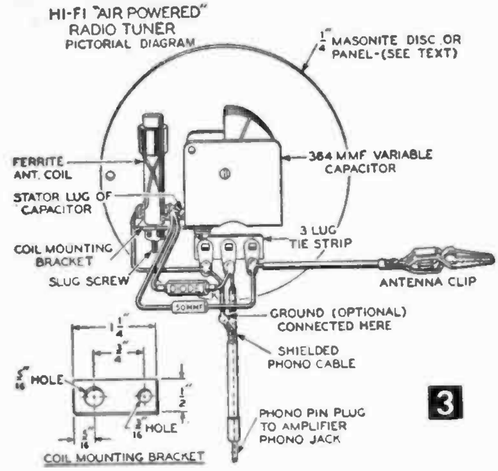
You'll also find that this "air powered" tuner is virtually static free. Clicks, and buzzes common to conventional radios, do not exist. Only severe electrical storms will create static and to a much lesser degree than they do on electric powered sets.

Because of the few parts required for this tuner (Fig. 3), we were able to build the unit on a Masonite or plywood panel which fits into a plastic case which once contained an alarm clock (Fig. 2). You can easily make a case for the tuner if you don't have a defunct clock handy. Our clock case had a round flanged opening for the 3¾ in. diameter clock face and bezel. A 3¾ in. diameter Masonite disc was cut to fit this opening and the radio components were mounted on this disc.

Two holes drilled close to the disc edge allow it to be rigidly clamped in the clock case, using two 6-32 x ½ in. *rh* machine screws, washers and nuts. A ⅜-in. hole drilled in the center of the panel will clear the capacitor shaft and its ball bearing rotor. The 6-32 tuning capacitor mounting holes are located and drilled after the capacitor has been obtained, since mounting hole



Masonite panel fits opening in clock case, and is securely clamped by two 6-32 machine screws on each side of flanged retainer. Note phono pin plug connector at A and antenna clip lead at B.



Tuning capacitor carries all components which are wired before assembly is secured to Masonite panel. Single 6-32 screw fastens coil bracket and soldering tie-strip to the frame of tuner.

locations vary widely from one make to another.

The variable tuning capacitor is a small broadcast type of either 364 or 374 *mmf*. The antenna coil is a high-Q ferrite slug-tuned type. Make a small bracket for the coil as in Fig. 3. Then snap the coil into the 5/16 in. bracket hole, and mount the bracket into one of the various 6-32 holes found on the capacitor frame. Also screwed down with the coil bracket a 3-lug soldering tie-strip, to which various components are eventually terminated for a neat and rigid assembly.

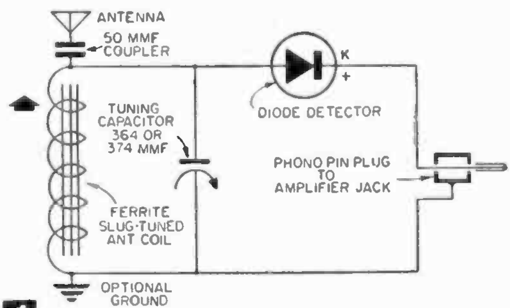
Wire up components as in Figs. 3 and 4. When soldering the germanium diode detector into the circuit, hold a small wad of damp cotton or cleansing tissue around the pigtail lead being soldered, so that heat is not conducted up into the little unit. Excessive heat can ruin the diode's internal adjustment.

Not shown in Figs. 3 and 4, though *theoretically* necessary, is a dc load resistance across the output jack. You can use a ½-watt unit of from 39,000 to 50,000 ohms. You will need to add it, however, only if the output signal is distorted.

When connecting up the antenna coil, note that the inside or "start" lead of the winding connects to the stator (stationary plate) lug of tuning capacitor along with one side of the 50 *mmf* coupling capacitor and the anode or unmarked end of the crystal detector (Figs. 3 and 4). Remaining coil lug, and capacitor and diode pigtails terminate on the tie-strip as in Fig. 3.

The output cable is ordinary shielded phono wire which consists of a light copper outer braid and center insulated lead. Connect the braid to the lefthand tie-strip lug, and connect the inner lead to the center lug (Fig. 3). Connect the remaining end of the phono cable to a phono pin plug—braid to plug shell, and inner wire to plug pin.

Cut about 6 foot of insulated wire for antenna lead. Solder one end to the righthand tie-lug, and attach a small battery or test clip to the



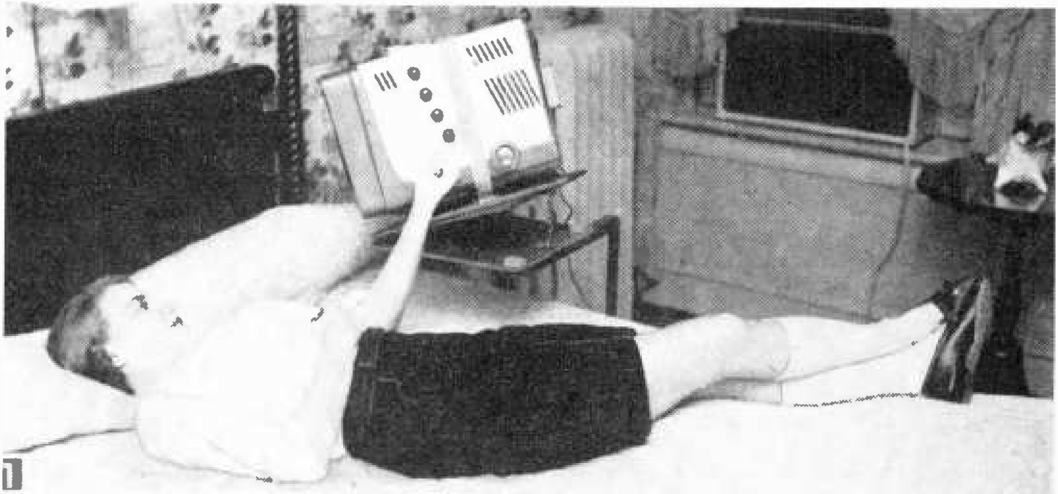
4 SCHEMATIC DIAGRAM

remaining end of the wire. Your "air-powered" tuner is now ready for testing.

Testing. If the tuning capacitor does not tune high enough with plates open, turn the slug screw on the antenna coil *out* until a station at the 1500 *kc* end of the dial comes in (assuming you have a local station at this point on the dial). On the other hand, if a local station is around 550 *kc* on the dial, turn the coil screw *in* until it can be picked up with the variable capacitor's plates in meshed position.

Assuming that your wiring is correct, and that your amplifier is a 2- or 3-stage job that provides ample volume when used to play LP records with a low voltage output crystal, your "air-powered" tuner should provide excellent results.

But remember, in areas where there are a number of local stations, the tuner may lack selectivity if too much antenna pick-up is used. We found a 6 ft. length of wire ample for local reception with volume control 50% retarded. Therefore, if you have a selection of local stations, a good antenna isn't necessary. Where more signal pick-up is needed (since local stations are non-existent) the use of a more efficient antenna will not pose any problem since distant station selectivity will be as good as with a TRF type electric receiver.—T. A. BLANCHARD.



1

Relax while enjoying the program with a portable television set carried on a bedside stand. Simply roll it into position, swivel the set to face you, then tilt it to a good viewing angle.

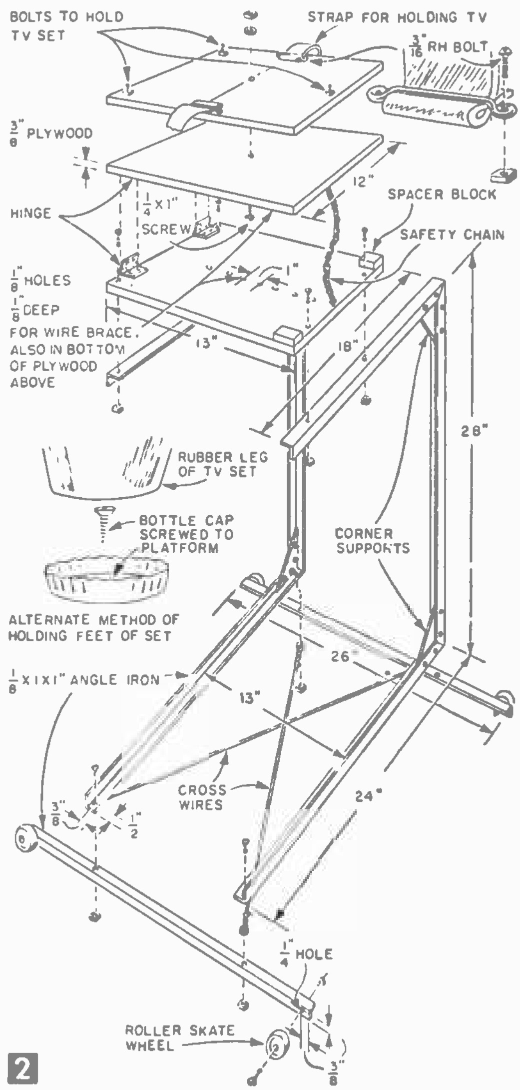
Bedside TV

ATTACH a portable television set to this adjustable bedside stand and you can watch your favorite TV programs while resting or convalescing in bed. The swivel top allows set to be turned in any direction; hinges permit tilting for best viewing (Fig. 1). Wheels on the base of the stand make it easy to position set at any distance from the bed. Designed to hold a 14-in. GE set, table can be altered to accommodate your portable TV.

Make the top or platform of three pieces of 3/8 x 12 x 13-in. plywood (Fig. 2). At the exact center of two of the pieces, drill a 1/4-in. hole and insert a 1/4-in. dia. x 1-in. long machine screw which serves as a pivot. Pull up the screw finger-tight into the nut and, with a center punch, upset the end of the screw slightly so that the nut cannot come off. Hinge the lower piece of plywood to the third piece at what will be the front of the platform.

Equidistant from each edge, drill a row of matching 1/8 x 1/8-in. deep holes 1 in. apart in bottom of center piece and in top of bottom piece. Cut a 2 1/2-in. length of stiff coat-hanger wire to use for tilting platform to desired angle. Attach a length of safety chain with screw eyes to center and lower parts of the platform to protect TV set from toppling forward if tilted too far. Two spacer blocks of scrap wood glued to bottom piece of platform will keep TV set level when wire tilt-top brace is removed.

Cut a web-type army belt in two so that it can be buckled at top center of the set when attached to platform. Fold cut belt ends under and hold down with section of coat-hanger wire



2

MATERIALS LIST—ADJUSTABLE TV STAND

No.	Size and Description	Use
3 pcs	3/8x12x13" plywood	platform
2 pcs	1/8x1x1"x8' angle iron	stand
1	web-type army belt	holding strap
1	1/4 dia. x1" long machine screw	pivot
4	1/8x3x3" right-angle triangles	corner supports
2 doz.	1/4x1" rh stove bolts	stand
4	ball-bearing roller-skate wheels	wheels
8	1/4 dia. x1" fh stove bolts	wheels, platform
8	3/16" fh or rh stove bolts	crosswires, belt hold-down
3	1/4x3/4" fh bolts	feet
	coat-hanger wire, 2 hinges, length of small chain, 2 small screw eyes, spacer blocks, enamel	

bent as shown (Fig. 2) and secured to plywood platform top with 3/16-in. *rh* stove bolts. To prevent interference with movement of swivel top, countersink nuts into the plywood and file off any rough projections, or use *fh* stove bolts countersunk with nut on top toward strap.

The three rubber bumpers used as feet on the TV set can be placed in bottle caps screwed to swivel top of platform or, if the feet are hollow, bolt them directly to plywood. Run countersunk *fh* bolts upward through top plywood piece only so they project about 1/4 in. above nut, but don't attach TV set just yet. Never set the feet down into holes bored in the platform, or you will cut off the movement of air and the set may overheat.

To make the steel stand (Fig. 2), cut two 70-in. lengths from the 1/8 x 1 x 1-in. angle iron stock and mark off 24 in. from one end and 18 in. from the other end of both pieces. At each mark saw out a 90° wedge from one side of the angle iron, then make a right-angle bend at each notch using a vise (see Fig. 2).

Now file round the corners of the remaining two 26-in. lengths of the angle iron stock. Measure 3/8 in. from one edge and 3/8 in. from each end of each piece. Drill a 1/4-in. hole at this point and bolt a ball-bearing roller skate wheel in place.

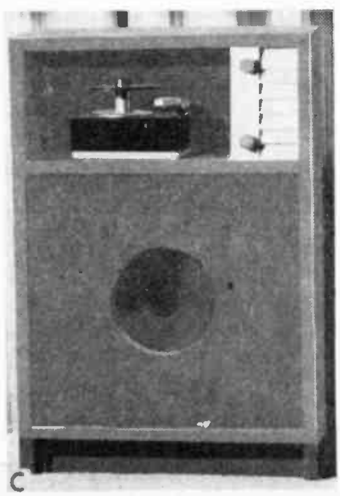
Using small C-clamps to clamp the two 26-in. lengths onto the 24-in. portion of the angle-iron stand, drill through the two thicknesses of angle iron with a 1/4-in. drill. Assemble with 1/4 x 1-in. *rh* stove bolts. To give rigidity to the assembly, add a right-angle triangle at each corner.

Now clamp the bottom plywood board of top assembly to the 18-in. horizontal brackets of the stand. Drill 1/4-in. holes through the board and, using 1/4 x 1-in. *fh* stove bolts, attach stand to board. Saw off any extra length of bolt and file.

While crosswires at the base are not absolutely necessary, they will make the assembly more rigid. Stretch coat-hanger wire from corner to corner, fastening each end around a bolt. With assembly completed, give it two coats of black iron enamel or choose a color to match or contrast with the furniture in the room. Then slide hollow legs of set down over bolt threads projecting from top of platform. With the TV set secured in position, pull the strap over the top of the set and draw up moderately tight, and you're ready for that late, late show—E. P.

Shelf Amplifier Systems

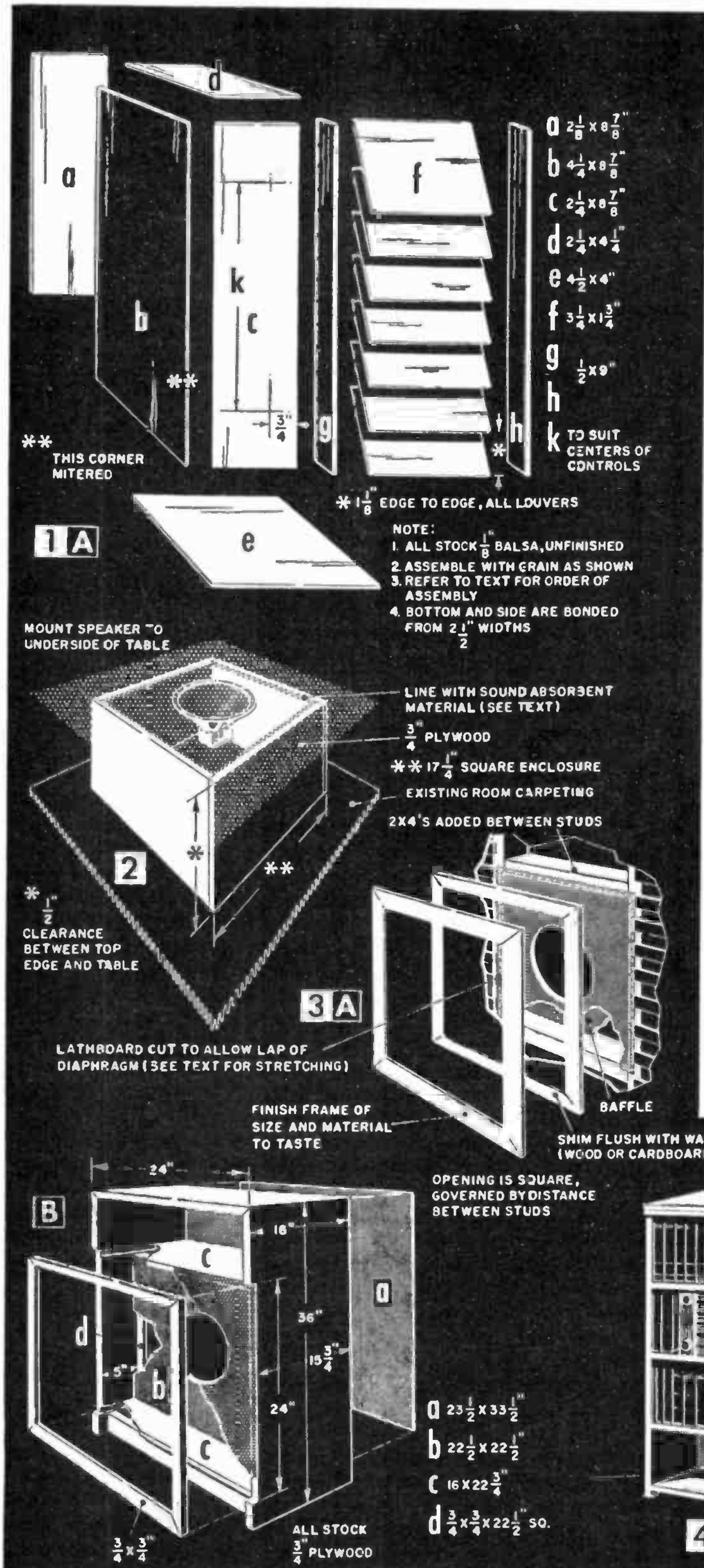
A Amplifier cabinet is shown next to record player on corner table. Speaker is open-ended enclosure (Fig. 2) beneath table.

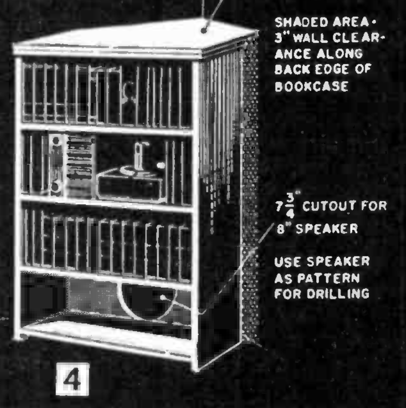


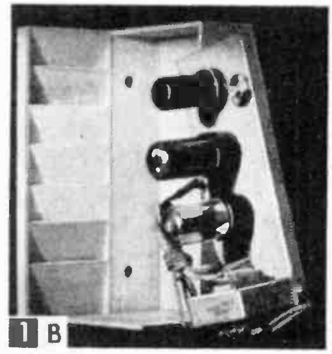
B Corner bookcase installation of speaker (detailed in Fig. 4).

C Diaphragm enclosure system (diagrammed in Fig. 3) with amplifier at top right of shelf.

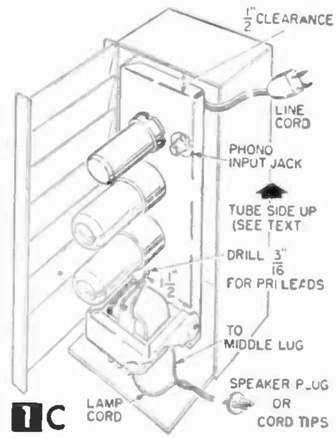
DESIGNED for installation in bookcases or similar pieces of furniture, and producing good reproduction for cost, these auxiliary amplifier cabinet and speaker systems feature simplicity and flexibility. The materials are all easily obtained with the possible exception of the balsa wood; this should have a brown or






1B

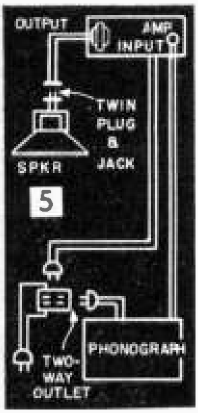
Amplifier and cabinet in which it is placed.

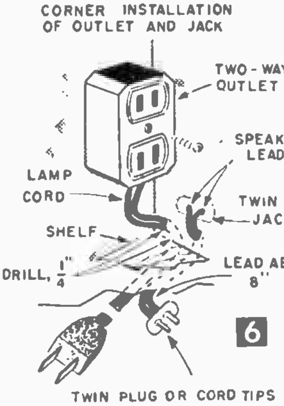


reddish color, (stronger than the good-looking white) and should be well dried.

The amplifier cabinet can be waxed, but left unfinished it has a soft, attractive quality—and is easy to clean.

To construct the amplifier





MATERIALS LIST—SHELF AMPLIFIER SYSTEMS

No. Req.	Description
1	amplifier kit Cat. #83Y790
2	knobs Cat. #71H208
1	twin-tip jack Cat. #43H261
1	twin-tip plug Cat. #43H260
1	two-way outlet
12′	lamp cord
1	line plug
1 tube	Comet cement
2½ sheets	Balsa wood ⅛ x 3 x 36" (see text)
1	8" speaker Cat. #81D144
4 pcs.	¾" plywood 12½ x 17¼" corner table installation
1 pc.	¾" plywood 26 x 26" bookcase installation
2 doz.	#7 x 1½" fh screws
1 doz.	#3 x ½" rh screws
1 doz.	#6-1" fh screws
	Diaphragm Enclosure
1 pc.	22½ x 22½" Plywood, ¾"
2 pcs.	16 x 36" Plywood, ¾"
2 pcs.	16 x 22¾" Plywood, ¾"
1 pc.	16 x 24" Plywood, ¾"
9′	1 x 2 stock
1 yd.	100 count muslin
1 pc.	hardboard 23½ x 32½"

(Catalog #'s are those of Allied Radio Corp. 100 N. Western Ave., Chicago 80)

cabinet, cut all parts to the dimensions indicated in Fig. 1A and sand lightly with fine sandpaper to produce a satin-like finish. Assemble the louvered unit first, then cut the control holes in the front panel. Although the overall dimensions will remain similar no matter what type of two or three tube amplifier you use, control locations will vary from one unit to another and for that reason the center to center distances of the control holes should be taken from the chassis of the amplifier you're housing. Be sure, however, to leave the required ½-in. ventilation space all around as in Fig. 1C. (The amplifier shown in Fig. 1 is a three-tube amplifier. The Knight-Kit "Low-Cost Phono Amplifier Kit" listed in the Materials List is a two-tube amplifier that also fits well in the cabinet. Kits, usually, are less expensive than pre-built units.)

Build the remainder of the cabinet, starting with the front panel, adding the side panel of two cement-bonded pieces, then the rear panel, top, and bottom panel of two bonded pieces. Sand square and add the louvered section, finish with #00 sandpaper. Use a sanding block; the sanding must be even.

Mount the amplifier with the hottest, or tube side upward to assure optimum heat dispersal (Fig. 1C).

You can control the record player from the amplifier switch, or, as shown in Figs. 5 and 6, you can plug it into a two-way outlet (more flexible) and control it with its own switch.

Three extremely simple adaptations of well-known speaker enclosures can be used in conjunction with the amplifier unit.

The first enclosure, suitable for corner table installation, consists of four pieces of plywood (Fig. 2) lined with a sound absorbent material, such as 1 in. of felt, or deep pile carpeting, fiberglass or cotton batting. Make the interior as "dead" as possible, allowing ½-in. clearance between the top edge of the enclosure and the table top. Screw-fasten the speaker snug against the underside of the table using #3 x ½-in. *fh* screws, but be careful not to warp the frame of the speaker.

The second enclosure (Fig. 4), for use with a corner-located bookcase, gives slightly better results with the same speaker and is even easier to construct than the open-ended enclosure.

Make a cut-out in the back-board of a corner-located bookcase centered between the two bottom shelves and fasten your speaker to the rear of the bookcase with machine screws. Again, be careful not to warp the frame of the speaker. Locate the bookcase at equal angles to two intersecting walls, allowing 3-in. clearance along the back edges (Fig. 4). Then cut a ¾-in. plywood wedge top to fit snug with the walls and flush with the front and side edges of the bookcase.

In the third system the speaker is installed in a wall (Fig. 3A) or in an entirely portable enclosure providing for the installation of both amplifier and record player with speaker (Fig. 3B). (Since the size of the enclosed shelf space is not critical, the dimensions given in Fig. 3B for the portable enclosure can be altered to suit your record player.)

Cut out pieces to size and dado the sides and miter the top and top side edges as indicated. Then assemble the sides, top and bottom, and secure the shelf into place, using finishing nails and glue. Add the kick plate, fasten the supports into place with #6 x 1-in. screws, and fasten the baffle to the supports.

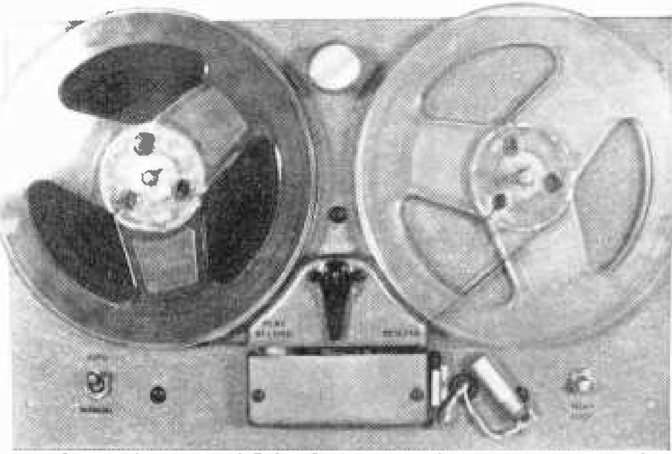
Next, cut a hole 8 in. in dia. in the center of a yard of 100-count muslin. Draw the 1-in. lap of material through the baffle hole and staple in place, then pull the material taut to the outer edge of the enclosure and staple in even tension. (The surface must be smooth.)

Now nail and glue the face in place, spray the muslin with three or four heavy coats of lacquer —sufficient to make this diaphragm resonant, but not stiff enough to make response difficult—and finally fasten the speaker in place, again being careful not to warp its frame.—W. R. WADKINS

Automatic Stop for Tape Recorders

By W. F. GEPHART

THE better record changers provide for automatic shut-off following the last record, but few tape recorders are so equipped. Lack of this feature means that the recorder must be shut off promptly near the end of the tape to prevent the tape from coming loose. If the tape does come loose, it may be damaged; in any case, re-threading for re-winding purposes is always necessary. It is particularly annoying to have to be alert to stop the mechanism when listening to music on tape.



1 Lamp, photocell and Relay Lock switch of automatic tape recorder stop are located lower right. This arrangement of stopper is that shown in Fig. 2B.

The circuit shown in Fig. 4 will automatically stop the mechanism at any desired point on the tape. It can also be used at the start of the tape to prevent the tape coming off the take-up reel during re-winding as well as at the end of the recorded material on the tape. It can be adapted to any recorder.

The circuit is complete with power supply, but power can be secured from the recording amplifier if desired. The power supply is shown within the dotted lines on the schematic and, if external voltages are available, the parts within the dotted lines and half of the "Auto-Manual" switch (Sla) can be eliminated. Power requirements are 6.3 *v.* at .45 *amp.* (connected to points "C" and "D" on Fig. 1) and 130 volts at 10 *ma* (positive connected to point "A" and negative connected to point "B").

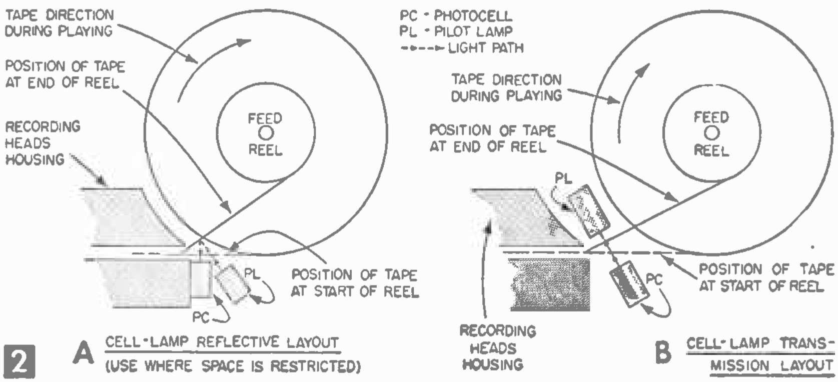
When the recorder is to be used on "automatic stop," S1 is put in the "Auto" position, connecting the motor circuit through the upper contacts of RY1 (and turning on the power to the control unit). The motor circuit is not complete until the relay (RY1) is closed *and* the regular recorder starting switch is closed. The relay is closed by pressing the "Relay Lock" button (S2). It is held closed by the lower set of its own contacts, connected in a locking circuit. The recorder is then started (either "Forward" or "Rewind") in the usual manner.

Due to adjustment of the sensitivity control (R3) as explained below, tube V1 is not conducting and RY2 is not energized. When light strikes the photocell, however, the tube conducts, energizing RY2, which breaks the circuit to the coil of RY1, which opens and stops the motor.

Figure 2 shows two means of lamp-cell placement. In most recorders, the arrangement shown in Fig. 2A will be required, particularly when large reels are used. In this case, a strip of aluminum foil is cemented to the outside of the tape at the point where the mechanism is to stop. As this reflective coating passes the lamp-cell area, light is reflected into the cell which starts the tube conducting and stops the motor.

If sufficient room is available, the arrangement in Fig. 2B can be used. In this case, a section of clear cellophane is spliced in the tape at the desired point, and the light goes through the tape to stop the motor.

In either case, the sensitivity of the circuit must be set at a level



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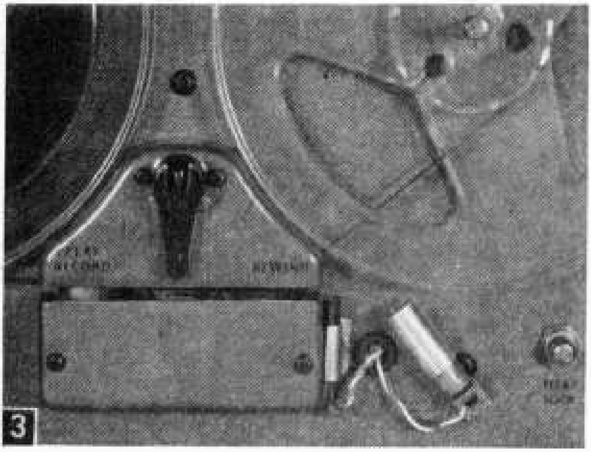
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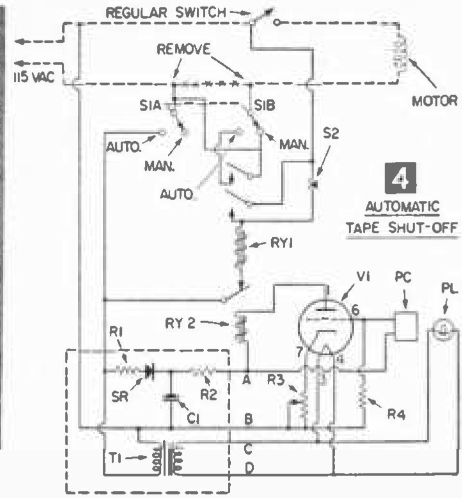
Closeup of photocell housing (left), lamp (center), and Relay Lock switch on top of tape recorder case.



4 AUTOMATIC TAPE SHUT-OFF

which will prevent the circuit from operating at normal room light. This is best done by placing the regular tape in front of the light, and adjusting the sensitivity control (R3) until the "stop relay" (RY2) closes, and then backing off the control until the relay just opens. Check adjustment by moving the transparent or reflective tape in the path and seeing if the relay closes. The adjustment should be right on the edge of sensitivity, that is, the relay should just barely close when the transparent or reflective coating is in line. It needn't close firmly, just enough to break the circuit to RY1 for an instant. The most sensitive adjustment may mean that RY2 will chatter slightly when the transparent or reflective coating is in line, but it guarantees that random room light will not actuate the circuit.

MATERIALS LIST—AUTOMATIC STOP

R1	39 ohms, 1 watt*
R2	250 ohms, 5 watt*
R3	5000 ohm potentiometer
R4	1.5 megohm, ½ watt
C1	50 mfd., 150 volt*
SR	65 ma. selenium rectifier*
T1	6.3 volt @ 1 amp. filament transformers*
S1	DPDT toggle switch ("Auto-Manual") #
S2	SPST push button ("Relay Lock")
Ry1	DPST relay with 110-volt coil
Ry2	SPST (normally closed) relay with 5000-ohm coil (Potter & Blumfield LM5 or equivalent)
V1	6AB4
PC	Crystal photocell, Clairex CL-2
PL	6.3 volt (.3 amp.) pilot light

* Not required if power supply is not to be included.
# A SPDT switch can be used if power supply is not to be included.

To further minimize the chance of room light affecting the cell, it is housed well back in a large diameter piece of "spaghetti" which acts as a hood (see Fig. 3). The lamp is also enclosed in an aluminum clip-on hood (bent around a ⅜-in. rod) to concentrate the light.

These hoods and mounting details (using the reflective system) are shown in Fig. 3. Both units must be placed in back of the line of the tape when feeding from a full reel of maximum size, but as close to the tape as possible. The actual location of each unit will depend on the recorder used; it must be determined by trial and error. Mount one of the units (preferably the cell), set the reflective or transparent section of tape in the area, and move the lamp around to the point that gives best results. Then fasten the lamp in place.

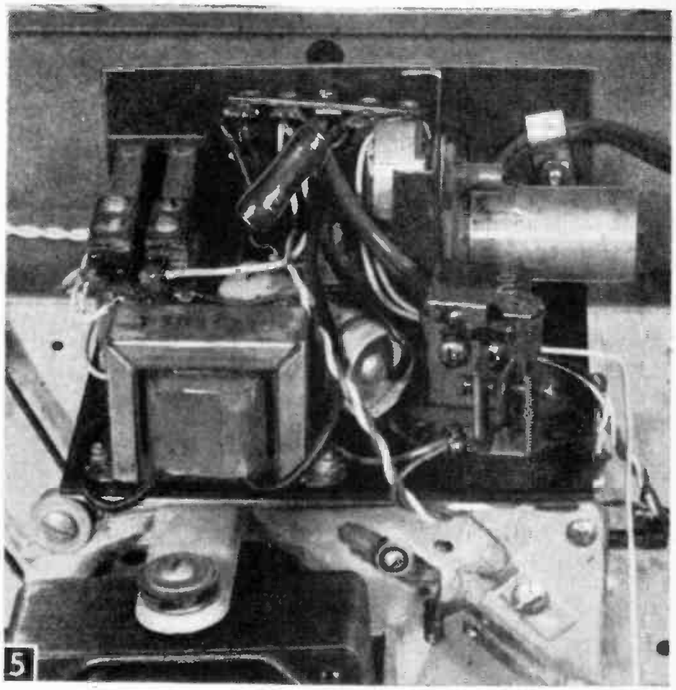
Due to the locking feature of RY1, only a small piece of "trigger tape" (reflective or transparent) need be used. As long as the trigger tape is in the lamp-cell area, the motor cannot be started with S1 on "Auto," since RY2 is closed and RY1 cannot be closed. If the trigger tape stays in the light-cell area after the mechanism has stopped, it must be moved manually out of the light-cell area to start the motor (or S1 can be thrown to "Manual"). After the trigger tape is out of the area, the motor can be started again by pressing the "Relay Lock" button (S2) and using the regular motor starting switch. Whenever the mechanism has stopped automatically, turn the regular motor switch "Off," thus disengaging the mechanism, before restarting the motor.

If a section of trigger tape is placed near the beginning of the reel of tape, the automatic stop feature can be used when re-winding to prevent the tape from coming loose from the take-up reel and to insure starting over at the same point. Due to tape speed of re-winding, the trigger tape should be several inches long for this purpose.

The location of the "Auto-Manual" switch (S1) and the "Relay Lock" button (S2) is not important, but must necessarily be clear of mechanism beneath the panel and clear of the largest size reels to be used.

All under-panel wiring must be carefully routed and fastened in place to prevent fouling any part of the mechanism. Also, adequate shielding must be used to prevent any *ac* hum from being induced into the heads and to prevent any demagnetization of tape from taking place. For that reason, particularly if a power supply is to be used, the components should be mounted as far from the heads as possible. The

Under-case view of tape recorder showing mounting of control components and wiring of automatic stop (top center).



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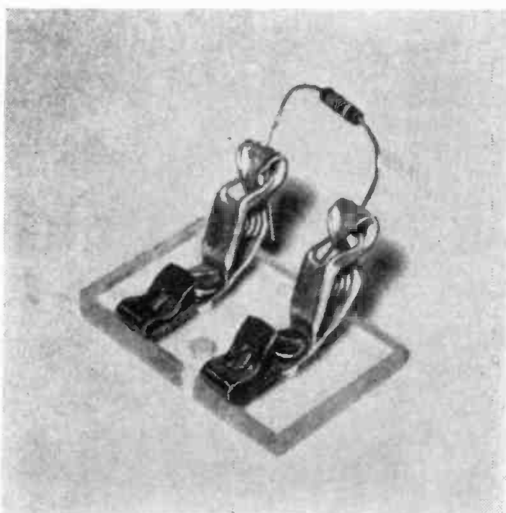
chassis for mounting parts should be of heavy gage steel for additional shielding.

Figure 5 shows the under-panel view of the circuit used with a recording mechanism, with the power supply included. The placement of parts is not critical, although an effort was made to put the filament transformer as far from the heads as possible. The tube has a shield only to act as a hold-down to prevent it from working loose in the socket. The sensitivity control is locked at the proper setting with a dab of nail polish on shaft and its housing.

So, load her up, set S1 on "Auto," press the "Relay Lock" button momentarily, start the mechanism with the regular switch, and forget it. It will stop automatically wherever you put the trigger tape.

Parts Substitution Block

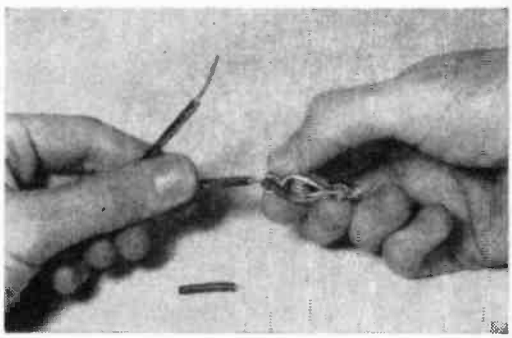
• Experimenters will find this parts substitution block a convenient timesaver when working with experimental circuits. Make the block from two test clips (Muller #45), two single ended Fahnestock clips, and a piece of plastic or other suitable insulator (for the base). Cut off the wire supports at the rear of the test clips, remove the



screws and drill the holes slightly larger. Secure the clips with longer screws to the base as shown. Place the part to be substituted in the jaws of the clips and connect test leads from the circuit to the Fahnestock clips.—John A. Comstock.

Test Clip Strips Wire

• Have you ever tried to strip insulation from stranded wire with a knife or nail clipper only to find several of the wire strands accidentally cut?



Next time you have some wire to strip, place it in the jaws of a test clip, grasp the clip by the outside of the jaws and pull. This will peel off the insulation without appreciably harming the conductors.—John A. Comstock.

ANSWER TO ELECTRONIC CROSSWORD PUZZLE Page 24

G	■	H	I	F	I	■	R	E	D
R	■	E	■	■	O	■	A	■	I
I	■	N	E	O	N	■	D	■	O
D	■	R	■	■	■	■	I	■	D
■	E	Y	E	■	P	H	O	N	E
X	D	■	T	■	L	■	■	O	■
■	I	■	H	■	A	■	■	I	■
■	S	H	E	A	T	H	■	S	■
L	O	■	R	■	E	■	■	E	P
■	N	C	■	I	■	L	P	■	A

As an amateur radio "ham" you can join local and national radio clubs (such as the American Radio Relay League headquartered in West Hartford, Conn.) and make a host of airwave friends.

Six-Meter Radiotelephone Station

By C. F. ROCKEY
W9SCH

To quote from a recent issue of a leading national magazine, "'Ham' radio makes plenty of sense as a hobby. . . . It's practical; it's a lot of fun and a lot more sociable than you might think; it can be surprisingly inexpensive; it even has a community service side that gives the hobby a solid, worthwhile purpose. . . . On the social side, you get to know fellow hams both in person and over the air—and it's astonishing how airwave friendships last. . . . As for service, you can take part in one of the ham 'nets' that handle communications for the civil authorities in times of emergency or disaster."

If you're a ham already, you know all this. If you're not, the information may prompt you to become a ham. In either case, the six-meter station described in this article would make an ideal set for you. Why? well, for one thing, the six-meter band for which it is engineered is characterized by consistent and reliable communication over a 20- to 30-mile range. For another, the band is remarkably free from interference in most localities. It is, therefore, ideal for low-power operation. And when multi-element, high-gain, directive antenna systems are used, communication ranges of thousands of miles are possible.

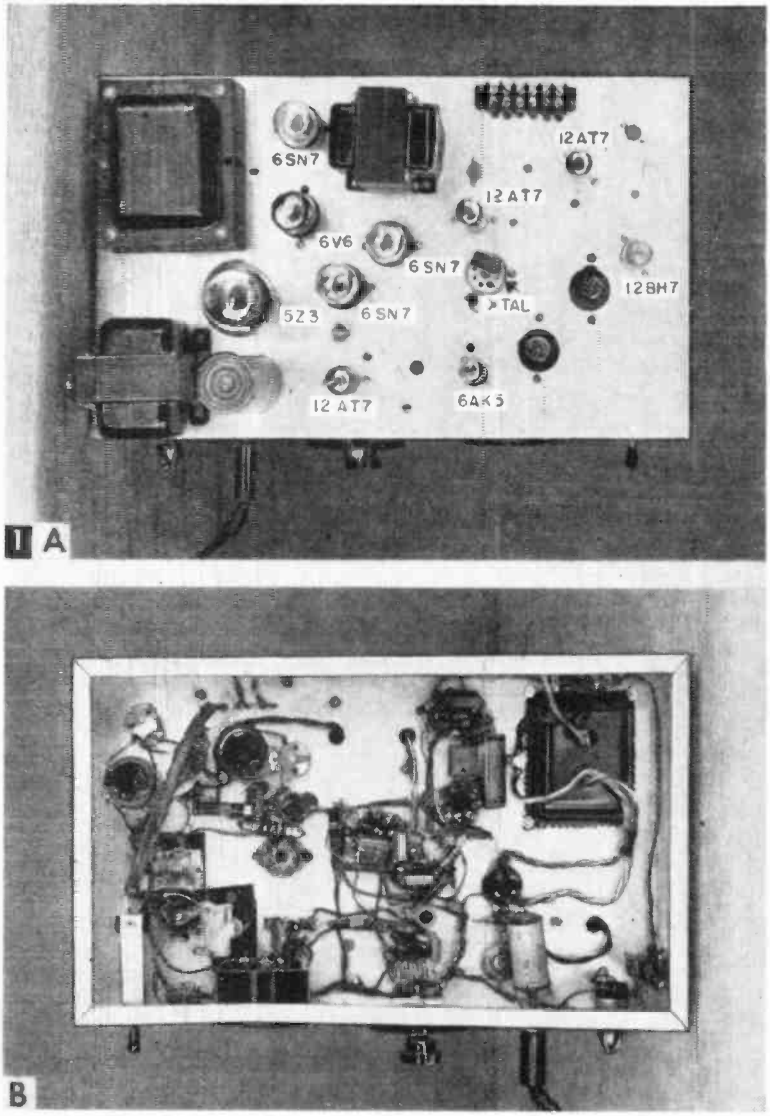
It is the consistency and reliability of relatively short-range communication, however, that especially recommends the six-meter band to the more serious amateur. And civil-defense authorities have especially recommended the six-meter band for emergency communication work!

Most commercially-built equipment for this band is expensive; the most widely-known unit sells for over $200. The set described in this article, however, can be built for only a little more than one-third of this sum, even when new parts are used. If you use second-hand parts, the cost will be greatly reduced even over this.

The transmitter section of this amateur radiotelephone station is crystal-controlled. With crystal control, it is virtually impossible to emit an illegal off-frequency signal. The receiver section combines the sensitivity and reliability of the superheterodyne circuit with the simplicity and inexpensiveness of the super-regenerative. It is easy to "get-going," free from radiation, and sensitive enough to receive from any distance that the transmitter can reach.

No "overtone oscillators" or other trick circuits are used in this unit; all tubes are ordinary types, available everywhere. We feel that this unit will provide the absolute per-dollar maximum in Very High Frequency communication for the low-power or Technician class amateur.

Begin construction by cutting the large opening for the power transformer in the 4 x 10 x 17-in. chassis (Fig. 2). Exact dimensions for this opening are best obtained by measurement directly from the transformer you will use. Such openings are usually cut by drilling a series of closely spaced 1/8-in. holes along the outline and breaking away the strips of metal left between these holes with a screwdriver. After making the cut-out for the power transformer, cut the



Top (A) and bottom (B) views of the completed six-meter station.

large, round opening for the tuning meter by transferring the hole dimensions from the manufacturer's template (usually supplied in carton with the milliammeter) and drilling ⅛-in. holes and breaking away with a screwdriver as with the transformer opening. Punch the tube socket holes with Greenlee or other make chassis punches, and drill and cut away opening for the Send-Receive switch, following the template supplied by the manufacturer.

With large holes cut, drill small holes, using each socket or small part as its own template. Mount the power transformer, the filter choke, the can-type electrolytic capacitor, the combination volume control and Off-On switch, the 5Z3 rectifier tube socket and other tube sockets (large sockets with 6-32 x ⅜-in. *rh* machine screws, small with 4-36 x ¼-in.), the terminal strip, and the Send-Receive switch on the chassis.

Wiring for the power supply is shown in the schematic, Fig. 3. (Figure 5 gives a pictorial wiring diagram for the power supply, receiver section, and transmitter section.) Most of the wiring for the entire unit can be done with #20 plastic-insulated hookup wire; connections should be soldered with rosin-core solder.

Wire placement in the power supply is not critical; leads may be as long as necessary. The 20 *mfd* electrolytic capacitor and other, similar, small parts are mounted by their leads, using insulated tie-points screwed to the chassis at convenient locations. Be sure to observe polarity when connecting electrolytic capacitors, since they would be permanently damaged by wrong connections. (Other types of capacitors are not critical as to polarity of connection.) All grounds in unit are made to chassis.

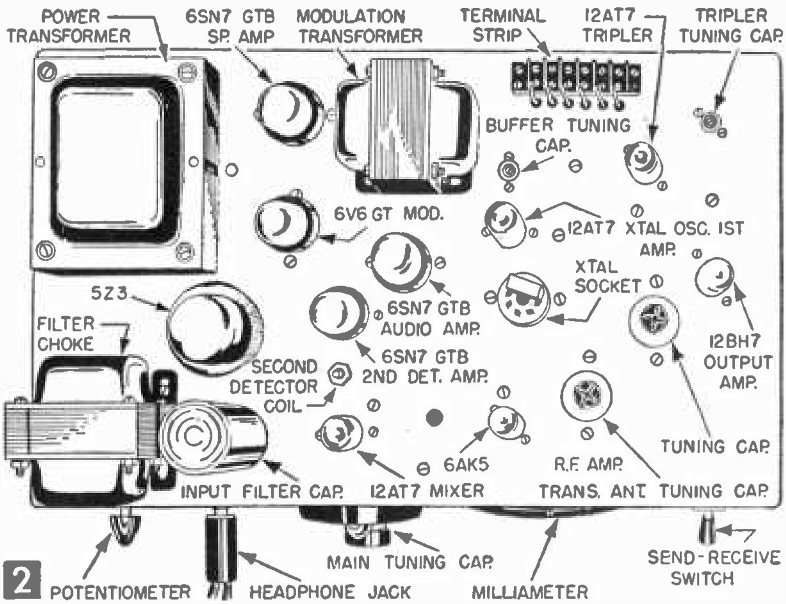
When the power supply wiring has been completed, check it carefully. With the 5Z3 rectifier tube in its socket and operating, the power supply should deliver from 350 to 500 volts *dc* measured across the 20 *mfd* output filter capacitor with a radio service-type *dc* voltmeter. When full transmitter load is applied, the voltage will drop to the correct operating value of about 350 volts.

Begin receiver wiring by first connecting heater circuits of all tubes (see Fig. 4). One side of each tube's heater is connected to a common heater supply wire which is then connected to point "H" in the power supply (Fig. 3). The other side goes to ground. Insert receiver tubes in sockets (do not insert the 5Z3 rectifier) and apply power. If wiring is correct, all heaters will light.

With heater circuit checked, wire the audio amplifier circuits of the receiver. Mount the phone jack on the front of the chassis and work forward from the last stage of audio amplification. Mount mica capacitors and resistors by their leads, using insulated tie-points as necessary. When you have wired the last amplifier stage, insert the audio amplifier 6SN7 GTB into its socket and plug headphones into jack. With power supplied and Send-Receive switch in "Receive" position, touching pin #4 grid terminal of the tube with the tip of a screwdriver should produce a noticeable click or buzz in the headphones. If this, or any other stage does not operate, the difficulty is incorrect wiring, a solder-spot short, or a defective component or tube.

Wire the next stage of audio amplification and test similarly. A screwdriver on pin #1 grid of the 6SN7 GTB should now produce a very much stronger buzz in the headphones.

The first connections for the second-detector stage are to the volume control potentiometer, with its associated 100 K ohm (100,000 ohms) resistor and 5 *mfd* bypass capacitor. The second detector coil is wound on a National XR-50 variable-slug coil form as shown in Fig. 6E. The position of the cathode-tap on this coil is particularly critical. Make sure that it is closest to the *grounded* end of the coil. Fasten turns in place by coating with polystyrene cement.



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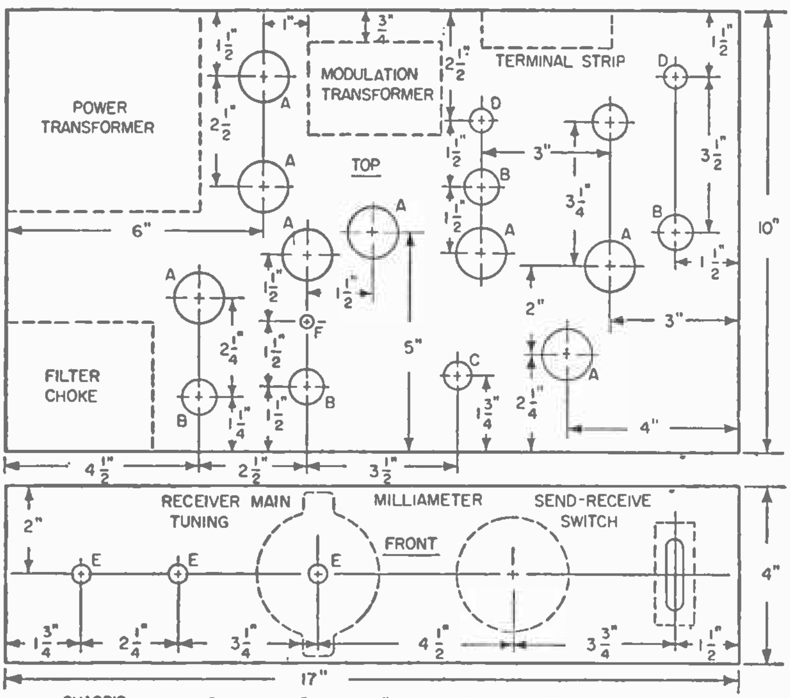
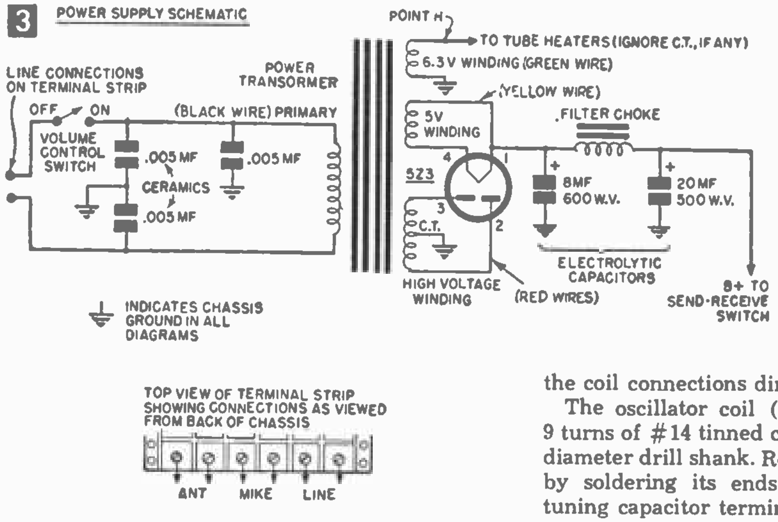


CHASSIS LAYOUT   A-1 1/8" DIA., B-3/4" DIA., C-5/8" DIA., D-1/2" DIA., E-3/8" DIA., F-1/4" DIA.

Since the second detector is the heart of the receiver, check and recheck its wiring, then insert tubes and plug in phones and apply power with Send-Receive switch in "Receive" position. When the tubes have warmed, gradually advance the volume control clockwise. A loud, clean hiss should be heard in the phones and it should be possible to control the strength of this hiss from inaudible to very strong with the volume control.

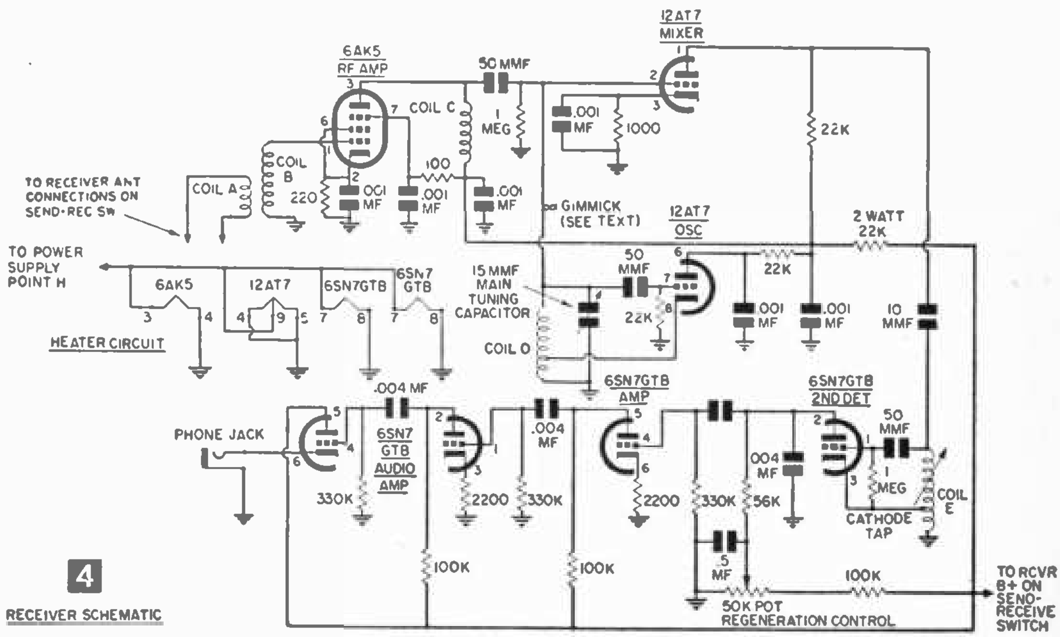
When wiring the R. F. amplifier and oscillator-mixer circuits, keep leads as short as possible. Although zero-length leads are not as essential in a 50-megacycle unit as they would be in higher-frequency units, short lead-length will pay dividends in operating effectiveness. It is also good construction technique in any VHF circuit to establish a single ground point for each tube, and bring all high-frequency grounds to that point. And, when wiring circuits using miniature tubes, it is important to avoid excess solder on the tube socket connections. Use a hot iron and do a quick but thorough job on each connection.

3 POWER SUPPLY SCHEMATIC



Keeping these construction principles in mind, wire the R.F. amplifier, mixer and oscillator circuits as shown in Fig. 4. The grid (A and B) and plate (C) coils for the R.F. amplifier are each wound on high-resistance 1-watt carbon resistors (see Fig. 6A, B and C). Any 1-watt carbon resistor larger than 100 K ohms will do. Where possible, solder the coil connections directly to the resistor leads.

The oscillator coil (D) is formed by winding 9 turns of #14 tinned copper wire around a ½-in. diameter drill shank. Remove drill and mount coil by soldering its ends directly to the receiver tuning capacitor terminals. This coil should have



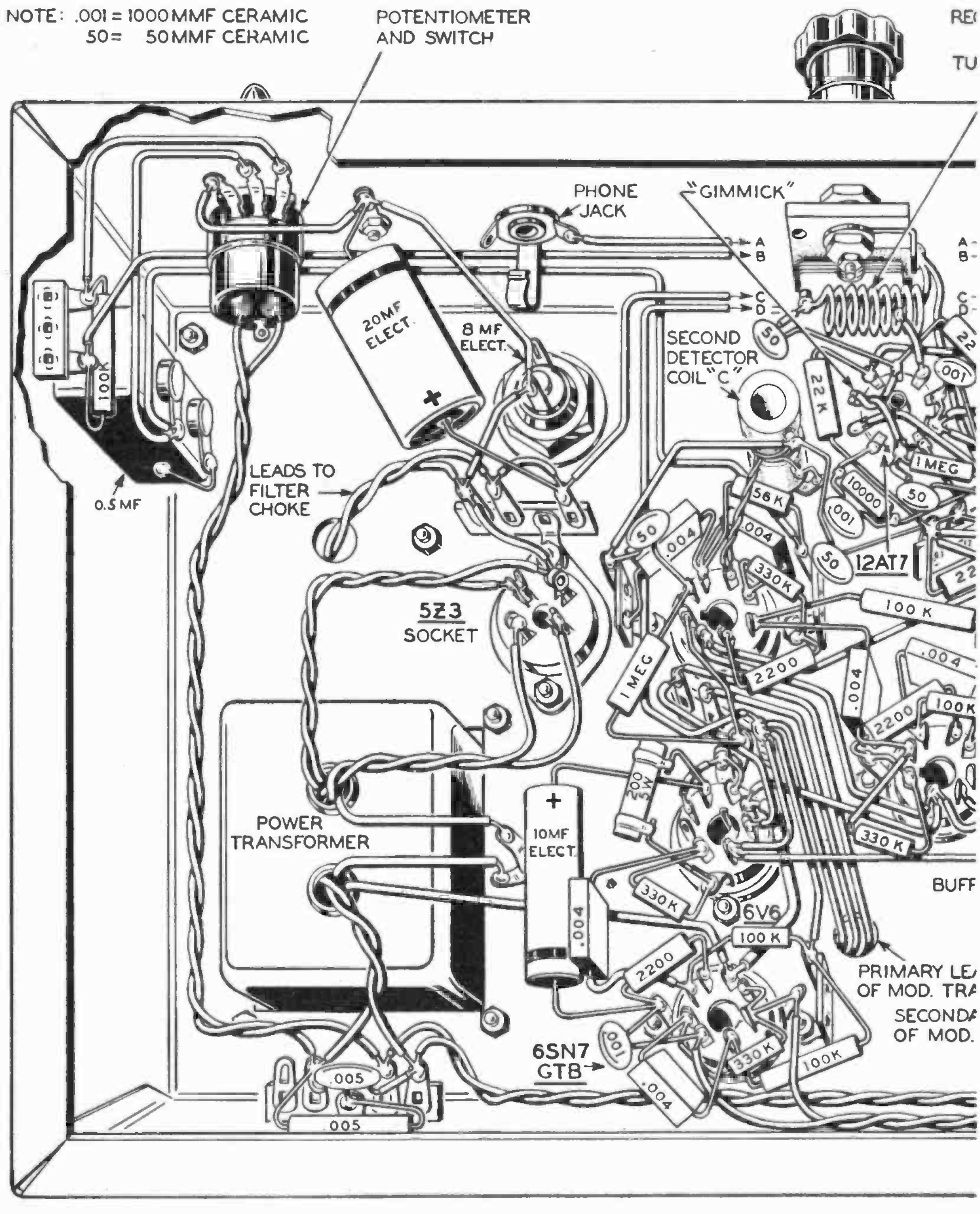
4 RECEIVER SCHEMATIC

its turns uniformly spaced so that the total length of the coil is about 1¼ inches. The ground end of this coil is the end which connects to the capacitor rotor plate terminal. The cathode tap should be two full turns from the ground end.

The circuit component labelled "Gimmick" in Fig. 4 capacitively couples signal energy from the 12AT7 oscillator section into the mixer section. It consists of two pieces of ordinary hookup wire (insulation left on) twisted together 5 times.

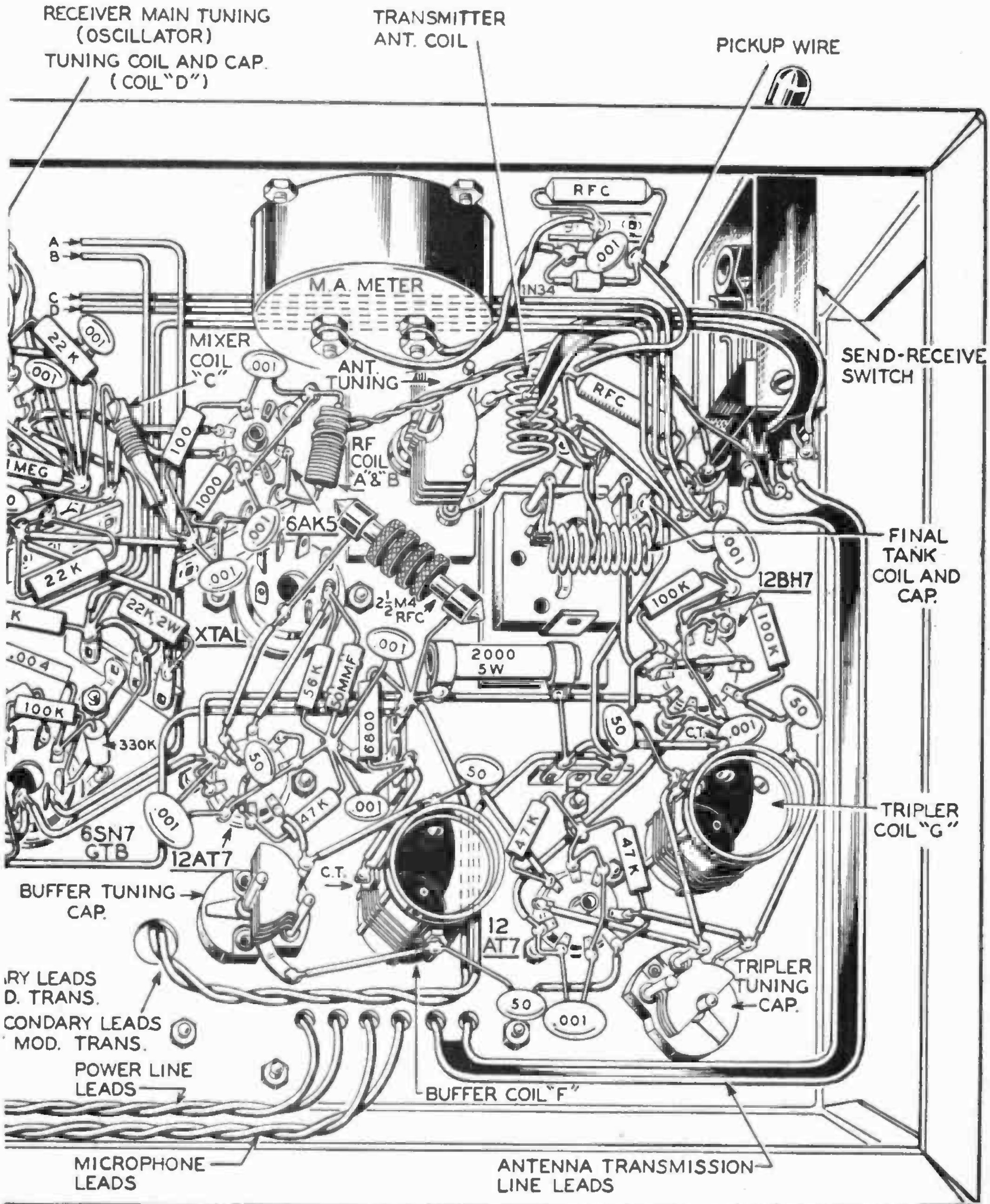
To adjust the coils for proper resonant frequency, a grid-dip meter will be needed. Usually, such a meter can be borrowed from another ham. Instructions for its use are supplied by the manufacturer.

With power Off, plug tubes into their respective sockets and adjust the slug in the second-detector coil (coil E) until the grid-dip meter indicates



resonance at 30 megacycles. Then check the tuning-range of the oscillator coil (coil D) to see that it includes the range from 80 to 84 megacycles. A slightly greater range for this coil is of no particular disadvantage, but if the oscillator tuning range does not cover 80 to 84 megacycles, recount the turns and recheck the connections. Small deviations can be corrected by either stretching or squeezing together coil D's turns.

Next, adjust coils B and C to resonate with the tube and circuit capacitance at 51 megacycles. Add or remove a turn or two from each of these coils to bring them into resonance correctly. When correctly adjusted, fasten the turns in place with a touch of polystyrene cement. Remember, to adjust these coils correctly, the tubes must be in their sockets but not lighted, that is, power is Off. (See Table A for coil resonant frequencies.)



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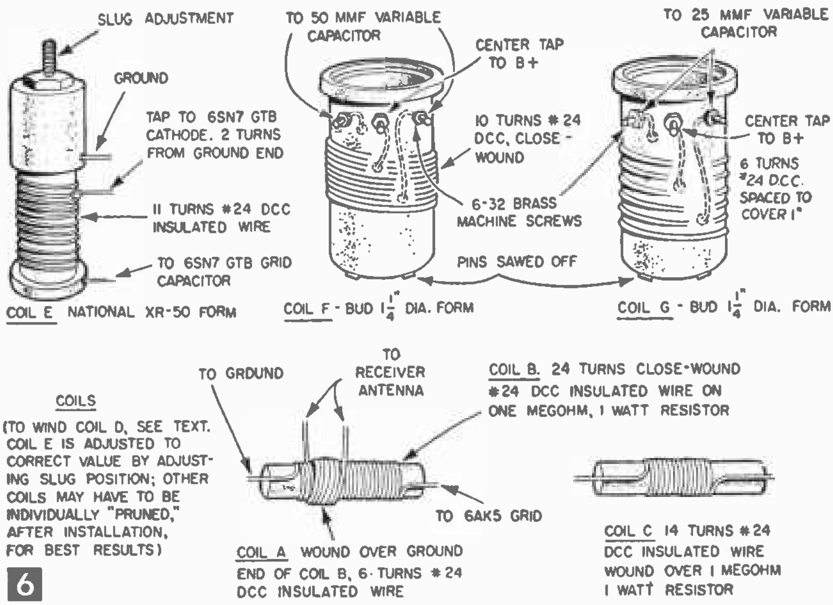

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TABLE A—RESONANT FREQUENCIES

Coil	Tuning Capacitor	Resonant Frequency, MC approximate (8.33 MC XTAL)
A	none	not significant (antenna coil)
B	tube-circuit capacitance	51 MC
C	tube-circuit capacitance	51 MC
D	tuned by main receiver tuning capacitor, 15 mmf	tuning range must include 80 to 84 MC (for 30 MC I.F.) may be wider without harm
E	tube-circuit capacitance	adjust slug for resonance at 30 MC
F	50 mmf max.	8.33 MC
G	15 mmf	25 MC
H	15 mmf	50 MC
I & J	none	not significant (coupling links)
K	50 mmf	50 MC

With coils adjusted, plug in headphones and apply power. Connect a simple VHF antenna such as that used with TV receivers, or that shown in Fig. 12, to the receiver input, or to the antenna terminals of the terminal strip, and throw the Send-Receive switch to the "Receive" position. Adjust the volume control until you hear a slight hiss in the phones and if there are 50-megacycle amateurs operating in your vicinity you should be able to tune them in. As a signal is tuned in, the hiss will tend to disappear and the voice will ride in strongly above it. A slight readjustment of the regeneration control will clarify and strengthen weaker signals.

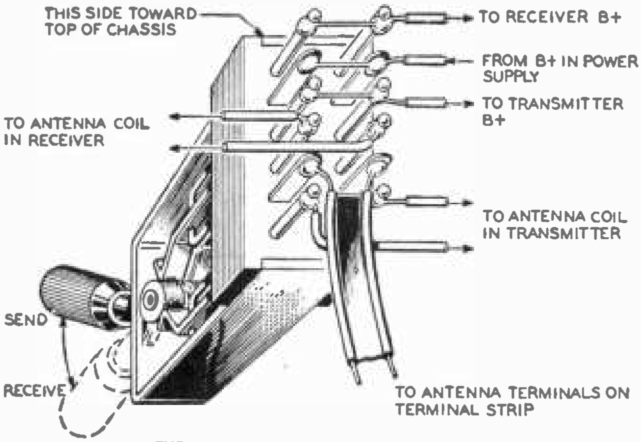
Building the Transmitter. First of all, do *not* build this or any other transmitter unless you have a General or Technician class amateur license from the FCC. (See *Do You Need A License?*, bottom of page 107, for further information on this subject.)

Begin construction of the transmitter section by making heater circuit connections (see Fig. 8). Next, wire the crystal oscillator circuit, using an octal (8-pin) tube socket for the crystal socket. You may use any two *alternate* pins for the crystal connections. (We used pins 1 and 3). The crystal oscillator circuit is the simple and reliable Pierce type and will oscillate with any 8-megacycle crystal. (None of the other circuit component values are critical, either). Any modern crystal having a fundamental frequency between 8.334 megacycles and 9.000 megacycles will enable you to operate in the six-meter band, but since most amateurs prefer to operate below 52 megacycles, the highest preferred crystal frequency will be 8.666 megacycles. Be sure that as you wire the transmitter you obtain B+ for all stages at the proper terminal of the Send-Receive switch (see Fig. 7).

When wiring for the oscillator stage is completed and has been checked, apply power with 12AT7 and crystal plugged in and Send-Receive switch in "Send" position. Now, holding a 2-watt neon lamp bulb *by its glass envelope*, touch the base of the bulb to pin #1 of the 12AT7 oscillator section. A bluish-pink glow in the bulb indicates proper oscillation.

Next, disconnect power and wire the buffer amplifier stage of the transmitter. Coil F (see Fig. 6F) is wound on a Bud 1¼-in. dia. plug-in coil form. It consists of 10 closely-wound turns of #24 double cotton-covered, center-tapped. Three 6-32 brass screws of about ¼ in. dia. can be used as coil terminals. Saw the pins of the coil form off flush with the bottom of the form, and mount it on the chassis with a 6-32 machine screw up through the bottom. When mounting the 50 *mmf* tuning capacitor, drill a hole in the chassis large enough to give ample shaft clearance, since you must insulate both rotary and stationary plates from the chassis. Mount capacitor with 4-40 x ¼-in. *rh* machine screws.

When wiring of this stage is completed, apply power as before and check for output. Coil F should tune to the correct frequency with the 50 *mmf* capacitor nearly completely meshed. Check



7 SEND-RECEIVE SWITCH (END VIEW)

for this by inserting the tuning lamp and loop shown in Fig. 9 into the coil; sufficient energy should be present to light the lamp dimly but definitely. *Remember*—the shafts of the tuning capacitors in the plate circuits of the transmitter tubes have 350 volts of B+ on them when the transmitter is On. Do *not* touch these shafts. The buffer's output should be on 8 megacycles.

With the buffer amplifier completed, disconnect power and proceed to the construction of the push-pull 12AT7 tripler stage. Mount the 25 *mmf* variable capacitor in the same manner as the 50 *mmf* capacitor for the buffer stage was mounted. Wind coil G as shown in Fig. 6G and mount it as you did coil F.

When the tripler stage is completely wired, insert tubes and crystal and apply power. Using the grid-dip meter, retune the first amplifier to the crystal frequency to compensate for the added grid capacitance of the tripler. Then set the grid-dip meter to 25 megacycles and adjust the 25 *mmf* tripler tuning capacitor for maximum output as indicated by a brightly glowing tuning lamp when loop is inserted into coil G. Avoid accidental contact with the coil or the tuning capacitors.

When the tripler stage is functioning properly, disconnect power, and wire the doubler final amplifier. The grid circuit of this amplifier is identical with that of a push-pull stage, but the plates of the two triode elements are in parallel. This circuit arrangement, called "push-push" amplification, provides strong, efficient output on *twice* the frequency of the input, while strongly suppressing output on other frequencies. It is an ideal circuit for applications of this nature and provides good output on 50 megacycles.

Punch a 1⅛-in. socket hole in the chassis for the 15 *mmf* tuning capacitor and make an insulating strip as shown in Fig. 11. Mount it under the 1⅛-in. hole with 6-32 x ¼-in. *rh* machine screws. Coil H consists of 10 turns of #14 tinned copper wire wound on a ½-in. drill shank. Space the turns uniformly until the winding is about 1¼-in. long, remove drill and solder the ends of this coil directly to the 15 *mmf* tuning capacitor.

An important temporary change in the wiring of the final amplifier stage is made at point P (see Fig. 8). When transmitter is completed, the lead to the left of this point will go through the modulation transformer secondary to B+. Since the modulation transformer is not yet installed, however, a length of hookup wire should be temporarily connected from point P to a transmitter B+ terminal of the Send-Receive switch so that you can conveniently test this stage.

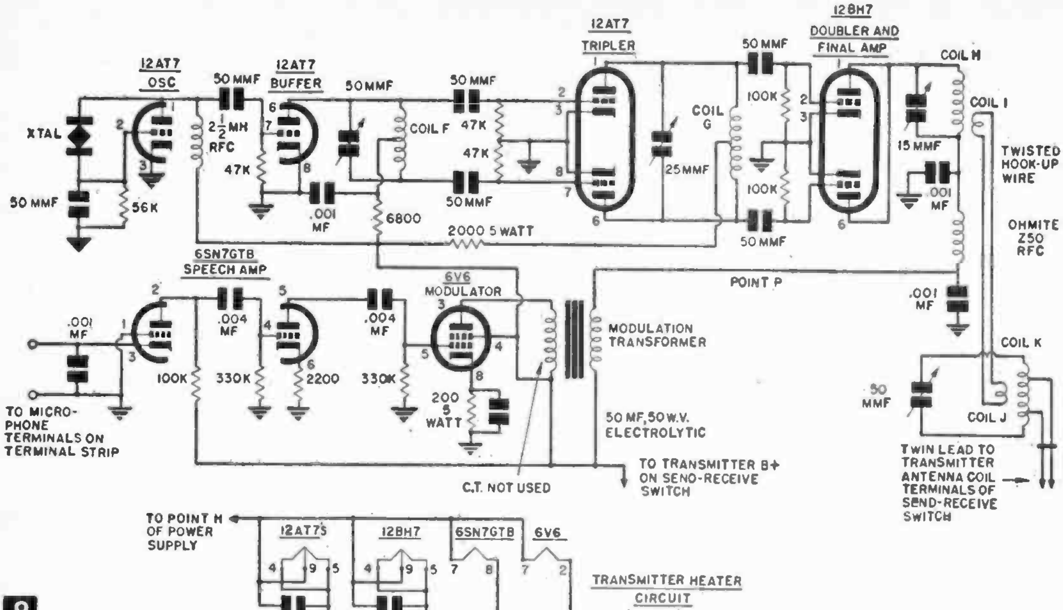
To test the push-push final amplifier stage, insert tubes and crystal, apply power and throw Send-Receive switch to "Send." With the grid-dip meter set to 50 megacycles, couple it to the final tank coil and adjust the 15 *mmf* tank capacitor for maximum output as indicated by the tuning lamp. A slight readjustment of the tripler tuning capacitor will also increase the 50 megacycle output. When the tuning-lamp loop is brought near the push-push amplifier tank coil it should glow very brightly—perhaps even burn out. For a further check, you can connect a similar tuning loop to a standard 15 *v.* series-string Christmas-tree lamp. With the loop inserted in the final tank coil and everything tuned on-the-nose, the Christmas-tree lamp should glow brilliantly.

If R.F. power output of the strength indicated is not obtained, first recheck the tuning of the buffer amplifier and tripler, using a completely insulated alignment screwdriver to avoid introducing hand capacity. Also make sure that the tuning-lamp loop is pushed completely into the coil, and the final tuning capacitor is precisely set for maximum possible output. If output is still low, measure the B+ *dc* supply voltage with a radio-TV service type voltmeter. This supply voltage should be between 350 and 400 *v.* for maximum power output. Finally, make sure that all the tubes you are using are in top shape.

When the final amplifier gives satisfactory output, punch a 1⅛-in. hole in the chassis for the antenna tuning capacitor, and make and mount a second plastic insulating strip (Fig. 11). Then fasten the 50 *mmf* antenna tuning capacitor securely to the insulating strip.

The antenna coil (Coil K) is wound with #14 tinned copper wire in the same manner as was the final tank coil. It consists of 7 turns on a ½-in. dia. form (drill shank) spaced to roughly 1 in. It is soldered directly to the terminals of the 50 *mmf* antenna tuning capacitor. The "twin-lead" from coil K to the Send-Receive switch is tapped-off two turns from the end of the coil.

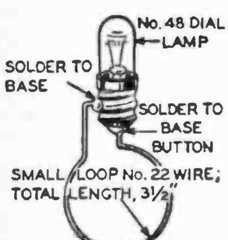
The antenna coil is coupled to the tank coil by means of a twisted hookup wire link. A one-turn loop inserted all the way into the tank coil at the B+ end couples the tank to the link. At the other



8 TRANSMITTER SCHEMATIC

end, a one-turn loop pushed between the center turns of the antenna coil transfers the power. Make sure the insulation on these coupling loops is in good condition, the link is continuous, and the loops are pushed tightly into the respective coils. When the loops are in position fasten them there with polystyrene cement.

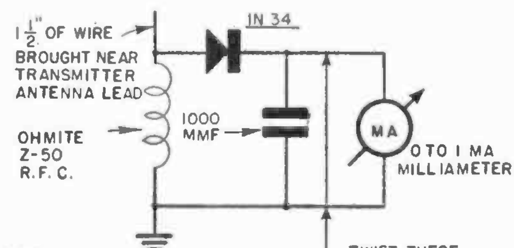
The Ohmite R.F. choke, 1N34 crystal diode, and the bypass capacitor of the R.F. tuning meter (Fig. 10) can all be neatly fastened by their leads to a two-lug insulated tie-point. The pickup wire for this meter is a length of hookup wire brought near the antenna tuning coil. RFC1 is an Ohmite Z-50 R.F. choke. A twisted pair of hookup wires run to the 0-1 milliammeter terminals. Mount this meter in the hole on the front of the chassis and connect to read up-scale when the transmitter is energized. (If it reads backwards, reverse its leads.)



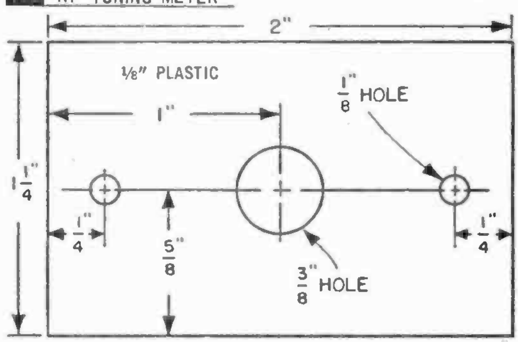
9 TRANSMITTER TUNING LAMP

With the radio-frequency portion of the transmitter completed, wire the speech amplifier and modulator stages. To test these stages, use a loudspeaker output transformer, speaker connected, temporarily wired in place of the still uninstalled modulation transformer. With tubes in place and microphone connected at the back of chassis terminal strip, the system should function as a good low-power PA system when the Send-Receive switch is thrown to "Send."

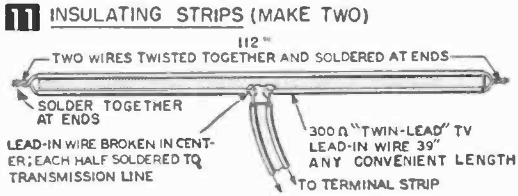
After testing, remove the loudspeaker transformer and the temporary connection from point P to B+ and install and connect the modulation



10 RF TUNING METER



11 INSULATING STRIPS (MAKE TWO)



RULES FOR ERECTING ANTENNA

(1) KEEP IT HORIZONTAL.
(2) KEEP IT BROADSIDE TO THE DIRECTIONS YOU WISH MOST TO WORK.
(3) ERECT IT AS HIGH ABOVE GROUND AS POSSIBLE.

12

MATERIALS LIST—SIX-METER RADIOTELEPHONE STATION

Req'd.	General
1	Bud aluminum chassis 4 x 10 x 17"
1	Federal type 1424 4PDT anti-capacity switch
1	6-terminal Jones barrier terminal strip
1	line cord and plug
3	1/4"-shaft knobs
	assorted screws, nuts, wire, solder, insulated tie-points, 1/8" plastic sheet
	Power Supply
1	power transformer, Thordarson No. 22R07
1	filter choke, Thordarson #20C55
1	8 mfd filter capacitor, Cornell-Dubilier #608C
1	20 mfd 500 w.v. filter capacitor, Sprague "Atom"
1	four prong socket, Amphenol "MIP"
1	.01 mfd 400 w.v. paper capacitor
2	.005 mfd ceramic capacitors
1	5Z3 rectifier tube
	Receiver
1	National type BM vernier dial
1	single-circuit phone jack
1	100K (100,000 ohms) linear-taper potentiometer, with Off-On switch
2	8-prong sockets, Amphenol "MIP"
1	9-prong, high-frequency plastic socket, Amphenol ("miniature")
1	7-prong, high-frequency plastic socket, Amphenol ("miniature")
1	15 mmf variable capacitor, Hammarlund HF-15
1	0.5 mf, 600 w.v. Aerovox "bathtub" capacitor
1	National type XR-50 coil form
3	1 megohm (1,000,000 ohms) 1 watt, carbon resistors
1	1 megohm, 1/2 watt, carbon resistor
1	220 ohm, 1/2 watt, carbon resistor
1	100 ohm, 1/2 watt, carobn resistor
3	22K, (22,000 ohms) 1 watt, carbon resistors
1	22K, (22,000 ohms) 2 watt, carbon resistor
1	56K, (56,000 ohms) 1 watt, carbon resistor
3	100K, (100,000 ohms) 1 watt, carbon resistors
3	330K, (330,000 ohms) 1 watt, carbon resistors
1	1000 ohm, 1/2 watt, carbon resistor
1	2200 ohm, 1 watt, carbon resistor
4	.004 mfd postage-stamp mica capacitors
6	.001 mfd, disc, ceramic capacitors
3	50 mmf, disc, ceramic capacitors
1	10 mmf, disc, ceramic capacitors

	Transmitter
3	9-prong, high-frequency plastic sockets, Amphenol ("miniature")
3	8-prong sockets, Amphenol "MIP"
1	Hammarlund 15 mmf type HF-15 variable capacitor
1	Bud 50 mmf type MC variable capacitor
1	25 mmf Hammarlund "APC-25" variable capacitor
1	50 mmf Hammarlund "APC-25" variable capacitor
2	Bud 1 1/4" dia. plug-in coil forms
1	National R-100 R.F. choke coil, 2 1/2 millihenries
1	Ohmite Z-50 R.F. choke
1	modulation transformer, Thordarson type 21M54
1	James-Knights type H73 crystal or equivalent (see text)
2	.004 mfd postage-stamp mica capacitors
1	10 mfd, 50 volt electrolytic capacitor
7	.001 mfd disc ceramic capacitors
6	50 mmf disc ceramic capacitors
3	47K (47,000 ohms) 1/2 watt, carbon resistors
2	100K (100,000 ohms) 1 watt, carbon resistors
2	100K (100,000 ohms) 1/2 watt, carbon resistors
2	330K (330,000 ohms) 1 watt, carbon resistors
1	2200 ohm, 1 watt carbon resistor
1	6800 ohm, 1 watt, carbon resistor
1	200 ohm, 5 watt, wire-wound resistor
1	2000 ohm, 5 watt, wire-wound resistor
	Tuning Meter
1	Ohmite Z-50 R.F. choke
1	.001 mf ceramic disc capacitor
1	IN34 crystal diode
1	0-to-1 ma D.C. milliammeter Triplett model 321
	Tubes for receiver and transmitter
3	6SN7GTB
1	6V6GT
3	12AT7
1	6AK5
1	12BH7
	External Equipment
1	single-button, telephone-type carbon microphone
1 pair	2000 ohm headphones, magnetic
	several No. 48 dial lamp bulbs, one 2-watt neon lamp bulb, 15 v. "series" Christmas lamp bulb
1	headphone plug, single circuit
1 roll	"twin-lead" TV lead-in, 300 ohm, and other antenna supplies as necessary

transformer. As a final test, connect the Christmas-tree lamp to the antenna terminals on the terminal strip and with tubes and crystal in place energize and throw Send-Receive switch to "Send" position. Adjust all transmitter controls for maximum light emission from the Christmas-tree lamp. Speaking into the microphone should cause the lamp to fluctuate noticeably in brilliance and the tuning-meter needle to flutter (indicating sufficient modulation.)

The last step in construction of this amateur radiotelephone station is to make and connect a dipole antenna as shown in Fig. 12. With antenna connected, tune the transmitter for maximum indication on the tuning meter (with the pickup wire set for half-scale meter reading) and you're ready to communicate.

The transmitter has been designed to avoid interfering with the operation of properly installed TV receivers. Any six-meter transmitter—including expensive commercially built models—can occasionally cause interference in nearby TV sets, however. Such interference can be eliminated if the TV set owner will install a Drake No. TV-300-HP high-pass filter on his set. (This unit is designed to suppress 50 MC feed-through).

Such interference as may be caused by ham equipment is not the fault of the ham transmitter but is an inherent property of wide-band TV apparatus. A filter, such as the Drake high-pass, will stop the interference. If a set owner will not install such a filter, or wishes to become obstreperous, invite him to write to the Federal Communications Commission. They will deal fairly with the case. To date, no licensed amateur who cooperates with the Commission has lost his operating privileges because his equipment is suspected of being the source of TV interference.

Do You Need a License?

Yes! Although anyone may use the receiver section of this station, the transmitter cannot be used without an amateur's license issued by the Federal Communications Commission. Failure to obtain a valid license from the FCC exposes the offender to a penalty of $10,000 and/or two years' imprisonment.

The Technician class of amateur operator license is available to any U.S. citizen who can pass a five words per minute code test and a simple examination in radio theory and law. (Write to your nearest FCC office for complete details on this examination.)

The Technician class license, unlike that for the Novice class, is renewable by application every five years if you have been operating actively during that time. However, like that for the Novice class, it does carry limited privileges as to the frequency bands you may use.

Ultra-Small Wrist Radio

By HOMER L. DAVIDSON

ONLY three-quarters of an inch high by 1½ inches square, this receiver can be worn on the wrist and has *plenty* of volume, even on weak stations. To get a satisfactorily performing set down to such a small size, a printed circuit is used not only as a functional part of the wiring, but also an On-Off switch.

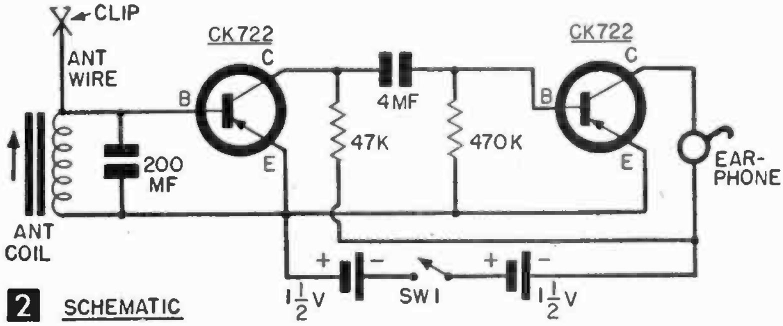
The circuit (Fig. 2) is simple and standard. A short, flexible length of wire with a small alligator clip attached to its loose end (clip to a bed spring, a metal window frame, a screen, etc.) brings the signal to the antenna coil—a small, ferrite type modified by removing its metal mounting clip and cutting the cardboard form with a razor blade back as close as possible to the coil winding itself while still permitting replacement of the clip by bending its terminals down close to the form and slipping it back on. The clip mounts the screw by means of which the powdered iron slug core is turned in and out of the coil. Cut the form back at the opposite end of the coil close to the windings also (to enable the coil assembly to fit the case) and turn the core all the way in, mark the length which extends from the form (about ¼-in.), unscrew the core from the coil and with a power grinder, grind it off to length. If you don't have a power grinder, an ordinary file will also do the trick.

A small fixed capacitor (C1), together with the ferrite-type coil, tunes the entire broadcast band. The first transistor (TR1) acts as a rectifier (detector) and also as the first amplifier stage, while C2 capacity couples the two stages of amplification, and a second CK722 transistor feeds the signal into a small magnetic earphone. Output is amazingly strong on local stations. On one of our locals, the phone can be laid down and the station can still be heard. Batteries are the size of small buttons. They were purchased at a Sonotone hearing aid store for 30¢ each.

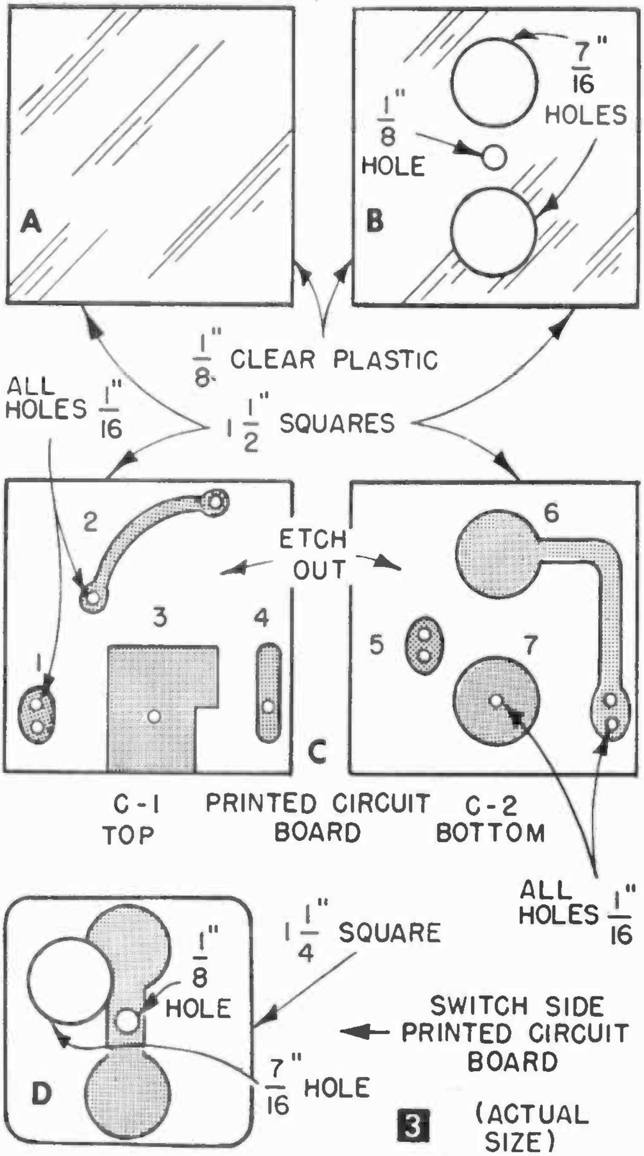
Super small (the toy watch placed on top of its case gives you the scale), this wrist radio provides a terrific amount of volume.

Printed Circuit Assembly. Figure 3 shows the four small pieces that go to make up the PC assembly. Piece A is nothing more than a 1½-in. square of clear plastic ⅛ in. thick. Piece B is another piece of the same with two 7/16 in. holes and a ⅛-in. hole drilled into it as shown. (The hearing-aid, button-size batteries locate in the 7/16-in. holes; the ⅛-in. hole is for the bolt that goes to switch SW1, piece D). Views C-1 and C-2 are top and bottom of the actual printed circuit board, copper-clad both sides. View C-1 is the top side, the numbers on it key to those in the pictorial diagram, Fig. 5. Number 2, for instance, ties the collector side of TR1 to the small coupling capacitor C2. Number 3 is the point to which the metal clip lug of the tuning coil is soldered; it is actually the grounded side of the circuit.

On the bottom side of the printed board, view C-2, numbers 6 and 7 are the battery rests. Number 7 is the positive side of one battery; number 6, the negative side of the other. Insert a wire in the small hole indicated in number 7, it will come through the hole in the middle of number



2 SCHEMATIC



3, and solder both ends to the copper strips.

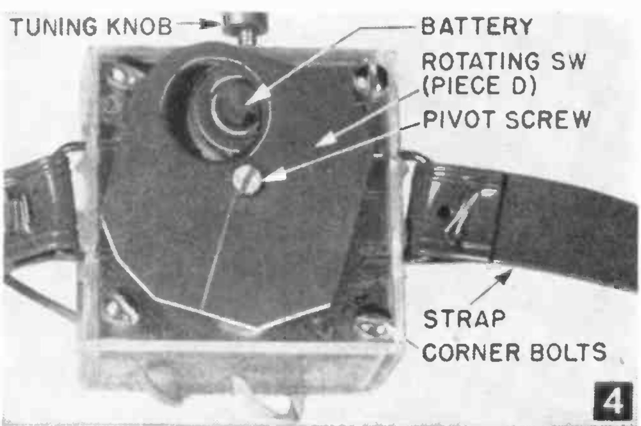
The switch board, piece D, is a single-side printed circuit board, smaller than the others since it must turn without hitting the small bolts that secure the assembly. When turned to the On position, it shorts against a battery terminal. (Drill a 7/16-in. hole through piece D so that the batteries can be inserted and removed.)

First cut out, sand and drill pieces A and B. Then print circuit pieces C-1 and C-2 and D. To print, trace with carbon paper directly from Fig. 3, onto the printed circuit boards (see Materials List). I used a ball-point liquid resist pen (see Materials List) to draw the circuits. Simply push down on the ball of the pen and the liquid resist will flow. Stay *inside* the traced lines of the circuit. (For a detailed discussion of PC techniques, see "Printed Circuit Phono Amplifier," page 21.)

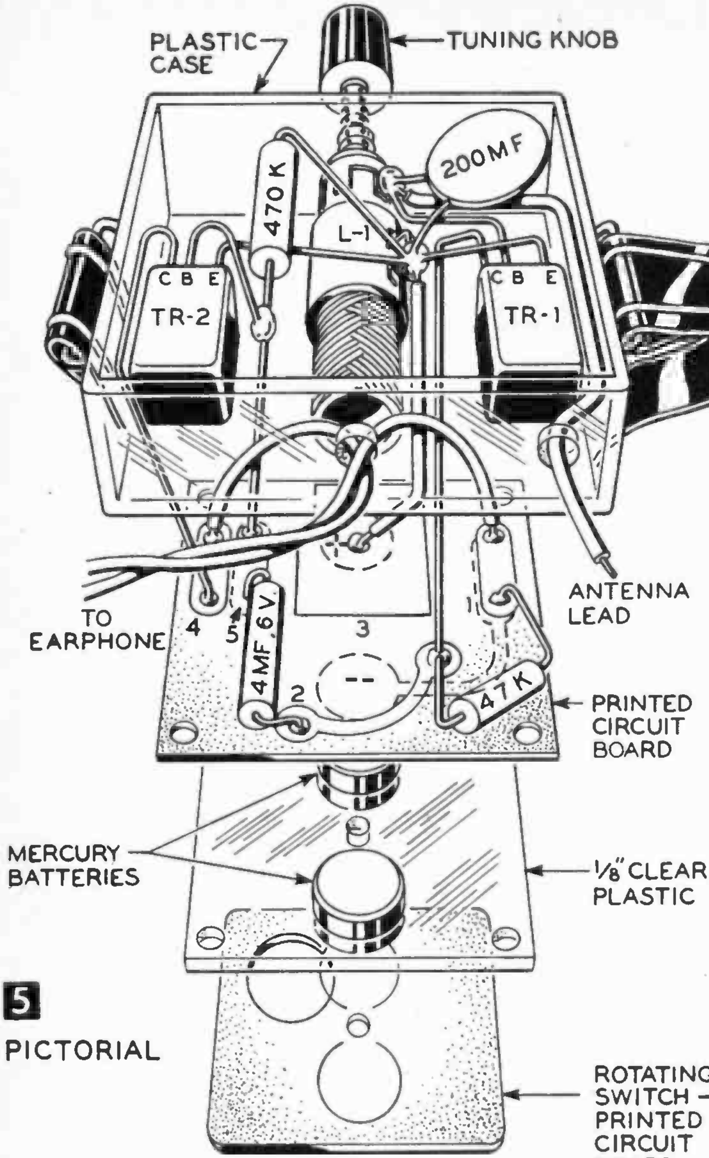
After the circuit has been drawn on the copper clad laminate and is dry, place pieces in etch solution. Turn piece C-1 and C-2 over so that both sides are etched evenly. Rock or agitate the solution so that the pieces move, thus quickening the etching process. To check the etching process, lift the boards from the solution with a pencil. A clear brown color indicates that all of the copper has been etched away.

Wash the etched board in running water (and pour the remaining etch solution back into its container; it can be used again), and remove the resist paint with the sharp point of a pocket knife. Now, drill all the holes indicated in Fig. 3. The small holes indicated in the printed circuitry should be about 1/16 in., no larger than necessary to pass conventional wiring.

Fasten pieces B and D together with a small bolt and nut. Countersink the head of the bolt into the plastic of piece B. The nut should be turned tightly enough to secure piece D firmly, then solder it to the bolt. (The printed side of piece D faces piece B). Mount and solder all parts including transistors into place on piece C-1. Align pieces as

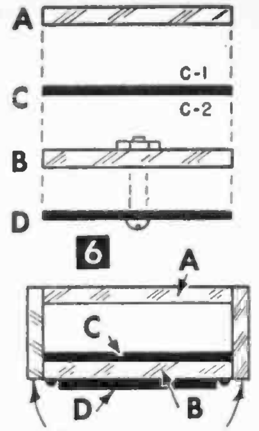


Back view of receiver showing laminate switch (piece D). Here, the Wrist Radio is shown in all its ultra-smallness, just slightly less than full-size.



5

PICTORIAL



PLASTIC SIDES GLUED TO ASSEMBLY

BOLT PIECES C AND B AT ALL FOUR CORNERS. B AND D THROUGH CENTER

shown in Fig. 6 and drill a 1/8-in. hole at each corner. Then bolt pieces B and C together at the corners, pieces B and D through the center. (The unit must be tested before piece A is secured in position.)

When the unit has been assembled, insert the batteries. Place a dot of red paint on number 7, piece C-2, to identify this as the positive terminal of one of the batteries. The other battery, of course, is turned to its negative side on number 6.

Now turn the switch (piece D) to its *On* position (you'll hear a click in the earphone) and tune for a station.

When you are sure you have reception, glue small pieces of 1/16-in. plastic around the sides of the assembly, filing down corners and sides for neatness. Drill 1/8-in. holes in the side opposite the tuning knob for the antenna and phone wires. Then buy a toy dime-store watch and remove its band and fasten the band to the sides (see Fig. 4) by pressing holding clips into the plastic case with a hot soldering iron.

MATERIALS LIST—WRIST RADIO

C1	200 mfd ceramic disc capacitor (Centralab DD201)
C2	4 mfd 6-v. transistor midget electric capacitor
R1	47,000 ohms, 1/4-watt carbon resistor
R2	470,000 ohms, 1/4-watt carbon resistor
L1	high-gain loopstick (Lafayette MS-11; see text for physical modification)
B1, B2	Sonotone miniature hearing aid batteries (M-40A)
SW1	see text
TR1, TR2	Raytheon CK722 transistors
Earphone	Dynamic (Lafayette MS-260)

Printed Circuit Material*

ball point pen (PRLT)
Piece D—copper laminate XXXP (PC-D)
Piece C—copper laminate XXXP (PC-DD)
liquid etchant (PE-5)

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

Crayons Mark Terminals

• When removing defective parts such as transformers from a radio or TV, use wax crayons to mark the terminals from which leads have been unsoldered, for identification when installing a new part.

Designed primarily for use by the student ham who wants to keep up his code speed, the *Student's Special* can be modified to receive the standard broadcast band.

Student's Special

By C. F. ROCKEY

Here's a project for the radio-minded high school or college student, or for the man whose son is such a student—an inexpensive short-wave receiver for the study desk

THIS receiver employs an untuned radio frequency amplifier, a regenerative detector, and an audio amplifier. In addition to increasing the unit's sensitivity, the RF amplifier isolates the detector from the antenna, thus minimizing hand-capacity effects. A voltage regulator tube also makes a big contribution to overall stability. This circuit thus offers the maximum in short-wave receiving satisfaction at minimum cost. And, since a large resistance unit is required to drop the heater voltage, a lamp bulb is used for this purpose, a lamp that normally burns only slightly less brightly than normal and does double duty as a close-in reading lamp. In addition, a sturdy book trough, capable of holding half a dozen textbooks, is included.

Build the receiver unit itself first; then, the book trough and lamp assembly. Begin by laying out the chassis as shown in Fig. 2. Set the tubes and coil in position in order to assure proper clearance, then drill all small holes with a No. 27 drill, large enough to clear the body of a 6-32 screw. Punch socket holes with a 1³⁄₁₆-in. Greenlee socket punch (available from any large radio supply house).

Next, take the 7 x 10-in. front panel (see Materials List) to your neighborhood sheet-metal shop and have the tinsmith cut exactly 1 in. from it, making it 7 x 9 in. He can do this on his foot-powered shear much more neatly than you can with a hacksaw. If no such facilities are available, however, you'll have to use the saw; this metal is too tough for hand tin shears. Finish the raw edge of the panel with black automobile "touch-up" enamel.

Now lay out and drill holes for the front-panel mountings (Fig. 3). Consult the instructions and template enclosed with the tuning dial when drilling mounting holes for it. Then fasten the sockets, terminal strip and selenium rectifier to the chassis, using 6-32 steel machine screws and hex nuts (buy 1-in. screws, cutting them shorter where too long with diagonal cutters and pliers) and secure to the chassis the insulated tie points for holding the electrolytic filter capacitors. Insert other tie points as the wiring progresses.

Figure 4 gives the schematic for the wiring; Fig. 5, the pictorial. Heater and plate-supply leads can be as long as convenient; you can even group these together cable-like if you wish. Keep these wires close to the chassis, however, in order to avoid hum troubles later.

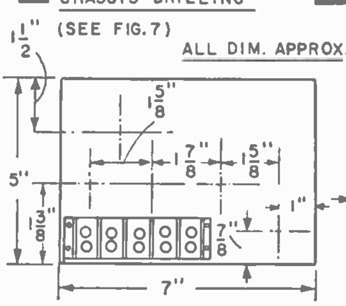
Keep plate, grid and other signal-carrying leads as short and direct as possible. Except for the electrolytic and large paper capacitors (which should be hung between tie points) the resistors and capacitors can be wired-in directly without other mounting precautions.

Care is the only preventer of wiring errors. Mark over the schematic as wires are inserted; check each stage or circuit as it is completed. Carefully observe polarity on electrolytic capacitor and selenium rectifier connections. Finally, have one of your radio-minded friends recheck the wiring for you, before plugging-in to eliminate those annoying mistakes a person misses when checking his own work.

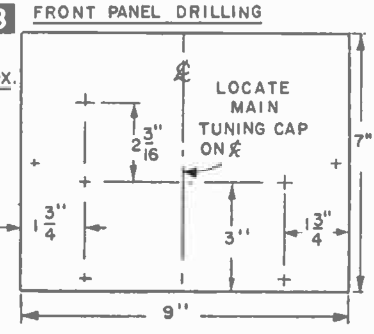
When you are sure that the under-chassis wiring is complete and correct, mount the variable capacitors, dial, potentiometer and phone jack securely on the panel. Then fasten the chassis and panel together, and complete the wiring.

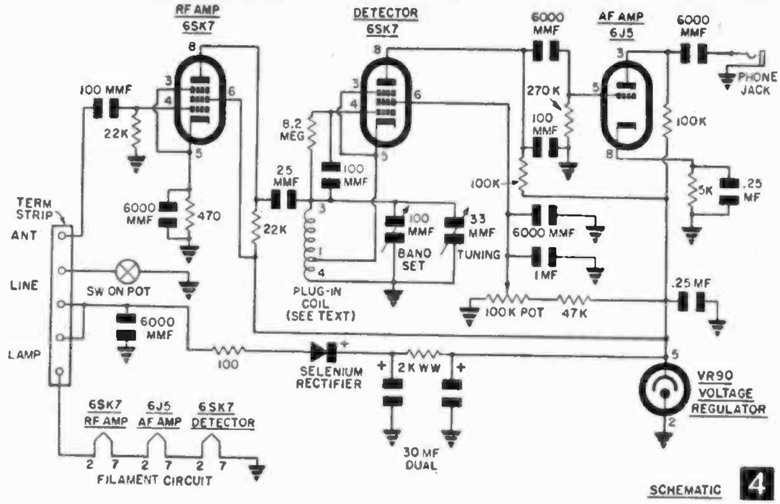
When all wiring has been completed and checked, insert

2 CHASSIS DRILLING



3 FRONT PANEL DRILLING





SCHEMATIC 4

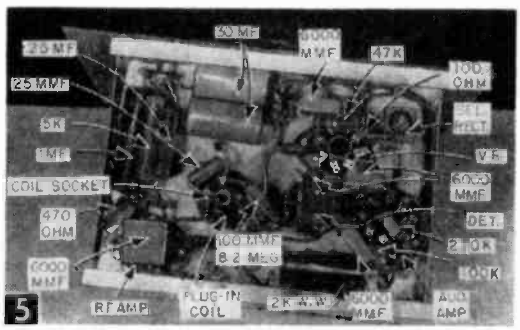
the voltage regulator tube into socket (insert *only* the VR tube, no others). Then plug in the line cord and turn on the line switch. A bright pink glow inside of the VR tube indicates that the plate voltage supply is satisfactory. If such a glow is not observed, pull the plug instantly and recheck the wiring. If it is correct, try a different VR tube, check electrolytic and shunting .25 *mf* paper capacitors for short circuits with an ohmmeter and try another selenium rectifier unit. One of these checks will turn up the trouble.

When the VR tube lights up properly, remove the line-cord plug and insert the rest of the tubes in their sockets. Connect a *40-watt* lamp bulb (any other size bulb may damage tubes) to the terminals marked "lamp" in Fig. 4. Plug into the line again and turn on the line switch. If the filament circuit is satisfactory, the 40-watt lamp bulb should light up to nearly full brilliancy. Removing any tube except the voltage regulator will cause the lamp to go out.

If the lamp does not light, recheck the wiring, then check the lamp bulb and tube filaments for open circuits to locate the trouble.

When the filament circuit has been checked out satisfactorily, wind the coils. Figure 6 illustrates the construction of the short-wave coils and gives the turn specifications for the various frequency bands. (For those who like occasional standard-broadcast reception, coil specifications are given for the broadcast band. However, many features desirable in broadcast reception have been sacrificed here for best possible short-wave reception. Only local broadcast stations can be received satisfactorily). When making the cathode tap, be sure that you don't short circuit adjacent turns. Wind and check each coil's operation before beginning another. Start with the lowest-frequency (25-turn) short-wave coil.

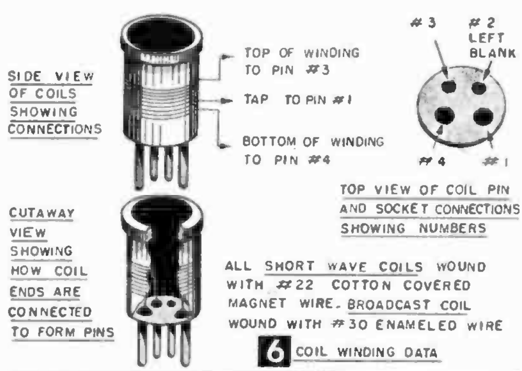
When your first coil is finished and checked, plug it into the four-prong, plug-in coil socket. Then insert the phone plug into its front-panel jack, plug the line cord in and turn on the line switch. After allowing a reasonable warm-up period, put on the headphones. With the potentiometer knob at its extreme counterclockwise position, slowly rotate clockwise. With the control knob between one-third and two-thirds fully rotated, you should hear a soft "swish," followed by an increase in the hiss level. The "swish" is the receiver's point of oscillation. If it is not heard, carefully recheck the wiring, and



5 Under-chassis pictorial view of receiver.

test the tubes in a good, reliable tube tester. Then re-examine the plug-in coil and its connections. One of these is at fault if oscillation does not occur.

When oscillation occurs freely and regularly, connect roughly 25 ft. of wire to the antenna



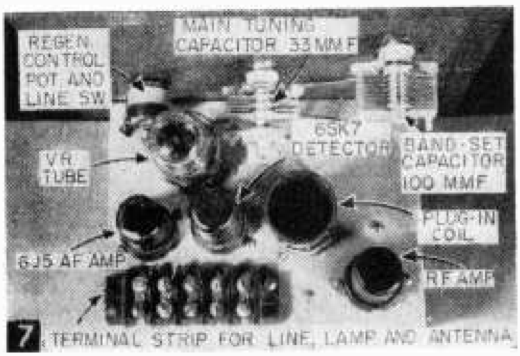
6 COIL WINDING DATA

APPROXIMATE FREQUENCY RANGE	NO. TURNS ON COIL	NO. OF TURNS BETWEEN BOTTOM END OF COIL AND CATHODE TAP
9 TO 16 MEGACYCLES	5	1
5 TO 10 MEGACYCLES	12	1½
3.3 TO 6 MEGACYCLES	25	2
HIGH FREQ. END OF BROADCAST BAND	75	5
LOW FREQ. END OF BROADCAST BAND	175	10

MATERIALS LIST—SHORT-WAVE RECEIVER

No.	Description
1	7 x10" steel panel (Bud Radio Corp.)
1	chassis, steel, 1½ x 5 x 7" (Bud Radio Corp.)
1	terminal strip, 5-terminal barrier type (Allied Radio Corp., catalog no. 41-H-673)
1	vernier tuning dial, national type BM
2	knobs, ¼" shaft
1	100 mmf variable band-set capacitor (Bud Radio Corp., type #1855)
1	33 mmf variable main tuning capacitor (Bud Radio Corp., type #1852)
1	100K linear taper potentiometer, with S.P.S.T. switch
4	8-prong (octal) socket, amphenol, type "MIP"
1	4-prong socket, amphenol, type "MIP"
1	single circuit headphone jack (Mallory type 701)
1	phone plug (Mallory type 75)
1	selenium rectifier, half-wave, 65 ma (Selectron)
6	insulated tie-points, 2 insulated lugs
	coil forms, 4-prong (I.C.A. type 2158) one for each coil desired
2	6SK7 tubes (metal type preferable; "GT" type may be used) 6SG7 tubes may be used instead of 6SK7's if available
1	6J5 tube (a 6L5 may be used; metal type preferred)
1	VR 90 tube (sometimes called OB-3)
	wire, screws and solder as required

No.	Description
	Capacitors Required
	Mica ("postage stamp" type)
3	100 mmf
5	6000 mmf
1	25 mmf
	Paper (200 v. working voltage)
2	0.25 mf tubular
1	1.0 mf tubular
	Electrolytic (150 v. working voltage, tubular type)
2	30 mfd
	Resistors Required
	Carbon type (all 1-watt size unless otherwise stated) All values in ohms (K-1000 ohms)
2	22K
2	100K
1	470
1	100
1	8.2 megohm
1	270K
1	47K
1	5K, 2-watt
	Wire-wound type:
1	2K, 10 watt
1	40-watt, Mazda lamp, 110 volt, with socket.
	Headphones required: Trimm "dependable," or any other good high-impedance double headset. Crystal phones may be used, but are expensive and not necessary here.
1	line cord and plug



Top of chassis view.

post on the terminal strip. With the potentiometer set just above the oscillation point (slightly on the "hiss" side), rotate the band-set capacitor. Whistling, indicating the presence of signals, should be heard. For best reception of code signals, the potentiometer should be set just on the oscillating point; for voice signals, just below the oscillation point.

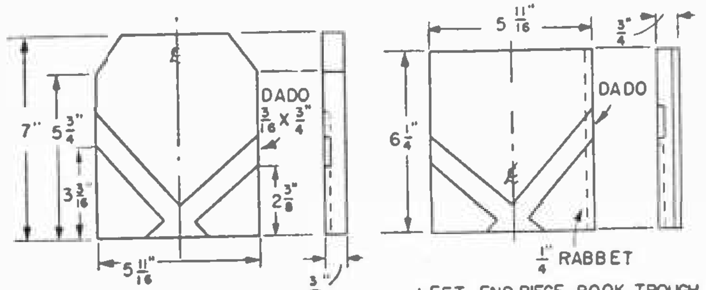
The correct technique for tuning-in a voice signal is first to tune for the steady whistle, indicating the presence of the "carrier wave," then gradually back down the potentiometer until the whistle just stops. Finally, carefully and slowly readjust the tuning control until the voice or music comes in the best. Much as with playing the violin, a little practice is prerequisite to good results.

The band-set, band-spread tuning system used in this receiver enables you to spread a narrow section of the spectrum, such as an amateur or a short-wave broadcasting band, over the whole dial. When used properly, this vastly improves tuning, and enables you to hear many stations which otherwise would be missed completely.

As designed, this receiver is for use with headphones. This is to avoid barraging a non-radiotic roommate with irritating "noise." However, many strong amateur and short-wave broadcasting stations (the Voice of America, the British Broadcasting stations, and occasionally Russia) come in strong enough to work a small PM speaker when coupled through a plate-to-voice coil output transformer. Stick to the 'phones for regular work, however. You'll hear many more stations with them.

Oh yes, the set is automatically grounded through the power line. *Do not use an outside ground* (you may blow a line fuse). And, if the hum-level seems high, reverse the plug. If you want to use a doublet antenna instead of the straight wire, connect one side to the antenna terminal and the other to the chassis.

Building the Book Trough Unit. Make this unit from clear white pine unless you are equipped for and experienced in working with hard woods. Begin by cutting and dadoing the book trough end pieces (see Fig. 8). Then make

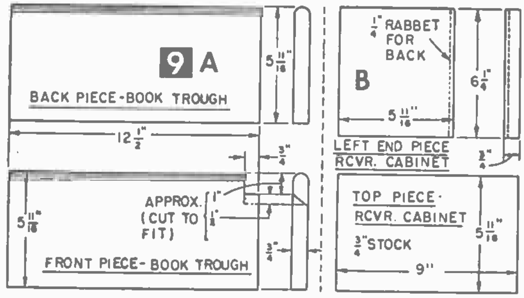


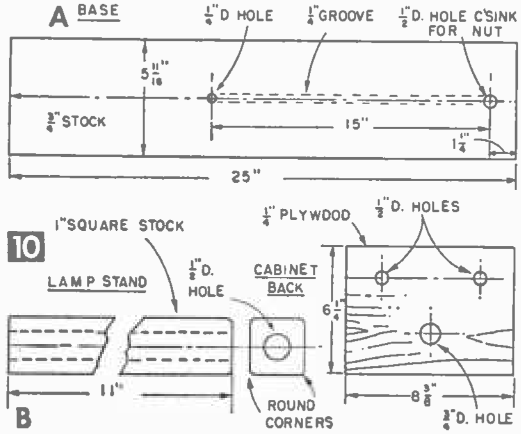
8 RIGHT END PIECE - BOOK TROUGH

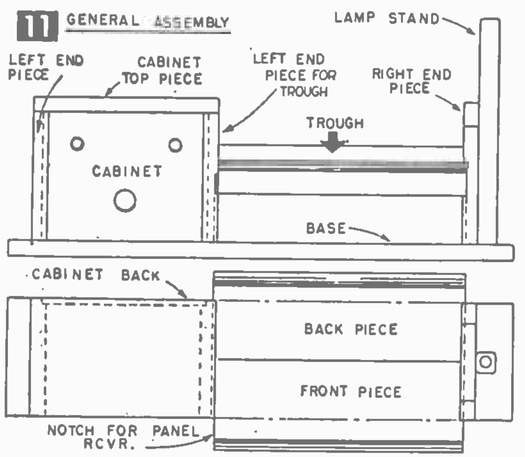
LEFT END PIECE-BOOK TROUGH (RIGHT END PIECE-RCVR.CABINET)

MATERIALS LIST—BOOK TROUGH

No.	Description
7 linear ft.	¾ x 5 and 11/16" white pine stock, clear
11"	1 x 1" white pine
3'	rubber covered lamp cord
12¼"	lamp tubing, threaded
1	nut to fit lamp tubing
1	keyless lamp socket
1	clip-on-bulb lamp shade, 8" dia. at bottom
Nails, insulated staples, finishing materials	







the front and back pieces for the book trough (Fig. 9A). If you don't have dadoing equipment, nail the book trough directly to the ends, shortening the back and front pieces by about ½ in. in order to keep the overall proportions correct and omit the panel recess shown in Fig. 9A in the book trough front piece. Sand these parts and assemble, using 3*d* finishing nails.

Next, make the left-hand receiver cabinet end pieces, and the top piece for the receiver cabinet (Fig. 9B). You can simplify this part of the project by not recessing the cabinet back or by omitting the back entirely if you don't need its dust-proofing protection.

Now cut off 25 in. of the 5 11/16-in. stock for the base (Fig. 10A), drill the ½-in. and ¼-in. holes, and groove the bottom for the lamp cord.

Begin the general assembly (Fig. 11) by first nailing the left-hand cabinet end to the baseboard, with its outside edge ¾-in. from the left end of the baseboard. Then nail the left-hand end of the book trough (right-hand end of the cabinet) to the base with its right-hand edge exactly 9 in. from the outside edge of the previously nailed end piece. Then nail down the right-hand end of the book trough.

After the cabinet top has been nailed on, make the lamp stand (Fig. 10B) from an 11-in. piece of 1x1 stock. Carefully drill a ½-in. hole (lengthwise) through this piece, using a long, electrician's auger bit, or drill halfway from each end with a regular auger bit. Round the corners at the upper end.

From your local electrical supply store get 12¼-in. of lamp tubing (long, threaded steel pipe through which the cord is passed in nearly every table lamp), and a nut to fit. Pass this lamp tubing through the lampstand and through the ½-in. hole at the right-hand end of the base. Screw the nut on to the bottom of the lamp tubing, thus fastening the lampstand on to the base. Next, screw the shank of a lamp socket on to the upper end of the lamp tubing until it presses firmly on the upper end of the wooden lampstand. Now nail the lampstand to the right-hand end of the book trough. Remove the lamp socket to facilitate finishing the woodworking. Cutting, drilling and installing the back of the cabinet completes the woodwork.

This unit may be finished either by painting or by staining and varnishing.

When the finish is dry, screw the lamp socket back on the upper end of the lamp tubing, connect about 3 ft. of rubber-covered lamp cord to the socket and assemble after passing the cord down through the lamp tubing to the bottom of the base. Run the lamp cord through the groove and pass it up through the ¼-in. hole into the cabinet.

Fasten the cord into the groove with small insulated staples, at several places, being careful not to pierce the insulation on the lamp cord.

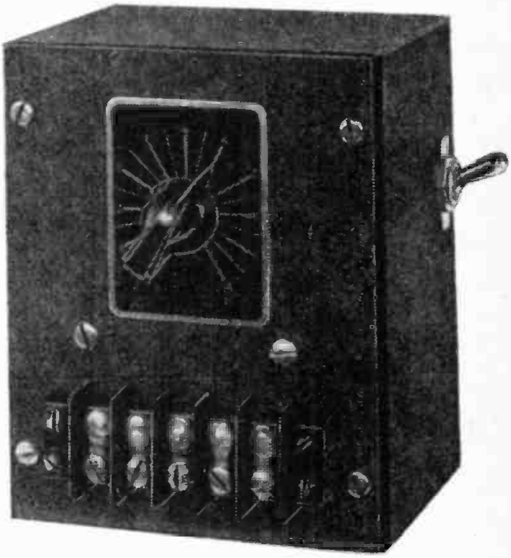
Now make lamp, power line, and antenna connections to the terminal strip on the back of the receiver chassis and fasten the receiver panel to the front of the cabinet. Screw a 40-watt lamp bulb into the lamp socket, put an appropriate shade on this bulb, and your *Student's Special* is complete.

ELECTRONIC TIMER

Now You Can Split Seconds

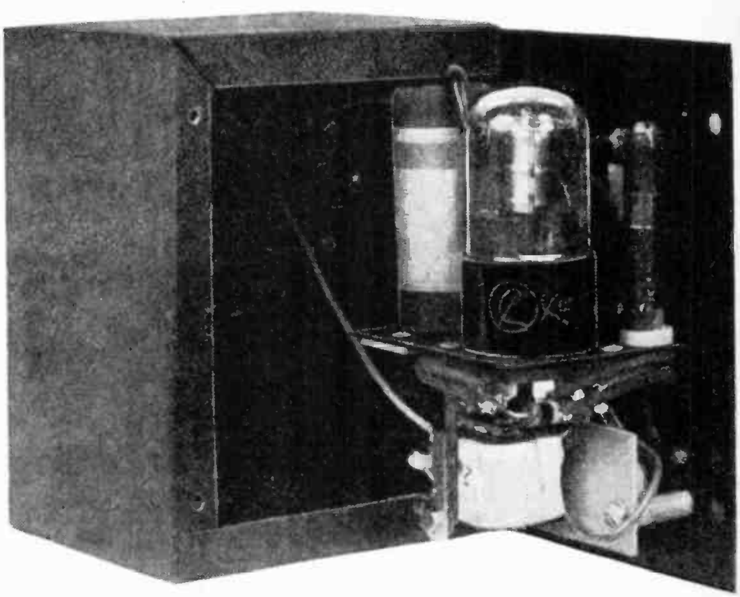
By THOMAS A. BLANCHARD

FEW projects in the field of electronics have the general appeal to all experimenters as do timing devices which operate without benefit of moving parts. In industry, electronic timers are already widely used in the control of precision operations where a motor-driven timer would be much too sluggish to time short interval operations.



Unlike mechanical timers, which depend upon various gear escapements, the electronic timer depends merely upon a vacuum tube and the charging or discharging of a condenser in the grid bias system to control the time cycle. Without question, the timer described here is simple enough for beginning radio experimenters to duplicate with success. More important, few parts are required in construction—all generally available, including tubes, since any one of several low current-low voltage tubes may be employed. However, the constructor is not limited to one of the pentodes suggested in the schematic. Actually the pentode is connected to function as a triode, therefore, any triode such as a 30, 1E4G, 1H4G, 1LE3, 1G4G, etc., may be substituted simply by changing the filament resistors from 600 to 1000 ohms each.

The timer is housed in a 3x4x5 metal box such as stocked by all radio supply houses. The chassis is a simple metal bracket consisting of a 1⅛ in. diameter hole for mounting an octal wafer socket, and two ½ in. diameter holes; one for mounting the timing condenser and the other for passing wires.



It can be stated here that these physical specifications may be ignored if the constructor has other materials on hand for housing the timer.

As shown in the drawings, the box panel is drilled to accommodate a 10-meg potentiometer, and terminal strip. Also, a suitable hole is drilled in the side of the box, toward the rear, to receive a double pole-single throw toggle switch.

To assemble the chassis: Attach the wafer socket first; then put a strip of bakelite over the adjoining ½-in. hole for mounting the 0.5 mfd. paper condenser. A brass eyelet or lug in the center of this strip provides a convenient mounting for the condenser. One of condenser leads is passed through eyelet and soldered securely.

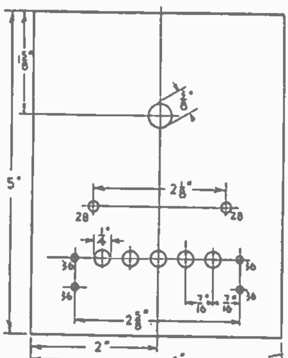
The filament voltage drop resistors are mounted vertically in each corner of the chassis by means of long 6-32 machine screws. A fiber washer should be placed over each end of the resistor if

ELECTRONIC TIMER—Materials List

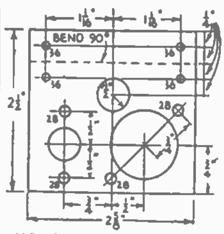
1 3x4x5 Metal Box
1 Metal chassis (homemade)
1 10 meg (or more) potentiometer
1 30,000 ohm, ½ watt resistor
1 50,000 ohm, ½ watt resistor
2 600 ohm, 10 watt resistors for .1 amp. tubes ohmite (1000 ohm, 10 watt resistors for .06 amp. tubes)
1 octal wafer socket
1 potentiometer dial plate
1 bar knob
1 terminal strip
1 0.5 mfd. or larger paper condenser
1 4 mfd., 150 volt electrolytic condenser
1 Pentode or triode tube of the low current type
Pentodes: (.1 amp. filaments)
1Q5GT, 1C5GT, 3Q5GT*, etc.
Pentodes: (.05 amp. filaments)
1T5GT, 1A5GT, 1LA4*, 1LB4*, 30*,
1E4G, 1LE3*, 1G4GT, 1H4G, 1E4G, etc.

Tubes marked with asterisk (*) require socket wiring changes. All others interchangeable in circuit.

NOTE: For simplification, pentode in schematic is drawn as a triode. The sup. grid, (prong 4) is tied to plate (prong 3) in all instances. Thus pentodes and triodes may be interchanged without altering wiring.



TAP NO. 36 HOLES 6-32
PANEL DRILLING SPECIFICATIONS



TAP NO 36 HOLES 6-32
CHASSIS SPECIFICATIONS

its lugs are apt to come in contact with the screw head or chassis.

The chassis is attached to the panel at this stage. Since the panel carries the terminal strip and potentiometer, the control now stands ready for wiring. Because of the timer's simplicity, no special comments are needed because the drawings show all details. The relay and toggle switch are installed after all other work has been completed.

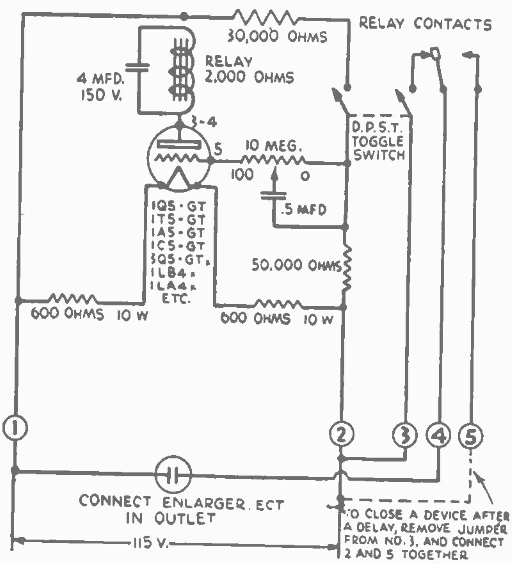
In the original model, two studs were threaded and screwed directly onto two of the screws projecting from the terminal strip to provide a mounting for the relay. The spacing of these studs is identical to the mountings of several popular relays sold by radio suppliers. However, in the original model, it was necessary to mount the relay on a bakelite strip since its design did not include a mounting bracket.

A D.C. relay of the single pole-double throw type, and having a coil resistance of 2,000 ohms or more, controls the load circuit. A 4 mfd., 150 volt electrolytic condenser is shunted across the coil to eliminate the A.C. in the half-wave rectified current delivered to the relay.

The control is completed by wiring in the relay contacts and d.p.s.t. toggle switch. One half of the toggle switch serves to put positive bias, through a 30,000 ohm resistor, on the grid. The two remaining poles on the toggle switch are wired in series with the normally closed contact of the relay.

When the toggle switch is open, the grid of the tube is negatively biased and the relay does not close. Tripping the toggle switch does two things: First, negative bias is applied, but is retarded in reaching the grid because of the high resistance potentiometer and condenser in the grid circuit. At the instant positive bias is applied, we complete the circuit through the normally closed contact of the relay. This causes the device being timed (photo enlarger, etc.) to come on. After an elapse of time, depending upon the position of the potentiometer adjustment, the grid becomes positive. At that instant, the relay becomes energized, and the timer circuit opens, shutting off the device being timed.

This same timer may be employed to perform the reverse operation simply by changing the terminal connections shown in the schematic.



Now when the toggle switch is closed, the controlled circuit will remain open, and not close until a predetermined elapse of seconds. The circuit will then remain closed until the timer is reset. Tripping the toggle switch back to its "off" position automatically resets the timer.

The timer, using the 10 meg potentiometer and 0.5 mfd. paper condenser specified, will time from 0 to 35 seconds, approximately. However, the timing range can be increased by increasing the grid capacitance to 1 mfd. or more. A 20 meg potentiometer will still further extend the time delay to minutes.

There are no bugs prevalent in this circuit, but if the timer is wired properly and does not function, look to the relay for the source of the trouble. Some relays may have the fixed contacts spaced too far from the moving arm, or the spring tension on the arm may be too stiff. The solution is to carefully bend the arms with flat-nose pliers, or weaken the coil spring by removing it from the relay and stretching it slightly. The latter measure should be employed before bending the fixed contacts.

Simple Phono Amps for Earphone Listening

By ARTHUR TRAUFFER

Youngsters can listen to records without disturbing the rest of the family (and you can play your favorite discs late at night) with this simple phono amplifier.

THEY don't come any simpler than these phono amplifiers. Both models (Figs. 2 and 3) are built around a low-priced transistor and a small battery, using the same basic circuit as shown in Fig. 4.

Either model will boost the output of any crystal or ceramic phono cartridge so you can hear the music loud and clear in a pair of magnetic earphones—where it won't disturb the household!

Note in Fig. 4 that the collector is connected to the "ground" side of the circuit, instead of the emitter to the ground as in most transistor audio amplifier circuits. With this common-collector configuration, you'll have high input impedance and low output impedance. And, although this circuit has little actual gain, it serves as an efficient impedance-matching device which matches the impedance of common magnetic earphones to the comparatively high impedance of crystal and ceramic phono cartridges. This results in more efficient coupling between cartridge and phones.

Breadboard Model. In the "breadboard" model of this phono amp (Figs. 1 and 2), four #15 Fahnestock clips, and the two parts of the mercury cell clip, are mounted with four 2-56x¼-in. roundhead machine-screws in #44-drill holes in a 1/16x1x2-in. piece of perforated Bakelite. You can screw-fasten the clips on a small block of hardwood if no Bakelite is handy.

The two parts of the battery clip are cut, bent, and drilled as in Fig. 2 from lightweight tin or brass sheet. Place the two Fahnestock clips that hold the battery clip so their mounting holes are about 1⅛ in. apart.

Cover the three leads of a low-priced general-purpose p-n-p junction transistor with small diameter spaghetti tubing to prevent shorts. But cut this tubing short enough so you can pinch the leads, close to the soldering ends with the nose of a pair of pliers to absorb some of the heat while soldering the leads to the clips.

As shown in Figs. 1 and 4 solder the *base* (B) lead of the transistor to the upper-left clip, the *collector* (C) lead to the lower-left clip, and the *emitter* (E) lead to the upper-right clip. When inserting the Mallory RM-625 mercury cell into the clip, be sure that the bottom or negative side

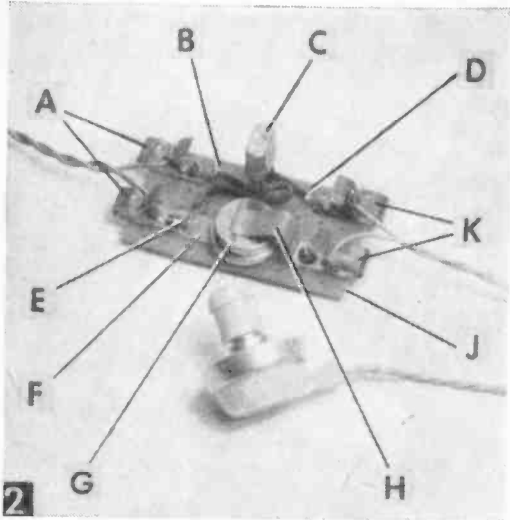
MATERIALS LIST—SIMPLE PHONO AMP

"Breadboard" Model:

1	low-priced general-purpose p-n-p junction transistor
1	Mallory RM-625 mercury cell (1.3 volt)
1 pc	1/16 x 1 x 2" Bakelite (or hardwood will do) thin tin or brass sheet, ¼" wide by 2¼" long
4	#15 Fahnestock clips
4	round-head 2-56 x ¼" machine-screws with hex nuts 6" length small diameter spaghetti tubing

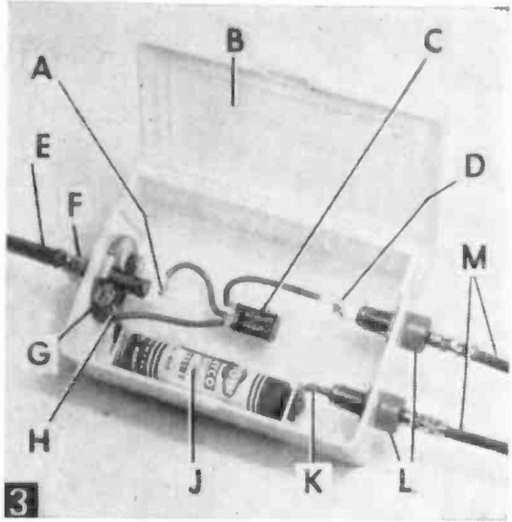
Plastic Box Model:

1	low-priced general-purpose p-n-p junction transistor
1	battery-holder for single penlite cell (Lafayette Radio, MS-137)
1	Ray-O-Vac #400 or Eveready #912 penlite cell
1	standard phono jack
2	standard phone tip jacks
1	plastic hinged-cover box 1¼ x 2 x 3" (dime store) 6" small diameter spaghetti tubing
2	round-head 4-36 x ¼ in. machine-screws, with hex nuts
1 pair	sensitive high-impedance magnetic earphones, or one Lafayette Radio, No. MS-260 magnetic earpiece. Do not use crystal phones with this amplifier



Closeup of "breadboard" model.

(A) input (#15 Fahnestock clips); (B) solder "base" lead of transistor to upper-left Fahnestock clip; (C) low-priced p-n-p junction transistor; (D) solder "emitter" lead of transistor to lug of upper-right Fahnestock clip; (E) solder "collector" lead of transistor to lower-left Fahnestock clip; (F) battery clip, 1/4" by 1" thin metal strip. Bore hole in left end and fasten under Fahnestock clip; (G) Mallory RM-625 mercury cell; (H) battery clip, 1/4 x 1 1/4" thin metal strip bent to hold battery. Bore hole in right end and fasten under Fahnestock clip; (J) 1/16 x 1 x 2" perforated Bakelite strip; (K) output (#15 Fahnestock clips).



Closeup of plastic case model.

(A) solder "base" lead of transistor to center lug of phono jack; (B) dime store plastic box with hinged cover, 1 1/4 x 2 x 3"; (C) any low-priced p-n-p junction transistor. (The writer used a Raytheon CK721 because he happened to have it on hand; (D) solder "emitter" lead to lug of phone tip jack; (E) cable from phono pickup; (F) standard phono plug; (G) input (standard phono jack); (H) solder together: outer lug of phono jack, lug of battery-holder, "collector" lead of transistor; (J) 1 1/2 volt penlite cell held in an Acme battery holder; (K) solder battery-holder lug directly to lug on phone tip jack; (L) output (standard phone tip jacks); and (M) phone cords and tips.

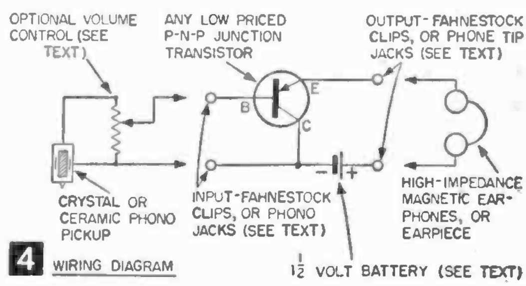
Input and output jacks are used for convenience.

of the cell goes to the collector of the transistor. If you happen to have an n-p-n transistor and want to use it, then turn the mercury cell upside-down so the positive side goes to the collector, being careful not to short the cell while slipping it into the clip. Stick a piece of tape over the bottom of the "breadboard" model amplifier so the mercury cell cannot short out if the amplifier is placed on a bare metal surface.

Plastic Box Model. Figure 3 shows this fancier model. The dime store hinged-cover plastic box measures 1¼x2x3-in., but you can use most any plastic box of similar size. This model has a standard phono jack input to take the phono plug found on the cords of many record-players. Two phone tip jacks are used in the output so the tips on the earphone cords can be plugged-in quickly. A 1½ volt penlite cell is held in an Acme battery-holder.

Mark the locations for the three phono jack mounting holes on the left side of the plastic box (Fig. 3). Then use a 5/16 in. drill for the center hole, and a #34 drill for the two screw holes. Secure the phono jack to the case using two 4-36x ¼ in. roundhead machine screws. Mount the two phone tip jacks in two ¼ in. diameter holes drilled in the right side of the box.

Cover the three transistor leads with small spaghetti tubing; then solder the *base* (B) lead to the center lug on the phono jack, the *collector* (C) lead and one battery-holder lug to the outside lug on the phono jack, and the *emitter* (E) lead to the upper-right phone tip jack (Fig. 3).



WIRING DIAGRAM

Solder the remaining battery-holder lug to the lower-right phone tip jack.

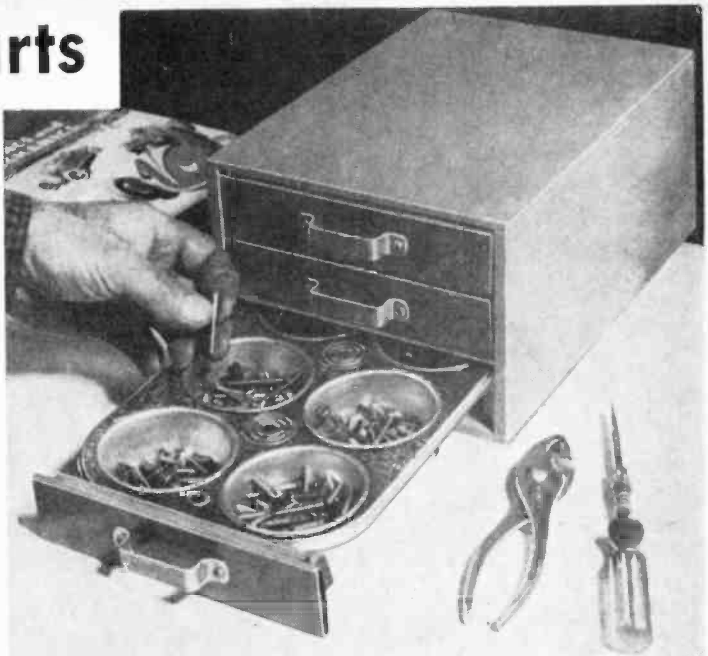
When inserting the penlite cell, be sure that the negative end goes to the collector of the transistor. If you want to use a n-p-n transistor, simply reverse the battery in the holder so the positive end goes to the collector.

Using a low-output crystal phono cartridge and a pair of good high-impedance magnetic earphones, I get surprisingly good volume and tone quality with the simple amplifier. If you use a high-output crystal or ceramic cartridge, you may find it necessary to use a volume control connected as in Fig. 4. Or, it may be that your record-player is already equipped with a volume control.

If you hear too much treble and not enough bass, connect a .01 *mfd* (or smaller) fixed capacitor across the earphone. Experiment to find the size capacitor which works best.

Small Parts Cabinet

By HAROLD JACKSON

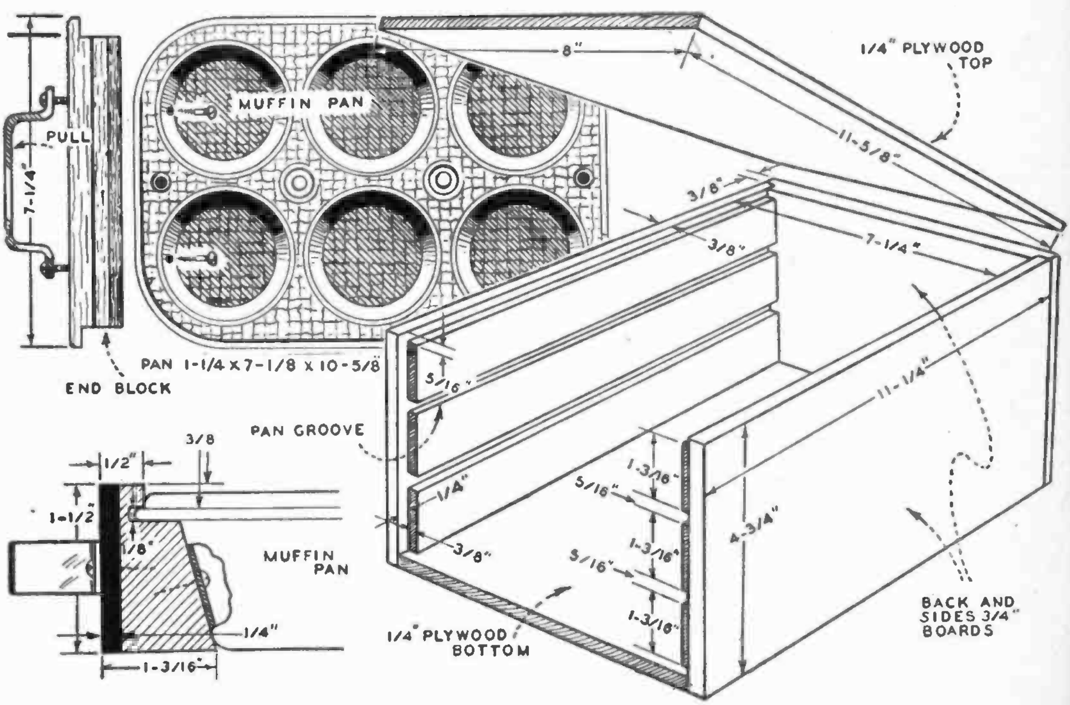


Test bench housekeeping is easier for the experimenter if he has a small parts and component cabinet like this one made from dime-store muffin pans. Rims of the pans slide in grooves dadoed into the sides of the cabinet. If you use a pan of different size than the 1¼ x 7⅛ x 10⅝-in. ones I used, change the dimensions accordingly, allowing ⅛ in. extra at sides and ends to keep trays from binding. Simply glue and brad the box parts together.

Since most muffin pans have slanting sides, make up the end blocks to grip the rim and bear against the slanted cup side. Top of the pans should be perpendicular to front block. Screw through the sides of two end cups into end block. Attach pulls or handles ½ x 3 in. A colorful decorative scheme is to paint cabinet gray and end blocks red.

MATERIALS LIST—SMALL PARTS CABINET

1—¼ plywood x 7¼ x 11¼"	bottom
1—¼ plywood x 8 x 11⅝"	top
2—¾ plywood x 4¾ x 11¼"	sides
1—¾ plywood x 4¾ x 8"	back end
3—1 3/16 plywood x 1½ x 7¼"	end block
3—6-cup muffin pans; 3—tray pulls, screws	



1

For demonstration purposes, this is all you need for stereophonic sound. Here a record changer with stereo pickup (center) simultaneously feeds the small amplifier on bench next to it and in turn the temporary speaker assembly at right from one channel of the stereo disc, and feeds the amplifier and speaker unit in the TV set at left from the other channel. Distances are about right for stereo listening in the average living room.

How to Add Stereo to Hi-Fi

By CLIFF HALL

UNTIL recently, stereophonic sound systems for the home have been financially out of the reach of most people.

Today, if you already have a reasonably good high-fidelity record playing system plus a reasonably good television set, the likelihood is that you can convert these units for stereophonic sound reproduction at a cost as low as $35, or in some cases as low as $20.

The reason for this abrupt revolution in stereo costs lies in the development by the industry of a new animal in the field—the stereophonic disc record.

What Is Stereo? In case we lost you on the first turn, stereophonic (or binaural—"two-eared") sound reproduction means the same thing to music as stereoscopic photography means to pictures. Because we have two eyes, we look at any object from two angles and in this way can perceive depth and the relative positions of more than one object. Thus the stereoscopic camera, with two lenses ("eyes"), makes two pictures which we can view at the same time and see the scene in proper perspective, just as though we were viewing it in person with our own two eyes.

Similarly, with two ears, we actually hear any sound from two "listening points" separated by the width of our head (see pages 130 through 134). If the sound is coming from the right, its vibration gets to our right ear first and to our left ear a fraction of a second later. Automatically, our mental system translates this fraction-of-a-second of time lag and tells us that the source of the sound is to the right. Thus, even with our eyes closed, we can tell with considerable accuracy the direction from which sounds around us come.

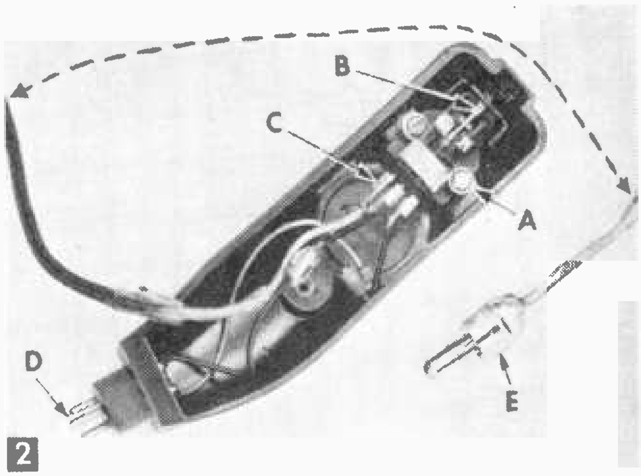
Just like a conventional camera with its single lens (eye), a conventional sound system with its single microphone (ear) picks up the sound from only one point; you might say that it is listening with one ear closed.

To solve this problem and re-create as realistically as possible the illusion that you are actually on the scene—listening with both ears and hence able to tell the direction the various sounds are coming from—technicians have been working for years to develop stereophonic sound systems. To do this requires what actually amounts to two complete and separate sound recording and reproducing systems; two microphones placed a distance apart (the two "ears" of the sound system); two recording machines each to record what its own microphone is hearing, and what amounts in actuality to two records. On the reproducing end, in turn, you'll need a device which will play these two records simultaneously, two amplifiers, and two sets of speakers on opposite sides of the room.

Until this year, the only method available to the public to do this job has been through the use of a stereophonic tape reproducer. In this method, the two sound channels are recorded on opposite edges of a magnetic tape; they are then played back simultaneously through two separate amplifiers (or one two-channel amplifier, which is substantially the same thing) and two sets of speakers.

Costs of such a system have generally run to a minimum of about $400, while adding tape stereo to your present hi-fi would involve an outlay generally in the $200 and up vicinity. Even at these prices, popularity of the system has been growing by leaps and bounds because of the extreme realism—the feeling of actually being present in the concert hall—which stereophonic sound systems give you.

Meanwhile, manufacturers of disc records have been hard at work de-



2

The Electro-Voice stereo cartridge (here installed in a Garrard plug-in head) has a mounting flange with standard centers for two bolts (A). The 45° diamond stylus (B) feeds three output terminals (C)—a common ground in the center and one channel through each outside terminal. Here one channel is fed through the standard Garrard plug-in leads (D), while the second feeds a secondary shielded cable, equipped with standard phono jack plug (E), to attach to TV amplifier.

for $35

vising a new method to do the same job—on discs instead of tape—to combat this threat to their business.

Out of a welter of varying technical approaches industry leaders late in 1957 agreed upon the basis for a new stereo disc system. At the time this is written you can actually buy the equipment to play the new records, and by the time this reaches print, you should be able to buy the records themselves.

Viewed through a microscope, the groove in a conventional high-fidelity disc record consists of a series of side-to-side wiggles (Fig. 4). As the stylus of your record player passes through the groove, this side-to-side motion or vibration at varying speeds (frequencies) is translated into electrical impulses which your amplifier boosts so that your speaker can reproduce the original sound or something close to it.

In the new stereo discs, the microscopic picture is different (C in Fig. 4). Here, both sides of the groove are cut to a 45° angle, and each side carries its own independent set of wiggles which is in fact a separate recording (coming from a separate microphone). When a specially designed stylus passes through this new groove, it picks up side-to-side vibrations from one of the channels and up-and-down vibrations from the other; it then passes these two sets of impulses into two sets of wires and in turn into two amplifiers and two sets of speakers.

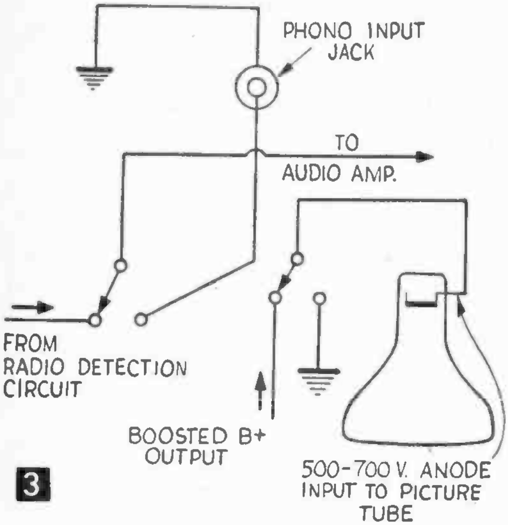
The result, reproduced as described above, is true stereophonic sound. But the new records have an additional gimmick: They are designed to be totally compatible, as well, with former high-fidelity pickups and systems. In other words, it is possible to play the new stereo disc through your present hi-fi system and get (it is claimed) approximately the same result as you would with a conventional hi-fi disc.

When the new system was agreed upon, manufacturers throughout the industry followed through with announcements that they would have pickups to play the new records on the market "in the near future," while record companies announced that the discs themselves would be forthcoming—likewise in the near future. Opinions as to costs varied widely.

After these original announcements, little further was heard until one firm, Electro-Voice of Buchanan, Mich., jumped the competitive gun by actually placing on the market a diamond-stylus stereo pickup cartridge (Fig. 2)—and not at the over $50 price many had anticipated, but at a modest $19.50.

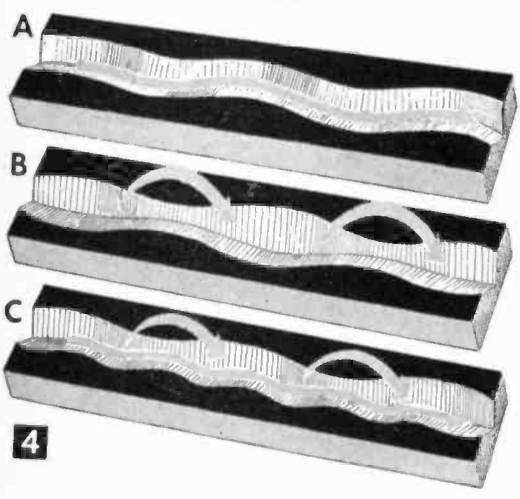
Science and Mechanics secured one of the first of these for evaluation.

Installation of the cartridge is a simple matter (Fig. 3). Flanges on the cartridge are spaced the conventional half-inch apart and simply by removing two screws, in most cases, the new stereo pickup can be dropped into the head of your pickup arm in place of your old hi-fi cartridge. Instead of the conventional pair of leads coming from the old cartridge, you now have three—one on each side for the two channels and a common ground in the center. Wiring simply involves connecting two terminals to your two old pickup leads and attaching a new shielded lead



3

One of the common methods of converting a TV set for phono use is by installing a phono input jack and a switch which cuts out radio detector output and grounds one of the control anode inputs to the picture tube. A number of other methods are used, too; if you don't understand TV circuitry, better call a service man.



4

A Opposite sides of the groove in a conventional disc recording are exact mirror images of each other. Where one side of the groove has a bulge, the opposite side has an exactly matching indentation. Thus the stylus (needle) moves only from side to side.

B If a groove were made in which bulges on one side were matched by bulges on the other, rather than indentations, then the stylus would be squeezed up and down, rather than moved from side to side.

C In a stereophonic disc, the above two methods are combined. Some of the bulges on one side are matched by indentations on the other, causing side-to-side movement which records one of the sound channels. Meanwhile, some of these same bulges on one side are opposed by bulges on the other side, causing up and down movement which records the other sound channel. The in-phase and out-of-phase variations are so finely spaced that manufacturers claim up to 25,000 cycles per second can be recorded on both channels.

(available at any radio shop) of suitable length.

In such record players as the Garrard (which we used), which has a plug-in pickup head, it is possible to get a spare head in which to install the stereo cartridge, so that you can change back to your hi-fi cartridge at any time simply by unplugging one and plugging in the other. You will, of course, have to adjust the tracking weight (11 grams is recommended for the stereo cartridge). The new lead can be taped to the pickup arm out of the way.

Now that you have your stereo pickup installed, next comes the problem of two amplifiers and two sets of speakers. You already have one—your regular hi-fi setup through which your record player played in the first place. But don't rush right out and buy another amplifier and speaker setup unless you have money to burn. Instead, take a good look around the living room. See that TV set over in the corner (Fig. 1). Let's look at it more closely.

If it's a good TV, especially if it's a console model of good manufacture, the chances are that it has a sound system almost as good as most of the lower-priced so-called hi-fi assemblies. And that sound system—that amplifier and speaker unit—can supply the "other side" of your stereo setup, at least to start.

Several models of console sets have for some years been manufactured with a phonograph input and selector switch already installed. If yours is one of these, you're in. (We used a five-year-old RCA 21-in. console already so equipped.) The TV, you see, is designed to do a job of reproducing the frequency modulated sound signal that accompanies the picture signal; most of them have amplifier units far superior to those of low-priced radios, and many have coaxial speakers of good size.

If your TV is not so equipped, you have two options: Install an input and selector yourself, or call your local radio-TV repairman, who will make the installation for you, in most cases for about $15.

In this connection, we strenously recommend that unless you have some little specific knowledge about TV innards, you call the repairman. High voltages, high enough to knock you flat, are involved here, with dangers too complex to discuss in this article. If, on the other hand, you know what you are doing inside that back panel, the problem is simply one of installing a switch to cut out the radio detector output and ground one of the central anode inputs to the picture tube. It is best to install a jack socket on the back panel to accept the lead from your stereo pickup. The schematic diagram (Fig. 3) presents such a typical instalation; a number of other methods are used, however, and your service man may suggest one more suitable for your set.

Long enough leads between components should be left at the outset to permit moving the speaker units about the room to find the locations that will give the best result. (You'd better get the wife in the act here.)

Many leaders in the field suggest a separation between speakers of about six feet. In our installation, we found a wider spread—10 to 12 feet—provided a clearer separation of sound sources, perhaps because of room acoustics or because we are simply not accustomed enough to listening to stereo.

You will have to do some twiddling, too, to achieve a balance between the two dissimilar amp and speaker units. You will probably have to cut back the highs a bit on the hi-fi side to get its quality of reproduction closer to that of the TV.

As for fidelity, as in the case of any kind of a hi-fi or so-called hi-fi installation, the "finished product" will be no better than the quality of your weakest component—in this case, likely the amplifier of your TV set. But you will have stereo sound's startling realism at low cost.

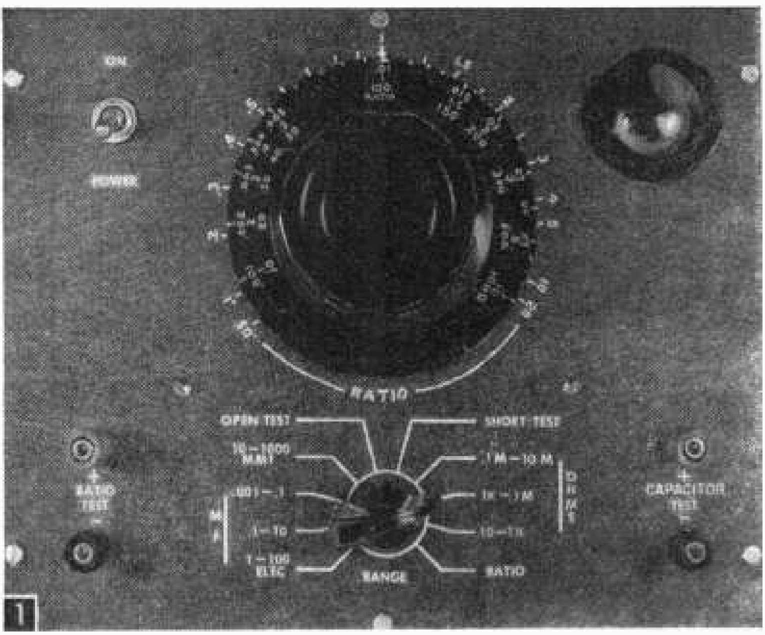
With our test setup, the first stereo disc we could get was the Audio-Fidelity waxing of the Dukes of Dixieland, Vol. III. We also obtained the identical recording in a conventional, monaural LP version. We asked several trained musicians to listen.

All were impressed with the clarity with which you could place the relative physical location of the instruments in the combo. But all had reservations, too. The comparison monaural disc without question yielded higher fidelity—wider frequency range—when played through the hi-fi unit alone with conventional pickup than did any of the other possible combinations. Playing the stereo disc with conventional pickup yielded a good sound; so did playing the stereo disc with the stereo pickup through two amplifiers; so did playing the stereo disc with both channels fed to the hi-fi amplifier alone, and so also did playing the conventional disc with the stereo pickup fed to one amplifier—but none were up to the straight conventional setup in our opinion, although the systems are adequately compatible in all directions.

Certainly, both equipment and disc quality will improve. Late in May, Electro-Voice announced a second pickup equalized to a velocity curve and capable of being interchanged with a magnetic rather than a ceramic cartridge. Other manufacturers will have equipment on the market this summer, they say, and platters will soon be plentiful.

If you dig this new sound, you can go as far as you wish in equipment. But you can also get in the act now for as little as $35.

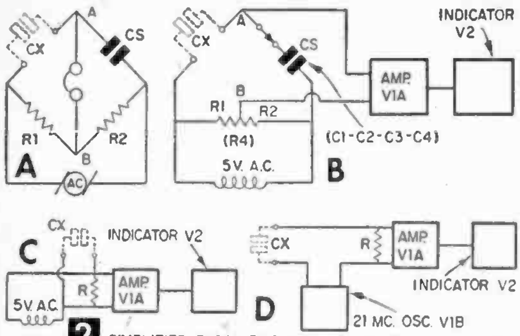
Magic-Eye Capacitor Checker



Front-panel view of checker. Not only can capacitance values be checked with it, but also resistance values and capacitance and resistance ratios.

NEXT to tubes, capacitors probably give more trouble in electronic circuits than any other single component. Sometimes, in critical applications, capacitors change value and upset circuit operation. Since this kind of trouble cannot be found by ohmmeter tests, substitution is usually resorted to. With a capacitance checker, however, a supply of substitution capacitors is not needed for checking; and the checker, if of the bridge type, can *also* be used for circuit design work.

Two types of capacitor checkers are normally available: the bridge, which measures capacitance value and also indicates shorted and open capacitors *when out of the circuit;* and a second instrument which does not measure capacitance, but does check for shorted and open capacitors *while they are still wired in the circuit.* The checker described in this article performs *both* of these functions as well as checking electrolytic capacitors, measuring resistance, and comparing R and C ratios.



2 SIMPLIFIED BLOCK DIAGRAMS OF CHECKERS (SEE TEXT)

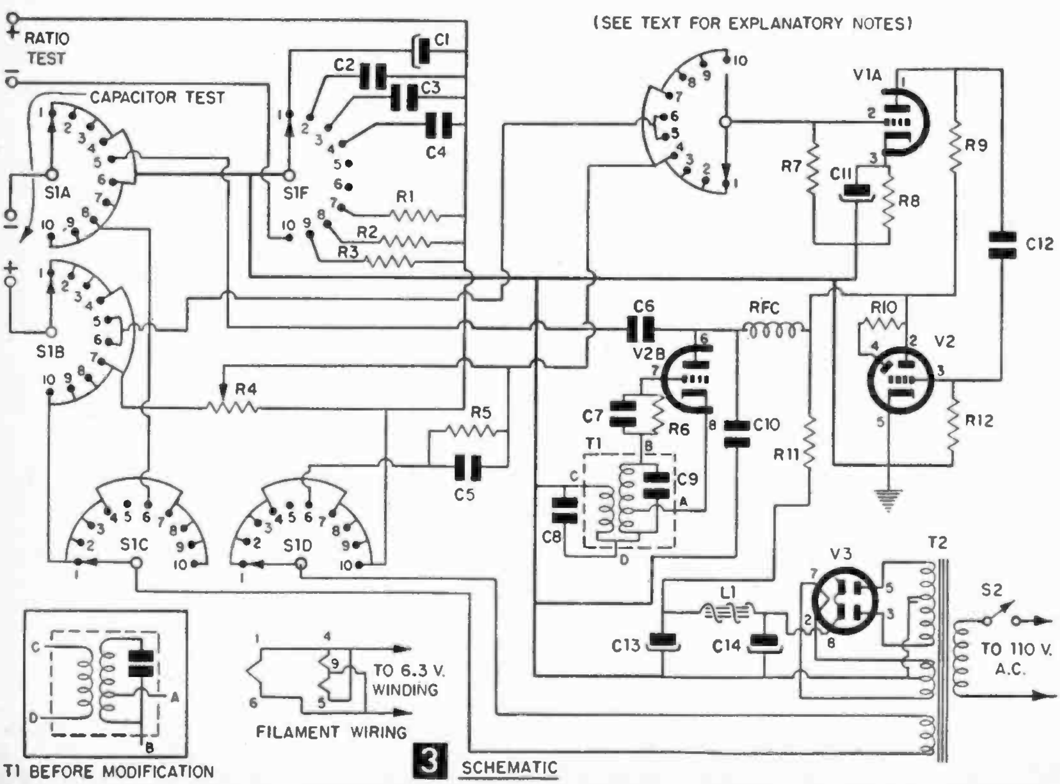
Since three different basic circuits are used, let's first look at them in simplified form. Figure 2A shows an ordinary capacitance bridge; C_x is a capacitor of unknown value and C_s is a capacitor of known, or "standard" value. When the ratio of the resistance of R_1 to R_2 is the same as the ratio of the reactance of C_x to C_s, the voltage drop at point A and point B will be equal and there will be no voltage drop across the headphones.

In other words, a null indication. If the voltage used is sufficient, null indicators other than headphones, such as meters or tuning eye tubes, can be used. When other indicators are used, however, you normally cannot test electrolytic condensers, since appreciable *ac* voltage will damage them.

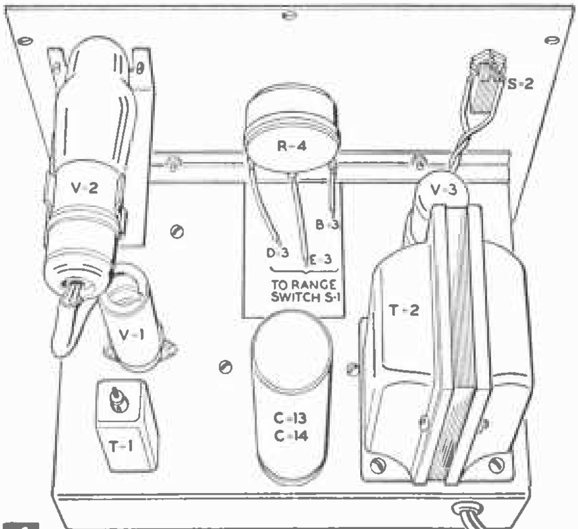
In the checker described in this article, a low test voltage is used, permitting a check of electrolytic condensers; this voltage is then amplified, enabling the use of a tuning eye as an indicator. The simplified circuit diagram for this checker is shown in Figure 2B, with a single potentiometer used as a two-ratio resistance divided by the arm. The voltage between points A and B appears across the grid resistor of the amplifier V1A. When a null is reached by moving the arm, no voltage appears and the tuning eye opens.

On the "Short Test," as shown in Figure 2C, the capacitor under test is connected in parallel with the grid resistor, which is connected across a 5 *v ac* source. The voltage drop across the resistor closes the tuning eye. If a shorted capacitor is connected across the resistor, the voltage drop is shorted out and the eye opens. This test can be made with the questionable capacitor wired in its regular circuit. External resistances as low as, roughly, 50 ohms in parallel with the capacitor will not materially affect the test.

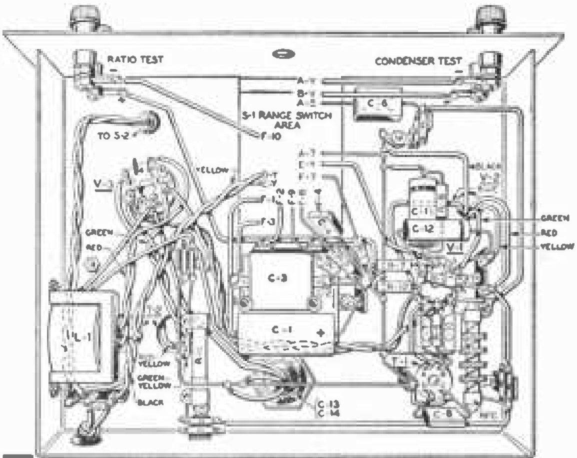
Figure 2D shows the "Open Test" circuit. In this case, the output of a 21-megacycle oscillator (V1B) is connected to the grid resistor in series with the capacitor under test. If the capacitor is good, it will pass virtually all of the oscillator output, which will cause a voltage drop across the grid resistor and close the eye. If the capacitor is open, it will not pass the oscillator output and the lack of voltage drop across the resistor permits the eye to open, an "in circuit" test.



3 SCHEMATIC



4 PICTORIAL (TOP CHASSIS VIEW)



5 PICTORIAL (UNDER CHASSIS VIEW)

By referring to Figure 2A, it can be seen that resistances could be substituted for C_x and C_s, and a null obtained. Three resistances (R_1, R_2, and R_3) have been included in the Range Switch (S1) circuits of our checker to allow resistance measurements of anywhere from 10 ohms to 10 megohms.

Often there is a need for matched capacitors or resistors that have identical values, or have an exact relationship in values. In Figure 2B it can be seen that R_4 could be calibrated to read the ratio of resistance, and, if a second unknown value were substituted for C_s, the ratio of two external values could be determined. A position on the Range switch of our checker provides for this arrangement, using a second set of binding posts.

Figure 3 gives the detailed schematic diagram of this checker; Figure 4, a back view of the unit, showing parts placement. The numbered positions of the Range Switch (S_1) on Figure 3 correspond to the ranges as shown in the photo, Fig. 1, as follows:

Position 1—Electrolytic capacitor, 1 to 100 mfd.
Position 2—Capacitance, .1 to 10 mfd.
Position 3—Capacitance, .001 to .1 mfd.
Position 4—Capacitance, 10 to 1000 mmfd.
Position 5—"Open" Test
Position 6—"Short" Test
Position 7—Resistance, .1 to 10 megohm
Position 8—resistance, 1000 to 100,000 ohms
Position 9—Resistance, 10 to 1000 ohms
Position 10—Ratio Bridge

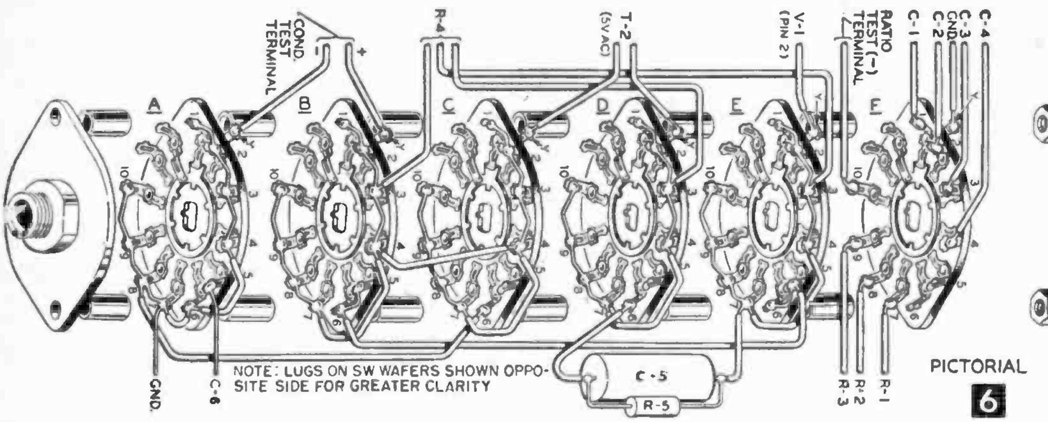
Since the bridge operates on *ac*, it is important to follow good shielding practice, and isolate the power transformer, choke and rectifier tube from the oscillator-amplifier tube V1. Figure 7 shows the chassis layout, giving the dimensions for the specific parts listed in the Materials List. If alternate parts are used, there may be slight deviations in mounting holes, but the general layout should be the same.

Since the unit itself will have some internal capacitance which will be added to the measured value, and will determine the minimum value that can be measured, every effort should be made to keep this internal capacitance to a minimum. The use of a single ground bus tends to reduce such internal capacitance and also reduces chassis currents which are detrimental to *ac* instruments.

The overall accuracy of the unit will depend on the accuracy of the "standard" capacitors, C1, C2, C3 and C4, the "standard" resistors, R1, R2, and R3, and the accuracy of calibration. (Spend a little additional to secure precision components unless a laboratory-type bridge is available to test lower-priced components to secure accurate values). In the case of C_1, the electrolytic capacitor, low-tolerance units are generally not available and it is suggested that stock units be tested to get as nearly as possible the correct value. Most stock units have a value in excess of their rated value, and a 5 mfd. or 8 mfd capacitor will be closer to the required 10 mfd. than one rated at 10 mfd.

If a laboratory bridge is not available to select C1, build your checker without connecting C1. When the bridge is functioning and the ratio scale has been calibrated (as explained later), set the Range on ".1-10", connect various stock units across the "Capacitor Test" terminals, and, using the ratio scale, attempt to find one that gives a ratio reading of 10:1. This will provide a reasonably accurate measurement, although balancing an electrolytic unit against non-electrolytic units causes some error.

In wiring the checker, run the filament circuits first, twisting the wires and running them next to the chassis. Then wire the power supply



PICTORIAL 6

completely, with all wires carrying *ac* twisted and flat against the chassis. If a dropping resistor (R_{11}) is to be used, do not select its value or solder it in place until the rest of the unit is built. This resistor is necessary only when the power supply voltage *under load* exceeds 250 *v*, and its value is selected by trial-and-error in final testing, to reduce the supply voltage to 250 *v*.

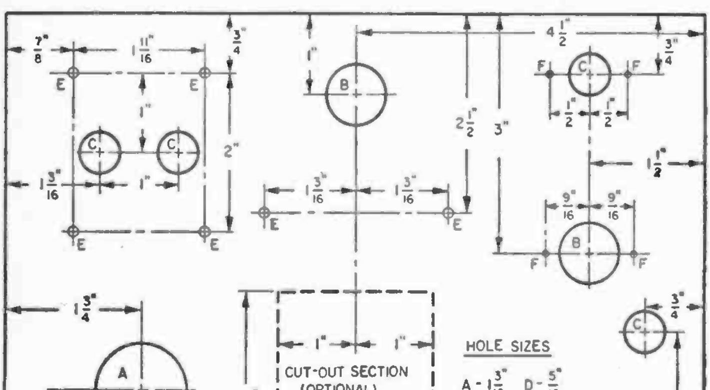
After the power supply is wired, connect the ground bus wire in place and complete the remainder of the wiring (see Figs. 5 and 6). Many of the Range Switch (S_1) wafers have jumpers between terminals, and it simplifies wiring if these are wired before the switch is mounted. The switch wiring is also simplified if a section of the chassis above the switch is cut out, as shown in Fig. 7.

In the unit pictured, the cabinet used was smaller than specified, which required cutting the front of the chassis off and attaching it to the panel with an angle. Normally, the chassis would be attached to the panel by the binding posts and the range switch. However, part of the underedge chassis lip should be cut away (as shown in Fig. 8) to give clearance for the Range Switch.

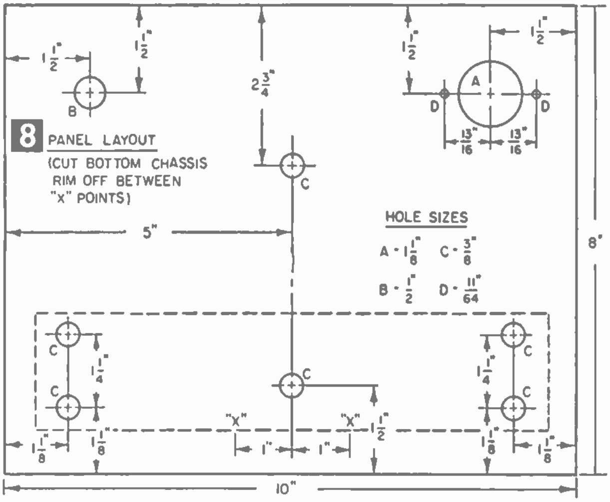
To minimize lead length and internal capacitance, the switch wafers must be designated in the order shown in Figs. 3 and 6. Wafer "A" (S_{1A}) is at the front of the switch, wafer "F" (S_{1F}) at the back, etc.

The coil (T_1) must be modified before mounting. The inset in Figure 3 shows the coil wiring as purchased and the letter designations on the terminals in the main diagram show the modified connections. This change is made by removing the coil from the shield can and unsoldering the coil and capacitor connections that go to terminal "B" and moving them to the terminal marked "D" along with the other coil connection. Then run a lead from the upper end of the coil and capacitor to terminal "B."

When the oscillator is wired, some adjustments may have to be made to secure optimum oscillation. Using a VTVM (or oscilloscope, if available), adjust the coil cores for maximum output. Adjust the upper screw first (coil "A"-"B"), and then the lower. After adjustment, short the "Capacitor Test" terminals together (with Range Switch on "Open Test") to make sure that oscillation doesn't stop when a load is connected. If so, back off the coil adjustments.



Calibration. Before attempting to calibrate the unit, initial tests should be made. Test the bridge in each capacitance and resistance range (using capacitors and resistors of values within the range) to see if a null is obtained, opening the eye, in each range. Turn the potentiometer (R_4) slowly, as the nulls are usually quite sharp. Test the "Short"



and "Open" ranges by seeing if the eye opens and closes as the "Capacitor Test" terminals are shorted out.

The Ratio range should be calibrated first. This can be done with an accurate ohmmeter, a Wheatstone bridge or a series of 1% tolerance resistors. If an ohmmeter or bridge is used, make a series of measurements of the resistance on either side of the potentiometer arm at various positions and calibrate the scale according to the ratio of these measurements. For this scale, the center point (where the resistance on either side of the arm is equal) is calibrated "1" and points on one side reduced to .05, and those on the other side increased to 20. If 1% resistors are used to calibrate this range, various ratio combinations are connected across the two sets of terminals and spot calibrations made.

The most accurate means of calibrating the bridge scale is to use a series of precision capacitors or resistors. Since the resistance scales follow the same calibrations as the capacitance, use precision resistors to calibrate both scales, since precision resistors are cheaper than good capacitors. Only the center range (1000 to 100,000 ohms) need be calibrated; the other ranges are direct multiples. By using seven precision resistors (1000, 2000, 3000, 4000, 20,000, 30,000 and 40,000 ohms), each 1000-ohm point on the range can be calibrated.

A cheaper means of calibration would be to use a series of regular stock resistors, if a Wheatstone bridge can be borrowed from the local high school or a junior college or university physics lab or from some other source. When you have it, the exact value of the stock resistor is checked on the bridge, and then spot calibrations are made.

Since this main control has no "zero" point where the potentiometer is fully clockwise or counter-clockwise, it is necessary to make a reference mark in case the knob has to be removed. Turn the knob to either extreme and mark a reference point.

In the unit pictured in Fig. 1, part of the calibrations are on the skirt of the knob, referring to an arrow on the panel, and a mark can be seen on the knob skirt beyond the "1000" mark. When the potentiometer is fully counter-clockwise, the knob is placed on the shaft so that this mark aligns with the top arrow on the panel itself.

If a skirted knob is used as shown, part of the scales can be on the skirt, referring to an arrow on the panel, and part on the panel, referring to an arrow on the knob skirt. Another means would be to paste a piece of paper on the panel and use a knob with a clear plastic pointer (with a hairline scribed on it) to indicate the scale. If it is desired to maintain the black face of the panel and yet make scales on it, the figures can be lettered directly on the panel using Johnston's "Snow White" ink.

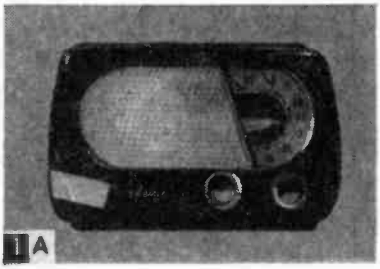
Because of the single range-function switch (S_1), the unit is simple to use. With the exception of the Ratio range, all connections are made to the "Capacitor Test" terminals. In bridge tests, the main knob (R_1) is turned slowly for a null, and in the "Short" and "Open" tests, no manipulation is required. When checking capacitance values, attach the capacitor directly to the terminals instead of using leads which might have some inherent capacitance. For "Open" and "Short" tests, leads may be used. The binding posts on the front panel of this unit will take plugs as well as wires.

MATERIALS LIST—CAPACITANCE CHECKER

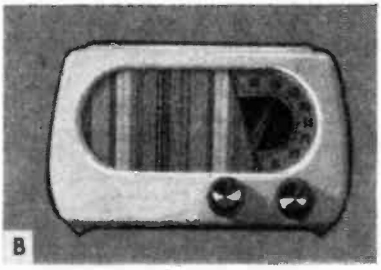
R1	1 meg., 1%
R2	10,000 ohm, 1%
R3	100 ohms, 1 %
R4	15,000 ohms, 4 watt (Mallory M15MKP or equiv.)
R5	4000 ohm, 1 watt
R6	1 meg., 1/2 watt
R7	2.2 meg., 1/2 watt
R8	2500 ohm, 1/2 watt
R9	50,000 ohm, 1 watt
R10	1 meg., 1/2 watt (included in Amphenol Eye Assembly —see below)
R11	See text
R12	5 meg, 1/2 watt
C1	10 mfd, 300-volt electrolytic (see text)
C2	1 mfd., 5% (Cornell-Dubilier Type 6100)
C3	.01 mfd., 5% (Cornell-Dubilier Type 1DR or 1AD)
C4	.0001 mfd., 5% (Aervox Type 1469)
C5	.5 mfd., 200 volt
C6	270 mmfd., 400 volt mica
C7	200 mmfd., mica
C8	75 mmfd., mica, 300 volt
C9	Included in T_1
C10	.01 mfd., mica, 300 volt
C11	10 mfd., 25 volt
C12	.05 mfd., 300 volt
C13-C14	8-8 mfd., 450-volt electrolytic (Sprague PLS-88, Mallory SR638)
S1	6 pole, 10-position rotary switch (Mallory 1361L)
S2	SPST toggle
T1	21 mc. TV converter transformer (Miller #6185)
T2	480 v. C.T. @ 55 ma., 5v & 6.3v. Fil. (Stancor PC-8402)
V1	12AU7
V2	6E5
V3	6X5
L1	6 hy. 50 ma. choke (Stancor C-1707)

Amphenol MEA6 Tuning eye assembly
2 x 7 x 9" chassis
8 x 8¼ x 10" cabinet (Bud C-1789)
Binding Posts, Knobs, AC cord, tube sockets & shields, etc.

Giving Old Radios a New Look



1A



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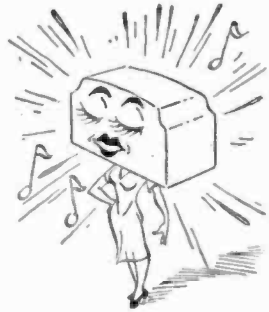
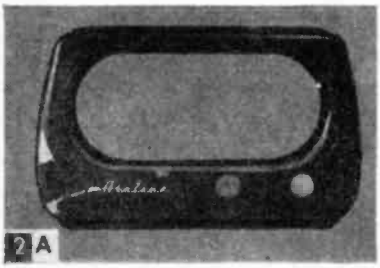
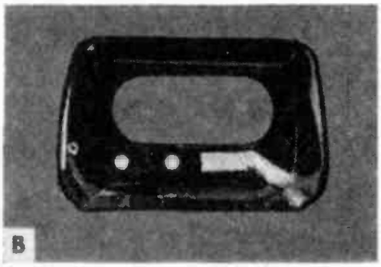




2A



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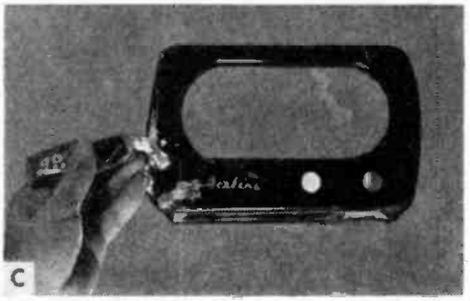


C

MOST families have an old table model radio around the house that looks terrible. Chances are that it has had a fall or two and that the plastic cabinet has some cracks in it, possibly even some holes where lost pieces were not retrieved. Quite often, a radio which has been dropped once or twice is abandoned in the garage or the attic—although it may still perform satisfactorily as a receiver. If you have a set that has met this fate, dig it out and devote a few hours to fixing it up. The finished product can look better than the original. (If you don't have such a set, table model radios with broken cabinets can be obtained for $2 to $5 at many used furniture or second-hand stores. Add a little of your time and less than a dollar's worth of materials to them and you have an extra radio for the kitchen, a child's bedroom, or a summer bungalow).

The radio shown in Fig. 1A cost $2. It wasn't working, but I didn't mind since I knew I could repair it myself. If it had been working, it would have cost $3 or $4. The cabinet was a drab brown; the grill cloth, tan.

I removed the radio from the cabinet by loosening two screws at the rear. Most radios have three or four additional screws which can be loosened at the bottom of the cabinet. Tuning knobs usually just pull off their shafts, but in some of the older radios, they're held by small set screws.

Next I removed the celluloid dial face which was fastened with snap fasteners, and the cardboard speaker baffle and grill cloth assembly, which was also fastened with snaps, and set them aside.

The stripped plastic cabinet was then soaked in lukewarm detergent water, scrubbed, rinsed and allowed to dry. The cracks were filled with cement (Duco or *Pliobond*) forced together, held with twine, and allowed to dry. When the cement had dried I reinforced the cracks with masking tape on the inside, bottom and other less obvious points on the cabinet as shown in Fig. 2B. I used a piece of masking tape along a back edge of one of the sides where a piece of the cabinet had been cracked out and lost. This broken edge could have been built up on a wire screen base, but I didn't feel that it was worth the effort. This portion of the cabinet is rarely noticed and the masking tape patch was later concealed by paint.

Next, I filled in gouges, places where chips had been lost from the cabinet, and glue seams with plastic wood (Fig. 2C). I built the plastic wood up well above the remainder of the cabinet surface so I could sand it down smooth with the surface. Since plastic wood shrinks when it hardens, I had to make several applications. (On the first application I used too much plastic wood and the surface hardened and sealed the sub-surface so it couldn't dry and harden. If this happens to you, pin-prick the surface of the plastic wood.

When the plastic wood hardened, I sanded it down smooth with the cabinet surface. If, after you've finished sanding, you have some doubts about any of the surface being smooth, refill again with plastic wood and repeat the sanding process. Next, clean the cabinet with a damp cloth first, then a dry one to remove dust left by the sanding. The repaired cabinet is shown in Fig. 2A ready for painting. Paint can be sprayed on or applied by brush. If you did a good job of filling and sanding, one coat will do. Choose color to suit the surrounding in which the radio will be placed.

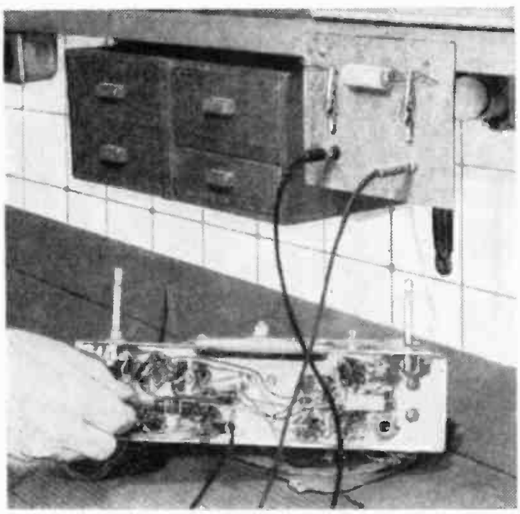
During one of the waiting periods in the cabinet repair and refinishing procedure, I removed the old grill cloth from the speaker cardboard baffle and replaced it with a new, many-colored, striped cloth, that would blend with almost any surrounding. (The cabinet was painted light gray for the same reason). The new cloth was cut using the old one as a pattern, and was fastened to the cardboard with mucilage. The mucilage was applied sparingly to prevent it from soaking through the cloth and spotting the front side of the new grill.

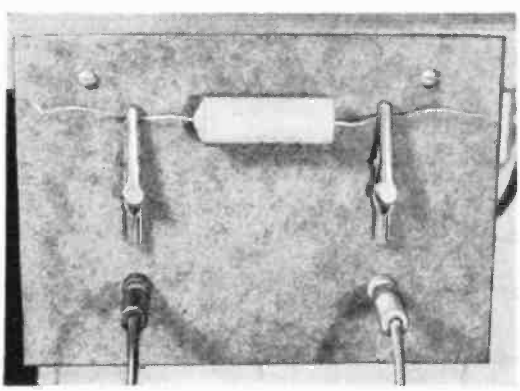
I cleaned the old tuning dial face and knobs with a damp cloth. Refinishing the dial is undesirable from the standpoint of the difficulty in doing a good job and the time involved. Refinishing the knobs is undesirable because painted knobs may eventually become tacky and unattractive.

Finally, I reassembled the radio. The finished product shown in Fig. 1B leads me to believe that my time (about an hour) was well spent.—F. H. FRANTZ, SR.

Circuit Substitution Board

WHEN working on a radio or TV set, it is often necessary to temporarily substitute a replacement capacitor or resistor in a circuit. Usually this means bending the leads *just* so and substituting the part directly, an awkward process that often results in shorting out the circuit with the bare leads.



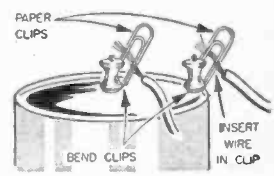


Substitution is greatly facilitated by mounting a pair of alligator clips and pin jacks (red and black for polarity) on a piece of hardboard. Then a new component can be tested in the circuit simply by placing it in the clips and running test leads to its connections.

Mount clips with moveable jaw up using small machine screws set about 3½ in. apart. Mount board over bench within easy reach.—H. Y. M.

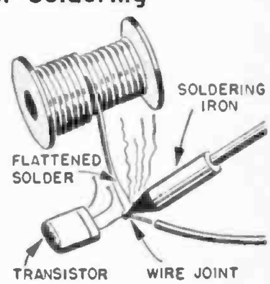
Paper Clips Grip Test Wires

• Bend paper clips at right angles and attach to the posts of a dry battery as illustrated, for quickly attaching wires used in low-voltage testing jobs.—G. E. H.



Transistor Soldering

• When soldering a transistor into a circuit, there is always the hazard of overheating the component through heat conduction. To eliminate this possibility, hammer the end of the solder flat. This will allow it to melt almost instantly at the touch of the iron, reducing the amount of heat needed to solder the joint.—J. A. C.



1

A complete stereophonic home music system, the Ampex Crescendo Console has a tape recorder-stereophonic reproducer, two separate speaker-amplifier systems, an AM-FM tuner, a four-speed record changer and a microphone.

STEREOPHONIC SOUND

By TOM JASKI

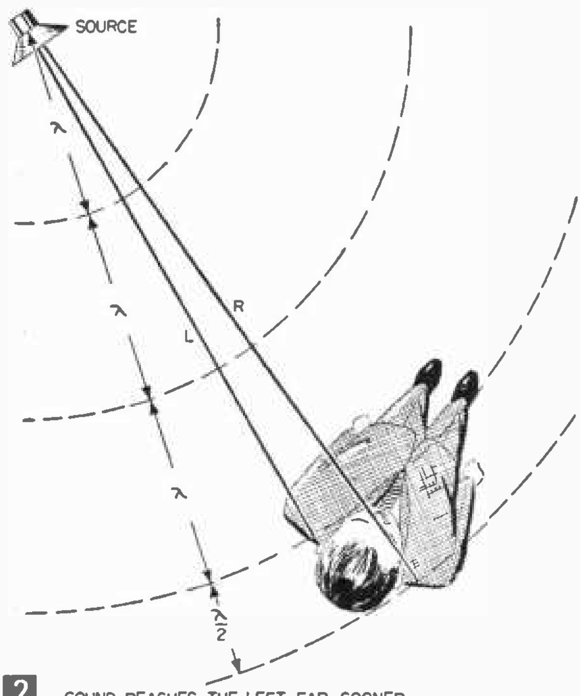
STEREOPHONIC sound has been called the "ultimate" that modern technology offers to the discriminating music listener; it has added dimension and depth to music and given a living, moving quality to sound available otherwise only at a live concert performance.

Bell Telephone Laboratories demonstrated stereophonic sound more than 25 years ago, picking up a live program with two microphones and conveying it over two separate telephone circuits to a concert hall where the two signals were amplified and fed into two specially designed speaker systems. (Leopold Stokowski, conducted the Philadelphia Symphony Orchestra for this experiment.)

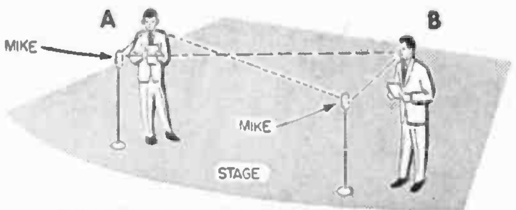
A more recent event in the evolution of stereophonic sound took place in 1956 in San Francisco's War Memorial Opera House, the San Francisco Symphony Orchestra performing. At least so far as the audience could tell, the orchestra was playing, but in the middle of the performance the musicians laid down their instruments, the music went on, and the audience learned that they had been listening to a previously recorded stereo tape, the musicians faking their instrumental efforts.

Stereophonic—or binaural sound has been in use commercially for several years in movie theaters where it adds to the lifelike quality of Cinemascope and other wide-screen film techniques. It has been only very recently, however, that equipment and tape manufacturers began to focus attention on consumer markets. But they have now entered the field with such enthusiasm, and are offering such a wide variety of equipment, that the pleasures of stereo sound are presently within the budget of almost everyone.

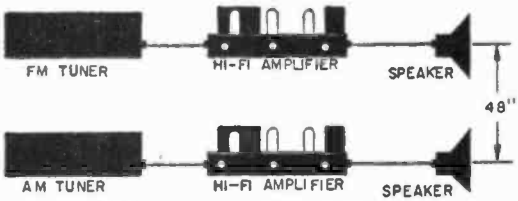
What Is Stereophonic Sound? Although we



2 SOUND REACHES THE LEFT EAR SOONER



3 TWO MICROPHONES DETECT A DIFFERENCE IN SOUND COMING FROM A AND B



4 HI-FI STEREO EQUIPMENT

normally pay little attention to the phenomenon, practically all of us can determine with fair accuracy the direction from which a sound comes. Sound has to travel a different distance to reach each of our ears and thus it differs slightly in loudness and phase at each ear (see Fig. 2). As infants, we learned to interpret this difference so that we could determine the point of origin of sound; if a sound moves from one place to another, we are capable of detecting this motion.

In Fig. 2 the sound from the speaker source has to travel a slightly greater distance to reach the right ear of the listener than it does to reach the left ear. The distance from the source to the left ear in portions equal to the wavelength of the sound at a specific frequency is three wavelengths; the distance to the right ear is three and one-half wavelengths. Thus, there is not only a difference in the loudness of the sound reaching the two ears, but also a phase shift of 180 degrees. The faculty that enables the human brain to use these differences in phase and loudness to determine full direction is called binaural hearing.

When recording with a single microphone (which is reasonably directional) the microphone may detect a slight difference in loudness, but it is incapable of providing any significant indication of phase difference. When making a recording with a single microphone, the sense of direction and the sense of motion are almost completely lost except that we can still tell whether or not the source of sound is approaching or receding from the microphone.

If we reproduce the sound recorded with a single microphone through a single amplifier channel and speaker, we compound the difficulty. Some of the dynamic range caused by the variation in distance from the microphone to the sound source will be lost in the recording and the reproducing system and the reproduced sound will have even more of the characteristics of a single point source of sound.

If two microphones are mounted on a stage at a considerable distance from each other, however, and we record individually what each microphone picks up, we have a different story, (see Fig. 3). There will be a difference in the loudness and the phase of the sound reaching each microphone and if we make two separate recordings, each fed by one of the microphones, and then play the two recordings back through two amplifiers and two physically separated speakers, any sound from a moving source will appear to be moving in the room in which we are listening. In the dual recording of an orchestral performance, for example, the reproduction will pro-

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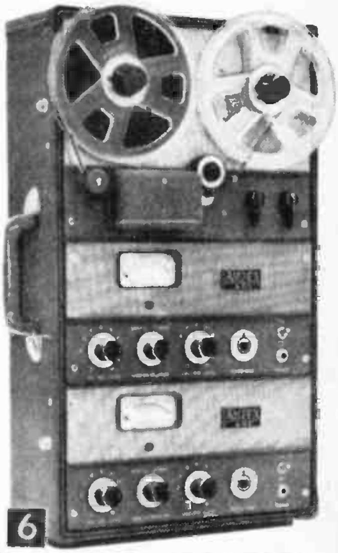


6

Fig. 5. This stereophonic system, the Ampex A121, includes a tape recorder-stereophonic reproducer and two matched speaker-amplifier systems. Fig. 6. The Ampex 601 for the professional audio engineer and the semi-professional who takes his stereo recording seriously and is willing to pay the price for high quality.

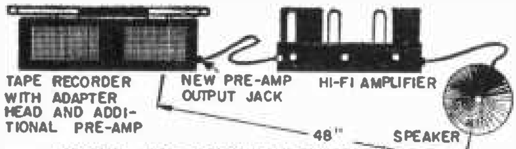
TABLE A—STEREO EQUIPMENT

The following list gives a sampling of equipment of interest to the audiophile:

Ampex Corp., 934 Charter Street, Redwood City, Calif.
Viking, 9600 Aldrich Ave. S., Minneapolis 20, Minn.
VM Corp.,* Benton Harbor, Michigan
Berlant Concertone, 9449 W. Jefferson Blvd., Culver City, Calif.
David Bogen Co. Inc.,* P.O. Box 500, Paramus, N. J. (pre-amplifiers)
E.M.C. Corp., St. Paul 6, Minnesota
Wollensak,* 320 East 21st Street, Chicago 16, Ill.
Pentron Corp.,* 777 S. Tripp Ave., Chicago 24, Ill.
RCA (Victor), Camden 2, New Jersey
* adapters

(The Harrison Publishing Company prints a catalog of available tapes, listing over 50 recording companies. The catalog can be obtained from your hi-fi dealer or from the Harrison Co., 274 Madison Ave., New York 16. Here are some of the companies listed:

RCA VICTOR	PENTRON
EMC	NATIONAL
WESTMINSTER SONOTAPE	MERCURY
HIFITAPES	OMEGATAPES
BEL CANTO	STEREOPHONY INCORP.
CELESTIAL	WEBCOR)



7 ADAPTED TAPE RECORDER WITH ADDITIONAL POWER AMPLIFIER AND SPEAKER

vide us with the same sense of direction we would have if we were in the concert hall, hearing one instrument from one place on the stage and another from the other side, and some from the middle. This is stereophonic sound reproduction.

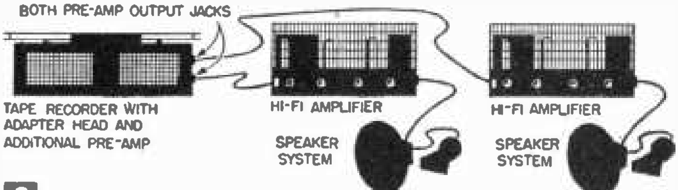
We need not limit ourselves to orchestral music to enjoy the benefits of stereo reproduction. Even a recording of a group conversation will give us the feeling of audio perspective when it is played back. We might, for example, hear conversations from one corner of the room; or steps moving down the hall; or the sound of cars passing by.

Program Sources. Obviously, most of us will not have the opportunity to set up stereophonic recording equipment at a concert. But fortunately there are several companies which make two-channel stereo tape recordings. They offer thousands of selections of every type of music, from Brahms to Beethoven to Dixieland jazz. (Most stores that sell phonograph records are beginning to stock stereophonic tape.) In addition, a number of radio broadcasting stations have inaugurated the practice of weekly stereophonic concerts. This is done by stations which transmit the same program, but over two separate broadcast channels, simultaneously on AM and FM. The listener picks up the program on both channels simultaneously with separate radio sets, and thus obtains the benefit of stereophonic sound. (Programs may be taped or live, or both.)

The minimum amount of equipment that can be used to listen to such programs is two radios, one an FM receiver and the other a standard AM broadcast receiver, each picking up one channel of the dual-channel program. Set them about four feet apart in the same room. Even with inexpensive table model receivers, the results are thrilling.

Figure 4 shows a somewhat more elaborate set-up, one that will appeal to high-fidelity enthusiasts: two tuners, one an FM tuner and the other an AM tuner, two high-fidelity amplifiers and two speakers (again placed about four feet apart in the same room). By adding a suitable tape reproducer to the equipment shown in Fig. 4 you can enjoy taped stereophonic programs.

Stereophonic tapes have two sound tracks, each recorded through an individual recording channel. Each half of the tape carries one-half of the recorded program. Standard stereo tapes sold today for home use are recorded at a speed of 7½ inches per second. Almost all home tape re-



8 QUALITY OF REPRODUCTION DEPENDS ON QUALITY OF COMPONENTS

corders are dual speed types, providing tape speeds of 7½ *ips* and 3¾ *ips*. For reproduction of commercial stereo tapes, a special dual head which will pick up the program from both tracks of the tape simultaneously, or in some cases, two heads, one for each of the two sound tracks on the tape, plus a separate pre-amplifier for the second channel, are required.

This may sound like an expensive proposition; sometimes it is. The Ampex Crescendo Console, shown in Fig. 1, for example, costs almost $1500; the Ampex A121 system (Fig. 5), and the portable Ampex 601 (Fig. 6) for the professional and semi-pro, $995.

Similar systems at slightly lower prices, are produced by RCA, by the Berland Concertone Audio Division of American Electronics, Inc. and by Viking. For most of us, however, these are likely to be astronomical outlays.

But let's see what can be done with much slimmer budgets. To begin with, if we own any late model tape recorder providing 7½ *ips* tape speed that can satisfactorily reproduce music, we already have half of a stereophonic system. Today, several manufacturers of inexpensive and medium priced home recorders are producing adapter kits to convert their recorders for stereophonic tape. Pentron, for instance, offers a conversion kit for $16.95 consisting of a pre-amplifier, extra head, cable and mounting hardware, complete with instructions, for converting your present tape recorder to stereo.

There are two basic kinds of stereo tape recordings, one type for use with separate heads, the other for use with dual heads. For tape players with a single dual-track head, the recording companies are producing tapes with "stacked" program channels. This means that the two tracks on the tape are perfectly aligned, one above the other, so that there is no displacement in time. When an extra head is used in addition to the existing head, we need a "staggered" type of recording in which the program tracks are displaced by the distance between the centers of the two heads, so that they still reproduce the program with no displacement in time. Any discrepancy in the timing of the two tracks would of course cause very unpleasant results. It would give the same effect as if the musicians in the orchestra failed to keep in time with each other. Tapes for both "stacked" and "staggered" heads are commonly available.

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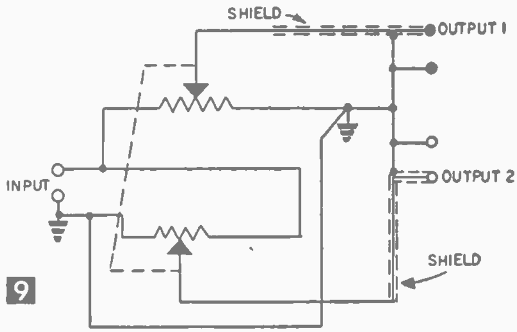


POTENTIOMETER FADER

Suppose then, that we have an existing tape recorder of satisfactory quality for which we can get a conversion kit. The kit will generally include a pre-amplifier for boosting the signal from the second track. The output of this pre-amplifier is fed to the second power amplifier which has its own speaker system (see Fig. 7). Here one-half of the program is reproduced through the tape recorder directly and the other half through the power amplifier and speaker. The quality of this set-up is limited by the quality of the speaker and amplifier in the tape recorder. Most home type tape recorders use only small speakers in the interests of portability.

A more elaborate and undoubtedly a more satisfactory arrangement is shown in Fig. 8. where the signal from both tape recorder pre-amplifiers is applied to two identical power amplifiers. This, within limits set by the amplifiers and speaker systems, and, of course, by the quality of the heads in the tape recorder, provides the next best thing to a completely engineered stereophonic sound system.

Speaker Placement. Considering the size and the acoustics of the concert hall or the broadcast studio where musical programs are recorded on tape, it is not difficult to understand that it is almost impossible to duplicate the same acoustical conditions in a living room. The placement of the speakers of a stereophonic system in a room cannot be considered as an exact science; in the final analysis it will be the listener who has to determine his preference between the several possible speaker placements.

If you want to provide a dramatic demonstration of stereophonic sound effects, place the loudspeakers as far apart as possible along one wall of the room, facing into the room at a slight angle. The apparent motion of the sound from one corner of the room to the other will then be very obvious. This type of speaker placement in rooms with hard acoustical surfaces may, however, allow enough diffusion of sound from reflection of wall to ceiling to cause loss of a great deal of the stereophonic effect.

At the other extreme, with the speakers placed close together, no matter at what angle we set the speakers most of the effect of the stereophonic reproduction will be lost. In general it has been found that a spacing of four feet between the speakers tends to give the most satisfactory results. For best results, of course, you should experiment with the actual equipment and judge for yourself what spacing and arrangement of speakers produces the most desirable results.

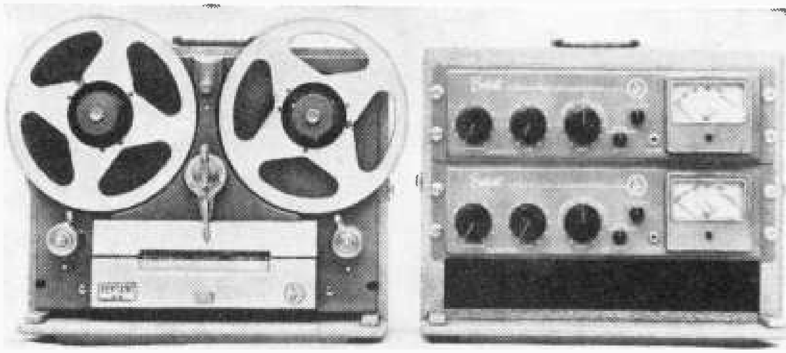
Stereophonic sound system speakers may be built into a home as in conventional hi-fi systems, but careful experimentation should be conducted before cutting holes in the wall to house the speakers. In built-in installations, care must be given to the problem of possible acoustical feedback from one speaker to the other inside the structure of the wall. There is also the unpleasant possibility that the two speakers might produce sufficient acoustical power to cause resonance in the wall at the lower frequencies.

The importance of the quality of the speakers and the speaker housing for true high fidelity reproduction is, if anything, more important in stereo sound than in conventional systems. Any spurious resonance or natural frequency in the speaker or baffle will obviously emphasize undesirable characteristics. You might find that such a simple thing as throw rugs on the floor or drawn draperies, produce a noticeable effect on the quality of reproduction. Arrangement of furniture and variations in the number of people in any room may also contribute one way or another to the result.

About the only specific thing that can be said about speaker arrangements is that the best results can only be determined by actual experimentation with the equipment in the room in which it is to be used and with the furniture arranged as you expect it to be.

Operation. Careful adjustment of amplifier volume and tone controls will always be necessary, no matter what equipment you use. If the equipment is to be used for monaural reproduction as well as binaural, keep a record of the control settings for stereo reproduction, so that the adjustments will not have to be experimented with each time.

You can test your stereo system with a test tape. Such a tape is similar in content and function to hi-fi test records. Sono tape #SWB-AL101 is typical; recorded on it are the tests necessary to check the tape player with stacked heads as well as the other components of the system. With the tape comes an instruction manual explaining these various tests in detail. The tape contains such things as single-frequency tones on each track alternately, a 3000-cycle tone for wow and flutter checks, and a 440-cycle tone for checking left and right speaker connection; equalization and loudness; correct speaker placement; transient response; distortion; and very high volume. The test tape was produced for standard NARTB playback equalization characteristics and contains spoken instructions to let the listener know whether the sound should come from the left or right. (For recording purposes it should be remembered that the microphone placement should correspond with this arrangement.)



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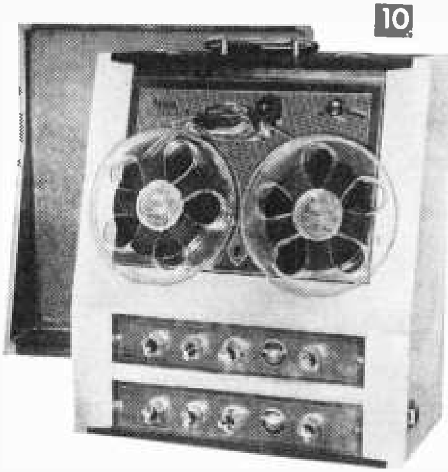


Above, the portable stereo unit made by Berlant Concertone; on the left, Viking's portable unit.

Making Your Own Recordings. Careful attention must be given to microphone placement. Too wide a separation between microphones will produce a dead area when the sound moves from the range of one microphone to the other; too close a spacing between microphones will reduce the effects you are aiming for. Correct microphone placement depends upon the type of recording you are making; a ping-pong game requires a different set-up than an orchestral performance.

Always remember that you are dealing with two recording tracks. It is possible to make up to a certain extent for the deficiencies in the recording of one track or another by adjustment in the reproduction system, but this is doing it the hard way. The more nearly you achieve equality in the level and tone range on the two tracks, the easier it will be to properly reproduce them.

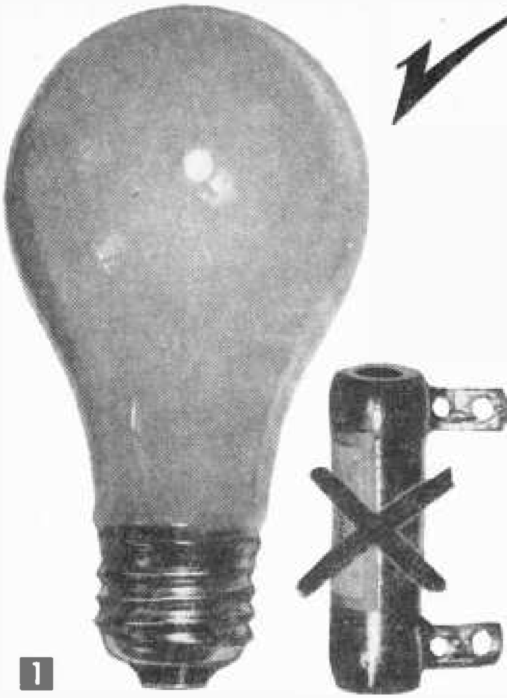
If your favorite music is not available on stereo tape, you might be interested in making simulated stereophonic recordings from phonograph records or other single-channel sources. In order to do this you can use the right-left-middle fader shown in Fig. 9. This consists of two ganged potentiometers with linear taper and the necessary jacks. For low-impedance sources, such as the output of some tuners, or the voice coil of terminals of existing amplifiers, the potentiometers should be about 10,000 ohms each. For high-impedance sources, such as pre-amplifiers, the potentiometers should be one-half megohm. If high-impedance potentiometers are used, all leads must be carefully shielded. When you re-record the music, adjust the potentiometer to make the music come either from the left or the right or the apparent middle.

Another way to accomplish a similar, psuedo-stereophonic effect is to feed the single channel signal to two amplifiers, one of which has the treble turned up and the bass control down while the other favors the basses. The result will be an apparent separation between the bass instruments and the treble instruments.

A stereo set-up, in addition to providing stereo reproduction, can also be a lot of fun in other experiments. For example, while recording one channel, it is possible to dub in comment on the second track which, when played back, will be heard simultaneously with the music. This can be useful in some types of instruction or educational work. If you have a recorder with staggered heads you can feed part of the signal from the second head into the same final amplifier as the first head to produce an artificial echo. When you do this, remember that each pre-amplifier has a bias oscillator and that if improperly adjusted, the bias oscillators may produce a beat or whistle in your recorder when you use them for special effects (such as the special echo).

Mazda Lamp Resistors

By T. A. BLANCHARD



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While larger than wire-wound resistors, Mazda lamps provide voltage-drop resistance and yield useful illumination at the same time. This 60-watt lamp can handle almost three times the load of the ex'd-out 75-ohm resistor.

LIGHT BULB resistors eliminate stepdown power transformers when building and experimenting with small sets. Ten lamps provide ten useful resistance values.

You may have noticed how carefully tube manufacturers work out the filament operating voltages of tubes employed in compact *ac-dc* type receivers. In a standard five-tube receiver, there are three 12-*v.* tubes, a 35-*v.* tube, and a 50-*v.* tube. Adding up these filament voltages you will find the total is 121. Simply by wiring each tube in a series string (just like many older Christmas tree light strings) the tubes can be operated directly off the domestic power line (105-125-*v.*) without need for a bulky step-down transformer.

Some compact sets employ only 4 tubes. In these sets, the manufacturer must *lose* 12-*v.*, otherwise tubes would burn out. To lose the 12-*v.*, a voltage-drop resistor is inserted in series with the tubes. In a modern four-tube set, a 75-ohm, 5-watt resistor will breach the gap caused by the absence of a fifth 12-*v.* tube.

TABLE A
MAZDA LAMP RESISTANCES

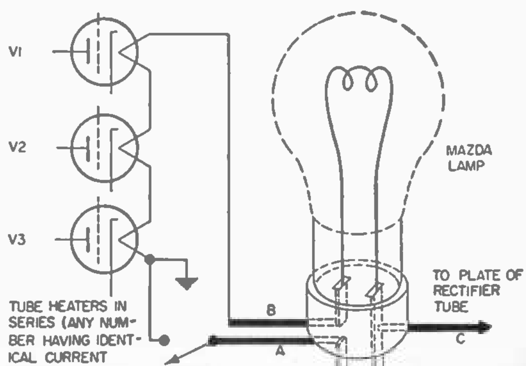
Mazda Lamp WATTAGE	Resistance in OHMS
150	88
100	132
75	177
60	221
50	240
40	329
25	518
15	802
10	1321
6	2210

Where the required voltage-drop is small, a resistor is not objectionable, and many manufacturers use ordinary carbon 2-watt resistors in series with the tubes for satisfactory results. Instead of the large 75-ohm wire-wound unit, a 33- and 39-ohm carbon resistor (total: 72 ohms, 4 watts) is employed.

Experimenters can apply this method to small sets—even one-tubers! However, as the voltage drop increases, the wattage rating of the resistor often increases so much that a very bulky unit is required. In addition to the size, a high-voltage dropping resistor becomes quite hot, affecting other components.

Since any voltage-dropping resistor is a total loss from standpoint of efficiency, the experimenter might as well get something for his money—that something is light! For practically any experimental application, ordinary Mazda light bulbs make excellent voltage-dropping resistors. Moreover, where a particular resistance and wattage rating isn't immediately available, you needn't kill time shopping for the necessary unit.

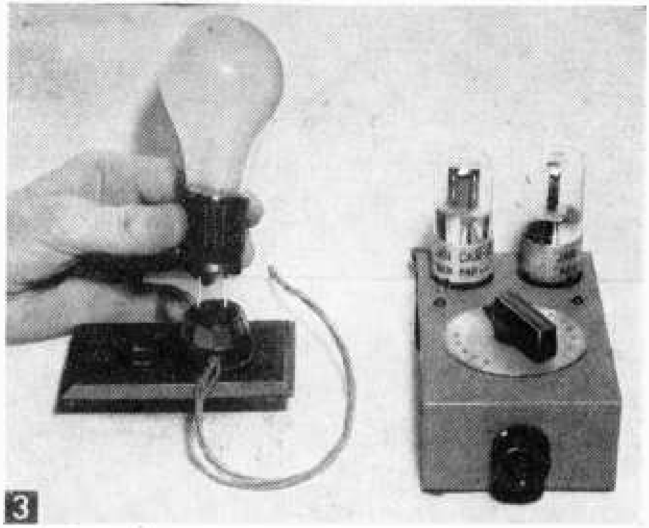
Table A lists all standard Mazda lamps from 150 down to 6 watts and the approximate resistance rating of each lamp size (when hot). After computing the required voltage-drop required for a particular circuit, select a lamp having a resistance as close to the computed *drop* as possible. The lamp can be within 10% plus or minus.



2

Unlike a carbon or wire-wound resistor, the Mazda lamp exerts a unique "shock absorber" action in the tube string. The lamp takes the initial inrush of current when the set is turned on, rather than letting it fall upon the more costly tube heaters. You'll note that the Mazda lamp comes on at full brightness, then dims off as much as 50% as the radio tubes reach operating temperature. Thus, you have a built-in surge absorber.

A Mazda lamp is more bulky than a resistor, of course, but it gives off useful light rather than damaging heat, and it is a cheap, quick solution for resistance problems in addition to its versatility. A small bedside radio with two or three tubes may be designed to fit in the base or housing of a table or bed lamp. You'll have a radio that costs almost nothing to operate, since the radio circuit consumes barely 10% more current than the lamp alone!



3

Small radio or other electronic devices can be fitted with 3-wire cord and series tap. Tap is plugged into outlet, then Mazda voltage-dropping lamp plugs into series tap for operating tube heaters.

Figure 3 shows a novel cord plug known as a "series tap." This plug resembles any ordinary plug, except that it has a female outlet in the cap. One side of the power line supplies both the receiver itself, its rectifier tube and the lamp, plugged into the top of the series tap (Fig. 2); the other side connects to B-minus in the radio and the end of the string of tube heaters operating in series with the lamp plugged into the series tap.

A separate On-Off switch for small radios operated in this manner is unnecessary. Merely turning off the table or bed lamp switch shuts off the radio. Very little current, if any, is drawn by the set with "cold" tube heaters (radio off).

When constructing or converting a set (not already designed with series filaments) the experimenter must observe this precaution—*all tube heaters must have the same amperage rating.* Check the ratings in a tube manual. If you find that two tubes are .15 *amp* and one is .3 *amp*, you cannot wire these tubes in series without a complicated shunt system. Select a similar tube in the manual with a .15 *amp* heater to match the other tubes. Or, if two tubes are listed as .3 *amp*, change the remaining .15 *amp* tube to a type with .3-*amp* heater. Any set already designed with series heater tubes does not pose this problem; simply select a Mazda lamp with a resistance near that of the wire or carbon resistor unit indicated in the set's schematic diagram.

To compute the voltage drop required for a particular set, follow these three steps:

1) Determine from the local power company, the peak line voltage in your locality.
2) Add up the operating voltages of each tube in your circuit. Subtract the total from the line voltage.
3) Divide the current rating of the tubes used *into* the remaining voltage after subtracting total of tube voltages in step 2. Answer: resistance in ohms required for line-drop.

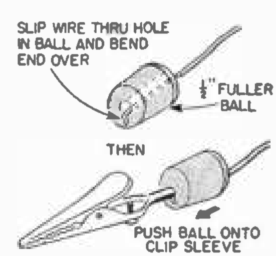
For example, let us assume that your power company delivers 120 volts into your home. You have constructed a set with just two 6.3-*v*. tubes. Each tube draws .3 amperes. Adding up the tube filament voltages totals 12.6 *v*. Subtracting 12.6 *v*. from 120 leaves 107.4 *v*. Now, divide .3 into 107.4, giving the required voltage dropping resistance of 358 ohms.

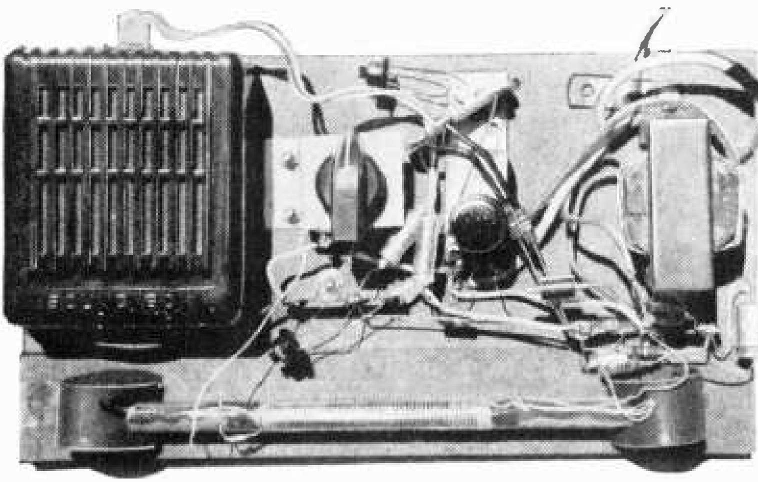
Checking the lamp resistances in Table A shows that a 40-watt bulb has a resistance of 329 ohms. Since this value is within the 10% tolerance, it is the right size to use.

You can use lamps for resistors when operating motors, buzzers, low-voltage bulbs, or when testing electrical circuits. If you don't know the current rating of such apparatus, start with a 10-watt Mazda lamp, working up to higher wattage lamps until the device functions at proper speed or intensity. With their almost unlimited versatility, you'll find that an assortment of ten Mazda lamps is one of the best buys you can make.

Quick Wire Connections

• To make a quick and secure wire connection to an alligator clip without soldering, use a ½-in. rubber Fuller ball, which has a hole just the right size for this purpose. This also saves the threads on clips with terminal screws, which tend to strip threads.—A. TRAUFFER.





The two transistors used in this powerful little set use, together, less than 1/4 watt of power.

Tie-Rack Radio

By FORREST H. FRANTZ, SR.

"IT LOOKS like a tie rack," was my first thought when I saw the high-Q transistor loop antenna used here. You may get your ties slightly snarled up in circuit components if you try to make this radio double as a tie rack, but you'll never get a snarl up on set performance. Room-filling loudspeaker volume without an outside antenna, good selectivity, short construction time, and low cost are the outstanding features of this two-transistor radio.

The outstanding performance of this simple set results from utilizing some basic knowledge, the "tie-rack" antenna, and some novel construction techniques. The basic knowledge referred to is something any experimenter who's ever built a battery receiver has learned. Namely: a battery radio which performs poorly with a short antenna will perform well against ground. The tie-rack radio has a return to ground through the 6.3 *v* transformer and the *ac* line which provides operating power.

The tie-rack antenna, a transistor loop antenna with a Q of 450, is as essential to this receiver's outstanding performance as the indirect ground. The high Q (quality factor) of this antenna assures sensitivity and selectivity far in excess of that possible from a simple crystal diode circuit with a more ordinary antenna coil. A short length of wire—about 12 in. long in metropolitan areas, to 36 in. in areas more remote from radio stations—is all the antenna that's required.

Note also the use of a crystal diode as a power supply rectifier. It can perform in this infrequently seen application because the current and voltage demands of the two transistors used are small.

Construction. The tie-rack radio can be built in two or three hours. And it was designed to be safe because my youngsters will be using it.

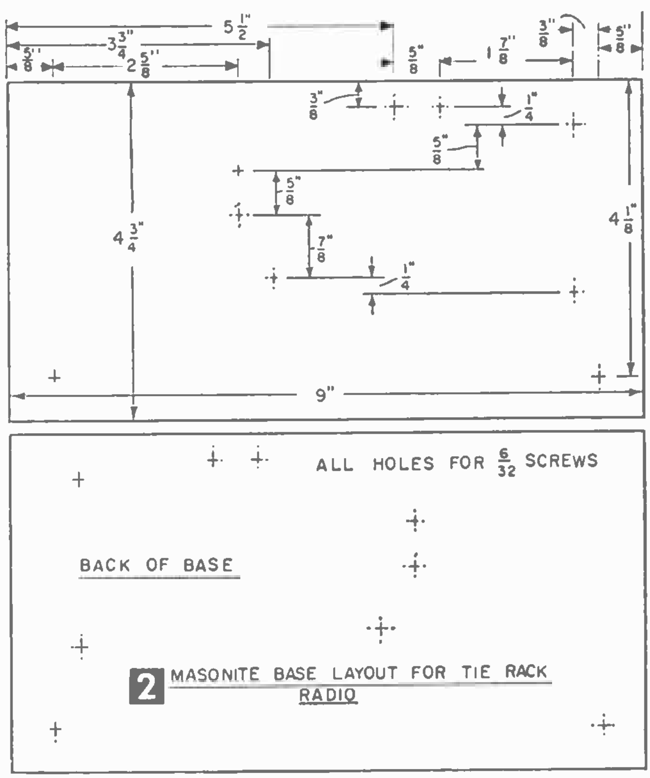
The base for the set is a piece of Masonite 4¾ x 9 in. Figure 2 gives the hole placement for the components designated in the Materials List.

The most rapid construction sequence to follow is:

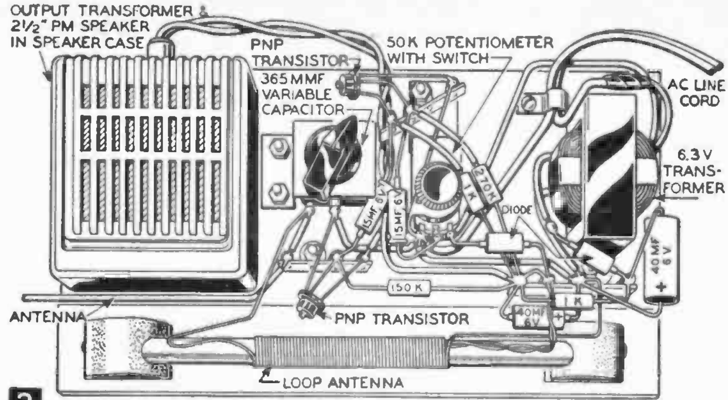
1) Cut and drill the Masonite panel.

2) Mount tuning capacitor C1 and volume control R1 on their brackets.

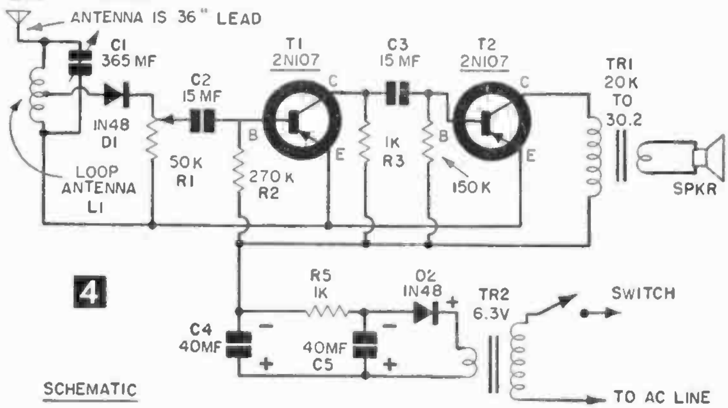
3) Solder one lead from the *ac* line cord to one lead from the transformer TR2. Tape the splice. The other lead from the line cord and



2 MASONITE BASE LAYOUT FOR TIE RACK RADIO



3 PICTORIAL



transformer TR2 primary lead connect to the switch SW terminals on R1. (In soldering connections to miniature components, diodes and transistors, apply heat for shortest possible amount of time and use pliers between soldering iron and component as heat sink.)

4) Mount transformer TR2, volume control R1, and tuning capacitor C1 on the base. A metal clamp under the upper transformer mounting screw holds the line cord in place. The four-terminal connection (tie-down) strip is fastened under the other transformer mounting screw. A three-terminal tie-down strip is fastened with the volume control bracket mounting screw.

5) Mount the loop antenna L1 and the remaining three-connection tie-down strip on the board as shown in Fig. 3.

6) Wire the power supply (secondary of TR2, D2, R5, C4, and C5) being careful to connect D1, C4 and C5 for correct polarity. To avoid mistakes in wiring, go over each connection on the circuit diagram (Fig. 4) with a red pencil as you make the connections.

7) Wire the detector circuit (L1, C1, D1 and R1).

8) Wire the audio amplifier (C2, R2, R3, R4, C3, T1, T2). The leads to the speaker are brought out to a plug furnished with the speaker case.

9) Wire the output transformer TR1 to the speaker and the terminals in the speaker case. Bend the output transformer mounting lugs out to the side so that a grommet or piece of rubber tape can be wedged between the side of the speaker case and the top of the transformer to hold it in place against the speaker frame (see Fig. 5). Fasten the back of the speaker case with the four screws provided. When you've checked the set out, fasten the speaker case to the Masonite with Duco cement.

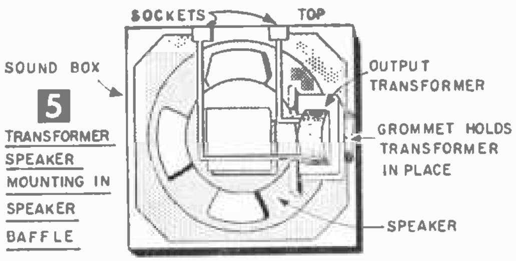
Tie-Rack Radio Check Out. Check the wiring and examine connections. If everything looks good, connect a voltmeter (set to 5 *v* or higher *dc* range) across C4 with voltmeter connection polarity the same as that of C4. Plug the set's line cord into an *ac* outlet and turn the switch On. If the voltmeter reads between 3 and 6 *v*, advance volume control R1 to full volume and touch the center terminal with your finger. A hum indicates the audio amplifier is working, and you're ready to tune in stations. If any of the tests do not give the desired indication, unplug the set and recheck the wiring. Be especially careful that the cases of the miniature electrolytic capacitors do not touch other wiring.

If you can hear a small hum in the loudspeaker when you're tuned off a station with the volume all the way up, connect the volume control mounting bracket to the common emitter return.

The critical component is the antenna coil. But even this may be changed if you use a tapped transistor coil of equally high Q. All other components can readily be replaced by their less ex-

MATERIALS LIST—TIE RACK RADIO

C1	365 mmfd variable capacitor (Lafayette MS-274)
C2, C3	15 mfd, 6v capacitor
C4, C5	40 mfd, 6v capacitor
R1	50K potentiometer w/sw (Lafayette NC-31)
R2	270K, ½ watt resistor
R3, R5	1K, ½ watt resistor
R4	150K, ½ watt resistor
L1	loop antenna (Miller 2000)
TR1	output transformer, 20K to 3.2 (Lafayette AR131)
TR2	6.3v filament transformer (Lafayette 106-01)
SPKR	2½" PM speaker (SK-65)
D1, D2	crystal diode (CBS—Hytron 1N48)
T1, T2	PNP transistor (GE 2N76 or 2N107, or Raytheon CK722)
1	speaker baffle (Lafayette MS-315)
1	line cord
2	knobs
1	Masonite board 4¾ x 9"
2	brackets
2	3-terminal connection strips
1	4-terminal connection strip



5 TRANSFORMER SPEAKER MOUNTING IN SPEAKER BAFFLE

pensive equivalents without appreciable sacrifice in performance. The transistors T1 and T2, for example, can be the inexpensive CK722's. And the output transformer, speaker, volume control, and capacitors can be standard-size components. Figures 1 and 3, for example, show a standard size component in place of the C5 called out on the parts list. If you push economy to the hilt, I believe your Tie Rack radio will materialize for less than $8!

How It Works. The tie-rack radio employs a crystal diode detector (D1) followed by a two-transistor audio amplifier (T1 and T2). It derives its power from the *ac* half-wave power supply consisting of TR2 which steps the 110-*v* line voltage down to 6.3 *v*, diode D2 which rectifies this voltage to provide pulsating *dc*, and capacitors C4 and C5 and resistor R5 which filter the pulsations out to provide pure *dc* for the transistor operating biases.

The short antenna lead and loop antenna L1 pick up RF signals. The setting of C1 determines the frequency to which L1-C1 are resonant. A signal at the resonant frequency is in essence amplified by the combination while signals at other frequencies are rejected.

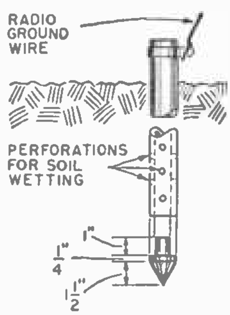
A tap on the "tie-rack" loop antenna L1 provides a low impedance match to the crystal diode detector D1 which would reduce the circuit Q if connected to the upper end of L1. The diode D1 is non-linear (that is, it allows current to flow more readily in one direction than the other), and rectifies the received signal.

The high-frequency pulsations remaining in the signal after such rectification are filtered by the capacitance of the succeeding circuitry, and an audio signal appears across the volume control R1. The fraction of this signal to be amplified is determined by the volume control setting.

The audio signal is then passed through C2, but *dc* cannot and the bias established for the base of transistor T1 by R2 is not disturbed. Transistor T1 amplifies the signal. Resistor R3 provides collector operating bias for T1. The signal feeds in turn through C3 into T2 where further amplification occurs. Because the *ac* primary impedance of TR1 is high, small changes in T2 collector current result in large output signals. The output transformer matches the high-impedance collector circuit to the low-impedance loudspeaker, thus assuring the high voltage gain necessary if this set is to have the high speaker volume it has.

Pointed-End for Radio Ground Pipe

• A simple pointed end makes it easier to drive a radio ground pipe. Insert the lathe-turned point into the bottom end of the pipe to keep dirt from plugging the pipe. Holes drilled through the pipe for soil wetting reduce electrical resistance between ground pipe and soil.—ARTHUR TRAUFFER.



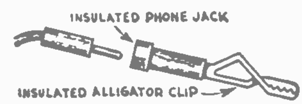
For Better TV Reception

• If the voltage on a house wiring circuit drops below 108 volts due to inadequate wiring, the results in terms of TV viewing may be a greyed picture, smaller picture, no picture at all, distorted image, inability of the set to receive weak signals or less satisfactory reception in fringe areas.

To get the best reception from your TV set, connect it to a circuit used for lights primarily, rather than to a circuit which serves motor-driven appliances—especially such equipment as the refrigerator, automatic washer and dishwasher. If you still have trouble from low voltage, install a branch circuit for TV use alone.

Plug-in Alligator Clip

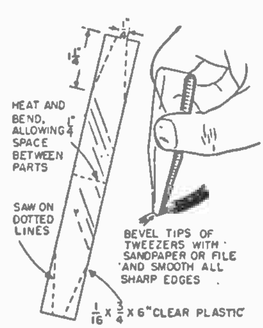
• Prods on the ends of test leads may be easily converted to alligator clips. Obtain an insulated alligator clip and one insulated 'phone jack. Then bore clip so 'phone jack will screw snugly into it. With this setup test leads may be used with both prods or with clip and prod.



Plastic Tweezers

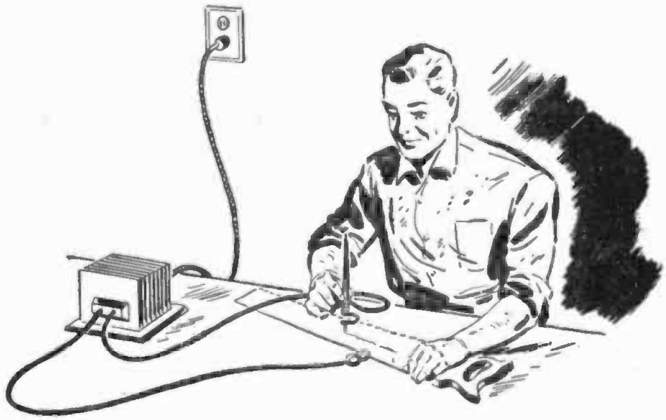
• With this plastic tweezers, you can probe for loose connections in a radio or TV receiver. If you make it 8 in. long, it will also prove handy for handling prints in photo solutions.

Cut clear plastic (polystyrene, Plexiglas or Lucite) to length, and shape ends as shown. Heat across center with match and bend strip double, allowing ¼ in. space between halves. Hold until plastic sets, then bevel tips of tweezers with sandpaper or file and smooth all sharp edges.



ELECTRIC ETCHER for Marking Tools

By NATHAN BOGOCH



AN ELECTRIC etcher is an exceedingly simple device, and any amateur workman should be able to make one. It enables one to etch permanently upon the metal parts of his tools, not only his name, but also the sizes and numbers of such tools as drills, taps, dies and wrenches. Progressive steps of construction for making the etcher are shown in the drawings below.

First obtain a penholder with a cork or rubber end. Remove this cork or rubber and also the springy piece of metal which originally was intended to hold the pen point in place.

To form a core for what will be an electro-magnet, fill the metal tube with thin iron nails, cut to protrude slightly from the end of the cylinder. Insert enough so that they will be wedged permanently in place.

Now obtain a piece of light spring steel (a watch spring will do) about an eighth of an inch wide and carefully bend it into a "U" shape so that the ends are about half an inch apart. Heat one of the ends and drill with a 1/16-inch drill. Then solder about half an inch of No. 14 copper wire in this hole and file the end to a point. Solder the other end to the end of the nail core.

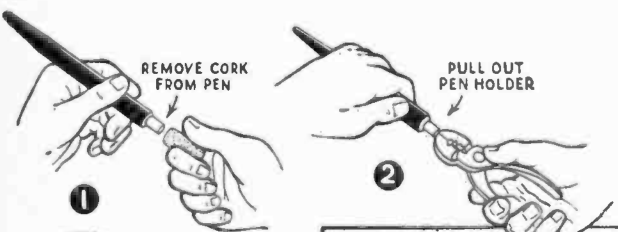
To make the magnet winding first solder one end of a piece of No. 20 insulated copper wire to the lower end of the metal tube. Then wrap a strip of paper around the tube for insulation and wind 100 turns of the wire upon it. Terminate the other end under a machine screw located just above the metal tube. This completes construction of the metal etcher.

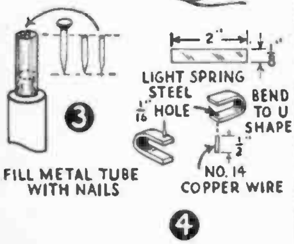
In operation, one of the wires coming from a toy transformer (dry cells or a storage battery), which should supply about 10 volts, is connected to the machine screw on the etcher and the other is connected to the object to be etched by means of an ordinary clip.

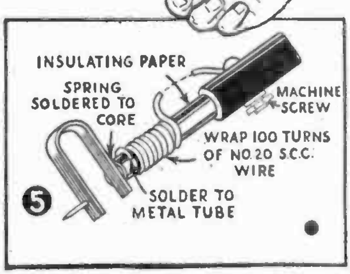
The current flowing through the coil forms an electromagnet which attracts the steel spring, breaking the circuit. When the circuit is broken the spring is released and, the copper point again coming in contact with the metal object, the circuit is again completed and the operation is once more repeated.

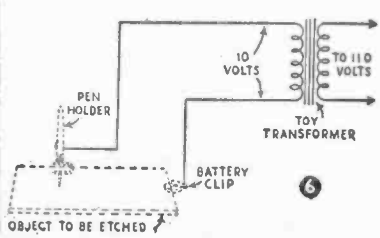
This occurs so rapidly that the electric spark formed at the contact of the object to be etched and the copper point is practically constant. It is this spark that melts enough of the surface metal of the object to produce a clear and permanent "etching" you'll be proud of.

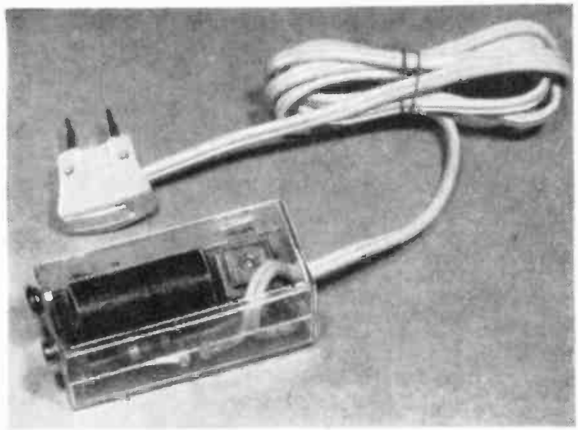
After a short period of operation you may have to file the copper wire to a new point in order to continue to get clear etching action. But you'll find this etcher a stout friend when it comes to neighbors who have forgetful memories.











Battery eliminator (above) built into hinged plastic box delivers 9-volts to this six-transistor set.

Battery Eliminator for Transistor Radios

Tiny power pack provides low-voltage d-c for operating transistor sets from 117-volt lines

By THOMAS A. BLANCHARD

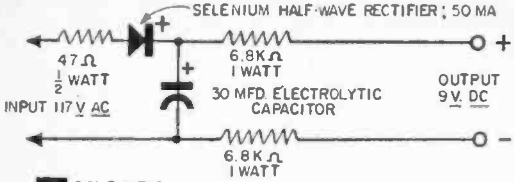
WHILE most transistor battery packs commercially available are priced under $1, their special type does not always make them readily available when needed. Too, there are many instances where a transistorized set could be operated indefinitely—and with results superior to battery operation—if house current could be substituted for the expendable dry cells.

Well, sir, this tiny battery eliminator (Fig. 1) does just that. Operating off any 117-120-*v*. power line, it provides approximately 9 *v*. *d-c* for portables with five to seven transistors, and—because the radio circuit is provided with an earth return via the powerline—the range of any transistor radio using it will be greatly improved over battery operation.

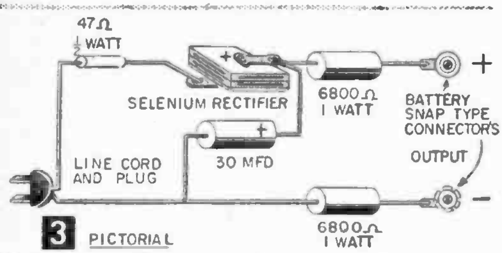
Because the unit must fit inside the radio, the power pack is built on a chassis that fits inside a transparent plastic box measuring 1x1¼x3 in. In those cases where this size may still be too large, the builder can always operate the set with the battery eliminator outside the radio case. It is also possible to choose a plastic box of another shape and arrange the parts accordingly; because the chassis is a piece of perforated Bakelite, a great variety of layouts is possible.

With the exception of a 4-40x⅝-in. *fh* machine screw and nut (used to mount the ½-wave selenium rectifier), the component leads serve as mountings and tie-lugs. Pigtail leads of capacitor and resistor are threaded through the holes in the Bakelite. Lead ends are brought to the top of the panel, and small loops formed with needle-nose pliers or a wire tool. The loops make excellent soldering lugs for the line cord and flexible output leads and there is no chance for parts to shift or tear loose from their moorings. No hook-up wire is required between the input *a*-c and output *d*-c; since components pigtails are more than adequate in length for this purpose.

As the schematic (Fig. 2) shows, this power supply differs in certain respects from those used in conventional *ac-dc* power supplies. First, instead of the two or three filter capacitor sections required in vacuum-tube circuits, only a single 30-*mfd*., 150-*v*. electrolytic unit is used. Unlike tubes, transistors are not so susceptible to *a*-c hum, making additional filtering unnecessary. In tests using a conventional highly filtered and smoothed *d*-c supply, no improvement in set performance was obtained over pack use.

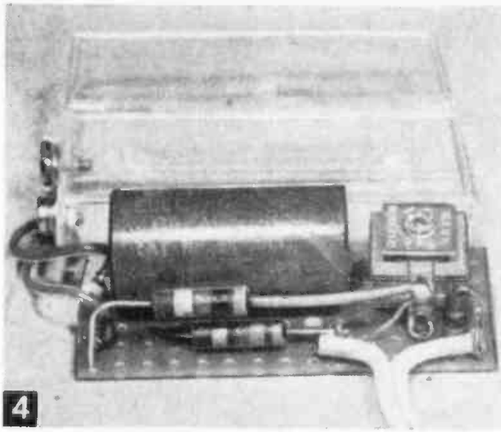


2 SCHEMATIC



3 PICTORIAL

Note—Battery eliminator should be assembled in non-metallic container ONLY. Size and shape may be varied to suit individual requirements.



Components are self-supported by threading leads through holes in perforated Bakelite panel. Bare threaded component leads are insulated by box. Pigtail ends of component leads are bent into loop-lugs for soldering line cord and connector wires. Chassis is held secure by a 2-56 self-tapping screw from outside of plastic case.

MATERIALS LIST—BATTERY ELIMINATOR

- 1 transparent plastic box; 1 x 1¼ x 3" (size optional)
- 1 piece perforated 1/16" Bakelite (size optional)
- 1 half-wave selenium dry disc rectifier. If available, 30 ma. size (11/16—" sq.) may be used; otherwise, use 50 ma. (13/16" sq.)
- 2 6.8K (6800) ohm 1-watt, IRC composition resistors
- 1 30 mfd., 150v., electrolytic capacitor (C-D Blue Beaver)
- 1 47 ohm, ½-watt, IRC composition resistor
- 1 line cord plug
- 2 suitable battery connectors
- 1 4–40 x ⅝" fh machine screw and nut

Another advantage offered by transistor circuits is that voltage-drop resistors may be inserted in both sides of the power line. There is about 90-*v.* d-c at the selenium rectifier. This means a voltage drop of 81 *v.* is required for a typical 9-*v.*, 9 *ma* (no signal) transistor radio. Ordinarily, these 81 *v.* would be dropped with a single dropping-smoothing resistor. We found that by splitting the drop on both sides of the line using two 6.8 K, 1-watt resistors, less heat had to be dissipated less space was necessary, and a safety feature was added. With a voltage-drop resistor on both sides of the line, shock hazard was greatly reduced. Also, with the unit plugged into an outlet that was not of the polarized type, the resistor in the grounded lead would "blow" on external shorts.

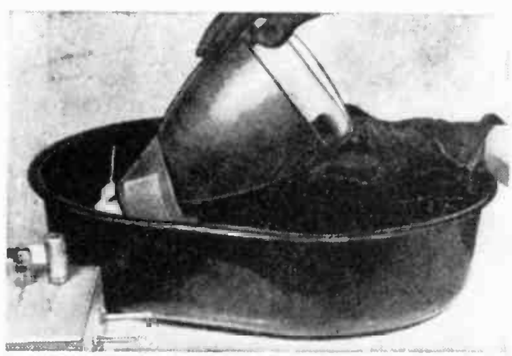
Of course, precautions should be taken to avoid careless handling of *ac-dc*-power supplies. First, the battery eliminator should *never* be built into anything except a plastic box—battery connections should be made before the cord is connected to the power line—and, if the battery connectors are apt to contact any metal inside the radio, connectors should be carefully insulated against shorts with plastic electrical tape. Finally, when the eliminator is not being used, disconnect it from the wall receptacle.

Wire the unit as shown in Figs. 2 and 3. With the chassis wiring completed, solder fixture cord and short leads to battery snap connectors. (Battery connectors may be salvaged from a dead cell.) Connectors are attached to the lid of the box with 4-40x¼-in. machine screws. Soldering lugs should be attached to the ends of the output leads before connectors are mounted on the box, or heat · ill damage the container.

File a slot in the end of the box lid opposite from the connectors just wide enough to pass the fixture cord. Make this slot tigh: enough so that when the box lid is closed it will hold the cord secure. Use a strip of transparent tape to seal the box unit.

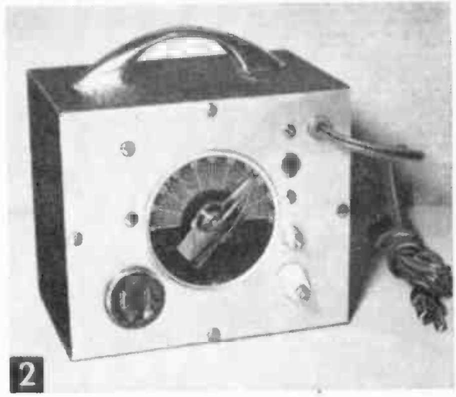
When the eliminator is to be used for lengthy sessions, provide a few vent holes in the case to release heat generated in the two 6.8 K-ohm resistors. The eliminator as described in this article is designed for circuits operating on 6 to 9-*v.* batteries. For circuits requiring lesser operating voltages, increase the values of the 6.8 K voltage-dropping resistors.

Basin Prevents TV Tube from Rolling



• 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.

Hand approaching metal plate causes the lamp plugged into control receptacle to light up. Bells, motors, etc. may be plugged into the 110-120 v outlet.



Capacity control is housed in a stock radio chassis cabinet. Outlet is at left, insulated control terminal is at right of dial on front panel of control unit.

Experimenting With a

Capacity Control

No phototubes or light beams are required with this simple electronic unit which turns lights on or off with a mere wave of the hand

By THOMAS A. BLANCHARD

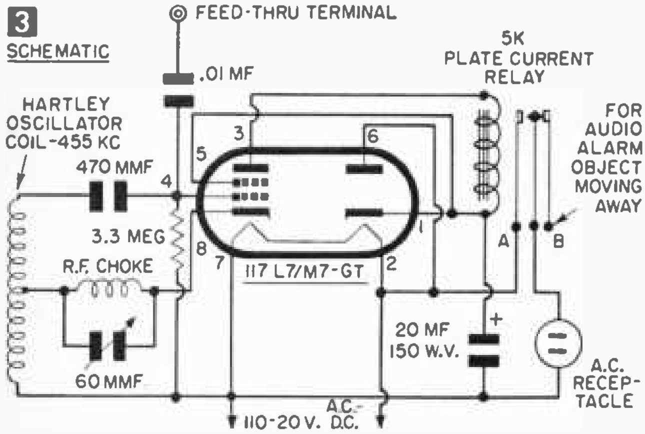
THIS capacity control is simply another application of the versatile oscillator. In respect to the jobs it can do, it is similar to the photo-electric control. No light beams or phototubes are required to trigger it, however, only the presence of a human being near it.

The circuit can be wired for sensitive or for ultra-stable operation. For sensitive operation, for example, a metal plate could be attached inside a store window. A shopper standing outside, then, placing his hand near or on the window glass would cause a display in the window to light up. When he moved away from the "sensitive" area, the lights would go out. (By substituting a length of insulated wire for the metal plate, a larger area of the window could be made sensitive to the approach of a shopper. There would never be actual contact between the window-shopper and the control because of the plate-glass barrier.)

It works like this: A small R.F. choke and tuning capacitor is inserted in series with the circuit's oscillator coil's cathode lead (see Fig. 3). Varying the capacity across the R.F. choke provides the sensitivity control so that the point at which the plate current relay picks up can be accurately determined.

Omitting the choke and tuning capacitor, gives a much more stable effect. The control then requires actual physical contact for triggering. Thus, if the control wire is attached to a metal door knob, for instance, you have to touch the knob before the circuit will operate. The control lead can be attached to any ungrounded metal object. When touched at any point it will cause the control relay to close. There is no danger of shock.

Suppose you have water seepage in the basement of your home. Mount the control lead ¼ in. off the basement floor and if the water rises ¼ in. it contacts the control lead, causing an alarm to ring. Applications of a capacity control are almost limitless—not to mention its amusement (and educational) value. For example, you can cut a piece of aluminum foil



MATERIALS LIST—CAPACITY CONTROL

1 metal radio chassis cabinet, 4 x 5 x 6"
1 octal wafer socket
1¾" lead-in or feed-thru insulated bushing
1 amphenol female receptacle #61-F1
1 10,000-ohm plate current relay; Sigma 4F or P&B LS-5
1 Hartley oscillator coil, 6/12SA7 type (Stanwyck 225 or 212; Miller 5481-C)
1 R.F. choke approx. 100 uh (see text)
1 midget variable capacitor, 60 to 1000 (max.) mmf.
1 20 mfd., 150 w.v. electrolytic capacitor, tubular pigtail type
1 .005 or .01 mfd. paper capacitor, 150 w.v. or higher
1 500 or 470 mmf. mica or ceramic fixed capacitor
1 3.3 megohm, ½-watt resistor
⅜" rubber or plastic grommet
6' line cord and plug
1 117L7/M7GT vacuum tube
miscellaneous hook-up wire, ⅝ x 2¼" metal spacers, bar knob and dial plate

about 1 ft. square, attach the control lead to one corner and conceal it under a carpet. Your "victim" will jump when he walks over the "hot spot" and rings a bell or causes a table lamp to light up.

The unit (Fig. 2) is constructed in a standard 4 x 5 x 6-in. radio chassis cabinet (4 in. deep). Lay out the panel as shown in Fig. 4 and mount the components (see Fig. 5). Mount the wafer-type octal socket on ¼ x ⅝ in. long metal spacers secured to the control panel with 6-32 machine screws.

The oscillator circuit is a Hartley electron-coupled type using a 117L7/M7 combined pentode and half-wave rectifier. The heater of this tube operates directly off the power line. No step-down transformer is needed.

The oscillator coil is an ordinary 455 kc. radio type of the simple Hartley 3-terminal design (sometimes called a 6SA7 or 12SA7 coil). This coil, depending upon make, may be mounted with a screw and nut, or snapped into a suitable hole drilled in the control panel.

The outside end of the oscillator coil (the ground side) goes to pin #7 of the octal wafer tube socket, line cord, etc. The tap or center coil lug attaches to the cathode (pin #8) through the R.F. choke and midget tuning capacitor *for sensitive operation.* For stable operation, run the tap directly to pin #8. The remaining oscillator coil lug connects the grid of the 117L7/M7 through the 500 *mmf* fixed capacitor.

The plate circuit relay I used was a Sigma Type 4F with a 10,000-ohm coil. The less expensive Potter and Brumfield Type LS-5 with 10,000-ohm coil can be substituted for it and is readily available from most electronics parts suppliers.

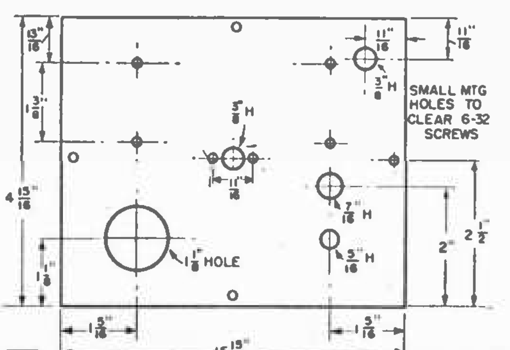
A small porcelain feed-through insulator brings the sensitive grid actuating lead out through the panel. A capacitor is inserted between this insulated terminal and the #4 grid pin on the tube socket. This value was originally .01 *mfd* in the miniature size. If the midget size isn't available, use .005 *mfd* since it is also physically smaller than a standard size .01 *mfd* unit and affords ample coupling capacity in this circuit.

Bring the line cord through a ⅜-in. plastic or rubber insulating grommet inserted in the hole located adjacent to the tube socket. Line-cord leads terminate on socket pins #2, 6 and 7 as shown in Fig. 5. Connect one lead to socket pin #2 and one terminal of the female *ac* receptacle mounted on the panel, another from the receptacle and through the relay contacts to pin #6 and #7, thus providing a 110-120-*v* control circuit which is switched on or off by the magnetic action of the relay coil.

Note that the relay is provided with single pole, double throw contacts. When wired as shown in Figs. 3 and 5, no current reaches the receptacle so long as there is no contact with the porcelain feed-through terminal. Touching this screw, or approaching a metal plate attached to it, however, causes the relay to energize and completes the circuit to the *a.c.* outlet receptacle.

Now, if the reverse action is desired—causing a light to go out when the control is approached, say—you need only move the receptacle lead from relay contact B to A. The moving contact connection of the relay (the armature connection) is not disturbed.

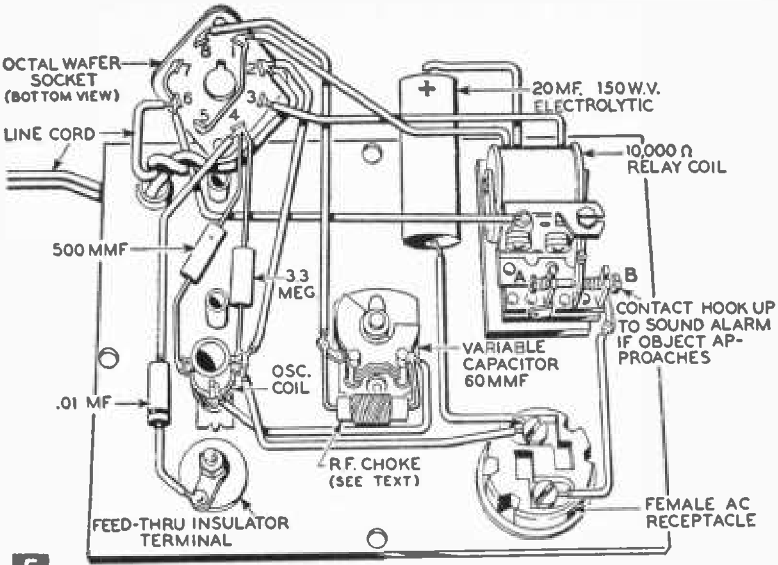
To test, connect a short piece of hook-up wire across the midget variable capacitor where



4 PANEL LAYOUT FOR CAPACITY CONTROL #16 STEEL OR ALUMINUM

the R.F. choke will eventually be located. (In fact, even the capacitor itself isn't needed at this point.) With power applied, the relay should close when the insulated terminal screw is touched. The control can be used for non-sensitive applications in this form.

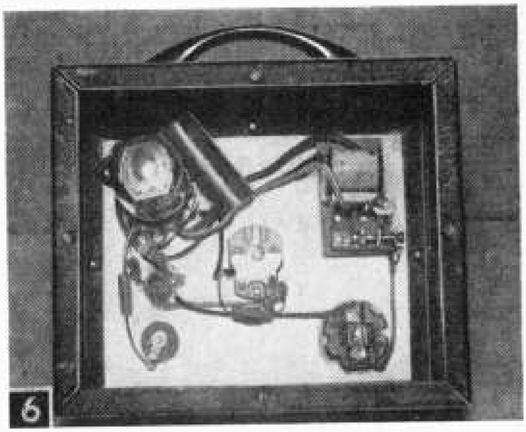
For sensitive control, the variable capacitor can be any midget type between 60 and 100 *mmf*. A less expensive compression-type trimmer can be substituted here if more readily available. The R.F. choke may require some experimental work in order to obtain maximum sensitivity from the circuit. For the choke, we used a TV "peaking coil" of approximately 100 microhenries. Both peaking coils and R.F. chokes of the miniature type are wound on Bakelite pigtail forms that resemble 1-watt resistors. When connected across the stator and rotor lugs of the tuning capacitor with plates wide open, the control relay should pull in. Now, slowly closing the plates, you should reach a point where the relay drops out.



5 PICTORIAL

When this action is obtained, the choke will be of suitable inductance. However, if the relay remains energized with the plates of the tuner fully meshed, the inductance is excessive, and turns will have to be taken off.

You may find it more convenient to make your own choke. All you will need is fine enameled magnet wire (size #34 to #40). Measure off about 12 ft. and scramble-wind the wire on a 1-watt insulated resistor having a high resistance (22 megohms or more.) Carefully scrape off insulation from the leads and solder one to each pigtail.



6 Looking into rear of control box with cover removed. Front panel and chassis are one, making for simplified construction.

Add or subtract turns until the relay will release when the variable capacitor plates are about at the half-closed position. Install in the chassis cabinet with a suitable dial plate and bar knob to adjust the tuning capacitor and attach a short lead and metal plate to the control's insulated terminal. Plug a light bulb into the receptacle and rotate the capacitor knob until the light comes on.

Now back off the sensitivity control until the light just goes out. Leave the control alone now, and bring your hand toward the metal plate. At a point ranging from 6 inches to one foot, body capacity will cause the control to turn on the light. Withdrawing your hand will turn off the light.

If the length of the lead and/or size of the metal plate is changed, the control must be readjusted. Note, too, that if too much fixed capacity is attached to the control, the relay will remain locked-in. If this happens, use a smaller metal object, or shorter connecting line from control to plate.

Since the capacity control employs the popular *ac-dc* hook-up, you will find that it operates best when its ground circuit plugs into the ground side of the power line. (Reverse the line plug to determine the best operating position.)

Attach a metal drawer pull to the chassis cabinet for carrying convenience. To provide ventilation for the tube, punch two rows of holes in the back panel of chassis cabinet or use perforated Reynolds do-it-yourself aluminum for the box cover. (You can cut this material with a kitchen shears.)

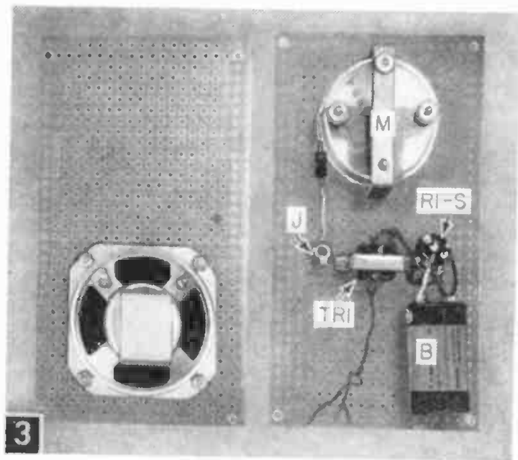
Applause Meter

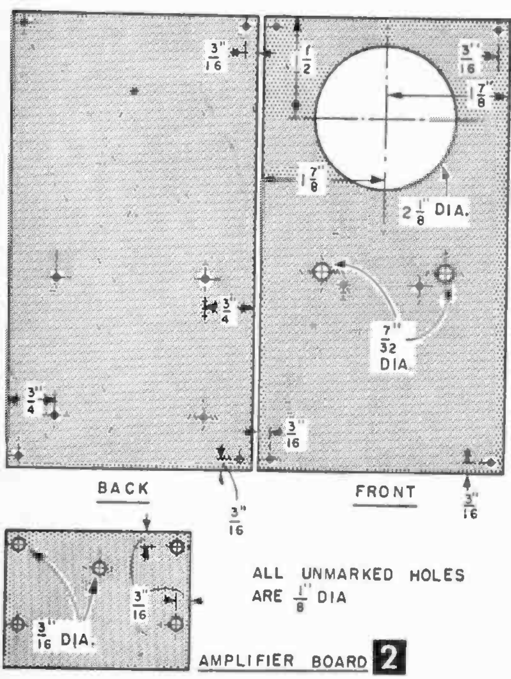
This inexpensive and compact applause and sound level meter has plenty of reserve gain and a headphone output. It can double as a hearing aid or remote "listener"

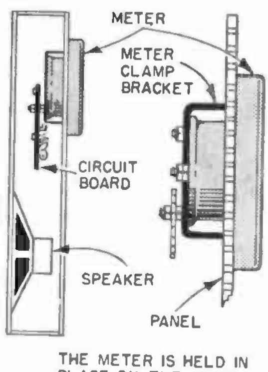
By FORREST H. FRANTZ, SR.

Small, inexpensive and tops in performance for price, that's this sound-level, applause meter.

A COMBINATION applause and sound level meter is a device that is both useful and entertaining. If you should be looking for a nice quiet location for your new home, for instance, this instrument will help you do the job scientifically. More probable jobs would be locating rattles in cars, vibrations in machinery, and even termites in woodwork.







THE METER IS HELD IN PLACE ON THE PANEL BY THE METER CLAMP BRACKET 4

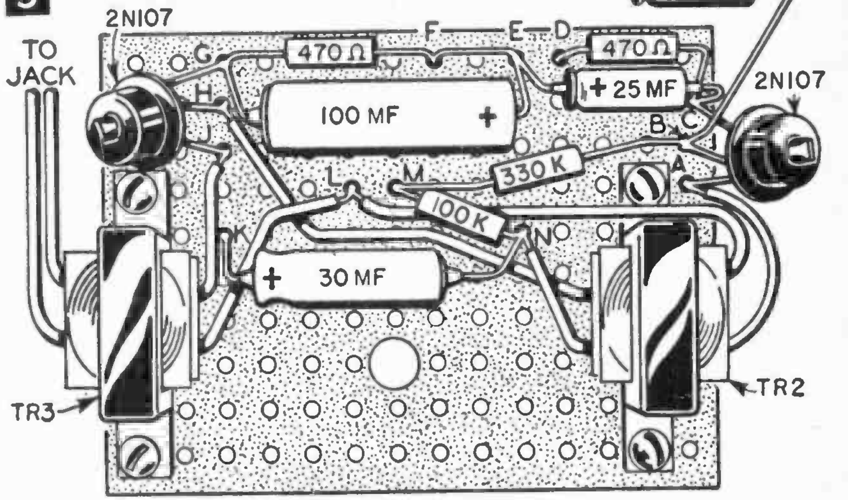
And when those amateur contests are held, here's your scoring device. We'll say no more about what it can do; as soon as you've constructed it, you'll start to find uses to which to put it.

High - precision sound level meters cost several hundred dollars. They're made out of the highest quality components and they have high caliber circuitry wired into them. As an experimenter, you don't need—and probably can't afford—such precision. This meter can be built for about $14 less headphones and battery.

To achieve a slim package you'll need wood strips of the type used for garden trellises. These strips are 5/16 x 1 1/8 in. You need two of them 6 3/4 in. long, and two 3 in. long. Glue and brad them together to form a frame on which the 3 11/16 x 6 3/4 in. perforated Bakelite front and back panels will fit. I enameled my frame gray, but almost any color goes nicely with the perforated boards.

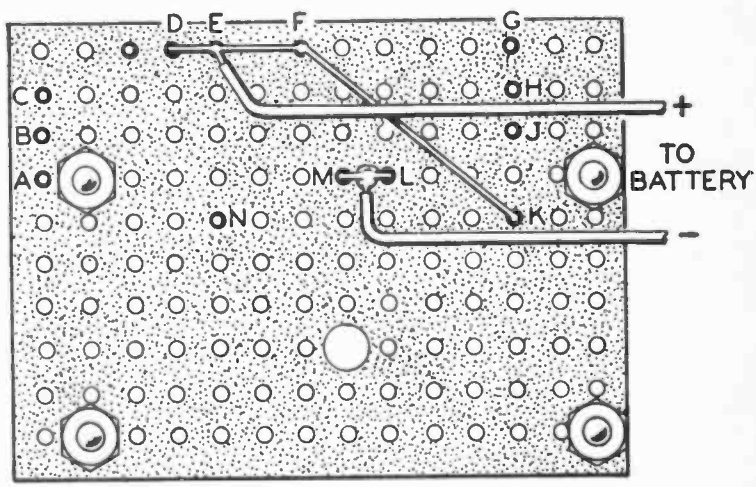
Drill the front and back panels as shown in Fig. 2. I used a fly cutter to cut the 2⅛-in. meter hole. A coping saw will do just as well if you take some time to trim your work with a file. When you drill or saw the boards, back them with wood to prevent splitting. The holes at the corners are used to fasten the boards to the wooden frame.

The small perforated board is the wiring board. It's cut with a hack saw from the small sheet of perforated Bakelite board listed in the Materials List and is mounted on the meter in the final assembly. The only work required on the back panel is the mounting of the loudspeaker, which will serve as a microphone. (A loudspeaker is used in preference to a microphone because it is less directional and more sensitive.) When it is mounted, saw off the long meter mounting screws (*not* its terminal screws) to a length of ½ in. from the back of the meter. Fasten the end of the screw to be discarded in a vise to do the sawing, and support the meter gently with your hand. Then shorten the volume control (R1-S) shaft to a length of ⅝ in. from the front of the bushing. Again, the end to be discarded is the end you should fasten in the vise.



5 PICTORIAL (TOP VIEW)

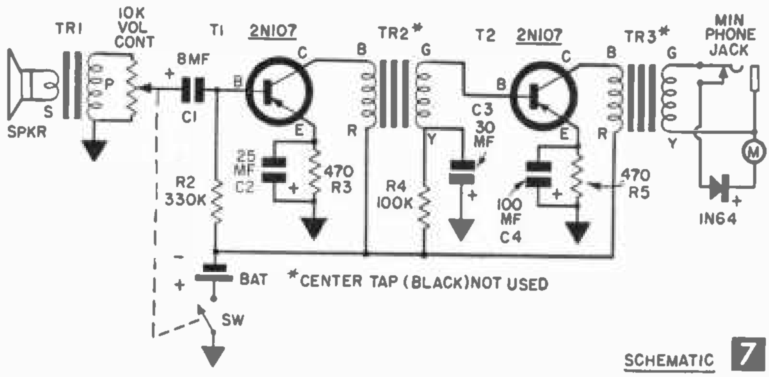
LETTERS DESIGNATE HOLE INSERTIONS



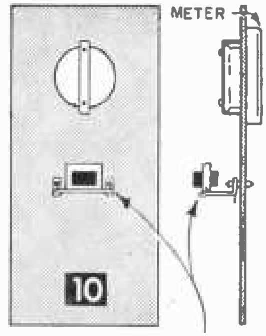
6 PICTORIAL (BOTTOM VIEW)

Now, secure the meter M, the jack J, the transformer TR-1, and the 10K volume control to the front panel. The meter is fastened to the panel as shown in Fig. 4. Connect the diode D and the battery as shown in Fig. 3 and complete the wiring for the transformer winding marked "P." You can use six penlite cells (#7) in series to obtain 9 *v.*, three cells in the location occupied by the battery in my model, three on the other side of the board. If you place the front and back panels on the frame, you'll be able to place these batteries more easily. Be sure that they don't short-circuit. You'll want to do some insulating with tape after you complete the entire construction job.

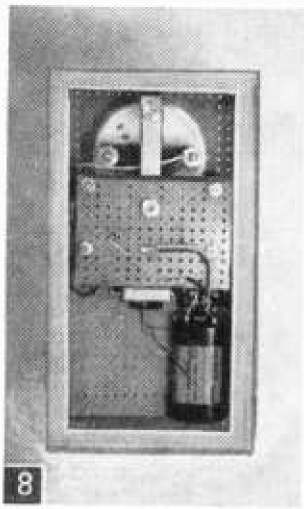
Now you're ready to wire the circuit board. Figures 5 and 6 will help you in mounting the components, the circuit itself is shown in Fig. 7. Connections are made by forcing the component pigtail leads through the perforations and soldering. Excess lead length is clipped off on the side of the board shown in Fig. 6. Note that the plus lead of C3 is used to form a common return, or



SCHEMATIC 7



IF YOU EXPERIENCE FEEDBACK, MOUNT TRANSFORMER (TR1) PARALLEL TO THE PANEL, ON BRACKETS, INSTEAD OF DIRECTLY ON THE PANEL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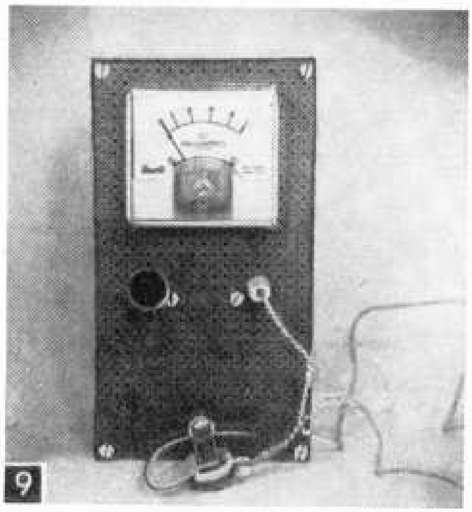
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and fasten the back to the wooden frame with wood screws.

The front of the completed instrument is shown in Fig. 9. To test it, turn the switch *On* and advance the volume control. Whistle or make some other noise. You should get deflection before you turn the gain all the way up because this is a very sensitive instrument. Listening with the earphone will be helpful. Note that the meter is disconnected "ground," for the battery through the switch.

Use rosin-core solder for all connections and use a hot, clean soldering iron. Grasp the pigtails of the transistors between the transistor body and the point at which heat is applied, thus shunting heat away from the transistor during soldering. Tape up (or clip off) the center tap leads on TR2 and TR3; you won't be using them.

After you've completed the construction of the amplifier, you're ready to assemble the three sub-assemblies you've prepared. First, fasten the front panel to the wooden frame with wood-screws. Then place the amplifier within the case and solder the leads from the secondary of TR3 to the phone jack. Connect a lead from the phone jack to the negative terminal of M, connect C1 to the center lead of the volume control, and fasten a lead from the ground bus on the amplifier to the switch.

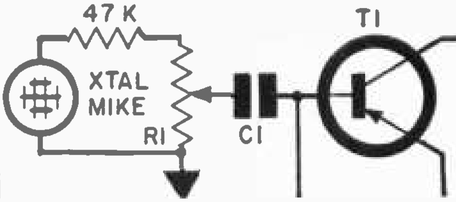
Now place the amplifier on the back of the meter and fasten the lower nut (which holds the meter clamp bracket against the meter panel) to hold the circuit board in place. Finally, fasten the negative return from the amplifier to the battery. The back of the completed instrument, with the exception of the speaker-mike, is shown in Fig. 8. Solder the leads on the side of the transformer marked "S" to the loudspeaker terminals,

MATERIALS LIST—APPLAUSE METER

½ watt carbon resistors, 10% tolerance

R3, R5	470 ohms
R4	100K
R2	330K
R1-S	10K miniature volume control & switch (Lafayette VC-28)
C1	8 mfd, 6v ultra-miniature electrolytic capacitor (Lafayette P6-8)
C3	30 mfd, 6v miniature electrolytic capacitor (Lafayette CF-104)
C2	25 mfd, 6v ultra-miniature electrolytic capacitor (Lafayette P6-25)
C4	100 mfd, 6v miniature electrolytic capacitor (Lafayette CF-106)
MIKE	2½" PM loudspeaker, 10-ohm voice coil (Lafayette TR-93
TR2, TR3	10K/2K driver transformer (Lafayette TR-96)
T1, T2	2N107 transistor (General Electric)
D	1N64 diode (General Electric)
J	subminiature phone jack (Lafayette MS-282)
M	0-1 ma meter (Shurite 8300Z)
B	battery (Mallory TR146F) (See text for less expensive alternates)
1	sheet of miniature perforated Bakelite board (Lafayette MS-304)
2	3¹¹⁄₁₆ x 6¾" miniature perforated Bakelite boards (Lafayette MS-305)
1	3K headphone (Lafayette AR-46; the jack is supplied with the headphone and does not have to be obtained separately if the headphone is obtained from Lafayette)
1	miniature knob (Lafayette MS-185)

All circuit components can be obtained from Lafayette Radio, 165-08 Liberty Ave., Jamaica 33, N. Y.



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when the earphone is plugged in. If you don't hear anything, or if you don't get a deflection of the meter when the earphone is disconnected, turn the amplifier off and check your wiring.

If you get a squeal on the phone, or a constant full-scale deflection of the meter without having an input noise, you're having feedback trouble and you may have to shorten some of the input and output leads or turn TR-1 sideways and mount it on a bracket as shown in Fig. 10 to eliminate magnetic coupling.

Since both sides of the instrument case are perforated, the speaker-mike is sensitive to sound from front or back, a decided advantage. In order to be able to make comparisons of readings, provide the volume control with a scale marked in India ink on the front panel or fasten a paper scale on the panel with Carter's Rubber Cement. Place an index mark on the knob with a triangular file and fill it with white India ink to make it stand out. My model doesn't have this feature, but it's worth adding. Then, if the sound level or applause hits peaks that require a reduction in the volume control setting, you can readily interpret levels without loss of reference by using the control setting in conjunction with the meter reading.

There are some modifications to the sound level-applause meter that you may wish to incorporate. One, meter response is fast; if you want to slow it down so that it will tend to hold peaks, connect an electrolytic capacitor across the terminals of the meter. Use from 10 to 100 *mfd* depending on how "slow" you want to make the meter; a 6 *v* capacitor is adequate.

If you want to use a crystal microphone instead of the loudspeaker, eliminate TR1 and connect the mike as in Fig. 11. You won't have as much sensitivity with this arrangement, but you'll have enough.

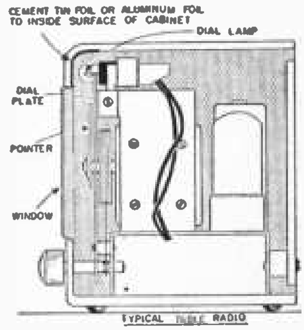
There it is—an inexpensive sound level meter that can be used for many measurements. It has a microphone to convert sound to electrical energy; an attenuator (the volume control) to choose a range; an amplifier to get the signal up to strength to drive a meter through the rectifier; and a phone jack to listen in if you wish. These are the features that you find on an expensive instrument. If you're wondering how a two-transistor instrument can be so sensitive, the answer lies in the transformer coupling which provides better match between the transistors and enables us to work them more efficiently. But this costs us something in frequency response. Bear this in mind, and don't use to measure frequency response of hi-fi systems.

First Aid for Speakers

• Speakers on inexpensive small radios can often be given a new lease on life with a little fingernail polish applied around the center of the cone. The fuzziness of sound may be cut down by stuffing a bit of Kleenex or tissue paper between the cone and the speaker arms. If sparking contacts on door bells and buzzers are causing noise and interference in the speakers of nearby radio receivers, much of this interference can be prevented by bridging a one or two *mfd* capacitor directly across the contacts of the bell or buzzer. The capacitor will absorb most of the spark produced.—Ralph R. Doister

Improved Radio Dial Illumination

• To increase the dial illumination in a radio having a lamp projecting over the top edge of the dial as shown below, cement a strip of tinfoil or aluminum foil to the inside surface of the cabinet directly over the bulb to serve as a reflector.



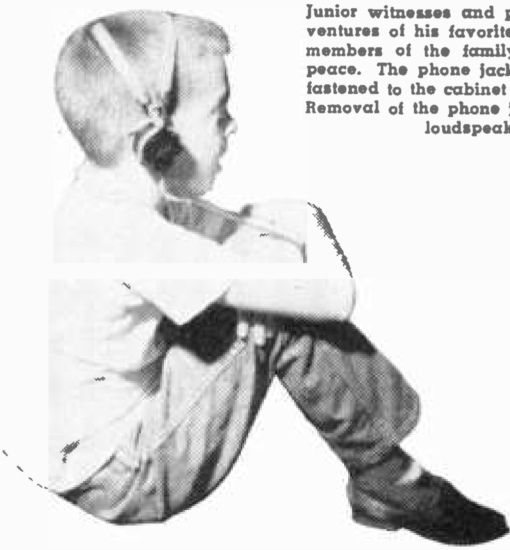
Do this also where the lamp is located to the side or on the bottom of the dial, if the wall of the cabinet is close enough to the lamp to allow the foil to act as an effective reflector. Otherwise, bend a reflector from a piece of tin cut from a can and solder or cement it onto the dial plate. —A. Trauffer.

Radio Locates Right Fuse

• Instead of using the trial-and-error or up-and-down-the-stairs method to find the right fuse in the cellar fuse box to an outlet on an upper floor, simply plug a radio into the outlet and turn the volume up high. The blaring radio will let you know when you screw a new fuse into the right socket.—R. M. Woodbury.

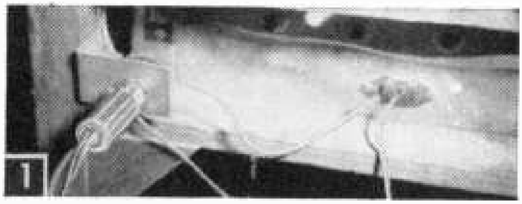
Wire Soldering Technique

• When joining electrical wires or wires in electronic circuits, it is frequently difficult to hold two wires and the soldering iron or gun in position for a good solder joint. This problem can be considerably eased by tinning both wires before placing in contact. This then becomes a sweating rather than a soldering technique, which takes less heat for less time because the work does not have to be brought up to soldering temperature. Touch the wires lightly and apply the iron for just an instant to melt the solder and complete the joint. The joint will have sufficient mechanical strength and, if the resin core type of solder is used, it will carry current efficiently. —Robert A. Wason.



Junior witnesses and privately listens to the adventures of his favorite TV character while other members of the family enjoy their activities in peace. The phone jack is mounted on a bracket fastened to the cabinet with wood screws (below). Removal of the phone jack automatically restores loudspeaker operation.

Phone Jack for Radio or TV



1

By FORREST H. FRANTZ

AT TIMES—at many times—a blaring loudspeaker is incompatible with the other activities going on in a room, at our house, the family den. Our den, in addition to housing the highly revered television receiver, contains my desk and technical books, my writing workshop, and the usual assortment of magazines and books that other members of the family prefer to "The Mickey Mouse Club," the present TV favorite of our eight-year-old.

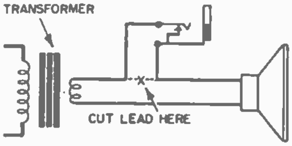
The obvious solution to the problem was the installation of a headphone jack. This solution proved to be most welcome to the eight-year-old and also to his eleven-year-old brother, both of whom find wearing headphones fascinating. (They occasionally model in them before a mirror!) The headphones are popular too when one member of the family wants to see a late movie on TV.

The installation of a headphone jack is simple, and inexpensive. There are several possible schemes that may be employed. No wiring changes are required in the radio or TV chassis wiring. And no connections are made in high-voltage circuits.

First, cut one of the leads from the output transformer secondary to the loudspeaker and connect a shorting phone jack to the two wire ends (see Fig. 2). This type of jack closes the circuit and keeps the speaker operating until the phones are plugged in. When the phones are plugged in, they receive the major portion of the output signal while the loudspeaker receives so little that it is silent. (Headphones should have an impedance of 1000 to 3000 ohms.)

Our TV set (a small console) has an off-chassis speaker. The output transformer is mounted on the chassis and the speaker plugs into the rear of the chassis (see Fig. 1). The leads are long enough to allow them to be connected directly to the jack. The jack is mounted on a small bracket fastened to the side of the cabinet with woodscrews.

If your receiver has its output transformer mounted on the loudspeaker, connect leads out to the phone jack mounting location by removing one of the output transformer leads from the speaker connection terminals with soldering iron and pliers. Fasten a one- or two-terminal strip to the loudspeaker frame and connect the loose output transformer lead to a lug on the terminal strip (see Fig. 3). One of the phone jack leads is connected to this lug, the other to the loud-



SHORTING JACK (MALLORY A-2 OR EQUIVALENT)

CIRCUIT FOR ADDING A PHONE JACK TO RADIO OR TV SET

WHEN PHONES ARE PLUGGED IN, SPEAKER IS SILENCED

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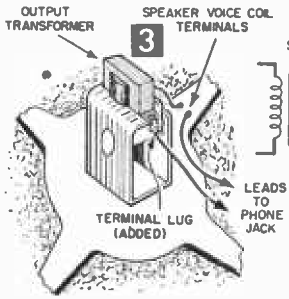
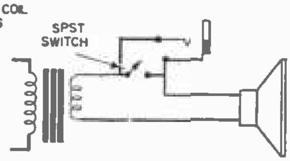


3

CONNECTIONS AT SPEAKER WHEN OUTPUT TRANSFORMER IS MOUNTED ON SPEAKER

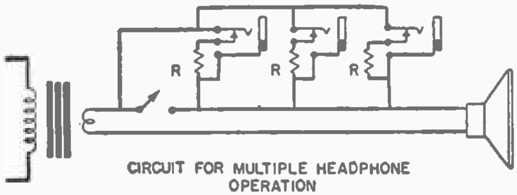


OPEN CIRCUIT JACK (MALLORY A-1 OR EQUIVALENT)

PHONE JACK CIRCUIT WITH SWITCH CONTROL

CLOSE SWITCH FOR SPEAKER OPERATION; OPEN FOR HEAD PHONES

4



CIRCUIT FOR MULTIPLE HEADPHONE OPERATION

5 CLOSED CIRCUIT JACKS (MALLORY A2-A OR EQUIVALENT) ARE USED

THE RESISTOR "R" IS A $\frac{1}{2}$ WATT CARBON WITH RESISTANCE EQUAL TO THE HEADPHONE IMPEDANCE (APPROXIMATELY)

speaker's voice coil lug. If you want to keep the headphone jack plugged in and control it with a switch, the circuit of Fig. 4 on the opposite page, employing an open circuit jack, should be used.

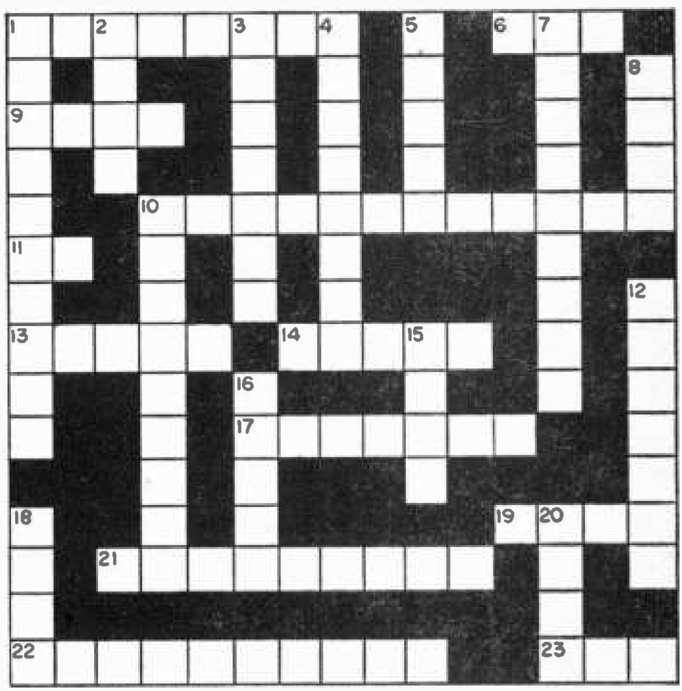
For multiple headphone use, wire as shown in Fig. 5. A switch on the receiver controls the speaker-headphone choice. Phone jacks are the closed circuit type. They can be mounted in wall outlets for permanent installation or run to portable outlet boxes wired to the set through parallel lamp cord. The resistor "R" wired into each jack should be equal to the headphone impedance. When a set of headphones is removed from a jack, this resistance is then automatically switched into the circuit, keeping the load on the headphone line constant and preventing the volume from changing abruptly on the other phones.

With all of these arrangements, the receiver volume control also controls the headphones. The volume control setting for comfortable headphone listening is the same as for comfortable loudspeaker listening when a single jack is used. Even with several pairs of phones, there's not enough difference to expose you to "loudspeaker blaring" when you switch from the headphones.

Electronic Circuits Puzzle

By JOHN A. COMSTOCK

How extensive is your knowledge of electronic circuits? Can you fill in all of the blocks in the diagram correctly and complete the circuits? (Solution to puzzle is on page 158.)



CLUES

ACROSS

1) Demodulator circuit.
6) A full-wave rectifier utilizes a transformer with a center ______.
9) The circuits in a TV set that synchronizes the received image with transmitted image.
10) A circuit sometimes used in an amplifier to secure greater gain.
11) A type of coupling between circuits (abbreviation).
13) The terminals of a circuit to which an incoming signal is applied.
14) A tube and its associated components within an amplifier.
17) The circuit in an FM receiver which "clips" amplitude peaks from the FM signal.
19) The circuit between the grid and cathode of a vacuum tube.
21) A network used in a hi-fi speaker system.
22) A circuit used to prevent interstage feedback.
23) A tuned radio frequency stage or receiver (abbreviation).

DOWN

1) The unfaithful amplification of a signal through an amplifier.
2) Parallel resonant circuit.
3) A "flip-flop" oscillator circuit.
4) An oscillatory circuit.
5) The "front-end" of a TV set.
7) Circuit that increases voltage, power, or current.
8) The ratio of output signal to input signal of an amplifier.
12) Meaning the output of one stage connected to the input of the next.
15) A trigger circuit.
16) A ______ "A" amplifier is a linear amplifier.
18) Device placed in a circuit to absorb or convert power.
20) Power supply circuit that converts a-c to pulsating d-c (abbreviation).

Answer to Electronic Circuits Puzzle, Page 158

Electronic Bull's Eye GAME

A beam of light, not bullets, scores bull's eyes in this game

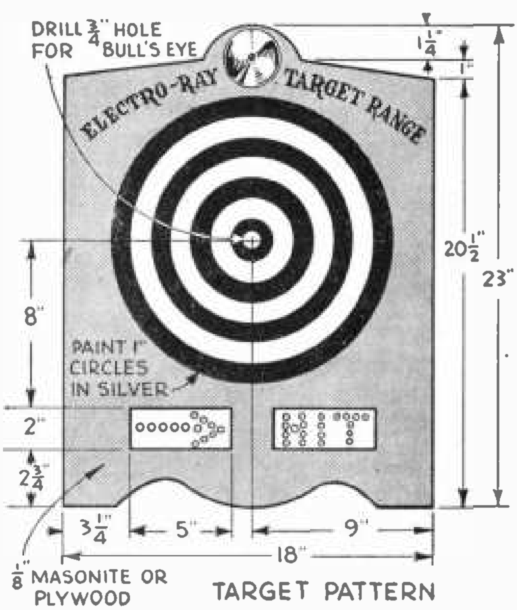
By T. A. BLANCHARD

THIS electro-ray target game is a gift that not one-in-a-million kids will get and yet you can build it for just a couple of dollars. Many so-called electronic target ranges use a dummy rifle whose trigger works a *stepper switch*, causing certain lights to flash on as the trigger is pulled. (With these, I have actually aimed at the ceiling and scored a "Bull's Eye.") But you'll find nothing phoney about this Electro-Ray Target game. To ring the bell and flash the "HIT" lights depends upon your *aim*, not luck! Because your ammunition is a beam of light, this game is ideal for every member of the family as electronics eliminates the danger that goes with the use of darts, slugs, BB shot, etc. The nucleus of this game is a compact photo-electric amplifier mounted behind a plywood or Masonite target. A small aperture in "dead center" of bull's eye allows a beam of light to strike a photo-electric cell. This beam is provided by a plastic pistol which you can purchase in 5-10c stores for about 20c.

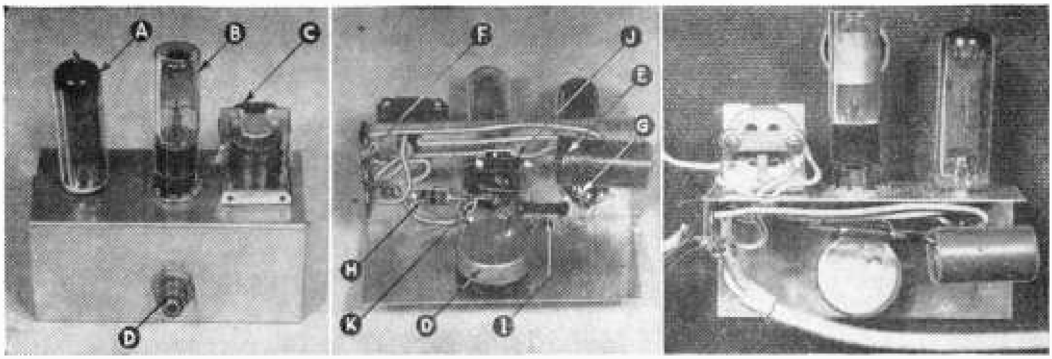
Let's start construction with the simplest unit —the *target*. First lay out the *bull's eye* as shown, using either ⅛ in. plywood or Masonite. Outside diameter of bull's eye is 14 in. and each ring and space is 1 in. wide. Cut 2 x 5 in. windows below bull's eye for the *hit* register. Then enamel Masonite panel brilliant red, using silver for the Bull's Eye. Make the circles using a draftsman's compass pen filled with silver *bronze* instead of the ordinary India ink. Then fill in the space with silver paint applied with a camel's hair brush. After paint has dried, bore a ¾ in. hole in dead-center of target with a brace and wood bit. This will allow light-beam from gun to hit light-sensitive phototube, sound *bull's eye* alarm, and light up the register.

Scroll work at top and bottom of target is optional. Two triangular brackets, cut from a 12 x 14 in. piece of ½ in. box-grade pine, support the target. A diagonal line drawn through 12 x 14 panel and a single saw cut produced these two triangles. To make brackets rigid, nail and glue a piece of ⅛ in. stock, 18 x 5 in., across the bottom (see rear view of completed target). Use any 5 and 10c store variety doorbell or buzzer which will operate on 6 to 8 volts ac for alarm. Bell shown here is the *one stroke* type, but a "repeater" type (Edwards, Monowatt, Bryant, etc.) would make the game more dramatic.

Ordinarily, you would need a step-down transformer to operate the bell alarm from 115-120 volts ac. But here the visual alarm is provided



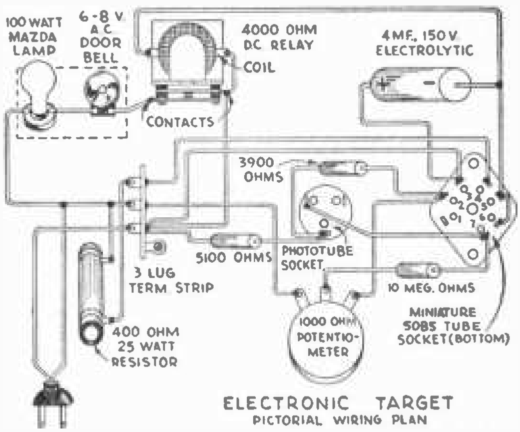
TARGET PATTERN



Electronic control on L-shaped chassis. (A) type 50B5 tube; (B) phototube; (C) relay; (D) potentiometer; (E) electrolytic condenser; (F) terminal strip; (G) 7 pin tube socket; (H) 5100 ohm resistor; (I) 10 megohm resistor; (J) 3900 ohm resistor; (K) phototube socket. Photo at right shows electronic control in position behind target, attached to target with projecting bushing of 1000 ohm potentiometer.

by two window openings each lit by a 100 watt Mazda lamp, under the target. This bulb also acts as a voltage drop resistor to ring the bell, and both bell and light respond together. When a perfect aim is made on target, the electronic control causes relay to close. Contacts of this relay close a 115-120 volt circuit through doorbell and 100 watt bulb. Thus bell rings and light comes on.

Using black photo album paper, punch out an *arrow* and the word *hit* with ordinary paper punch. Now cut strips of colored cellophane and cover back of paper with these strips, placing over punched openings. Use Scotch tape to se-



ELECTRONIC TARGET
PICTORIAL WIRING PLAN

cure cellophane strips. The results will be similar to movie exit signs. Vari-colored cellophane strips can be affixed over letter-holes for more sparkling effects. The black paper mask is sandwiched between an 11½ x 2¼ in. glass panel (rear) and a 11½ x 2¼ in. plastic sheet (front). Three wooden cleats hold assembly rigid behind target.

The electronic control is assembled on an "L" shaped aluminum chassis. First cut a 4 x 3½ in. metal piece and then bend this panel to form a 1¾ x 4 in. chassis. Drill or cut ⅝ in. holes for socket, plus a ⅜ in. hole in center of lower apron for potentiometer. Then wire up according to the pictorial plan. For convenience, a 3-lug terminal strip is mounted to chassis so that power cord, light socket, bell, and 400-ohm resistor may be mounted on target brackets easily. A wooden sub-panel may replace the aluminum chassis if desired.

The gun, a replica of a regular automatic pistol, is available in many models and sold in all Woolworth and many other 5 and 10c stores from 20c. The pistol is molded in two halves and cemented together. Using a razor knife or an Exacto-type tool, separate the pistol to reveal the "works." Note that it has a dimpled spring "clicker" or "cricket" which operates when trigger is pulled. When the trigger is pulled, the spring "cricket" comes in contact with battery holder mounted in grip of pistol. This completes the circit and throws a beam of light

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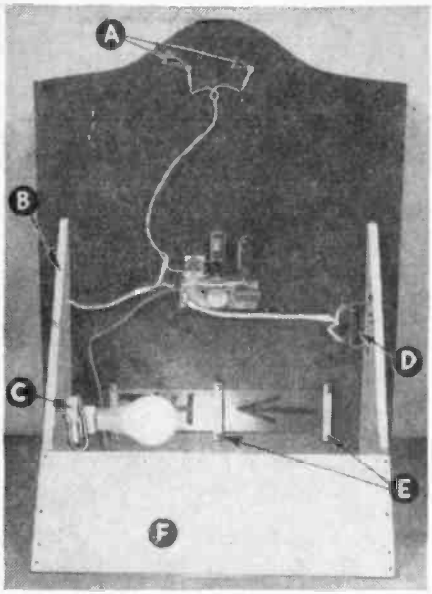
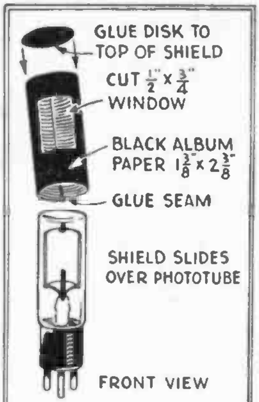
MATERIALS LIST—ELECTRONIC BULL'S EYE

Mechanical Parts:
- About 4 sq. ft. ⅛" plywood or Masonite
- Misc. white pine scrap
- Piece window glass, 11½ by 2¼"
- Piece clear plastic, 11½ by 2¼"
- 8 RH Wood Screws & Washers, #8, 1" long
- 8 RH 4-40 Machine Screws and Nuts, 1" long

Electrical Parts:
- 1 100 watt Mazda bulb
- 1 Porcelain cleat socket for Mazda bulb
- 1 Penlite bulb (1½ or 2.5)
- 1 Xmas tree socket for Penlite bulb
- 1 6 to 8 v. a.c./d.c. doorbell or buzzer
- 1 6 ft. extension cord and plug

Electronic Parts:
- L-shaped aluminum-steel chassis (see text)
- 1000 ohm potentiometer (screw adj. type)
- 5100 ohm, ½ watt resistor
- 3900 ohm, ½ watt resistor
- 10 megohm resistor, ½ watt
- 400 ohm, 20 watt resistor
- 3-lug terminal strip
- Misc. nuts, bolts & hookup wire
- Sensitive 4000 ohm SPST (plate type)
- 4 mfd., 150 v. electrolytic
- Type 50B5 electronic tube
- Type 927 phototube
- 7-pin miniature socket
- 3-pin miniature phototube socket





LIGHT SHIELD FOR PHOTOTUBE

Rear view. (A) bell connections; (B) target brackets (½x12x14" pine); (C) 100 watt bulb and socket; (D) 400 ohm 25 watt resistor; (E) wood cleats; (F) ⅛x5x18" brace.

from pistol barrel (see photo of gun assembly).

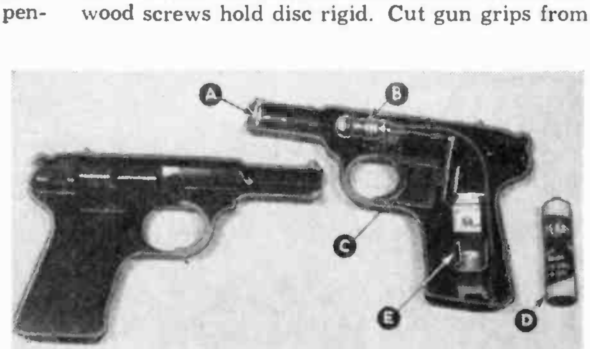
The battery holder is a simple clip arrangement fashioned from a small strip of fiber of thin Bakelite, and fitted with tin brackets into which a penlight battery may be inserted. When trigger is pulled, circuit is closed through a flashlight bulb mounted in gun barrel. Beam is concentrated to a powerful pin-point of light by a small lens cemented in front of barrel. Lens is available from Edmund Salvage Co. for a few cents. It has a diameter of 14mm (about 9/16 in.) and a focal length of approximately 40mm (about 1½ in.). Mount lens in gun barrel by first coating edge with Ambroid or Duco cement and allowing it to dry. The flashlight bulb mounts in a Christmas tree decoration socket, discarding the Bakelite shell and making use only of the brass screw shell. A good coating of cement is used to secure the socket to the plastic gun. Make an adjustment of socket with a lighted bulb before socket is put in place to insure sharpest focus.

When gun is operated with a single penlight cell, be sure to use the proper size bulb, identified by a pink bead. For longer service, make an adapter to clip into the penlight battery holder. By means of a flexible cord, power is supplied from a flashlight case. If a two cell case is used, insert a 2.5 volt bulb, (of the focussing type, identified by a blue bead), or a 2.5 magnifying penlight bulb (with white bead). To wire up gun, solder one socket wire to bottom of battery clip. Then solder remaining socket wire to top edge of spring "cricket." Remember to *remove parts from gun while soldering as heat will melt the plastic.*

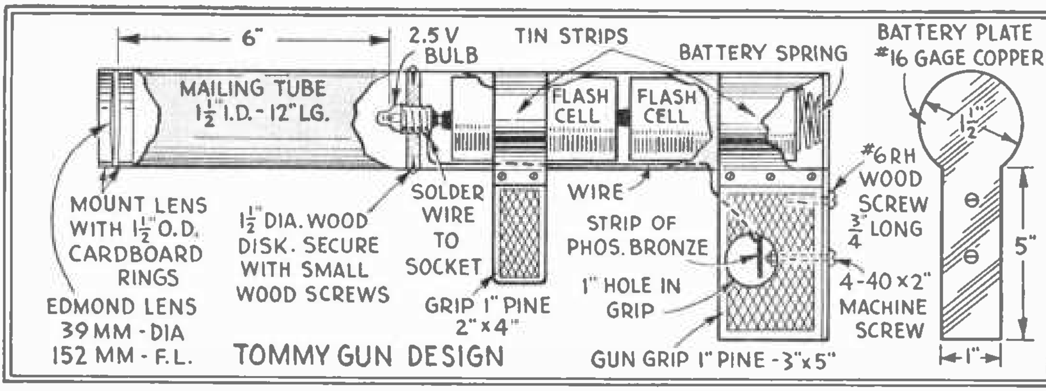
Two halves of pistol are assembled with a single 1 in. by 4-40 binding head machine screw and nut. If screw projects a little beyond nut, file off surplus. Locate hole for this screw somewhere near center of pistol grips (see drawing). To insure alignment, assemble gun and drill right through pistol grip with ⅛ in. twist drill. For a neater looking assembly, you may use a rosette-head 6-32 screw and ferrule, secured from any hardware store, or—also—a leather Key Kaddy with a screw and ferrule arrangement to support keys, can be used. Either way, a single screw is all you need as registration pins molded in the plastic prevent sections from getting out of alignment.

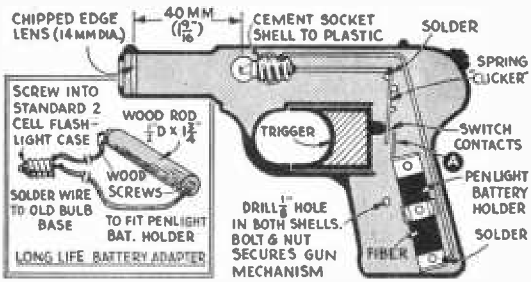
For those who want a more impressive type of gun, try the Tommy Gun shown in drawing on next page. Here a 5 and 10c store reading glass lens provides the optical system and you can remove this lens from the plastic holder by placing in very hot water for several minutes, then snapping it out of softened plastic frame. Lens shown in drawing is similar physically to the reading glass lens, but of superior quality. It is a chipped edge type stocked by Edmund Salvage Co. and has a 39 mm (about 1½ in.) diameter and a 152 mm (about 6 in.) focal length.

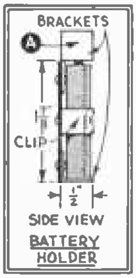
Tommy Gun barrel is a 12 in. length of sturdy cardboard mailing tube having a 1½ in. *inside* diameter. Mount lens in one end of tube, using two rings of 1½ in. o.d. tubing to support it. Now cut a 1½ in dia. wood disc of ¼ in. pine, and in its center, bore a hole just large enough to permit brass shell from Christmas tree socket to be forced-threaded in the opening. Solder length of wire to brass shell as shown. Insert socket and disc in tube so that filament of penlite bulb will be 6 in. from the Edmund lens. Small escutcheon wood screws hold disc rigid. Cut gun grips from



Toy plastic pistol separated at seams with razor blade. (A) salvage lens; (B) flashlight bulb and socket; (C) trigger; (D) Penlite cell; (E) battery holder.







1 in. white pine to a design and size which suits your need. Cut trigger grip to dimensions shown, then bore a 1 in. hole through stock for trigger switch. With a fine scroll or fret saw, cut a slot and force a strip of phosphor bronze or spring steel in position for the trigger.

Next cut metal bands from #20 gage tinplate, etc., and form them into clamps. Gun grips are secured to bands with 4-40 rh machine screws, 1¼ in. long. Then bring wire previously attached to socket shell out through a small hole in tubing, down the gun stock, and solder it to the spring trigger. Insert standard flashlight cells into rear of tube under tension of a coil spring salvaged from a discarded flashlight. A copper or aluminum retainer plate screws into back of pistol grip as shown. Upper screw is a #6 rh wood type 1 in. long. Lower screw is a 4-40 rh machine screw, 2 in. long, which passes through a ⅛ in. hole in the grip to the finger opening. This bolt completes trigger switch mechanism. Thus when spring trigger is pulled, circuit to lamp is completed since spring contacts end of retainer plate screw. Should 4-40, 2 in. screw project too far, cut off surplus and file smooth.

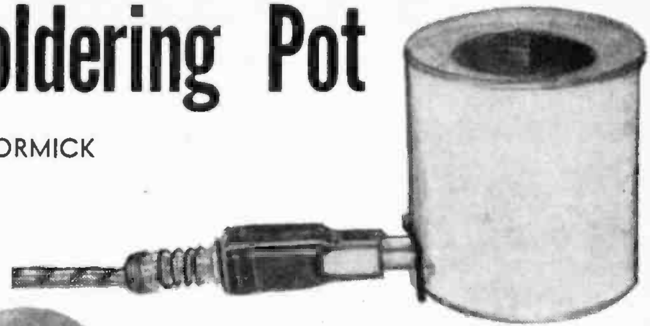
With gun complete, Electronic Bull's Eye Game is ready for a trial. First, however, as photocell is sensitive to all light, make a hood for it to protect it from extraneous illumination, covering phototube with a tight-fitting black paper tube made of photo album paper. Cut a ½ x ¾ in. window in front of cover to admit light through bull's eye. Also glue a disc of paper to top of paper tube. With phototube shield in place, set up target in a position where brilliant sunlight won't strike it. Now place your hand over bull's eye opening to completely shut off frontal light. Slowly adjust potentiometer until bell and light operate. At this point, turn back potentiometer screw just enough to silence bell. Target is now adjusted to the most sensitive point, so remove your hand from bull's eye. Aim ray gun at target, pull the trigger, and if your aim was good, the bell will ring and *HIT* will flash from the illuminated scoreboard.

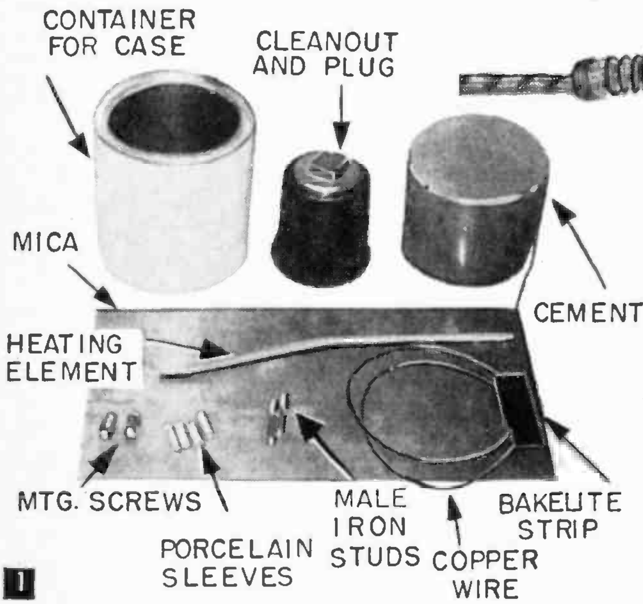
Bushing for TV Line

• To bring TV twin-leads into the house with low-loss and without letting cold air in, make sealed feed-through bushings from polystyrene tubing. For 300-ohm line, bore a ½ in. dia. hole through window frame and push a length of ½ in. O.D. polystyrene tubing through the hole, allowing about 1½ in. of tubing to project on each side of frame. Push line through tubing. Seal tube ends by heating with matches or a cigarette lighter, and, wearing a glove to protect the fingers, pinch the tube ends firmly together. Hold until plastic sets. For 150-ohm and 75-ohm twin-leads use smaller diameter tubing.—A. Trauffer.

Heavy-Duty Soldering Pot

By W. McCORMICK



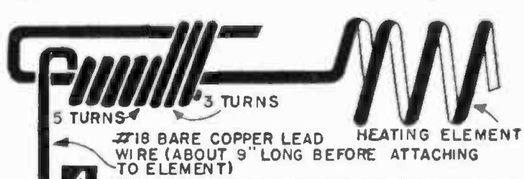


1 Soldering pot operates on house power (115 v. *ac* or *dc*), at 5.5 amps, 600 watts. Solder capacity is 3 lbs. Materials needed are shown at left below pot.

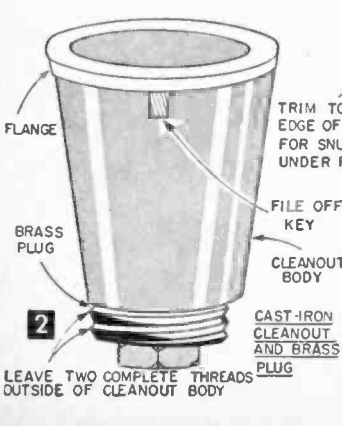
THE experimenter will find a heavy-duty soldering pot a valuable piece of shop equipment. It tins wires and makes perfect solder joints on brass and copper as quick as a wink, preheats parts too large to be soldered with an iron alone so that they can be soldered with ease, even makes possible the soldering of aluminum if an aluminum flux is used. (Stainless steel, the most stubborn member of the metals family, will also yield if a little acid flux is first applied.) The pot described in this article is ultra-simple, rugged, efficient, and can be built for about $2.50.

Assemble the materials needed (see Materials List; parts are available at plumbing and heating and electrical supply houses as well as from mail-order firms such as Sears, Roebuck & Co.) and begin construction by screwing the brass plug into the bottom of the cast-iron cleanout of the unit, leaving two complete threads outside the cleanout body (Fig. 2). Use refractory (furnace) cement to hold the heating element assembly in the case. Since this cement shrinks very little, it *will* hold.

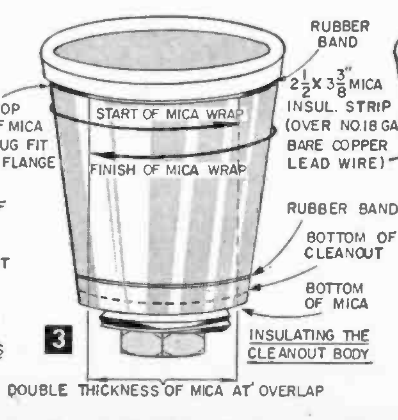
File off the key under the cleanout's flange, and then cut a strip of reinforced mica 3⅜ in. wide by 12 in. long. Crimp this along its length with long-nosed pliers until it forms a circle. It will snap, crackle and pop as it's crimped, but the woven reinforcing between plys will not allow it to split and peel as ordinary mica would.



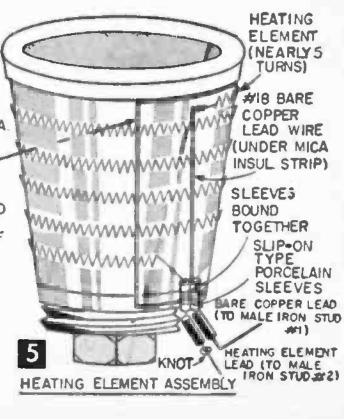
4 ATTACHING HEATING ELEMENTS TO LEAD WIRE



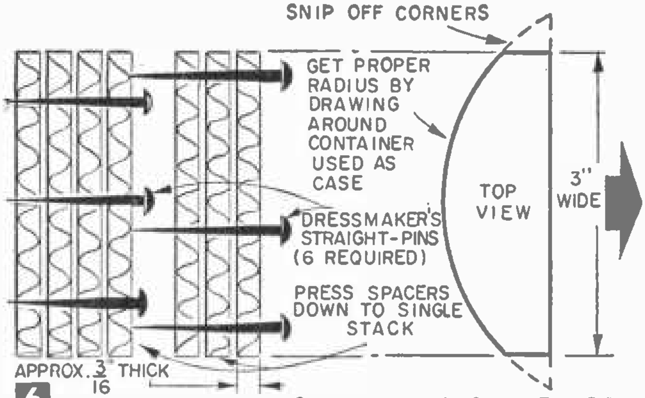
2 CAST-IRON CLEANOUT AND BRASS PLUG



3 INSULATING THE CLEANOUT BODY



5 HEATING ELEMENT ASSEMBLY



6 CORRUGATED CARDBOARD SPACER STACK-7 REQUIRED

BOTTOM VIEW OF POT SHOWING ACCESS SPACE FROM WHICH CARDBOARD SPACERS WERE REMOVED

Wrap the mica around the body of the cleanout, trimming its top edge to fit snugly up under the flange, and fasten with rubber bands—one just beneath the lower edge of the flange, the other near the bottom of the cleanout body (see Fig. 3). Next, make a mica insulator strip 2½ in. wide by 3⅜ in. long (high) and slip one end of it under the top rubber band. Slide it around until it is over the first piece of mica's overlap.

Now, stretch the coiled heating element out to about 34 in. and attach it to the copper lead wire as shown in Fig. 4. Then slip the lead wire, with element attached, up under the mica insulator-strip and work the lower rubber band up over the bottom end of the mica. Position the "start" of the element winding about ⅜ in. down from the underside of the flange by working the copper lead wire up or down. Straighten out the last three in. of the elment wire.

Next, wind the element in a spiral down the mica. When you reach the bottom you should have slightly less than five turns (as shown in Fig. 5). If not, compress or stretch the coils until you do.

This done, unwind the element and slip two porcelain insulating sleeves on its free end. Tie a loose knot in the element wire protruding through the sleeve, work the knot up against the end of the sleeve and tighten it snug.

Slip a second pair of porcelain sleeves over the end of the copper lead wire, bending the wire that protrudes at a sharp angle to the end of the sleeve. The sleeves should now be jammed between the bend and the cleanout body.

Rewind the element, spiraling it down the mica as before. When the "finish" has been reached, bind the upper sleeve on the element wire to the upper sleeve on the copper lead wire, twisting the ends of this wire wrap with pliers.

Inspect the element for shorted turns. Make an ohmmeter check to guarantee that the copper lead wire is not in contact with the cleanout body.

Mix a cup of refractory cement with water and cover the element, rubber bands and all, with a thin coat, taking care not to disturb the element windings. Put the element assembly, plug end up, aside to dry.

To make the case for the solder pot, take a can opener and cut the bottom and top lips out of the metal container you have selected (I used an empty tobacco can). Then make a stack of cardboard spacers to keep the cement out of the access space in the bottom of the case (as shown in Fig. 6).

A cardboard cement retainer is needed, so stand the case on a sheet of corrugated cardboard and scribe around both its inside and outside edges. Cut down between these two circles with a knife, but do not cut all the way through. Place the edge of the case on the circular channel in the cardboard and force it down into the cut.

Reach inside the case from the top and tape the stack of cardboard spacers to the inside of the case, away from the seam, at the very bottom. The spacers should rest on the cardboard cement retainer.

Now mix enough cement to fill the inside of the case level with the top of the spacers, fill, and allow four hours for this to partially set. While waiting, make the bakelite terminal board.

Returning to the case, dig the spacers out of the access space and lower the element assembly into the case, guiding the element leads into the

MATERIALS LIST—SOLDER POT

1 600 watt, coiled heating element
1 2" cast-iron cleanout with brass plug
1 sheet reinforced mica, 3½ x 15"
2 electric iron studs (male)
4 porcelain insulating sleeves
3 lbs. refractory cement
2 rubber bands
2 sq. ft. corrugated cardboard
6 dressmaker's straight pins
1 wad of cotton or 3 Kleenex tissues
1 metal container, approx. 4½ x 4½" (empty ½ lb. tobacco can)
1 strip Bakelite, 3/32 x 1 x 22
1 12" length #18 or heavier bare copper wire
2 #6 x 32 machine screws, ⅝" long
2 #6 x 32 hex. nuts
2 #6 internal tooth lock washers
1 asbestos shingle for base (optional)
1 12" length transparent tape, ½" wide

empty access space. Pack the access space with cotton (or cleansing tissue).

Fill the wall space between the element assembly and the case with cement, even with the bottom edge of the cleanout flange. Allow 24 hours for this to dry, then remove the cotton.

Drill two holes ⅝ in. up from the bottom of the case, ¾ in. on centers, straddling the deepest part of the access space; ream them to ⅝ in. diameter.

Hold the terminal board against the side of the case with the back ends of the electric iron studs centered in these holes and scribe the location of the terminal board mounting holes on the case, bolt the terminal board in place and connect one element lead to each of the electric iron studs. See that no bare wires have been left dangling, and that your connections are good and tight.

The next, and last, step is to appropriate the family iron cord and put your heavy-duty soldering pot into service.

Answer to Crossword, Page 151

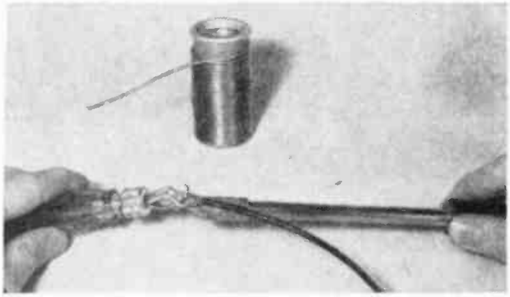
D	E	T	E	C	T	O	R	■	T	■	T	A	P	■
I	■	A	■	■	R	■	E	■	U	■	■	M	■	G
S	Y	N	C	■	I	■	S	■	N	■	■	P	■	A
T	■	K	■	■	G	■	O	■	E	■	■	L	■	I
O	■	■	R	E	G	E	N	E	R	A	T	I	O	N
R	C	■	E	■	E	■	A	■	■	■	■	F	■	■
T	■	■	G	■	R	■	N	■	■	■	■	I	■	C
I	N	P	U	T	■	S	T	A	G	E	■	E	■	A
O	■	■	L	■	C	■	■	■	A	■	■	R	■	S
N	■	■	A	■	L	I	M	I	T	E	R	■	■	C
■	■	■	T	■	A	■	■	■	E	■	■	■	■	A
L	■	■	O	■	S	■	■	■	■	■	G	R	I	D
O	■	C	R	O	S	S	O	V	E	R	■	E	■	E
A	■	■	■	■	■	■	■	■	■	■	■	C	■	■
D	E	C	O	U	P	L	I	N	G	■	■	T	R	F

Answers to Test on Page 43

1. Capacitor (or capacitance); inductance (or coil).
2. a) The inductive reactance equals the capacitive reactance.
3. 10 ohms $\frac{(R_1 \times R_2)}{(R_1 + R_2)}$.
4. The total of the wattage ratings, 20 watts.
5. b) Ohm.
6. True (the law of conservation of energy).
7. Capacitor; capacitance; a) 25 microfarads.
8. b) Microphone.
9. d) All of the devices.
10. Emitter.
11. a) Junction type.
12. b) Reduce flicker.
13. d) 15,750 *cps*.
14. Frequency.
15. Sync (or synchronization).
16. a) Negative phase transmission—white maximum signal, black minimum signal.
17. A TV receiver that uses a common I.F. for amplifying both picture and sound.
18. Blank out; retrace.
19. The "Y" or luminosity signal, a combination of the three colors.
20. a) True.

Test Clip as Hand Vise

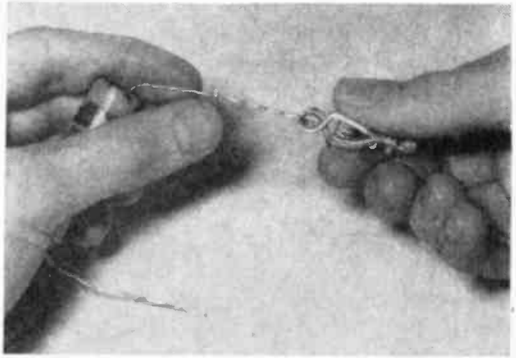
• Need a hand vise for holding phone plugs and other small parts while you solder wires to them? Make one by chucking a test clip (Muller #45)



into the chuck handle of an interchangeable screwdriver set. Such a vise may also be used to pull away the hot ends of wire leads unsoldered from terminals or for starting screws and nuts in hard-to-reach places.—J. A. C.

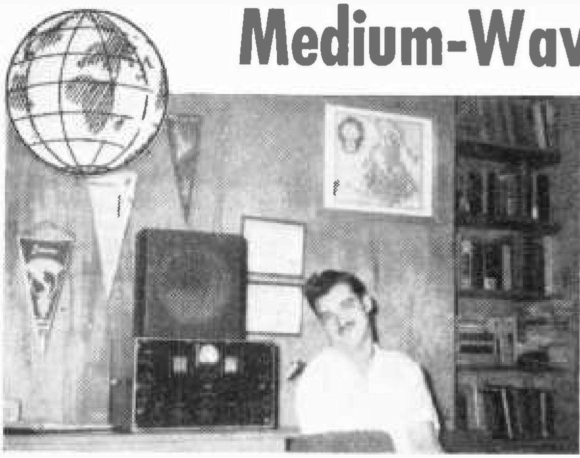
Clip Brightens Wire Leads

• Ever wish you had some tool other than a knife that you could use to brighten the corroded wire leads of capacitors, resistors, and other electronic circuit components? Chances are, you already have such a tool but don't realize it. How about a



test clip? By grasping the lead to be cleaned in the jaws of the clip and pulling it over the wire toward yourself gently, the sharp teeth of the clip will bite in and scrape away corroded metal from the surface of the lead. Although battery clips and clips of the type shown work best for cleaning purposes, alligator clips will also serve.—John A. Comstock.

World-Wide Reception on the Medium-Wave Broadcast Band



By C. M. STANBURY II

OCCASIONALLY someone mentions distant reception (DX) on the standard, medium-wave broadcast band (535 to 1605 kc, the band you tune in on with your home AM radio set). What do you think of? A 50-kilowatt station in the next state that carries the baseball games? Or maybe you're an old timer and you think of KDKA in Pittsburgh or WWJ in Detroit. Well, my friend, you're selling the broadcast band short! From wherever you're sitting you can reach out and tune in on, say, Hawaii, or New Zealand, and many another far-off spot.

During the minimum sunspot activity from 1953-1955, DX on the broadcast band reached a recent peak. Christmas Mass from Bordeaux, France, was heard in the state of Washington on 1205 *kc*. (East Coast listeners will be familiar with this spot on the dial—it is just 5 *kc* below powerful WCAU in Philadelphia.) And on a spring morning in May, 1954, Khabarovsk, Siberia, was heard near Buffalo, N. Y., on 629 *kc*. In addition, medium-wave hot shots logged and verified the following: VQO, 1030 *kc*, British Solomon Islands (from Vermont); Voice of America, 1140 *kc*, Philippines (from Illinois and eastern Canada); and CB106, 1060 *kc*, Santiago, Chile (from New Mexico).

"Yes," you may say, "but those conditions won't prevail again for another six or seven years." Well, you're still selling the band short. During the season that began in the fall of 1956 and ended in the spring of 1957—a period of very *high* sunspot activity—the following were heard and confirmed: 4VA, 1080 *kc*, Port au Prince, Haiti (from the state of Washington); JOKD, 1370 *kc*, Japan (from Illinois); JOTR and JOJR, two 500-watters on 940 *kc*, Japan (logged simultaneously by a DX'er in California); and Radio Omdurman, 572 *kc*, Anglo-Egyptian Sudan (from Vermont).

Convinced? Good. Here's how you can do it:

Tools. The antenna is important, but the receiver is probably considerably more important. Any fairly good outdoor antenna will provide consistently good results if your radio is suitable. Remember, unlike antennas used for short wave reception, a receiving antenna for the broadcast band is—in most cases—not tuned. (It's usually impractical to try to do so.)

Some DX'ers get by with a very good standard set. However, the communications type receivers are always preferable to standard sets. Their sensitivity is greater, and, even more important, since the broadcast band is undoubtedly the most crowded portion of the radio spectrum, they have *selectivity*. Tops of all sets for BCB DXing are those with crystal selectivity. A crystal is a must for logging those stations operating between the 10 *kc* FCC allocations (split-frequency stations). When the crystal is turned on and the phasing control adjusted, stations only 4, 3 and even 2 *kc* apart can be separated.

The majority of American communications re-

TABLE A—WHEN TO LISTEN FOR WHAT

LISTENER'S AREA (NORTH AMERICA)	STATION'S AREA (OUTSIDE U. S. & CANADA)	SEASON
East	N. & S. America	Fall
East	N. & S. America	Winter
East	N. & S. America	Spring
East	Europe & Africa	Fall
East	Europe & Africa	Winter
East	Asia & Pac.	Fall
East	Asia & Pac.	Winter
East	Pacific	Spring
East	Asia	Spring
Central	N. & S. America	Fall
Central	N. & S. America	Winter
Central	N. & S. America	Spring
Central	Europe	Fall
Central	Europe	Winter
Central	Africa	Fall
Central	Africa	Winter
Central	Pacific	ALL
West	N. & S. America	Fall
West	N. & S. America	Spr-Wtr
West	Europe & Africa	Winter
West	Pacific	Fall
West	Pacific	Winter
West	Pacific	Spring
West	Asia	Fall
West	Asia	Winter
West	Asia	Spring

LISTENER'S TIME

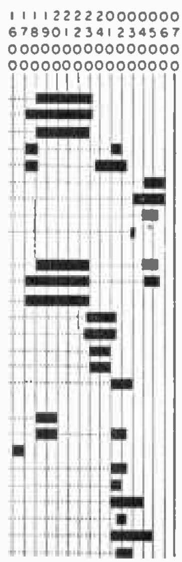


TABLE B—STATIONS TO START WITH

STATION	KC	LOCATION	LISTENER'S AREA	WHEN	ADDRESS
XEWA	540	San Luis Potosi, Mexico	Everywhere except N.W.	Before 0200 EST	Cadena Radiodifusora Mexicana, Ayuntamiento 54, Mexicio City
CMHQ	640	Santa Clara, Cuba	East & Central	Before 0030 EST	Circuito CMQ, Radiocentrom. Vedado, Habana
TGW	640	Guatemala, Guatemala	East & Central	0030-0130 EST	Radio Nacional. Calle "18 de Septiembre" y 7a Av., Z1
YSS	655	San Salvador, El Salvador	Everywhere except N.Y.C. & Dixie	Before 2400 EST	Radio Nacional, Teatro Nacional
Radio Nacional	655	Lisbon, Portugal	East except N.Y.C.	1700-1900 EST	Rua de Quelhas 2
YNDS, Union Radio	665	Managua, Nicaragua	Everywhere except N.Y.C. & Chicago	Before 0200 EST	
JOBK	670	Osaka, Japan	West	Early AM	N.H.K.
KULA	690	Honolulu, T. H.	Everywhere	0300 EST Mon AM	
1YZ	800	Rotorua, New Zealand	Everywhere	0300-0500 EST	P. O. Box 298
JOBB	830	Osaka, Japan	West	Early AM	N.H.K.
CMBZ	830	Habana, Cuba	East	Before 2400 EST	Radio Salas, San Rafael 108, Segundo Piso
HJKC	840	Bogota, Colombia	East & West	Before 2400 EST	CARACOL, Calle 19, No. 9-48
TGJ	880	Guatemala,	West	Early Evening	Radio Nuevo Mundo, 6a Av., 10-45, Z1
Radio Africa	935	Tangier, Morocco	East	0200 EST (Winter)	9 rue de Russie
YVMF	1120	Maracaibo, Venezuela	East	1800-2000 EST	Ondas del Lago, Apartado 261
Voice of America	1140	Okinawa	West	Early AM	Washington 25, D. C.
N.W.D.R.	1586	West Germany	East	2255-0100	Norddeutscher, Rundfunk, Hamburg 13

TIME CONVERSIONS
CST equals EST minus 1 hour
MST equals EST minus 2 hours
PST equals EST minus 3 hours

ceivers are manufactured by: 1) Hallicrafters Company, 4401 W. 5th Ave., Chicago 24, Illinois; 2) Hammarlund Manufacturing Co., 460 W. 34th St., New York 1, N. Y.; 3) National Company, Malden 48, Massachusetts. Write these companies for information on their receivers, then study it carefully.

When you have your receiver, get a good reference log. For the U. S., and its territories, and for Canada, *White's Radio Log* (see pages 161-191) is a very complete and excellent reference. For Europe, most stations in Asia and the Pacific, and many stations in North and South America, the *World Radio Handbook* is very good. It is available from Gilfer Associates, P. O. Box 239, Grand Central Station, New York 17, for $2.20. It gives addresses, although usually a station's call letters or slogan can be used in lieu of a street address. (Incidentally, many foreign stations identify by their slogan, not their call letters.)

Finally the U. S. Government Printing Office, Washington 25, D. C., issues the following:

Catalogue No.	*Lists All Foreign Stations by*
Pr. 34.659:957/pt.1	Country and City $1.50
Pr. 34.659:957/pt.2	Frequency ... $1.50
Pr. 34.659:957/pt.3	Station Name or Slogan. $1.25

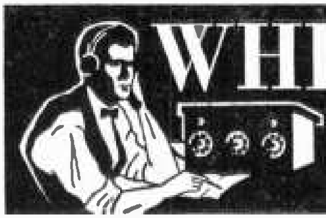
The best way to know what is being heard, and thus what to try for, is to belong to a radio club. The National Radio Club, R. D. 1, Lake City, Pennsylvania, devotes about 99% of its activities to the broadcast band. The Newark News Radio Club, 215 Market St., Newark 1, N. J., also has a good broadcast band section in its bulletin. The best times to look, and what to look for first, are given in Tables A and B of this article.

Reporting. The payoff for most DX hunters is the verification card or letter. In this connection, the method of reporting is obviously very important: the program data you give must establish the validity of your report to the satisfaction of the station.

As an absolute minimum, there must be a complete general description of the program or programs heard. Much better than the general description is the definite item system. Commercials, program name, announcer's name, etc., would all be definite items. A minimum of two items is usually required, three is preferable. Song titles generally will not do because many stations keep no record of them. (Major exceptions are programs or tests transmitted especially for DX'ers and those few European and Asiatic stations which keep extremely complete records.)

When you are logging the rare station, very often the above orthodox methods must be adapted to fit conditions. Say that the station is heard very poorly. The DX'er must take what program data he can get because he probably won't get another chance at the station. So he combines the description and definite item methods. And he accurately describes the announcer's voice, or notes an unusually long period of dead air. The possibilities are endless; 90% of the occasions when a rare station is logged but impossible to report, the reason is that the DX'er was not alert enough.

When you write a station for verification, always enclose return postage. If you cannot obtain foreign stamps from a dealer, get International Reply Coupons from the post office. You can expect just about anything from medium-wave broadcast band DX. Unlike short-wave, DX, it is *always* difficult. But like short wave, everything is possible. Because of this, it represents the greatest DX challenge a listener can take on.



WHITE'S RADIO LOG

An up-to-date broadcasting directory
AM, FM, TV and Short-Wave Stations

Vol. 35 **No. 2**

QUICK REFERENCE INDEX

History of White's Radio Log

White's Radio Log was founded in Providence, R. I., by Charles DeWitt White as an extension of his earlier publishing activities which, in turn, were a continuation of the business established by his father: the publication of city directories, street guides and municipal tax guides.

In the early days of broadcasting, the compilation of a list of operating stations and their frequencies was no simple task. Prior to the Dill-White Radio Act of 1927, if a feed merchant, auto dealer, barber or undertaker wanted to advertise his wares or services, he had only to select a frequency and go on the air.

Nevertheless, Mr. White's directory publishing experience had convinced him that he could successfully assemble a radio log, and in 1924 he justified this conviction with *The Rhode Island Radio Call Book*, following this shortly after with *White's Triple List of Radio Broadcasting Stations*.

In 1927 the two publications were merged, nation-wide distribution was established and in ensuing years related publications, such as *Sponsored Radio Programs*, *Radio Announcer's Guide*, *Short-Wave Schedule Guide* and a special Canadian edition of *White's Radio Log* (which had had its title shortened to the one it bears today), were also issued. The *Log* reached a combined circulation of well over 1,000,000 copies at one time.

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

In 1957, Mr. White, who was then 76 years old, died in his sleep. His heirs sold all rights in and to the *Log* to Science and Mechanics Publishing Company and in January of this year the first edition of *White's Radio Log* released under our auspices—Vol. 35, No. 1—was published as a special supplement to the *Radio-TV Experimenter* (Vol. 6).

This current edition of the *Log*—Vol. 35, No. 2—cross-indexes over 3100 U.S. standard broadcast (AM) stations, separately lists U.S. frequency modulation (FM) and television stations, has a complete compilation of Canadian broadcasters and, in addition, has a greatly expanded list of world-wide short-wave stations that identifies those stations beaming regular evening broadcasts to the United States. Completely new to the *Log* with this edition is a list grouped by state and city of Mexican stations that can be heard in the United States. Finally, over 2000 changes (2438 precisely) have been made in this edition to bring the listings up-to-date, and to make them as complete, as is humanly possible.

White's Radio Log is under continuous revision as new stations come on the air and others go off. Work on revision to make the next edition even more complete and useful has already begun. To this end, any changes that you, as a user of the *Log*, have to suggest will be greatly appreciated.

Publisher
Science and Mechanics

United States

Standard Broadcast (AM) Broadcasting Stations Listed Alphabetically by Call Letters

C.L., call letters; Kc., frequency in kilocycles (for watt power of station, see list arranged by frequency, p. 169)

C.L.	Location	Kc.
DYBU	Cebu, P.I.	1260
DZPI	Manila, P.I.	800
DZRH	Manila, P.I.	710
KAAA	Kingman, Ariz.	1230
KABC	Los Angeles, Calif.	790
KABI	Ketchikan, Alaska	580
KABR	Aberdeen, S. Dak.	1220
KACT	Andrews, Tex.	1360
KADA	Ada, Okla.	1230
KADO	Marshall, Tex.	1410
KAFP	Petaluma, Calif.	1490
KAFY	Bakersfield, Calif.	550
KAGE	Winona, Minn.	1570
KAGH	Crossett, Ark.	800
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
KAND	Corsicana, Tex.	1340
KANE	New Iberia, La.	1240
KANI	Oahu, Hawaii	1150
KANN	Sinton, Tex.	1590
KANO	Anoka, Minn.	1470
KANS	Wichita, Kan.	1480
KAOK	Lake Charles, La.	1400
KAPA	Raymond, Wash.	1340
KAPB	Marksville, La.	1370
KAPK	Minden, La.	1240
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
KASL	Newcastle, Wyo.	1240
KASM	Albany, Minn.	1150
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
KATT	Pittsburgh, Calif.	990
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
KBAB	El Cajon, Calif.	910
KBAL	San Saba, Tex.	1410
KBAM	Longview, Wash.	1220
KBAR	Burley, Idaho	1230
KBBA	Benton, Ark.	690
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
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
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
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
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
KCIL	Houma, La.	1490
KCIM	Carroll, Iowa	1380
KCJB	Minot, N.Dak.	910
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
KCMO	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
KCSB	San Bernardino, Calif.	1350
KCSJ	Pueblo, Colo.	590
KCSR	Chadron, Nebr.	1450
KCTI	Gonzales, Tex.	1450
KCTX	Childress, Tex.	1510
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
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.	1460
KDMD	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
KDRD	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
KEED	Springfield, Oreg.	1050
KEEL	Shreveport, La.	710
KEEN	San Jose, Calif.	1370
KEEP	Twin Falls, Idaho	1450
KELA	Centralia, Wash.	1470
KELD	El Dorado, Ark.	1400
KELO	Sioux Falls, S.Dak.	1320
KELK	Elko, Nev.	1240
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
KENO	Las Vegas, Nev.	1460
KENS	San Antonio, Tex.	680
KENT	Shreveport, La.	1550
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.	1450
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
KFGO	Fargo, N.Dak.	790
KFGQ	Boone, Iowa	1260
KFGT	Fremont, Nebr.	1340
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
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
KGKO	Dallas, Tex.	1480
KGLC	Miami, Okla.	910
KGLN	Glenwood Sprgs., Colo.	980
KGLO	Mason City, Iowa	1300
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

C.L.	Location	Kc.
KGO	San Francisco, Calif.	810
KGOL	Golden, Colo.	1250
KGON	Oregon City, Oreg.	1520
KGOS	Torrington, Wyo.	1490
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
KGYW	Vallejo, Calif.	1190
KHAM	Albuquerque, N.Mex.	1580
KHAS	Hastings, Nebr.	1230
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
KHON	Honolulu, T.H.	1380
KHOT	Madera, Calif.	1250
KHOZ	Harrison, Ark.	900
KHQ	Spokane, Wash.	590
KHSL	Chico, Calif.	1290
KHUZ	Borger, Tex.	1490
KHVH	Honolulu, Hawaii	1040
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	1400
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
KIKS	Sulphur, La.	1310
KIKI	Honolulu, Hawaii	830
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

C.L.	Location	Kc.
KKOG	Ogden, Utah	730
KLAC	Los Angeles, Calif.	570
KLAD	Klamath Falls, Oreg.	900
KLAK	Lakewood, Colo.	1600
KLAM	Cordova, Alaska	1450
KLAN	Renton, Wash.	910
KLAS	Las Vegas, Nev.	1230
KLBM	La Grande, Oreg.	1450
KLCB	Libby, Mont.	1230
KLCN	Blytheville, Ark.	910
KLCO	Poteau, Okla.	1280
KLEA	Lovington, N.Mex.	630
KLEC	Jonesville, La.	1480
KLEE	Ottumwa, Iowa	1480
KLEM	LeMars, Iowa	1410
KLEN	Killeen, Tex.	1050
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
KLUE	Shreveport, La.	1300
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
KNBC	San Francisco, Calif.	680
KNBX	Kirkland, Wash.	1050
KNBY	Newport, Ark.	1280

C.L.	Location	Kc.
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
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
KOCS	Ontario, Calif.	1510
KOCY	Oklahoma City, Okla.	1340
KODE	Joplin, Mo.	1230
KODI	Cody, Wyo.	1400
KOOL	The Dalles, Oreg.	1440
KODY	North Platte, Nebr.	1240
KOEL	Oelwein, Iowa	950
KOFA	Yuma, Ariz.	1240
KOFE	Pullman, Wash.	1150
KOFI	Kalispell, Mont.	980
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.	1050
KOKO	Warrensburg, Mo.	1450
KOKX	Keokuk, Iowa	1310
KOL	Seattle, Wash.	1300
KOLD	Tucson, Ariz.	1450
KOLE	Port Arthur, Tex.	1340
KOLJ	Quanah, Tex.	1150
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
KOSF	Nacogdoches, Tex.	1230
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	Bijou, Calif.	1490
KOXR	Oxnard, Calif.	910
KOXY	Little Rock, Ark.	1440
KOY	Phoenix, Ariz.	550
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

C.L.	Location	Kc.
KPAM	Portland, Oreg.	1410
KPAN	Hereford, Tex.	860
KPAS	Banning, Calif.	1490
KPAY	Chico, Calif.	1060
KPBA	Pine Bluff, Ark.	1590
KPBM	Carlsbad, N.Mex.	740
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
KPIO	Payette, Idaho	1450
KPIG	Cedar Rapids, Iowa	1450
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
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
KQDY	Minot, N.Dak.	1320
KQIK	Lakeview, Oreg.	1230
KQTY	Everett, Wash.	1230
KQUE	Albuquerque, N.Mex.	920
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
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

C.L.	Location	Kc.
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
KRWS	Post, Tex.	1370
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
KSED	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
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
KSLR	Oceanside, Calif.	1320
KSLV	Monte Vista, Colo.	1240
KSMA	Santa Maria, Calif.	1240
KSML	Seminole, Tex.	1250
KSMN	Mason City, Iowa	1010
KSMO	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
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
KTAC	Tacoma, Wash.	850
KTAE	Taylor, Tex.	1260
KTAN	Sherman, Tex.	1500
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	Brownfield, Tex.	1300
KTHE	Thermopolis, Wyo.	1240
KTHS	Little Rock, Ark.	1090
KTHT	Houston, Tex.	790

C.L.	Location	Kc.
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
KTLD	Tullulah, La.	1380
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
KTML	Marked Tree, Ark.	1580
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
KTOD	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
KTXC	Big Spring, Tex.	1400
KTXJ	Jasper, Tex.	1350
KTXL	San Angelo, Tex.	1340
KTXN	Austin, Tex.	1370
KTYM	Inglewood, Calif.	1460
KUBA	Yuba City, Calif.	1600
KUBC	Montrose, Colo.	580
KUBE	Pendleton, Oreg.	1050
KUDI	Great Falls, Mont.	1450
KUDL	Kansas City, Mo.	1380
KUDU	Ventura, Calif.	1590
KUDY	Littleton, Colo.	1510
KUEN	Wenatchee, Wash.	1410
KUEQ	Phoenix, Ariz.	740
KUGN	Eugene, Oreg.	590
KUIK	Hillsboro, Oreg.	1360
KUIN	Grants Pass, Oreg.	1340
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
KUND	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
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
KVAS	Astoria, Oreg.	1230
KVBC	Farmington, N.Mex.	1390
KVCK	Wolf Point, Nebr.	1490
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
KVHC	O'Neill, Nebr.	1400
KVHL	Homer, La.	1320
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

C.L.	Location	Kc.
KVNU	Logan, Utah	610
KVOA	Tucson, Ariz.	1290
KVOC	Casper, Wyo.	1230
KVOD	Denver, Colo.	630
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
KWCO	Chickasha, Okla.	1560
KWDM	Des Moines, Iowa	1150
KWEB	Rochester, Minn.	1270
KWED	Seguin, Tex.	1580
KWEI	Weiser, Idaho	1220
KWEL	Midland, Tex.	1580
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
KWGB	Goodland, Kans.	730
KWHI	Brenham, Tex.	1280
KWHK	Hutchinson, Kans.	1260
KWHN	Fort Smith, Ark.	1320
KWHO	Salt Lake City, Utah	860
KWHW	Altus, Okla.	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
KWKW	Pasadena, Calif.	1300
KWLC	Decorah, Iowa	1240
KWLK	Longview, Wash.	1400
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.	1340
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
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
KXIC	Iowa City, Iowa	800
KXIT	Dalhart, Tex.	1410
KXJK	Forrest City, Ark.	950

C.L.	Location	Kc.
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	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
KZDL	Muleshoe, Tex.	1570
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
KZEA	Shreveport, La.	980
KZEE	Weatherford, Tex.	1220
KZEY	Tyler, Tex.	690
KZIN	Coeur d'Alene, Idaho	1050
KZIP	Amarillo, Tex.	1310
KZOK	Prescott, Ariz.	1340
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
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
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
WAHL	Hastings, Mich.	1220
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
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
WAMI	Opp, Ala.	860
WAML	Laurel, Miss.	1340
WAMM	Flint, Mich.	1420
WAMO	Homestead, Pa.	860

C.L.	Location	Kc.
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	Watertown, N.Y.	1240
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
WATD	Cheraw, S.C.	1420
WATE	Knoxville, Tenn.	620
WATG	Ashland, Ohio	1340
WATH	Athens, Ohio	970
WATK	Antigo, Wis.	900
WATM	Atmore, Ala.	1590
WATO	Oak Ridge, Tenn.	1490
WATP	Marion, S.C.	1430
WATR	Waterbury, Conn.	1320
WATS	Sayre, Pa.	960
WATT	Cadillac, Mich.	1240
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
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
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
WBCK	Battle Creek, Mich.	930
WBCM	Bay City, Mich.	1440
WBCO	Bessemer, Ala.	1450
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

C.L.	Location	Kc.
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
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
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
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
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

C.L.	Location	Kc.
WCGA	Calhoun, Ga.	900
WCGC	Belmont, N.C.	1270
WCHA	Chambersburg, Pa.	800
WCHB	Inkster, Mich.	1440
WCHF	Chippewa Falls, Wis.	1150
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
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.	1490
WCPO	Cincinnati, Ohio	1230
WCPS	Tarboro, N.C.	760
WCRA	Effingham, Ill.	1090
WCRB	Waltham, Mass.	1330
WCRI	Scottsboro, Ala.	1050
WCRK	Morristown, Tenn.	1150
WCRL	Oneonta, Ala.	1570
WCRO	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
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

C.L.	Location	Kc.
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
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	Washington, 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
WEEK	Peoria, Ill.	1350
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

C.L.	Location	Kc.
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
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
WETB	Johnson City, Tenn.	790
WETO	Gadsden, Ala.	930
WETU	Wetumpka, Ala.	1250
WETZ	New Martinsville, West Virginia	1330
WEUC	Ponce, P.R.	1420
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
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
WFCR	Fairfax, Va.	1310
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.	1480
WFMJ	Youngstown, Ohio	1390
WFMO	Fairmont, N.C.	860
WFMW	Madisonville, Ky.	730
WFNC	Fayetteville, N.C.	1390
WFNM	DeFuniak Springs, Florida	1480
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
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, Fla.	1260
WFUL	Fulton, Ky.	1270

C.L.	Location	Kc.
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
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
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
WHA	Madison, Wis.	970
WHAB	Baxley, Ga.	1260
WHAI	Greenfield, Mass.	1240
WHAK	Rogers City, Mich.	980
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

C.L.	Location	Kc.
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
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
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.	880
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
WHWL	Nanticoke, Pa.	730
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
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

C.L.	Location	Kc.
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
WING	Dayton, Ohio	1410
WINI	Murphysboro, Ill.	1420
WINK	Fort Myers, Fla.	1240
WINN	Louisville, Ky.	1240
WINR	Binghamton, N.Y.	680
WINS	New York, N.Y.	1010
WINX	Rockville, Md.	1600
WINZ	Miami, Fla.	940
WIOD	Sanford, Fla.	1360
WION	Ionia, Mich.	1430
WIOU	Kokomo, Ind.	1350
WIP	Philadelphia, Pa.	610
WIPA	Annapolis, Md.	810
WIPC	Lake Wales, Fla.	1280
WIPR	San Juan, P.R.	940
WIPS	Ticonderoga, N.Y.	1250
WIRA	Fort Pierce, Fla.	1400
WIRB	Enterprise, Ala.	1230
WIRC	Hickory, N.C.	630
WIRE	Indianapolis, Ind.	1430
WIRK	W. Palm Beach, Fla.	1290
WIRL	Peoria, Ill.	1290
WIRO	Ironton, Ohio	1230
WIRU	Humboldt, Tenn.	740
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
WJCM	Sebring, Fla.	960
WJDA	Quincy, Mass.	1300
WJDB	Thomasville, Ala.	630
WJDX	Jackson, Miss.	620
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
WJKD	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

C.L.	Location	Kc.
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
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.	790
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
WKTF	Warrenton, Va.	1420
WKTG	Thomasville, Ga.	730
WKTM	Mayfield, Ky.	1050
WKTQ	South Paris, Maine	1450
WKTS	Brooksville, Fla.	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.	1540
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.	1490
WLAV	Grand Rapids, Mich.	1340
WLAY	Muscle Shoals, Ala.	1450
WLBA	Gainesville, Ga.	1580
WLBB	Carrollton, Ga.	1100
WLBC	Muncie, Ind.	1340
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
WLBS	Birmingham, Ala.	900
WLBZ	Bangor, Maine	620
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
WLOI	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
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
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
WMCD	Welch, W.Va.	1340
WMCH	Church Hill, Tenn.	1260
WMCK	McKeesport, Pa.	1360
WMCW	Harvard, Ill.	1600
WMDC	Hazlehurst, Miss.	1220
WMDO	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
WMGE	Madison, Ga.	1250
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
WMIS	Natchez, Miss.	1240
WMIQ	Iron Mountain, Mich.	1450
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
WMMA	Miami, Fla	1260
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
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
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.	1580
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
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
WNIL	Niles, Mich.	1290
WNJR	Newark, N.J.	1430
WNKY	Neon, Ky.	1450
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
WNRC	New Rochelle, N.Y.	1460
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
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
WOSA	Wausau, Wis.	550
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
WOW	Omaha, Nebr.	590

C.L.	Location	Kc.
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
WPBB	Jackson, Ala.	1290
WPBC	Minneapolis, Minn.	980
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
WPFD	Darlington, S.C.	1350
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	Brooklyn, 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
WRBS	Tuscaloosa, Ala.	790
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
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
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
WRDY	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.	1400
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
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
WSHE	Sheboygan, Wis.	950
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
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, Virgin Islands	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
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	College Sta., 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
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
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
WTPR	Paris, Tenn.	710
WTPS	New Orleans, La.	940
WTRA	Latrobe, Pa.	1480
WTRB	Ripley, Tenn.	1570
WTRC	Elkhart, Ind.	1340
WTRL	Bradenton, Fla.	1490
WTRN	Tyrone, Pa.	1290
WTRD	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
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, Maine	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
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
WWJ	Detroit, Mich.	950
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
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
WYLD	New Orleans, La.	600
WYMB	Manning, S.C.	1410
WYSE	Lakeland, Fla.	1330
WYSR	Franklin, Va.	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

Canadian

Amplitude-Modulation (AM) Broadcasting Stations Listed Alphabetically by Call Letters

C.L., call letters; Kc., frequency in kilocycles (for watt power of station, see list arranged by frequency, below).

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.	1050
CFAR	Flin Flon, Man.	590
CFBC	Saint John, N.B.	930
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
CFNB	Fredericton, N.B.	550
CFNS	Saskatoon, Sask.	1170
CFOB	Fort Frances, Ont.	800
CFOR	Orillia, Ont.	1570
CFOS	Owen Sound, Ont.	1470
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.	900
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
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
CKBB	Barrie, Ont.	1230
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.	1050
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.	1240
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	1320
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.	1400
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.	1250
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.	1350
CKTS	Sherbrooke, Que.	1240
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

United States and Canadian

Amplitude-Modulation (AM) Broadcasting Stations Grouped by Frequency; U.S. stations listed alphabetically by location within groups, Canadian stations precede U.S.

Abbreviations: Kc., frequency in kilocycles; W.P., watt power—Wave length is given in meters (all AM stations broadcasting at a higher frequency than 1600 Kc. are listed under Short-Wave Stations, see p. 185 and p. 187)

Kc. Wave Length	W.P.
540—555.5	
CBK Regina, Sask.	50000
KVIP Redding, Calif.	1000
KFMB San Diego, Calif.	5000
WGTO Cypress Gardens, Florida	10000
KBRV Soda Springs, Idaho	500
KWMT Ft. Dodge, Iowa	1000
WDVM Pocomoke City, Md.	500
WCNG Canonsburg, Pa.	250
WDXN Clarksville, Tenn.	250
WRIC Richlands, Va.	1000
550—545.1	
CFNB Fredericton, N.B.	5000
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	5000
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.	500
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.	1000
KMVI Wailuku, T.H.	1000
KCRS Midland, Tex.	5000
KTSA San Antonio, Tex.	5000
WDEV Waterbury, Vt.	1000
WSVA Harrisburg, Va.	5000
WOSA Wausau, Wis.	5000
560—535.4	
CFRA Ottawa, Ont.	5000
CJKL Kirkland Lake, Ont.	5000
WOOF Dothan, Ala.	5000
KYUM Yuma, Ariz.	1000
KSFO San Fran., Calif.	5000
KLZ Denver, Colo.	5000
WQAM Miami, Fla.	5000
WIND Chicago, Ill.	5000
WMIK Middlesboro, Ky.	500
WGAN Portland, Maine	5000
WHYN Springfield, Mass.	1000
WMIC Monroe, Mich.	500
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	
CKEK Cranbrook, B.C.	1000
CKCQ Quesnel, B.C.	1000
CJEM Edmundston, N.B.	1000
WCAS Gadsden, Ala.	5000
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.	1000
KGRT Las Cruces, N.Mex.	1000
WMCA New York, N.Y.	5000
WSYR Syracuse, N.Y.	5000
WWNC Asheville, N.C.	5000
WMSN Raleigh, N.C.	500
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	
CFCL Timmins, Ont.	1000
CJFX Antigonish, N.S.	5000
CKEY Toronto, Dnt.	5000
CKPR Ft. William, Ont.	5000
CKUA Edmonton, Alta.	1000
CKY Winnipeg, Man.	5000
WTUS Tuskegee, Ala.	500
KABI Ketchikan, Alaska	1000
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.	5000
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.	500
KDAV Lubbock, Tex.	500
WCHS Charleston, W.Va.	5000
WKTY LaCrosse, Wis.	1000
590—508.2	
CFAR FlinFlon, Man.	1000
CKRS Jonquiere, Que.	1000
COCM St. Johns, N.F.	1000
WRAG Carrollton, Ala.	1000
KBHS Hot Springs, Ark.	5000
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	
CFCF Montreal, Que.	5000
CFCH North Bay, Ont.	1000
CFQC Saskatoon, Sask.	5000
CJOR Vancouver, B.C.	5000
CKCL Truro, N.S.	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
WYLD New Orleans, La.	1000
WFST Caribou, Maine	5000
WCAD Baltimore, Md.	5000
WTAC Flint, Mich.	1000
KGEZ Kalispell, Mont.	2000
WSJS Winston-Salem, N.C.	5000
KSJB Jamestown, N.D.	5000

Kc.	Wave Length	W.P.
WFRM	Coudersport, Pa.	1000
WAEL	Mayaguez, P.R.	1000
WREC	Memphis, Tenn.	5000
KROD	El Paso, Tex.	5000
KERB	Kermit, Tex.	1000
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.	500
KUAM	Agana, Guam	1000
KESE	Iowa Falls, Iowa	250
WRUS	Russellville, Ky.	500
KOAL	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.	5000
WSUN	St. Petersburg, Fla.	5000
WTRP	LaGrange, Ga.	1000
KWAL	Wallace, Idaho	1000
KMNS	Sioux City, Iowa	1000
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
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
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.	1000
WJDB	Thomasville, Ala.	1000
KJNO	Juneau, Alaska	1000
KVMA	Magnolia, Ark.	1000
KIDD	Monterey, Calif.	1000
KVOD	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.	1000
WMFD	Wilmington, N.C.	1000
WEJL	Scranton, Pa.	500
WPRO	Providence, R.I.	5000
KGFX	Pierre, S.Dak.	250
KPOA	Honolulu, T.H.	5000
KMAC	San Antonio Tex.	5000
KGDN	Edmunds, Wash.	1000
KZUN	Opportunity, Wash.	500

640—468.5

CBN	St. John's, N.F.	10000
KFI	Los Angeles, Calif.	50000
WOI	Ames, Iowa	5000
WHKK	Akron, Ohio	1000
WNAD	Norman, Okla.	1000

650—461.3

WSM	Nashville, Tenn.	50000
KRCT	Baytown, Texas	250

660—454.3

KFAR	Fairbanks, Alaska	10000
KOWH	Omaha, Nebr.	500
WRCA	New York, N.Y.	50000
WESC	Greenville, S.C.	5000
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.	5000
CKGB	Timmins, Ont.	5000
KNBC	San Fran., Calif.	50000
WPIN	St. Petersburg, Fla.	1000
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.	250
WPTF	Raleigh, N.C.	50000
WISR	Butler, Pa.	250
WAPA	San Juan, P.Rico	10000
WMPS	Memphis, Tenn.	10000
KENS	San Antonio, Tex.	50000
KOMW	Omak, Wash.	1000

690—434.5

CBU	Vancouver, B.C.	10000
CBF	Montreal, Que.	50000
WVOK	Birmingham, Ala.	50000
KVNA	Flagstaff, Ariz.	1000
KEVT	Tucson, Ariz.	250
KBBA	Benton, Ark.	250
WADS	Ansonia, Conn.	500
KBLI	Blackfoot, Idaho	1000
KGGF	Coffeyville, Kans.	10000
WTIX	New Orleans, La.	5000
KSTL	St. Louis, Mo.	1000
KRCO	Prineville, Oreg.	1000
KUSD	Vermillion, S.Dak.	1000
KULA	Honolulu, T.H.	10000
KHEY	El Paso, Tex.	10000
KPET	Lamesa, Tex.	250
KZEY	Tyler, Tex.	250
WCYB	Bristol, Va.	10000
WNNT	Warsaw, Va.	250
WELD	Fisher, W.Va.	500

700—428.3

WLW	Cincinnati, Ohio	50000

710—422.3

CJSP	Leamington, Ont.	250
CFRG	Gravelbourg, Sask.	5000
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.	1000
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.	250
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.	1000
KNBY	Newport, Ark.	1000
WKTG	Thomasville, Ga.	1000
KWGB	Goodland, Kans.	1000
WFMW	Madisonville, Ky.	250
WMTC	Vancleve, Ky.	1000
KTRY	Bastrop, La.	250
WARB	Covington, La.	250
WMMS	Bath, Maine	500
WACE	Chicopee, Mass.	1000
KWRE	Warrenton, Mo.	500
KWOA	Worthington, Minn.	1000
WDOS	Oneonta, N.Y.	500
WFMC	Goldsboro, N.C.	1000
WOHS	Shelby, N.C.	1000
WTLG	Bowling Green, Ohio	250
KBOY	Medford, Oreg.	1000
WHWL	Nanticoke, Pa.	1000
WPIT	Pittsburgh, Pa.	1000
WPAL	Charleston, S.C.	1000
WLIL	Lenoir, Tenn.	1000
KBCS	Grand Prairie, Tex.	500
KKOG	Ogden, Utah	1000
WPIK	Alexandria, Va.	1000
WMNA	Gretna, Va.	1000
KULE	Ephrata, Wash.	1000

740—405.2

CBXA	Edmonton, Alta.	250
CBL	Toronto, Ont.	50000
WBAM	Montgomery, Ala.	50000
KUEQ	Phoenix, Ariz.	1000
KBIG	Avalon, Calif.	10000
KCBS	San Francisco, Calif.	50000
KWBY	Colo. Sprgs., Colo.	250
KVFC	Cortez, Colo.	1000
WKIS	Orlando, Fla.	5000
KYME	Boise, Idaho	500

WVLN	Olney, Ill.	250
KBOE	Oskaloosa, Iowa	250
WNOP	Newport, Ky.	1000
WTAO	Cambridge, Mass.	250
KPBM	Carlsbad, N.Mex.	1000
WGSM	Huntington, N.Y.	1000
WMBL	Morehead City, N.C.	1000
WPAQ	Mount Airy, N.C.	10000
KRMG	Tulsa, Okla.	50000
WVCH	Chester, Pa.	1000
WIBS	Santurce, P.Rico	10000
WBAW	Barnwell, S.C.	500
WIRU	Humbolt, Tenn.	250
WJIG	Tullahoma, Tenn.	250
KTRH	Houston, Tex.	50000

750—399.8

WSB	Atlanta, Ga.	50000
WBMD	Baltimore, Md.	1000
KMMJ	Grand Island, Neb.	1000
WHEB	Portsmouth, N.H.	1000
KSEO	Durant, Okla.	250
KXL	Portland, Oreg.	10000
WPOX	Clarksburg, W.Va.	1000

760—394.5

KGU	Honolulu, Hawaii	10000
WJR	Detroit, Mich.	50000
WCPS	Tarboro, N.C.	1000

770—389.4

KUOM	Minneapolis, Minn.	5000
WCAL	Northfield, Minn.	5000
WEW	St. Louis, Mo.	1000
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.	1000
WBBO	Forest City, N.C.	1000
KSPI	Stillwater, Okla.	250
WARL	Arlington, Va.	1000

790—379.5

CBY	Corner Brook, N.F.	1000
CKMR	Newcastle, N.B.	1000
CKSO	Sudbury, Ont.	5000
WRBS	Tuscaloosa, Ala.	500
KCEE	Tucson, Ariz.	1000
KOSY	Texarkana, Ark.	1000
KDAN	Eureka, Calif.	5000
KABC	Los Angeles, Calif.	5000
WLBE	Leesburg, Fla.	1000
WPFA	Pensacola, Fla.	1000
WQXI	Atlanta, Ga.	5000
WGRA	Cairo, Ga.	1000
KXXX	Colby, Kans.	5000
WGRC	Louisville, Ky.	5000
WRUM	Rumford, Me.	1000
WSGW	Saginaw, Mich.	1000
KGHL	Billings, Mont.	5000
WWNY	Watertown, N.Y.	1000
WLSV	Wellsville, N.Y.	500
WTNC	Thomasville, N.C.	1000
WKLM	Wilmington, N.C.	500
KFGO	Fargo, N.Dak.	5000
KWIL	Albany, Oreg.	1000
WAEB	Allentown, Pa.	500
WPIC	Sharon, Pa.	1000
WEAN	Providence, R.I.	5000
WWBD	Bamberg, S.C.	1000
WETB	Johnson City, Tenn.	1000
WMC	Memphis, Tenn.	5000
KTHT	Houston, Tex.	5000
KFYO	Lubbock, Tex.	5000
WSIG	Mount Jackson, Va.	1000
WTAR	Norfolk, Va.	5000
KVOS	Bellingham, Wash.	1000
KNEW	Spokane, Wash.	5000
WEAU	Washington, Wis.	5000

800—374.8

CHAB	Moose Jaw, Sask.	5000
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.	1000
WMGY	Montgomery, Ala.	1000
KINY	Juneau, Alas.	5000
KAGH	Crossett, Ark.	250
KVOM	Morrilton, Ark.	250
KHIL	Brighton, Colo.	500
WLAD	Danbury, Conn.	250
WMBM	Miami Beach, Fla.	1000
WSUZ	Palatka, Fla.	1000
WJAT	Swainsboro, Ga.	1000
KXIC	Iowa City, Iowa	1000
WRUS	Russellville, Ky.	1000
WBOK	New Orleans, La.	1000
WCCM	Lawrence, Mass.	1000
KREI	Farmington, Mo.	1000
KDBM	Dillon, Mont.	1000
WKDN	Camden, N.J.	1000
KTOW	Okla. City, Okla.	250
KPDQ	Portland, Oreg.	1000
WCHA	Chambersburg, Pa.	1000

DZPI	Manila, P.I.	10000
WOSC	Dillon, S.C.	1000
WEAB	Greer, S.C.	250
WDEH	Sweetwater, Tenn.	1000
KODD	Dumas, Tex.	250
KBUH	Brigham City Utah	250
WSVS	Crewe, Va.	1000
WHTN	Huntington, W.Va.	1000
WDUX	Waupaca, Wis.	1000

810—370.2

KGO	San Francisco, Calif.	50000
WIPA	Annapolis, Md.	250
KCMO	Kansas City, Mo.	50000
WGY	Schenectady, N.Y.	50000
WKBC	N.Wilkesboro, N.C.	1000
WCEC	Rocky Mount, N.C.	1000
WEDO	McKeesport, Pa.	1000
WKVM	San Juan, P.R.	25000

820—365.6

WAIT	Chicago, Ill.	5000
WCBD	Chicago, Ill.	5000
WIKY	Evansville, Ind.	250
WOSU	Columbus, Ohio	5000
KIKI	Honolulu, Hawaii	250
WFAA	Dallas, Tex.	50000
WBAP	Ft. Worth, Tex.	50000

830—361.2

WCCO	Minneapolis, Minn.	50000
KBOA	Kennett, Mo.	1000
WNYC	New York, N.Y.	1000

840—356.9

WKAB	Mobile, Ala.	1000
WKNB	New Britain, Conn.	1000
WHAS	Louisville, Ky.	50000
WVPO	Stroudsburg, Pa.	250

850—352.7

CKVL	Verdun, Que.	10000
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.	5000
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.	250
WAMI	Opp, Ala.	1000
KIFN	Phoenix, Ariz.	1000
KOSE	Osceola, Ark.	1000
KWRF	Warren, Ark.	250
KTRB	Modesto, Calif.	10000
WKKO	Cocoa, Fla.	1000
WERD	Atlanta, Ga.	1000
WDMG	Douglas, Ga.	5000
WMRI	Marion, Ind.	250
KWPC	Muscatine, Iowa	250
KOAM	Pittsburg, Kans.	10000
WSON	Henderson, Ky.	500
WAYE	Dundalk, Md.	500
WSBS	Gt. Barrington, Mass.	250
KNUJ	New Ulm, Minn.	1000
WMAG	Forest, Miss.	500
WFMO	Fairmont, N.C.	1000
WAMO	Homestead, Pa.	250
WTEL	Philadelphia, Pa.	250
WLBG	Laurens, S.C.	250
WIVK	Knoxville, Tenn.	1000
WMTS	Murfreesboro, Tenn.	250
KFST	Ft. Stockton, Tex.	250
KPAN	Hereford, Tex.	250
KSFA	Nacogdoches, Tex.	1000
KONO	San Antonio, Tex.	5000
KWHO	Salt Lake City, Utah	1000
WEVA	Emporia, Va.	1000
WOAY	Oak Hill, W.Va.	10000
WFOX	Milwaukee, Wis.	250

870—344.6

KIEV	Glendale, Calif.	250
KAIM	Kaimuki, Hawaii	1000
WWL	New Orleans, La.	50000
WKAR	E. Lansing, Mich.	5000
WHCU	Ithaca, N.Y.	1000
WGTL	Kannapolis, N.C.	1000
KJIM	Ft. Worth, Tex.	250
WFLO	Farmville, Va.	1000

880—340.7

WCBS	New York, N.Y.	50000
WRRZ	Clinton, N.C.	1000
WRFD	Worthington, Ohio	5000

890—336.9

WLS	Chicago, Ill.	50000
WHNC	Henderson, N.C.	1000
KBYE	Okla. City, Okla.	1000

Kc. Wave Length W.P.

900—333.1

CHLT	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
WLBS	Birmingham, Ala.	1000
WOZK	Ozark, Ala.	1000
KFRB	Fairbanks, Alaska	10000
KHOZ	Harrison, Ark.	250
KBIF	Centerville, Calif.	1000
WJWL	Georgetown, Del.	1000
WSWN	Belle Glade, Fla.	1000
WMOP	Ocala, Fla.	1000
WCGA	Calhoun, Ga.	1000
WCRY	Macon, Ga.	250
WJIV	Savannah, Ga.	1000
WKYW	Louisville, Ky.	1000
WLSI	Pikeville, Ky.	1000
KREH	Oakdale, La.	250
WCME	Brunswick, Maine	500
WATC	Gaylord, Mich.	1000
KTIS	Minneapolis, Minn.	1000
WDDT	Greenville, Miss.	1000
KFAL	Fulton, Mo.	1000
KJSK	Columbus, Nebr.	1000
WOTW	Nashua, N.H.	1000
WBRV	Boonville, N.Y.	500
WSPN	Saratoga Sprgs., N.Y.	250
WAYN	Rockingham, N.C.	1000
WIAM	Williamston, N.C.	1000
KFNW	Fargo, N.Dak.	1000
WAND	Canton, Ohio	500
WFRD	Fremont, Ohio	500
KLAD	Klamath Falls, Oreg.	1000
WCPA	Clearfield, Pa.	1000
WKXV	Knoxville, Tenn.	1000
WCOR	Lebanon, Tenn.	250
KALT	Atlanta, Tex.	1000
KMCO	Conroe, Tex.	500
KFLD	Floydada, Tex.	250
KCLW	Hamilton, Tex.	250
WAFC	Staunton, Va.	1000
WATK	Antigo, Wis.	250

910—329.5

CKLY	Lindsay, Ont.	1000
CBD	Ottawa, Ont.	5000
CFJC	Kamloops, B.C.	1000
CHRL	Roberval, Que.	1000
KPHO	Phoenix, Ariz.	5000
KLCN	Blytheville, Ark.	5000
KAMD	Camden, Ark.	1000
KBAB	El Cajon, Calif.	1000
KLX	Oakland, Calif.	5000
KOXR	Oxnard, Calif.	1000
KPOF	nr. Denver, Colo.	5000
WHAY	New Britain, Conn.	5000
WPLA	Plant City, Fla.	1000
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.	1000
KBIM	Roswell, N.Mex.	5000
WLAS	Jacksonville, N.C.	1000
KCJB	Minot, N.Dak.	1000
WPFB	Middletown, Ohio	1000
KGLC	Miami, Okla.	1000
WAVL	Apollo, Pa.	1000
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	500
KRIO	McAllen, Tex.	1000
KRRV	Sherman, Tex.	1000
KALL	Salt Lake City, Utah	1000
WRNL	Richmond, Va.	5000
WHYE	Roanoke, Va.	1000
KORD	Pasco, Wash.	1000
KLAN	Renton, Wash.	1000
KVAN	Vancouver, Wash.	1000
WHSM	Hayward, Wis.	1000
WDOR	Sturgeon Bay, Wis.	500

920—325.9

CJCH	Halifax, N.S.	5000
CKNX	Wingham, Ont.	2500
WCTA	Adalusia, Ala.	5000
WWWR	Russellville, Ala.	1000
KARK	Little Rock, Ark.	5000
KDES	Palm Springs, Calif.	500
KVEC	San Luis Obispo, Cal.	1000
KIUP	Durango, Colo.	5000
KREX	Grd. Junc., Colo.	5000
KLMR	Lamar, Colo.	1000
WMEG	Eau Gallie, Fla.	1000
WGST	Atlanta, Ga.	5000
KAHU	Waiphau, Hawaii	1000
WMOK	Metropolis, Ill.	1000
WBAA	W. Lafayette, Ind.	5000
KFNF	Shenandoah, Iowa	1000
WTCW	Whitesburg, Ky.	1000
WHXY	Bogalusa, La.	1000
WPTX	Lexington Pk., Md.	500
WMPL	Hancock, Mich.	1000
KDHL	Faribault, Minn.	1000
KWAD	Wadena, Minn.	1000
KRAM	Las Vegas, Nev.	1000
KOLO	Reno, Nev.	1000
KQUE	Albuquerque, N.Mex.	1000
WTTM	Trenton, N.J.	1000
WKRT	Cortland, N.Y.	1000
WSKN	Saugerties, N.Y.	1000
WBBB	Burlington, N.C.	5000
KGAL	Lebanon, Oreg.	1000
WKVA	Lewiston, Pa.	1000
WJAR	Providence, R.I.	5000
WTND	Orangeburg, S.C.	1000
WLIV	Livingston, Tenn.	1000
KELP	El Paso, Tex.	1000
KECK	Odessa, Tex.	1000
KTLW	Texas City, Tex.	1000
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.	5000
WETO	Gadsden, Ala.	1000
KTKN	Ketchikan, Alaska	1000
KAPR	Douglas, Ariz.	1000
KHJ	Los Angeles, Calif.	5000
KIUP	Durango, Colo.	5000
WKSB	Milford, Del.	500
WJAX	Jacksonville, Fla.	5000
WKXY	Sarasota, Fla.	1000
WMGR	Bainbridge, Ga.	5000
KSEI	Pocatello, Idaho	5000
WTAD	Quincy, Ill.	5000
WKCT	Bowling Green, Ky.	1000
WFMD	Frederick, Md.	1000
WREB	Holyoke, Mass.	500
WBCK	Battle Creek, Mich.	1000
WSLI	Jackson, Miss.	5000
KWOC	Poplar Bluff, Mo.	1000
KOGA	Ogallala, Nebr.	500
WWNH	Rochester, N.H.	5000
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.	1000
KSDN	Aberdeen, S.D.	1000
WSEV	Sevierville, Tenn.	5000
KDET	Center, Tex.	1000
KITE	San Antonio, Tex.	1000
WSAZ	Huntington, W.Va.	5000
WLBL	Auburndale, Wis.	5000

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
WTPS	New Orleans, La.	1000
WSEA	Charleroi, Pa.	250
WIPR	San Juan, P.R.	10000
KLYN	Amarillo, Tex.	1000

950—315.6

CKNB	Campbellton, N.B.	1000
WRMA	Montgomery, Ala.	1000
KXJK	Forrest City, Ark.	5000
KFSA	Ft. Smith, Ark.	1000
KAHI	Auburn, Calif.	500
KIMN	Denver, Colo.	5000
WFBS	Ft. Walton Bch., Fla.	1000
WLOF	Orlando, Fla.	5000
WGTA	Summerville, Ga.	1000
WGOV	Valdosta, Ga.	5000
KBOI	Boise, Idaho	5000
WAAF	Chicago, Ill.	1000
WXLW	Indianapolis, Ind.	5000
KOEL	Oelwein, Iowa	1000
KJRG	Newton, Kans.	500
WBVL	Barbourville, Ky.	1000
WORL	Boston, Mass.	5000
WWJ	Detroit, Mich.	5000
WBKH	Hattiesburg, Miss.	5000
KLIK	Jefferson City, Mo.	5000
WBBF	Rochester, N.Y.	1000
WIBX	Utica, N.Y.	5000
WPET	Greensboro, N.C.	500
WNCC	Barnesboro, Pa.	500
WPEN	Philadelphia, Pa.	5000
WSPA	Spartanburg, S.C.	5000
KWAT	Watertown, S.Dak.	1000
WAGG	Franklin, Tenn.	1000
KDSX	Denison, Tex.	500
KPRC	Houston, Tex.	5000
KSEL	Lubbock, Tex.	1000
WXGI	Richmond, Va.	1000
KJR	Seattle, Wash.	5000
WKAZ	Charleston, W.Va.	5000
WSHE	Sheboygan, Wis.	500

960—312.3

CFAC	Calgary, Alta.	5000
CHNS	Halifax, N.S.	5000
CKWS	Kingston, Ont.	5000
WBRC	Birmingham, Ala.	5000
WMOZ	Mobile, Ala.	1000
KDDL	Phoenix, Ariz.	5000
KAVR	Apple Valley, Calif.	5000
KROW	Oakland, Calif.	1000
WELI	New Haven, Conn.	5000
WJCM	Sebring, Fla.	1000
WRFC	Athens, Ga.	5000
WSBT	South Bend, Ind.	5000
KMA	Shenandoah, Iowa	5000
WPRT	Prestonsburg, Ky.	1000
KROF	Abbeville, La.	1000
WBOC	Salisbury, Md.	5000
WHAK	Rogers City, Mich.	5000
KLTF	Little Falls, Minn.	500
WABG	Greenwood, Miss.	1000
KFVS	Cape Girardeau, Mo.	1000
KNEB	Scottsbluff, Nebr.	1000
KWYK	Farmington, N.Mex.	1000
WEAV	Plattsburg, N.Y.	5000
WFTC	Kinston, N.C.	5000
WWST	Wooster, Ohio	1000
KGWA	Enid, Okla.	1000
WHYL	Carlisle, Pa.	1000
WADP	Kane, Pa.	500
WATS	Sayre, Pa.	1000
WBEU	Beaufort, S.C.	1000
WBMC	McMinnville, Tenn.	500
KIMP	Mt. Pleasant, Tex.	1000
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.	5000
WTBF	Troy, Ala.	5000
KNEA	Jonesboro, Ark.	1000
KBIS	Bakersfield, Calif.	1000
KCHV	Coachella, Calif.	1000
KBEE	Modesto, Calif.	1000
KFEL	Pueblo, Colo.	1000
WFLA	Tampa, Fla.	5000
WIIN	Decatur, Ga.	1000
WVOP	Vidalia, Ga.	5000
KHBC	Hilo, Hawaii	1000
KAYT	Rupert, Idaho	1000
WMAY	Springfield, Ill.	1000
WAVE	Louisville, Ky.	5000
KSYL	Alexandria, La.	1000
WCSH	Portland, Maine	5000
WAMD	Aberdeen, Md.	500
WESO	Southbridge, Mass.	1000
WKHM	Jackson, Mich.	1000
KOOK	Billings, Mont.	5000
KJLT	No. Platte, Nebr.	5000
WNTA	Newark, N.J.	5000
WEBR	Buffalo, N.Y.	5000
WCHN	Norwich, N.Y.	500
WRCS	Ahoskie, N.C.	1000
WWIT	Canton, N.C.	1000
WDAY	Fargo, N.Dak.	5000
WICA	Ashtabula, Ohio	5000
WATH	Athens, Ohio	1000
KAKC	Tulsa, Okla.	1000
KOIN	Portland, Oreg.	5000
WWSW	Pittsburgh, Pa.	5000
WJMX	Florence, S.C.	5000
KNOK	Ft. Worth, Tex.	1000
KREM	Spokane, Wash.	5000
WWYO	Pineville, W.Va.	1000
WHA	Madison, Wis.	5000

980—305.9

CFPL	London, Ont.	5000
CBV	Quebec, Que.	5000
CHEX	Peterboro, Ont.	5000
CKRM	Regina, Sask.	5000
WKLF	Clanton, Ala.	1000
KINS	Eureka, Calif.	5000
KEAP	Fresno, Calif.	500
KFWB	Los Angeles, Calif.	5000
KGLN	Glenwood Sprgs., Colo.	1000
WRC	Washington, D.C.	5000
WDVH	Gainesville, Fla.	5000
WBOP	Pensacola, Fla.	500
WKLY	Hartwell, Ga.	1000
WBBN	Perry, Ga.	500
KUPI	Idaho Falls, Idaho	1000
WITY	Danville, Ill.	1000
KZEA	Shreveport, La.	5000
WCAP	Lowell, Mass.	1000
WPBC	Minneapolis, Minn.	1000
WAPF	McComb, Miss.	1000
KMBC	Kansas City, Mo.	5000
KSGM	Ste. Genevieve, Mo.	500
KOFI	Kalispell, Mont.	1000
KICA	Clovis, N.Mex.	1000
KMIN	Grants, N.Mex.	1000
WTRY	Troy, N.Y.	5000
WKLM	Wilmington, N.C.	5000
WAAA	Win.-Salem, N.C.	1000
WONE	Dayton, Ohio	5000
WILK	Wilkes-Barre, Pa.	5000
KDSJ	Deadwood, S.Dak.	1000
WSIX	Nashville, Tenn.	5000
KFRD	Rosenberg, Tex.	1000
KSVC	Richfield, Utah	1000
WFHG	Bristol, Va.	5000
KUTI	Yakima, Wash.	1000
WPRE	Prairie du Chien, Wis.	500
WCUB	Manitowoc, Wis.	1000

990—302.8

CBW	Winnipeg, Man.	50000
CBY	Grand Falls, N.F.	1000
WWWF	Fayette, Ala.	1000
WTCB	Flomaton, Ala.	500
KTKT	Tucson, Ariz.	10000
KATT	Pittsburg, Calif.	5000
KLIR	Denver, Colo.	1000
WBZY	Torrington, Conn.	1000
WHOO	Orlando, Fla.	10000
WDWD	Dawson, Ga.	1000
WCAZ	Carthage, Ill.	1000
WITZ	Jasper, Ind.	1000
KAYL	Storm Lake, Iowa	250
KRSL	Russell, Kans.	250
WJMR	New Orleans, La.	250
KCLP	Rayville, La.	250
WABO	Waynesboro, Miss.	250
KRMO	Monett, Mo.	250
KSVP	Artesia, N.Mex.	1000
WEEB	Southern Pines, N.C.	1000
WJEH	Gallipolis, Ohio	1000
WTIG	Massillon, Ohio	250
WIBG	Philadelphia, Pa.	10000
WVSC	Somerset, Pa.	250
WPRA	Mayaguez, P.R.	10000
WAKN	Aiken, S.C.	1000
WNOX	Knoxville, Tenn.	10000
KWEM	Memphis, Tenn.	1000
KTRM	Beaumont, Tex.	1000
KAML	Kenedy, Tex.	250
KSYD	Wichita Falls, Tex.	10000
KTUT	Tooele, Utah	1000
WNRV	Narrows, Va.	1000
WANT	Richmond, Va.	1000
WKLJ	Sparta, Wis.	250

1000—299.8

CKBW	Bridgewater, N.S.	1000
WCFL	Chicago, Ill.	50000
KTOK	Okla. City, Okla.	5000
KSTA	Coleman, Tex.	250
KGRI	Henderson, Tex.	250
WHWB	Rutland, Vt.	1000
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.	10000
WCNU	Crestview, Fla.	1000
WZRO	Jacksonville Beach, Florida	1000
WEAS	Decatur, Ga.	50000
WCSI	Columbus, Ind.	500
KSMN	Mason City, Iowa	1000
KIND	Independence, Kans.	250
KDLA	DeRidder, La.	1000
WSID	Baltimore, Md.	1000
KCHI	Chillicothe, Mo.	250
KJCF	Festus, Mo.	250
KRVN	Lexington, Nebr.	25000
KLAS	Las Vegas, Nev.	5000
WABZ	Albermarle, N.C.	1000
WELS	Kinston, N.C.	1000
WITT	Lewisburg, Pa.	250
WHIN	Gallatin, Tenn.	1000
WORM	Savannah, Tenn.	250
KAMQ	Amarillo, Tex.	5000
KMLW	Marlin, Tex.	250
WELK	Charlottesville, Va.	1000
WMEV	Marion, Va.	1000
WSPT	Stevens Pt., Wis.	250

1020—293.9

KPOP	Los Angeles, Calif.	5000
WCIL	Carbondale, Ill.	1000
WPEO	Peoria, Ill.	1000
KDKA	Pittsburgh, Pa.	50000

1030—291.1

WBZ	Boston, Mass.	50000
WBZA	Springfield, Mass.	1000
KATR	Corpus Christi, Tex.	50000

1040—288.3

KHVH	Honolulu, Hawaii	5000
WHO	Des Moines, Iowa	50000
KIXL	Dallas, Tex.	1000
WIVI	Christiansted, V.I.	250

1050—285.5

CFAM	Altona, Man.	5000
CFGP	Grand Prairie, Alta.	10000
CKDM	Dauphin, Man.	1000
CJIC	Sault Ste. Marie, Ont.	250
CHUM	Toronto, Ont.	2500
WRFS	Alexander City, Ala.	1000
WCRI	Scottsboro, Ala.	250
KVWM	Show Low, Ariz.	250
KVLC	Little Rock, Ark.	1000
KOFY	San Mateo, Calif.	1000
KWSO	Wasco, Calif.	1000
KLMD	Longmont, Colo.	250
WJSB	Crestview, Fla.	1000
WIVY	Jacksonville, Fla.	1000
WHBO	Tampa, Fla.	250
WRMF	Titusville, Fla.	500
WJAZ	Albany, Ga.	1000
WAUG	Augusta, Ga.	1000

Kc. Wave Length W.P.

(1050—285.5)

WBIE Marietta, Ga. 500
KZIN Coeur D'Alene, Idaho 250
WDZ Decatur, Ill. 1000
KNCO Garden City, Kans. 1000
WZIP Covington, Ky. 250
WKTM Mayfield, Ky. 1000
KLPL Lake Providence, La. 250
KOKA Shreveport, La. 250
WGAY Silver Sprg., Md. 1000
WPAG Ann Arbor, Mich. 1000
KLOH Pipestone, Minn. 1000
WACR Columbus, Miss. 1000
KSIS Sedalia, Mo. 1000
KRBO Las Vegas, Nev. 500
WBNC Conway, N.H. 1000
WMGM New York, N.Y. 50000
WFSC Franklin, N.C. 500
WLON Lincolnton, N.C. 1000
WWGP Sanford, N.C. 1000
KCCO Lawton, Okla. 250
KFMJ Tulsa, Okla. 1000
KUBE Pendleton, Oreg. 1000
KEED Springfield, Oreg. 1000
WBUT Butler, Pa. 250
WLYC Williamsport, Pa. 1000
WSMT Sparta, Tenn. 1000
KLEN Killeen, Tex. 250
WBRG Lynchburg, Va. 1000
WCMS Norfolk, Va. 1000
KNBX Kirkland, Wash. 1000
WCEF Parkersburg, W.Va. 1000
WECL Eau Claire, Wis. 1000
WLIP Kenosha, Wis. 250
KWIV Douglas, Wyo. 250

1060—282.8

CFCN Calgary, Alta. 10000
KPAY Chico, Calif. 10000
WNOE New Orleans, La. 50000
WHFB Benton Harbor, Mich. 1000
WMAP Monroe, N.C. 250
WCMW Canton, Ohio 1000
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. 1000
WIBC Indianapolis, Ind. 50000
KFBI Wichita, Kans. 10000
KHMO Hannibal, Mo. 5000
WHPE High Point, N.C. 1000
WEWO Laurinburg, N.C. 1000
WDIA Memphis, Tenn. 50000
KOPY Alice, Tex. 1000
WKOW Madison, Wis. 10000

1080—277.6

CHED Edmonton, Alta. 1000
KSCO Santa Cruz, Calif. 1000
WTIC Hartford, Conn. 50000
WKLO Louisville, Ky. 5000
WOAP Owosso, Mich. 250
WINE Kenmore, N.Y. 1000
KWJJ Portland, Oreg. 10000
WEEP Pittsburgh, Pa. 1000
KRLD Dallas, Tex. 50000

1090—275.1

CFJB Brampton, Ont. 250
CHRS St. Jean, Que. 1000
KTHS Little Rock, Ark. 50000
WCRA Effingham, Ill. 250
KNWS Waterloo, Iowa 1000
WBAL Baltimore, Md. 50000
WILO Boston, Mass. 1000
WMUS Muskegon, Mich. 1000
KING Seattle, Wash. 50000

1100—272.6

KJBS San Francisco, Calif. 1000
WLBB Carrollton, Ga. 250
WHLI Hempstead, N.Y. 250
KYW Cleveland, Ohio 50000
WGPA Bethlehem, Pa. 250

1110—270.1

CFTJ Galt, Ont. 250
KXLA Pasadena, Calif. 10000
WALT Tampa, Fla. 10000
WMBI Chicago, Ill. 5000
KFAB Omaha, Nebr. 50000
WBT Charlotte, N.C. 50000
KBND Bend, Oreg. 5000
WNAR Norristown, Pa. 500
WVJP Caguas, P.R. 250
WHIM Providence, R.I. 1000
KIPA Hilo, T.Hawaii 1000

1120—267.7

WUST Bethesda, Md. 250
KMOX St. Louis, Mo. 50000
WWOL Buffalo, N.Y. 1000
KCLE Cleburne, Tex. 250

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. 1000
KLPR Oklahoma City, Okla. 1000
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. 1000
WGEA Geneva, Ala. 1000
WJRD Tuscaloosa, Ala. 5000
KCKY Coolidge, Ariz. 1000
KXLR Little Rock, Ark. 5000
KFSG Los Angeles, Calif. 2500
KRKD Los Angeles, Calif. 5000
KGMC Englewood, Colo. 1000
WCNX Middletown, Conn. 500
WDEL Wilmington, Del. 5000
WNDB Daytona Bch., Fla. 1000
WTMP Tampa, Fla. 1000
WFPM Fort Valley, Ga. 1000
WJEM Valdosta, Ga. 1000
KANI Oahu, Hawaii 1000
WGGH Marion, Ill. 5000
KWDM Des Moines, Iowa 1000
KSAL Salina, Kans. 5000
WMST Mt. Sterling, Ky. 500
WLOC Mumfordville, Ky. 1000
WJBO Baton Rouge, La. 5000
WGHM Skowhegan, Maine 1000
WCOP Boston, Mass. 5000
WCEN Mt. Pleasant, Mich. 1000
KASM Albany, Minn. 500
KRMS Osage Beach, Mo. 1000
KIYI Shelby, Mont. 1000
KDEF Albuquerque, N.Mex. 1000
WRUN Utica, N.Y. 5000
WFNS Burlington, N.C. 1000
WGBR Goldsboro, N.C. 5000
WCUE Akron, Ohio 1000
WIMA Lima, Ohio 1000
KNED McAlester, Okla. 1000
KFJI Klamath Falls, Oreg. 5000
WHUN Huntingdon, Pa. 1000
WKPA New Kensington, Pa. 250
WORA Mayaguez, P.R. 1000
WRNO Orangeburg, S.C. 5000
WTYC Rock Hill, S.C. 1000
WSNW Seneca Township, South Carolina 1000
WAPO Chattanooga, Tenn. 5000
WCRK Morristown, Tenn. 1000
WTAW College Station, Tex. 1000
KCCT Corpus Christi, Tex. 1000
KJBC Midland, Tex. 1000
KOLJ Quanah, Tex. 500
KOFE Pullman, Wash. 1000
KAYO Seattle, Wash. 5000
KKEY Vancouver, Wash. 1000
WELC Welch, W.Va. 1000
WCHF Chippewa Falls, Wis. 5000
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. 5000
WLBH Mattoon, Ill. 250
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. 1000
WHAM Rochester, N.Y. 50000

1190—252.0

KGYW Vallejo, Calif. 250
WOWO Ft. Wayne, Ind. 50000
WANN Annapolis, Md. 1000
WKOX Fram'gham, Mass. 1000
WLIB New York, N.Y. 1000
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. 1000

WKNX Saginaw, Mich. 1000
WADE Wadesboro, N.C. 1000
WAVI Dayton, Ohio 250
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. 1000
KVSA McGehee, Ark. 1000
KIBE Palo Alto, Calif. 1000
KFSC Denver, Colo. 1000
WPEG Arlington, Fla. 250
WRWB Kissimmee, Fla. 250
WFEC Miami, Fla. 250
WCLB Camilla, Ga. 1000
WSFT Thomaston, Ga. 250
KWEI Weiser, Idaho 1000
WLPO LaSalle, Ill. 1000
WKRS Waukegan, Ill. 1000
WSLM Salem, Ind. 1000
KJAN Atlantic, Iowa 250
KOFO Ottawa, Kans. 250
WFKN Franklin, Ky. 250
KBCL Bossier City, La. 250
WSME Sanford, Maine 1000
WAHL Hastings, Mich. 250
WAVN Stillwater, Minn. 1000
WMDC Hazlehurst, Miss. 250
KBHM Branson, Mo. 250
KGMO Cape Girardeau, Mo. 250
KLPW Union, Mo. 250
WGNY Newburgh, N.Y. 1000
WKMT Kings Mtn., N.C. 1000
WREV Reidsville, N.C. 250
WENC Whiteville, N.C. 1000
WGAR Cleveland, Ohio 50000
KGYN Guymon, Okla. 1000
WJUN Mexico, Pa. 250
WRIB Providence, R.I. 1000
WALD Walterboro, S.C. 1000
KABR Aberdeen, S.Dak. 250
WFWL Camden, Tenn. 250
WCPH Etowah, Tenn. 1000
KTET Livingston, Tex. 250
KZEE Weatherford, Tex. 250
WLSD Big Stone Gap, Va. 1000
WFAX Falls Church, Va. 1000
KBAM Longview, Wash. 1000

1230—243.8

CFCW Camrose, Alta. 250
CFGR Gravelbourg, Sask. 250
CFYT Dawson City, Yukon T. 250
CKBB Barrie, Ont. 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
WIRB Enterprise, Ala. 250
WJBB Haleyville, Ala. 250
WBHP Huntsville, Ala. 250
WHTB Talladega, 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
KROG Redding, Calif. 250
KWG Stockton, Calif. 250
KEXO Grand Junc., Colo. 250
KLVC Leadville, Colo. 250
KDZA Pueblo, Colo. 250
KGEK Sterling, Colo. 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
KLCB 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
KVAS Astoria, Oreg. 250
KRNS Burns, Oreg. 250
KOOS Coos Bay, Oreg. 250
KGRO Gresham, Oreg. 100
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
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
KDLK Del Rio, Tex. 250
KNUZ Houston, Tex. 250
KERV Kerrville, Tex. 250
KLVT Levelland, Tex. 250
KOSF 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

Kc.	Wave Length	W.P.
CJRW	Summerside, P.E.I.	250
CKLN	Nelson, B.C.	250
CKLS	LaSarre, Que.	250
CKTS	Sherbrooke, 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
KRDO	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
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
KAPK	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.	250
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
KANI	Kailua, T. Hawaii	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
WRDV	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	Dakville, Ont.	1000
CKBL	Matane, Que.	5000
CKSB	St. Boniface, Man.	1000
WZOB	Ft. Payne, Ala.	1000
WETU	Wetumpka, Ala.	1000
KFAY	Fayetteville, Ark.	500
KGHI	Little Rock, Ark.	1000
KHOT	Madera, Calif.	500
KTMS	Santa Barbara, Calif.	1000
KGOL	Golden, Colo.	1000
WNER	Live Oak, Fla.	1000
WDAE	Tampa, Fla.	5000
WMGE	Madison, Ga.	1000
WIZZ	Streator, Ill.	500
WGL	Ft. Wayne, Ind.	1000
WRAY	Princeton, Ind.	1000
KFKU	Lawrence, Kans.	5000
WREN	Topeka, Kans.	5000
WARE	Ware, Mass.	1000
WWBC	Bay City, Mich.	1000
KGDE	Fergus Falls, Minn.	1000
KCUE	Red Wing, Minn.	1000
WHNY	McComb, Miss.	5000
KVLV	Fallon, Nev.	1000
WMTR	Morristown, N.J.	1000
WIPS	Ticonderoga, N.Y.	1000
WBRM	Marion, N.C.	1000
WCHO	Washington Court House, Ohio	500
WPEL	Montrose, Pa.	1000
WCAE	Pittsburgh, Pa.	5000
WNOW	York, Pa.	1000
WTMA	Charleston, S.C.	5000
WKBL	Covington, Tenn.	1000
KFTX	Paris, Tex.	500
KPAC	Port Arthur, Tex.	5000
KEXX	San Antonio, Tex.	500
KSML	Seminole, Tex.	1000
KVEL	Vernal, Utah	1000
WDVA	Danville, Va.	5000
WYSR	Franklin, Va.	1000
WNRG	Grundy, Va.	1000
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.	1000
KPIN	Casa Grande, Ariz.	1000
KGIL	San Fernando, Calif.	1000
KYA	San Francisco, Calif.	5000
WWDC	Washington, D.C.	5000
WFTW	Fort Walton, Fla.	1000
WMMA	Miami, Fla.	5000
WWPF	Palatka, Fla.	1000
WHAB	Baxley, Ga.	5000
WTJH	East Point, Ga.	5000
WIBV	Belleville, Ill.	1000
WFBM	Indianapolis, Ind.	5000
KFGQ	Boone, Iowa	250
KWHK	Hutchinson, Kans.	1000
WXOK	Baton Rouge, La.	1000
WEZE	Boston, Mass.	5000
WALM	Albion, Mich.	1000
WJBL	Holland, Mich.	500
KROX	Crookston, Minn.	1000
KDUZ	Hutchinson, Minn.	1000
WGVM	Greenville, Miss.	1000
WNSL	Laurel, Miss.	1000
KGBX	Springfield, Mo.	5000
WBUD	Trenton, N.J.	5000
KVSF	Santa Fe, N.Mex.	1000
WNDR	Syracuse, N.Y.	5000
WGWR	Asheboro, N.C.	1000
WCDJ	Edenton, N.C.	1000
WDOK	Cleveland, Ohio	5000
WNXT	Portsmouth, Ohio	5000
KWSH	Wewoka-Seminole, Oklahoma	1000
KMCM	McMinnville, Oreg.	1000
WERC	Erie, Pa.	5000
WPHB	Philipsburg, Pa.	1000
WISO	Ponce, P.R.	1000
WMUU	Greenville, S.C.	1000
WJOT	Lake City, S.C.	1000
KWYR	Winner, S.Dak.	5000
WMFS	Chattanooga, Tenn.	1000
WMCH	Church Hill, Tenn.	1000
WDKN	Dickson, Tenn.	1000
WCLC	Jamestown, Tenn.	1000
KSPL	Diboll, Tex.	1000
KBLP	Falfurrias, Tex.	500
KWFR	San Angelo, Tex.	1000
KTUE	Tulia, Tex.	1000
KTAE	Taylor, Tex.	1000
WCHV	Charlottesville, Va.	5000
WBCR	Christiansburg, Va.	1000
KWIQ	Moses Lake, Wash.	1000
WVVW	Grafton, W.Va.	500
WEKZ	Monroe, Wis.	1000
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	1000
WAIP	Prichard, Ala.	1000
KBYR	Anchorage, Alaska	1000
KDJI	Holbrook, Ariz.	1000
KCOK	Tulare, Calif.	1000
WNOG	Naples, Fla.	500
WHIY	Orlando, Fla.	5000
WTAL	Tallahassee, Fla.	5000
WGBA	Columbus, Ga.	5000
WJJC	Commerce, Ga.	1000
KTFI	Twin Falls, Idaho	5000
WEIC	Charleston, Ill.	1000
WHBF	Rock Island, Ill.	5000
WCMR	Elkhart, Ind.	500
WWCA	Gary, Ind.	1000
WORX	Madison, Ind.	1000
KSCB	Liberal, Kans.	1000
WAIN	Columbia, Ky.	1000
WFUL	Fulton, Ky.	1000
KVCL	Winnfield, La.	1000
WSPR	Springfield, Mass.	1000
WXYZ	Detroit, Mich.	5000
KWEB	Rochester, Minn.	500
WLSM	Louisville, Miss.	1000
KUSN	St. Joseph, Mo.	1000
WTSN	Dover, N.H.	5000
KRAC	Alamogordo, N.Mex.	1000
WHLD	Niagara Falls, N.Y.	5000
WDLA	Walton, N.Y.	1000
WCGC	Belmont, N.C.	1000
WMPM	Smithfield, N.C.	1000
KBOM	Mandan, N.Dak.	1000
WILE	Cambridge, Ohio	1000
KWPR	Claremore, Okla.	500
KAJO	Grants Pass, Oreg.	1000
WLBR	Lebanon, Pa.	1000
WBHC	Hampton, S.C.	1000
KIHO	Sioux Falls, S.Dak.	1000
WLIK	Newport, Tenn.	5000
KIOX	Bay City, Tex.	1000
KHEM	Big Spring, Tex.	1000
KEPS	Eagle Pass, Tex.	1000
KFJZ	Fort Worth, Tex.	5000
WYUO	Newport, News, Va.	1000
KCVL	Colville, Wash.	1000
WKYR	Keyser, W.Va.	5000

1280—234.2

CHED	Edmonton, Alta.	10000
CJMS	Montreal, Que.	5000
CKCV	Quebec, Que.	5000
WPID	Piedmont, Ala.	1000
WNPT	Tuscaloosa, Ala.	5000
KHEP	Phoenix, Ariz.	1000
KFOX	Long Beach, Calif.	1000
KJOY	Stockton, Calif.	1000
KTLN	Denver, Colo.	5000
WSUX	Seaford, Del.	1000
WDSP	DeFuniak Sprgs., Fla.	5000
WQIK	Jacksonville, Fla.	1000
WIPC	Lake Wales, Fla.	1000
WIBB	Macon, Ga.	1000
WMRO	Aurora, Ill.	250
WGBF	Evansville, Ind.	5000
KCOB	Newton, Iowa	1000
KSOK	Arkansas City, Kans.	1000
WDSU	New Orleans, La.	5000
WEIM	Fitchburg, Mass.	5000
WFYC	Alma, Mich.	1000
WTCN	Minneapolis, Minn.	5000
KVOX	Moorhead, Minn.	1000
WSJC	Magee, Miss.	500
KDKD	Clinton, Mo.	1000
KCNI	Broken Bow, Nebr.	1000
KTOO	Henderson, Nev.	5000
WHBI	Newark, N.J.	2500
KHOB	Hobbs, N.Mex.	1000
WOV	New York, N.Y.	5000
WVET	Rochester, N.Y.	5000
WRSA	Saratoga Sprgs., N.Y.	1000
WSAT	Salisbury, N.C.	1000
WONW	Defiance, Ohio	500
WLMJ	Jackson, Ohio	1000
KLCO	Poteau, Okla.	1000
KERG	Eugene, Oreg.	5000
WBRX	Berwick, Pa.	500
WHVR	Hanover, Pa.	5000
WKST	New Castle, Pa.	5000
WCMN	Arecibo, P.R.	1000
WANS	Anderson, S.C.	1000
WJAY	Mullins, S.C.	1000
WJGD	Columbia, Tenn.	1000
KNIT	Abilene, Tex.	500
KWHI	Brenham, Tex.	1000
KLTI	Longview, Tex.	1000
KNAK	Salt Lake City, Utah	5000
WYVE	Wytheville, Va.	1000
KIT	Yakima, Wash.	5000
WMNF	Richwood, W.Va.	1000
WNAM	Neenah, Wis.	1000

1290—232.4

CKSL	London, Ont.	5000
WPBB	Jackson, Ala.	1000
WMLS	Sylacauga, Ala.	1000
KVOA	Tucson, Ariz.	1000
KDMS	El Dorado, Ark.	5000
KUOA	Siloam Sprgs., Ark.	5000
KHSL	Chico, Calif.	5000
KPER	Gilroy, Calif.	500
KITO	San Bernardino, Calif.	5000
WCCC	Hartford, Conn.	500
WTUX	Wilmington, Del.	1000
WTMC	Ocala, Fla.	5000
WIRK	W. Palm Bch., Fla.	5000
WDEC	Americus, Ga.	1000
WCHK	Canton, Ga.	1000
WTOC	Savannah, Ga.	5000
KYTE	Pocatello, Idaho	1000
WIRL	Peoria, Ill.	5000
WCBL	Benton, Ky.	1000
KJEF	Jennings, La.	1000
WHGR	Houghton Lake, Michigan	5000
WNIL	Niles, Mich.	500
WOIA	Saline, Mich.	1290
KBMO	Benson, Minn.	500
WBLE	Batesville, Miss.	1000
KALM	Thayer, Mo.	1000
KGVO	Missoula, Mont.	5000
KOIL	Omaha, Nebr.	5000
WKNE	Keene, N.H.	5000
WNBF	Binghamton, N.Y.	5000
WHKY	Hickory, N.C.	5000
WEYE	Sanford, N.C.	1000
WTRX	Bellaire, Ohio	1000
WHIO	Dayton, Ohio	5000
KUMA	Pendleton, Oreg.	5000
KLIQ	Portland, Oreg.	1000
WTRN	Tyrone, Pa.	1000
WICE	Providence, R.I.	500
WFIG	Sumter, S.C.	1000
WOKE	Oak Ridge, Tenn.	1000
KIVY	Crockett, Tex.	500
KRGV	Weslaco, Tex.	5000
KTRN	Wichita Falls, Tex.	5000
WPVA	Colonial Hgts., Va.	5000
WAGE	Leesburg, Va.	1000
WYOW	Logan, W.Va.	5000
WMIL	Milwaukee, Wis.	1000
WCOW	Sparta, Wis.	1000

1300—230.6

CBAF	Moncton, N.B.	5000
CJRH	Richmond Hill, Ont.	500
WTLS	Tallassee, Ala.	1000
KWCB	Searcy, Ark.	1000
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.	1000
WMTM	Moultrie, Ga.	5000
WIMO	Winder, Ga.	1000
KOZE	Lewiston, Idaho	5000
WTAQ	LaGrange, Ill.	500
WFRX	W. Frankfort, Ill.	1000
WHLT	Huntington, Ind.	500
WMFT	Terre Haute, Ind.	500
KGLO	Mason City, Iowa	5000
WBLG	Lexington, Ky.	1000
WIBR	Baton Rouge, La.	1000
KLUE	Shreveport, La.	1000
WFBR	Baltimore, Md.	5000
WJDA	Quincy, Mass.	1000
WOOD	Grand Rap., Mich.	5000
WRBC	Jackson, Miss.	5000
KMMO	Marshall, Mo.	1000
KBRL	McCook, Nebr.	1000
WTNJ	Trenton, N.J.	250
WOSC	Fulton, N.Y.	1000
WGOL	Goldsboro, N.C.	1000
WSYD	Mt. Airy, N.C.	5000
WERE	Cleveland, Ohio	5000
WMVO	Mt. Vernon, Ohio	500
KOME	Tulsa, Okla.	5000
KRMW	The Dalles, Oreg.	1000
WTIL	Mayaguez, P.R.	1000
WCKI	Greer, S.C.	1000
KOLY	Mobridge, S.Dak.	1000
WMTN	Morristown, Tenn.	5000
WMAK	Nashville, Tenn.	5000
KVET	Austin, Tex.	1000
KTFY	Brownfield, Tex.	1000
KOL	Seattle, Wash.	5000
WCLG	Morgantown, W.Va.	1000
WKLC	St. Albans, W.Va.	1000

1310—228.9

CKOY	Dttawa, Ont.	5000
WHEP	Foley, Ala.	1000

Kc. Wave Length	W.P.
(1310—228.9)	
WJAM Marion, Ala.	5000
KBUZ Mesa, Ariz.	5000
KBOK Malvern, Ark.	1000
KWBR Oakland, Calif.	1000
KTKR Taft, Calif.	500
KFKA Greeley, Colo.	1000
WICH Norwich, Conn.	1000
WODO Deland, Fla.	5000
WAUC Wauchula, Fla.	500
WBRO Waynesboro, Ga.	1000
KLIX Twin Falls, Idaho	1000
WISH Indianapolis, Ind.	5000
KOKX Keokuk, Iowa	1000
WTTL Madisonville, Ky.	500
WDOC Prestonsburg, Ky.	5000
KIKS Sulphur, La.	500
KUZN W. Monroe, La.	1000
WLOB Portland, Maine	1000
WDRC Worcester, Mass.	1000
WKMH Dearborn, Mich.	5000
KRBI St. Peter, Minn.	1000
WXXX Hattiesburg, Miss.	1000
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.	1000
WTLB Utica, N.Y.	1000
WISE Asheville, N.C.	5000
WTIK Durham, N.C.	1000
KNDX Grand Forks, N.Dak.	5000
WFAH Alliance, Ohio	1000
KNPT Newport, Oreg.	1000
WBFD Bedford, Pa.	1000
WSGA Ephrata, Pa.	1000
WNAE Warren, Pa.	5000
WDKD Kingstree, S.C.	5000
WDOD Chattanooga, Tenn.	5000
WDXI Jackson, Tenn.	5000
KZIP Amarillo, Tex.	1000
WRR Dallas, Tex.	5000
KOYL Odessa, Tex.	500
WFCR Fairfax, Va.	500
WGH Newport News, Va.	5000
KARY Prosser, Wash.	1000
WIBA Madison, Wis.	5000

1320—227.1

CKNW New Westminster, British Columbia	5000
CJSD Sorel, P.Q.	1000
WAGF Dothan, Ala.	1000
WEZB Homewood, Ala.	1000
KWHN Fort Smith, Ark.	5000
KRLW Walnut Ridge, Ark.	1000
KSLR Oceanside, Calif.	500
KCRA Sacramento, Calif.	5000
KAVI Rocky Ford, Colo.	1000
WATR Waterbury, Conn.	1000
WGMA Hollywood, Fla.	1000
WJHP Jacksonville, Fla.	5000
WHIE Griffin, Ga.	1000
WNEG Toccoa, Ga.	1000
WKAN Kankakee, Ill.	1000
KLWN Lawrence, Kans.	500
WBRT Bardstown, Ky.	1000
WNGO Mayfield, Ky.	1000
KVHL Homer, La.	1000
WICO Salisbury, Md.	500
WARA Attleboro, Mass.	1000
WILS Lansing, Mich.	5000
WDMJ Marquette, Mich.	1000
WCPC Houston, Miss.	5000
WRJW Picayune, Miss.	5000
KXLW Clayton, Mo.	1000
KOLT Scottsbluff, Nebr.	5000
WWHG Hornell, N.Y.	5000
WCOG Greensboro, N.C.	5000
KQDY Minot, N.Dak.	1000
WHOK Lancaster, Ohio	500
KWOE Clinton, Okla.	1000
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.	5000
KVMC Colo. City, Tex.	1000
KXYZ Houston, Tex.	5000
KDYL Salt Lake City, Utah	5000
WLLY Richmond, Va.	1000
KXRO Aberdeen, Wash.	1000
KHIT Walla Walla, Wash.	1000

1330—225.4

CBH Halifax, N.S.	100
WROS Scottsboro, Ala.	1000
KMOP Tucson, Ariz.	500
KFAC Los Angeles, Calif.	5000
WARN Ft. Pierce, Fla.	1000
WYSE Lakeland, Fla.	1000
WEBY Milton, Fla.	1000
WMEN Tallahassee, Fla.	5000
WMLT Dublin, Ga.	1000
WEAW Evanston, Ill.	1000
WRAM Monmouth, Ill.	1000
WRRR Rockford, Ill.	1000
WJPS Evansville, Ind.	5000
KWWL Waterloo, Iowa	5000
KFH Wichita, Kans.	5000
WMOR Morehead, Ky.	1000
KVOL Lafayette, La.	1000
WASA Havre deGrace, Md.	1000
WCRB Waltham, Mass.	5000
WBBC Flint, Mich.	1000
WLOL Minneapolis, Minn.	5000
WCRR Corinth, Miss.	500
WJPR Greenville, Miss.	1000
WDAL Meridian, Miss.	1000
KUKU Willow Springs, Mo.	500
KGAK Gallup, N Mex.	5000
WEVD New York, N.Y.	5000
WPDW New York, N.Y.	5000
WEBO Oswego, N.Y.	1000
WHAZ Troy, N.Y.	1000
WFIN Findlay, Ohio	1000
WKOV Wellston, Ohio	500
KPOJ Portland, Oreg.	5000
WICU Erie, Pa.	5000
WLAT Conway, S.C.	1000
WFBC Greenville, S.C.	5000
WAEW Crossville, Tenn.	1000
WTRD Dyersburg, Tenn	500
KMIL Cameron, Tex.	500
KSWA Graham, Tex.	500
KINE Kingsville, Tex.	1000
KDOK Tyler, Tex.	1000
WBTM Danville, Va.	5000
WESR Tasley, Va.	1000
KFKF Bellevue, Wash.	1000
WETZ New Martinsville, West Virginia	1000
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
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
KDMY 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
KRMO 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
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
KLOD Corvallis, Ore.	250
KUIN 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
WMCD 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.	1350
WGAD Gadsden, Ala.	5000
KWFC Hot Springs, Ark.	1000
KLYD Bakersfield, Calif.	1000
KCSB San Bernardino, Calif.	500
KSRO Santa Rosa, Calif.	1000
KGHF Pueblo, Colo.	5000
WNLK Norwalk, Conn.	500
WPCT Putnam, Conn.	1000
WDCF Dade City, Fla.	1000
WRPB Warner Robins, Ga.	1000
KRLC Lewiston, Idaho	5000
WEEK Peoria, Ill.	1000
WIBD Salem, Ill.	500
WIOU Kokomo, Ind.	1000
KRNT Des Moines, Iowa	5000
KMAN Manhattan, Kans.	500
WLOU Louisville, Ky.	5000
WSMB New Orleans, La.	5000
WHMI Howell, Mich.	500
KDIO Ortonville, Minn.	1000
WCMP Pine City, Minn.	1000
WKOZ Kosciusko, Miss.	5000
KCHR Charleston, Mo.	1000
WLNH Laconia, N.H.	5000
WCBA Corning, N.Y.	1000
WHIP Mooresville, N.C.	1000
WADC Akron, Ohio	5000
WCHI Chillicothe, Ohio	500
KRHD Duncan, Okla.	250
KTLQ Tahlequah, Okla.	500
WORK York, Pa.	5000
WPFD Darlington, S.C.	500
WGSW Greenwood, S.C.	1000
KTXJ Jasper, Tex.	1000
KCOR San Antonio, Tex.	5000
WBLT Bedford, Va.	1000
WNVA Norton, Va.	5000
WSAP Portsmouth, Va.	5000
WPDR Portage, Wis.	1000

1360—220.4

WWWB Jasper, Ala.	1000
WMFC Monroeville, Ala.	1000
WELR Roanoke, Ala.	1000
KRUX Glendale, Ariz.	5000
KLYR Clarksville, Ark.	500
KFFA Helena, Ark.	1000
KFIV Modesto, Calif.	1000
KRCK Ridgecrest, Calif.	1000
KGB San Diego, Calif.	1000
WDRC Hartford, Conn.	5000
WOBS Jacksonville, Fla.	5000
WKAT Miami Beach, Fla.	5000
WIOD Sanford, Fla.	500
WAZA Bainbridge, Ga.	1000
WLBK DeKalb, Ill.	500
WVMC Mt. Carmel, Ill.	500
KXGI Ft. Madison, Iowa	1000
KSCJ Sioux City, Iowa	5000
KBTO El Dorado, Kans.	500
WFLW Monticello, Ky.	1000
KDBC Mansfield, La.	1000
KVIM New Iberia, La.	1000
KTLD Tallulah, La.	500
WEBB Dundalk, Md.	5000
WLYN Lynn, Mass.	1000
WKMI Kalamazoo, Mich.	5000
KLRS Mountain Grove, Mo.	1000
WNNJ Newton, N.J.	500
WWBZ Vineland, N.J.	1000
WKOP Binghamton, N.Y.	5000
WMNS Olean, N.Y.	1000
WCHL Chapel Hill, N.C.	1000
WSAI Cincinnati, Ohio	5000
KUIK Hillsboro, Oreg.	1000
WMCK McKeesport, Pa.	1000
WPPA Pottsville, Pa.	1000
WELP Easley, S.C.	1000
WLCM Lancaster, S.C.	1000
WNAH Nashville, Tenn.	1000
KRAY Amarillo, Tex.	500
KACT Andrews, Tex.	1000
KREL Baytown, Tex.	1000
KRYS Corpus Christi, Tex.	1000
KXOL Ft. Worth, Tex.	5000
WBOB Galax, Va.	1000
WHBG Harrisonburg, Va.	5000
KMO Tacoma, Wash.	5000
WHJC Matawan, W.Va.	1000
WMOV Ravenswood, W.Va.	1000
WBAY Green Bay, Wis.	5000
WISV Viroqua, Wis.	500
WMNE Menomonie, Wis.	1000
KVRS Rock Sprgs., Wyo.	1000

1370—218.8

WBYE Calera, Ala.	1000
KBUC Corona, Calif.	1000
KEEN San Jose, Calif.	5000
KGEN Tulare, Calif.	1000
WHYS Ocala, Fla.	1000
WCOA Pensacola, Fla.	5000
WAXE Vero Beach, Fla.	1000
WBGR Jesup, Ga.	1000
WFDR Manchester, Ga.	1000
WKLE Washington, Ga.	1000
WPRC Lincoln, Ill.	500
WTTS Bloomington, Ind.	5000
WGRY Gary, Ind.	500
KDTH Dubuque, Iowa	1000
KGNO Dodge City, Kans.	5000
KAPB Marksville, La.	1000
WKIK Leonardtown, Md.	1000
WGHN Gr'd Haven, Mich.	500
KSUM Fairmont, Minn.	1000
WDOB Canton, Miss.	1000
KWRT Boonville, Mo.	1000
KCRV Caruthersville, Mo.	1000
KXLF Butte, Mont.	5000
KAWL York, Nebr.	500
WFEA Manchester, N.H.	5000
WALK Patchogue, N.Y.	500
WSAY Rochester, N.Y.	5000
WLTC Gastonia, N.C	1000
WTAB Tabor City, N.C.	5000
KFJM Grand Forks, N.D.	1000
WSPD Toledo, Ohio	5000
KAST Astoria Oreg.	1000
WOTR Corry, Pa.	1000
WPAZ Pottstown, Pa.	1000
WKMC Roaring Sprgs., Pa.	1000
WIVV Vieques, P.R.	1000
WDEF Chattanooga, Tenn.	5000
WDXE Lawrenceburg, Tenn.	1000
WRGS Rogersville, Tenn.	1000
KTXN Austin, Tex.	1000
KFRO Longview, Tex.	1000
KRWS Post, Tex.	500
KSOP Salt Lake City, Utah	1000
WBTN Bennington, Vt.	500
WHEE Martinsville, Va.	1000
WJWS South Hill, Va.	1000
KPOR Quincy, Wash.	1000
WMOO Moundsville, W.Va.	1000

Kc.	Wave Length	W.P.
WCCN	Neillsville, Wis.	1000
KVWO	Cheyenne, Wyo.	1000

1380—217.3

CFDA	Victoriaville, Que.	1000
CKPC	Brantford, Ont.	1000
CKLC	Kingston, Ont.	5000
WGYV	Greenville, Ala.	1000
KNLR	N. Little Rock, Ark	1000
KBVM	Lancaster, Calif.	1000
KGMS	Sacramento, Calif.	1000
KSBW	Salinas, Calif.	1000
KFLJ	Walsenburg, Colo.	1000
WAMS	Wilmington, Del.	1000
WQXQ	Ormond Bch., Fla.	1000
WTSP	St. Petersburg, Fla.	5000
WAOK	Atlanta, Ga.	5000
WKJG	Ft. Wayne, Ind.	5000
KCIM	Carroll, Iowa	1000
WMTA	Central City, Ky.	500
WWKY	Winchester, Ky.	1000
WEND	Baton Rouge, La.	500
WTTH	Port Huron, Mich.	1000
KLIZ	Brainerd, Minn.	1000
WNLA	Indianola, Miss.	500
WTUP	Tupelo, Miss.	1000
KUDL	Kansas City, Mo.	1000
KWK	St. Louis, Mo.	5000
KUVR	Holdredge, Nebr.	500
WAWZ	Zarephath, N.J.	5000
WBNX	New York, N.Y.	5000
WLOS	Asheville, N.C.	5000
WTOB	Winston-Salem, N.C.	5000
WPKO	Waverly, Ohio	1000
KSWO	Lawton, Okla.	1000
KMUS	Muskogee, Okla.	1000
KSRV	Ontario, Oreg.	1000
WACB	Kittanning, Pa.	1000
WAYZ	Waynesboro, Pa.	1000
WNRI	Woonsocket, R.I.	1000
WAGS	Bishopville, S.C.	1000
KOTA	Rapid City, S.Dak.	5000
KHON	Honolulu, T.H.	5000
KJET	Beaumont, Tex.	1000
KBWD	Brownwood, Tex.	1000
KTSM	El Paso, Tex.	1000
KMUL	Muleshoe, Tex.	500
KBOP	Pleasanton, Tex.	1000
WSYB	Rutland, Vt.	5000
WMBG	Richmond, Va.	5000
KRKO	Everett, Wash.	1000
WBEL	Beloit, Wis.	5000

1390—215.7

WHMA	Anniston, Ala.	5000
KDQN	DeQueen, Ark.	500
KAMO	Rogers, Ark.	1000
KGER	Long Beach, Calif.	5000
KTUR	Turlock, Calif.	1000
KFML	Denver, Colo.	1000
WAVP	Avon Park, Fla.	1000
WGES	Chicago, Ill.	5000
WFIW	Fairfield, Ill.	500
WJCD	Seymour, Ind.	1000
KCLN	Clinton, Iowa	1000
KCBC	Des Moines, Iowa	1000
KNCK	Concordia, Kans.	500
KNOE	Monroe, La.	5000
WCAT	Orange, Mass.	1000
WPLM	Plymouth, Mass.	1000
WCER	Charlotte, Mich.	1000
KRFO	Owatonna, Minn.	500
WROA	Gulfport, Miss.	1000
WQIC	Meridian, Miss.	5000
KVBC	Farmington, N.Mex.	5000
WEOK	Poughkeepsie, N.Y.	1000
WRIV	Riverhead, N.Y.	1000
WFBL	Syracuse, N.Y.	5000
WFNC	Fayetteville, N.C.	5000
WEED	Rocky Mt., N. C.	5000
KLPM	Minot, N.Dak.	5000
WOHP	Bellefontaine, Ohio	500
WFMJ	Youngstown, Ohio	5000
KCRC	Enid, Okla.	1000
KSLM	Salem, Oreg.	1000
WLAN	Lancaster, Pa.	1000
WHPB	Belton, S.C.	500
WCSC	Charleston, S.C.	5000
WTJS	Jackson, Tenn.	1000
KULP	El Campo, Tex.	500
KBEC	Waxahachie, Tex.	500
KLGN	Logan, Utah	1000
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
CKRB	Ville St. George, Que.	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
KIFI	Idaho Falls, Idaho	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
KVHC	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
KDMB	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
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
KTXC	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
WSAU	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	Ft. Smith, Ark.	500
KERN	Bakersfield, Calif.	500
KTEE	Carmel, Calif.	500
KMYC	Marysville, Calif.	5000
KCAL	Redlands, Calif.	1000
KCOL	Ft. Collins, Colo.	1000
WPOP	Hartford, Conn.	5000
WDOV	Dover, Del.	1000
WMYR	Ft. Myers, Fla.	5000
WBIL	Leesburg, Fla.	1000
WDAX	McRae, Ga.	1000
WLAQ	Rome, Ga.	1000
WRMN	Elgin, Ill.	500
WTIM	Taylorville, Ill.	1000
KGRN	Grinnell, Iowa	500
KLEM	LeMars, Iowa	1000
KCLO	Leavenworth, Kans.	500
KWBB	Wichita, Kans.	1000
WLBJ	Bowling Green, Ky.	5000
WHLN	Harlan, Ky.	5000
KDBS	Alexandria, La.	1000
WGRD	Grand Rap., Mich.	1000
WBKN	Newton, Miss.	500
WHTG	Eatontown, N.J.	500
WDOE	Dunkirk, N.Y.	500
WEGO	Concord, N.C.	1000
WSRC	Durham, N.C.	1000
WING	Dayton, Ohio	5000
KPAM	Portland, Oreg.	1000
WLSH	Lansford, Pa.	1000
KQV	Pittsburgh, Pa.	5000
WYMB	Manning, S.C.	1000
WCMT	Martin, Tenn.	1000
KBUD	Athens, Tex.	250
KVLB	Cleveland, Tex.	500
KXIT	Dalhart, Tex.	500
KADO	Marshall, Tex.	500
KRIG	Odessa, Tex.	1000
KBAL	San Saba, Tex.	500
KNAL	Victoria, Tex.	500
WRIS	Roanoke, Va.	5000
KUEN	Wenatchee, Wash.	1000
WKBH	LaCrosse, Wis.	5000
KWYO	Sheridan, Wyo.	1000

1420—211.1

CJMT	Chicoutimi, Que.	1000
CKOM	Saskatoon, Sask.	5000
KHFH	Sierra Vista, Ariz.	1000
KPOC	Pocahontas, Ark.	1000
KSTN	Stockton, Calif.	1000
WLIS	Old Saybrook, Conn.	500
WDBF	Delray Bch., Fla.	500
WSTN	St. Augustine, Fla.	1000
WRBL	Columbus, Ga.	5000
WLET	Toccoa, Ga.	5000
WINI	Murphysboro, Ill.	500
WIMS	Michigan City, Ind.	1000
WOC	Davenport, Iowa	5000
KJCK	Junction City, Kans.	1000
WTCR	Ashland, Ky.	5000
WHBN	Harrodsburg, Ky.	1000
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.	1000
WQBC	Vicksburg, Miss.	1000
KBTN	Neosho, Mo.	500
KOOO	Omaha, Nebr.	500
WACK	Newark, N.J.	500
WALY	Herkimer, N.Y.	1000
WLNA	Peekskill, N.Y.	1000
WMYN	Mayodan, N.C.	500
WVOT	Wilson, N.C.	1000
WHK	Cleveland, Ohio	5000
KTJS	Hobart, Okla.	250
KYNG	Coos Bay, Oreg.	1000
WCOJ	Coatesville, Pa.	5000
WCED	DuBois, Pa.	5000
WEUC	Ponce, P.R.	1000
WATD	Cheraw, S.C.	1000
WEMB	Erwin, Tenn.	1000
WKSR	Pulaski, Tenn.	1000
KFYN	Bonham, Tex.	250
KTRE	Lufkin, Tex.	1000
KGNB	New Braunfels, Tex.	1000
KPEP	San Angelo, Tex.	1000
WWSR	St. Albans, Vt.	1000
WDDY	Gloucester, Va.	1000
WKTF	Warrenton, Va.	5000
KITI	Chehalis, Wash.	1000
KUJ	Walla Walla, Wash.	5000
WPLY	Plymouth, Wis.	500

1430—209.7

WFHK	Pell City, Ala.	1000
KHBM	Monticello, Ark.	1000
KAMP	El Centro, Calif.	1000
KARM	Fresno, Calif.	5000
KALI	Pasadena, Calif.	5000
KOSI	Aurora, Colo.	5000
WSDB	Homestead, Fla.	500
WLAK	Lakeland, Fla.	5000
WGFS	Covington, Ga.	1000
WRCD	Dalton, Ga.	1000
WWGS	Tifton, Ga.	5000
WCMY	Ottawa, Ill.	500
WIRE	Indianapolis, Ind.	5000
KASI	Ames, Iowa	1000
WKIC	Hazard, Ky.	1000
KMRC	Morgan City, La.	500
WNAV	Annapolis, Md.	1000
WHIL	Medford, Mass.	5000
WION	Ionia, Mich.	500
WBRB	Mt. Clemens, Mich.	500
WIL	St. Louis, Mo.	5000
KRGI	Grand Island, Nebr.	1000
WNJR	Newark, N.J.	5000
WENE	Endicott, N.Y.	5000
WMNC	Morganton, N.C.	5000
WRXO	Roxboro, N.C.	1000
WFOB	Fostoria, Ohio	1000
WCLT	Newark, Ohio	500
KALV	Alva, Okla.	5000
KTUL	Lookout Mountain, Oklahoma	5000
KGAY	Salem, Oreg.	5000
WVAM	Altoona, Pa.	1000
WBLR	Batesburg, S.C.	5000
WATP	Marion, S.C.	1000
KBRK	Brookings, S.Dak.	500
WENO	Madison, Tenn.	5000
KSTB	Breckenridge, Tex.	1000
KSIJ	Gladewater, Tex.	1000
KCOH	Houston, Tex.	1000
KLO	Ogden, Utah	5000
KBRC	Mt. Vernon, Wash.	1000
WEIR	Weirton, W.Va.	1000
WBEV	Beaver Dam, Wis.	1000

1440—208.2

WHHY	Montgomery, Ala.	5000
KPOK	Scottsdale, Ariz.	5000
KOKY	Little Rock, Ark.	1000
KVON	Napa, Calif.	500
KPRO	Riverside, Calif.	1000
WBIS	Bristol, Conn.	500
WABR	Winter Park, Fla.	5000
WWCC	Bremen, Ga.	500
WGIG	Brunswick, Ga.	5000
WXLI	Dublin, Ga.	1000
WRAJ	Anna, Ill.	500
WPRS	Paris, Ill.	500
WGEM	Quincy, Ill.	1000
WROK	Rockford, Ill.	1000
WPGW	Portland, Ind.	500
KCHE	Cherokee, Iowa	500
KJAY	Topeka, Kans.	5000
WKLX	Paris, Ky.	1000
KMLB	Monroe, La.	5000
WAAB	Worcester, Mass.	5000
WBCM	Bay City, Mich.	1000
WCHB	Inkster, Mich.	500
KEVE	Minneapolis, Minn.	5000
WMVB	Millville, N.J.	1000
WBAB	Babylon, N.Y.	500
WJJL	Niagara Falls, N.Y.	1000
WBLA	Elizabethtown, N.C.	1000
WBUY	Lexington, N.C.	5000
KILO	Grand Forks, N.D.	1000
WHHH	Warren, Ohio	5000
KMED	Medford, Oreg.	5000
KODL	The Dalles, Oreg.	1000
WCDL	Carbondale, Pa.	5000
WGCB	Red Lion, Pa.	1000
WQOK	Greenville, S.C.	5000
WZYX	Cowan, Tenn.	1000
WHDM	McKenzie, Tenn.	500
KFDA	Amarillo, Tex.	5000
KEYS	Corpus Christi, Tex.	1000
KDNT	Denton, Tex.	1000
KETX	Livingston, Tex.	1000
WKLV	Blackstone, Va.	5000
KITN	Olympia, Wash.	500
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

Kc.	Wave Length	W.P.
CJOY	Guelph, Ont.	250
WDNG	Anniston, Ala.	250
WBCO	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
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
WKTS	Brooksville, Fla.	250
WMFJ	Daytona Beach, Fla.	250
WSKP	Miami, Fla.	250
WBSR	Pensacola, Fla.	250
WSPB	Sarasota, Fla.	250
WSTU	Stuart, Fla.	100
WTNT	Tallahassee, Fla.	250
WGFC	Albany, Ga.	250
WBHF	Cartersville, Ga.	250
WCON	Cornelia, Ga.	250
WKEU	Griffin, Ga.	250
WMVG	Milledgeville, Ga.	250
WCCP	Savannah, Ga.	250
KPID	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
WNKY	Neon, 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
KJRX	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
KEYZ	Williston, N.Dak.	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
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

Kc.	Wave Length	W.P.
CJNB	N. Battleford, Sask.	1000
WFMH	Cullman, Ala.	5000
WPNX	Phenix City, Ala.	1000
KTYM	Inglewood, Calif.	1000
KDON	Salinas, Calif.	5000
KYSN	Colo. Sprgs., Colo.	1000
WBAR	Bartow, Fla.	1000
WFNM	DeFuniak Sprgs., Fla.	1000
WMBR	Jacksonville, Fla.	5000
WDMF	Buford, Ga.	1000
WROY	Carmi, Ill.	1000
WKAM	Goshen, Ind.	500
WOCH	North Vernon, Ind.	500
KSO	Des Moines, Iowa	5000
KCRB	Chanute, Kans.	1000
WRVK	Mt. Vernon, Ky.	500
WAIL	Baton Rouge, La.	5000
KBSF	Springhill, La.	1000
WBET	Brockton, Mass.	1000
WBRN	Big Rapids, Mich.	1000
WPON	Pontiac, Mich.	500
KRNY	Kearney, Nebr.	5000
KENO	Las Vegas, Nev.	1000
WOKO	Albany, N.Y.	5000
WNRC	New Rochelle, N.Y.	500
WHEC	Rochester, N.Y.	5000
WFVG	Fuquay Sprgs., N.C.	1000
WMMH	Marshall, N.C.	500
WBNS	Columbus, Ohio	5000
WPVL	Painesville, Ohio	500
KPLK	Dallas, Oreg.	500
WCMB	Harrisburg, Pa.	5000
WBCU	Union, S.C.	1000
WJAK	Jackson, Tenn.	1000
KBRZ	Freeport, Tex.	500
KLLL	Lubbock, Tex.	1000
WACO	Waco, Tex.	1000
WPRW	Manassas, Va.	500
WRAD	Radford, Va.	5000
KIMA	Yakima, Wash.	5000
WRAC	Racine, Wis.	500

1470—204.0

Kc.	Wave Length	W.P.
CFOS	Owen Sound, Ont.	1000
WBLO	Evergreen, Ala.	1000
KBLO	Hot Springs, Ark.	1000
KBMX	Coalinga, Calif.	500
KUTY	Palmdale, Calif.	1000
KXOA	Sacramento, Calif.	1000
WMMW	Meriden, Conn.	1000
WDCL	Tarpon Sprgs., Fla.	5000
WAAG	Adel, Ga.	1000
WDOL	Athens, Ga.	1000
WRGA	Rome, Ga.	5000
WMBD	Peoria, Ill.	5000
WCBC	Anderson, Ind.	1000
KTRI	Sioux City, Iowa	5000
KARE	Atchison, Kans.	1000
WSAC	Radcliff, Ky.	1000
KPLC	Lake Charles, La.	5000
WLAM	Lewiston, Maine	5000
WTTR	Westminster, Md.	1000
WNBP	Newburyport, Mass.	500
WKMF	Flint, Mich.	1000
WKLZ	Kalamazoo, Mich.	500
KANO	Anoka, Minn.	1000
WCHJ	Brookhaven, Miss.	1000
WNAU	New Albany, Miss.	500
KGHM	Brookfield, Mo.	500
KTCB	Malden, Mo.	1000
WTKO	Ithaca, N.Y.	1000
WPDM	Potsdam, N.Y.	1000
WBIG	Greensboro, N.C.	5000
WPNC	Plymouth, N.C.	1000
WTOE	Spruce Pine, N.C.	1000
WOHO	Toledo, Ohio	1000
KVLH	Pauls Valley, Okla.	250
KVIN	Vinita, Okla.	500
WSAN	Allentown, Pa.	5000
WFAR	Farrell, Pa.	1000
WOIC	Columbia, S.C.	5000
WEAG	Alcoa, Tenn.	1000
WHER	Memphis, Tenn.	1000
WVOL	Nashville, Tenn.	1000
KRBC	Abilene, Tex.	5000
KWRD	Henderson, Tex.	500
KCNY	San Marcos, Tex.	250
KELA	Centralia, Wash.	5000
KSEM	Moses Lake, Wash.	5000
WPLH	Huntington, W.Va.	5000
WBKV	West Bend, Wis.	500
KSPR	Casper, Wyo.	5000

1480—202.6

Kc.	Wave Length	W.P.
WABB	Mobile, Ala.	5000
KGLU	Safford, Ariz.	1000
KTCN	Berryville, Ark.	1000
KIEM	Eureka, Calif.	5000
KYOS	Merced, Calif.	5000
KWIZ	Santa Ana, Calif.	1000
WAPG	Arcadia, Fla.	1000
WEZY	Cocoa, Fla.	1000
WTHR	Panama Beach, Fla.	500
WYZE	Atlanta, Ga.	5000
WRDW	Augusta, Ga.	5000
WTHI	Terre Haute, Ind.	1000
WRSW	Warsaw, Ind.	500
KLEE	Ottumwa, Iowa	500
KBKC	Mission, Kans.	500
KANS	Wichita, Kans.	5000
WKOA	Hopkinsville, Ky.	1000
KLEC	Jonesville, La.	500
KJOE	Shreveport, La.	1000
WSAR	Fall River, Mass.	5000
WMAX	Grand Rapids, Michigan	1000
KAUS	Austin, Minn.	1000
KGCX	Sidney, Mont.	5000
KLMS	Lincoln, Nebr.	1000
KWEW	Hobbs, N.Mex.	1000
WLEA	Hornell, N.Y.	1000
WHOM	New York, N.Y.	5000
WWOK	Charlotte, N.C.	1000
WAGR	Lumberton, N.C.	1000
WMSJ	Sylva, N.C.	5000
WHBC	Canton, Ohio	5000
WCIN	Cincinnati, Ohio	1000
WTRA	Latrobe, Pa.	500
WDAS	Philadelphia, Pa.	1000
WISL	Shamokin, Pa.	1000
WLOK	Memphis, Tenn.	5000
KGKO	Dallas, Tex.	5000
KLVL	Pasadena, Tex.	1000
WCFR	Springfield, Vt.	1000
WBBL	Richmond, Va.	5000
WLEE	Richmond, Va.	5000
KBLU	Salem, Va.	1000
KPVA	Camas, Wash.	1000
WISC	Madison, Wis.	1000

1490—201.2

Kc.	Wave Length	W.P.
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
KAFP	Petaluma, Calif.	250
KBLF	Red Bluff, Calif.	250
KDB	Santa Barbara, Calif.	250
KOWL	Tahoe Valley, 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
WCPM	Cumberland, Ky.	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
KLGR	Redwd. Falls, Minn.	100
WLOX	Biloxi, Miss.	250
WCLD	Cleveland, Miss.	250
WLAU	Laurel, 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

Kc. Wave Length W.P.

1500—199.9

CHUC Port Hope, Ont. 1000
KXRX San Jose, Calif. 1000
WTOP Washington, D.C. 50000
WJBK Detroit, Mich. 10000
KSTP St. Paul, Minn. 50000
KTAN Sherman, Tex. 250

1510—199.1

CKOT Tillsonburg, Ont. 1000
KOCS Ontario, Calif. 250
KTIM San Rafael, Calif. 1000
KUDY Littleton, Colo. 1000
WKAI Macomb, Ill. 250
WMEX Boston, Mass. 5000
KIMO Independence, Mo. 1000
WLAC Nashville, Tenn. 50000
KCTX Childress, Tex. 250
KSTV Stephenville, Tex. 250
KGA Spokane, Wash. 50000
WAUX Waukesha, Wis. 250

1520—197.4

WHOW Clinton, Ill. 1000
KSIB Creston, Iowa 1000
WKBW Buffalo, N.Y. 50000
WKIT Mineola, N.Y. 250
KOMA Okla. City, Okla. 50000
KGON Oregon City, Oreg. 10000
WWWW Rio Piedras, P.R. 250

1530—196.1

KFBK Sacramento, Calif. 50000
WCKY Cincinnati, Ohio 50000
KGBT Harlingen, Tex. 50000

1540—195.0

ZNS Nassau, B.W.I. 5000
KPOL Los Angeles, Calif. 10000
WSMI Litchfield, Ill. 1000
WBNL Boonville, Ind. 250
WLOI LaPorte, Ind. 250
KXEL Waterloo, Iowa 50000
KNEX McPherson, Kans. 250
KLKC Parsons, Kans. 250
WDON Wheaton, Md. 250
WPTR Albany, N.Y. 50000
WIFM Elkin, N.C. 250
WJMO Cleveland, Ohio 1000
WJMJ Philadelphia, Pa. 1000
WPTS Pittston, Pa. 1000
WPME Punxsutawney, Pa. 1000
WADK Newport, R.I. 1000
KCUL Ft. Worth, Tex. 10000
KGBC Galveston, Tex. 1000
KIWW San Antonio, Tex. 250
WTKM Hartford, Wis. 500

1550—193.5

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. 1000
WBSC Bennettsville, S.C. 10000

1560—192.3

CFRS Simcoe, Ont. 250
KPMC Bakersfield, Calif. 10000
WBYS Canton, Ill. 250
KSWI Council Bluffs, Iowa 500
WQXR New York, N.Y. 50000
WTNS Coshocton, Ohio 1000
WTOD Toledo, Ohio 1000
KWCO Chickasha, Okla. 1000
WENA Bayamon, P.R. 250
KHBR Hillsboro, Tex. 250

1570—191.1

CHUB Nanaimo, B.C. 1000
CFRY Portage la Prairie, Manitoba 250
CBI Sidney, N.S. 1000
CFOR Orillia, Ont. 10000
WCRL Oneonta, Ala. 250
WRWJ Selma, Ala. 1000
KCVR Lodi, Calif. 1000
KLOV Loveland, Colo. 250
WTWB Auburndale, Fla. 1000
WFBF Fernandina Bch., Fla. 1000
WJOE Ward Ridge, Fla. 250
WOKZ Alton, Ill. 1000
WFRL Freeport, Ill. 1000
WBEE Harvey, Ill. 1000
WTAY Robinson, Ill. 250
WILO Frankfort, Ind. 250
WAWK Kendallville, Ind. 250
WLRP New Albany, Ind. 1000
KMCD Fairfield, Iowa 250
KJFJ Webster City, Iowa 250
KNDY Marysville, Kans. 250
KWSK Pratt, Kans. 250
WABL Amite, La. 500
KLLA Leesville, La. 250
KMAR Winnsboro, La. 500
WAQE Towson, Md. 1000
WPEP Taunton, Mass. 1000
WDEW Westfield, Mass. 1000
WMRP Flint, Mich. 1000
WFUR Grand Rap., Mich. 1000
KMRS Morris, Minn. 1000
KAGE Winona, Minn. 1000
KLEX Lexington, Mo. 250
WFLR Dundee, N.Y. 1000
WBUZ Fredonia, N.Y. 250
WNCA Siler City, N.C. 1000
WHOT Campbell, Ohio 250
WCLW Mansfield, Ohio 250
WPTW Piqua, Ohio 250
KTAT Frederick, Okla. 250
KOLS Pryor, Okla. 1000
KRWC Forest Grove, Oreg. 1000
KOHU Hermiston, Oreg. 250
WBUX Doylestown, Pa. 250
WAKU Latrobe, Pa. 1000
WMLP Milton, Pa. 1000
WFGN Gaffney, S.C. 250
WHLP Centerville, Tenn. 1000
WCLE Cleveland, Tenn. 1000
WTRB Ripley, Tenn. 250
KZOL Muleshoe, Tex. 250
KTER Terrell, Tex. 250
KWIC Salt Lake City, Utah 500
WYTI Rocky Mount, Va. 500
WEER Warrenton, W.Va. 500
WAPL Appleton, Wis. 1000

1580—189.2

CBJ Chicoutimi, Que. 10000
WJHB Talladega, Ala. 1000
KTML Marked Tree, Ark. 250
KWIP Merced, Calif. 500
KDAY Santa Monica, Calif. 10000
KPIK Colorado Sprgs., Colo. 5000
WWIL Ft. Lauderdale, Fla. 1000
WCLS Columbus, Ga. 1000
WLBA Gainesville, Ga. 5000
WDQN DuQuoin, Ill. 250
WBBA Pittsfield, Ill. 250
WKID Urbana, Ill. 250
WCNB Connersville, Ind. 250
WJVA South Bend, Ind. 250
WAMW Washington, Ind. 250
KCHA Charles City, Iowa 250
KFMA Davenport, Iowa 500
KDSN Denison, Iowa 500
WGOR Georgetown, Ky. 250
WWXL Manchester, Ky. 250
WPKY Princeton, Ky. 250
KLUV Haynesville, La. 250
KLOU Lake Charles, La. 1000
WRNC Bradbury Hgts., Md. 1000
WFGM Fitchburg, Mass. 1000
WAMY Amory, Miss. 5000
WGLC Centreville, Miss. 250
WPMP Pascagoula, Miss. 1000
KBIA Columbia, Mo. 250
KNIM Maryville, Mo. 250
WCRV Washington, N.J. 500
KHAM Albuquerque, N.Mex. 1000
WPAC Patchogue, N.Y. 5000
KZKY Albemarle, N.C. 250
WTYN Tryon, N.C. 250
WVKO Columbus, Ohio 1000
KLTR Blackwell, Okla. 250
WCOY Columbia, Pa. 500
WANB Waynesburg, Pa. 250
WYCL York, S.C. 250
WMSR Manchester, Tenn. 1000
WTUC Union City, Tenn. 250
KGAF Gainesville, Tex. 250
KWEL Midland, Tex. 1000
KIRT Mission, Tex. 1000
KTLU Rusk, Tex. 500
KWED Seguin, Tex. 1000
KEVA Shamrock, Tex. 250
WILA Danville, Va. 500
WPUV Pulaski, Va. 5000
WTTN Watertown, Wis. 250

1590—188.7

WATM Atmore, Ala. 1000
WVNA Tuscumbia, Ala. 5000
KPBA Pine Bluff, Ark. 1000
KSJO San Jose, Calif. 1000
KUOU Ventura, Calif. 1000
WBRY Waterbury, Conn. 5000
WILZ St. Petersburg Beach, Florida 1000
WDAT S. Daytona Bch., Fla. 1000
WALB Albany, Ga. 1000
WLFA Lafayette, Ga. 5000
WNMP Evanston, Ill. 1000
WQUB Galesburg, Ill. 5000
WGEE Indianapolis, Ind. 5000
WPCO Mt. Vernon, Ind. 500
KWBG Boone, Iowa 1000
KVGB Great Bend, Kans. 5000
WLBN Lebanon, Ky. 1000
KEVL White Castle, La. 1000
WTVB Coldwater, Mich. 5000
WDOG Marine City, Mich. 1000
WISK So. St. Paul, Minn. 5000
WOKJ Jackson, Miss. 5000
KDEX Dexter, Mo. 1000
KPRS Kansas City, Mo. 1000
KMAM Tularosa, N.Mex. 1000
WEHH Elmira Hghts.-Horseheads, N.Y. 500
WNYS Salamanca, N.Y. 1000
WGTC Greenville, N.C. 5000
WNOS High Point, N.C. 1000
WAKR Akron, Ohio 5000
WSRW Hillsboro, Ohio 500
KHEN Henryetta, Okla. 500
KTIL Tillamook, Oreg. 250
WXRF Guayama, P.R. 1000
WCBG Chambersburg, Pa. 5000
WDRF Chester, Pa. 1000
WABV Abbeville, S.C. 1000
WACA Camden, S.C. 1000
WDBL Springfield, Tenn. 1000
KGAS Carthage, Tex. 1000
KERC Eastland, Tex. 500
KYOK Houston, Tex. 5000
KCBD Lubbock, Tex. 1000
KBUS Mexia, Tex. 500
KANN Sinton, Tex. 1000
WEZL Richmond, Va. 5000
KTIX Seattle, Wash. 5000
WSWW Platteville, Wis. 1000
WTRW Two Rivers, Wis. 1000

1600—187.5

CHVC Niagara Falls, Ont. 5000
WAPX Montgomery, Ala. 1000
KGST Fresno, Calif. 1000
KWOW Pomona, Calif. 1000
KUBA Yuba City, Calif. 1000
KLAK Lakewood, Colo. 1000
WKEN Dover, Del. 500
WKTX Atlantic Beach, Fla. 1000
WKWF Key West, Fla. 500
WGKA Atlanta, Ga. 1000
WMCW Harvard, Ill. 500
WBTO Linton, Ind. 500
WARU Peru, Ind. 1000
KLGA Algona, Iowa 5000
KCRG Cedar Rapids, Iowa 5000
KMDO Ft. Scott, Kans. 500
WNES Central City, Ky. 500
WSTL Eminence, Ky. 500
KFNV Ferriday, La. 1000
KLFT Golden Meadow, La. 1000
KLVI Vivian, La. 500
WINX Rockville, Md. 1000
WBOS Brookline, Mass. 5000
WTYM E. Longmeadow, Mass. 5000
WHRV Ann Arbor, Mich. 1000
WTRU Muskegon, Mich. 5000
WKDL Clarksdale, Miss. 1000
KATZ St. Louis, Mo. 5000
KTTN Trenton, Mo. 500
WONG Oneida, N.Y. 1000
WWRL Woodside, N.Y. 5000
WGIV Charlotte, N.C. 1000
WIDU Fayetteville, N.C. 1000
WFRC Reidsville, N.C. 1000
WBLY Springfield, Ohio 1000
KUSH Cushing, Okla. 1000
KASH Eugene, Oreg. 1000
WHOL Allentown, Pa. 500
WFIS Fountain Inn, S.C. 1000
WKBJ Milan, Tenn. 1000
KBOR Brownsville, Tex. 1000
KCFH Cuero, Tex. 500
KMAE McKinney, Tex. 1000
KOGT Orange, Tex. 1000
KBBC Centerville, Utah 1000
WBOF Virginia Bch., Va. 1000
WHLL Wheeling, W.Va. 5000
WCWC Ripon, Wis. 5000

Mexico

Amplitude-Modulation (AM) Stations Reported Heard in Parts of the Southwestern U. S. Listed Alphabetically by Location

Abbreviations: C.L., call letters; Kc., frequency in kilocycles; W.P., watt power

Location	C.L.	Kc.	W.P.
BAJA CALIFORNIA			
Ensenada	XEPF	1400	250
Mexicali	XED	1050	5000
	XEAA	1340	250
	XEAO	910	250
	XECL	990	5000
Tijuana	XEC	1310	250
	XEAC	690	5000
	XEAU	1470	5000
	XEAZ	1270	500
	XEBG	1550	1000
	XEGM	950	2500
	XEMO	860	5000
	XEXX	1420	2000
CHIHUAHUA			
Chihuahua	XEM	1390	500
	XEBU	620	1000
	XEBW	1280	1000
	XEFI	1440	1000
	XERA	1490	250
Ciudad Camargo	XEHA	580	500
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	1550	500
N. Casas Grandes	XETX	1400	250
COAHUILA			
Monclova	XEMF	1260	250
Piedras Negras	XEMJ	920	1000
	XEMU	580	5000
Sabinas	XEBK	1340	100
Saltillo	XESJ	1250	500
Villa Acuna	XEDH	1340	250
	XERF	1570	50000
DISTRITO FEDERAL			
Mexico City	XEL	1260	5000
	XEN	690	5000
	XEQ	940	50000
	XEW	900	100000
	XEX	730	250000
	XEFR	1180	1000
	XEJP	1150	1000
	XELA	830	1000
	XELZ	1440	5000
	XEMX	1380	1000
	XENK	620	5000
	XEOY	1000	10000
	XEPH	590	5000
	XEQB	1110	5000
	XEQK	1350	1000
	XEQR	1030	1000
	XERC	790	1000
	XERH	1500	5000
	XESM	1470	5000
	XEUN	860	5000
DURANGO			
Durango	XEDU	860	1000
NUEVO LEON			
Linares	XER	1260	250
Monterrey	XEG	1050	100000
	XEH	1420	1000
	XET	990	5000
	XEAR	1480	1000
	XEAW	1280	1000
	XEFB	630	5000
	XEMR	1370	500
	XEOK	920	500
SAN LUIS POTOSI			
San Luis Potosi	XEWA	540	150000
SONORA			
Agua Prieta	XEAQ	1490	250
	XEFH	1310	1000
Cananea	XEFQ	980	500
Ciudad Obregon	XEOX	1340	1000
Hermosillo	XEBH	920	5000
	XEDL	1250	500
	XEDM	1580	50000
	XEHQ	590	500
Magdal	XEDJ	1450	100
Naco	XETM	1350	1000
Nogales	XEHF	1370	1000
San Luis	XECB	1450	250
Santa Ana	XEAB	1400	250
TAMAULIPAS			
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	250
	XEXO	1550	50000
	XEOR	1390	1000
	XERT	590	5000

United States and Canadian

Amplitude-Modulation (AM) Broadcasting Stations Listed Alphabetically 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. (For watt power of station, see list arranged by Frequency, p. 169)

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
	KQUE	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.	WDKZ	1570	
Altona, Man.	CFAM	1050	
Altoona, Pa.	WFBG	1340	N
	WRTA	1240	A
	WVAM	1430	C
Alturas, Calif.	KCND	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	
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	
	WIPA	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.	WADS	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	
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
	KVAS	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	1340	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
	KTXN	1370	
	KVET	1300	M
Avalon, Calif.	KBIG	740	
Avon Park, Fla.	WAVP	1390	
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	
Barbourville, Ky.	WBVL	950	
Bardstown, Ky.	WBRT	1320	
Barnesboro, Pa.	WNCC	950	
Barnwell, S.C.	WBAW	740	
Barrie, Ont.	CKBB	1230	
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	WDHP	1390	
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
Belmont, N.C.	WCGC	1270	M
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.	WBCO	1450	
Bethesda, Md.	WUST	1120	
Bethlehem, Pa.	WGPA	1100	
Biddeford, Maine	WIDE	1400	M
Big Rapids, Mich.	WBRN	1460	
Big Sprg., Tex.	KBST	1490	A
	KHEM	1270	
	KTXC	1400	M
Big Stone Gap, Va.	WLSD	1220	
Biloxi, Miss.	WLDX	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	
	WLBS	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
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
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.	WLDA	1550	
Bradenton, Fla.	WTRL	1490	
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.	KBRD	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, S.Dak.	KBRK	1430	
Brookline, Mass.	WBDS	1600	
Brooklyn, N.Y.	WPOW	1330	
Brooksville, Fla.	WKTS	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	

Location	C.L.	Kc.	N.A.
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
	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	
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
	KPRM	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
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	KBRC	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	
	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.	WATD	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.	WCHF	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-M
	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	
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	
	WERE	1300	
	WGAR	1220	C
	WHK	1420	N
	WJMO	1540	
	WJW	850	A
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	
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	
College Sta., Tex.	WTAW	1150	
Colonial Heights, Va.	WPVA	1290	
Colorado City, Tex.	KVMC	1320	
Colo. Sprgs., Colo.	KRDO	1240	
	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.	WOAK	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
	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
Covington, Ga.	WGFS	1430	
Covington, Ky.	WZIP	1050	
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	1490	
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
	KGKO	1480	
	WRR	1310	M
The Dalles, Oreg.	KRMW	1300	
	KODL	1440	A
Dalton, Ga.	WBLJ	1230	M
	WRCO	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.	WPFD	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	
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	M
	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	
	KIMN	950	M
	KLIR	990	
	KLZ	560	C
	KMYR	710	
	KOA	850	N
	KPOF	910	
	KFSC	1220	
	KTLN	1280	
	KVOD	630	A
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	C
	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	
Douglas, Wyo.	KWIV	1050	
Dover, Del.	WDOV	1410	
	WKEN	1600	
Dover, N.H.	WTSN	1270	
Dover, Ohio	WJER	1450	
Doylestown, Pa.	WBUX	1570	
Drummondville, Que.	CHRD	1340	
Dublin, Ga.	WMLT	1330	

Location	C.L.	Kc.	N.A.
	WXLI	1440	
Du Bois, Pa.	WCED	1420	C
Dubuque, Iowa	KOTH	1370	A
	WOBQ	1490	M
Duluth, Minn.	KDAL	610	C
	WEBC	560	N
	WREX	1080	
Dumas, Tex.	KODD	800	
Duncan, Okla.	KRHO	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	
	KOGO	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.	KBAB	910	A
El Campo, Tex.	KULP	1390	
El Centro, Calif.	KXO	1230	M
El Dorado, Ark.	KOMS	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
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 Hghts.-Horseheads, N.Y.	WEHH	1590	A
El Paso, Tex.	KROD	600	C
	KELP	920	
	KHEY	690	
	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	980	M
Enterprise, Ala.	WIRB	1230	
Ephrata, Pa.	WGSA	1310	
Ephrata, Wash.	KULE	730	
Erie, Pa.	WERC	1260	A
	WICU	1330	N
	WJET	1400	
	WLEU	1450	
Erwin, Tenn.	WEMB	1420	
Escanaba, Mich.	WDBC	680	M
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
	KDAN	790	

Location	C.L.	Kc.	N.A.
	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.	WFCR	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.	WMDO	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	
	KFGO	790	A
Faribault, Minn.	KDHL	920	
Farmington, Mo.	KREI	800	
Farmington, N.M.	KVBC	1390	
	KWYK	960	
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	
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, Fla.	WFTW	1260	
Ft. Walton Beach, Fla.	WFBS	950	
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	
	KNOK	970	
	WBAP	570	A

Location	C.L.	Kc.	N.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, 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.	KFGT	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.	WOVH	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	N
Gloucester, Va.	WDDY	1420	
Gloversville-Johnston, N.Y.	WENT	1340	C
Golden, Colo.	KGOL	1250	
Golden Meadow, La.	KLFT	1600	
Goldsboro, N.C.	WFMC	730	
	WGBR	1150	A
	WGOL	1300	
Gonzales, Tex.	KCTI	1450	
Goodland, Kans.	KWGB	730	M
Goshen, Ind.	WKAM	1460	
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	
	KSTR	620	
Grande Prairie, Alta.	CFGP	1050	
Grand Prairie, Tex.	KBCS	730	

Location	C.L.	Kc.	N.A.
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.	KUIN	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	
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.	WAHL	1220	
Hastings, Nebr.	KHAS	1230	
Hattiesburg, Mississippi	WBKH	950	
	WFOR	1400	N
	WHSY	1230	A
	WXXX	1310	
Haverhill, Mass.	WHAV	1490	

Location	C.L.	Kc.	N.A.
Havre, Mont.	KOJM	610	M
Havre de Grase, 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	
	KTDO	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	M
	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, N.Y.	WGSM	740	
Huntington, W.Va.	WPLH	1470	M
	WHTN	800	M-A
	WSAZ	930	N
Huntsville, Ala.	WBHP	1230	M
	WFUN	1450	
	WAAY	1550	A
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	1400	A-M
	KUPI	980	
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.	WPBB	1290	M
Jackson, Mich.	WIBM	1450	A
	WKHM	970	M
Jackson, Miss.	WJDX	620	N
	WJQS	1400	C
	WJXN	1450	
	WDKJ	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.	WJHL	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.	KLEC	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	980	
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	
Kerrville, Tex.	KERV	1230	
Ketchikan, Alaska	KABI	580	A-M-N
	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	
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	1490	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	
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	
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.	KLCB	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
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.	KWLK	1400	M
	KBAM	1220	
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	
	KRKO	1150	
Louisville, Ky.	WAVE	970	N
	WGRC	790	M
	WHAS	840	C
	WKLO	1080	A
	WINN	1240	
	WKYW	900	
	WLOU	1350	
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	
	KDUB	1340	
	KFYO	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	

Location	C.L.	Kc.	N.A.
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.	WMGE	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.	WHNY	1250	A
Magnolia, Ark.	KVMA	630	M
Malden, Mo.	KTCB	1470	
Malone, N.Y.	WICY	1490	M
Malvern, Ark.	KBOK	1310	
Manassas, Va.	WPRW	1460	
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
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.	KTML	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

Location	C.L.	Kc.	N.A.
	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, Fla.	WGBS	710	C
	WCKR	610	N
	WFFC	1220	
	WMMA	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	1580	
Milan, Tenn.	WKBJ	1600	
Miles City, Mont.	KATL	1340	M
Milford, Del.	WKSB	930	
Milford, Mass.	WMRC	1490	
Milledgeville, Ga.	WMVG	1450	M
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.	KAPK	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.	KRMO	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

Location	C.L.	Kc.	N.A.
	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	M
	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.	KTLD	1490	
Mt. Airy, N.C.	WPAQ	740	
	WSYD	1300	M
Mt. Carmel, Ill.	WVMC	1360	
Mt. Clemens, Mich.	WBRB	1430	
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	1340	
Mt. Sterling, Ky.	WMST	1150	
Mt. Vernon, Ill.	WMIX	940	
Mt. Vernon, Ind.	WPCD	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.	KOSF	1230	A
	KSFA	860	
Nampa, Idaho	KFXD	580	
Nanaimo, B.C.	CHUB	1570	
Nanticoke, Pa.	WHWL	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	1240	
Neon, Ky.	WNKY	1450	
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	

Location	C.L.	Kc.	N.A.
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	A
New Glasgow, N.S.	CKEC	1230	
New Haven, Conn.	WAVZ	1300	
	WELI	960	
	WNHC	1340	A
New Iberia, La.	KANE	1240	A
	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	
	WYLD	600	
	WBOK	800	
	WNOE	1060	
	WSMB	1350	A
	WNPS	1450	
	WTPS	940	M
	WTIX	690	
	WWL	870	C
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
	WYUD	1270	
New Rochelle, N.Y.	WNRC	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	1320	
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	
	WPDW	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. Battleford, Sask.	CJNB	1460	
North Bay, Ont.	CFCH	600	
North Bend, Oreg.	KFIR	1340	C
Northfield, Minn.	WCAL	770	
Northampton, Mass.	WHMP	1400	
N. Little Rock, Ark.	KNLR	1380	
	KXLR	1150	
	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 Hill, W.Va.	WOAY	860	
Oakland, Calif.	KLX	910	
	KROW	960	

Location	C.L.	Kc.	N.A.
	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.	KSLR	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	
	KLPR	1140	
	KOCY	1340	
	KOMA	1520	
	KTOK	1000	C
	KTOW	800	
	WKY	930	N
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	
	KOOO	1420	
	KOWH	660	
	WOW	590	C
Omak, Wash.	KOMW	680	
Oneida, N.Y.	WONG	1600	
O'Neill, Nebr.	KVHC	1400	
Oneonta, Ala.	WCRL	1570	
Oneonta, N.Y.	WDOS	730	
Ontario, Calif.	KOCS	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	
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.	KOFD	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	1470	
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	
	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	
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

Location	C.L.	Kc.	N.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	
Pasco, Wash.	KORD	910	
	KPKW	1340	A
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	KPID	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	
Philadelphia, Pa.	WPEN	950	
	WRCV	1060	N
	WTEL	860	
Philipsburg, Pa.	WPHB	1260	
Phoenix, Ariz.	KIFN	860	
	KONI	1400	
	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.	KATT	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
	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	

Location	C.L.	Kc.	N.A.
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 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.	KRWS	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	
	WRJN	1400	A
Radcliff, Ky.	WSAC	1470	
Radford, Va.	WRAD	1460	
Raleigh, N.C.	WKIX	650	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

Location	C.L.	Kc.	N.A.
	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	
Reno, Nev.	KOH	630	N
	KATO	1340	M
	KOLO	920	C
	KONE	1450	
	KDOT	1230	
Renton, Wash.	KLAN	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	
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	1800	
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
	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	

Location	C.L.	Kc.	N.A.
	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	N
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	1250	
St. Catharine, Ont.	CKTB	610	
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	
Salisbury, N.C.	WSTP	1490	M
	WSAT	1280	A
Salt Lake City, Utah	KALL	910	M
	KDYL	1320	N
	KLUB	570	
	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.	KCSB	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	

Location	C.L.	Kc.	N.A.
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	1540	
	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	
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	
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
	WSHE	950	
Shelby, Mont.	KIYI	1150	M
Shelby, N.C.	WOHS	730	M
Shelbyville, Tenn.	WHAL	1400	
Shenandoah, Iowa	KFNF	920	

Location	C.L.	Kc.	N.A.
	KMA	960	A
Sherbrooke, Que.	CHLT	900	
	CKTS	1240	
Sheridan, Wyo.	KWYO	1410	M
Sherman, Tex.	KRRV	910	M
	KTAN	1500	
Show Low, Ariz.	KVWM	1050	
Shreveport, La.	KRMD	1340	A
	KOKA	1050	
	KENT	1550	M
	KZEA	980	
	KJOE	1480	
	KLUE	1300	
	KEEL	710	
	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
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. Pittsburgh, Tenn.	WEPG	910	
So. St. Paul, Minn.	WISK	1590	M
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	A
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	

Location	C.L.	Kc.	N.A.
Stuttgart, Ark.	KWAK	1240	M
Sudbury, Ont.	CKSO	790	
	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	
Tahoe Valley, Calif.	KOWL	1490	
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.	WOCL	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	1350	
Ticonderoga, N.Y.	WIPS	1250	
Tifton, Ga.	WTIF	1340	
	WWGS	1430	
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	

Location	C.L.	Kc.	N.A.
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
	KEVT	690	
	KMOP	1330	
	KTKT	990	
	KOLD	1450	C
	KVOA	1290	N
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	
	WNPT	1280	A
	WRBS	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	
	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.	KGYW	1190	
Valley City, N.Dak.	KOVC	1490	M
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	1400	
Vincennes, Ind.	WAOV	1450	M
Vineland, N.J.	WWBZ	1360	
Vinita, Okla.	KVIN	1470	
Virginia, Minn.	WHLB	1400	N
Virginia Bch., Va.	WBOF	1600	
Virouqua, 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	M
	WMAL	630	A
	WOL	1450	
	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
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.	WARN	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.	WSAU	1400	N
	WOSA	550	A
	WHVF	1230	
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	
	WMCD	1340	M
Wellsboro, Pa.	WNBT	1490	M
Wellston, Ohio	WKOV	1330	
Wellsville, N.Y.	WLSV	790	
Wenatchee, Wash.	KPQ	560	A
	KUEN	1410	
	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, 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
	KANS	1480	N
	KFBI	1070	
	KFH	1330	C
	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
Williamsport, Pa.	WLYC	1050	
	WRAK	1400	N
	WWPA	1340	C
Williamston, N.C.	WIAM	900	
Willimantic, Conn.	WILI	1400	
Williston, N.D.	KEYS	1450	
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	790	
	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	1570	
Winslow, Ariz.	KVNC	1010	M
Winston-Salem, N.C.	WAAA	980	
	WAIR	1340	
	WSJS	600	N
	WTOB	1380	M-C
Winter Haven, Fla.	WSIR	1490	M
Winter Park, Fla.	WABR	1440	
Wisconsin Rapids, Wis.	WFHR	1340	M
Wolf Pt., Nebr.	KVCK	1490	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	

World-Wide Short-Wave Stations

Active and Most Commonly Heard in U. S. Listed by Frequency

(For Canadian Short-Wave Stations, see separate listing, p. 187) 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
3310	YVOG	Trujillo, Venez.
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
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.
3450	YVQI	Barcelona, 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.

Kc. C.L. Location

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.
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.R.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 ZJI4 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.

Kc. C.L. Location

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 SPI3 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 CSA2I Lisbon, Port.
6405 TGQA Quezaltenango, Guat.
6632 HC2RL Guayaquil, Ecu.
6450 COCY Santa Clara, Cuba
6660 HROW Tegucigalpa, Hond.
6758 YNVP Managua, Nic.
6790 ZJM6 Limassol, Cyprus
6830 4XB2I 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 COBZ 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

Kc. C.L. Location

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. ●
9555 OIX2 Pori, Finland
9555 XETT Mexico, Mex.
9560 JBD2 Kawachi, Japan
9560 London, England
9560 Paris, France
9560 Tangier, Tangier
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 PCJ 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
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.

Kc. C.L. Location

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.
9764 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
10220 PSH Rio de Janeiro, Brazil
10258 XRRA Peiping, China
10780 SDB2 Motala, Sweden
11027 CSA29 Lisbon, Portugal
11090 CSA92 PontaDelgada, Azores
11630 Leningrad, U.S.S.R.
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 PHI Hilversum, Nether. ●
11730 CEII73 Santiago, Chile
11735 BED6 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 CEII74 Santiago, Chile
11750 GSD London, England
11755 Radio Portugal ●
11755 Moscow, U.S.S.R.
11760 OLR4B Prague, Czecho.
11760 Voice of America, Tangier
11760 VLAII/VLBII Shepparton, Aus.
11760 VUD7/II Delhi, India
11764 CR7BH Lourenco 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.
11800 GWH London, England
11800 Brussels, Belgium
11810 Moscow, U.S.S.R. ●
11810 Radio Sweden ● (except—Nov. to Febr.)
11810 Rome, Italy
11810 VLAII Shepparton, Aus. ● (Morning program)
11815 Warsaw, Poland
11820 GSN London, England
11820 XEBR Hermosillo, Mex.
11825 JKI6 Tokyo, Japan
11825 Moscow, U.S.S.R.
11825 ZYK3 Recife, Brazil
11830 FZS4 Saigon, Fr.Indo-C.
11830 Moscow, U.S.S.R. ●

Kc.	C.L.	Location
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	PCJ	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	VUD5/9	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
15345		Formosa Radio ●
15335		Karachi, Pakistan
15340		Moscow, U.S.S.R.
15340	KCBR	Delano, Cal., U.S.A.
15340		Voice of Amer., Tangier
15345		Athens, Greece
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	PZC	Paramaribo, Surinam
15410		Moscow, U.S.S.R.
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
17700	GVP	London, England
17715	GRA	London, England ●
17720	LRA5	Buenos Aires, Arg.
17730	GVQ	London, England
17750	WRUL	Boston, U.S.A.
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
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
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 Poland ●
17800	KRHO	Honolulu, Hawaii
17800		Stockholm, Sweden
17800	OIX5	Pori, Finland ●
17804		Rome, Italy
17805	DZ16	Manila, P.I.
17815		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		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
17865		Damascus, Syria
17870	CSA44	Lisbon, Portugal
17890	HCJB	(Missionary Station) Quito, Ecuador
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	VUD10	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
25750	GSQ	London, England
26080	GSK	London, England

Canadian Short-Wave Stations

Listed by Frequency

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

Frequency-Modulation (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

Location	C.L.	Mc.
ALABAMA		
Albertville	WAVU-FM	105.1
Alexander City	WRFS-FM	106.1
Andalusia	WCTA-FM	98.1
Anniston	WHMA-FM	100.5
Birmingham	WAFM	99.5
Clanton	WKLF-FM	100.9
Cullman	WFMH-FM	101.1
Decatur	WHOS-FM	92.5
Homewood	WJLN	104.7
Lanett	WRLD-FM	102.9
Mobile	WKRG-FM	99.9
Talladega	WHTB-FM	97.1
Tuscaloosa	WTBC-FM	95.7
Tuscaloosa	WUOA	*91.7
ARIZONA		
Globe	KWJB-FM	100.3
Mesa	KTYL-FM	104.7
Phoenix	KELE	95.5
	KFCA	*88.5
Tucson	KFMM	99.5
ARKANSAS		
Blytheville	KLCN-FM	96.1
Ft. Smith	KFPW-FM	94.9
Jonesboro	KBTM-FM	101.9
	KASU	91.9

Location	C.L.	Mc.
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
	WHOF	99.5
Marysville	KMYC-FM	99.9
Modesto	KBEE-FM	103.3
	KTRB-FM	104.1
Ontario	KEDO	93.5
Pasadena	KPCS	89.3
Sacramento	KCRA-FM	96.1
	KFBK-FM	96.9
	KJML	95.3
	KXOA-FM	107.9
San Bernardino	KVCR	*91.9
San Diego	KFSD-FM	94.1
	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
	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	WNOB-FM	94.5
Gainesville	WRUF-FM	*104.1
Jacksonville	WJAX-FM	95.1
	WZOK-FM	96.9
	WMBR-FM	96.1
Miami	WMET-FM	93.9
	WCKR-FM	97.3
	WGBS-FM	96.3
	WTHS	*91.7
	WWPB-FM	101.5
Miami Beach	WKAT-FM	93.1
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
Connersville	WCNB-FM	100.3
Crawfordsville	WBBS	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
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	KOPS	*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
Bowling Green	WLBJ-FM	101.1
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
	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
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
Pittsfield	WBEC-FM	94.3
S. Hadley	WMHC	88.5
Springfield	WHYN-FM	93.1
	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
	WJBK-FM	93.1
	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
	WFUM	*107.1
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	*98.3
	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
	KCUR-FM	89.3
Kennett	KBOA-FM	98.9
Poplar Bluff	KWDC-FM	94.5
St. Louis	KCFM	93.7
	KSLH	*91.5
Springfield	KTTS-FM	94.7
West Plains	KWPM-FM	93.9

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
Nashua	WOTW-FM	106.3

NEW JERSEY

Location	C.L.	Mc.
Asbury Park	WJLK-FM	94.3
Bridgeton	WSNJ-FM	98.9
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.
Auburn	WMBO-FM	96.1
Binghamton	WNBF-FM	98.1
	WKDP-FM	95.3
Brooklyn	WNYE	*91.5
Buffalo	WBEN-FM	106.5
	WBNY-FM	92.9
	KWDL-FM	104.1
	WILY	103.3
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
Jamestown	WJTN-FM	93.3
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
	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	WHOL-FM	95.7
Patchogue	WALK-FM	97.5
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
	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
High Point	WHPE-FM	95.5
	WHPS	*89.3
	WMFR-FM	99.5
	WNDS-FM	100.3
Laurinburg	WEWO-FM	96.5
Leaksville	WLOE-FM	94.5
Lexington	WBUY-FM	94.3

Location	C.L.	Mc.
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	WSIC-FM	105.7
Tarboro	WCPS-FM	104.3
Thomasville	WTNC-FM	98.3
Winston-Salem	WAIR-FM	93.1
	WSJS-FM	104.1
OHIO		
Akron	WAKR-FM	97.5
	WAPS	*89.1
Alliance	WFAH-FM	101.7
Ashland	WATG-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
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
Steubenville	WSTV-FM	103.5
Toledo	WSPD-FM	101.5
	WMHE	92.5
	WTDS	*91.3
	WTOL-FM	104.7
	WTOD-FM	99.9
Wooster	WWST-FM	104.5
Youngstown	WKBN-FM	98.9
OKLAHOMA		
Norman	WNAD-FM	*90.9
Oklahoma City	KOKH	*88.9
Shawnee	KBGC	*89.9

Location	C.L.	Mc.
Stillwater	KAMC-FM	*91.7
	KSPI-FM	93.9
Tulsa	KWGS	*90.5
OREGON		
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
PENNSYLVANIA		
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		
Providence	WPJB-FM	105.1
	WPFM	95.5
	WPRO-FM	92.3

Location	C.L.	Mc.
	WXCN	101.5
Woonsocket	WWON-FM	106.3
SOUTH CAROLINA		
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		
Bristol	WOPI-FM	96.9
Greenville	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		
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	94.3
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	KPRC-FM	102.9
	KFMK	97.9
	KTRH-FM	101.1
	KUHF	*91.3
Lubbock	KSEL-FM	93.7
Nacogdoches	KELS	100.1
Plainview	KHBL	*88.1
San Antonio	KISS	99.5
	KITE-FM	97.3
	KONO-FM	92.9
Texarkana	KCMC-FM	98.1
UTAH		
Ephraim	KEPH	*88.9
Logan	KVSC	*88.1
Salt Lake City	KDYL-FM	98.7
	KSL-FM	100.3
VIRGINIA		
Arlington	WARL-FM	105.1
Charlottesville	WINA-FM	95.3
	WTJU	91.3
Crewe	WSVS-FM	104.7

Location	C.L.	Mc.
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		
Cheney	KEWC-FM	*89.9
Seattle	KING-FM	98.1
	KIRO-FM	100.7
	KISW	99.9
	KUOW	*94.9
Spokane	KREM-FM	92.9
Tacoma	KCPS	90.9
	KTNT	97.3
	KTOY	*91.7
WEST VIRGINIA		
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		
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	94.9
Highland	WHHI	91.3
Highland Twp.	WHSA	*89.9
Janesville	WCLD-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
Racine	WRJN-FM	100.7
Rice Lake	WJMC-FM	96.3
Wausau	WHRM	*91.9
Wisc. Rapids	WFHR-FM	103.3
HAWAII		
Honolulu	KAIM-FM	95.5
	KUOH	*90.5
	KVOK	*88.1

Canadian

Frequency-Modulation (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.	CKDA-FM	98.5
Windsor, Ont.	CKLW-FM	93.9
Winnipeg, Man.	CJOB-FM	103.1

United States Television Stations

Listed Alphabetically by Location

(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	WABT	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
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	KRBB	10
Ft. Smith	KFSA-TV	22
	KNAC-TV	5
Little Rock	KARK-TV	4
	KTHV	11
Pine Bluff	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

Location	C.L.	Chan.
	KRMA-TV	*6
	KTVR	2
Grand Junction	KREX-TV	5
Montrose	KFXJ-TV	10
Pueblo	KCSJ-TV	5

CONNECTICUT

Location	C.L.	Chan.
Bridgeport	WICC-TV	43
Hartford	WHCT	18
	WTIC-TV	3
New Britain	WNBC	30
New Haven	WNHC-TV	8
Waterbury	WATR-TV	53

DELAWARE

Location	C.L.	Chan.
Wilmington	WVUE	12

DIST. OF COLUMBIA

Location	C.L.	Chan.
Washington	WMAL-TV	7
	WRC-TV	4
	WTOP-TV	9
	WTTG	5

FLORIDA

Location	C.L.	Chan.
Daytona Beach	WESH-TV	2
Fort Myers	WINK-TV	11
Jacksonville	WJCT	*7
	WFGA-TV	12
	WMBR-TV	4
Miami	WCKT	7
	WPST-TV	10
	WTHS-TV	*2
	WTVJ	4
Orlando	WOBO-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
	WTVT	13
W. Palm Beach	WEAT-TV	12

GEORGIA

Location	C.L.	Chan.
Albany	WALB-TV	10
Atlanta	WAGA-TV	5
	WSB-TV	2
	WETV	*30
	WLW-A	11
Augusta	WJBF	6
	WROW-TV	12
Columbus	WRBL-TV	4
	WTVM	28
Macon	WMAZ-TV	13
Savannah	WSAV-TV	3
	WTOC-TV	11
Thomasville	WCTV	6

IDAHO

Location	C.L.	Chan.
Boise	KBOI	2
	KIOO-TV	7
Idaho Falls	KID-TV	3
Lewiston	KLEW-TV	3
Twin Falls	KLIX-TV	11

ILLINOIS

Location	C.L.	Chan.
Bloomington	WBLN	15
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

Location	C.L.	Chan.
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

Location	C.L.	Chan.
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

Location	C.L.	Chan.
Ensign	KTVC	6
Great Bend	KCKT	2
Hutchinson	KTVH	12
Pittsburg	KOAM-TV	7
Topeka	WIBW-TV	13
Wichita	KAKE-TV	10
	KARO-TV	3

KENTUCKY

Location	C.L.	Chan.
Lexington	WLEX-TV	18
	WKYT	27
Louisville	WAVE-TV	3
	WHAS-TV	11
	WQXL-TV	41
Paducah	WPSO-TV	6

LOUISIANA

Location	C.L.	Chan.
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	WOSU-TV	6
	WJMR-TV	20
	WWL-TV	4
	WYES	*8
Shreveport	KSLA-TV	12
	KTBS-TV	3

MAINE

Location	C.L.	Chan.
Bangor	WABI-TV	5
	W-TWO	2
Poland Spring	WMTW	8
Portland	WCSH-TV	6
	WGAN-TV	13
Presque Isle	WAGM-TV	8

MARYLAND

Location	C.L.	Chan.
Baltimore	WJZ-TV	13
	WBAL-TV	11
	WMAR-TV	2
Salisbury	WBOC-TV	16

MASSACHUSETTS

Location	C.L.	Chan.
Adams	WCOC	19
Boston	WBZ-TV	4
	WGBH-TV	*2
	WHOH-TV	5
	WNAC-TV	7
Greenfield	WRLP	32
Springfield	WHYN-TV	40
	WWLP	22

MICHIGAN

Location	C.L.	Chan.
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
East Lansing	WKAR-TV	*60
Grand Rapids	WOOO-TV	8
Kalamazoo	WKZO-TV	3
Lansing	WJIM-TV	6
Marquette	WDMJ-TV	6
Saginaw	WKNX-TV	57
Traverse City	WPBN-TV	7

MINNESOTA

Location	C.L.	Chan.
Austin	KMMT	6
Duluth	KDAL-TV	3
	WOSM-TV	6
Minneapolis	KMSP	9
	WCCO-TV	4
	WTCN-TV	11
Rochester	KROC-TV	10
St. Paul	KSTP-TV	5
	KTCA-TV	*2

MISSISSIPPI

Location	C.L.	Chan.
Columbus	WCBI-TV	4
Hattiesburg	WOAM-TV	9
Jackson	WJTV	12
	WLBT	3
Meridian	WTOK-TV	11
	WCOC-TV	30
Tupelo	WTWV	9

MISSOURI

Location	C.L.	Chan.
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

Location	C.L.	Chan.
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
Missoula	KMSO-TV	13

NEBRASKA

Location	C.L.	Chan.
Hastings	KHAS-TV	5
Hay Springs	KOUH-TV	4
Hayes Center	KHPL-TV	6
Kearney	KHOL-TV	13
Lincoln	KOLN-TV	10
	KUON-TV	*12
Omaha	KMTV	3
	KETV	7
	WOW-TV	6
Scottsbluff	KSTF	10

NEVADA

Location	C.L.	Chan.
Henderson	KLRJ-TV	2
Las Vegas	KLAS-TV	8
	KSHO-TV	13
Reno	KOLO-TV	8

NEW HAMPSHIRE

Location	C.L.	Chan.
Manchester	WMUR-TV	9

NEW JERSEY

Location	C.L.	Chan.
Newark	WNTA-TV	13

NEW MEXICO

Location	C.L.	Chan.
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

Location	C.L.	Chan.
Albany	WTEN	10
	WTRI	35
Binghamton	WINR-TV	40
	WNBF-TV	12
Buffalo	WBEN-TV	4
	WBUF	17
	WGR-TV	2
Carthage	WCNY-TV	7
Elmira	WSYE-TV	18
New York	WABC-TV	7
	WABD	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	KCJB-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
Youngstown	WFMJ-TV	21
	WKBN-TV	27
	WKST-TV	45
Zanesville	WHIZ-TV	18

OKLAHOMA

Location	C.L.	Chan.
Ada	KTEN	10
Ardmore	KVSO-TV	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	WLBR-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	KOKA-TV	2
	WIIC	11
	WQEO	*13
	WTAE	4
Scranton	WNEP-TV	16
	WOAU-TV	22
Wilkes-Barre	WBRE-TV	28
	WILK-TV	34
York	WNOW-TV	49
	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	8
Greenville	WFBC-TV	4
Spartanburg	WSPA-TV	7

SOUTH DAKOTA

Location	C.L.	Chan.
Florence	KOLO-TV	3
Rapid City	KOTA-TV	3
	KRSO-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	WOXI-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	KEOY-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	KHAD-TV	8
Lubbock	KCBD-TV	11
	KDUB-TV	13
Lufkin	KTRE-TV	9
Midland	KMID-TV	2
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

Location	C.L.	Chan.
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		
Salt Lake City	KSL-TV	5
	KTVT	4
	KUED	*7
	KUTV	2
VERMONT		
Burlington	WCAX-TV	3
VIRGINIA		
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		
Bellingham	KVOS-TV	12
Ephrata	KBAS-TV	16
Kennewick	KTRX-TV	25
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		
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		
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	19
Wausau	WSAU-TV	7
Whitefish Bay	WITI-TV	6
WYOMING		
Casper	KTWO-TV	2
	KSPR-TV	6
Cheyenne	KFBC-TV	5
Riverton	KWRB-TV	10
U. S. TERRITORIES AND POSSESSIONS		
ALASKA		
Anchorage	KENI-TV	2
	KTVA	11
Fairbanks	KFAR-TV	2
	KTVF	11
Juneau	KINY-TV	8
GUAM		
Agana	KUAM-TV	8
HAWAII		
Hilo	KHBC-TV	9
Honolulu	KGMB-TV	9
	KHVH-TV	13
	KONA	2
	KULA-TV	4
Wailuku	KMAU	3
	KMVI-TV	12
PUERTO RICO		
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

Listed Alphabetically by Location

Abbreviations: C.L., call letters; Chan., channel number.

Location	C.L.	Chan.
ALBERTA		
Calgary	CHCT-TV	2
Edmonton	CFRN-TV	3
Lethbridge	CJLH-TV	7
Medicine Hat	CHAT-TV	6
Red Deer	CHCA-TV	6
BRITISH COLUMBIA		
Kamloops	CFCR-TV	4
Kelowna	CHBC-TV	2
Penticton	CHBC-TV	13
Vancouver	CBUT	2
Vernon	CHBC-TV	7
Victoria	CHEK-TV	6
MANITOBA		
Brandon	CKX-TV	5
Winnipeg	CBWT	3
LABRADOR		
Goose Bay	CFLA-TV	8
NEW BRUNSWICK		
Moncton	CKCW-TV	2
Saint John	CHSJ-TV	4
NEWFOUNDLAND		
Argentia	CJOX-TV	10
St. John's	CJON-TV	6
Stephenville	CFSN-TV	8
NOVA SCOTIA		
Halifax	CBHT	3
Sydney	CJCB-TV	4
ONTARIO		
Barrie	CKVR-TV	3
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		
Charlottetown	CFCY-TV	13
QUEBEC		
Estcourt	CJES-TV-1	70
Jonquiere	CKRS-TV	12
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		
Prince Albert	CKBI-TV	5
Regina	CKCK-TV	2
Saskatoon	CFQC-TV	8
Swift Current	CFJB-TV	5

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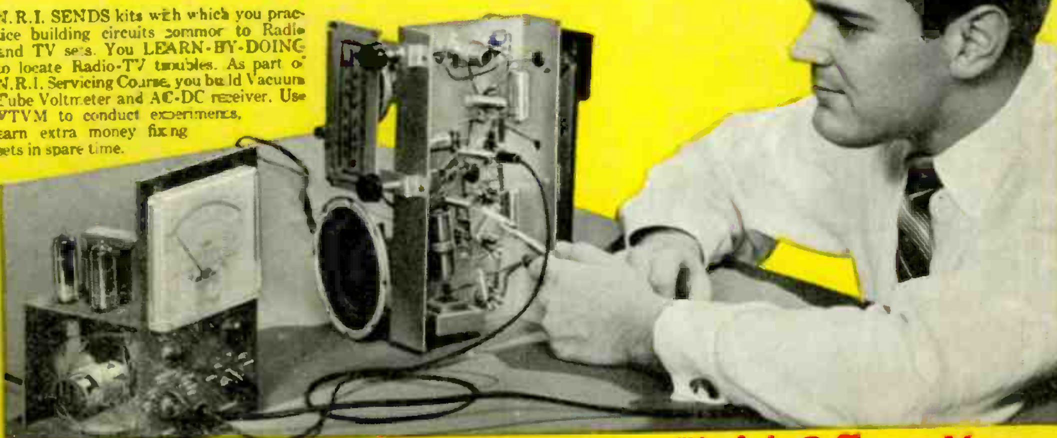

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