

LIGHT TRIGGERS OUR ADD-ON TREMOLO—see page 72

Science and Electronics

JUNE-JULY
75c

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RADIO
LOG**

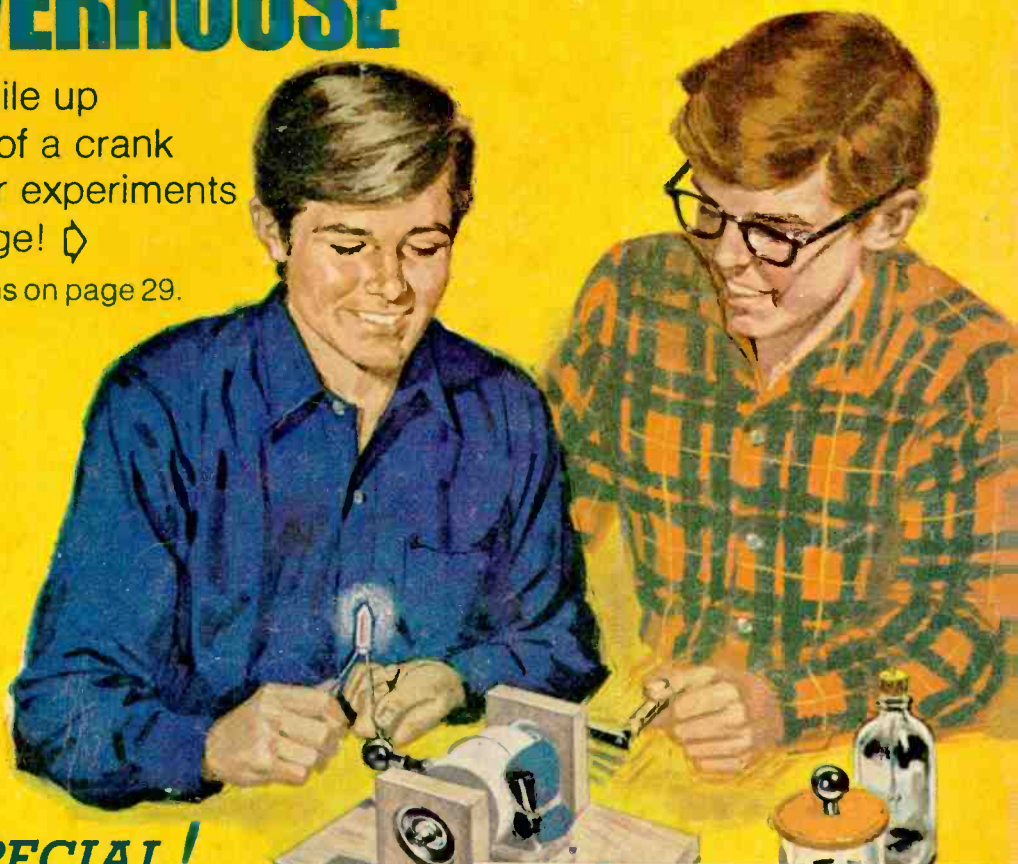
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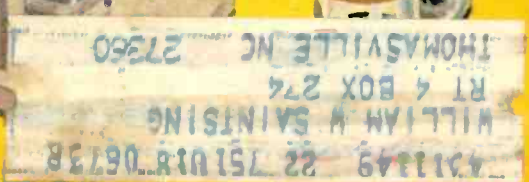
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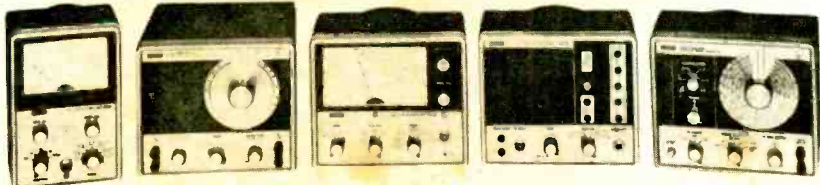
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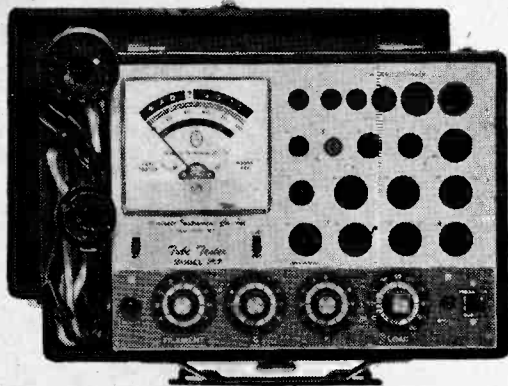
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Cover illustration by Len Goldberg

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Number 3

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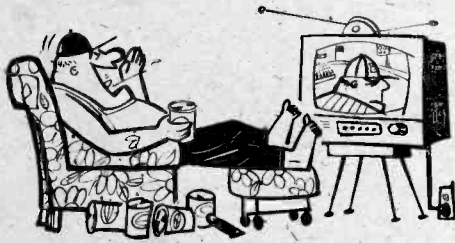
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POSITIVE FEEDBACK

Julian M. Sienkiewicz
EDITOR-IN-CHIEF

The great mail strike of 1970 is now ancient history to most people (unless they'll have pulled another one on us ere now), but not to you, my dear readers. While you are thumbing through this issue of **SCIENCE AND ELECTRONICS**, you will find that one of our regular columns, "Famous Patents," is not present. Alas, it was in a mail bag somewhere in the vastness of the New York General Post Office as we were setting type for this here issue. But don't fret. Our Famous Patent columnist, Arthur Cookfair, has conspired with us to employ the services of that "Leave the driving to us" hound, so that we'll be able to catch up with patent history by the next issue.

Hot Stuff! The Seventies will see the introduction of electronics to milady's kitchen. It's been a long time coming, but it's here—and there is no stopping it. Radar (microwave) ovens, formerly relegated to short-order restaurants in the past, will be standard items in over 100,000 homes this year. What will happen to the sales of these home ovens in 1971 will probably make the air-conditioning marketplace look like five-and-dime store stuff.

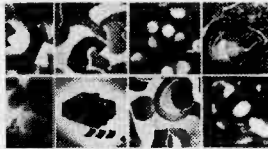
To discover how they cook with "cool" heat, I suggest you read our article beginning on page 55 of this issue.

I would like to hear from our readers who own microwave ovens and are using them. What I would like to know is "exactly how good they really are, is improvement needed with the model presently in use, what cooks good and what does not?" We prefer not to believe makers' claims. Too many "blue sky" statements are made by 100 many appliance manufacturers lately. There is nothing as good as the final consumer test performed by the consumer in the home.

And say, fellahs, if you want to get your wife's name in print, why not send in your better half's favorite recipe for cooking or baking in a microwave oven. This is not a contest, but the best recipes will be judged by the salivation of this editor and published. Let's hear from you!

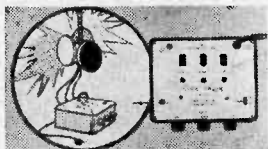
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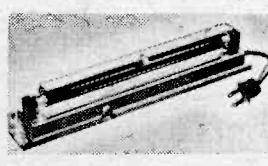
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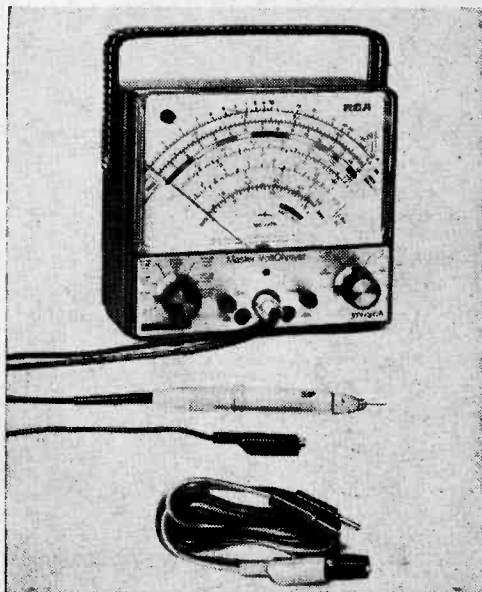
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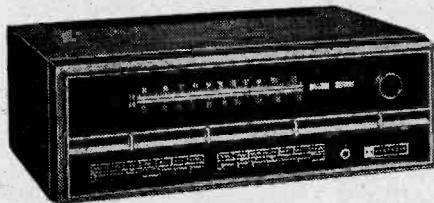


RCA WV-510A Master VoltOhmyst

plex waveforms from 0.5 to 4200 volts, resistance values from 0.2 ohms to 1000 megohms. Seven overlapping ranges are provided for AC, resistance, and current measurements, and eight ranges are provided for DC voltage measurement. Accuracy for all voltage and current functions is $\pm 3\%$ of full-scale reading. Dimensions of the WV-510A, less handle are $6\frac{7}{8} \times 5\frac{1}{4} \times 3\frac{3}{8}$ in.; weight is $3\frac{1}{2}$ lb. Price is \$128.00 and you can get further technical information from Commercial Engineering, RCA Electronic Components, Harrison, N.J. 07029, or from RCA test equipment distributors.

Put Together 60 Watts of Stereo

Last time out, we reported on the Heathkit AR-29 AM/FM/FM-stereo receiver, which puts out 100 watts. Now for those of you who don't need all those watts, here's the AR-19, a 60-watt job, and naturally it's more moderately priced. The AR-19 features the same advanced FET, IC design as the AR-29. There are five integrated circuits for a total of 57 transistors and 35 diodes. Frequency response is from 6 to 35,000 Hz with less than 0.25% harmonic distortion at any power level (Heath says this is the lowest distortion of any receiver in this power class). For the ease and comfort

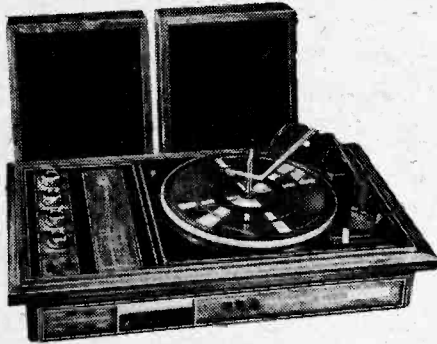


Heathkit AR-19 AM/FM/FM-Stereo Receiver

of the kit builder, all eight circuit boards snap in and out in seconds. This also means that later checking of circuits can be done with a minimum of dismantling. The factory-assembled FM tuner has a $2.0\text{-}\mu\text{V}$ sensitivity. Unit has necessary output terminals to connect a second pair of stereo speakers for use in another room, or you can connect three speaker systems—right, center (mixed), and left. With Heath's Black Magic panel lighting no dial or scale markings show til the set is turned on. Price of the AR-19 is \$225.00. For more dope, write the Heath Co., Benton Harbor, Mich. 49022.

Ambidextrous System

Lafayette's new LSC-888 combines a solid-state stereo modular phono with an 8-track tape system—a happy combo! The LSC-888 brings together a Garrard 4-speed automatic record changer, an 8-track tape system, a 20-watt solid-state amplifier, and a pair of acoustically matched speaker systems. The record changer has tubular tonearm with stereo turnover car-

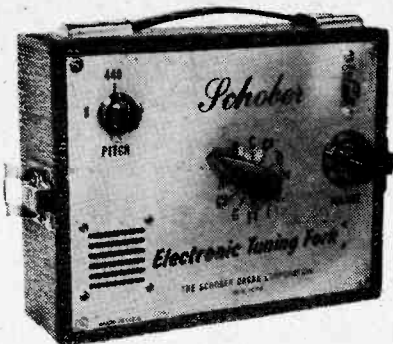


Lafayette LSC-888 Stereo Phono and Tape System

tridge and diamond needle, plus cueing control. The amplifier controls include balance, bass, treble, volume, selector; there's also an automatic shut-off switch, a front panel stereo headphone jack, and an auxiliary input jack for tuner or tape recorder. Speakers are 8 in. There's a tinted plastic dust cover and a 45 rpm spindle. Control unit measures 23½ x 4 x 14 in.; speakers, 15 x 10 x 4¾ in. Price of the LSC-888 is \$149.95, and for more specs write to Lafayette Radio Electronics, 111 Jericho Tpke., Syosset, N.Y. 11791.

Tuning Fork with Electronic Brain

With the new Schober Electronic Tuning Fork you can tune any musical instrument, except a piano, which requires a process known as "stretching." Fork provides 12 steady tones, middle C through the B above it. Pitch accuracy is within 5 cents (5% of a semitone). A special knob sets the scale a A=440 but permits resetting to anything between about 435 and 445. The tones have harmonics, making the zero-beat tuning technique easier and permitting the fork to be used directly to tune in-



Schober Electronic Tuning Fork

struments in higher and lower octaves. Housed in a strong wooden case, 5½ x 7 x 3 in., it operates on two 9-volt transistor radio batteries and has its own built-in speaker. A voltage regulator maintains pitch accuracy during the entire life of the batteries—about 18 hours

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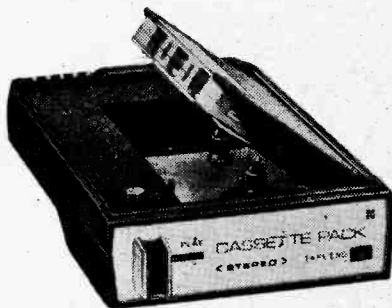
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continuous operation and several times that in normal use. The fork is factory-calibrated for pitch accuracy; price is \$49.95. For detailed descriptive sheet write The Schober Organ Corp., 43 W. 61st St., New York, N.Y. 10023.

8-Track or 4? Be Adaptable!

Panasonic adds another item to its line of car stereo accessories by introducing a cassette adaptor pack which allows you to play a 4-track stereo cassette in any Panasonic 8-track tape player. Designed specifically for the car, it fits into an 8-track tape player like an ordinary stereo cartridge and plays cassette tapes

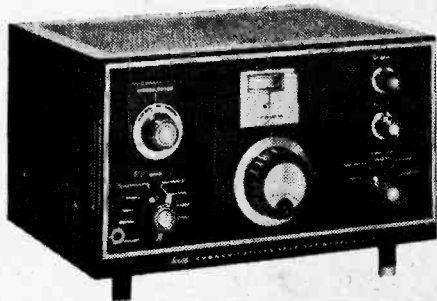


Panasonic CJ-980 Cassette Adaptor Pack

instantly. A panel light automatically switches on to signal the end of a tape. The cassette adaptor pack, Model CJ-980, comes with a leatherette carrying case and polishing cloth, and is priced at \$39.95. For more details write Panasonic, 200 Park Ave., New York, N.Y. 10017.

Slam-Bang Ham Band Box

Allied has a new, moderately-priced 80- to 10-Meter ham band receiver that, they say, not only has highly satisfactory performance, but, also, clean, attractive styling that will please your XYL. Model A-2516 features a deluxe filter for highly selective AM, CW, and SSB reception on all ham bands between 3.5 and 29.7 MHz. This includes 80, 40, 20, 15, and 10 Meters, as well as the WWV signal on 10 MHz. Unit has a crystal-controlled first local

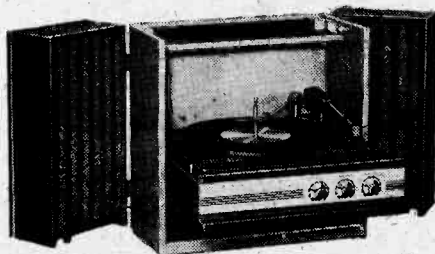


Allied A-2516 Ham Receiver

oscillator and a solid-state VFO-type second oscillator with negligible frequency drift. The VFO circuit has output terminals for use as a transmitter VFO. The mechanical IF filter provides a 1.5-kHz bandwidth at 6 dB down, 6 kHz at 60 dB down. Sensitivity is 1.5 μ V for 10 dB signal-to-noise ratio at 14 MHz. Image ratio and IF rejection are better than 40 dB at 14 MHz. Price is \$169.95 and for more specs you can write to Allied Radio Corp., 100 N. Western Ave., Chicago, Ill. 60680.

Carry-O the Stere-O

Heathkit has a new portable stereo phonograph, the GD-109. It has 18 watts output, a deluxe record changer, and full-range speakers. Each 4½-in. speaker can be lifted off the changer cabinet and placed up to 5 ft away. The 9-watt per channel solid-state amplifier is combined with a preassembled, 4-speed automatic record changer—a Maestro—which tilts



Heathkit GD-109 Portable Stereo Phonograph

up and locks for portability. The GD-109 features a ceramic stereo cartridge having 30 dB separation; diamond stylus pressure is a low 3½ grams. Controls include volume, tone, and balance, and there's a 45-rpm adapter. Cabinet is wood with plastic-coated covering and the price is \$74.95. For additional information, write the Heath Co., Benton Harbor, Mich. 49022.

Vehicular Vane

Avanti has three new tunable antennas for vehicular applications, featuring base-loaded and ruggedized construction. Model numbers apply as follows: SS-27, 27 to 33 MHz; SS-34, 34 to 40 MHz; SS-45, 40 to 50 MHz. All three have taper ground stainless steel whips and can be tuned to exact frequency. Loading coil is finned to aid heat dissipation and potted in epoxy for water proofing. Nominal impedance is



Avanti SS Series Mobile Antenna

50 ohms; power handling, 100+ watts. The antennas come with their own integral mounts, 20 ft of RG-58/U cable, and PL259 connectors,

and are guaranteed for one year. Components are heavy chrome-plated brass and are compatible with the new Avanti no-hole trunk lip base. Price of any of the models is \$21.25. For more information write to Avanti Research & Development, Inc., 33-35 W. Fullerton Ave., Addison, Ill. 60101.

Two Can Listen as Cheaply* as One

This new device from Robins Industries, called Twinfone, lets two persons in on a phone call. It has no moving parts and requires no electricity. One end of Twinfone slips over the earpiece, while a length of tubing carries the sound to another earpiece. What you have is the convenience of an extension phone without the expense of a second telephone instrument. A



Robins Twinfone

business associate can join in a call, a secretary can listen to take notes, or, both parents can chat simultaneously with a child away from home. Twinfone also helps the hard-of-hearing by amplifying the sound when the extra earpiece is held to the other ear. Twinfone is priced at \$4.98, and you can get more dope from Robins Industries Corp., 15-58 127th St., College Point, N.Y. 11356. ■



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One for the Test Bench. Here's a "one-stop" source of practical electronic troubleshooting procedures, based on tried-and-tested measurement techniques. It's John J. Schultz's new text entitled *Electronic Test and Measurement Handbook*.

Covering a variety of tests on receivers, transmitters, transceivers, antennas (up to and including VHF), and a wide range of accessory



Hard cover
224 pages
\$7.95

equipment, this is one handbook that clearly shows how to apply factual and crystal-clear information to testbench problems. Based on years of practical experience, the author tells how to measure even critical performance, using moderately-priced test equipment. Encompasses many tests that heretofore required the use of lab-type gear to equal the accuracy attainable with the methods outlined in this work. In each case there's a complete, detailed procedure and setup diagram to show how to conduct each test or measurement with ease. With the help of a thorough index the reader can find a specific test in seconds and be on his way to accurate, dependable measurements. Available directly from the publisher—Tab Books, Blue Ridge Summit, Pa. 17214.

The Answer Men. Since the early 1950's, the manufacture and sales of high fidelity equipment has become a multi-million dollar industry. And it seems that with each dollar, a question was asked. Authors Leo G. Sands and Fred Shunaman combined forces to answer 101 of the most asked questions. You guessed it, the title of this book is *101 Questions and Answers about Hi-Fi and Stereo*.

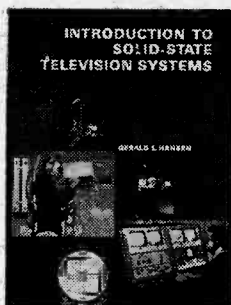
The question and answer format is the quickest way to inform an audio neophyte. The text is divided into six sections to aid the reader in finding the information he desires. The first section deals with hi-fi/stereo systems,



Soft cover
128 pages
\$3.50

while the second and third sections discuss amplifiers and tuners respectively. Record and tape players are covered in the next two sections. Maintenance and troubleshooting procedures are given in the last section. Interested? Then write to the publisher—Howard W. Sams & Co., Inc., 4300 W. 62nd Street, Indianapolis, Ind. 46268.

Solid TV. Here's a text—*Introduction to Solid-State Television Systems* by Gerald L. Hansen—that's unique. It is devoted entirely to TV today! Its up-to-date information and broad, detailed coverage make it a "must" with anyone concerned with the vital, changing field of television today. No exceptional knowledge is necessary to understand the clear, readable text. The author has bypassed complex mathe-



Hard cover
449 pages
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tical formulas, so that readers with a basic grasp of electronic and transistor theory will find the text readily comprehensible.

Several photographs and detailed diagrams of the latest transistorized circuits accompany the text, making it an excellent introduction to solid-state TV systems. That's how it got its title! For your copy, order directly from your local bookstore or direct from the publisher—Prentice-Hall, Inc. Englewood Cliffs, N. J. 07632.

You Can Do It! Here's just the book you've been looking for—*TV Troubleshooter's Handbook* by the Editors of Electronic Technician/Dealer. It's completely updated, quick-reference source for scores of tried-and-tested solutions to "tough-dog" TV troubles.

This detailed compilation of practical help
(Continued on page 102)

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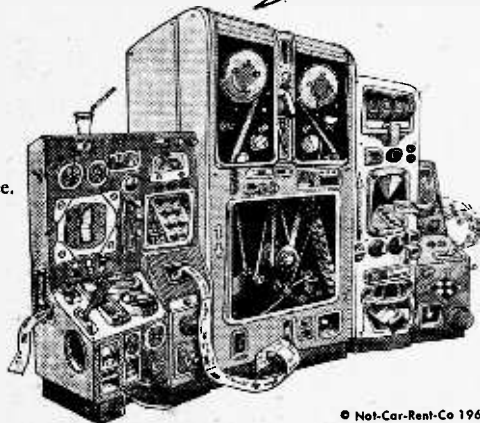
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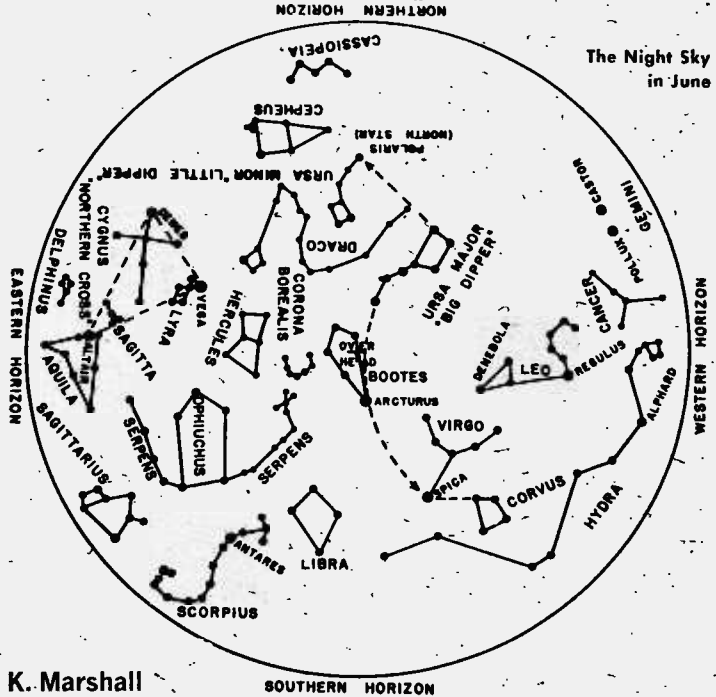
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The Skies Above Us

by Dr. Roy K. Marshall



☆☆ When I look at the map of our June sky, I see almost exactly overhead the ruddy star Arcturus and I recall an evening in the Spring of 1933 when many thousands of people on the grounds of Chicago's Century of Progress Exposition awaited the moment when a signal from that star, caught by a photocell at the tailpiece of the greatest refracting telescope in the world, the 40-inch at the Yerkes Observatory, about 75 miles away, and carried by wire to Chicago, would trigger a relay atop the Hall of Science and turn on the lights of the most magnificent fairyland and most profitable (even in depression times!) exposition ever held (admission to the grounds, 50¢). In 1959-60, I went to Chicago for a little more than a year to reorganize the Adler Planetarium; my wages were paid from a fund resulting from the Century of Progress Exposition, a quarter-century earlier.

☆ They had picked Arcturus as the most conspicuous star with a distance most nearly 40 light-years, to tie it in with the other great world's fair, the Columbian Exposition in Chicago in 1893 (delayed a year from the quadricentennial of the voyage of Christopher Columbus, by labor strikes!). The distance of Arcturus is really 36.2 light-years, so the starlight we used in 1933 left that star in 1897, still a very appropriate year, because that's when the great telescope in its 90-foot dome at the Yerkes Observatory was installed.

☆ Note how the curve of the handle of the Big Dipper points out Arcturus and the white star

Spica. We have quite a zoo in our summer sky, with two bears (Ursa Major and Ursa Minor), a water snake (Hydra), another snake in Serpens, a lion (Leo), a crab (Cancer), a scorpion, a dragon (Draco), a swan (Cygnus), an eagle (Aquila) and a dolphin (Delphinus).

☆ These can all be spotted in the June map, while we have three unnatural creatures in the July map. Sagittarius is normally called "The Teapot," from its shape, but classically it is a centaur, who is an Archer. And Capricornus is a "Sea Goat"—front half a goat, hind half a fish! Then, just peeping up on the eastern horizon (better seen later at night or later in the year), there's Pegasus, the beautiful winged horse that impudent Bellerophon tried to ride to the abode of the gods on Mount Olympus. Pegasus was bitten by a gadfly and bucked so hard that Bellerophon was thrown, and fell from the skies to be so badly maimed that he dragged out the remainder of his life as a lonely, unhappy cripple. Some poet has said of him, "Yet was it noble so to aspire." But you can't win 'em all!

☆ In the July map, we find two good men on the southern half of the meridian, the imaginary line that divides the sky into eastern and western halves. Hercules, almost overhead, is the famous hero and, when his figure is filled out with fainter stars toward the north, we find that he has one foot on the quadrilateral that marks the head of Draco, the dragon. The head of Hercules, not indicated, is a star just over the "C" of Ophiuchus, as the head of that latter giant is just below. This man is thought to



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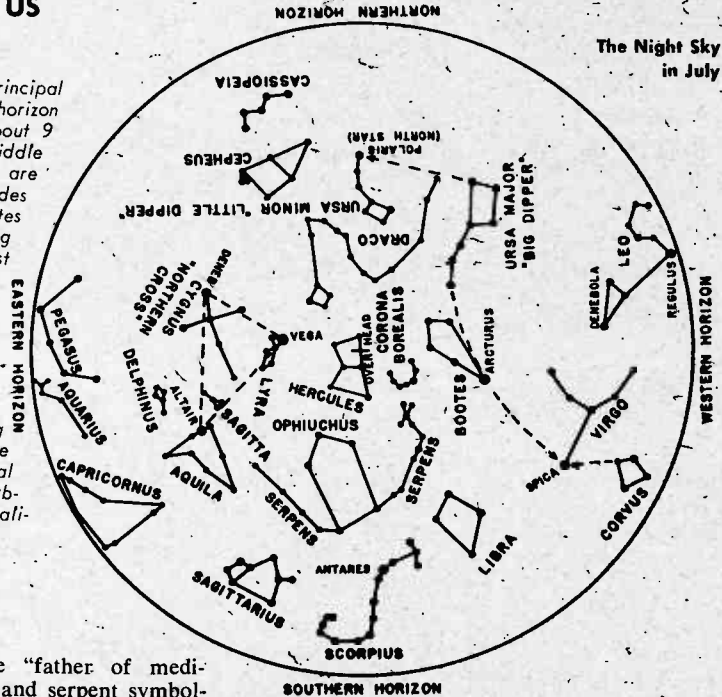
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THE SKIES ABOVE US

☆☆☆ The maps show the principal stars which are above the horizon at latitude 34° North at about 9 p.m. standard time at the middle of the month. These maps are practical star location guides anywhere in the United States throughout the month showing the sky at 10 p.m. on the first and at 8 p.m. on the last of the month. To look at the night sky in June and July, select the proper map and hold it vertically. Then turn the map so that the point of the compass toward which you are facing shows at the bottom of the map. ☆☆☆ Our special thanks go to the Griffith Observatory in Los Angeles, California. ☆☆☆



represent Aesculapius, the "father of medicine," whose walking staff and serpent symbolize medical men and societies today. Because snakes shed their skins, ancient people thought that they renewed their lives.

☆ If your sky is not too flooded with the glow from lights, and you have binoculars or a small telescope, look carefully at the "overhead" marker in Hercules. There you may spot a fuzzy glow that is a magnificent globular star cluster, when photographed. And the Milky Way now arches halfway up in the eastern sky, through Sagittarius, Cygnus and Cassiopeia.

☆☆ If you can recall, in the last issue I was talking about how the calendar came about. Unfortunately, I ran out of space and will finish the discussion in this issue.

☆ It is the fourteenth day of Nisan, either the first or second full moon after March 21, that is a very solemn holy day in the Hebrew calendar, commemorating the exodus of the children of Israel from their travail in Egypt. It is the Passover which, in 1970, is celebrated on April 21 because, while a full moon occurs on March 22, it falls in the embolismic month Veadar.

☆ Historians believe that it was probably Seti I who was the Pharaoh who welcomed the Hebrews to Egypt during a time of famine. They made their homes in the land called Goshen, just to the east and northeast of modern Cairo. They were well treated and they prospered, as had Abraham and his family in Egypt, some 500 years earlier. But Seti died in 1290 B.C. and was succeeded by Rameses II who saw the Hebrews as possible future enemies. He made life miserable for them and

reduced them almost to the conditions of slavery. Many times he promised to let them leave, but just as often he had broken his promise. Finally, Jehovah visited a dreadful calamity upon the Egyptians—the death of the firstborn child of every family, on the night of the full moon in the month of Nisan (then called Abib). But he had told the Jews to put lamb's blood on the side-posts, and lintels of the doors of their homes as a sign, and these houses he "passed over." In the confusion, the Jews took their belongings and escaped from Goshen by crossing the salt marshes, then existing, called the Reed Sea (and not, as usually stated, "Red Sea," which was quite far away), where the pursuing chariots of Rameses bogged down.

☆ It is in remembrance of this event that the Jewish people celebrate the Passover, each year, as they have since the exodus, on the fourteenth day of the month Nisan, in the evening of the full moon. The proper date is set, as we have seen, by the lunar calendar.

☆ Jesus and his disciples were Jews and, as such, would not fail to observe the Passover. In the closing days of his life on earth, he sent Peter and John into Jerusalem to prepare the room where they would celebrate it. The Christians know this as the Last Supper and, because it was the Passover, we can date it and other events.

☆ We read that on the following day Jesus was arrested, tried and crucified. His body lay in a borrowed tomb over the Sabbath (Saturday) and the Resurrection occurred on the

(Continued on page 101)

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—the men needed to inspect,
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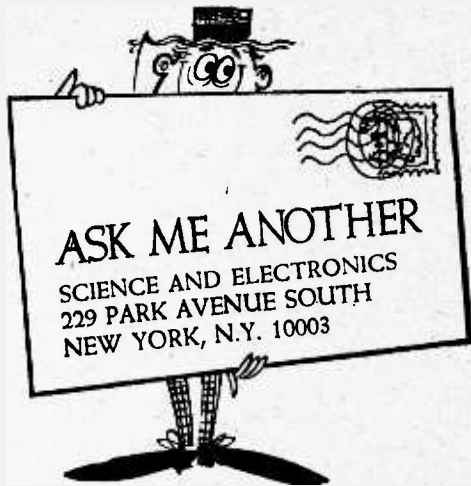
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EX-38



What's to Squelch?

I have a \$59.95 8-band receiver that covers from 26 MHz to 174 MHz. What kind of antenna do I need for greater distance? I connected a piece of rubber-coated wire to an old car aerial, but aside from hearing the local police and taxis and two FM stations, I get nothing more. What can I possibly receive up here?

—R. D'V., Bangor, Maine

If the Bangor & Aroostock Railroad up there even installed the radio system they talked



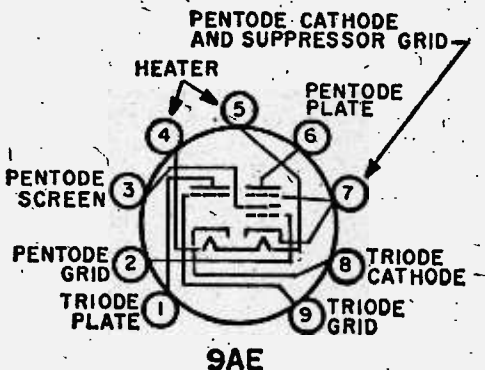
about in 1954, you might hear the crews trying to get the potato trains rolling on around 161 MHz. Otherwise there's not much DX to hear up there except CB and amateur stations. For better results, you need a CB antenna for 25-50 MHz reception, and a 148-174 MHz antenna. Be sure to mount them securely and as high as possible.

Tube Tester Up-Dated

The tube table for setting my tube tester for various tubes doesn't list all of the tubes used in my TV set, such as a 6GH8A. How do I test them? The manufacturer of the tube tester is no longer in business.

—H. K., Newport, R. I.

Get a General Electric tube manual and look up the tubes you want to test. For example, you will find that the 6GH8A is a medium-mu triode/sharp-cut off pentode and its basing diagram is 9AE as illustrated here. Then look



9AE

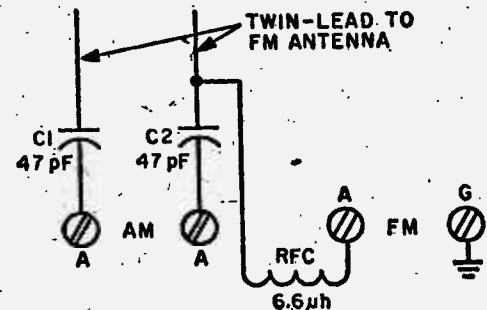
through the short form tube type listings in the manual and find another tube with the same basing diagram. You will find it to be a 6U8. It is the same basic tube with slightly different operating characteristics. Setting your tube tester for a 6U8 and plugging in a 6GH8A won't damage the tube nor the tester. The short test won't be affected, but the merit test might be a little higher. Apply the same technique to other tubes. Another good reference is a tube substitution manual.

AM Antenna Gimmick

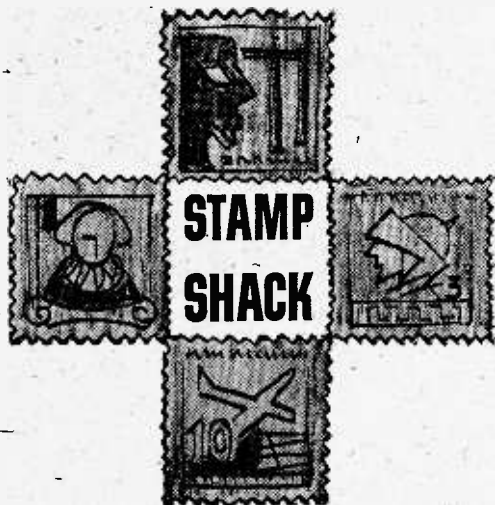
My FM reception is great, but on AM I can pick up local stations only. I have an AM/FM stereo receiver which has a built-in loop antenna for AM and terminals for external AM and FM antennas. I have installed an outdoor FM antenna. How can I use it for AM, too?

—H.S., Menlo Park, Calif.

Connect a 6.6 mH RF choke from one of the FM antenna terminals to the AM antenna terminal. This forms a low-pass filter, allowing BCB signals to pass while attenuating vhf (FM band) signals. If the FM band antenna coil inside the receiver has a grounded



center tap, you will need to connect the AM antenna terminal as shown in the diagram. Capacitors C1 and C2 prevent grounding of the antenna system at BCB frequencies. Although the choke causes some FM antenna lead-in unbalance, it should be negligible. On FM, the antenna functions as intended. On AM, the twinlead plus the FM antenna pick up BCB signals.



● ● Ever since July 20, 1969, when Astronauts Armstrong and Aldrin took their first moon walk, postal administrations all over the Earth produced special commemoratives to mark the epochal event. Many of them were genuinely spontaneous tributes of nations who wished to postally honor the United States' triumph. This is proven by the fact that designing, printing and release were decided upon only after Apollo 11's success.

● Belgium, for example, did not issue its tribute until Sept. 20, and then kept the face value down to six francs (12¢) which is the normal rate on normal letters mailed to domestic and European destinations:

● The stamp portrays the Apollo 11 team against a background of the moon (the Tranquility landing site is marked) and the exact landing time. So many Belgians used it on their mail post office stocks were exhausted in a few weeks. Korea issued five special stamps, all of a modest 20 won (6¢) denomination and showing progress pictures of the mission. India, too, issued a single, low-value stamp for the occasion.

● ● Other postal administrations were not quite so conservative. Their "tributes" comprised long sets with needlessly high-face values. Few of them, of course, did any real postal service but were intensively merchandised to the philatelic market.

● Some of the Iron Curtain satellites, who long used Space conquest subjects for designs since 1957, were ready for Apollo 11. Stamps were prepared long in advance and ready for the market within days after the landing—two months before the United States issued the 10-center, the die of which was actually aboard "Columbia" on the half-million-mile flight.

● Romania's comprises a souvenir sheet, imprinted with four 3.30-lei designs showing "The Eagle" and Col. Armstrong taking the first Lunar steps. These are flanked by stamp-shaped

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STAMP SHACK

labels portraying the individual Astronauts and an inscription giving the dates of the entire mission against an outline of the LM.

● Hungary's includes an entire set, but only one of which is for Apollo 11; the others show pictures of previous flights, including some made by Soviets to outer Space.

● What probably is the most striking of all was released by the African nation of Burundi (See page 10, April/May 1970). It is a super-size, 100-franc stamp printed singly on a sheet in such a way that the entire picture spills over into the margins. It shows Neil Aldrin, with camera in hand, walking in front of "The Eagle" and the United States flag as "The Columbia" speeds away for its orbits before picking up the Astronauts later on that memorable July 20.

● The whole is inscribed, "The First Man on the Moon," in French, and date, 21-7-1969 (although the landing was actually made the previous day!)

● And was to be expected, there were those other administrations whose "stamps" are produced by profit-minded promoters, which capitalized on the universally popularity of the event. It made little difference to them that domestic mail service is minimal; their aim was the exploitation of collectors who spend their dollars on the basis of alluring eye- or topical appeal than philatelic sophistication or knowledge.

● In the past they turned out tonnages of stickers honoring every and all American events such as the assassinations of John F. and Robert Kennedy, the death of Gen. Dwight D. Eisenhower, earlier Space flights, etc., so the Apollo 11 flight was right down their alley.

● Togo, Ghana, Dahomey, the Maldives, Panama, Paraguay and Ecuador all had theirs—



Hungary



Republic of Korea



India

with pictures as fancy as the asking prices. So did the sand-dune sheikhdoms of Arabia, which for years have turning out "stamps" through New York, London and Beirut operators even though they don't have their own postal service but depend upon neighboring administrations to handle the few pieces of mail dispatched by petroleum-exploration company employees.

● Ajman, for example, issued seven stickers and a souvenir sheet, each showing "progress pictures" of the Apollo program from #1 through 12. Later it released huge round adhesives made in similitude of silver coins so they could be foisted on the numismatic market as well as the philatelic.

● Panama's eight labels recall as many flights made by both Soviet and U.S. astronauts since the first Space walk.

● Umm al Qaiwain first took existing label stocks and overprinted them for immediate sale while the presses were busy producing a dozen new ones, each showing a photo reproduction (in gaudy colors) of various phases of the mission from lift-off at Cape Kennedy to landing at Tranquility and the lunar walk.

● They're all pretty and enticing souvenirs of an historic event, but buyers will do well to realize that spending dollars with hopes of future resale profits may not be the wisest decision: catalog editors spurn them; knowledgeable philatelists blacklist them. ■



Ajman



Belgium



Dubai

LITERATURE LIBRARY



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4. Olson's catalog is a multi-colored newspaper that's packed with more bargains than a phone book has names.
5. Edmund Scientific's new catalog contains over 4000 products that embrace many interests and fields.
6. Bargains galore, that's what's in store! Poly-Paks Co. will send you their latest 8-page flyer.
7. Before you build from scratch, check the Fair Radio Sales latest catalog for surplus gear.
8. Get it now! John Meshna, Jr.'s new 96-page catalog is jam packed with surplus buys.
9. Troubleshooting without test gear? Get with it—let Accurate Instrument clue you in on some great buys.
10. Burstein-Applebee offers a new giant catalog containing 100s of big pages crammed with savings.
11. Now available from EDI (Electronic Distributors, Inc.): a catalog containing hundreds of electronic items.
12. C. B. Hanson's new Automatic Control records both sides of a telephone call automatically.
23. No electronics bargain hunter should be caught without the 1970 copy of Radio Shack's catalog.
26. Get with 1970's hi-fi jet set. H. H. Scott sets the pace with their fantastic line of audio components, some in kit form too!
42. Heath's new 1970 full-color catalog is a shopper's dream. Its 116 pages are chuck full of gadgets and goodies everyone would want to own.
44. Kit builder? Like wired products? EICO's 1970 catalog takes care of both breeds of buyers.
45. CBers, Hams, SWLs—get your copy of World Radio Labs' 1970 catalog. Circle 45 now!
48. Hy-Gain's new CB antenna catalog is packed full of useful information. Get a copy.
74. Get two free books—"How to Get a Commercial FCC License" and "How to Succeed in Electronics"—from Cleveland Institute of Electronics.
78. Discover how to drive nuts and screws, ream, scribe, pierce holes with Xcelite's Series 99 handles and interchangeable blades.
96. Get your copy of E. F. Johnson's new booklet, "Can Johnson 2-way Radio Help Me?"
100. You can get increased CB range and clarity using B&K's hot "Cobra" transceivers.
107. Want a deluxe CB base station? Then get the specs on Tram's super CB rigs.
111. Get the scoop on Versa-Tronics' Versa-Tenna with instant magnetic mounting.
114. Prepare for tomorrow by studying at home with Technical Training International. Get the facts on how you can step up in your present job.
116. Pep-up your CB rig's performance with Turner's M+2 mobile microphone.
127. National Schools will help you learn all about color TV as you assemble their 25-in. color TV kit.
130. Bone up on CB with the latest Sams books. Titles range from "ABC's of CB Radio" to "99 Ways to Improve your CB Radio."
135. RCA Experimenter's Kits for hobbyists, hams, technicians and students are the answer for successful and enjoyable projects.
136. You can become an electrical engineer only if you take the first step. Let ICS send you their free illustrated catalog describing 17 special programs.
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141. CB antenna catalog by Antenna Specialists makes the pickin' easy.
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the OM's XYL

by Buz Holland



"Hold it half a second, Winifred, while I fix Frank's dinner!"



"Now listen, Rhona, I wish you'd stop referring to me as your QRM-OM!"



"Will you please QRT and come to B-E-D!"



"Do you realize that you're giving the best years of our life to 40 Meters!"

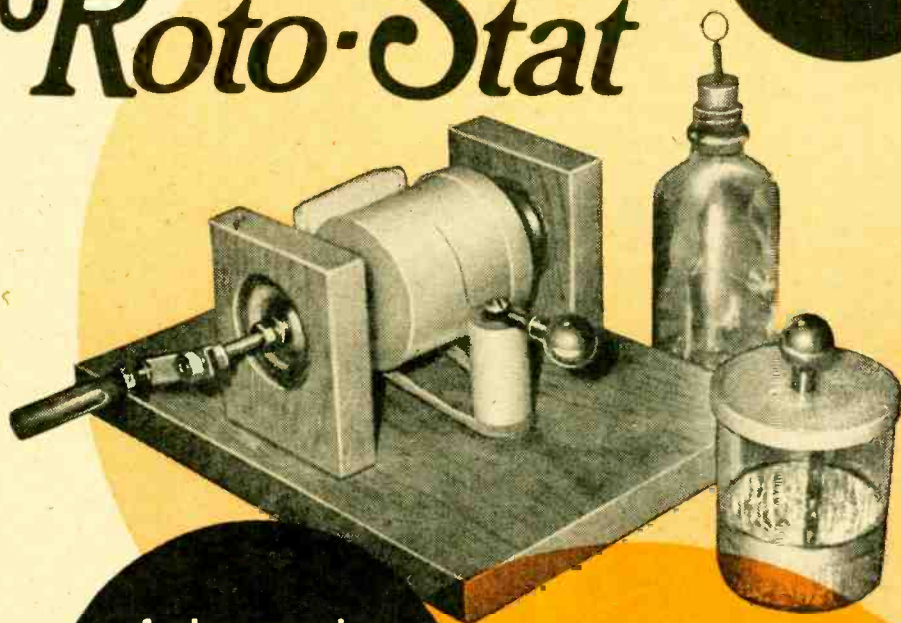


"What we need is more intelligent communication between people in this country!"



"You got as far away as Australia, eh! Too bad you had to come back."

Roto-Stat



An inexpensive
efficient
hand-powered
electrostatic
generator

From the earliest days of experimenting with electrostatic electricity—say in the 4th Century B.C., when Plato mentioned the wonderful attracting power of amber—electrostatic electricity was produced by laboriously rubbing glass rods or other electrostatic producing objects with dry fur or cloth. In 1663, in Germany, Otto von Guericke used a large ball of sulphur to generate electrostatic electricity by rotating the sulphur ball and rubbing it with his fingers. In 1706, in England, Francis Hauksbee employed rotating glass globes and cylinders to generate static

by Charles Green
W6FFQ

Roto-Stat

electricity, and he used a metallic conductor to collect the generated static electricity from the generator.

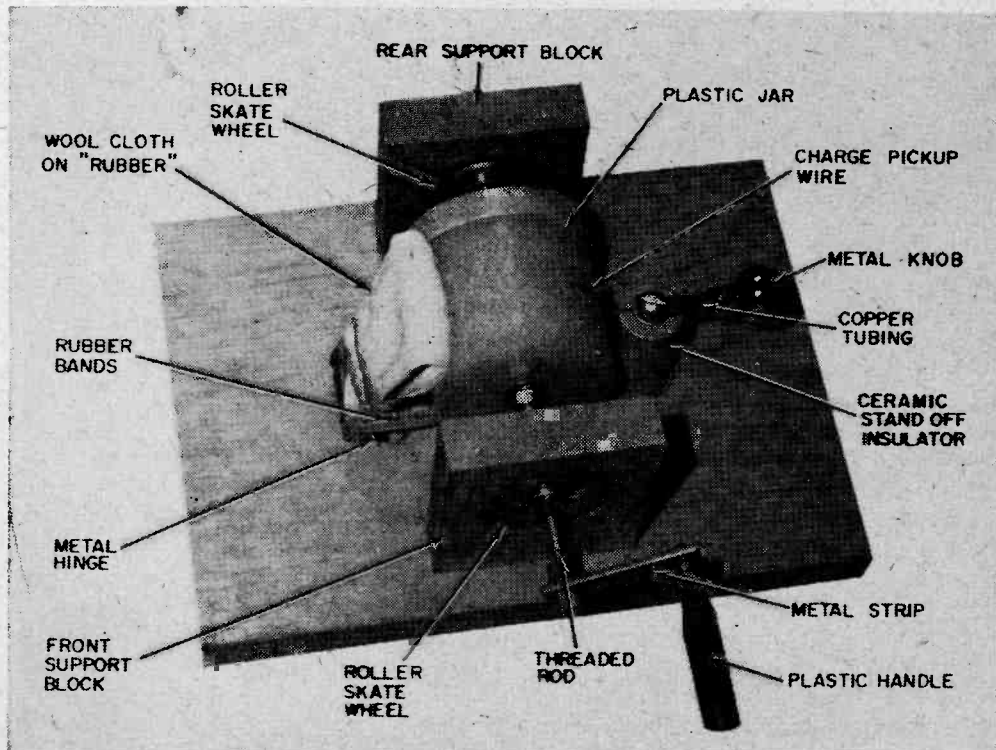
In 1744, in Germany, J.H. Winkler invented a mechanical rubbing device to use in place of rubbing the glass cylinder with the fingers. His *rubber* used a leather-covered cushion pressed against the rotating globe. In America, in 1747, Ben Franklin used an electrostatic generator in some of his electrical experiments; it contained a rotating glass cylinder with a mechanical *rubber*.

Even in this day and age, electrostatic experiments still fascinate the avid experimenter. You can perform electrostatic electricity experiments by building and using our Roto-Stat electrostatic generator, instead of generating the electrostatic charges by hand-rubbed glass or plastic rods. Our Roto-Stat, designed for easy construction, uses a plastic cosmetic or similar jar in place of a glass

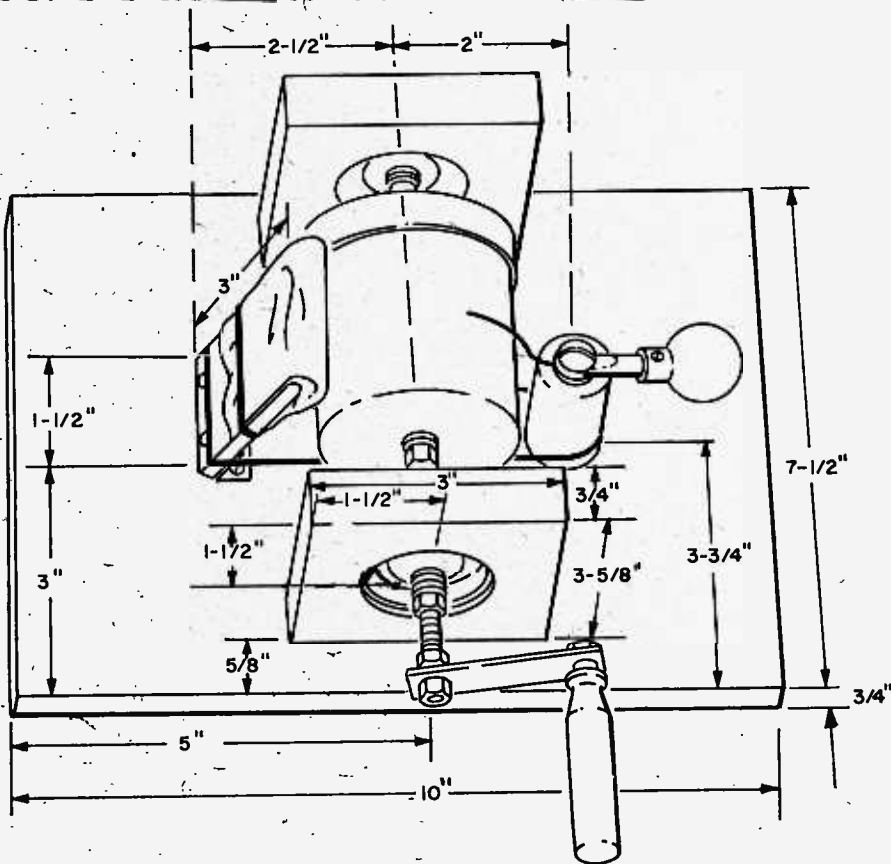
ball or cylinder. The generator is built on a 3/4-in. white pine base and uses a wool cloth *rubber* and a copper wire electrostatic collector that's formed round the jar.

How It Works. Turning the generator handle rapidly in a clockwise direction causes the wool cloth to rub against the plastic jar's surface. The friction of this rubbing releases electrons which electrostatically charge the jar's surface. As the jar is rotated, the pickup wire mounted on the ceramic standoff collects electrostatic charges from its surface and conducts them to the metal ball output electrode. A Leyden jar can be charged by contacting its terminals to the metal ball output electrode and ground. (For complete construction details for a Leyden jar and an electroscope see *Ben Franklin's Leyden Jars*, Dec./Jan. 1970 SCIENCE AND ELECTRONICS.)

Plastic Power. We used a plastic jar 2 3/4-in. high x 2 3/4 in. diameter with plastic screw top for the rotating element of our Roto-Stat. If another size plastic jar is used, scale the dimensions of your unit proportionately. Since different types of plastic vary in their ability to generate electrostatic electricity,



Our Roto-Stat electrostatic generator, though not as huge as original ones built in early 18th Century, is quite efficient. From details in photo and drawing you can build it.



MATERIALS LIST FOR ROTO-STAT

- 1—Ceramic (L5 glazed) standoff insulator, threaded at both ends, 2-in. high x 1-in. dia. (JAN type N55WO416, E.F. Johnson 135-503, or equiv.)
- 1—Hard rubber or plastic handle, 2-in. long x 1/2-in. dia. (we used handle from radio aligning tool)
- 1—1 1/2 x 1/2-in. metal hinge
- 1—Plastic jar, with screw-on or snap-on plastic lid, 2 3/4-in. high x 2 3/4-in. dia; (you may also want to use this size for Leyden jar and electroscopes—see text)
- 2—Metal knobs, approx. 7/8-in. dia. (available as automobile dash control or seat control knobs at auto parts stores)
- 1—2 1/4 x 1/2 x 1/8-in. metal strip for mounting handle
- 1—NE2 neon lamp
- 2—Roller skate wheels, ball bearing (available as replacement wheels at toy stores and toy counters in department stores)
- 1—Threaded metal rod, 8-in. long x 1/4-in. dia.
- Misc.—1 1/2 x 4-in. wool cloth strips, wood screws, nuts and washers for threaded rod, screws to fit ceramic insulator, cement, rubber bands, #18 to #22 bare copper wire, 3/4-in. thick pine for base, etc.

test the jar—you've selected by rubbing it with a wool cloth and noting whether the jar attracts small pieces of paper when the jar is moved over them. If it doesn't, try a jar made of different plastic material.

Any type of soft wood can be used for the base. Just make sure that the wood is clean and dry. The dimensions given in our drawing are approximate, to serve as a guide. Any size generator unit can be built, but for best results it's suggested you follow

the general layout of our unit.

Begin construction by cutting a 7 1/2 x 10-in. base of 3/4-in. thick pine or other soft wood, then cut two 3 5/8 x 3 x 3/4-in. wood blocks. Roller skate wheels, available as replacements at most hardware or bicycle shops, are used as driveshaft bearings. Cut a hole in each wood block to fit roller skate wheel used for this purpose. The hole in each block of our unit is made just large enough to force-fit the wheel into the hole in the

Roto-Stat

block. Duco cement or Elmer's Glue is used to hold the wheel securely in place. You may prefer to use long sheet metal screws through the sides of the mounting blocks to hold the wheel.

Cone Or Cylinder. Drill holes in the center of the bottom of the plastic jar, and also its lid, to fit the $\frac{3}{8}$ -in. threaded metal rod. Cut and drill a conical wood section to fit inside the plastic jar if the jar isn't straight-sided (if it is, then you'll need a wooden cylinder), extending from the jar bottom to the jar lid for internal support. A clearance hole for the metal rod, which serves as the axle for the jar, is drilled through the center of this wooden block.

Mount front supporting block on the base as shown in our drawing. We used two wood screws through the base to hold the block to the base. Insert threaded metal rod through jar and skate wheel bearing and hold them in position on the rod with a nut and washer top and bottom of the jar and on either side of the bearing mounted in the

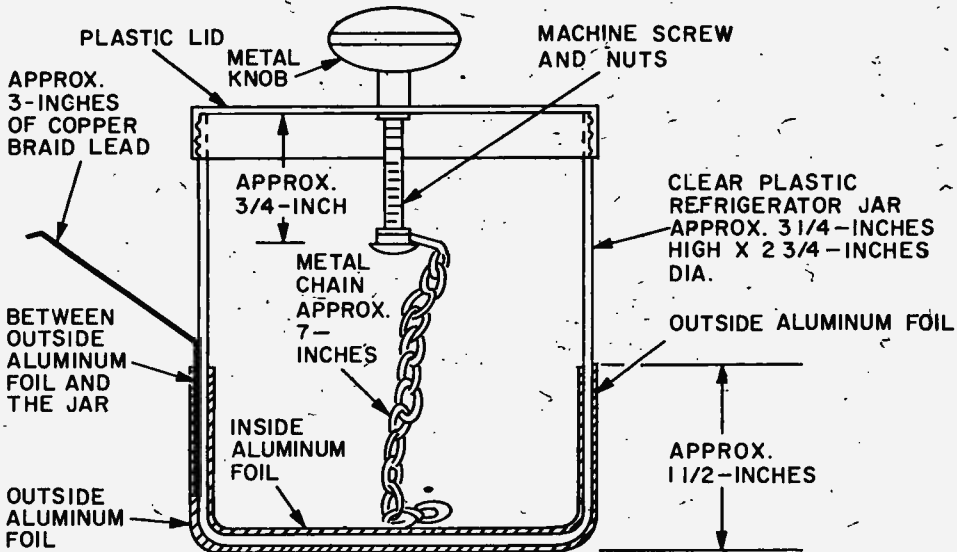
wood block. Don't tighten the nuts now, you'll probably re-position the jar.

Position the rear block-mounted bearing on threaded metal rod with a nut and washer on both sides of the bearing. Adjust spacing of nuts on the metal rod so that the jar is in the center of the base as shown in photos and drawing. Position the rear wood block so that metal rod and jar can turn freely without binding, and fasten this block in position to the base with wood screws. Make sure that about $1\frac{3}{4}$ in. of metal rod projects out from the front bearing for attaching the metal strip that holds the handle, then tighten nuts against the jar and bearings.

Plastic Handle. We made the plastic handle from an alignment tool and bolted it to a $2\frac{1}{4} \times \frac{1}{2} \times \frac{1}{8}$ -in. metal strip with washers to allow the handle to rotate freely. Fasten a $3 \times 1\frac{1}{2} \times \frac{1}{4}$ -in. piece of plywood to a hinge, and mount the hinged plywood section to the wood base adjacent to one side of the jar. Mount a 2-in. high \times 1-in. diameter ceramic standoff to the base on the opposite side of the jar as shown in our drawing and photos.

Mount a small unpainted metal knob onto a piece of copper tubing, flatten the free end of the copper tubing, and mount it on

About Leyden Jars and Electroscopes



Even though we used materials found either in kitchen or bathroom this Leyden jar can store electrostatic charge generated by our Roto-Stat, so be sure it's discharged when stored.

the ceramic standoff. Also fasten a length of #22 or larger copper wire to the ceramic standoff and bend it so that it curves around the jar for a length of about 1½ in. but doesn't touch it. Position the wire approximately 1/16 in. away from the jar's surface and cut off the excess length of wire. Small rubber bumpers are fastened to each of the corners on the bottom of the base.

Fold a piece of clean, dry wool cloth over the top end of the hinged plywood piece, holding the cloth in place by means of a rubber band. Clean the surface of the jar carefully. Place several rubber bands around the base of the ceramic standoff and stretch them round the bottom of the hinged plywood section so that the wool cloth that is folded over its free end will be seated firmly against the side of the jar.

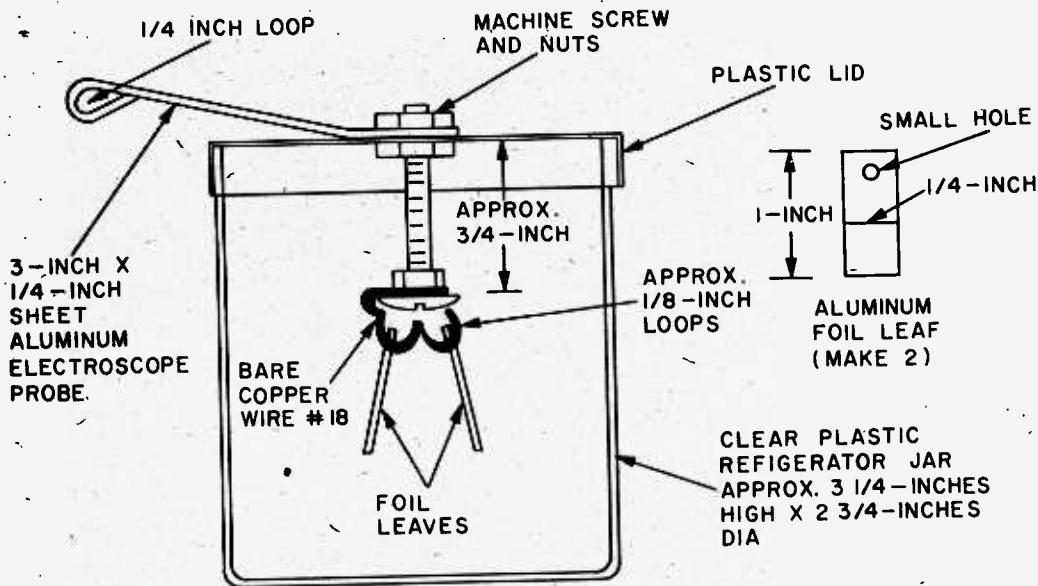
Rotate the jar by turning the handle, making sure that the jar turns freely, but with a slight resistance from the wool cloth rubber, and that the pickup wire does not touch the surface of the jar. Do not touch the surface of the jar or the wool cloth after the jar has been cleaned, because of the possibility of transferring moisture on your hands to either or both.

Experiment 1. Before performing any ex-

periment, make sure that both the cloth on the rubber and the jar's surface are clean and dry. If necessary, expose both cloth and jar to the rays of a heat lamp to dry up any moisture. These experiments may not work as well, or may not work at all in a humid area, since a dry environment is necessary for best results. We suggest you perform them in an air-conditioned room if at all possible for driest atmosphere.

Rotate generator handle rapidly in a clockwise direction, and hold the electroscope so that its electrode makes contact with generator's metal ball. Observe that the electroscope leaves deflect away from each other. This indicates that the electrostatic generator is operating and producing an electrostatic output voltage.

Experiment 2. Connect the outer foil of a Leyden jar to ground or a large metal object, and bring the Leyden jar top electrode in contact with the generator metal ball. Rotate generator handle rapidly in a clockwise direction for a few minutes, then move the Leyden jar away from the generator. Make sure you do not touch Leyden jar top electrode with your fingers. Carefully disconnect the Leyden jar outer foil lead from the ground. Then move the outer foil lead very



You'll want an electroscope to reassure you that your Roto-Stat is actually generating current before you start each experiment. It's easy to build and well worth the effort.

Roto-Stat

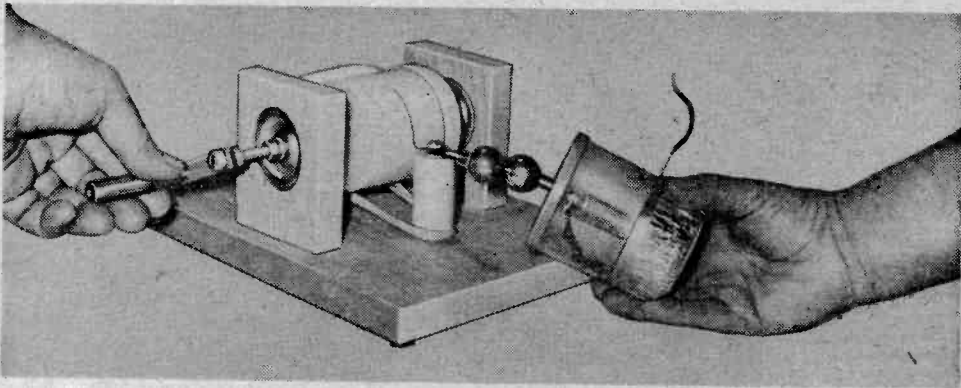
close to the top electrode. Note that a small spark will jump between the top electrode and the outer foil lead of the Leyden jar. This indicates that the Leyden jar was charged with the electrostatic output voltage from the generator.

Repeat the experiment, except connect a VTVM (preferably with a high voltage

clockwise direction, and momentarily bring one lead of an NE-2 neon lamp in contact with the generator metal ball while you hold the other lamp lead. The neon lamp should flash momentarily, indicating that the generator is operating.

Move one of the neon lamp leads around the surface of the rotating plastic jar. Note that the neon lamp flashes, indicating the electrostatically charged areas.

Remove the neon lamp lead from the jar, rotate generator handle rapidly for a minute, and then stop. Now move neon lamp lead



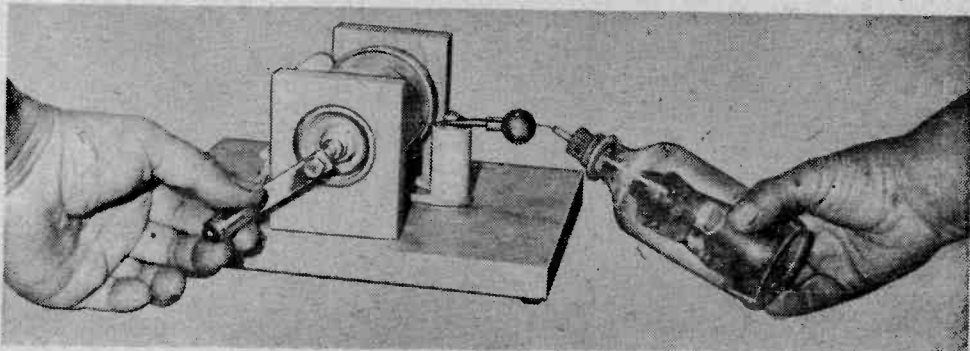
Here's how to hold your Leyden jar when you charge it from your Roto-Stat. Keep two metal balls in constant contact while turning handle to generate charge.

probe) between the Leyden jar outside foil and its top electrode, after Leyden jar has been charged. Fasten one lead to ground strap and touch top electrode with the other lead of the VTVM. Observe that the VTVM momentarily indicates a large negative voltage. This shows that the generator has a negative electrostatic output voltage.

Experiment 3. This experiment requires a dimly lit area in order to best see the neon lamp. Rotate generator handle rapidly in a

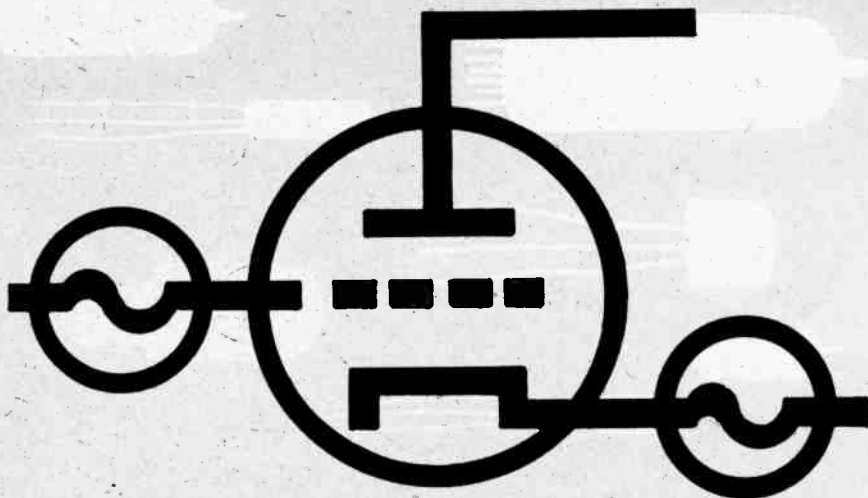
around on the surface, noting that the neon lamp still flashes, indicating that the electrostatically charged areas on the plastic jar will remain active for a period of time after the surface of the jar is excited by rubbing.

Try different types of cloths for the rubber in place of the wool cloth and compare their operation with that of a wool cloth. Note rotation speed affects size of charge. You can also try different configurations of the wire collector. ■



If there's a doubting Thomas amongst those you're showing your Roto-Stat, prove it's generating by placing Electrostat's collector against Roto-Stat's output ball.

the riddle of the **FOLLOWER FAMILY**



Or, who in his right mind would stick by a circuit that provides no voltage gain whatever?

by Norman Crawford

Everybody knows that in electronics, the name of the game is *gain*, or *amplification*. That's why all electronic equipment is filled with vacuum tubes and transistors, which give the amplification needed to make the various circuits work. Hooked up properly, each of these devices can turn microvolts into millivolts, or millivolts into volts. Result is that a tiny signal from a microphone or stereo cartridge can drive a loudspeaker with room-filling sound.

Yet, tucked away in the corner of a great many electronic circuits, we find transistors and tubes hooked up so as to give no voltage gain at all. In fact, they give a loss! A volt of signal applied to the input of such a circuit gives less than a volt out! What are these devices? What is their excuse for being? In short, why bother with something that costs money and takes up chassis space, yet gives no voltage gain in return?

C, E, Or S. The general name for these devices is *voltage follower*. This is because the signal voltage coming out of such a device *follows*

FOLLOWER FAMILY

(in other words, moves in step with) the input voltage.

If built with a vacuum tube, the device is called a *cathode follower*, because the cathode voltage follows any signal impressed on the grid. A very similar circuit using an ordinary junction transistor is called an *emitter follower*. In this circuit, the emitter voltage follows the signal on the base. And, in the new circuitry using field-effect transistors, we are seeing more and more *source followers*, where . . . you guessed it . . . the source voltage follows a signal impressed on the gate.

These three circuits, which are all basically very much alike, are diagrammed as shown in Fig. 1 below:

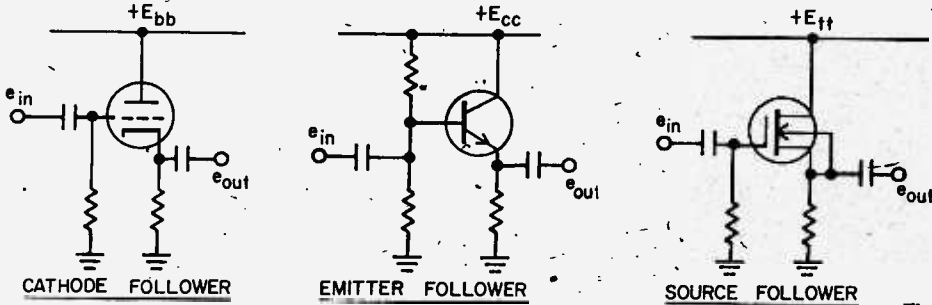


Fig. 1

In each of the above circuits, a 1-volt signal at the input gives less than 1 volt out. At first glance, then, it would seem that the designer would be wiser to replace the whole circuit with a piece of wire! What motivates people to go to all this trouble just to lose signal voltage?

Hidden Ts. One of the standard answers to this question is that the Follower Family, like a transformer, gives *impedance matching*. A transformer, as you probably know, can act as an impedance magnifier. For example; if you have an amplifier designed to drive an 800-ohm load, and you want to

drive an 8-ohm load instead (a speaker, say), you can use a transformer with a 10-to-1 turns ratio to magnify the 8-ohm load to look like 800 ohms. The amplifier, looking at the speaker through the transformer, sees the 800-ohm impedance it was designed to drive (see Fig. 2).

Can an emitter follower do this? Certainly, if you use a transistor with a beta (current gain) of exactly 99. The impedance magnification of an emitter follower is found by adding 1 to the current gain. This means that a transistor with a beta of 99 will provide a 100-to-1 impedance magnification—see Fig. 3. (Don't rush out and build this circuit; we're talking about concepts, not design. This explanation ignores a few essential items, such as the need for bias networks and for keeping DC out of the speaker.)

One practical problem is immediately visible. You can't buy a transistor with a

beta guaranteed to be 99. The best guarantee you can usually get is that beta is ". . . more than 25 . . ." (how much more?); or ". . . between 60 and 350 . . ." In other words, you can't impedance match *accurately* with an emitter follower. Could there be some other reasons for its widespread use?

The Es' And Is. You guessed it—there are. And you can see one of these reasons when you examine the current relationships in the above circuit. When we say that a transistor has a current gain of 99, we mean that for 1 mA flowing into its base, it will draw 99 mA into its collector (see Fig. 4).

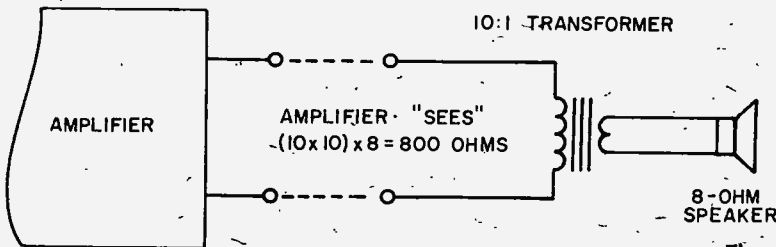


Fig. 2

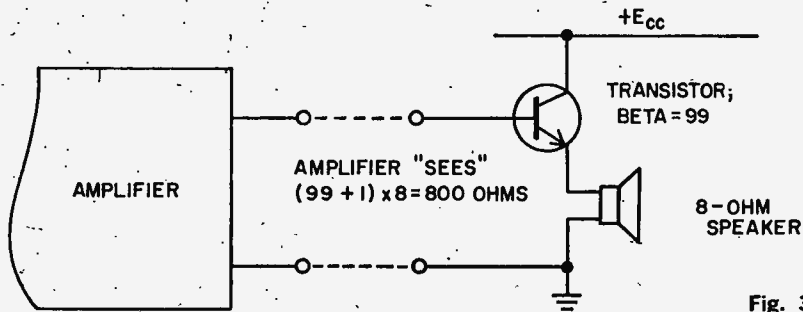


Fig. 3

From our sketch, it's apparent that the load resistor has 100 times more current flowing in it than flows into the base. An emitter follower doesn't give voltage gain, but it's pretty clever when it comes to *current* gain! Any transistor worthy of the name can rack up a sizable current gain when connected as an emitter follower.

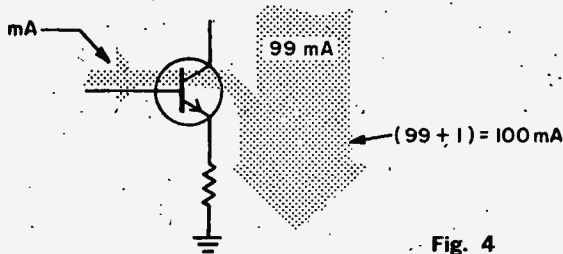


Fig. 4

Another reason for using emitter followers is revealed if we examine the power relationships of both transformers and emitter followers. Power, after all, is the product of *voltage* and *current*. In a transformer which steps voltage *down* 10 to 1, the current is stepped *up* 10 to 1. The voltages and currents of a transformer are on a see-saw; as one is stepped up, the other goes down in proportion. Therefore, the transformer's output power is the same as its input power (assuming no power is lost inside the transformer)—see Fig. 5.

Power Gain! In an emitter follower, how-

ever, the output current is made larger than the input current—stepped up, in transformer language—*without* a corresponding step down in voltage. (Remember, the output voltage follows the input voltage, and is nearly identical to it). Therefore, the power output of an emitter follower is considerably greater than its power input. In brief, it has *power gain*, something no transformer can boast of. (See Fig. 6).

To judge a member of the Follower Family solely on its voltage-gain capabilities is like judging a submarine on its ability to fly. Voltage gain is the one ability a follower does *not* have; where it really shines is in its ability to provide *current gain* and *power gain*.

The Follower Family—cathode-followers, emitter-followers, and source-followers—represent a basic way of hooking up a gain-

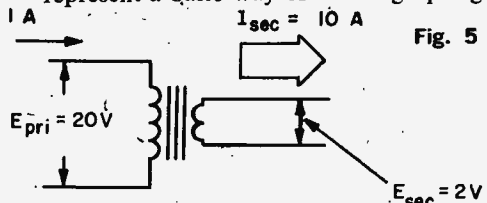


Fig. 5

$$P_{pri} = E \times I = 20 \times 1 = 20W$$

$$P_{sec} = E \times I = 2 \times 10 = 20W$$

giving device to give current gain without voltage gain. There is another family, called grounded-grid, grounded-base, and grounded-gate, which gives voltage gain without current gain. However, that's a story for another day. ■

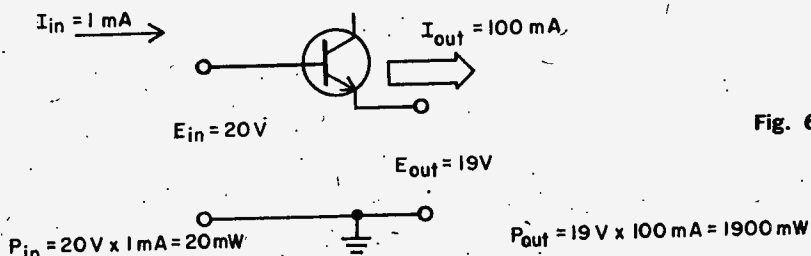
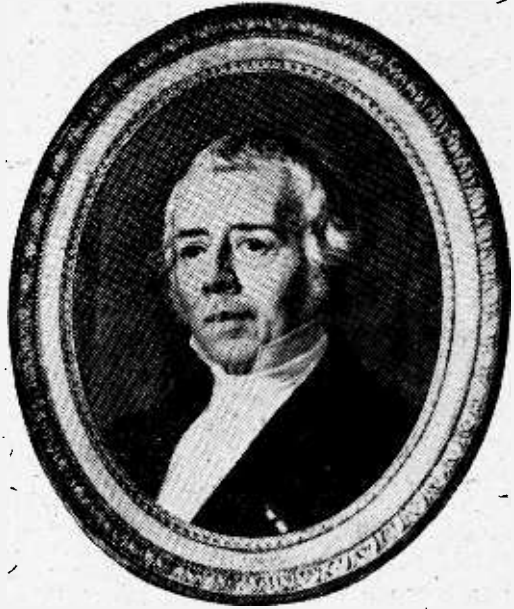


Fig. 6

GREAT MEN OF SCIENCE

by Webb Garrison



THE 1819-20 academic year got off to a very bad start. All over Europe, educators shuddered when they heard that German universities had been placed under State supervision and that freedom of the press had been abolished.

Fortunately, things were better in Denmark. A man was still free to teach and publish without interference.

Standing before a handful of advanced students who were being introduced to the mysteries of electricity, Prof. Hans Christian Oersted brushed his long hair out of his eyes. He peered over his big nose and promised: "Now, young gentlemen, you shall see something remarkable!"

To the best of his knowledge, no member of the class suspected that electricity can cause a wire to glow. Oersted had attached a fine length of platinum to the terminals of a battery; within seconds, it should begin to heat.

As the wire became pink and then white-hot, students made appropriate noises to express their amazement. Their professor reached to move a small compass away from his apparatus and in the process drew the instrument under the glowing wire.

He stared, stuttered, and forgot the rest of his lecture. Hastily dismissing the class, he repeated the movements made earlier—and saw that the needle of the compass really did

waver toward the Mediterranean Sea when drawn underneath the electrically-heated wire.

Here was something new under the sun—a clear demonstration of a long-suspected but never discovered relationship between electricity and magnetism. A more powerful battery should cause greater deflection; tested, it showed just that effect. Eight different conductors of electricity were tried; in each case a flow of current through a wire caused a magnetized needle to change its position.

Though he didn't yet know what to call it, the Danish scientist had stumbled upon the phenomenon of electromagnetism. By July 21, 1820, he had completed a sonorous Latin tract describing his findings. Ambiguous language of the report makes it impossible to be absolutely sure of circumstances surrounding his discovery. Weight of evidence, however, favors chance—chance fed by 13 years of ceaseless inquiry into the riddles of electricity.

Oersted's little pamphlet *Experimenta Circa Effectum Conflictus Electrici in Acum Magneticam*, was drab and unprepossessing in appearance. But when circulated among the scientists of Europe it created a sensation. He was made a knight of the order of Dannebrog, received the Copley medal from

(Continued on page 102)

Cal-Trace



by Homer L. Davidson

**Disciplining
the signal injector
makes it
an inexpensive
signal generator**

No, it's not a miniature, radio-controlled rocket launcher, though at first glance a non-technical person may misconstrue it to be one.

Heart of our *Cal-Trace* is the EICO model PS1 Signal Injector probe. It's a pocket-sized, self-powered generator that's extremely handy for locating the faulted portion of an electronic circuit, be it a transistor radio, a hi-fi system, a tape recorder, a TV set, a CB rig, etc. The signal the PS1 generates is so rich in harmonics that it covers RF, IF, and audio ranges.

There's only one problem: as you move from stage-to-stage, starting from the speakers and working back towards the input, the build-up in signal level in your progression from stage-to-stage may be such that before arriving at the antenna or the input, a point is reached where this relatively large signal blocks the device. This creates a false impression as to where the trouble really lies.

An easy way to solve this problem is to use an attenuator to control the output level of the signal injector. We've gone one step further by providing a calibrated scale on the attenuator. This is a big help in determining first if a particular stage actually has gain and then in giving a relative value to the

Cal-Trace

measure of the amount of gain in the stage. The combination of PS1 with an attenuator is an easy way to make an inexpensive signal generator.

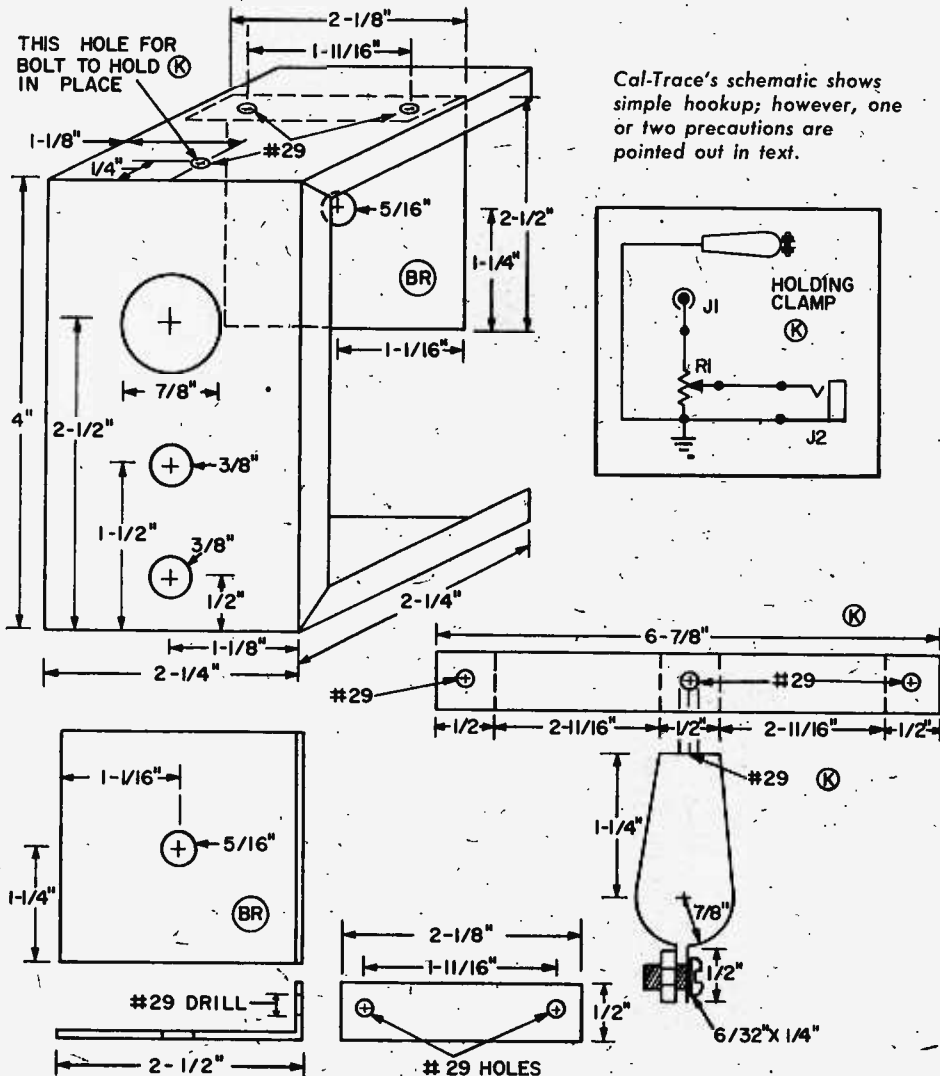
How To Make It. *Cal-Trace* is such a simple device that you should be able to build

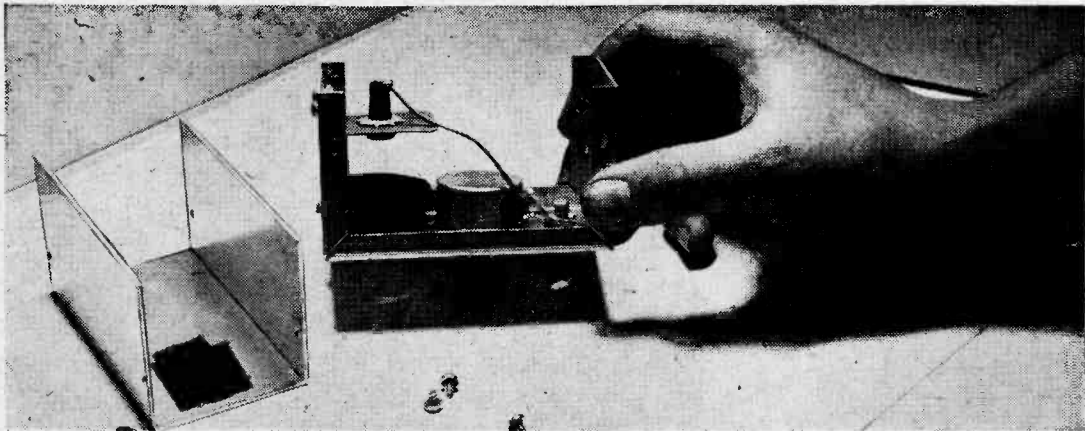
PARTS LIST FOR CAL-TRACE

- J1—Tip jack (Lafayette 32E65113 or equiv.)
- J2—Open circuit phone jack (Lafayette 99E62135 or equiv.)
- P1—2-conductor phone plug to fit J2 (Lafayette 99E62218 or equiv.)
- P2—Phono needle test prod (Lafayette 32E65089 or equiv.)
- R1—1000-ohm, linear taper potentiometer (La-

- fayette 33E11149 or equiv.)
- 1—Dial plate (Lafayette 30E40953 or equiv.)
- 1—2¼ x 2¼ x 4-in. minibox (Lafayette 12E83704, 12E83878 or equiv.)

Misc.—Scrap aluminum strip ½ x 6½ in; for clamp K (could be brass or phosphor bronze), hookup wire, solder, screws, nuts, etc.





This innards view easily locates all parts needed to make Cal-Trace. You can see how tip jack is centered over spring clamp that holds signal injector.

it in little more than an hour. It's housed in a 2¼ x 2¼ x 4-in. minibox. Mark centers of holes on the front panel and top of box, then, being careful not to mar the finish of the minibox, drill and de-burr all the holes. Mount the potentiometer and its knob and calibration scale as well as the phone jack J2 on the front panel.

Make a bracket (Br) to fit inside the box on which tip jack J1 is centered. The tip jack makes contact with the output probe of the signal injector and also helps to hold it in position, centered in the hole in the front panel. Make spring clip (K) from an aluminum strip; a scrap of about the same thickness as the minibox will do nicely. Form it as shown in our drawing so that it grips the signal injector body snugly yet permits its free insertion and extraction when required. Mount the clip on front panel as shown in the assembly drawing.

Output test lead is made from two lengths of hookup wire approximately 3 ft. long. A phone plug to fit the J2 jack is connected to one end of these leads. On the opposite end of the lead connected to the sleeve of the plug, fasten an alligator clip. Fasten a standard test lead prod to the free end of the other lead, connected to the tip of the phone plug.

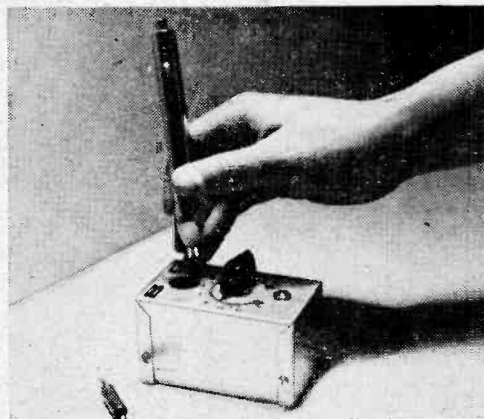
Wire the unit as shown in the schematic, taking care to connect the arm of the potentiometer (center lead) to J2 and the high side of the potentiometer (lead to the left when looking at the rear) is connected to J1. When mounting the spring clip to the panel be sure to remove any paint that may prevent metal-to-metal contact. This point is the ground return for the signal injector.

Now that you have completed this easy wiring and assembly you're ready to use *Cal-Trace*.

How To Use It. We'll just give the basics. Certainly you'll be able to go on from these and devise many ways to use this very handy service instrument.

Place the PC1 signal injector in its holder through the panel of *Cal-Trace*, being sure that its probe is firmly seated in J1, and plug in the test leads. Connect the alligator clip to the ground (in most instances the chassis) of the device you want to test and turn the probe on by locking its battery switch in the *on* position. Set the calibration control on its highest point for maximum signal.

Starting at the speaker, touch the probe of the test leads first to the speaker and then to the input of each stage from the speaker



It's easier than threading a needle—just put the signal tracer in place and you're ready to check gains, trace circuits, etc.

Cal-Trace

until you reach the antenna or input. It might be wise to try the unit out first on a set that is working so you get the hang of it and get some idea as to how much, approximately, to reduce the control as you proceed back to the input. Now try a defective receiver. When you reach a faulted stage you will no longer hear the signal. Remember, you need maximum signal at the speaker for the gain of that stage. Bear one thing in mind: the lower the signal from the injector, the easier it's going to be to determine whether or not a particular stage is functioning properly.

You can measure the relative gain of a stage by comparing the setting of the control under test with the setting to give constant output for the preceding stage. If you require more attenuation to maintain constancy

of output it is obvious that the stage under test is functioning and that it is increasing the signal level in proportion to the amount of attenuation you have inserted to maintain constancy of output. This will be true for all amplifier stages.

If you cannot tune in a station on a receiver but can get the injector signal through from the antenna, then, most probably, the oscillator of the receiver is not working.

Defective transistors can be checked by injecting the signal first to the base and then to the collector. If no signal is heard from the base but is heard from the collector, the transistor is defective.

The same procedure can be followed in checking coupling capacitors, especially the tiny electrolytic types in transistor circuits. If the signal is weak or non-existent on the input side but normal on the output side of the coupling capacitor it should be replaced. These are just a few tips on how to use *Cal-Trace*. As you gain experience with it you will devise your own methods to use it to best advantage. ■

A TREAT FOR TIRED TICKERS



A mechanical "heart helper" that can be completely implanted within a patient's chest to ease the load on his natural heart has been successfully tested in animals. Batteries for the device were specially adapted for the purpose by the General Electric Research and Development Center and the company's Battery Business Section.

In the system under development, electric power for the pump would normally be supplied from external sources. The batteries would automatically take over whenever the patient needed to be disconnected temporarily from the external source—when moving from one room to another, for example.

Unlike earlier systems, the battery-equipped device has no tubes or wires penetrating the patient's skin. Electricity from the external source is supplied through a flat metal plate placed over the patient's chest and located opposite a similar plate implanted beneath the skin—in effect, a transformer. ■

AN XYL'S HANDBOOK, OR



How I Learned To Live With a DXer and Love It!

by Arlene Jensen

WOMEN'S magazines regularly shed sympathetic tears for the poor "golf widow," who must mow the lawn while hubby is out digging divots on the Country Club back nine. Psychiatrists study the "Saturday Syndrome," the mental plight of wives banished to the kitchen while their men, sofa-sprawled, watch the Game of the Week on TV.

But what about the forgotten legion of lonely women married to America's short-wave addicts? Not a word has been written about the care and feeding of a DXer. Nobody ever tells you how to amuse yourself while sitting in the dark because your hus-

band thinks the fluorescent light causes QRM. How does one keep her sanity when the OM has obviously lost his to the magic box he calls his receiver?

Take the word of one XYL, it's tough! But it can be done. Here are a few tips on how to live with a radio nut.

First and foremost in this crash course is learning the jargon. Calling his receiver a radio is something akin to asking an admiral about his boat. Do make an attempt to learn the meaning of words like veries and propagational disturbances. If you can keep a civil tongue in your head when he talks about a triple-conversion, solid-state superhet, score an A on this one.

Refrain from comments like, "How can you hear anything with all that noise?" Or, "Why don't we go anywhere anymore?"

When he makes wistful sounds about a new \$500.00 receiver, smile. You've got to admire a guy who can be so picky about the money you spend on clothes, then become a financial genius when he



XYL'S HANDBOOK

wants to find room in the budget for a Ham-mascratcher SPX-3000A.

Get acquainted with other DX widows. They're the only people who can *really* understand your problem. The slogan of one such group I know is, "We also serve who only sit and complain." Honest!

Here are a few more handy tips:

- When the neighbors demand to know the reason for the strange-looking wires on the roof, tell them it's a clever device to trip bats.

- Never—but never—accompany him to a DXers convention. I mean, can you imagine a roomful of them sitting around talking about transpolar auroral flutter?

- Learn to ignore the suspicious glances you get from the postman when he delivers a QSL from Peking. After seeing all the



strange mail you get, he's sure you belong to a subversive group.

- Never touch his gear, even if the dust is an inch thick. One XYL suggested slip-covering the monster, and she hasn't been heard from since.

An SWL's nocturnal habits deserve a word, too. Never sneak up behind when he has his headphones on. If you want his attention, just stomp on the floor until his receiver vibrates. This is most effective after midnight.

Buy an electric blanket. This is an absolute must on cold nights when you wake up to find he's deserted his half of the bed in favor of a pre-dawn newscast from Ulan Bator or a rare Panamanian sign-on.

Try to get the baby's night feeding to coincide with your DXer's night patrol of the



shortwave bands. After all, he needs only his ears to listen and he might as well be doing something constructive—like warming a bottle—with his hands.

And practice looking impressed. This will come in handy when he wakes you up at 4 a.m. to tell you he's just logged Radio Bougainville.

A little T.L.C. (that's Tender Loving Care, as if you didn't know) goes a long way. If you really want to turn him on, lift his right earphone and tenderly whisper, "Dinner will be served at 2330 GMT, dear."

DXers are lovable weirdos, so let's be fair. Anyone who can name the capitals of 142 different countries, understand a smattering of Swahili and

Serbian, identify the national anthem of Lesotho, and fix the TV set when it gets a bad case of flip-flops, can't be all bad.

So, grin and bear it. And when he signs your anniversary card, "73" . . . you expected maybe 88, squared? ■



THE EMPEROR'S COMPUTER



IBM's system/
360 Model 44,
linked to a giant Van de
Graaff accelerator, enables
scientists at Yale University to
monitor experiments in real time!

At Yale University, in an earth-shielded concrete building that resembles a Mayan pyramid, physicists bombard a variety of materials with high-speed ions. Their goal: to understand more fully the structure and behavior of the atomic nucleus.

Part of Yale's A. W. Wright Nuclear Structure Laboratory, which is directed by Dr. D. Allan Bromley, the building houses a giant tandem Van de Graaf accelerator. Called, the Emperor, this Van de Graaf produces the most energetic particles yet obtained with an electrostatic accelerator.

The main part of the accelerator is an 81-ft.-long tank with a bulge in the middle that makes the tank look much like a submarine. Within the bulge is a cylinder-shaped positive electrode that can be given a maximum potential of 12 million volts. Outside one end of the tank is an ion source, which projects a beam of negative ions into the tank and along its axis, where the ions are accelerated toward the positively charged cylinder.

As the ions move through the cylinder, they pass through a gas-filled stripping canal, where electrons are removed by collision with gas molecules. Removal of the electrons gives the ions a positive charge, so that upon leaving the cylinder they are repelled from the positive electrode and accelerated again, on toward the other end

EMPEROR'S COMPUTER

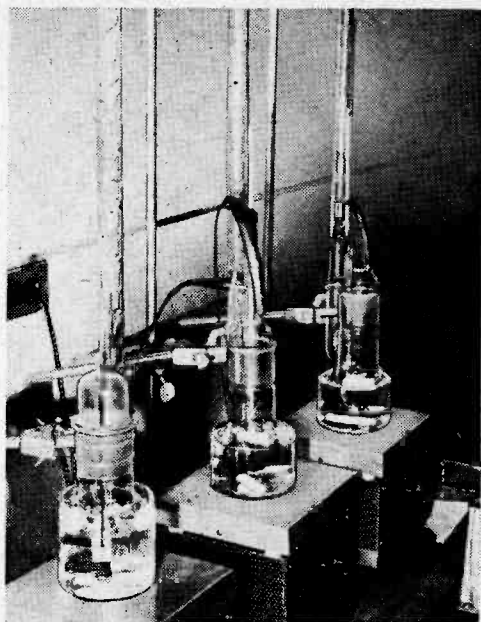
of the tank—hence the designation “tandem Van de Graaf.”

Focused by Magnets. When the ions leave the far end of the tank, the energy of each ion is proportional to twice the voltage of the central electrode in the case of protons, and higher in the case of ions from which several electrons have been removed. Focused by magnetic lenses, the ion beam can be directed to targets in any of three experiment rooms in the Nuclear Structure Laboratory.

A target is composed of whatever substance a physicist wants to study. The ion beam scatters upon striking the target—or, more precisely, upon striking the nuclei of atoms within the target. By measuring the directions taken by the scattered ions, and their momentums, the physicist can tell much about the structure and behavior of the target nuclei.

Accurate results from an experiment depend on the precision of the energy of the ion beam, its geometric localization, and accurate knowledge of the target's composition.

The scattered particles strike detectors in the target area, which feed a Niagara of



Radiation detectors are made by drifting lithium ions through silicon and germanium crystals in drifting ovens. Detectors measure charged particles and gamma radiation.

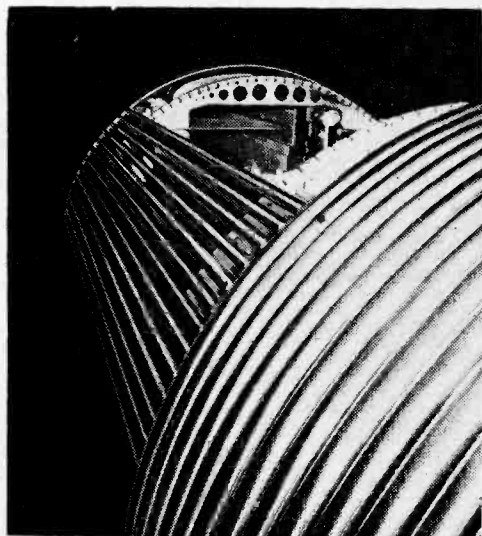
signals into banks of electronic equipment in the accelerator control room. The signals indicate both the number of hits and the nature of the reactions.

Control by Computer. To enable physicists to make real-time decisions during experiments, the staff of the Nuclear Structure Laboratory and the Research Division of IBM are collaborating in the development of an advanced, computer-based data acquisition and control system. Headed by Dr. Martin W. Sachs of Yale and Dr. Joel Birnbaum of IBM, the project is designed to make the computer accessible to the experimenter in a flexible and natural way, so that it can serve as an extension of his analytic abilities and scientific judgment.

The project is keyed to the philosophy that the physicist need not be a computer expert. With an hour's training, he should be able, in the words of one project worker, to “plug his experiment into the system.”

From the mass of signals entered into it, the computer analyzes only those that the experimenter has defined, through his program, as being of interest. As a filter, the computer readily fits into the lightning-fast world of the accelerator.

The system's real-time operation is a distinct advantage over other methods of weigh-



Rings and bars protect central terminal of Van de Graaff from electrostatic breakdown.

ing an experiment, in which several days might be required to find out whether the experiment had proceeded correctly. The high-speed cathode-ray-tube display enables the physicist to view plots of his experiment while it is in progress. If he finds it going astray, he can change its course accordingly.

A multiprogramming system developed for the project provides for program preparation and data analysis as well as on-line data acquisition. As one feature of the system, a physicist can connect any FORTRAN or Assembler-language program to any of the buttons on the function keyboard by a control card. When a button is pressed, the system responds by locating and executing the associated program.

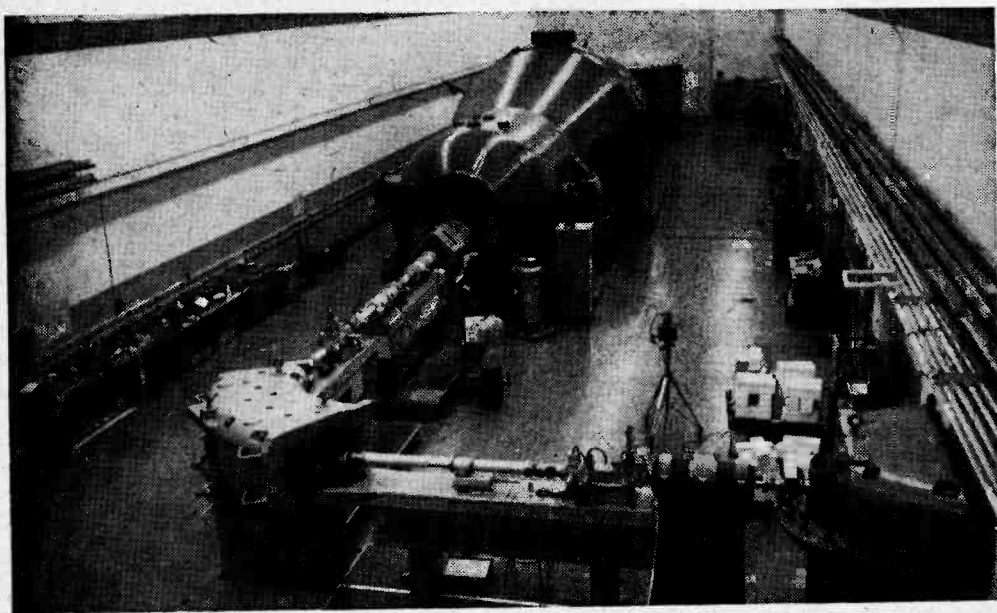
Moreover, the acquisition, display, and control of experimental data are readily changeable through the function keyboard or the graphic terminal and typewriter. All data-acquisition statements are programmed as two-part instructions. An action statement performs a particular function, such as pulse-height analysis, and a specification statement determines the operation's parameters, such as the number of channels in the pulse-height analysis.

Checking the Experiment. "Computer data reduction," explains Dr. Sachs, "enables a physicist to determine whether an unusual

reading is a true result of the experiment or a flaw in the equipment. Without the computer, it might take weeks to find out." The ability to alter the course of an experiment while it is under way may save repeating the experiment—an expensive proposition when working with an accelerator.

Possibly the most striking achievement of the system, however, is that it can, under certain circumstances, enable the physicist to use his measurements to make an immediate test of physical theory, again while the experiment is in progress. In most cases, a test of theory can be made only after several stages of data reduction and analysis—hence the importance to the physicist of real-time processing.

The Control Interface. The heart of the system is a control interface that links the computer directly to the digital output instruments that carry information from the experiment. On one side of the control unit are scaler-timers, which keep track of experimental-data monitor registers, and analog-to-digital converters. This equipment was developed as part of the Yale project by IBM's Systems Development Division in Kingston, New York. On the other side of the control unit is a diode pinboard, half the size of a chess board, that determines which instruments will read data into the



Emperor accelerator is housed in 200 x 40 ft. vault in Yale's Nuclear Structure Laboratory. Ion source is at far end of accelerator tank; magnets (foreground) focus and direct ion beam.

EMPEROR'S COMPUTER

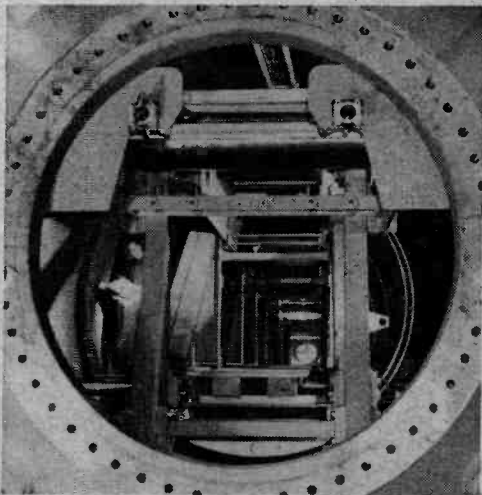
computer and permits the instruments to be multiplexed among the experiments—all completely under electronic control.

When a physicist sets up his experiment, he prepares a pinboard by inserting tiny diodes into holes in the board. The diodes, in effect, order the information that will flow into the computer.

The Yale group is now engaged in a

broad study of nuclear behavior. As Dr. Birnbaum puts it, "Nuclear physicists are searching for a unified mathematical model for all nuclear behavior—a mathematical statement of the conditions under which any nuclear reaction takes place."

In this search, the introduction of on-line computer facilities is providing more data than ever before—but far more important is an increase in the *quality* of data. The Emperor's computer provides a basis for solving physical problems that cannot be handled in other ways, and it is helping to make the physicist's choice of experimental alternatives both simpler and more meaningful. ■



View of accelerating structure inside pressure vessel during installation. Large cylinder at top is 100-hp motor driving belt which transports charge to high-voltage terminal. Glass and stainless-steel beams supporting high-voltage structure are clearly visible in foreground.

Overall view of Laboratory, looking north toward East Rock. Heavy Ion and Electron Linear Accelerator Laboratories appear at left; three entry doorways lead to storage space, offices and laboratories, and accelerator vault, respectively. Truncated pyramids on roof contain cooling towers for closed loop water supply in Lab.



ADD A FLASHING LIGHT TO YOUR TELEPHONE BELL

by Robert S. Kelland

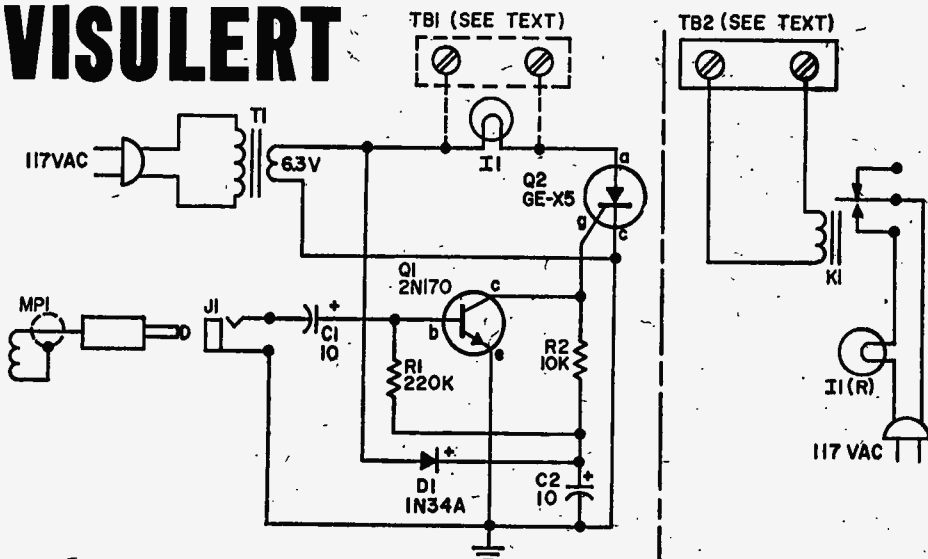


ARE there times when you'd like to turn down the telephone bell so that baby or grandma can nap, and yet you need to know when that important call comes in? Because high platform noise overrides the normal telephone bell, and you're skeptical of the effectiveness of so-called loud ringers, do you have need for another means of alerting the shipping clerk to take a telephone call? Or, perhaps you know a deaf person who can't hear the phone bell at all.

Our Visulert, a small, self-contained, easily constructed telephone accessory, solves all these problems. And the beauty of it is that you don't have to connect it directly to the telephone lines, a no-no rule of most telephone companies.

An inductive pickup coil ordinarily used for recording phone messages, placed on or under a telephone, picks up just the ringing pulses by magnetic induction and feeds them to an am-

VISULERT



PARTS LIST FOR VISULERT

C1, C2—10- μ F, 35-VDC miniature electrolytic capacitor (Radio Shack 272-1025 or equiv.)

D1—75-PIV, 50-mA silicon diode, type 1N34A

I1—Panel-mounting pilot lamp assembly with clear plastic dome lens (Lafayette 99E63406 for miniature bayonet base lamp 32E66194 or equiv.) (note: our model was adorned with the addition of a large plastic lens salvaged from a toy fire engine)

J1—Miniature phone jack (Lafayette 99E63147 or equiv.—includes matching plug)

MPI—Inductive pickup coil assembly (Radio Shack 44-533 or equiv.)

Q1—GE 2N170 npn germanium transistor

Q2—GE X5 silicon-controlled rectifier

R1—220,000-ohm, 1/2-watt resistor

R2—10,000-ohm, 1/2-watt resistor

T1—Filament transformer; primary 117 V, 50-60 Hz; secondary 6.3 V at 1.2 A (Radio Shack 273-050 or equiv.)

I—4 x 2 1/4 x 2 1/4-in. aluminum minibox (Lafayette 12E83704 or equiv.)

I—AC power cord (Lafayette 12E39011 or equiv.)

I—2 point + ground lug tie strip (Lafayette 32E12073 or equiv.)

I—5 point + ground lug tie strip (Lafayette 32E12131 or equiv.)

Misc.—Hookup wire, solder, hardware, spray paint or pressure-sensitive vinyl sheet (Contac or equiv.), grommets, etc.

If remote lamp is used add following:

I1(R)—50 to 250W, 117V lamp bulb in porcelain Edison base lamp socket, 3/4-in. diameter base (Lafayette 13E1359 or equiv.—mount on outer surface of junction box or cover panel of suitable box used)

K1—Spdt miniature ruggedized remote control relay (Lafayette 99E60915 or equiv.—mount on inner surface of box cover panel)

I—Pane for box (Lafayette 19E37010 or equiv.)

I—6 1/4 x 5 1/4 x 2 1/4-in. Bakelite Box (Lafayette 19E20016 or equiv.)

I—2-contact screw terminal strip (Lafayette 32E644488 or equiv.) (TB1, TB2)

plifier in the Visulert. This amplifier triggers an SCR that switches a lamp on and off in step with the pulsing of the ringing signal.

How It Works. Provided magnetic pickup MP1 is properly located within the ringer's magnetic field an electrical voltage is induced in the coil of MP1 whenever the ringer of a telephone is energized. This voltage is fed via jack J1 to the base of transistor Q1. The resulting amplified signal output on the collector of Q1 is coupled to the gate of silicon controlled rectifier Q2, and triggers it on whenever the signal appears on its gate. Lamp I1 is turned on

each time Q2 is triggered on and remains on until Q2 is triggered off by a drop in the induced signal level. Since the ringer voltage is pulsating, the Visulert will flash its lamp on and off, following the ringer pulses.

Building Visulert. Our model is housed in a standard 4 x 2 1/4 x 2 1/4-in. aluminum minibox. Though the layout isn't critical, you will speed up your construction time by following our layout as shown in our photos.

All of the components are mounted either directly on the minibox or to tie strips, which
(Continued on page 100)



by Art Fettig

CHARLIE Spaulding's mind was bugged. His dreams suffered from excessive roll over. He looked at the world and saw snow, venetian blinds, ghosts; and the world rolled and rolled over again. Mouth-watering steaks had begun to look like TV tubes to Charlie. Twice in the past two days he had caught himself trying to use the cigar lighter as a knob to adjust the picture on the windshield of his automobile. Friendly, lovable Charlie Spaulding had repaired so many TV sets in the past two weeks that it was changing his entire personality. Charlie's hang-ups were hung-up.

He'd been carefree and happy all summer when the usual lull overtook the TV repair business. He'd made a point of resting up sufficiently so that he'd be ready for the boom when it struck in the fall. Few customers bothered with their TV problems during the warm summer months. They were content to swim and boat and sweat it out at the friendly drive-ins and most of them couldn't care less if their screens looked like Modern Art.

Then it exploded like it always did when the new shows had their premieres. Charlie's list of calls for repair work looked like a Chinese laundry slip. To compound the problem, Frank Fenner, Charlie's number-one repairman, picked that time to go on a three-week honeymoon. Big-hearted Charlie told them to have a good time and resigned himself to his fate. He rolled up his

sleeves and started in.

Charlie knew his trade. He could smell out a faulty tube from five feet away. He was honest, too. Charlie believed that he could make the most money by doing fast repair work and charging honestly for it. None of this have-to-take-it-to-the-shop talk for Charlie. He made most repairs in the customers' homes. Charlie gave his customers their money's worth and that is why so many people called Charlie with their problems. "Why did they all have to pick the same week to call?" Charlie asked himself, but remembering the saying about people who answered themselves he gave no reply.

Charlie had survived two seven-day weeks. He'd put in mostly 14-hour days and maybe that was why it happened. Anyway, Charlie's mind just hopped off the track. He was just starting work on one of those big Admavox wall combinations. You know, the three thousand dollar job with the color TV, stereo recorder, multi-band radio, and you name it?

Charlie was standing there in the Harris' den with the set pulled away from the wall when suddenly he felt an overpowering impulse to give in to that maddening impulse to become an electronic experimenter. Why did he always have to put in the right tube? Why did he have to submit to those printed circuit boards. Why, just once couldn't he reach into his parts bag and go just *wheel!*?

how Charlie flipped

Conformity was just great for a while but after two weeks of 14-hour days Charlie needed a small rebellion and this was it.

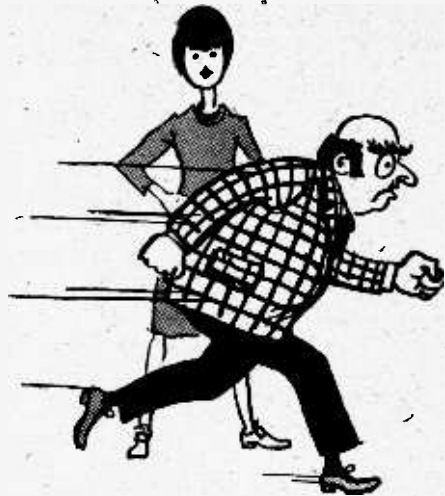
And what a beautiful outfit to set out with. Charlie got the most fiendish look in his eye and he set to work with a passion. His sensitive hands flew wildly at the electronic components. It was not simply a wild spree. It was as if all of the creative energy that had existed in Charlie before had suddenly sprung forth. After a full two hours of intense work Charlie pushed the set back against the wall, wrote out his usually modest bill, and laid it on the set. Wearing the widest smile he had worn in months, he left without waiting for Mrs. Harris to make her usual inspection.

When wild-eyed Sam Harris returned from a maddening day at the TV studio, he was exhausted. All life had become a catastrophe. Actor problems. Union problems. Electrical worker problems. The writers wouldn't write. Even the cigarette machine wouldn't work. It was one of those days that would make a grown man cry, but Sam Harris didn't cry. He held it all inside him and brought it home with him. Every night he brought it home to his den. Specifically, to his Admavox wall combination.

Silently Sam rushed passed his wife as he headed for the den. "Your TV is fixed, dear," she called as he passed. Sam offered a grunt for a reply.

Sam locked the door and began his nightly unwinding ritual. It was crazy, certainly, but Sam was a TV producer and they deserve a little understanding. He poured himself five fingers of Scotch and then with a childish grin on his face he snapped on the television and turned up the volume. Next he switched on the stereo player and cranked up the volume on it. In a final glorious gesture he snapped on the radio and turned up the volume full blast.

Now he went to his luxurious leather couch and lay prone, sipping the Scotch and unrelaxing. He listened for the usual roar of the three instruments, but instead of the deafening roar an eerie sound of floating waves came forth, softly at first, and then gradually building. Now the screen came alive with a fiery psychedelic glow and Sam Harris sat upright and stared right into the center of the bright eerie ball of light.



The troubled, worried look that had been on Sam's face began to leave, and after but a moment he wore a look of angelic serenity. He smiled now. A broad, excited smile. The kind he wore years before, when producing was not such a burden. He sprang lightly from the couch and danced, yes, glided across the room and snapped the set off.

Sam Harris grabbed the telephone and rapidly dialed Charlie Spaulding. Charlie had just walked through the door and exhaustion was about to claim him. "Yes, Mr. Harris?" he answered patiently.

"Charlie," Harris roared, "get over here right away. And bring your lawyer."

Charlie's spirits dropped that final foot to total despair. "So sue me," he said. "I'm sorry about what I did but I had to do it."

"Sorry?" Harris asked. "You should be sorry. You've just come up with the greatest invention since the wheel and you're sorry?"

"Invention?" Charlie asked.

"Yes, invention," Harris said. "You've made a Garden of Eden from the Vast Wasteland. That's why you should bring your lawyer. I want to sign a contract with you, Charlie. We'll make millions. I predict we'll put the TV industry right out of business. We'll wipe out mental illness. Charlie, it's just beautiful. All life is beautiful after looking at your invention."

"I'll be right over," Charlie said.

"Then you'll sign a contract with me?" Harris asked.

"Later for the contract," Charlie said. "I'm coming over to marvel at what I have wrought." ■

RADIO FROM THE ROARING



by Art Trauffer

Build an authentic Book Condenser Crystal Set

HERE'S a radio construction project that's just the reverse of what you'd expect. In this one, instead of making the coil and buying the variable tuning capacitor, we'll show you how to make a variable capacitor for use with a commercially made coil. You've got to admit that this is a project with a twist!

The variable capacitor we're going to show you how to build is called a book condenser. Its plates are hinged like the pages in a book, and capacitance is varied by increasing or decreasing pressure on the supports of the plates, which, in turn, increase or decrease spacing between the insulated plates—thus varying the capacity. Though this is a unique approach to varying capacity of a tuning capacitor, unfortunately we can't claim to be its innovator. Way back in the early 1920s, Crosley Radio Corporation (now a division of AVCO Corp. and renamed AVCO Electronics Div.) patented a design for and manufactured book condensers. These were used in the then famous Crosley Model 50, better known as the *Crosley Pup*, a one-tube broadcast band radio receiver.

Our *Book Condenser* is quite similar in basic design to the Crosley condenser. It's

also easy to build, since it uses hardwood blocks, aluminum foil, tissue paper, etc., all materials normally found around the house.

The coil, a major component of the radio you'll wind up building upon completion of the condenser, is a standard ferrite cored variable loopstick used in many commercial radio sets, and therefore easily procured as a replacement part.

The How of It. Either the coil or the tuning capacitor shunted across it must be capable of having its parameters varied in order to tune across the band for which the combination has been designed. In this project the capacitance of the tuning condenser is varied by moving the plates closer together without shorting them, for maximum and moving them further apart for minimum capacitance. As the plates are brought closer together capacitance increases; as they are separated it decreases. That's all there is to it. The mechanical construction we've adopted is quite simple and therefore it's easy to make our variable book capacitor.

Making the Book Condenser. Two plates, one fixed in position and the other hinged so that it can be moved closer or farther

RADIO FROM THE ROARING 20's

away from the fixed one, is how we achieve variation in capacity. The plates for the condenser are made by carefully cementing aluminum foil to one side of each of two wooden blocks. The two blocks are mounted so that the foil sides face one another. A piece of unused airmail stationery, placed between the foil, insulates them.

The thickness of the paper determines maximum capacity—the thinner the paper the higher the capacity. That's why we've specified airmail stationery. This is just about the correct thickness for the plate sizes used to give our *Book Condenser* the capacity required to tune the loopstick coil over the broadcast band. The sizes of the blocks and mechanical details are shown in our photo and in the materials list.

Plate Connections. Be sure to leave a tab of aluminum that can be folded over the edge of the wooden block to make connections to the plates. After the cement has dried, fasten a soldering lug to the tab with

a wood screw, making certain that the eyelet of the solder lug is held tightly against the foil by the head of the screw.

The foil must be as flat as possible, so be sure all air bubbles are pressed out before the cement dries and be careful not to tear the foil. A good cement to use is Pliobond. Since wood is more porous than the metal foil, spread the cement on the foil first and then on the wood. Press the foil to the wood immediately after spreading the cement on the wood.

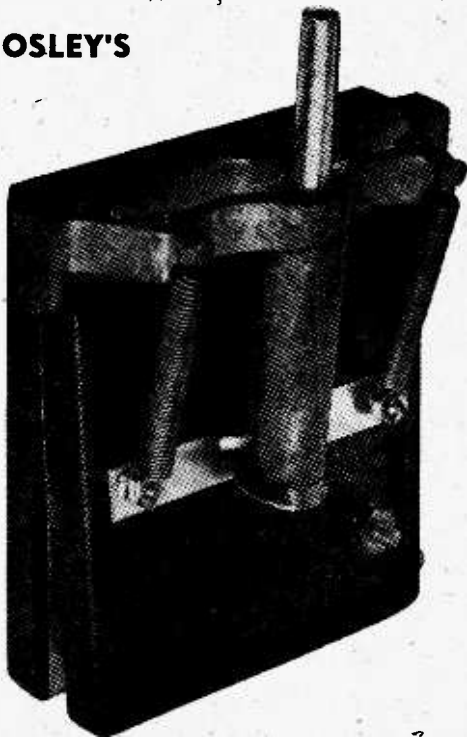
A good way to ensure that the foil will be cemented smoothly is to first place the foil on a table top or other hard, smooth surface, facing up the side on which the cement has been spread, and then pressing down the cemented side of the wood block to the cemented side of the foil. After the cement has dried, trim excess-foil to the size of the wood blocks. Cement the paper insulator, which has been cut slightly larger than the foil, to the hinged end of the large wooden block that is fixed in position.

When mounting the hinges hold the two wooden blocks together in a vise, or clamp, to ensure correct movement of the small wooden block.

IN THE BEGINNING WAS CROSLLEY'S BOOK CONDENSER

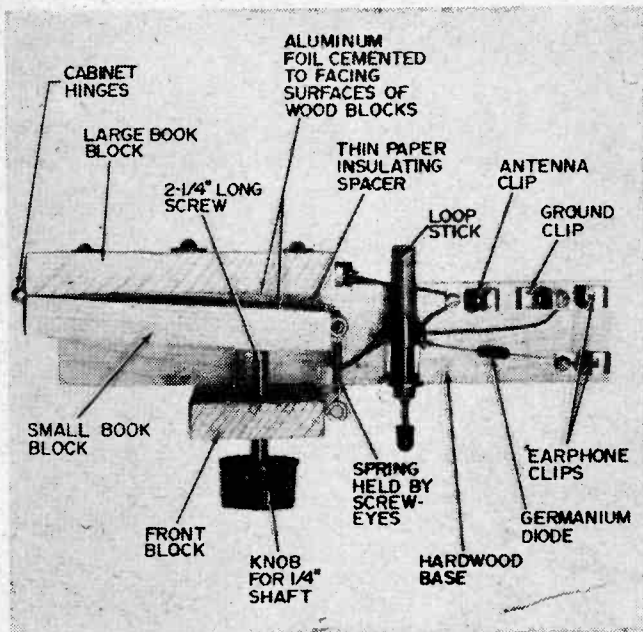
The Crosley book-type variable condenser consists of two molded insulating plates coated with metallic foil and hinged together at one edge so that they can be swung toward or away from each other like the leaves of a book. A cam, mounted on a shaft passing through a bearing in the condenser frame, and provided with a knob and dial, offers the mechanical means of adjusting this condenser. A thin sheet of mica is mounted between the plates in order that the capacity may be sufficiently high without making the plates excessively large, and so there will be no danger of short-circuiting no matter how close together the plates are pressed.

—Crosley Radio Corp., 1923



In this case innovation is the mother of invention. On the previous page we showed how one manufacturer, Crosley, made their commercial Book Condenser from metal and molded insulation. We've duplicated it with wood and aluminum foil.

This top view of a complete radio shows its construction as well as location of all major components.



A screw or threaded rod, approximately 2 1/4 in. long and having fairly heavy threads, is threaded through the Front Block to exert pressure on the metal strip fastened to the small wooden block. Turning the knob clockwise causes the screw to change the length of the screw that projects beyond this Front Block. This in turn moves the Small Book Block closer to the Large Book Block.

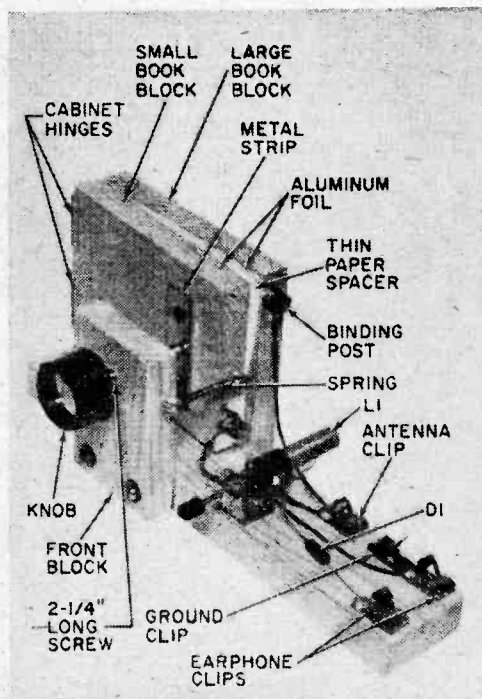
When the screw is turned counterclockwise, the part of the screw that moves the Small Book Block is shortened. The Small Book Block is pulled away from the Large Book Block by the spring stretched between the Front Block and the Small Book Block. Small screw eyes, one in the free end of the Small Book Block and one in the end of the Front Block that is adjacent to the free end of the Small Book Block, hold this spring in position.

Now the Coil. Remove all but 80 turns of wire from the loopstick coil to adjust its inductance to permit tuning the broadcast band with the capacitance of our Book Condenser. Mount this coil assembly on a 1 x 1 x 1/2-in. metal bracket with the ferrite core adjusting screw facing the front of the radio and fasten a small knob on the adjusting screw. You may find slight changes in the position of the core will improve the performance of the receiver.

Connect the Book Condenser, coil, and crystal diode as shown in the schematic.

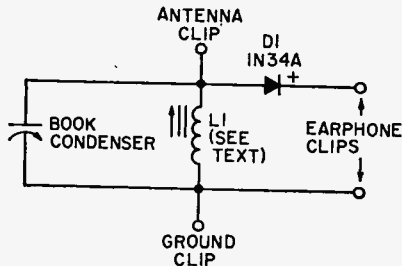
Enjoying Book Condenser Radio. Since there are no amplifier stages in this radio,

Just in case top view may not reveal all intimate details of construction of our Book Condenser we've included this oblique view. It's really a very crude approach by comparison with commercially produced ones even though they were made way back when radio was in its infancy.



RADIO FROM THE ROARING 20's

BILL OF MATERIALS FOR BOOK CONDENSER RADIO



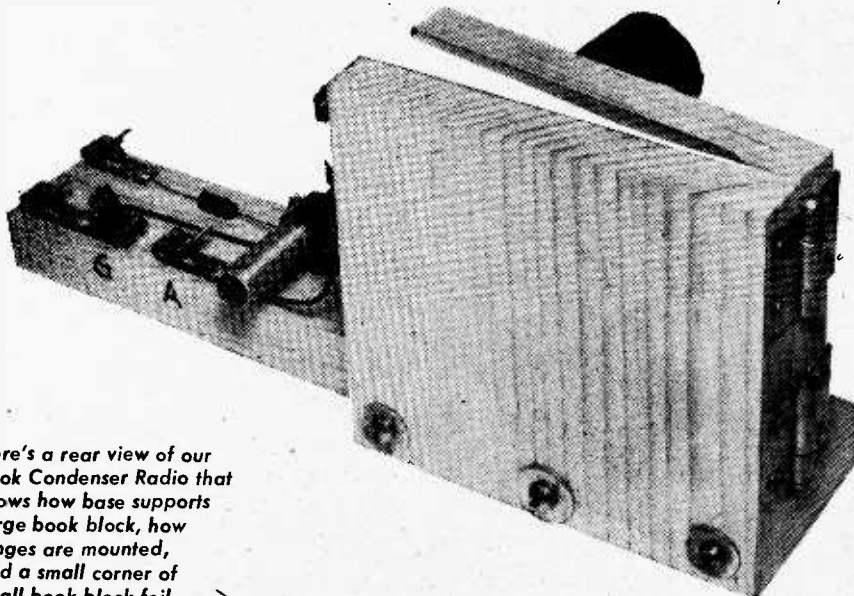
Back in the beginning we had solid-state radios but then they were called crystal sets. Note simplicity of circuitry.

- D1—Germanium diode, type IN34AS, IN60, IN82A, or IN295
- L1—Variable loopstick (Lafayette 32E41064 or equiv.)
- 4—Fahnestock clips, medium size (Lafayette 32E71028 or equiv.)
- 1—Base, hardwood, $8\frac{1}{2} \times 1\frac{1}{2} \times \frac{3}{4}$ in.
- 1—Block, hardwood, $3 \times 2 \times \frac{1}{2}$ in.
- 1—Small book block, plywood or hardwood, $4 \times 3 \times \frac{1}{2}$ in.
- 1—Large book block, plywood or hardwood, $4 \times 3\frac{3}{4} \times \frac{1}{2}$ in.
- 2—Brass cabinet hinges, 1 x 1 in. (usually available with required brass flathead screws)
- 1—Long screw, $\frac{1}{4}$ -28NF x $2\frac{1}{4}$ or equiv.
- 1—Brass or polished steel metal strip, $2 \times \frac{1}{2}$ in.
- 1—Spring, 1 in. long x $\frac{3}{16}$ in. diameter
- 1—Knob for $\frac{1}{4}$ -in. shaft
- 2—Screw eyes, $\frac{1}{2}$ -in.
- Misc.—Aluminum foil, paper spacer, $\frac{1}{2}$ -in. round head brass wood screws, $\frac{1}{4}$ -in. round head brass wood screws, washers, wire, glue, solder etc.

it's important to use a long antenna and good water-pipe ground in order to collect as much signal as possible for the set. Since the output is high impedance, you must use either high-impedance magnetic or crystal headphones on the output.

Because the Book Condenser Radio has a simple single tuned circuit, it will not tune

sharply, and therefore will receive only those stations whose signal strength is high and that are widely separated from other nearby stations. Strong local signals will be received best. If you are located near several powerful stations, this simple, broad-tuning receiver will make an ideal AM tuner for your hi-fi system. ■



Here's a rear view of our Book Condenser Radio that shows how base supports large book block, how hinges are mounted, and a small corner of small book block foil.

they
cook
with

COLD HEAT!



by Jorma Hyypia

It all started with a gooey candy bar. One day twenty some odd years ago, Dr. Percy Spencer was puttering with a radar set at Raytheon's New England laboratories. Reaching into the pocket of his white lab coat for a candy bar, he found only a warm, soggy mess. That was when Dr. Spencer discovered that microwaves generated by a radar power tube can cook food.

Since then, microwave cooking has come a long way. On an industrial scale it is used to fast-cook many kinds of food products—for example, 20,000 or more pounds of chicken parts per day. Have you noticed that those crunchy

COLD HEAT

potato chips no longer have a dark, half-burned look? It's because microwaves remove just the right amounts of residual water without scorching the outer surfaces of the chips.

Microwave ovens are also used extensively wherever large quantities of food must be prepared speedily, as in restaurants, hotels, medical and other institutions. Now microwave ovens are on the verge of revolutionizing home cooking. Tens of thousands of small microwave ovens are already used in private homes. But this is only a beginning—especially if the prices of the ovens can be cut substantially from the \$500.00 and more that they cost now.

Cold Heat. Microwaves constitute that range of electromagnetic energy that lies between radio waves and infrared radiation. Though the exact limits of the microwave spectrum are a bit vague, they are generally put at about 1000 MHz on the low end, and at 300,000 MHz at the top.

Under the right conditions, these high-frequency energy radiations can produce considerable amounts of heat, though not in any conventional way. In the cooking of food, for example, the heat is produced within the food by induced agitation of the molecules that make up the food.

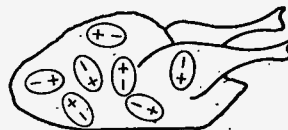
Unlike any other means of cooking food, microwaves generate no heat as such. Theory is that they cause food's polar molecules first to align with electromagnetic field, then alternately reverse because of field reversal. Resulting molecular friction causes heat, which quickly cooks food.

As our diagrams show, the molecules in any substance—chicken meat, for example—are ordinarily randomly oriented with respect to one another. When a microwave pulse passes through the chicken, it tends to align the polar food molecules parallel to the direction of wave propagation; all positive ends then point in one direction, all negative ends in the other. Within a fraction of a millionth of a second, the pulse reverses and the food molecules also try to reverse themselves accordingly. This flip-flopping occurs thousands of millions of times every second and results in considerable molecular friction. As anyone knows, friction produces heat. And heat cooks.

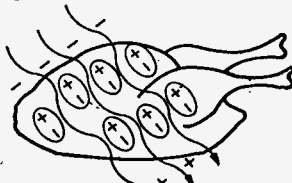
You might think of this as a kind of cold heat. The meat or other food becomes hot, of course, but the oven and the dishes holding the food remain cool to the touch. This is because the heat isn't generated by some external element, such as an electrical coil or gas flame, and then transmitted to the food through the air in the oven. Only cool microwave energy is transmitted through the oven, and the heat is produced only when it starts bouncing the food molecules about.

This still doesn't explain why the metal walls of the oven remain cool. The answer is that metals reflect rather than absorb microwaves. This is why metal cookware cannot be used in microwave ovens; the food must be contained in plastic, glass, or paper containers.

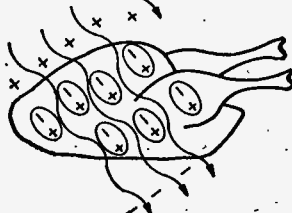
HOW MICROWAVES COOK FOOD



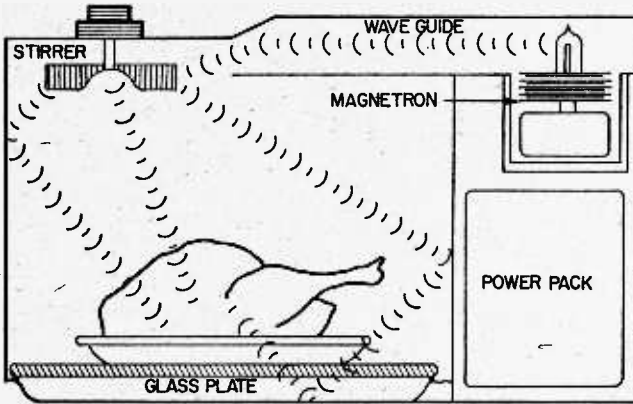
POLAR MOLECULES IN FOOD ARE NORMALLY RANDOM ORIENTED.



A MICROWAVE PULSE ALIGNS THE POLAR MOLECULES PARALLEL WITH THE ELECTROMAGNETIC FIELD, WITH LIKE CHARGES IN THE SAME DIRECTION.



ALTERNATE PULSES TEND TO REVERSE THE MOLECULES BECAUSE OF FIELD REVERSAL. THE MOLECULAR FLIP-FLOPS OCCUR MILLIONS OF TIMES EACH SECOND, CREATE HEAT BECAUSE OF MOLECULAR FRICTION.



Artist's conception of interior of microwave oven, using magnetron as its source of microwaves. Stirrer at upper left is nothing more than bladed fan, positioned so it can direct microwaves throughout entire interior of oven.

Oven Construction. There are four basic parts to a microwave oven: the microwave generator and its associated power pack; a wave guide that carries the microwaves to the oven; the oven itself which serves as a resonant cavity; and a stirrer.

In most ovens now on the market, the microwaves are generated by a *magnetron*, though klystrons and amplifiers can also be used. Some experts foresee eventual replacement of magnetrons by power grid tubes which operate at lower voltages provided by simpler power packs.

The magnetron converts DC energy, obtained from a power supply, to high-frequency energy of about 2450 MHz. This microwave energy is conducted to the oven by means of a hollow tube called a *wave guide*. The oven is a multi-mode resonant cavity designed so that the microwaves will bounce from wall to wall, passing through the food in their travels.

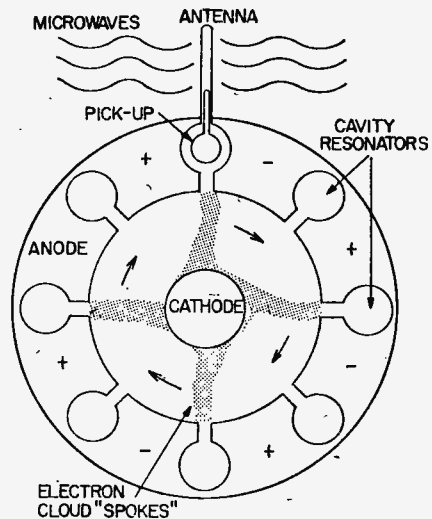
To resonate properly, the shape and size of the oven must be designed with considerable care. One of the trickiest problems was to create a uniform energy density within the oven cavity so that the food would cook evenly. In an ordinary oven the heat tends to distribute itself evenly regardless of the oven shape. Not so microwaves, even if the oven cavity is dimensioned to provide the largest number of resonant modes possible within the frequency limits imposed by the magnetron.

The ingenious solution was to add a microwave *stirrer*. This is nothing more than a bladed fan operated by a motor. It is positioned so that microwaves emerging from the wave guide strike the blades. As the blades rotate, they reflect the microwaves in different directions in the oven. The stirrer also constantly alters the effective dimen-

sions of the oven cavity, as is demonstrable by measuring microwave frequency changes in the oven when the stirrer is operating.

Magnetrons Favored. Magnetrons are currently the most popular microwave generators for heating applications, largely because they cost less than other devices and have high energy conversion characteristics—80% as compared to 65-70% for amplifiers and 50% for klystrons. The magnetron's main drawback has been its relatively short life; but recent improvements have extended the magnetron's useful life to over 10 years in home cooking applications.

Considering the energy wallop delivered by a magnetron, it is a remarkably simple



Simplified sketch of magnetron reveals how device produces microwaves. Electron "spokes" revolve around its cathode, generate microwaves in resonant cavities of anode.

COLD HEAT

though ingenious device. Heart of the magnetron is a small cylinder having a cathode rod in the central opening, and a series of resonant cavities in the outer anode body of the cylinder (see our diagram).

When pulsating DC current is applied to the cathode, it emits electrons just like any ordinary electron tube. But here the resemblance ends. Instead of traveling directly to the anode, the electrons tend to bunch, and these clusters spin rapidly around the central cathode hub like the spokes of a wheel.

As each electron "spoke" passes the mouth of a resonant cavity in the anode, it induces a surge of current around the anode walls, thereby transferring energy to the resonant cavity.

One cavity has a wire loop that serves as a pickup for the high-frequency pulses thus generated. The pulses are carried to an antenna atop the magnetron, from which they are beamed into the wave guide, and along it to the oven cavity.

Home-type microwave ovens operate off regular 117-V lines (grounded, and fused for 20 A), draw 13 to 18 A, and generate over 5000 VDC to operate the magnetron. A typical magnetron draws a current of about 250 mA.

Cooking With Microwaves. Microwave ovens are not intended to replace standard ovens, only supplement them. Many food items can be cooked faster and better with microwaves than with conventional ovens—but not everything.

When it works, it's fast! For example, it takes a couple of hours to properly barbecue a chicken by conventional means, only 45 minutes with microwaves. Want a quick

hamburger? It will be ready in 60 seconds instead of the usual 12 minutes. You can start dribbling a poached egg onto your tie in one minute, instead of the usual five. Right down the line—meats, vegetables, cereals, soups, beverages—just about anything you eat or drink can be prepared with considerable savings in time.

Many foods also gain in nutritional value. MIT scientists have discovered that microwave-cooked foods retain from 4% to 17% more of such vital nutrients as vitamin C, riboflavin, and thiamin.

One thing may bother you. Microwaves do not produce a browned pie crust, or a properly seared surface on meat. Such foods don't look "done," though they are fully cooked. The solution: stick them into your regular oven for a quick browning. Prolonged cooking in the microwave oven will not work; all you will get is a dried-out cake or chop.

Microwaves are best for thawing (frozen foods), quick warming, reheating (leftovers), and for preparing simple foods. Oven makers urge that you use conventional cooking methods for expensive roasts of beef, pork, hams, and lamb. They deserve that extra loving care that only a conventional oven can provide. But when it comes to reheating these for the next meal, you can't beat microwave.

Metal utensils can't be used in microwave ovens because they create high-standing-wave reflections that may arc and damage the magnetron. Moreover, they prevent the microwaves from entering the food from all sides.

Glass, plastic, ceramic, and paper containers all are satisfactory. But remember to remove foods from aluminum-foil containers they may be packaged in. Many foods can be portioned onto serving plates and carried directly to the table after cook-

Utilizing space-age technology, this Tappan electronic oven generates no external heat, yet cooks hamburger in 1 minute, fries strip of bacon in 2½, bakes potato in 4.



Single-oven Versatronic range by General Electric cooks food electronically in minutes, or conventionally, or both ways at once. Only 30 in. wide, Model JE 856E (shown here with JV 31 hood) features infinite controls on surface units and self-cleaning microwave oven.



ing because the plates don't become hot.

And here's a real plus. Since the oven walls don't become hot, splashed-on foods don't bake into the usual tough scales. To clean a microwave oven you need only wipe with a damp cloth.

Safety. It should be obvious that if microwaves can cook chicken, they can also cook a two-legged chick. These ovens must be used exactly as manufacturers direct. Government agencies are now watch-dogging microwave ovens to make sure they are safe, though there have been no reports of injuries despite their wide institutional usage.

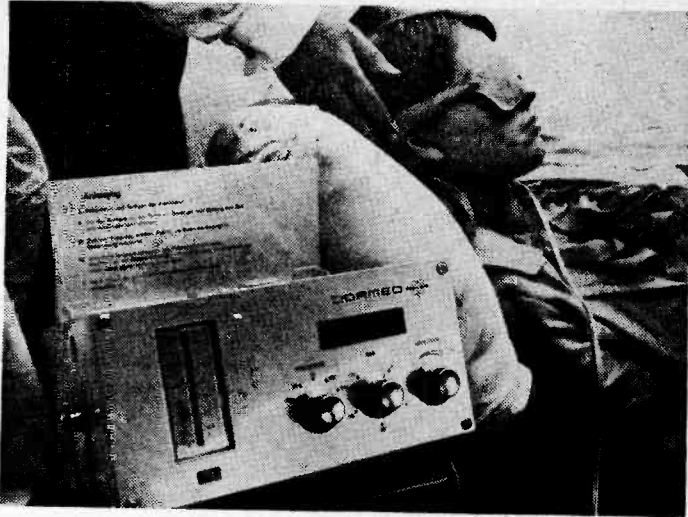
Doors of microwave ovens have double interlocks which turn off all cooking power

when opened. Nonetheless, to play it safe, stay at least an arm's length away from the oven when it's in operation. And don't let children watch the cooking process.

In a few years, microwave ovens may be as commonplace as rotisseries have become in the past few years. They are a housewife's dream. And if you live alone and cook your own meals, a microwave oven could change your whole way of life. Just think. You slide a TV dinner into the oven, and minutes later it's ready to eat. Afterwards you just throw away the paper plate; no pots, pans, or dishes to wash. Why, it could give you a whole extra hour with your CB rig every night! ■

Perhaps this century's most significant cooking advancement, microwave oven promises to save housewife countless hours in her kitchen. Eye-level oven on this GE Versatronic range cooks conventionally, boasts automatic rotisserie. Lower oven is microwave unit, which, like oven in stove above, is self-cleaning. This is GE's Model JE 896E.





With patient resting comfortably on back, operator adjusts spectacles containing sleep-inducing electrodes so they rest over eyes and just behind and below ears. Generator in foreground delivers pulsating current to patient's central nervous system.

Switched-on Flake-out

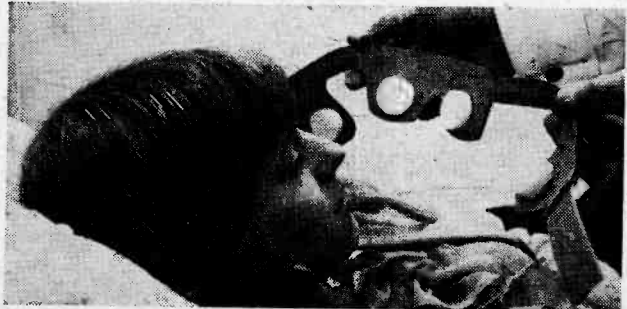


FIRST impression the patient gets is a flickering sensation in the eyes—not unpleasant, and vaguely soothing. This dies down after a few minutes, and a feeling of warmth, gentle and restful, seems to flood the whole system. Muscles relax, tension disappears. The time necessary to bring sleep varies from patient to patient, but strength, frequency, and rate of the dosage are all under the control of the physician or operator giving the treatment.

Where are we? In London, no less, where over 3,000,000 sleeping pills pass through British throats nightly—or at least they used to. Now, a new German invention called "Dormed" promises to put an end to pills of the sleep-inducing variety, perhaps forever. Basically, it consists of a set of electrodes in the form of a pair of spectacles. Fitted on a patient's head, they cause a pair of electrodes to rest lightly on the eyelids, another to rest just behind the ears. Pump in a signal from a small pulse generator resting on the bedside table, and—you guessed it—pill-less, pillow-talkless sleep.

Ah, sandman! It is you? ■

"Nothing to be afraid of," purrs operator, as she prepares to fit electrodes to patient's head. Four electrodes are covered with foam plastic and slightly moistened with salt solution to make better contact. Two go over eyelids, two just behind ears. Powered by six flashlight cells, generator produces square waves between 12 and 200 Hz.



a DXer's OPEN SESAME to **Old Mexico**

by Don Jensen



YOU'RE tooling along Route 39 in your fastback. The weather's clear, the track fast. There's a blonde in the bucket seat beside you, and an overripe melon of a moon hangs just above the horizon.

You turn the radio dial, looking for some groovy music to set the mood. Music—a gaggle of guitars, trumpets chording in thirds, a madly-malleted marimba—blares from the speaker. It's Mighty 1040, Wonderful WAMMO Radio, right?

Wrong, you discover a few moments later when the announcer cuts in with a quick burst of Spanish. Forgetting the chick at your elbow, you concentrate on the lingo. Nope, it's not your favorite rock-jock, old buddy. You've just DXed your first Mexican station!

Many DXers get started this way, accidentally tuning in Mexico on their standard broadcast-band radios. And, it's a good starting point for hobby newcomers. No special receiver is necessary. Distances, by shortwave standards, aren't great. There are plenty of easy-to-log stations, some of them more powerful than anything in the U.S.

Callous-eared veterans, too, will find all the challenge they could want in tuning mini-watt Mexicans on the crowded graveyard frequencies. To be sure, virtually all programming is in Spanish, but don't let that scare you off. You don't have to be a linguist to score. Careful listening and some experience is all you need to pick out the station identifications. *(Turn page)*

a DXer's OPEN SESAME to Old Mexico

MEXICAN STATES

Ags. —Aguascalientes	Gto. —Guanajuato	Oro. —Queretaro
* B.C. —Baja California	Hgo. —Hidalgo	Sin. —Sinaloa
Cam. —Campeche	Jal. —Jalisco	S.L.P. —San Luis Potosi
Chih. —Chihuahua	Mich. —Michoacan	Son. —Sonora
Chis. —Chiapas	Mor. —Morelos	Tab. —Tabasco
Coah. —Coahuila	Nay. —Nayarit	Tams. —Tamaulipas
Col. —Colima	N.L. —Nuevo Leon	Tax. —Tlaxcala
** D.F. —Distrito Federal	Oax. —Oaxaca	Ver. —Veracruz
Dgo. —Durango	Pue. —Puebla	Yuc. —Yucatan
Gro. —Guerrero	* Q.R. —Quintana Roo	Zac. —Zacatecas

*Territory or territories

**Federal District

On The XE Beat. Mexican stations have call letters beginning with XE, (a few FM and TV outlets use XH prefixes) followed by one, two, or three additional letters. Study the phonetic Spanish alphabet (see our box) and you'll soon be identifying, "EH-keess, eh, ah, beh, seh," as "XEABC."

As in other Latin American countries, some broadcasters in Mexico use identifying slogans, e.g., *Radio Acapulco*, *La Voz de la America Latina* (Voice of Latin America), etc. Some handy words to know are *cadena* (network), *emisora* (broadcasting station), *sistema* (system), and *ondas* (radio waves).

Probably the easiest medium-wave Mexican to hear, regardless of where you live, is the huckster's friend, XERF, 1570 kHz. Located near Ciudad Acuña, across the Rio Grande from Del Rio, Texas, this potent 250 kWer, for years, has been a boon to mailorder tombstone peddlers and Bible-thumping fundamentalist preachers, who use its facilities to reach rural America. More recently, fans of far-out California disc jockey Wolfman Jack have been able to hear his taped programs over XERF. Aimed at U.S. audiences, its programs are in English and hardly typical of Mexican radio.

Slightly more interesting to DXers is another 250-kW AM outlet, XEW, 900 kHz, in Mexico City. It may be one of the first

Mexican stations you log and before long, you may consider it little more than a pest when its solid signal blocks out other, weaker DX stations.

Among the high-powered transmitters in our neighbor to the south are XEUN, 860 kHz; XEQ, 940 kHz; XEDP, 1060 kHz; XERCN, 1110 kHz; and XEB, 1220 kHz; all in Mexico City. Another in the capital city is XEX on 730 kHz, which has repeater outlets at Leon and Veracruz on the same frequency. XETRA, 690 kHz, at Tijuana, directs its programs at the Southern California audience. Another strong border station is XELO, Ciudad Juarez, on 800 kHz. And, at Monterrey, XEG on 1050 kHz, runs 100 kW. See our listing for several hundred more to shoot for.

On The Short Side. Turning to shortwave, you'll find fewer Mexican stations, but plenty of challenge. Easy? Some of them are, but a scattered few on the very low frequencies are as difficult to log as any station in the world. A number of Mexican SWers merely relay medium-wave programming; others originate their own broadcasts. Ranchero music is typical fare, but the university-run stations, of which there are several, tend to offer more educational and talk shows in Spanish and a higher class of music, often symphonic.

Currently, the hottest Mexican on short-

PHONETIC SPANISH ALPHABET

a = ah	g = geh	m = EH-meh	t = teh
b = beh	h = AH-cheh	n = EH-neh	u = oo
c = seh	i = ee	o = oh	v = veh
d = deh	j = HOH-tah	p = peh	w = DOH-bleh veh
e = eh	k = kah	q = koo	x = EH-keess
f = EH-feh	l = EH-leh	r = EH-reh	y = ee-gree-EH-gah
	ll = EH-yah	s = EH-seh	z = SEH-tah

MEXICAN MEDIUM-WAVE BROADCAST STATIONS

kHz.	Call	Location	kHz.	Call	Location
540	XEWA	Monterrey, N.L.		XETQ	Orizaba, Ver.
	XEWA	San Luis Potosi, S.L.P.		XEZR	Zaragoza, Coah.
550	XEAF	Guadalajara, Jal.	860	XENW	Culiacan, Sin.
	XEKL	Jalapa, Ver.		XEDU	Durango, Dgo.
	XEQW	Merida, Yuc.		XEUN	Mexico City, D.F.
	XEUC	Tehuantepec, Oax.		XENL	Monterrey, N.L.
560	XEOC	Mexico City, D.F.		XEXZ	Tenosique de Pino Suarez, Tab.
570	XEVX	Comalcalco, Tab.		XERK	Tepic, Nay.
	XENZ	Culiacan, Sin.		XEMO	Tijuana, B.C.
	XEBJB	Monterrey, N.L.	880	XEEM	Rio Verde, S.L.P.
	XELO	Morelia, Mich.		XETZ	Tequila, Jal.
	XEOA	Oaxaca, Oax.	900	XEW	Mexico City, D.F.
	XETJ	Torreón, Coah.		XEWB	Veracruz, Ver.
580	XEFI	Chihuahua, Chih.	910	XEHO	Ciudad Obregon, Son.
	XEHP	Ciudad Victoria, Tams.	920	XEQD	Chihuahua, Chih.
	XEDZ	Cordoba, Ver.		XELT	Guadalajara, Jal.
	XEAV	Guadalajara, Jal.		XEBH	Hermosillo, Son.
	XEMU	Piedras Negras, Coah.		XEOK	Monterrey, N.L.
	XEUE	Tuxtla Gutierrez, Chis.		XEMJ	Piedras Negras, Coah.
590	XEE	Durango, Dgo.		XEBM	San Luis Potosi, S.L.P.
	XEPH	Mexico City, D.F.	940	XEWV	Mexicali, B.C.
	XEFD	Rio Bravo, Tams.		XEQ	Mexico City, D.F.
600	XEBB	Acapulco, Gro.		XERKS	Reynosa, Tams.
	XEZ	Merida, Yuc.	950	XERN	Montemorelos, N.L.
	XEDN	Torreón, Coah.		XEYJ	Nueva Rosita, Coah.
610	XECW	Ciudad Valles, S.L.P.	950	XEGM	Tijuana, B.C.
	XEEL	Fresnillo, Zac.	960	XERGO	Chetumal, Q.R.
	XEGS	Guasave, Sin.		XEGB	Coatzacoalcos, Ver.
	XEJA	Jalapa, Ver.		XEIQ	Ciudad Obregon, Son.
610	XEJB	Sabinas, Coah.		XEHK	Guadalajara, Jal.
	XEKZ	Tehuantepec, Oax.		XEOZ	Jalapa, Ver.
	XEUF	Uruapan, Mich.		XECS	Manzanillo, Col.
620	XEBU	Chihuahua, Chih.		XEMM	Morelia, Mich.
	XECK	Durango, Dgo.		XEK	Nuevo Laredo, Tams.
	XENK	Mexico City, D.F.		XEUQ	Zihuatanejo, Gro.
	XEOO	Tepic, Nay.	970	APCJ	Apatzingan, Mich.
	XEACM	Villahermosa, Tab.		XEJ	Ciudad Juarez, Chih.
630	XEACA	Acapulco, Gro.		XEO	Matamoros, Tams.
	XEFU	Cosmalaopan, Ver.		XEOW	Mazatlan, Sin.
	XERPS	Mazatlan, Sin.		XEMH	Merida, Yuc.
	XEFB	Monterrey, N.L.		XEDF	Mexico City, D.F.
	XETS	Tapachula, Chis.		XEVT	Villahermosa, Tab.
650	XETNT	Los Mochis, Sin.	980	XELC	La Piedad, Mich.
	XEZM	Zamora, Mich.		XEKE	Navojua, Son.
660	XERPM	Mexico City, D.F.		XENR	Nueva Rosita, Coah.
670	XETOR	Torreón, Coah.		XEQG	Queretaro, Qro.
680	XEFO	Chihuahua, Chih.		XETU	Tampico, Tams.
	XEORO	Guasave, Sin.		XEXT	Tepic, Nay.
	XELG	Leon, Gto.	990	XEBC	Ciudad Guzman, Jal.
	XEKQ	Tapachula, Chis.		XEHZ	La Paz, B.C.
	XEFJ	Teziutlan, Pue.		XECL	Mexicali, B.C.
690	XEN	Mexico City		XET	Monterrey, N.L.
	XETRA	Tijuana, B.C.	1000	XEFV	Ciudad Juarez, Chih.
700	XEAR	Zapopan, Jal.		XEOY	Mexico City, D.F.
710	XEKU	Acapulco, Gro.	1010	XEWS	Culiacan, Sin.
	XERL	Colima, Col.		XEDX	Ensenada, B.C.
	XEBL	Culiacan, Sin.		XEHL	Guadalajara, Jal.
	XEMP	Mexico City, D.F.		XETX	Nuevo Casas Grandes, Chih.
710	XEON	Tuxtla Gutierrez, Chis.		XEVK	Torreón, Coah.
730	XEX	Leon, Gto.		XEFM	Veracruz, Ver.
	XEX	Mexico City, D.F.	1020	XEXL	Patzcuaro, Mich.
	XEX	Veracruz, Ver.	1030	XEQR	Mexico City, D.F.
760	XEDGO	Durango, Dgo.	1050	XED	Mexicali, B.C.
	XEABC	Los Reyes, D.F.		XEG	Monterrey, N.L.
	XEZZ	Tonala, Jal.	1060	XEDP	Mexico City, D.F.
790	XEBI	Aguascalientes, Ags.	1070	XEIT	Ciudad del Carmen, Cam.
	XERPC	Chihuahua, Chih.		XESP	San Pedro Tlaquepaque, Jal.
	XEGZ	Ciudad Lerdo, Dgo.		XEGY	Tehuacan, Pue.
	XENT	La Paz, B.C.	1090	XEWL	Nuevo Laredo, Tams.
	XESU	Mexicali, B.C.		XERB	Tijuana, B.C.
	XERC	Mexico City, D.F.		XEQD	Veracruz, Ver.
	XEFE	Nuevo Laredo, Tams.	1110	XELEO	Leon, Gto.
	XEVA	Villahermosa, Tab.		XERCN	Mexico City, D.F.
800	XELO	Ciudad Juarez, Chih.		XEOQ	Rio Bravo, Tams.
	XEAN	Ocotlan, Jal.	1120	XEUONO	Guadalajara, Jal.
	XEMMM	Tijuana, B.C.	1130	XEZL	Jalapa, Ver.
810	XEFW	Tampico, Tams.	1140	XEXF	Leon, Gto.
	XEOE	Tapachula, Chis.		XEMR	Monterrey, N.L.
	XEUX	Tuxpan, Nay.	1150	XEAD	Guadalajara, Jal.
820	XKEG	Fortin de las Flores, Ver.		XEJS	Hidalgo del Parral, Chih.
	XEBA	Guadalajara, Jal.		XERTM	Macuspana, Tab.
	XESB	Santa Barbara, Chih.		XERM	Mexicali, B.C.
830	XELA	Mexico City, D.F.		XEJP	Mexico City, D.F.
	XENSM	Navolato, Sin.	1150	XEBF	S. Pedro de las Colonias, Coah.
840	XEFG	Celaya, Gto.		XEXZ	Zacatecas, Zac.
850	XEMIA	Chapala, Jal.	1160	XEVW	Acambaro, Gto.
850	XEM	Chihuahua, Chih.		XEJW	Uruapan, Mich.
	XEUS	Hermosillo, Son.	1170	XERT	Reynosa, Tams.
	XEAL	Manzanillo, Col.	1180	XEFR	Mexico City, D.F.

a DXer's OPEN SESAME to Old Mexico

MEXICAN MEDIUM-WAVE BROADCAST STATIONS

kHHz.	Call	Location	kHHz.	Call	Location
1190	XEPZ	Ciudad Juarez, Chih.	1380	XEGW	Ciudad Victoria, Tams.
	XEDO	Jojutla, Mor.	1380	XECO	Mexico City, D.F.
	XEMBC	Mexicali, B.C.	1390	XEOR	Reynosa, Tams.
1200	XEZI	Zacapu, Mich.		XETY	Tecoman, Col.
1220	XEB	Mexico City, D.F.		XETL	Tuxpan, Ver.
1240	XELD	Autlan de Navarro, Jal.	1400	XELH	Acaponeta, Nay.
	XEBN	Ciudad Delicias, Chih.		XEKJ	Acapulco, Gro.
	XEBQ	Guaymas, Son.		XEAC	Aguascalientes, Ags.
	XENG	Huauchinango, Pue.		XEPS	Empalme, Son.
	XERZ	Leon, Gto.		XEPB	Hermosillo, Son.
	XES	Tampico, Tams.		XEGD	Hidalgo del Parral, Chih.
1250	XELM	Tuxtla Gutierrez, Chis.		XEI	Morelia, Mich.
	XEDK	Guadalajara, Jal.		XEDE	Saltitillo, Coah.
	XEDL	Hermosillo, Son.		XEAB	Santa Ana, Son.
	XEJX	Queretaro, Qro.		XETO	Tampico, Tams.
	XESJ	Saltitillo, Coah.		XEVV	Tuxtla Gutierrez, Chis.
	XEPI	Tixtla, Gro.	1410	XEKB	Atemajac, Jal.
1260	XER	Linares, N.L.		XECF	Los Mochis, Sin.
	XEL	Mexico City, D.F.		XEBS	Mexico City, D.F.
	XEMF	Monclova, Coah.		XEAS	Nuevo Laredo, Tams.
	XEOG	Ojinaga, Chih.		XETAB	Villahermosa, Tab.
1270	XERPL	Leon, Gto.	1420	XEF	Ciudad Juarez, Chih.
	XENX	Mazatlan, Sin.		XEWE	Irapauto, Gro.
1270	XEGL	Navojoa, Son.		XEEW	Matamoros, Tams.
	XENY	Nogales, Son.		XEH	Monterrey, N.L.
	XEAX	Oaxaca, Oax.		XEWJ	Tehuacan, Pue.
	XEPV	Papantla de Clarte, Ver.		XEXX	Tijuana, B.C.
	XEMW	San Luis Rio Colorado, Son.	1430	XERAC	Campeche, Cam.
1280	XECAM	Campeche, Cam.		XEMO	Ciudad Miguel Aleman, Tams.
	XEBW	Chihuahua, Chih.		XEQX	Ciudad Obregon, Son.
	XEZS	Coatzacoalcos, Ver.		XEIG	Iguala, Gro.
	XEAG	Guadalajara, Jal.	1430	XELY	Morelia, Mich.
	XEQP	Cordoba, Ver.		XELL	Veracruz, Ver.
	XEAW	Monterrey, N.L.	1440	XELZ	Mexico City, D.F.
1290	XEAP	Ciudad Obregon, Son.	1450	XECM	Ciudad Mante, Tams.
	XEIX	Jiquilpan, Mich.		XEDJ	Magdalena, Son.
	XEDA	Mexico City, D.F.		XEJM	Monterrey, N.L.
1300	XEP	Ciudad Juarez, Chih.		XEPP	Orizaba, Ver.
	XESW	Ciudad Madera, Chih.		XEJD	Poza Rica, Ver.
	XEJL	Guamuchil, Sin.		XENA	Queretaro, Qro.
	XEHU	Martinez de la Torre, Ver.		XEVH	Valle Hermoso, Tams.
	XEKV	Morelia, Mich.	1460	XEHE	Atotonilco El Alto, Jal.
	XELE	Tampico, Tams.		XEYC	Ciudad Juarez, Chih.
1310	XEFH	Agua Prieta, Son.		XEHX	Ciudad Obregon, Son.
	XERU	Chihuahua, Chih.		XEJT	Tampico, Tams.
	XETIA	Guadalajara, Jal.		XELX	Zitacuaro, Mich.
	XEAM	Matamoros, Tams.	1470	XEHI	Ciudad Miguel Aleman, Tams.
	XEVI	San Juan del Rio, Qro.		XEDS	Colima, Col.
	XEPO	San Luis Potosi, S.L.P.		XEND	Durango, Dgo.
	XEBP	Torreón, Coah.		XEYA	Irapauto, Gro.
	XEHV	Veracruz, Ver.		XESM	Mexico City, D.F.
	XEIZ	Villa de Guadalupe, N.L.		XEBBC	Tijuana, B.C.
1320	XEUI	Comitan, Chris.	1480	XEHM	Ciudad Delicias, Chih.
	XERJ	Mazatlan, Sin.		XENS	Navojoa, Son.
	XEAI	Mexico City, D.F.		XEPR	Poza Rica, Ver.
	XENI	Nueva Italia, Mich.		XETKR	Villa de Guadalupe, N.L.
	XEIH	Tuxtepec, Oax.	1490	XEVZ	Arayucan, Ver.
1330	XEBO	Irapauto, Gro.		XEED	Amea, Jal.
	XELZ	Martinez de la Torre, Ver.		XEDR	Guaymas, Son.
	XEFC	Merida, Yuc.		XEMK	Huixtla, Chis.
	XEWQ	Monclova, Coah.	1490	XEMS	Matamoros, Tams.
1340	XEJK	Ciudad Delicias, Chih.		XEFF	Matehuala, S.L.P.
	XEJB	Ciudad Victoria, Tams.		XEXE	Queretaro, Qro.
	XEGR	Coatepec, Ver.		XEGT	Zamora, Mich.
	XEOM	Coatzacoalcos, Ver.	1500	XERH	Mexico City
	XEMA	Fresnillo, Zac.	1530	XEUR	Mexico City
	XEDKT	Guadalajara, Jal.		XESD	Silao, Gto.
	XECW	Los Mochis, Sin.	1540	XENC	Celaya, Gto.
	XENV	Monterrey, N.L.	1550	XENU	Nuevo Laredo, Tams.
	XESL	San Luis Potosi, S.L.P.		XEBG	Tijuana, B.C.
1350	XEQK	Mexico City, D.F.	1560	XEVIP	Mexico City, D.F.
	XETM	Naco, Son.	1570	XERF	Ciudad Acuna, Coah.
	XEJF	Tierra Blanca, Ver.	1580	KELI	Chilpancingo, Gro.
	XETB	Torreón, Coah.		XEDM	Hermosillo, Son.
1360	XEY	Celaya, Gto.		XENQ	Tufancingo, Hgo.
	XESA	Culliacan, Sin.		XEQL	Zamora, Mich.
	XEKF	Iguata, Gro.	1590	XENH	Escuinapa, Sin.
	XEDQ	San Andres Tuxtla, Ver.		XEVOZ	Mexico City, D.F.
1370	XEA	Campeche, Cam.		XEBZ	Villa de Meoqui, Chih.
	XEHF	Nogales, Son.	1600	XEAE	Ciudad Acuna, Coah.
	XEPA	Puebla, Pue.			

MEXICAN TV STATIONS

Channel	Call	Location	
2	XHIA-TV	Torreon, Coah.	
	XEPM-TV	Ciudad Juarez, Chih.	
	XHCH-TV	Chihuahua, Chih.	
	XEW-TV	Mexico City	
	XEWO-TV	Guadalajara, Jal.	
	XHI-TV	Ciudad Obregon, Son.	
	XHFA-TV	Nogales, Son.	
3	XEFE-TV	Nuevo Laredo, Tams.	
	XHFM-TV	Vera Cruz, Ver.	
	XHBC-TV	Mexicali, B.C.	
	XHJMA-TV	Hgo. del Parral, Chih.	
	XEZ-TV	El Zamorano, Gto.	
	XEFB-TV	Monterrey, N.L.	
	XHP-TV	Puebla, Pue.	
4	XHQ-TV	Culiacan, Sin.	
	XHCV-TV	Coatzacoalcos, Ver.	
	XHY-TV	Merida, Yuc.	
	XELN-TV	Torreon, Coah.	
	XHTV	Mexico City	
	XEG-TV	Guadalajara, Jal.	
	5	XHCC-TV	Colima, Col.
XEJ-TV		Ciudad Juarez, Chih.	
XHFI-TV		Chihuahua, Chih.	
XHAI-TV		Las Lajas, Ver.	
XHGC-TV		Mexico City	
6		XETV	Tijuana, B.C.
		XHZ-TV	El Zamorano, Gto.
	XEHL-TV	Guadalajara, Jal.	
	XET-TV	Monterrey, N.L.	
7	XEWB-TV	Hermosillo, Son.	
	XEX-TV	Paso de Cortes, Mex.	
	XHMZ-TV	Mazatlan, Sin.	
8	XHGO-TV	Ciudad Madero, Tams.	
	XHAS-TV	Las Lajas, Ver.	
	9	XEQ-TV	Paso de Cortes, Mex.
10		XHPT-TV	Merida, Yuc.
		XHK-TV	La Paz, B.C.
	XHA-TV	Durango, Dgo.	
	XHL-TV	Leon, Gto.	
	XHKW-TV	Morelia, Mich.	
	XHX-TV	Monterrey, N.L.	
11	XHAI-TV	Las Lajas, Ver.	
	XEIP-TV	Mexico City	
	XEUS-TV	Hermosillo, Son	
12	XEWT-TV	Tijuana, B.C.	
	XHAW-TV	Monterrey, N.L.	
	XHCG-TV	Los Mochis, Sin.	
	XHOW-TV	Mazatlan, Sin.	
13	XEW-TV	Aguaascalientes, Ag.	
	XHII-TV	Mexico City	

MEXICAN FM STATIONS

kHz.	Call	Location
86.0	XHCM-FM	Cuernavaca, Mor.
90.5	XEDA-FM	Mexico, D.F.
92.1	XHFO-FM	Mexico, D.F.
92.5	XHSRO-FM	Monterrey, N.L.
93.3	XEH-FM	Monterrey, N.L.
93.7	XHNOE-FM	Nuevo Laredo, Tams.
95.3	XHSH-FM	Mexico, D.F.
97.1	XEBA-FM	Guadalajara, Jal.
97.9	XETIA-FM	Guadalajara, Jal.
98.1	XHMLS-FM	Matamoros, Tams.
98.5	XELA-FM	Mexico, D.F.
99.3	XHMS-FM	Monclova, Coah.
99.3	XEN-FM	Mexico, D.F.
100.1	XHMM-FM	Mexico, D.F.
100.3	XEAV-FM	Guadalajara, Jal.
100.9	XEOY-FM	Mexico, D.F.
101.9	XEAD-FM	Guadalajara, Jal.
103.3	XERPM-FM	Mexico, D.F.
104.9	XHRPE-FM	Mexico, D.F.
106.5	XHMR	Mexico, D.F.

wave is XERM, R. Mexico, which first came on the air last year on 9534 and 11,718 kHz. A government venture, R. Mexico seems conscious of its foreign listeners and occasionally announces in English, French, German.

Listeners reporting reception to Box 20100, Mexico City, have been receiving LP recordings of speeches by Mexico's president, but few QSLs, in return.

Also frequently heard on shortwave are XEQM, R. Yucatan, 6105 kHz, from Me-XEFT, La Voz de Veracruz, 9545 kHz; and XEWW, 9515 kHz, and XERR, 15,110 kHz, both from Mexico City. As with Mexico's medium-wave stations, shortwave reception is best during the evening hours, after 0000 GMT (7:00 p.m. EST).

Rough But Ready. A more exotic, but distinctly harder, way to log Mexico is on the TV and FM bands. On these very high fre-

(Continued on page 106)

MEXICAN SHORTWAVE STATIONS

kHz.	Call	Station Name	Location
2160	XEVJ	Radifusora XEVJ	Chilpancingo, Gro.
2380	XESE	Sta. de Educacion Publica	Samachique, Chih.
4820	XEJG	Gobierno del Est. de Jalisco	Guadalajara, Jal.
6010	XEOI	Radio Mil	Mexico, D.F.
6020	XEUW	El Eco de Sotavento	Veracruz, Ver.
6045	XEXO	Radio Universidad	San Luis Potosi, S.L.P.
6065	XEXG	Radiodifusora Mexico	Leon, Gto.
6090*	XECMT	Radio Mante	Ciudad Mante, Tams.
6105	XEOM	Radio Yucatan	Merida, Yuc.
6115	XEUDS	Radio Universidad de Sonora	Hermosillo, Son.
6120	XETS	Radio Tapachula	Tapachula, Chis.
6185	XEWW	La Voz de la America Latina	Mexico, D.F.
6185	XEICM	La Voz del Maestro	Mexico, D.F.
9515	XEWW	La Voz de la America Latina	Mexico, D.F.
9534*	XERM	Radio Mexico	Mexico, D.F.
9545	XECT	La Voz de Veracruz	Veracruz, Ver.
9555	XEQK	La Hora Exacta	Mexico, D.F.
9600	XEYU	Radio Universidad	Mexico, D.F.
11,718*	XERM	Radio Mexico	Mexico, D.F.
11,740	XEMP	La Charrita del Cuadrante	Mexico, D.F.
11,820	XEBR	El Heraldito de Sonora	Hermosillo, Son.
11,880	XEHH	Radiodifusora Comerciales	Mexico, D.F.
15,110	XERR	Radiodifusora Comerciales	Mexico, D.F.

*Frequency varies



QSL from Mexico City's XEB.



HAM TRAFFIC DE W7DQS

by MARSHALL LINCOLN

Why DXCC Is Only The Beginning

LOOKING for a new award? Some hams, after making WAS, DXCC, and a bushel of county awards, seem to think they've conquered the world. They sort of slack off, as if there's nothing more worthy of their efforts. Actually, they're just beginning but haven't realized it.

For a new challenge, have you ever tried to get into the "A-1 Operator Club?" This is not something you apply for, or something you automatically obtain just by racking up a big score in a contest, or accumulating a tall stack of QSL cards. To become a member of the A-1 Operator Club, you just do one thing—*become an A-1 operator!*

Recognition that you have reached this level of competence will come when you are observed by other members of the Club and been nominated by at least two of them. They base their judgment on four basic items: 1) general keying and voice considerations, 2) correct use of operation procedures, 3) copying ability, and 4) judgment and courtesy.

Becoming a member isn't easy. But the honor is to be highly valued since it shows that the member has been recognized by other highly-qualified hams on the basis of his ability and on-the-air behavior and respect for his fellow hams. It's a goal for all of us to strive for. With each new member, ham radio is elevated another notch.

Let's Go To The Movies. *The movie* in this instance is called "Ham's Wide World," and it's a fascinating, well-organized 30-minute color film all about ham radio. You just might see it on your local TV station, or at a meeting of a civic group in your home town. And if it hasn't been shown there, you can help see to it that it is.

This film was produced by a professional film company hired by the ARRL as a public relations effort on behalf of ham radio. The folks involved did a really fine job. It's intended for showing to the general public—to people who have heard of ham radio, but never understood what it's all about.

All the actors are ordinary hams, going about all the things that hams across the country do. Narration is by two active hams who are well known to the general public: Barry Goldwater, K7UGA, and Arthur Godfrey, K4LIB.

Ham activities shown in the film include Field Day, DX rag chewing, technical experimenting, mobile operating, disaster communications, GI phone patches, and others. Each is explained in easily understandable, accurate terms. The narrative style should hold the attention of most anyone, regardless of his interest in the technical aspects of hamming.

If you want to help promote the advantages and value of ham radio among the general public, contact ARRL headquarters at Newington, Conn. 06111, or your own district ARRL director. A little effort on your part, and you should be able to arrange for a showing to a public-meeting or on your local TV station.

Never Too Old. A letter from W9DIW comments on a previous Ham Traffic column in which I pointed out how ham radio benefits from those hams who make an extra effort to help their fellow hams. He says he knows firsthand what a wonderful thing that is. At the age of 67, W9DIW has obtained his Advanced Class license, thanks to W9SFU, who assisted a small group of fel-

(Continued on page 101)



PHONE-FEEDING GOLDIE

What to do when a vacation beckons and you can't find a living soul who's willing to feed your pet goldfish? O Problem, thy name is Pitilessness! Or is it? For if Rube Goldberg were around . . .

One answer, as shown in our photos, is the creation of England's Stan Lewis (above). What Stan did was to fix a supply of fish food to the top of a flexible bar at-

tached to the side of the tank. This done, he ran a string from the bar to the hammer of his telephone bell and adjusted it so that ringing phone caused bar to shake and shaking bar caused fish food to fall.

When last heard from Stan was still on holiday. And Goldie, meanwhile, was munching merrily away. O Problem, thou art Powerless!—*Joe Gronk* ■



Under ever-present spell of gravity, fish food falls ever downward, unencumbered by resistance of air. Actuator is clapper of phone, which electrons cause to ring.

With bottom of phone removed, string can be seen running between clapper and bar. Not known is effect of Stan's friends' calls on gorgeous Goldie's gorging.



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*Earn \$5 or more an hour
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TV-RADIO SERVICING

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

*There's money and
success awaiting you in*

BROADCASTING— COMMUNICATIONS

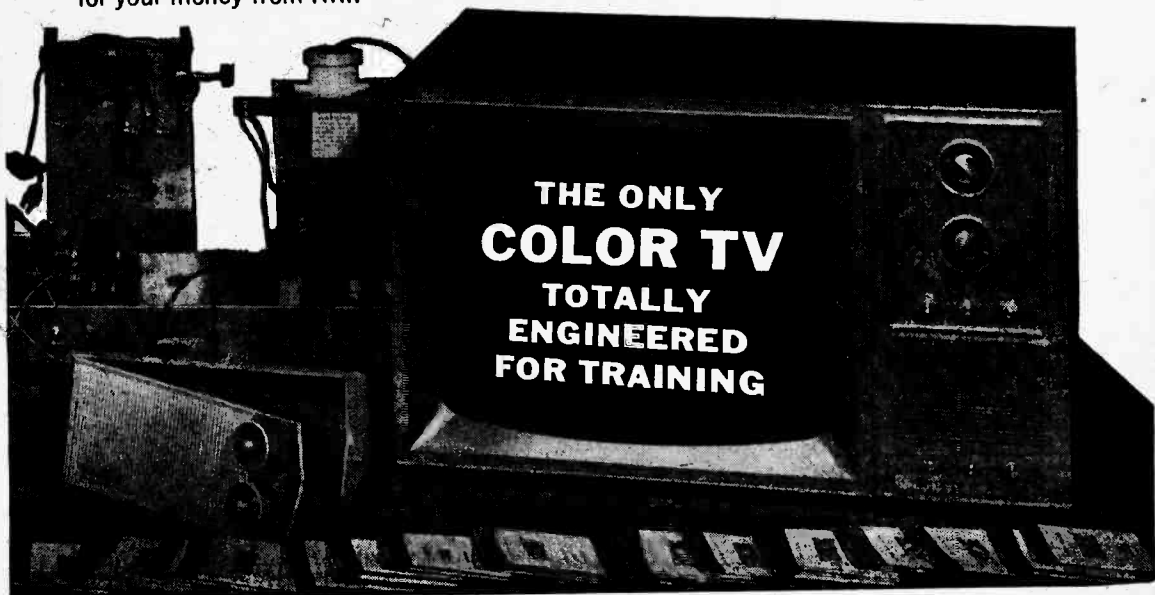
The experience you gain from intensely practical NRI training in Complete Communications equals as much as two years of training on the job. With NRI, you can train for a choice of careers ranging from mobile, marine and aviation radio to TV broadcasting and space communications. You learn how to install,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

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UNIUNCTION tremolo

Adds Rock Beat to Your Guitar

by Steve Daniels, WB2GIF



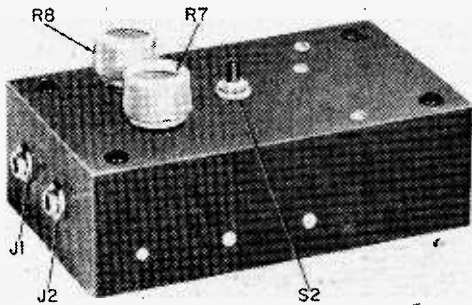
THE mournful throbbing and fast go-go effects that can be produced by an electronic tremolo make it a favorite instrument of rock groups to add interest to the sound of a guitar or organ. Unfortunately, many of these devices now commercially available produce a thumpy or choppy effect because the sound is modulated by heavy or sharp pulses. Most amps, especially bass amps, don't have a built-in tremolo circuit: therefore, our Unijunction Tremolo adds this refinement to help make your group an outstanding one.

How It Works. The basic unit of our Tremolo is a low-speed relaxation oscillator built around Q1, a unijunction transistor. Resistors R1 and R2 limit the fast and slow rates. Positive pulses, appearing on b1 of the UJT are coupled to the base of Q2, a common emitter amplifier, via C2 and R7. Lamp I1 is connected to the collector of Q2, which is slightly forward biased by R5. The lamp flashes on and off, following the pulses created by Q1. The thermal lag, inherent in incandescent lamps, reduces the thumping effect. Lamp I1 excites photocell PC1, charging capacitor C3. PC1 and C3 are connected to the output of the musical instrument (guitar, organ, etc.) and the input of the amplifier. As C3 is discharged across the input

UNIUNCTION tremolo

to the amplifier it momentarily bypasses the musical instrument output to ground. Each flash of the lamp recharges the capacitor, thus producing the smooth tremolo effect.

Although total current drain of the Tremolo is quite small (it actually could be operated from a 9-volt transistor radio battery with relatively long battery life) we have included a self-contained power supply to permit operation directly from the AC



Here's operating panel of our Uniunction Tremolo. Switch S2 lets you turn off tremolo effect anytime you want just plain old music without benefit of trembling tremolo.

power line. In the schematic we show where the battery is connected in the event you may prefer operating your Tremolo from a battery. Initial cost for the battery-operated version is less than for the power line operated one.

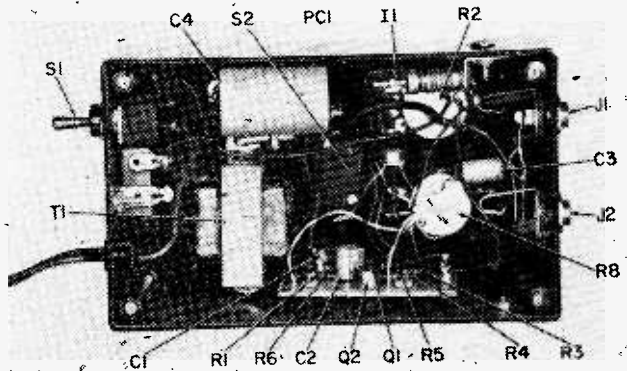
You must admit there's lots of parts crammed inside our box. After all, we do need a power supply as well as the UJT circuitry and photocell control unit. Photocell is suspended in space about an inch from lamp I1. Connection leads of photocell are stiff enough to hold it in position.

Let's Make It. In spite of the fact that we built a 117-V, 50-60 Hz power supply into the unit, we were able to house the Tremolo in a small (3¼ x 6¼ x 2-in.) plastic instrument case. The power supply is assembled in one third of the plastic box, leaving the balance of the space available for the electronic portion. Transistors, coupling capacitors, and resistors are mounted on a 1¼ x 2½-in. piece of perfboard, which is fastened to one of the side walls inside the case. Flea clips or push pins are used to mount these components and make connections to them.

Exciter lamp I1 is fastened to the opposite side wall and jacks J1 and J2 are mounted on one end. Photocell PC1 is self-supporting on its pigtailed and is positioned about an inch or inch-and-a-half away from its exciter lamp I1. For best results, you may have to push it around and/or vary the distance from the lamp by bending the leads. Mount power switch S1 on the end opposite to that holding the jacks and also drill a hole in this end for the power cord.

Potentiometers R2 and R7, as well as switch S2, are mounted on the base (which thereby converts it to be the front panel) of the plastic box, conveniently grouped nearer the end of the box holding the jacks. Power transformer T1 is mounted on the base of the plastic box as far as possible away from the input jacks, as are tie strips for holding rectifier diode D1, R9, C4, and power cord.

Preliminary check. Before tightening down the perfboard you will want to check out the flashing rate of exciter lamp I1. As stated earlier, the upper and lower limits of speed of oscillation (frequency) of the relaxation oscillator can be changed by varying the value of R1 for high rate, and R6



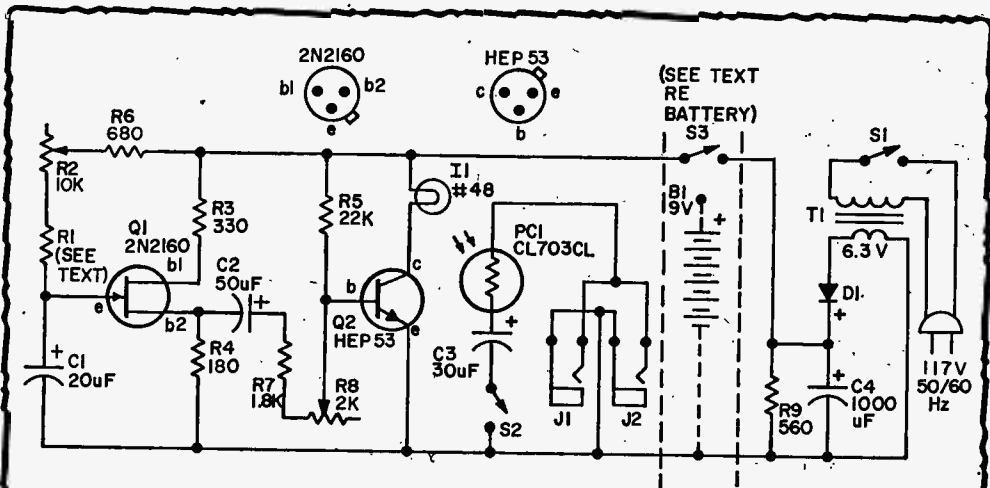
for low rate. As a preliminary adjustment, start initially with a 2700-ohm resistance value for R1 and substitute both higher and lower values until you have a maximum speed to meet your requirements. Of course, potentiometer R2 is set for maximum speed before making any substitutions. One you've adjusted the pulse rate to your satisfaction, fasten down the perfboard and you are ready to try your hand at tremolo-ing.

Let's Use It. The *Tremolo* is very easy to use. Just plug your guitar, or other musical instrument, pickup into J1, and plug into J2 the input to your amplifier. Connect the UJT Tremolo to the power line and turn on power switch S1. Initially set both controls to midpoint. Make certain that push

switch S2 is turned on by observing that lamp I1 is flashing. You adjust the rate of flash by rotating the left hand knob (R2) and the intensity by rotating the right hand knob (R5).

You may want to calibrate the pulse rate knob. This can be done easily by counting the number of pulses in a given time period (e.g., one minute) and marking the position of the knob on the face of the plastic case. You can use transfer letters (Datak or equiv.) to indicate calibration count.

If you want certain passages to be amplified without tremolo, just push switch S2 to the off position. When you give it a second push the Unijunction Tremolo is back in business again. ■



PARTS LIST FOR UNIJUNCTION TREMOLO

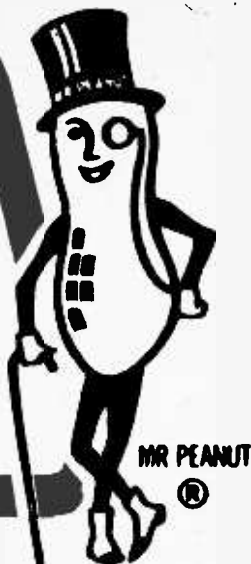
- C1—20- μ F, 15-VDC electrolytic capacitor (Lafayette 34E85489 or equiv.)
- C2—50- μ F, 15-VDC electrolytic capacitor (Lafayette 34E85521 or equiv.)
- C3—30- μ F, 15-VDC electrolytic capacitor (Lafayette 34E85505 or equiv.)
- C4—1000- μ F, 15-VDC electrolytic capacitor (Lafayette 34E55177 or equiv.)
- D1—50-PIV, 750-mA silicon rectifier (Lafayette 19E50070 or equiv.)
- I1—#48 pilot lamp, 2-V, 0.06-A (Lafayette 32E66202 or equiv.)
- J1, J2—Open circuit phone jack (Lafayette 99E62135 or equiv.)
- PC1—Photoelectric cell, Clairex CL703L (note: do not use any other type or number as circuit is designed around resistance of this cell)
- R1—2700-, 3900-, or 4700-ohm, $\frac{1}{2}$ -watt resistor (see text regarding choice of values)
- R2—10,000-ohm, linear potentiometer (Lafayette 33E11255 or equiv.)
- R3—330-ohm, $\frac{1}{2}$ -watt resistor
- R4—180-ohm, $\frac{1}{2}$ -watt resistor

- R5—3300-ohm, $\frac{1}{2}$ -watt resistor
- R6—680-ohm, $\frac{1}{2}$ -watt resistor
- R7—1800-ohm, $\frac{1}{2}$ -watt resistor
- R8—2000-ohm, linear potentiometer (Lafayette 33E11172 or equiv.)
- R9—560-ohm, $\frac{1}{2}$ -watt resistor
- S1—Spst toggle switch (Lafayette 34E33026 or equiv.)
- S2—Spst push-for-on, push-for-off switch (as in table lamps, available from hardware store)
- T1—Power transformer: 117-V, 50-60-Hz pri.; 6.3-V, 0.6-A sec. (Lafayette 33E80490 or equiv.)
- 1—Pilot lamp socket, miniature screw base with mounting bracket (Lafayette 32E28038 or equiv.)
- 1— $6\frac{1}{4} \times 3\frac{3}{4} \times 2$ -in. plastic instrument case with blank cover (Lafayette 19E20016 case, 19E37010 blank panel or equiv.)
- 1—Power cord and plug

Misc.—Perfboard, push pins or flea clips, wire, solder, tie strips, screws, nuts, $\frac{1}{4}$ -in. spacers, etc.

NutZee

A taste treat
for your ears!



by Capt. James E. Lockridge

Now you can install speakers everywhere in your home for less than a buck each—providing that you can be talked into eating a certain brand of peanuts. NutZee, our super-cheap speaker, goes together in 10 to 15 minutes and provides outstanding fidelity and volume considering its size and cost. NutZees can be hooked into your stereo system or used as simple auxiliary speakers for your personal radio or transistor portable. The author happily uses his with a Roberts 770X tape recorder and also with a table radio.

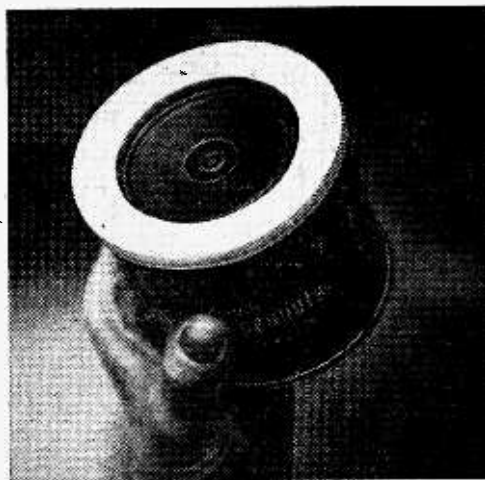
What It Is. Heart of our NutZee is a 2½-in. dia. transistor radio replacement speaker. This is cleverly mounted inside a Planters peanut can, serving the dual role of an effective baffle and enclosure for the speaker. The entire assembly is fitted with a subminiature phone jack; NutZee goes anywhere in your home. And finally, it needs only a length of zip cord to your music system before you lean back and enjoy it.

How to Make It. First step is to solder a 10-in. length of zip cord to the speaker lugs. Then, place the speaker face down on the middle of the plastic cover top (supplied with every can of Planters) and trace the circumference of the speaker on the plastic with a ballpoint pen. Next, remove the speaker and carefully draw another circle ⅛-in. smaller inside the first one.

Using the point of a pair of scissors, punch a hole in the center of the plastic. Carefully cut your way to the inner circle;

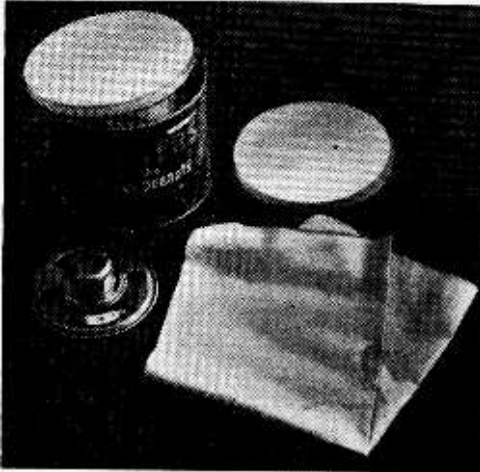
cut it out, and what you're left with is a ⅛-in. lip for mounting the speaker. Use a good brand of epoxy cement—the kind where you have to mix tubes A and B—and cement the speaker to the plastic top. Put the plastic top-speaker assembly aside to dry. While the epoxy compound is curing is a good time to mount the jack in the can.

(The plastic-top/speaker assembly will later be snapped into place on the peanut can so make sure that in mounting the speaker to the plastic you join them on the correct side. This is the one where the out-



Here's NutZee before finishing touches are applied. For effect, try painting plastic top matte black. Your friends will search high-and-low trying to find camouflaged NutZee!

NutZee

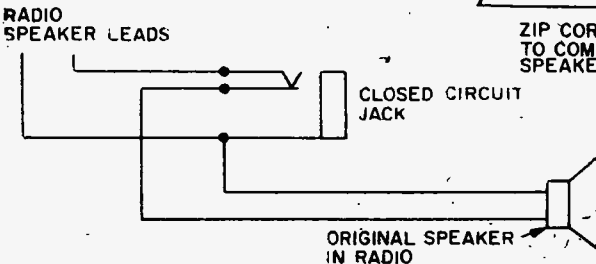


NutZee's major ingredients. Cloth covers speaker/plastic top assembly on author's NutZee; this pretties up NutZee and protects speaker cone from dust and prying fingers.

side flange of the plastic is facing towards the speaker.)

Drill a clearance hole $\frac{1}{2}$ -in. from the can bottom. Next, deburr the edge of the hole with a round file so the jack will mount cleanly. After the jack has been installed, you're ready to solder the speaker leads to it. Snap the plastic-top/speaker assembly into place and you're all set to finish NutZee.

NutZee can either be spray painted or covered with vinyl contact paper. Whichever you use, there are many colors and patterns to choose from to suit the decor of your home.



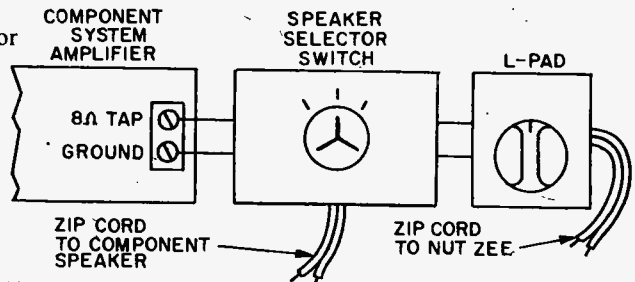
PARTS LIST FOR NUTZEE

- 1—2½-in. dia., 8-ohm loudspeaker (Lafayette 99E60386 or equiv.)
- 1—6¾-oz. size Planters peanuts can with plastic snap top
- 1—Subminiature open circuit phone jack (Lafayette 99E62119 or equiv.)
- 1—Subminiature phone plug (Lafayette 99E62101 as required, or equiv.)
- 1—8-ohm L-pad (Lafayette 99T6134 or equiv.)
- 1—Remote speaker switch (see text)
- Misc.—Zip cord, paint or vinyl, epoxy, solder, etc.

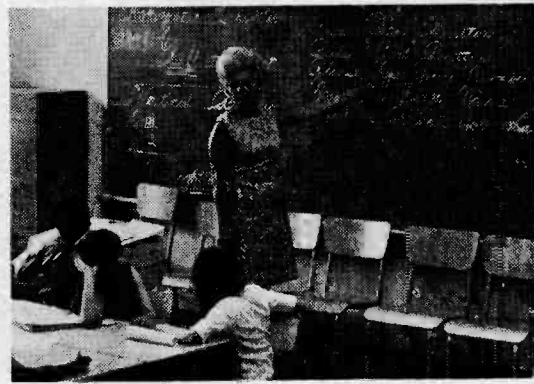
Broadening Your Music. You'll want to use your NutZees as auxiliary speakers for your table radios, or your stereo system. But first a word of caution. Do *not* use your NutZees with an AC/DC radio; a shock hazard may be present and could prove lethal. Some stereo systems have a couple of jacks marked *aux. speakers*. These jacks, when used with mating phone connectors, will disconnect the manufacturer's speakers from the set and give you the freedom to connect other external speakers.

After you've found a good place to put NutZee, solder the appropriate phone plugs to suitable lengths of zip cord. Make sure that the power is *off* when plugging or unplugging any speaker, since the transients caused may damage the output tubes or transistors in the set.

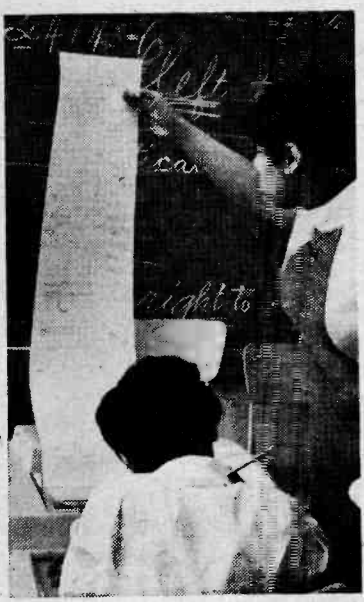
To use your NutZees with a personal radio (*not* an AC/DC set) or a portable, follow the same procedure and again make sure that the radio is turned off when NutZee is plugged in or out. If your radio has no jack for an external or auxiliary speaker connection, then you'll have to wire
(Continued on page 102)



Two ways to hook up NutZee. Above, those with component systems need two-way speaker selector switch and L-pad. Left, playing personal radio requires closed-circuit jack. Wire as shown.



COMPUTERS VS. TEACHERS



Originally intended as another tool to aid the teacher, the computer now threatens to replace him as well. Item: over 3000 pupils now find themselves mug-to-readout panel with a computer in New York City's elementary schools. Called Computer Assisted Instruction (CAI), the system brings modern technology to the aid of the teacher. It consists of 192 student terminals (i.e., teletype machines) connected by special lines to an RCA Spectra 70/45 computer located in midtown

COMPUTERS vs. TEACHERS



Manhattan. Currently programmed only for teaching arithmetic, the computer sends out drill problems, judges the pupils' answers, and records their scores, all in a split second. In essence the computer is the brains—teacher, if you will—of the system.

According to the Central Computer Facility, installers of the CAI machines, they are designed "to ask the student a question hard enough to make him work, but not too hard for him to answer, and based on the student's previous performance. The computer selects the appropriate level of difficulty for each student and guides him on an individual path of learning. Each student receives daily lessons geared to his own progress and learning ability."

Way in which a student takes a lesson is described by the company, "When a student's turn comes to run the system he goes to a convenient terminal and pecks out a number and his first name on the terminal keyboard. The system then identifies the student and confirms it by typing out his family name. In a split second the computer checks its memory stores, determines from the student's previous performance what

lesson he is to study, and begins the day's lesson. As the student answers the problems or questions given him, the system helps him correct his errors, giving him a second chance, and ends the lesson by telling him how well he did. Each lesson lasts for 8 to 12 minutes and the student tears off the graded lesson, or printout, to keep."

How do the pupils take to this new teacher? Some flip over it like flipping were going out of style, others remain stolidly unmoved. According to Cornelius Butler, director of the CAI program, "It's silly to think that there's any sort of alienation between pupil and machine. The kids know they are working with a machine and they're enthusiastic about it. One reason is that they seem to know intuitively that this is a fair system, that there is no possibility of partiality or favoritism."

He concludes by saying that "In 25 years every urban community will have at least one computer project where kids can have access to files of information on any subject, and will use satellites to convey this information. But no matter how far we go, we'll always need teachers." ■



WHITE'S RADIO LOG

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

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WHITE'S RADIO LOG

U. S. AM Stations by Location

Listing indicates stations on the air up to February 14, 1970

Location	C.L.	kHHz	Location	C.L.	kHHz	Location	C.L.	kHHz
Abbeville, Ala.	WARI	1480	Ambridge, Pa.	KRAY	1360	Bath, Maine	WJTD	730
Abbeville, La.	KROF	960	Americus, Ga.	WMBM	1660	Bath, N.Y.	WFSR	1580
Abbeville, S.C.	WABY	1590		WDEC	1290	Baton Rouge, La.	WAIL	1260
Aberdeen, Md.	WAMD	970		WISK	1390		WLUX	1550
Aberdeen, Miss.	WMPA	1240	Ames, Iowa	KASI	1430		WYNK	1380
Abreezen, S. Dak.	KSDN	950		WQTI	640		WYNR	1300
	KABR	1420	Amherst, Mass.	WTTT	1430		WJBO	1150
	KXRD	1320	Amherst, N.S.	CKDN	1400		WLCS	910
	KXRO	1450	Amherst, N.Y.	WUFO	1080		WXOK	1460
	KBKW	1350	Amite, La.	WABL	1570		WBCK	930
	KXRD	1420	Amory, Miss.	WAMY	1580		WKFR	1400
	KXRO	1470	Amsterdam, N.Y.	WKOL	1570		WYOV	1500
	KRBC	1320	Anaconda, Mont.	WCSS	1490		WUFE	1260
	KCAD	1560	Anacortes, Wash.	WVPC	1550	Baxley, Ga.	WUFE	1260
	KNIT	1280	Anaheim, Calif.	WVPC	1550	Bayard, N.M.	KNFT	950
	KWKC	1340	Anchorage, Alaska	KBFR	1270	Bay City, Mich.	WBGM	1440
	KABI	250		KFQD	750	Bay City, Tex.	WXOC	1260
Abingdon, Va.	WBBI	1230		KENI	550	Bay Minette, Ala.	WBGA	1110
Ada, Okla.	KADA	1230	Ann Arbor, Mich.	KAR	580	Bayonne, N.J.	WLUC	1600
Adel, Ga.	WBIT	1470		KYAK	650		WRSJ	1560
Adrian, Mich.	WAWY	1490	Andalusia, Ala.	WCIA	920	Baytown, Tex.	KWBA	1360
Agana, Guam	KNAH	810		WAAO	1530	Beacon, N.Y.	WBNS	1260
Aguaadita, P.R.	WABA	850	Anderson, Cal.	WVPC	1550	Beaumont, Ill.	WDBS	790
	WGRF	1340	Anderson, Ind.	WHIT	1470	Beaumont, N.C.	WBMA	1400
Ahoskie, N.C.	WRCS	970		WHU	1240	Beaufort, S.C.	WBUE	960
Aiken, S.C.	WAKN	990	Anderson, S.C.	WAIM	1230		WSIB	1480
	WRSM	1390	Andrews, Tex.	WANS	1280		KLVI	560
Ainsworth, Neb.	KRRB	1040	Annapolis, Md.	KACT	1190		KVW	1450
Aitkin, Minn.	KKIN	930		WANN	910		KJKT	1380
Akron, Ohio	WAKR	1590		WYRE	810	Beaver Dam, Wis.	WBVE	1430
	WSLR	1350		WNAE	100	Beaver Falls, Pa.	WBVP	1230
	WCUE	1150		WNAE	100	Beckley, W. Va.	WJLS	560
	WLM	840	Anna, Ill.	WRAJ	1050		WCIR	900
Alamogordo, N.M.	KALG	1230	Annisston, Ala.	WARA	1490		WVNR	820
	KINN	1270		WNS	1450		WBFB	1340
Alamo Heights, Tex.			Annville-Cleona, Pa.	WHMA	1390	Bedford, Ind.	WBFW	1430
Alamosa Colo.	KDRY	1110		WAHT	1510	Bedford, Pa.	WBFD	1310
Albany, Ga.	KGIT	1450	Anoka, Minn.	KAND	1479	Bedford, N.Y.	WBFL	1350
	WLGJ	1590	Ansania, Conn.	WADS	990	Bellefonte, Pa.	KJBL	1490
	WJAZ	960	Antigo, Wis.	WATK	900	Bel Air, Md.	WJSD	1530
	WLYB	1250	Apollo, Pa.	WAVL	910	Belen, N. Mex.	KARNS	860
	WGPC	1450	Apopka, Fla.	WTLN	1520	Belfast, Me.	WBNE	1230
	WJAZ	960	Apple Valley, Cal.	KAVR	960	Belgrade, Mont.	KGVW	1390
Albany, Ky.	WYBY	1390	Appleton, Wis.	WAPL	1579	Belleville, Ohio	WOMP	1260
Albany, Minn.	KASM	1510		WHBY	1230	Bellevue, Wash.	KWOT	1390
Albany, N.Y.	WABY	1400		WUNA	1340	Bellefonte, Pa.	WBFL	970
	WOKO	1460	Aquadilla, P. R.	WRAB	1380	Bell Fourche, S. Dak.	KBFS	1450
	WPRF	1540	Arab, Ala.	WRAB	1380	Belle Glade, Fla.	WSWN	900
	WRSM	990	Arcadia, Fla.	WAPG	1340	Belleville, Ont.	CBJQ	900
	KRKT	900	Areata, Calif.	KENL	1480	Bellevue, Ill.	WBVB	1260
	WABZ	1010		KATA	1340	Bellevue, Wash.	KPUG	1700
	WZKY	1580	Ardmore, Okla.	KATA	1340	Bellingham, Wash.	KGMI	790
Albert Lea, Minn.	KATE	1450		KVSD	1240		KBQT	1550
Albertville, Ala.	WAVU	630	Ardmore, Okla.	KVSD	1240		KBFW	930
Albiton, Mich.	WLM	1260	Ardmore Tenn.	WVSL	1110	Belmont, N.C.	WCCE	1279
Albuquerque, N.M.	KABQ	1350	Arcibo, P.R.	WCMN	1280	Beloit, Wis.	WGEZ	1490
	KDEF	1150		WMTA	1070	Belton, S.C.	WHPB	380
	KGGM	610	Argentina, Nnd.	WVSI	1230	Belton, Tex.	KTON	940
	KHIP	1520	Arkadelphia, Ark.	YOUS	1480	Belzoni, Miss.	WELZ	1460
	KQB	770	Arkan. City, Kans.	KVRC	1240	Bentley, Minn.	KBUN	1450
	KPAR	1190	Arlington, Fla.	WDCJ	1220	Bend, Ore.	KRND	1110
	KQEO	920		WEAM	1390		KERL	800
	KRZY	1450	Arroyo Grande, Calif.	KOAG	1280	Bennetsville, S.C.	WBSC	1550
	KDAZ	730		KQAG	1280	Bennington, Vt.	WBTN	1370
	KZIA	1580	Artesia, N.M.	KSVP	990	Benson, Minn.	KBMO	1290
	KRZY	1450		KQXI	1550	Benson, N.C.	WBFB	1130
Alcoa, Tenn.	WEAG	1470		WNES	1370	Benton, Ark.	KBB	990
Alexander City, Ala.			Artesia, N.M.	KSVP	990		KGKO	850
	KRZY	1450		KQXI	1550	Benton, Ky.	WCBT	1290
	WRFS	1050	Ashburn, Ga.	WJLK	1310	Benton Harbor-St. Joseph, Mich.	WHFB	1060
	KALB	580	Asbury Park, N.J.	WJLK	1310	Berkeley, Calif.	KPAT	1400
	KDVS	1410	Asbury Park-Eatontown, N. J.	WHTG	1410	Berkeley Springs, W. Va.	WCST	1010
	KSYL	970	Asheboro, N.C.	WJSE	1310		WMOU	1230
	KXRA	1490	Asheville, N.C.	WWSK	1230	Berlin, N.H.	WBRL	1400
Alexandria, Minn.	KPIK	790		WVWC	570	Berlin Wis.	WISS	1090
Alexandria Va.	KLGA	1600	Ashland, Ky.	WCMI	1340	Berry Hill, Tenn.	WVOT	1470
Algonu, Iowa	KOPY	1070		WTCR	1420	Berryville, Ark.	KTSS	1480
Alia, Tex.	KPVS	1570	Ashland, Ohio	WVNO	1340	Berwick, Pa.	WBRM	1280
Alisal, Cal.	WHOG	1460	Ashland, Ore.	KVRC	1350	Bessemer, Ala.	WYAM	1450
Altendale, S.C.	WDDG	1600		WIVE	1430	Bethesda, Md.	WGM5	570
Altontown, Pa.	WAEB	790	Ashland, Va.	WVIV	1430	Bethlehem, Pa.	WUST	1120
	WKAP	1320	Ashland, Wis.	WATW	1400	Beverly, Mass.	WMLO	1570
	WSAN	1470	Ashtabula, Ohio	WAGI	1600	Biddeford, Maine	WIDE	1400
	KDOW	1400		WREO	970	Big Bear Lake, Cal.		
Alliance, Neb.	KFAH	1310	Aspen, Colo.	KSNO	1600	Big Delta, Alaska	KTOT	1050
Alliance, Ohio	WULF	1400	Astoria, Ore.	KAST	1370	Big Lake, Tex.	KWLB	1290
Alma, Ga.	WULF	1400		KVAS	1230	Big Rapids, Mich.	WBRN	1460
Alma, Mich.	WFYC	1280	Atchinson, Kans.	KARE	1470	Big Spru., Tex.	KBST	490
Alpena Township, Mich.			Athens, Ala.	WKAC	1080		KHEM	1270
	WATZ	1450	Athens, Ga.	WGAL	1340		KBYG	1490
	KVLF	1240		WDOL	1470	Big Stone Gap, Va.	WLTX	1220
	WKDE	1400		WDOL	1470	Bifoxi, Miss.	WLOX	1490
	WOKZ	1570		WRFC	960		WYMI	570
	CFAM	1290	Athens, Ohio	KDGI	960	Billing, Mont.	KEMV	1240
	WFBG	1290		WQTI	970		KGHL	790
	WRTA	1240		WVUB	1340		KOOK	970
	WVAM	1450	Athens, Tenn.	WVLR	1450		KR 910	
Alturas, Calif.	KCNO	570		WYXI	1390		KURL	730
Altus, Okla.	KWHW	1450	Athens, Tex.	KBUD	1410	Binghamton, N.Y.	WVNR	680
Alva, Okla.	KALV	1430	Atlanta, Ga.	WPLD	1340		WKOP	1360
Amarillo, Tex.	KDJW	1010		WIGO	1340		WNBF	1290
	KPUR	1440						
	KGON	719						
	KIXZ	940						

WHITE'S RADIO LOG

Location	C.L.	kHz
Cochran, Ga.	WVMG	1440
Cocoa, Fla.	WKCC	860
	WEZY	1510
	WBRK	1300
Cocoa Beach, Fla.	KODJ	1400
Cody, Wyo.	KVNI	1240
Coeur d'Alene, Ida.	KVNI	1400
Coffeyville, Kans.	KGGF	690
Colby, Kans.	KXGX	790
Coldwater, Mich.	WTWB	1590
Coleman, Tex.	KSTA	1000
Colfax, Wash.	KCLX	1450
College Park, Ga.	WSSA	1570
College Station, Tex.	WTAW	1150
Collingsville, Tenn.	WPFB	1590
Collinsville, Va.	WFLC	1530
Colonial Heights, Va.	WPVA	1290
Colorado City, Tex.	KVMC	1320
Colo. Sprngs., Colo.	KPKK	580
	KVOR	1300
	KSSB	740
	KYSN	1480
	KRST	1930
	KRDQ	1240
Columbia, Ky.	WAIN	1270
Columbia, La.	KCTO	1540
Columbia, Miss.	WCJU	1450
	WFFF	1360
	KFRU	1400
	KTRG	1580
Columbia, Pa.	WVTV	1580
Columbia, S.C.	WCOS	1400
	WIS	560
	WOIC	1320
	WNOK	1230
	WXKL	1470
	WVVA	1280
Columbia, Tenn.	WKRM	1340
	WDAK	540
	WRBL	1420
	WHYB	1270
	WCL	1580
	WKKS	340
	WPNX	1460
Columbus, Ind.	WCST	1010
Columbus, Miss.	WACR	1050
	WCBI	550
	KJSK	1510
Columbus, Nebr.	WBNS	1460
	WCOL	1230
	WMNI	920
	WOSU	820
	WTVN	610
	WVVK	1580
Colville, Wash.	KCVL	1270
Comanche, Tex.	KCOM	1550
Commerce, Ga.	WJJC	1270
Comond, Calif.	KWUN	1480
Concord, N.H.	WKX	1450
Concord, N.C.	WEGO	1410
Concordia, Kans.	KNCK	1390
Conneaut, Ohio	WVOW	1360
Connessville, Pa.	WCVI	1340
Connersville, Ind.	WCNS	1580
Conroe, Tex.	KMCO	900
Conway, Ark.	KCON	1230
	KVEE	1330
Conway, N.H.	WBNC	1050
Conway, S.C.	WLAT	1330
Cookeville, Tenn.	WVBF	1400
	WPTN	1550
Coolidge, Ariz.	KCKY	1150
Coos Bay, Ore.	KODS	1230
	KYNG	1420
Copper Hill, Tenn.	WLSB	1400
Couville, Ore.	WZB	630
Coral Gables, Fla.	WRIZ	1550
	WVCC	1080
Corbin, Ky.	WCTT	680
	WYGO	1330
Cordova, Alaska	WMLN	1450
Corinth, Miss.	WCMA	1230
	WKCU	1350
	WCAN	1450
Cornelia, Ga.	WCON	1450
Corning, Ark.	KCCB	1260
Corning, N.Y.	WCBA	1350
	WCJJ	1450
Corning, N.Y.	WVLE	1170
Corona, Cal.	KREL	1370
Corpus Christi, Tex.	KCTA	1030
	KCCT	1150
	KEYS	1440
	KRYS	1360
	KXIK	1230
	KUNO	1400
Corry, Pa.	WOTR	1370

Location	C.L.	kHz
Corsicana, Tex.	KAND	1340
Cortez, Colo.	KVFC	740
Cortland, N.Y.	WKRT	920
Corvallis, Ore.	KLOO	1340
	KFLY	1240
	KOAA	550
Corydon, Ind.	WPDF	1550
Cashcocton, Ohio	WTNS	1560
Cottage Grove, Ore.	KNND	1400
Cottonwood, Ariz.	KVRD	1240
	KVIO	1600
	WFRM	600
Coudersport, Pa.	KRCB	1560
Council Bluffs, Iowa	KRCB	1560
Courtenay, B.C.	KCFP	1440
Covington, Ga.	WGFS	1430
Covington, Ky.	WCLU	1320
Covington, La.	WABR	730
Covington, Tenn.	WKBL	1250
Covington, Va.	WKEY	1340
Cowan, Tenn.	WZYX	1440
Cozad, Neb.	KAMI	1580
Craig, Colo.	KRAI	550
Crane, Tex.	KRRR	1390
	KBSN	970
Crawfordsville, Ind.	WCVL	1550
Crescent City, Calif.	KPLY	1240
	KPOD	1310
Creston, Iowa	KSIB	1520
Crestview, Fla.	WCNU	1010
	WJSB	1050
	WWSV	800
	KIVY	1290
Crockett, Tex.	KROK	1260
Crookston, Minn.	KRAH	800
Croft, Ark.	WAEW	1330
Crossville, Tenn.	WCSY	1520
	KSIG	1450
	WPED	810
Croyzet, Va.	WVNS	650
Crystal Lake, Ill.	KCFH	1600
Cuba, Tex.	WFMH	1460
Culman, Ala.	WKUL	1340
	WCVA	1490
Culpeper, Va.	WCPC	1280
Cumberland, Ky.	WCUM	1230
Cumberland, Md.	WUOG	1270
	WBGU	1450
	WSNE	1410
	KUSH	1660
Cummings, Ga.	WSNE	1410
Cushing, Okla.	KUSH	1660
Cuyahoga Falls, Ohio	WCUE	1150
Cypress Gardens, Fla.	WGTO	540
	WQYN	1400
Cynthiana, Ky.	WDCF	1350
Dade City, Fla.	WDVC	1350
Dadeville, Ala.	WDFC	910
Daisierfield, Tex.	KJSM	1560
Dalhart, Tex.	KXIT	1410
Dallas, N.C.	WAAK	960
Dallas, Ore.	KROW	1460
Dallas, Tex.	KRLD	1080
	KIXL	1040
	KSKY	960
	KLIF	1190
	WFAA	570
	WFAA	820
	KBOK	1480
	WRR	1510
	WBEL	1230
	WRCD	1480
	WTTI	1530
	WLAD	800
Danbury, Conn.	WLAN	1580
Danville, Ill.	WDAN	1490
	WTHR	1230
Danville, Ky.	WPGM	1570
Danville, Pa.	WBTD	1330
Danville, Va.	WYPR	970
	WDVA	1250
	WLA	1580
Dardanelle, Ark.	KCAB	980
Darlington, S.C.	WDAB	1350
Davenport, Iowa	WOC	1420
	KWNT	1580
	KSTT	1170
Dawson, Ga.	WDWJ	980
Dayton, Ohio	WHIO	1290
	WING	1410
	WONE	980
	WAVI	1210
	WNBT	1280
Dayton, Tenn.	WDNB	1150
Daytona Beach, Fla.	WVNF	1450
	WBOD	1340
	KDSJ	980
Deadwood, S.Dak.	WKNR	1310
Dearborn, Mich.	WHOS	800
Deatur, Ala.	WAJF	1490
	WMSL	1400
Deatur-Atlanta, Ga.	KGUN	1010
	WOMR	1310
	WDZ	1050
	WSOY	1340
Deatur, Ill.	WADM	1540
Deatur, Ind.	KWLC	1240
Deer Lodge, Mont.	KORG	1400
Deerfield, Va.	WABR	1510
Deference, Ohio	WONW	1280
De Funiak Springs, Fla.	WGTX	1280

Location	C.L.	kHz
De Kalb, Ill.	WZEP	1460
De Land, Fla.	WLBK	1360
	WIBS	1490
	W000	1310
Delano, Calif.	KCHJ	1010
Delaware, Ohio	WDE	1550
Delray Bch., Fla.	WBL	1400
Del Rio, Tex.	KDLK	1230
	KWDR	810
	KWMC	1490
Delta, Colo.	KDTA	1430
Deming, N.M.	KD0T	1200
Demopolis, Ala.	WKAL	1400
Denham Springs, La.	WLSI	1220
Denison, La.	KDSN	1530
Denison-Sherman, Tex.	KDSX	950
Denmark-Bamberg, S.C.	WVWB	790
Denton, Tex.	KDNT	1440
Denver, Colo.	KDEN	1340
	KFML	1390
	KHOW	630
	KIMN	950
	KLIF	990
	WKLZ	560
	KBTR	710
	KOA	850
	KPOF	910
	KFSK	1220
	KTKL	1260
Denver City, Tex.	KKAL	1590
De Queen, Ark.	KDQN	1390
De Ridder, La.	KDLA	1010
DeSoto, Mo.	KHAD	1190
Des Moines, Iowa	KCBC	1380
	KMOS	940
	KRNT	1350
	KSO	1460
	KWKY	1050
	WHD	1040
	WVNS	1180
	WDEE	1500
	WJLB	1400
	WJR	760
	WVJ	950
	WVYZ	1270
Detroit, Mich.	WDFW	1400
	WDEE	1500
	WJLB	1400
Detroit Lakes, Minn.	KDLM	1340
Devils Lake, N.Dak.	KDLR	1240
DeWitt, Ark.	KDEW	1470
Dexter, Mo.	KDEK	1590
Diboll, Tex.	KTKT	1260
Dickinson, N.Dak.	KDIX	1230
Dickson, Tenn.	WDKN	1260
Dillon, Mont.	KDBM	890
Dillon, S.C.	WDSC	800
Dimit, Tex.	KDNN	1470
Dimuba, Calif.	WJX	1340
Dixon, Ill.	WJHN	1460
Dodge City, Kans.	KGNO	1370
	KEDD	1550
Dodgeville, Wis.	WDMP	810
Doylesville, Ga.	WDM	1500
Donaldsonville, La.	WDL	890
Donaldsonville, La.	WSLG	1090
Donelson, Tenn.	WAMS	1190
Doniphan, Mo.	KDFN	1500
Dothan, Ala.	WAGF	1320
	WDAI	1460
	WOCF	580
Douglas, Ariz.	KAUT	1450
	KAPR	930
Douglas, Ga.	WDMG	860
	WOKA	1310
Douglas, Wyo.	KDAL	1470
Douglasville, Ga.	WDGL	1520
Dover, Del.	WDOV	1410
	WKEN	1590
Dover-Foxcroft, Me.	WDME	1340
Dover, N.H.	WTSN	1270
Dover, N.J.	WRAN	1510
Dover-New Philadelphia, O.	WJER	1450
Dowagiac, Mich.	WDWG	1440
Duncan, Pa.	WDR	1570
Dublin, Ga.	WDLT	330
	WLTJ	1230
Du Bona, Pa.	KDCE	1420
Dubuque, Iowa	WDBQ	1470
	WDBQ	560
	WBCB	690
	KAOH	890
Dumas, Ark.	KDDA	580
Dumas, Tex.	KDDD	800
Dunedin, Fla.	KRHD	1350
Dunedin, Fla.	WCHS	1490
Dundee, N.Y.	WFLR	1570
Dunkirk, N.Y.	WDOE	1470
Dunn, N.C.	WCCK	780
Du Quoin, Ill.	WDQN	580
Durand, Wis.	WRPN	1430
Durango, Colo.	KIPU	830
	KDGO	1240
Durant, Okla.	KSFO	750
Durham, N.C.	WDNC	620
	WSRC	1410
	WABR	1490
	WTKI	1310
Dyersburg, Tenn.	WDGO	1450
	WTR0	1330

Location	C.L.	kHz
Eagle Pass, Tex.	KEPS	1270
Eagle River, Wis.	WERL	950
Easley, S.C.	WELP	1360
E. Grand Forks, Minn.	KRAD	1590
	KECC	1590
Eastland, Tex.	WKAR	970
E. Lansing, Mich.	WTHJ	730
E. Liverpool, Ohio	WOHI	1490
East Longmeadow, Mass.	WTYM	1600
Eastman, Ga.	WUFF	710
E. W. Malone, Ill.	WDM	580
E. Point, Ga.	WJH	1250
East Prairie, Mo.	KYMO	1080
E. Syracuse, N.Y.	WPWA	1540
Easton, Md.	WEMO	1460
Easton, Pa.	WEEX	1230
	WEST	1050
Eastontown, Ga.	WPKP	1520
Eastontown, N.J.	WHTG	1410
Eau Claire, Wis.	WEAQ	790
	WBIZ	1400
	WOKL	1050
	WMEG	1520
	WEND	880
Ebensburg, Pa.	WCDJ	1260
Edenton, N.C.	KURV	710
Edinburg, Tex.	KGDN	630
Edmond, Wash.	KWYB	1130
E. Eden, Tex.	WCRA	1400
Emmham, Ill.	WELB	1350
Elba, Ala.	WSSG	1400
Elberton, Ga.	KOED	810
El Cajon, Calif.	KULP	1390
El Campo, Tex.	WTD	1470
El Centro, Calif.	KAMP	1330
El Dorado, Ark.	KDMS	1290
	KELD	1400
Eldorado, Kans.	KBTO	1390
Eldorado Springs, Mo.	WESM	1580
Eleele, Kana'i, Hawaii	KUAI	720
Elgin, Ill.	WRMN	1410
Elizabeth, N.J.	WELA	1530
Elizabeth City, N. C.	WCNC	1240
	WGAI	580
Elizabethton, Tenn.	WBEJ	1240
	WIDD	1520
Elizabethtown, Ky.	WIEL	1400
Elizabethtown, N.C.	WBIA	1440
Elizabethtown, Pa.	WEPN	1600
Eik City, Okla.	KBEK	1240
	WCMR	1270
Elkins, N.C.	WIFM	1540
Elkins, W.Va.	WELA	1240
Elko, Nev.	WELK	1240
Elkton, Md.	WSEB	1550
Ellensburg, Wash.	KXLE	1240
Ellenville, N.Y.	WELV	1350
Ellsworth, Me.	WDEA	1370
Elmira, N.Y.	WENY	1230
Elmira Heights-Horseheads, N.Y.	WEHJ	1690
El Paso, Tex.	KROD	600
	KEI	820
	KHEY	690
	KINT	1590
	KIZZ	1150
	KSET	1340
	KTSM	1390
	KMB	1460
El Reno, Okla.	WELV	1450
Ely, Minn.	KELY	1230
Ely, Nev.	WEOJ	930
Elyria, Ohio	WSTL	1600
Empire, Ky.	KVEE	1400
Emporia, Kans.	WEVA	860
Emporium, Pa.	WLEM	1250
Endicott, N.Y.	WENE	1440
Englewood, Colo.	KGMC	1150
Englewood, Fla.	WENG	1530
Englewood, Tenn.	KELF	730
Enid, Okla.	KCRG	1390
	KGWA	960
Enterprise, Ala.	WIRB	600
Enterprise, Ore.	KWVR	1340
Ephrata, Pa.	WGBA	1310
Ephrata, Wash.	KLF	730
Erie, Pa.	WVYN	1260
	WIET	1400
	WRIE	1330
	WWGO	1450
	KWVA	1470
Erwin, Tenn.	WDBC	580
Escanaba, Mich.	WLST	600
Escondido, Calif.	KOWN	1450
Espanola, N. M.	KDCE	970
Estes Park, Colo.	KKEP	1470
Esterville, Ia.	KIUP	830
Etowah, Tenn.	WCPN	1220
Eufaula, Ala.	WULA	1240
Eugene, Ore.	KEED	1450
	KASH	1800
	KATR	1320
	KFRG	1220
	KPNW	1120

Location	C.L. kHz	Location	C.L. kHz	Location	C.L. kHz	Location	C.L. kHz
Eunice, La.	KUGN 590	Ft. Madison, Iowa	WSRF 1580	Gardiner, Me.	WABK 1280	Greenville, Ala.	WGYV 1380
Eureka, Calif.	KZEL 1540	Ft. Morgan, Colo.	WAVS 1190	Gardner, Mass.	WGAW 1340	Greenville, Mich.	WPLB 1380
Eustis, Fla.	KEUN 1490	Ft. Myers, Fla.	KXGI 1360	Garner, N.C.	WKBQ 1000	Greenville, Miss.	WJPR 1330
Evanson, Ill.	KINS 980	Ft. Myran, Colo.	KFTM 4000	Gary, Ind.	WWCA 1270		WBT 800
Evanson, Wyo.	KRED 1480		WINK 1240		WHL 1370	Greenville, N.C.	WGVW 1260
Evansville, Ind.	WLCO 1240		WMYR 400	Gastonia, N.C.	WAGS 1450		WNCT 1070
Everett, Pa.	WAW 1330		WCAL 350	Gate City, Va.	WLTC 1370		WPOY 1340
Everett, Wash.	WNMP 1590	Ft. Payne, Ala.	WFOA 1400	Gaylord, Mich.	WGAT 1050	Greenville, Pa.	WDDY 1550
Excelsior Springs, Mo.	KEVA 1240	Ft. Pierce, Fla.	WZOB 1250	Geneese, Ill.	WATC 900	Greenville, S.C.	WESP 940
Exeter, N.H.	WRZO 1400		WIRA 400	Geneva, Ala.	WGEN 1500		WGR 1330
Fairbanks, Alaska	WGBF 1280	Ft. Scott, Kans.	KMDO 600	Geneva, Ill.	WGSB 1480		WHYC 1070
Fairbault, Minn.	WIKY 820	Ft. Smith, Ark.	KFPW 1230	Geneva, N.Y.	WVGA 1240		WHYZ 1490
Fair Bluff, N.C.	WLPS 1330		KFSA 950	Georgetown, Del.	WJWL 900	Greenville, Tex.	WMUR 1070
Fairbury, Nebr.	WVAY 1590		KTCS 1410	Georgetown, Ky.	WAXU 1580	Greenwich, Conn.	WMUO 1260
Fairfax, Va.	KEVA 1240		KWNN 1320	Georgetown, S.C.	WGTN 1400	Greenwood, Miss.	WQOK 1440
Fairfield, Ill.	WRZO 1400	Ft. Stockton, Tex.	WFPM 1150	Georgetown, Tex.	WGIN 1470		WGOI 1490
Fairfield, Iowa	WBBF 1280	Ft. Walton Beach, Fla.	WFLW 1150	Georgetown, Wyo.	WGET 1320		WAGB 960
Fairfield, O.	WIKY 820		WUOE 1400	Gillette, Wyo.	KIML 1270	Greenwood, S.C.	WGRM 1240
Fairhope, Ala.	WVAY 1590		WFTW 1280	Gilroy, Cal.	KAZA 1290		WLEF 540
Fairmont, Minn.	WABF 1220	Ft. Wayne, Ind.	WGL 1250	Gladewater, Tex.	KEES 1430	Greer, S.C.	WGSV 1350
Fairmont, N.C.	WSKE 1050		WFWR 0900	Glasgow, Ky.	WKAY 1490		WEAB 800
Fairmont, W.Va.	KRKO 1380		WOWO 1190	Glasgow, Mont.	KTZ 1440	Gresham, Ore.	WKCI 1300
Fall River, Mass.	KWYZ 1230		WLYV 1450	Glen Burnie, Md.	WISZ 1590		WNAO 1460
Falls Church, Va.	WBLO 1470	Ft. Worth, Tex.	KJIM 870	Glendale, Ariz.	KRUX 1360	Grtna, La.	KRLR 1230
Falls City, Nebr.	WXLG 1370		KBUY 1540	Glendale, Calif.	KIEV 870	Grtna, Va.	WNNM 730
Fargo, N.Dak.	KFGO 990		KFJZ 1270	Glendive, Mont.	KXGN 1400	Grtna, Va.	WNMA 730
Faribault, Minn.	KXES 1090		KNOP 970	Glennallen, Alaska	KGLE 590	Griffin, Ga.	WHIE 1320
Farmersville, La.	WKXR 1540	Fortuna, Cal.	KNCR 1090	Glens Falls, N.Y.	WWSC 1950		WGRI 1410
Farmington, Me.	KFCR 860	Fosston, Minn.	KEHG 1480	Glenville, Ga.	WKIG 1580	Grinnell, Iowa	KGRN 1410
Farmington, Mo.	KFRB 900	Fostoria, Ohio	WFBO 1430	Glenwood Sprgs., Colo.	GLN 980	Groton, Conn.	WSUO 980
Farmington, N.M.	KDHL 920	Fountain Inn, S.C.	WFIS 1500	Globe Ariz.	KZWB 1240	Grove City, Pa.	WSAJ 1340
Farmville, N.C.	WKKO 1480	Fowler, Calif.	KLIP 1220	Gloucester, Va.	WDDY 1420	Guayama, P.R.	WXRF 1590
Farmville, Va.	WKMT 1310	Framingham, Mass.	WKOX 1190	Gloverville-Johnston, N.Y.	KBLY 1320	Gulfport, Miss.	WROA 1390
Farwell, Tex.	WFIW 1390	Frankfort, Ind.	WIL0 1570	Gold Beach, Ore.	WBNT 1440		WCGM 1420
Fayette, Ala.	KMCO 1570	Frankfort, Ky.	WFKY 1490	Golden Meadow, La.	KLEB 1600	Gunnison, Colo.	KGUC 1490
Fayetteville, Ark.	WCNW 1560	Franklin, Ky.	KFRN 1590	Golden Valley, Minn.	KQRS 1440	Guntersville, Ala.	WGSV 1270
Fayetteville, N.C.	WABF 1220	Franklin, La.	WFCA 1100		KUXL 1570	Guthrie, Okla.	KRW 1400
Fayetteville, Tenn.	WFAB 1220	Franklin, N.C.	WFSC 1050	Goldsboro, N.C.	WFGC 730	Guymon, Okla.	KGYN 1210
Fergus Falls, Minn.	KFNO 900	Franklin, N.H.	WFTN 1240		WGBR 1150	Hackensack, N.J.	WJRZ 970
Fernandina Beach, Fla.	KQWB 1550	Franklin, Pa.	WFLA 1450		WGCR 1300	Hagerstown, Md.	WARK 1490
Ferriday, La.	WVAV 1390	Franklin, Tenn.	WAGG 950	Gonzales, Tex.	KCTI 1540	Haley, Idaho	KSKE 1340
Festus, Mo.	KRZE 1280	Franklin, Va.	WIZO 1580	Goodland, Kans.	KLOE 730	Haines City, Fla.	WHRM 1490
Festus-St. Louis, Mo.	WFAG 1250	Franklington, La.	WFCC 1110	Gordon, Ga.	WKOM 1560	Haleyville, Ala.	WJBB 1230
Findlay, Ohio	WFLO 870	Frederick, Md.	WFMD 930	Goshen, Ind.	WVAG 1460	Halfway, Md.	WHAG 1410
Fitchburg, Mass.	KZOL 1570	Frederick, Okla.	KTAT 1570	Gouverneur, N.Y.	WIGS 1250	Hamden, Conn.	WDQQ 1220
Fitzgerald, Ga.	WVWF 990	Fredericksburg, Va.	KNAF 910	Grafton, N.D.	WGPC 1340	Hamilton, Ala.	WERH 970
Flagstaff, Ariz.	KHOG 1440	Fredericktown, Mo.	WFLS 1350	Graham, N.C.	WVWP 1260	Hamilton, Mont.	KYLD 980
Florence, Ala.	KFAF 1250	Fredonia, N.Y.	KFTW 1450	Graham, Tex.	KSVA 1330	Hamilton, Ohio	WVLC 1450
Florence, S.C.	WFVA 1350	Freeport, N.Y.	WGBB 1240	Grand Coulee, Wash.	KFOR 1360	Hamlet, N.C.	WKOX 1250
Floydada, Tex.	WVFC 1490	Freeport, Tex.	KBRZ 1460	Grand Forks, N.D.	KFJM 1370	Hammond, Ind.	WJDB 1230
Foley, Ala.	WFUN 1340	Fremont, Mich.	WSHN 1550	Grand Haven, Mich.	WGMH 1370	Hammond, La.	WVRF 1400
Fond du Lac, Wis.	WFLA 1490	Fremont, Nebr.	KHUB 1340	Grand Island, Nebr.	KMMJ 750	Hammond, N.J.	WNJH 1580
Fordey, Ark.	WDIU 1600	Fremont, Ohio	KARM 1430	Grand Junction, Colo.	KRGJ 1430	Hampton, S.C.	WHLH 1410
Forest City, N.C.	WEKR 1240	Fresno, Calif.	KBIF 900		KREX 1100	Hampton, Va.	WVEC 1490
Forks, Wash.	WELD 890		KIRI 1510	Grand Prairie, Tex.	KKDA 730	Hancock, Mich.	WMPL 920
Forrest City, Ark.	WEIM 1280		KEAP 980	Grand Rapids, Mich.	WAFT 1480	Nanford, Calif.	KNGS 620
Fort Atkinson, Wis.	WFGL 960		KXEX 1550		WJEF 1230	Hannibal, Mo.	KHMO 1070
Fort Bragg, Calif.	WFUN 1340	Gaffney, S.C.	KFRE 940		WUR 1570	Hanover, N.H.	WVTS 1400
Fort Campbell, Ky.	WDB 1370	Gainesville, Fla.	KGST 1600	Grangeville, Idaho	KORT 1230	Hardin, Mont.	WHVR 1280
Fort Collins, Colo.	KEWE 800		KMAK 1340	Granite City, Ill.	WGNU 920	Hardinsburg, Ky.	WHIC 1250
Fort Dodge, Iowa	KWMT 540		KYN0 1300	Granite Falls, N.C.	WKJK 900	Harlan, Ky.	WHLN 1410
Fort Hays, Kan.	WFAW 940	Friona, Tex.	KNNN 1070	Grants, N.Mex.	KMIN 980	Harlingen, Tex.	KGBT 1530
Fort Hodge, Iowa	KVFD 1400	Front Royal, Va.	KNNN 1070	Grants Pass, Ore.	KAGI 930	Harrisonburg, Va.	WVBC 1240
Fort Knox, Ky.	WSAC 1470	Frontsburg, Md.	WFRB 980		KXEL 1270	Harrisonburg, Va.	WHBG 1360
Fort Lauderdale, Fla.	WFLL 1400	Fulton, Ky.	WFUL 1270	Grayson, Ky.	WGOH 1370	Hartford, Conn.	WCCC 1290
		Fulton, Miss.	WFTO 1330	Gt. Barrington, Mass.	WSBS 860	Hartford, Conn.	WCCJ 1450
		Fulton, Mo.	KFAL 900		KVGB 1590	Hartford, Conn.	WOP 1410
		Fulton, N.Y.	WOSC 1300	Gt. Bend, Kans.	KVGB 1590	Hartford, Conn.	WOP 1410
		Fuquay-Varina, N.C.	WAKS 1460	Great Falls, Mont.	KUDI 1450	Hartford, Conn.	WTIC 1080
			WAD 1350		KMON 560	Hartford, Conn.	WLLS 1600
			WJBY 930	Great Falls, Mont.	KARR 1400	Hartford, Wis.	WTKM 1540
			WAAX 570	Greeley, Colo.	WKFA 1310	Hartsville, Ala.	WHBC 1450
			WFGN 1570		KYDU 1450	Hartsville, S.C.	WHSC 1450
			WEAC 1500	Green Bay, Wis.	WUOZ 1400	Hartsville, Tenn.	WKJM 1090
			WVNH 980		WNFL 1440	Hartwell, Ga.	WKLY 980
			WGGG 1230	Greenfield, Mass.	WHAI 1240	Harvard, Ill.	WMCW 1600
			WRUF 850	Greensburg, N.C.	WHAI 1240	Harvey, Ill.	WVLC 1450
			WUWU 1390		WCOG 1320	Hastings, Minn.	KDWA 1450
			WVGA 550		WEAL 1510	Hastings, Nebr.	KHAS 1230
			WDUN 1240		WKTB 1550		KICS 1550
			WNRJ 1580		WGBG 1400	Hastingsville, Ga.	WCEH 610
			KCAF 580		WPET 930	Hays, Kans.	KAYS 1400
			WHMC 1150		WHT 1470	Haynesville, La.	KLUV 1500
			WBOB 1360		WCOJ 1320	Hzard, W.Va.	WVBC 1490
			WGIL 1400		WEAL 1510	Hazelhurst, Ga.	WV0H 920
			WAIK 1590		WKTG 1550		
			WHIN 1010		WGBT 1400		
			WANG 1130		WGTB 1450		
			WJEN 990		WGTB 1450		
			KGAK 1330		WGTB 1450		
			KYVA 1230		WGTB 1450		
			KYLE 1400		WGTB 1450		
			KGAB 1540		WGTB 1450		
			CBG 1450		WGTB 1450		
			WMNT 1520		WGTB 1450		
			KUIL 1240		WGTB 1450		
			KUPK 1050		WGTB 1450		
			WTAK 1090		WGTB 1450		

WHITE'S RADIO LOG

Location C.L. kHz

Hazelhurst, Miss. WMDC 1220
Hazelton, Pa. WAZL 1490
WZHN 1300
Heber Springs, Ark. KAWW 1370
Helena, Ark. KFFA 1360
Helena, Mont. KCAP 1340
KBLL 1240
Hemet, Calif. KHSJ 1320
Hemphill, S.C. WKYB 1000
Hemstead, N.Y. WHLI 1100
Henderson, Ky. WSON 860
Henderson, Nev. KBMI 1400
KTCO 1280
Henderson, N.C. WHNC 890
WIZS 1450
Henderson, Tenn. WHHM 1580
Henderson, Tex. KGRI 1000-
KWDR 1470
Hendersonville, N.C. WHKP 1450
WHVL 1600
Henryetta, Okla. KHEN 1590
Nerford, Tex. KPAN 860
Nerkimer, N.Y. WALY 1420
Nermonston, Oreg. KOHU 1570
Nerndon, Va. WRPA 1440
Nerrin, Ill. WJPF 1340
Nettinger, N.Dak. KNDC 1490
Nighting, Minn. WMFG 1240
Nickory, N.C. WHKY 1290
WIRC 630
Nighland, Ill. WINU 1510
Nighland Park, Ill. WEEF 1430
Nighland Park, Tex. KVLV 1150
Nighland Springs, Va. WENZ 1430
Nigh Point, N.C. WMFR 1250
WNDS 1590
WHPE 1070
Nilesboro, Ohio WSRW 1590
Nillsboro, Oreg. KUIK 1360
Nillsboro, Tex. KHBR 1560
Nillsdale, Mich. WCSR 1340
Nillsville, Va. WHHV 1400
Nilo, Hawaii KPUA 970
KIPA 1210
KALO 850
Hindman, Ky. WKCB 1540
Hinesville, Ga. KGML 990
Hinton, W.Va. WMTD 1380
Hohls, N.Mex. KWEW 1480
Hohenwald, Tenn. WMR 1540
Holbrook, Ariz. KHD 1270
Holdsville, Okla. KVVY 1370
Holdredge, Nebr. KUVR 1380
Holland, Mich. WHTC 1450
WJBL 1260
KMPG 1540
Hollister, Cal. KMPG 1540
Holy Springs, Miss. WGMA 1320
WKRA 1110
Holyoke, Mass. WREB 930
KHAL 1320
Homer, La. WHI 1430
Hornstead, Fla. WJLD 1400
Hondo, Tex. KRME 1460
Honolulu, Hawaii KAIM 870
KCCN 1420
KGBM 590
KED 1210
KHAJ 1090
KPOI 1380
KIKI 830
KGU 760
KHVV 1040
KHUA 890
KNDI 1270
KOH 1170
KORL 650
KTRG 990
KUI 1500
Wood River, Oreg. KHIR 1340
Hope, Ark. KXAR 1490
Hopewell, Va. WHAP 1340
Hopkinsville, Ky. WHOP 1330
Houma, La. WKOA 1480
KGB 1560
Houma, N.Y. WHHO 1320
WLEA 1480
Horseheads, N.Y. WIQT 1000
Hot Springs, Ark. KBHS 590
KXOW 420
KZNG 1340
Hot Springs, S.Dak. KOBH 580
WHDF 1400
Houghton, Mich. WHGR 1290
Houghton Lake, Mich. WHOU 1340
Houlton, Maine WHOU 1340
Houma, La. KJIN 1490

Location C.L. kHz
Houston, Miss. WBPC 940
Houston, Mo. KCBC 1290
Houston, Tex. KCOH 1430
KENR 1070
KILT 610
KNUZ 1230
KODA 1010
KPRC 950
KTHT 790
KTRH 740
KXYZ 1320
KYOK 1590
WHMI 1350
Hugo, Okla. KHIN 1340
Hudson, N.Y. WHUC 1230
Humacao, P.R. WALO 1240
Humboldt, Tenn. WIBJ 740
Huntingdon, Pa. WHUN 1150
Huntington, Ind. WHLT 1300
Huntington, N.Y. WGSW 740
Huntington, W. Va. WKEE 800
WSAZ 930
WHY 1470
Huntsville, Ala. WBHP 1230
WJUP 1600
WFX 4560
WAA 1550
WVOV 1000
Huntsville, Tex. KSAM 1490
Huron, S.Dak. KIJV 1340
Hutchinson, Kans. KWBW 1450
KWKK 1260
Hutchinson, Minn. KDUI 1260
Hyde Park, N.Y. WHV 950
Idabel, Okla. KBEL 1240
Idaho Falls, Idaho KTE 590
KTEE 1280
KUL 994
Immokalee, Fla. WCOF 1490
Independence, Ia. KOUR 1220
Independence, Kans. KIND 1010
KCCV 1510
Independence, Mo. WDDA 1480
Indiana, Pa. WATI 810
Indianapolis, Ind. WFBM 1500
WFBM 1260
WGE 1590
WIBC 1370
WIFE 1310
WIRE 1430
WXLW 950
Indianola, Iowa KBAB 1490
Indianola, Miss. WKLA 1380
Indian Rocks Beach, Fla. WGNP 1520
Indio, Calif. KREO 1400
Ingleswood, Calif. KTYM 1460
Inkster, Mich. WCHB 1440
International Falls, Minn. KGHS 1230
WYSE 1560
Iola, Kansas KALN 1370
Iola, Mich. WION 1430
Iowa City, Iowa KKIC 800
WSD 1190
Iowa Falls, Ia. KIFG 1510
Irondale, Ala. WLPH 1480
Iron Mtn., Mich. WMIQ 1450
Iron River, Mich. WKKB 1230
Ironton, Ohio WIR 1230
Ironwood, Mich. WMS 1500
Irvine, Ky. WIRV 1550
Isabella, P.R. WISA 1390
Ishpeming, Mich. WJPO 1240
WCKD 970
Islip, N.Y. WLIC 540
Ithaca, N.Y. WTKO 1470
WVOM 1270
Iuka, Miss. WHOD 1290
Jackson, Ala. WJBA 1540
Jackson, Ga. WEG 810
Jackson, Ky. WDX 1210
Jackson, Mich. WKHM 970
WJCO 1510
Jackson, Miss. WJDX 620
WJEG 1400
WJLS 1450
WOKJ 1550
WVUN 1590
WRBC 1300
WRLI 930
Jackson, Ohio WLMJ 1280
Jackson, Tenn. WMS 1210
WJAK 1450
WJTS 1390
WYLO 540
Jackson, Wis. KSGT 1340
Jackson, Wyo. WEGK 1480
Jacksonville, Ark. KGMR 1500
Jacksonville, Fla. WJAS 930
WAPE 690
WBOM 970
WVOJ 1320
WVIV 1050
WMBR 1460
WROB 1360
WPDQ 600
WQIK 1090
WRHC 1400
WJII 1550
WJLD 1160
Jacksonville, N.C. WJNC 1240

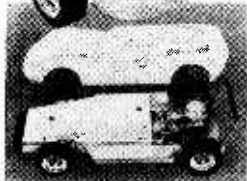
Location C.L. kHz
WBBS 1290
WLAS 910
WKEB 1010
WBIX 1010
WJKY 1060
Jamestown, N.Oak. KEJY 1400
WKSJ 600
WRF 1240
Jamestown, N.Y. WKSJ 1340
WCLC 1260
Jamestown, Tenn. WDEB 1500
WCLO 1230
Jasper, Ala. WNVW 1360
WAF 1240
Jasper, Ind. WITZ 990
Jasper, Tex. KJBY 1350
Jefferson City, Mo. KLIK 950
KWOS 1240
Jefferson City, Tenn. WJFC 1480
WVWV 1450
Jena, La. KCKW 1480
Jenkins, Ky. WREN 1000
Jennings, La. KJEF 1290
Jerome, Idaho KART 1400
Jesseville, Ill. WJBM 1500
Jesup, Ga. KJBY 370
John Day, Ore. KJDY 1400
Johnson City, Tenn. WJCV 910
WETB 790
WLEI 930
Johnstown, N.Y. WJAC 850
WARD 1490
WCRD 1230
WJOL 1340
WJRC 1510
CILA 1140
Joliet, Ill. KBTM 1230
KNEA 970
KTCO 920
Jonesboro, Tenn. WJSD 1590
Jonesville, La. KANV 1480
WJAC 1450
Joplin, Mo. KGXY 1560
KFBS 1310
KODE 1230
KJST 1470
KMG 1450
June City, Kans. KICK 1420
Juneau, Alaska KINY 800
KJNO 630
Jupiter, Fla. WJST 1000
Kahalui, Hawaii KNUT 1310
Kailua, Hawaii KJL 420
Kalamazoo, Mich. WKPR 1400
WZKO 590
WKMI 1360
WYYY 1470
KEEZ 890
KIC 1180
Kane, Pa. WKZA 960
Kankakee, Ill. WKAN 1320
Kannapolis, N.C. WGTL 870
WRKB 1460
Kans. City, Kans. KCM 310
Kans. City, Mo. KMBZ 980
KPRS 1590
WQAF 610
WNB 710
KGFW 1050
Kenedy-Karnes City, Texas KAML 990
Kealakekua, Hawaii KONA 790
KKON 740
KGF 1340
KRN 1460
WKBE 1290
WKBK 1220
KLOG 1490
KMER 950
Kendallville, Ind. WKC 1040
Kendy, Tex. KAML 990
Kennett, Mo. KBOA 830
KBXM 1340
Kennewick, Wash. KNGA 1340
Kennewick-Pasco-Rainier Wash. WEPR 610
Kenosha, Wis. WLIP 1050
Kent, O. WKNT 1520
Keokuk, Iowa KOKX 1310
Kermitt, Tex. KERB 600
Kerrville, Tex. WKS 1230
Kershaw, S.C. WKSC 1300
Ketchikan, Alaska KTKN 930
Kewanee, Ill. WKEI 1450
Keyser, W.Va. WKLF 1300
Key West, Fla. WKPE 1690
WJIA 1230
Kilgore, Tex. KOCA 1240
Killeen, Tex. KLEN 1050
Kimball, Nebr. KIMB 1260
King, N.C. KWTE 1090
King City, Calif. KRKC 1490
Kingman, Ariz. KCAA 1230
Kings Mountain, N.C. WKMT 1220
WKIN 1320
WKPT 1400
WVLA 1090
WBAZ 1550

Location C.L. kHz
WGHQ 920
WKNY 1490
WKEB 1310
WKSP 1090
KINE 1390
WFSP 1560
WELS 1010
WFTC 960
WIS 1230
KYAC 1460
KBLE 1050
KIRX 1450
WFIW 1080
WACY 1220
WACB 1380
KAGD 1150
KFLW 1450
KNIA 1340
WBIR 1240
WVW 830
WJBE 1450
WATE 620
WKNJ 1340
WKXV 900
WNQX 990
WRRO 960
WSTT 1580
WIOU 1350
WKOZ 1340
WLNH 1350
WEMJ 1490
WDSR 1340
WLX 490
WLDY 580
WKTY 1340
WLFA 1590
WASK 1450
WLSK 1450
WBA 920
KPEL 1420
KVOL 1330
KXKW 1520
WEEN 1480
WFLA 1450
KLB 1340
WLAG 1240
WTRP 620
WTAQ 1300
KMG 1570
Lajunta, Colo. KLF 1570
Lake Charles, La. KLOU 1580
KPLC 1470
KAOK 1400
WDSR 1340
WLSR 1340
WGR 960
Lake City, S.C. WJOT 1260
Lake Geneva, Wis. WMIR 1550
WLAK 1430
WLMK 1230
WNAS 1380
Lake Placid, N.Y. WIRD 920
Lakeport, Cal. KBLC 1270
Lake Providence, La. KPLP 1050
Lake Tahoe, Calif. KOWL 1490
Lakewood, Oreg. KOLF 1230
Lake Wales, Fla. WIPC 1460
Lakewood, Colo. KLAB 1600
Lakewood Center, Wash. KODD 1480
WLIZ 1380
Lafayette, Colo. KPL 850
Lamesa, Tex. KLET 890
Lampasa, Tex. KCYL 1450
Lancaster, Calif. KAVL 610
KBVM 1380
Lancaster, Ky. WIXI 1280
Lancaster, N.Y. WMI 1300
Lancaster, Ohio WHOK 1320
Lancaster, Pa. WGL 1490
WLAN 1390
Lancaster, S.C. WLCM 1360
WAGL 1560
Lander, Wyo. WLD 1330
Lanett, Ala. WRLD 1490
Langdon, N.D. KNDX 1080
Lansdale, Pa. WJPS 1440
Lansford, Pa. WLSH 1410
Lansing, Mich. WLM 1240
WITL 1010
WPMC 1230
Lapeer, Mich. WTHM 1530
WLM 1560
Lafayette, Md. WLS 1430
Lafayette, Ind. WLS 1430
Laramie, Wyo. KLME 1490
KOWB 1290
KLAR 1300
KVQZ 1490
Larned, Kans. KANS 1510
LaSalle, Ill. WLO 1420
Las Cruces, N.Mex. KDBE 1450
KERT 570
KENO 1460
KLAV 1230
KRAM 1340
KLUU 1140
KOKK 820
KVEG 970
KFUN 1230
Las Vegas, N.Mex. WPKV 1570
WQW 1570
WTRA 1480

4 New Action-Packed Kits from Heath



Heathkit GD-101
\$49.95*

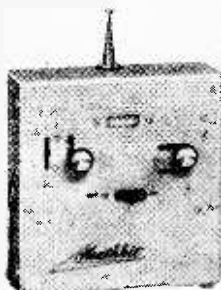


NEW Heathkit "Spectre" 1/8 Scale R/C Car

Join The Most Exciting New Hobby In America . . .

building and racing radio-controlled Grand Prix cars up to scale speeds of 200 mph. The Heathkit "Spectre" R/C car reaches that speed and has already proven itself a winner. And no wonder; its design is unique. It has a chrome plated steel chassis, adjustable caster and toe-in, specially formulated rubber tires that lock onto the cast nylon wheels, independent front suspension for excellent cornering and a 5.5:1 gear ratio for maximum torque at all speeds. The snap on, 1/8 scale car body (length: 19 1/2") is of high impact plastic — almost indestructible. Suspension is by real coil springs. The radio equipment compartment is dirt and oil proof. The Heathkit "Spectre" is the only complete car kit available. You get the body, chassis, wheels & tires, 4 oz. fuel tank & tubing, equipment case & protective foam, centrifugal clutch & gears, axles, servo linkages & mounting tape, all hardware, decals, numbers and a comprehensive manual. The "Spectre" accepts any .15 to .23 cubic inch R/C engine and any proportional R/C electronics system. It requires only two servos to operate the steering, brake and throttle. Get in on all the thrills of R/C car racing at the lowest possible price . . . order a Heathkit "Spectre".

Kit GD-101, R/C car only, 8 lbs. \$49.95*
Assembled GDA-101-1, Veco .19 R/C engine, 1 lb. \$19.95*



Transmitter

Heathkit GD-57
\$129.95*



Receiver



Battery Pack



Servos

NEW Heathkit 3-Channel Digital Proportional R/C System For Planes, Gliders, Cars And Boats

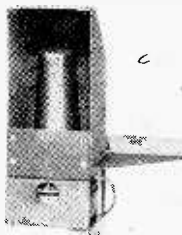
Ideal for use with the new Heathkit "Spectre" R/C car to give you total control . . . ease of handling. Here's what the Heathkit GD-57 R/C system includes: Transmitter with assembled, factory aligned RF circuitry; new 2 oz. miniature receiver that needs no IF alignment, in a tough nylon case; you also get two servos; all plugs; connectors; cables; charging cord; new flat-pack rechargeable nickel-cadmium transmitter and receiver batteries . . . and a special soldering iron. You can have your choice of five operating frequencies in each of three bands . . . 27, 53 or 72 MHz. This is the most value ever offered in a 3-channel rig.

Kit GD-57, transmitter, receiver, 2 servos, batteries, charging cord, switches and soldering iron, (specify freq. desired), 11 lbs. \$129.95*
Kit GDA-57-1, transmitter, battery, charging cord, (specify freq. desired), 5 lbs. \$54.95*
Kit GDA-57-2, receiver only, (specify freq.), 1 lb. \$34.95*

Heathkit Siren & Speaker
\$99.95*



Amplifier & Controls



Concealed Horn



Exterior Horn

NEW Heathkit Siren/PA For Licensed Emergency Vehicle Only

Hey Chief! Save up to 60% on a new electronic siren/PA system by ordering the low cost Heathkit GD-18. The siren gives both "wail" and "yelp" warnings at 50 watts output power, and you can adjust the pitch. As a public address it will amplify your voice with a full 20 watts of power, and it's practically immune to acoustical feedback. (Either PA or siren can be interrupted to use the other.) Incoming radio calls can be channeled through the GD-18 so you can hear them when away from your vehicle. Use it on any 12-volt auto electrical system with either positive or negative frame ground. It will operate from -20° to 150° F conditions. Control panel is lighted. Comes with gimbal bracket mounting. Take your choice of speakers . . . concealed or exposed.

Kit GD-18, Siren/PA Amplifier, 7 lbs. \$54.95*
Assembled GDA-18-1, Exterior Horn, 9 lbs. \$49.95*
Assembled GDA-18-2, Concealed Horn, 4 1/2 x 4 1/2 x 13", 9 lbs. \$49.95*
System GD-18A, (includes GD-18 plus exterior horn), 16 lbs. \$99.95*
System GD-18B, (includes GD-18 plus concealed horn), 16 lbs. \$99.95*

Heathkit MI-29
\$84.95*



NEW Heathkit Solid-State Portable Fish Spotter

Costs half as much as comparable performers. Probes to 200 ft. Doubles as depth sounder. Transducer mounts anywhere on suction cup bracket. Adjustable Sensitivity Control. Exclusive Noise-Rejection Control stops ignition noise. Runs for 80 hrs. on two 6 VDC lantern batteries (not included). Manual explains typical dial readings. Get set for next season; order your Heathkit MI-29 today.

Kit MI-29, 9 lbs. \$84.95*

NEW IMPROVED 1970 HEATHKIT® COLOR TV

New Lower-Than-Ever Prices



Here's How The Color TV That Thousands Call Best Became Even Better and Lower In Price

Since the very first model was introduced, thousands of owners, electronic experts, and testing labs have praised the superior color picture quality and extra features of Heathkit ColorTV. Now Heath has made improvements that make the 1970 models even better.



Sharper, More Detailed Pictures. Latest design improvement in the circuitry of Heathkit Color TV video amplifiers has increased their bandpass capabilities. The result is an increase in the number of lines of resolution . . . greater than in any other brand of color TV we have tested. This improvement means you get sharper, more detailed pictures as shown by test pattern measurements. You not only get the superior color pictures Heathkit Color TV has always been noted for, but you also get sharper pictures.

New Brighter Tube. Now all Heathkit Color TV models include the new brighter picture tube you've read so much about. These new tubes produce noticeably brighter pictures with more life-like, natural colors and better contrast. (We also offer the RCA Hi-Lite Matrix tube as an extra-cost option for the Heath GR-681 and GR-295 kits.)

New Safety Features. As an added safety precaution, AC interlocks have been added to all Heathkit Color TV cabinets.

Now The Best Costs Less. How can Heath make improvements in its Color TV Models and still reduce the prices? We have passed on to you the savings which have accrued due to reduced picture tube prices. The result is your 1970 Heathkit Color TV will cost you \$20 to \$55 less depending upon which model you choose . . . proof that Heathkit Color TV is a better buy than ever.

All Heathkit Color TV's Have These Superior Features

- New brighter American brand rectangular color tube with bonded-face, etched anti-glare safety glass • Exclusive built-in self-servicing aids so you can adjust and maintain the set for best performance always • Automatic degaussing plus mobile degaussing coil • New broader video bandwidth for better resolution • 3-stage video IF • Improved retrace blanking • Gated automatic gain control for steady pictures • Automatic color control • Exclusive Magna-Shield surrounds picture tube for better color purity • Deluxe VHF tuner with "memory" fine tuning and precious metal contacts (models with automatic fine tuning also are available in all 3 picture tube sizes) • 2-speed UHF solid-state tuner • Completely shielded hi-voltage supply • Extra B+ boost for better definition • 2 hi-fi sound outputs for built-in speaker or your hi-fi system • 300 ohm & 75 ohm antenna inputs • Circuit breaker protection • Optional wireless remote control can be added anytime • Factory assembled and adjusted tuners, IF section, and hi-voltage supply • Exclusive 3-way installation capability — in a wall, custom cabinet or Heath cabinets

Choose Your Heathkit Color TV Now . . .

It's Better Than Ever in Performance . . . and A Better Buy Than Ever

New Lower-Than-Ever Prices On All Models

- | | |
|------------------------------------------------------|---------------------------------------------------------------------------------------|
| Heathkit GR-681
(295" AFT)
save \$30 |  |
| Now only \$4695* | |
| Heathkit GR-681MX
(with Matrix tube)
save \$55 |  |
| Now only \$4795* | |
| Heathkit GR-295
(295" AFT)
save \$30 |  |
| Now only \$4195* | |
| Heathkit GR-295MX
(with Matrix tube)
save \$55 |  |
| Now only \$4295* | |
| cabinets from \$65* | |
| Heathkit GR-681
(227" AFT)
save \$20 |  |
| Now only \$3995* | |
| Heathkit GR-227
(227" AFT)
save \$20 |  |
| Now only \$3595* | |
| cabinets from \$39.95* | |
| Heathkit GR-481
(180" AFT)
save \$30 |  |
| Now only \$3295* | |
| Heathkit GR-180
(180" AFT)
save \$30 |  |
| Now only \$2995* | |
| cabinets from \$27.50* | |



NEW FREE 1970 CATALOG!

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

HEATH COMPANY, Dept. 19-6
Benton Harbor, Michigan 49022

Enclosed is \$_____ plus shipping.

Please send model(s) Please send Credit Application.
 Please send FREE Heathkit Catalog.

Name _____

Address _____

City _____

State _____

Zip _____

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

CL-375

WHITE'S RADIO LOG

Location	C.L.	kHx
Monette, Ark.	KBIB	1560
Monmouth, Ill.	WRAM	1330
Monroe, Ga.	WRMB	1400
Monroe, La.	KMLB	1440
	KLIC	1330
	KNOE	540
Monroe, Mich.	WQTE	580
	WMAF	1060
	WJLH	1190
Monroe, N.C.	WEKZ	1260
Monroe, Wis.	WMFC	1360
Monterey, Calif.	KIDD	630
	KMBY	1240
Montevideo, Minn.	KDMA	1460
Monte Vista, Colo.	KSLY	1240
Montezuma, Ga.	WMAW	1350
Montgomery, Ala.	WAPX	1600
	WCOV	1170
	WHYH	1440
	WHGQ	800
	WHM	950
	WQTY	1500
Montgomery, W. Va.	WMON	1340
Monticello, Ark.	KHBM	1430
Monticello, Fla.	WMSD	1090
Monticello, Ky.	WTW	1260
Monticello, Miss.	WMLC	1270
Montpelier, Ia.	KVSI	1450
Montpelier-Barre, Vt.	WSKI	1240
Montrose, Colo.	KUBC	580
Montross, Pa.	WPFL	1250
Mooreville, N.C.	WHIP	1350
Moorhead, Minn.	KVOX	1280
Moorhead, Ky.	WMOR	1330
Moorhead City, N.C.	WMBL	740
Morgan City, La.	KWCA	1400
Morganfield, Ky.	WMSK	1550
Morgantown, N.C.	WMNR	1430
Morgantown, W. Va.	WJAJ	1440
	WCLG	1300
Morrilton, Ark.	KPYM	800
Morris, Ill.	WCJ	1550
Morris, Minn.	KMRS	1250
Morristown, N.J.	WMTR	1230
Morristown, Tenn.	WCRK	1150
	WMTN	1300
Morton, Tex.	KRAN	1280
Moscow, Idaho	WJCF	1470
Moses Lake, Wash.	KSEM	1470
	KWIG	1260
Moss Point, Miss.	WCIS	1460
Moulton, Ala.	WLCB	1530
Moultrie, Ga.	WMTM	1130
	WMA	1170
Moundsville, W. Va.	WEIF	1370
Mountain City, Tenn.	WPAQ	1400
	WMCT	1390
Mountain Grove, Mo.	KLRS	1360
Mountain Home, Ark.	KTLO	1240
Mountain Home, Ida.	KFLI	1240
Mountainlake Terrace, Wash.	KURB	1510
Mt. Airy, N.C.	WSY	1400
	WSYJ	1300
Mt. Carmel, Ill.	WYMC	1360
Mt. Carmel, Pa.	WMIM	1590
Mt. Clemens, Mich.	WBRB	1430
	WBK	1580
	WIJZ	1460
Mt. Dora, Fla.	WISG	790
Mt. Holly, N.J.	WWIP	1310
Mt. Jackson, Va.	WDJS	1430
Mt. Kisco, N.Y.	WVSP	1430
Mt. Olive, N.C.	WJCS	1150
Mt. Pleasant, Mich.	KWEN	1150
Mt. Pleasant, Tex.	KIM	960
Mt. Shasta, Calif.	KWSJ	620
Mt. Sterling, Ky.	WMST	1150
Mt. Vernon, Ill.	WMIX	940
Mt. Vernon, Ind.	WPZO	1590
Mt. Vernon, Ky.	WRVK	1460
Mt. Vernon, Ohio	WVVO	1300
Mt. Vernon, Wash.	KBCR	1430
Mulshoe, Tex.	KMUL	1380
Mullins, S.C.	WJAY	1280
Murford, Ind.	WLBC	1340
	WER	990
Murfreesboro, Ky.	WLCC	1350
Munising, Mich.	WGOV	1400
Murfreesboro, N. C.	WDR	1080
	WDRS	1450
	WMTS	810
Murphy, N.C.	WCPV	800
	WKRK	1320

Location	C.L.	kHx
Murphysboro, Ill.	WINI	1420
Murray, Ky.	WNBS	1340
Murray, Utah	KMOR	1230
Muscatele, Iowa	KWPC	860
Muscle Shoals City, Ala.	WLAY	1450
	WBJ	850
Muskegon, Mich.	WKJR	1520
	WTRU	1600
	WMUS	1090
Muskogee, Okla.	KBIX	1490
	KMUS	1380
Myrtle Beach, S.C.	WVBY	1350
	WTGR	1520
Nacogdoches, Tex.	KEEE	1230
	KSFA	860
Nampa, Idaho	KFXD	580
	KAIN	1340
Nanticoke, Pa.	WNAK	1290
Napa, Calif.	KYON	1440
Naples, Fla.	WNOG	1270
Narrows-Pearlburg, Va.	WNRV	990
Nashua, N.H.	WOTW	900
	KBSC	1500
Nashville, Ark.	WBAH	1260
Nashville, Ga.	WNGA	1600
Nashville, Tenn.	WKDA	1240
	WLAC	1510
	WMAK	1300
	WNAH	1360
	WSIX	980
	WSM	650
	WVGM	1560
	ZNS-2	1240
Nassau, Bahamas	WMIS	1240
Natchez, Miss.	WNAI	1450
Natchitoches, La.	WMB	1360
Natick, Mass.	WGTR	1060
Naugatuck, Conn.	WOWW	1380
Navasota, Tex.	KWBC	1550
Nebraska City, Nebr.	KNCY	1600
Needles, Calif.	KSEF	1340
Neenah, Wis.	WNAM	1280
Nellisville, Wis.	WCCN	1370
Neonville, O.	WNAL	940
Neon, Ky.	WNKY	1480
Neosho, Mo.	KBTN	1420
Neovada, Mo.	KNEW	1240
New Albany, Ind.	WHEL	1570
	WREY	1290
New Albany, Miss.	WNAU	1470
Newark, Del.	WNRK	1260
Newark, N.J.	WNWJ	620
Newark, N.Y.	WCAL	1430
Newark, Ohio	WCLT	1430
New Bedford, Mass.	WBSM	1420
	WNBB	1340
New Bern, N.C.	WHIT	1450
	WRNB	1480
Newberry, Mich.	WBEY	1310
Newberry, S.C.	WKDK	1240
	WKMG	1520
New Boston, Ohio	WIOI	1010
New Boston, Tex.	KNBO	1530
New Braunfels, Tex.	KGNB	1420
New Britain, Conn.	WRCH	910
	WRYM	840
New Brunswick, N.J.	WCTC	1450
Newburgh, N.Y.	WGNV	1220
Newburyport, Mass.	WNB	1470
New Castle, Ind.	WCTW	1550
New Castle, Pa.	WBZ	1140
	WKST	1280
Newcastle, Wyo.	KASL	1240
New City, N.Y.	WRKL	910
New Haven, Conn.	WVJZ	1300
	WELI	960
	WNHC	1340
New Iberia, La.	KANE	1240
	KNIR	1360
New Kensington, Pa.	WKPA	1150
New London, Conn.	WNLC	1510
New Martinsville, W. Va.	WETZ	1330
Newman, Ga.	WCOB	1400
	WNEA	1500
New Orleans, La.	WDSU	1280
	WJMR	990
	WBOK	800
	WNOE	1060
	WWSB	1350
	WVPS	1450
	WSHO	800
	WTIX	890
	WWL	870
	WWOM	950
	WYLD	940
Newport, Ark.	KNO	1260
Newport, Ky.	WNOP	740
Newport, N.H.	WCNL	1010
Newport, Oreg.	KNPT	1310
Newport, R.I.	WADK	1540
Newport, Tenn.	WLJK	1270
Newport, Va.	WOK	1400
Newport News, Va.	WGH	1310
	WTID	1270
Newport Richey, Fla.	WGUL	1500
New Prague, Minn.	KTMF	1350

Location	C.L.	kHx
New Richmond, Wis.	WIXK	1590
New Roads, La.	KWRG	1500
New Rochelle, N.Y.	WVOX	1460
New Smyrna Beach, Fla.	WSSB	1230
	WVOG	1550
	KCOB	1280
Newton, Iowa	KJRG	950
Newton, Kans.	WNTN	1550
Newton, Mass.	WBKN	1410
Newton, Miss.	WNNJ	1360
Newton, N.J.	WNS	1250
Newton, N.C.	KNUJ	860
New Ulm, Minn.	WABC	770
New York, N.Y.	WDD	1280
	WBX	1380
	WCBS	880
	WEVD	1330
	WHN	1050
	WHOM	1400
	WINS	1010
	WLIB	1170
	WMCA	590
	WNBC	680
	WHD	1130
	WNYC	830
	WOR	710
	WPO	1330
	WQXR	1600
	WRL	1800
	WRN	1050
	WJL	1440
Niagara Falls, N.Y.	WNWJ	1250
Nicholasville, Ky.	WNIL	1290
Niles, Mich.	WNIO	1540
Niles, Ohio	WNIO	1540
Nogales, Ariz.	KFB	1340
Nome, Alaska	KICY	850
Norfolk, Nebr.	WJAG	780
Norfolk, Va.	WTAR	790
	WCMS	1050
	WNOR	1230
	WRAP	850
Normal, Ill.	WOK	1440
Norman, Okla.	WNAD	640
	KNOR	1400
Norristown, Pa.	WNAR	1110
N. Adams, Mass.	WMNB	1230
N. Atlanta, Ga.	WRNS	980
N. Augusta, S.C.	WFNS	1380
	WFNL	1660
N. Bend, Ore.	KBBR	1340
North Charleston, S.C.	WNCG	910
Northampton, Mass.	WHMP	1400
North East, Pa.	WHYP	1530
Northfield, Minn.	WCAL	770
	KYMN	1080
N. Little Rock, Ark.	KDXE	1380
	KFLR	1150
North Platte, Nebr.	KNOP	1410
	KODY	1240
North Pole, Alaska	KJND	1170
No. Syracuse, N.Y.	WSOQ	1240
No. Vernon, Ind.	WOCH	1460
No. Wilkesboro, N.C.	WKBC	810
	KNBI	1530
Norton, Kans.	WNVA	1350
Norton, Va.	WNLK	1350
Norwalk, Conn.	WLFK	1510
Oak Park, Ill.	WVLC	1310
Norwich, Conn.	WNCH	970
Norwich, N.Y.	WCHN	970
Oakdale, La.	KREH	900
Oakes, N. Dak.	KEYD	1220
Oak Grove, La.	KWCL	1280
Oak Hill, W. Va.	WWAY	860
Oakland, Cal.	KEW	910
	KABL	960
	KDIA	1310
Oakland, Md.	WMSS	1050
Oakland Park, Fla.	WIXX	1520
Oak Park, Ill.	WHLR	1480
Oak Ridge, Tenn.	WATO	900
Ocala, Fla.	WMOT	900
	WMCJ	1290
	WWKE	1370
Ocean City, Md.	WETT	1590
Ocean City, Somers	WLT	1220
Oceanlake, Oreg.	KBCB	1380
Oceanside, Calif.	KUDE	1320
Ocella, Fla.	WSIZ	1380
Oconto, Wis.	WOCO	1260
Odesa, Tex.	WOBE	920
	KOZA	1230
	KOYL	1310
	KRIG	1410
Delwein, Iowa	KOEL	950
Defalfa, Nebr.	KOGA	930
Odessa, Utah	KNO	1450
	KANN	1060
	KSVN	730
	KVGO	1490
Odgersburg, N.Y.	WLSB	1400
Oil City, Pa.	WKRZ	1340
Okechobe, Fla.	KBE	1570
Oklahoma City, Okla.	KLPR	1140
	KOCY	1340
	KOMA	1520
	KTKO	1110

Location	C.L.	kHx
KJEM	800	
OKKL	930	
Old Saybrook, Conn.	WLIS	1420
Olean, N.Y.	WMNS	1360
	WHDL	1450
Olney, Ill.	WLLN	740
Olympia, Wash.	KGY	1240
	WOW	530
Omaha, Nebr.	KBOB	1490
	KFAB	1110
	KOIL	1290
	KOOO	1420
	KOZN	660
	KRW	500
Omak, Wash.	KOMW	680
Oneida, N.Y.	WMCR	1600
Oneida, Tenn.	WBNT	1310
O'Neill, Nebr.	KBRX	1350
Oneonta, Ala.	WFLR	1570
Oneonta, N.Y.	WDS	730
Ontario, Cal.	KSON	1510
Ontario, Oreg.	KSRY	1380
Opelika, Ala.	WAOA	1520
	WPHO	1400
Opelousas, La.	KSLD	1230
Opp, Ala.	WLB	860
Opportunity, Wash.	KZUN	1390
Orange, Mass.	WCAT	1950
Orange, Tex.	KOGT	1600
Orange, Va.	WJMA	1340
Orangeburg, S.C.	WDIX	1150
	WFO	1580
	WTND	820
Orange Park, Fla.	WAYR	550
Ord, Neb.	KNLV	1060
Oregon City, Ore.	KYXI	1520
Orofino, Fla.	WDBO	580
	WOB	990
	WOF	1270
	WLOF	950
	WKIS	740
Orleans, Mass.	WVLC	1170
Ormond Beach, Fla.	WOAT	1380
Orofino, Fla.	KADR	1340
Oroville, Calif.	KADR	1340
Ortonville, Minn.	KDIO	1350
Osage Beh., Mo.	KRMS	1150
Oseola, Ark.	KOBE	860
Oshkosh, Wis.	WAGO	890
	WAGO	1460
Oskaloosa, Iowa	KBOE	740
North Charleston, S.C.	WSGO	1440
Othello, Wash.	KRSC	1400
Otsego, Mich.	WAOP	980
Ottawa, Ill.	WCMY	1430
Ottawa, Kans.	WVLE	1420
Ottumwa, Iowa	KBIZ	1240
	KLEE	1480
Owatonna, Minn.	KRFQ	1390
Owego, N.Y.	WEBQ	1330
Owensboro, Ky.	WOMI	1490
	WOMI	1420
Owosso, Mich.	WOAP	1080
Oxford, Miss.	WSUW	1420
Oxford, N.C.	WOXF	1340
Oxnard, Calif.	KOXR	910
Ozark, Ala.	WOZK	900
	WVY	1190
Ozark, Ark.	KZKR	1540
Paducah, Ky.	WDXR	1560
	KWXX	570
	WPAD	1450
Page, Ariz.	KPGE	1460
Paintsville, Ohio	WBE	1460
Paintsville, Ky.	WSPF	1490
Palatka, Fla.	WWPF	1260
	WSUZ	800
Palestine, Tex.	KNET	450
Palm Beh., Fla.	WQXT	1340
Palm Sprgs., Cal.	KCMJ	1010
	KDES	920
	KPAL	1450
Palmdate, Calif.	KUTY	1470
Palm Desert, Cal.	KGOL	1270
Palo Alto, Calif.	KJBE	1220
Pamona, Cal.	KWOW	800
Pampa, Tex.	KPDN	1340
	KGRD	1230
Panama City Beh. Fla.	WGNE	1480
	WSV	1290
Panama City, Fla.	WDLF	1490
	WPCC	1430
Paoli, Ind.	WYAK	1560
Paradise, Cal.	KEWQ	930
Paraguay, Ark.	KDRS	1490
Paris, A.	KOC	1460
Paris, Ill.	WPRS	1460
Paris, Ky.	WPDE	1440
Paris, Tenn.	WTPR	710
Paris, Tex.	KPLT	1490
	WPBE	1250
Parkersburg, W. Va.	WVVO	1050
	WPAR	1450
	WTAP	1230
	WNBI	980
Park Falls, Wis.		
Park Rapids, Minn.	KPRM	1240
Parsippany-Troy Hills, N.J.	WPRC	1310
Parsons, Kans.	KLKC	1540
Pasadena, Cal.	KPPP	1240
	KRLA	1110

Location	C.L. kHz	Location	C.L. kHz	Location	C.L. kHz	Location	C.L. kHz
Pasadena, Tex.	KWKW 1300 KLVL 1480 KIKK 650	Pleasanton, Tex.	WKDR 1070 KBOP 1380 WOND 1400	Prineville, Oreg.	KRCO 690 KARY 1310 WEAN 790	Richwood, W.Va.	WRVA 1140 WXGI 950 WRGM 1540
Pasagoula-Moss Point, Miss.	WPMP 1580 KORD 910 KFRJ 1230 WCGB 1050	Plymouth, Ind.	WTCA 1050 WPMC 1390 WPNC 1420 WPLY 1420	Prosser, Wash.	WHIN 1110 WICE 1220 WJAR 920 WLKW 930 WPRO 630 WRIB 1220	Ridgecrest, Cal.	WVAR 608 KLA 1240 WBUG 1408
Pasco, Wash.	KORD 910 KFRJ 1230 WCGB 1050	Plymouth, N.C.	WPKC 1410 WPNH 1300 WPLY 1420	Prov., Utah	KIXX 1420 KEYY 1450 KQVO 950 KOLS 1570	Rifle, Colo.	KWSR 810 WUNO 1320 WCSA 1260 WTBA 1570
Paso Robles, Calif.	KORD 910 KFRJ 1230 WCGB 1050	Plymouth, Wis.	WPLY 1420	Pryor, Okla.	KEYY 1450 KOLS 1570	Ripley, Miss.	WTBA 1570 WCSA 1260 WRBW 1240
Patagonia, N.J.	WALK 1370 WPAC 1580 KVLH 1470 KOSB 1500	Pocahontas, Ark.	KPOC 1420 KSEI 930 KWKI 1240 KSNM 1290 KWMV 540 KKAR 1220	Pueblo, Colo.	KZPI 1230 KAPI 690 KCSJ 590 KFCF 970 KKAM 1350 KPUB 1420 KWB 1420 KWPU 1580 WPSU 1256 KFUL 1150 WPC 1580	River Falls, Wis.	WRVJ 1240 WHRF 1570 KACE 1570 KQVO 1450 WXVI 1600 WELR 1360 WFI 960 WRIS 1410 WTDY 910 WRYV 1240 WLSL 610
Pauls Valley, Okla.	WALK 1370 WPAC 1580 KVLH 1470 KOSB 1500	Pocomoke City, Md.	WPKC 1410 WPNH 1300 WPLY 1420	Pueblo, Colo.	KZPI 1230 KAPI 690 KCSJ 590 KFCF 970 KKAM 1350 KPUB 1420 KWB 1420 KWPU 1580 WPSU 1256 KFUL 1150 WPC 1580	Riverside, Calif.	WRVJ 1240 WHRF 1570 KACE 1570 KQVO 1450 WXVI 1600 WELR 1360 WFI 960 WRIS 1410 WTDY 910 WRYV 1240 WLSL 610
Pawhuska, Okla.	WALK 1370 WPAC 1580 KVLH 1470 KOSB 1500	Pomona, Calif.	WPKC 1410 WPNH 1300 WPLY 1420	Punta Gorda, Fla.	KZPI 1230 KAPI 690 KCSJ 590 KFCF 970 KKAM 1350 KPUB 1420 KWB 1420 KWPU 1580 WPSU 1256 KFUL 1150 WPC 1580	Roa. Okla. Ala.	WRVJ 1240 WHRF 1570 KACE 1570 KQVO 1450 WXVI 1600 WELR 1360 WFI 960 WRIS 1410 WTDY 910 WRYV 1240 WLSL 610
Pawtucket, R.I.	WALK 1370 WPAC 1580 KVLH 1470 KOSB 1500	Pompano Beach, Fla.	WPKC 1410 WPNH 1300 WPLY 1420	Punxsutawney, Pa.	KZPI 1230 KAPI 690 KCSJ 590 KFCF 970 KKAM 1350 KPUB 1420 KWB 1420 KWPU 1580 WPSU 1256 KFUL 1150 WPC 1580	Roanoke, Va.	WRVJ 1240 WHRF 1570 KACE 1570 KQVO 1450 WXVI 1600 WELR 1360 WFI 960 WRIS 1410 WTDY 910 WRYV 1240 WLSL 610
Payette, Ida.	WALK 1370 WPAC 1580 KVLH 1470 KOSB 1500	Ponca, City, Okla.	WPKC 1410 WPNH 1300 WPLY 1420	Putnam, Conn.	KZPI 1230 KAPI 690 KCSJ 590 KFCF 970 KKAM 1350 KPUB 1420 KWB 1420 KWPU 1580 WPSU 1256 KFUL 1150 WPC 1580	Roanoke Rapids, N.C.	WRVJ 1240 WHRF 1570 KACE 1570 KQVO 1450 WXVI 1600 WELR 1360 WFI 960 WRIS 1410 WTDY 910 WRYV 1240 WLSL 610
Pearsall, Tex.	WALK 1370 WPAC 1580 KVLH 1470 KOSB 1500	Ponce, P.R.	WPKC 1410 WPNH 1300 WPLY 1420	Putnam, Wash.	KZPI 1230 KAPI 690 KCSJ 590 KFCF 970 KKAM 1350 KPUB 1420 KWB 1420 KWPU 1580 WPSU 1256 KFUL 1150 WPC 1580	Roaring Springs, Pa.	WRVJ 1240 WHRF 1570 KACE 1570 KQVO 1450 WXVI 1600 WELR 1360 WFI 960 WRIS 1410 WTDY 910 WRYV 1240 WLSL 610
Peos, Tex.	WALK 1370 WPAC 1580 KVLH 1470 KOSB 1500	Pontiac, Ill.	WPKC 1410 WPNH 1300 WPLY 1420	Quana, Tex.	KZPI 1230 KAPI 690 KCSJ 590 KFCF 970 KKAM 1350 KPUB 1420 KWB 1420 KWPU 1580 WPSU 1256 KFUL 1150 WPC 1580	Robervau, Que.	WRVJ 1240 WHRF 1570 KACE 1570 KQVO 1450 WXVI 1600 WELR 1360 WFI 960 WRIS 1410 WTDY 910 WRYV 1240 WLSL 610
Peekskill, N.Y.	WALK 1370 WPAC 1580 KVLH 1470 KOSB 1500	Pontiac, Miss.	WPKC 1410 WPNH 1300 WPLY 1420	Quantic, Va.	KZPI 1230 KAPI 690 KCSJ 590 KFCF 970 KKAM 1350 KPUB 1420 KWB 1420 KWPU 1580 WPSU 1256 KFUL 1150 WPC 1580	Rochester, N.H.	WRVJ 1240 WHRF 1570 KACE 1570 KQVO 1450 WXVI 1600 WELR 1360 WFI 960 WRIS 1410 WTDY 910 WRYV 1240 WLSL 610
Pekin, Ill.	WALK 1370 WPAC 1580 KVLH 1470 KOSB 1500	Pooli, Ind.	WPKC 1410 WPNH 1300 WPLY 1420	Quincy, Cal.	KZPI 1230 KAPI 690 KCSJ 590 KFCF 970 KKAM 1350 KPUB 1420 KWB 1420 KWPU 1580 WPSU 1256 KFUL 1150 WPC 1580	Rochester, N.Y.	WRVJ 1240 WHRF 1570 KACE 1570 KQVO 1450 WXVI 1600 WELR 1360 WFI 960 WRIS 1410 WTDY 910 WRYV 1240 WLSL 610
Pell City, Ala.	WALK 1370 WPAC 1580 KVLH 1470 KOSB 1500	Poplar Bluff, Mo.	WPKC 1410 WPNH 1300 WPLY 1420	Quincy, Fla.	KZPI 1230 KAPI 690 KCSJ 590 KFCF 970 KKAM 1350 KPUB 1420 KWB 1420 KWPU 1580 WPSU 1256 KFUL 1150 WPC 1580	Rochelle, Ill.	WRVJ 1240 WHRF 1570 KACE 1570 KQVO 1450 WXVI 1600 WELR 1360 WFI 960 WRIS 1410 WTDY 910 WRYV 1240 WLSL 610
Pendleton, Oreg.	WALK 1370 WPAC 1580 KVLH 1470 KOSB 1500	Port Angeles, Wash.	WPKC 1410 WPNH 1300 WPLY 1420	Quincy, Ill.	KZPI 1230 KAPI 690 KCSJ 590 KFCF 970 KKAM 1350 KPUB 1420 KWB 1420 KWPU 1580 WPSU 1256 KFUL 1150 WPC 1580	Rochester, Minn.	WRVJ 1240 WHRF 1570 KACE 1570 KQVO 1450 WXVI 1600 WELR 1360 WFI 960 WRIS 1410 WTDY 910 WRYV 1240 WLSL 610
Pennington Gap, Va.	WALK 1370 WPAC 1580 KVLH 1470 KOSB 1500	Port Arthur, Tex.	WPKC 1410 WPNH 1300 WPLY 1420	Quincy, Mass.	KZPI 1230 KAPI 690 KCSJ 590 KFCF 970 KKAM 1350 KPUB 1420 KWB 1420 KWPU 1580 WPSU 1256 KFUL 1150 WPC 1580	Rochester, N.Y.	WRVJ 1240 WHRF 1570 KACE 1570 KQVO 1450 WXVI 1600 WELR 1360 WFI 960 WRIS 1410 WTDY 910 WRYV 1240 WLSL 610
Pensacola, Fla.	WALK 1370 WPAC 1580 KVLH 1470 KOSB 1500	Port Hueneme, Calif.	WPKC 1410 WPNH 1300 WPLY 1420	Quincy, Wash.	KZPI 1230 KAPI 690 KCSJ 590 KFCF 970 KKAM 1350 KPUB 1420 KWB 1420 KWPU 1580 WPSU 1256 KFUL 1150 WPC 1580	Rochester, N.Y.	WRVJ 1240 WHRF 1570 KACE 1570 KQVO 1450 WXVI 1600 WELR 1360 WFI 960 WRIS 1410 WTDY 910 WRYV 1240 WLSL 610
Peoria, Ill.	WALK 1370 WPAC 1580 KVLH 1470 KOSB 1500	Port Huron, Mich.	WPKC 1410 WPNH 1300 WPLY 1420	Quitman, Ga.	KZPI 1230 KAPI 690 KCSJ 590 KFCF 970 KKAM 1350 KPUB 1420 KWB 1420 KWPU 1580 WPSU 1256 KFUL 1150 WPC 1580	Rockford, Ill.	WRVJ 1240 WHRF 1570 KACE 1570 KQVO 1450 WXVI 1600 WELR 1360 WFI 960 WRIS 1410 WTDY 910 WRYV 1240 WLSL 610
Perry, Fla.	WALK 1370 WPAC 1580 KVLH 1470 KOSB 1500	Port Jervis, N.Y.	WPKC 1410 WPNH 1300 WPLY 1420	Quitman, Miss.	KZPI 1230 KAPI 690 KCSJ 590 KFCF 970 KKAM 1350 KPUB 1420 KWB 1420 KWPU 1580 WPSU 1256 KFUL 1150 WPC 1580	Rockford, Ill.	WRVJ 1240 WHRF 1570 KACE 1570 KQVO 1450 WXVI 1600 WELR 1360 WFI 960 WRIS 1410 WTDY 910 WRYV 1240 WLSL 610
Perry, Ga.	WALK 1370 WPAC 1580 KVLH 1470 KOSB 1500	Port Lavaca, Tex.	WPKC 1410 WPNH 1300 WPLY 1420	Quincy, Wis.	KZPI 1230 KAPI 690 KCSJ 590 KFCF 970 KKAM 1350 KPUB 1420 KWB 1420 KWPU 1580 WPSU 1256 KFUL 1150 WPC 1580	Rockford, Ill.	WRVJ 1240 WHRF 1570 KACE 1570 KQVO 1450 WXVI 1600 WELR 1360 WFI 960 WRIS 1410 WTDY 910 WRYV 1240 WLSL 610
Perry, Iowa	WALK 1370 WPAC 1580 KVLH 1470 KOSB 1500	Portland, Ind.	WPKC 1410 WPNH 1300 WPLY 1420	Racine, Wis.	KZPI 1230 KAPI 690 KCSJ 590 KFCF 970 KKAM 1350 KPUB 1420 KWB 1420 KWPU 1580 WPSU 1256 KFUL 1150 WPC 1580	Rockford, Ill.	WRVJ 1240 WHRF 1570 KACE 1570 KQVO 1450 WXVI 1600 WELR 1360 WFI 960 WRIS 1410 WTDY 910 WRYV 1240 WLSL 610
Perryton, Tex.	WALK 1370 WPAC 1580 KVLH 1470 KOSB 1500	Portland, Maine	WPKC 1410 WPNH 1300 WPLY 1420	Raford, Va.	KZPI 1230 KAPI 690 KCSJ 590 KFCF 970 KKAM 1350 KPUB 1420 KWB 1420 KWPU 1580 WPSU 1256 KFUL 1150 WPC 1580	Rockford, Ill.	WRVJ 1240 WHRF 1570 KACE 1570 KQVO 1450 WXVI 1600 WELR 1360 WFI 960 WRIS 1410 WTDY 910 WRYV 1240 WLSL 610
Peru, Ind.	WALK 1370 WPAC 1580 KVLH 1470 KOSB 1500	Portland, Me.	WPKC 1410 WPNH 1300 WPLY 1420	Raford, N.C.	KZPI 1230 KAPI 690 KCSJ 590 KFCF 970 KKAM 1350 KPUB 1420 KWB 1420 KWPU 1580 WPSU 1256 KFUL 1150 WPC 1580	Rockford, Ill.	WRVJ 1240 WHRF 1570 KACE 1570 KQVO 1450 WXVI 1600 WELR 1360 WFI 960 WRIS 1410 WTDY 910 WRYV 1240 WLSL 610
Petaluma, Calif.	WALK 1370 WPAC 1580 KVLH 1470 KOSB 1500	Portland, Me.	WPKC 1410 WPNH 1300 WPLY 1420	Rainville, Ala.	KZPI 1230 KAPI 690 KCSJ 590 KFCF 970 KKAM 1350 KPUB 1420 KWB 1420 KWPU 1580 WPSU 1256 KFUL 1150 WPC 1580	Rockford, Ill.	WRVJ 1240 WHRF 1570 KACE 1570 KQVO 1450 WXVI 1600 WELR 1360 WFI 960 WRIS 1410 WTDY 910 WRYV 1240 WLSL 610
Peterborough, N.H.	WALK 1370 WPAC 1580 KVLH 1470 KOSB 1500	Portland, Me.	WPKC 1410 WPNH 1300 WPLY 1420	Raleigh, N.C.	KZPI 1230 KAPI 690 KCSJ 590 KFCF 970 KKAM 1350 KPUB 1420 KWB 1420 KWPU 1580 WPSU 1256 KFUL 1150 WPC 1580	Rockford, Ill.	WRVJ 1240 WHRF 1570 KACE 1570 KQVO 1450 WXVI 1600 WELR 1360 WFI 960 WRIS 1410 WTDY 910 WRYV 1240 WLSL 610
Petersburg, Va.	WALK 1370 WPAC 1580 KVLH 1470 KOSB 1500	Portland, Me.	WPKC 1410 WPNH 1300 WPLY 1420	Rails, Tex.	KZPI 1230 KAPI 690 KCSJ 590 KFCF 970 KKAM 1350 KPUB 1420 KWB 1420 KWPU 1580 WPSU 1256 KFUL 1150 WPC 1580	Rockford, Ill.	WRVJ 1240 WHRF 1570 KACE 1570 KQVO 1450 WXVI 1600 WELR 1360 WFI 960 WRIS 1410 WTDY 910 WRYV 1240 WLSL 610
Potosi, Mo.	WALK 1370 WPAC 1580 KVLH 1470 KOSB 1500	Portland, Me.	WPKC 1410 WPNH 1300 WPLY 1420	Railton, Ill.	KZPI 1230 KAPI 690 KCSJ 590 KFCF 970 KKAM 1350 KPUB 1420 KWB 1420 KWPU 1580 WPSU 1256 KFUL 1150 WPC 1580	Rockford, Ill.	WRVJ 1240 WHRF 1570 KACE 1570 KQVO 1450 WXVI 1600 WELR 1360 WFI 960 WRIS 1410 WTDY 910 WRYV 1240 WLSL 610
Potoskey, Mich.	WALK 1370 WPAC 1580 KVLH 1470 KOSB 1500	Portland, Me.	WPKC 1410 WPNH 1300 WPLY 1420	Rapid City, S.Dak.	KZPI 1230 KAPI 690 KCSJ 590 KFCF 970 KKAM 1350 KPUB 1420 KWB 1420 KWPU 1580 WPSU 1256 KFUL 1150 WPC 1580	Rockford, Ill.	WRVJ 1240 WHRF 1570 KACE 1570 KQVO 1450 WXVI 1600 WELR 1360 WFI 960 WRIS 1410 WTDY 910 WRYV 1240 WLSL 610
Philadelphia, Miss.	WALK 1370 WPAC 1580 KVLH 1470 KOSB 1500	Portland, Me.	WPKC 1410 WPNH 1300 WPLY 1420	Raton, N.Mex.	KZPI 1230 KAPI 690 KCSJ 590 KFCF 970 KKAM 1350 KPUB 1420 KWB 1420 KWPU 1580 WPSU 1256 KFUL 1150 WPC 1580	Rockford, Ill.	WRVJ 1240 WHRF 1570 KACE 1570 KQVO 1450 WXVI 1600 WELR 1360 WFI 960 WRIS 1410 WTDY 910 WRYV 1240 WLSL 610
Philadelphia, Pa.	WALK 1370 WPAC 1580 KVLH 1470 KOSB 1500	Portland, Me.	WPKC 1410 WPNH 1300 WPLY 1420	Ravenswood, W.Va.	KZPI 1230 KAPI 690 KCSJ 590 KFCF 970 KKAM 1350 KPUB 1420 KWB 1420 KWPU 1580 WPSU 1256 KFUL 1150 WPC 1580	Rockford, Ill.	WRVJ 1240 WHRF 1570 KACE 1570 KQVO 1450 WXVI 1600 WELR 1360 WFI 960 WRIS 1410 WTDY 910 WRYV 1240 WLSL 610
Phoenix, Ariz.	WALK 1370 WPAC 1580 KVLH 1470 KOSB 1500	Portland, Me.	WPKC 1410 WPNH 1300 WPLY 1420	Rawlins, Wyo.	KZPI 1230 KAPI 690 KCSJ 590 KFCF 970 KKAM 1350 KPUB 1420 KWB 1420 KWPU 1580 WPSU 1256 KFUL 1150 WPC 1580	Rockford, Ill.	WRVJ 1240 WHRF 1570 KACE 1570 KQVO 1450 WXVI 1600 WELR 1360 WFI 960 WRIS 1410 WTDY 910 WRYV 1240 WLSL 610
Philadelphia, Miss.	WALK 1370 WPAC 1580 KVLH 1470 KOSB 1500	Portland, Me.	WPKC 1410 WPNH 1300 WPLY 1420	Raymond, Wash.	KZPI 1230 KAPI 690 KCSJ 590 KFCF 970 KKAM 1350 KPUB 1420 KWB 1420 KWPU 1580 WPSU 1256 KFUL 1150 WPC 1580	Rockford, Ill.	WRVJ 1240 WHRF 1570 KACE 1570 KQVO 1450 WXVI 1600 WELR 1360 WFI 960 WRIS 1410 WTDY 910 WRYV 1240 WLSL 610
Philadelphia, Pa.	WALK 1370 WPAC 1580 KVLH 1470 KOSB 1500	Portland, Me.	WPKC 1410 WPNH 1300 WPLY 1420	Raymondville, Tex.	KZPI 1230 KAPI 690 KCSJ 590 KFCF 970 KKAM 1350 KPUB 1420 KWB 1420 KWPU 1580 WPSU 1256 KFUL 1150 WPC 1580	Rockford, Ill.	WRVJ 1240 WHRF 1570 KACE 1570 KQVO 1450 WXVI 1600 WELR 1360 WFI 960 WRIS 1410 WTDY 910 WRYV 1240 WLSL 610
Philipsburg, Pa.	WALK 1370 WPAC 1580 KVLH 1470 KOSB 1500	Portland, Me.	WPKC 1410 WPNH 1300 WPLY 1420	Rayville, La.	KZPI 1230 KAPI 690 KCSJ 590 KFCF 970 KKAM 1350 KPUB 1420 KWB 1420 KWPU 1580 WPSU 1256 KFUL 1150 WPC 1580	Rockford, Ill.	WRVJ 1240 WHRF 1570 KACE 1570 KQVO 1450 WXVI 1600 WELR 1360 WFI 960 WRIS 1410 WTDY 910 WRYV 1240 WLSL 610
Phillipsburg, Kans.	WALK 1370 WPAC 1580 KVLH 1470 KOSB 1500	Portland, Me.	WPKC 1410 WPNH 1300 WPLY 1420	Reading, Pa.	KZPI 1230 KAPI 690 KCSJ 590 KFCF 970 KKAM 1350 KPUB 1420 KWB 1420 KWPU 1580 WPSU 1256 KFUL 1150 WPC 1580	Rockford, Ill.	WRVJ 1240 WHRF 1570 KACE 1570 KQVO 1450 WXVI 1600 WELR 1360 WFI 960 WRIS 1410 WTDY 910 WRYV 1240 WLSL 610
Pikeville, Ky.	WALK 1370 WPAC 1580 KVLH 1470 KOSB 1500	Portland, Me.	WPKC 1410 WPNH 1300 WPLY 1420	Reading, Pa.	KZPI 1230 KAPI 690 KCSJ 590 KFCF 970 KKAM 1350 KPUB 1420 KWB 1420 KWPU 1580 WPSU 1256 KFUL 1150 WPC 1580	Rockford, Ill.	WRVJ 1240 WHRF 1570 KACE 1570 KQVO 1450 WXVI 1600 WELR 1360 WFI 960 WRIS 1410 WTDY 910 WRYV 1240 WLSL 610
Pine Bluff, Ark.	WALK 1370 WPAC 1580 KVLH 1470 KOSB 1500	Portland, Me.	WPKC 1410 WPNH 1300 WPLY 1420	Reading, Pa.	KZPI 1230 KAPI 690 KCSJ 590 KFCF 970 KKAM 1350 KPUB 1420 KWB 1420 KWPU 1580 WPSU 1256 KFUL 1150 WPC 1580	Rockford, Ill.	WRVJ 1240 WHRF 1570 KACE 1570 KQVO 1450 WXVI 1600 WELR 1360 WFI 960 WRIS 1410 WTDY 910 WRYV 1240 WLSL 610
Pine City, Minn.	WALK 1370 WPAC 1580 KVLH 1470 KOSB 1500	Portland, Me.	WPKC 1410 WPNH 1300 WPLY 1420	Reading, Pa.	KZPI 1230 KAPI 690 KCSJ 590 KFCF 970 KKAM 1350 KPUB 1420 KWB 1420 KWPU 1580 WPSU 1256 KFUL 1150 WPC 1580	Rockford, Ill.	WRVJ 1240 WHRF 1570 KACE 1570 KQVO 1450 WXVI 1600 WELR 1360 WFI 960 WRIS 1410 WTDY 910 WRYV 1240 WLSL 610
Pineville, Ky.	WALK 1370 WPAC 1580 KVLH 1470 KOSB 1500	Portland, Me.	WPKC 1410 WPNH 1300 WPLY 1420	Reading, Pa.	KZPI 1230 KAPI 690 KCSJ 590 KFCF 970 KKAM 1350 KPUB 1420 KWB 1420 KWPU 1580 WPSU 1256 KFUL 11		

WHITE'S RADIO LOG

Location	C.L. kHz	Location	C.L. kHz	Location	C.L. kHz
Saginaw, Mich.	WKNX 1210 WSAM 1210 WSGW 790 WWSR 1420 St. Albans, Vt. WKLC 1300 St. Albans, W.Va. KIGO 1400 St. Anthony, Ida. WFOY 1240 St. Augustine, Fla. WETH 1420 St. Charles, Mo. WIRL 1480 St. Cloud, Minn. KFAM 1450 St. George, S.C. WQIZ 810 St. George, Utah KDKX 1430 St. Helena, Mich. WHIC 1590 St. Helens, Oreg. WDH 1600 St. Ignace, Mich. WIDG 940 St. Johns, Mich. WRBJ 1580 St. Johnsbury, Vt. WTVN 1340 St. Joseph, Mich. WSIJ 1060 St. Joseph-Benton Harbor, Mich. WHFB 1060 St. Joseph, Mo. KFEQ 680 St. Joseph, Mo. KKKJ 1550 St. Louis, Mo. KUSN 1270 St. Louis, Mo. KAZZ 1600 St. Louis, Mo. KSTP 1120 St. Louis, Mo. KSD 550 St. Louis, Mo. KTSJ 690 St. Louis, Mo. KWK 1380 St. Louis, Mo. KXOK 630 St. Louis, Mo. WEW 770 St. Louis, Mo. WIL 1580 St. Louis Park, Minn. KXEN 1010 St. Mary's, Idaho KRSI 950 St. Mary's, Pa. KOFE 1480 St. Paul, Minn. WKBI 1400 St. Paul, Minn. KRSP 1500 St. Paul, Minn. DKWB 630 St. Paul, Minn. WMIN 1400 St. Paul, Minn. WMKT 1370 St. Paul, Minn. WCGO 830 St. Paul, N.C. WBYB 1060 St. Peter, Minn. KRTM 1310 St. Petersburg, Fla. WBA 680 St. Petersburg, Fla. WSN 620 St. Petersburg Beach, Fla. WLCB 1380 Salamanca, N.Y. WGO 1590 Salem, Ind. WJBD 1350 Salem, Ind. WSLM 1220 Salem, Mass. WESX 1230 Salem, Mo. KSMO 1340 Salem, N.J. WJIC 1510 Salem, N.J. WSD 600 Salem, Oreg. KSLM 1390 Salem, Oreg. KAPT 1220 Salem, Oreg. KBZY 1490 Salem, Oreg. KGAY 1480 Salem, Va. WBL 1480 Salida, Colo. KVM 1340 Salina, Kans. KSA 1570 Salina, Kans. KFRM 550 Salina, Kans. KLSI 910 Salinas, Calif. KDON 1460 Salinas, Calif. KOTM 1380 Salinas, Calif. KRSA 1310 Salinas, P.R. KCTY 980-1000 Saline, Mich. WHOY 1210 Salisbury, Md. WOIB 1290 Salisbury, Md. WBOC 960 Salisbury, Md. WIC 1320 Salisbury, Md. WBY 1470 Salisbury, N.C. WSTP 1490 Salisbury, N.C. WSA 1280 Salisbury, Okla. KBSJ 1510 Salmon, Idaho KSR 960 Salt Lake City, Utah KALL 910 Salt Lake City, Utah KCPX 1320 Salt Lake City, Utah KLB 570 Salt Lake City, Utah KNAK 1280 Salt Lake City, Utah KRSP 1550 Salt Lake City, Utah KRGO 1080 Salt Lake City, Utah KSL 1160 Salt Lake City, Utah KSOP 1370 Salt Lake City, Utah KSXX 630 Salt Lake City, Utah KWH 860 San Angelo, Tex. KTEO 1340 San Angelo, Tex. KGKL 960 San Angelo, Tex. KRF 1420 San Angelo, Tex. KWFR 1260 San Antonio, Tex. KAPE 1480 San Antonio, Tex. KBAT 680 San Antonio, Tex. KBER 1150 San Antonio, Tex. KBUC 1310 San Antonio, Tex. KCOR 1350 San Antonio, Tex. KDA 1540 San Antonio, Tex. KUKA 1250 San Antonio, Tex. KMCA 630 San Antonio, Tex. KONO 860	<p>KTSA 550 WOAI 1200</p> <p>San Bernardino, Calif. CKCK 1350 KFXM 590 KRNO 1240 KMEN 1290 WWSMT 1400 KCBQ 1170 KFMB 760 KOGO 600 KGB 1360 KSON 1240 KSDO 1130 KSPT 1400 Sandpoint, Idaho KSTW 1340 Sand Spring, Okla. KTOW 1340 Sandusky, Mich. WMIC 1560 Sandusky, Ohio WLEC 1450 San Fernando, Calif. KGIL 1260 Sanford, Fla. WTRR 1400 KOGO 600 KGB 1360 KSON 1240 KSDO 1130 KSPT 1400 Sandpoint, Idaho KSTW 1340 Sand Spring, Okla. KTOW 1340 Sandusky, Mich. WMIC 1560 Sandusky, Ohio WLEC 1450 San Fernando, Calif. KGIL 1260 Sanford, Fla. WTRR 1400 KOGO 600 KGB 1360 KSON 1240 KSDO 1130 KSPT 1400 Sanford, Me. WSM 1220 Sanford, N.C. WEYE 1290 WWGP 1050</p> <p>San Francisco, Calif. KFRC 610 KCBS 740 KFAX 1100 KGO 810 KNBR 680 KKHI 1550 KSB 1010 KSF 560 KSOL 1450 KYA 1280 KALJ 1430 WFIJ 1060 WSAO 1550 San Jose, Calif. KLOK 1170 KLIV 1590 KEEN 1370 KKRX 1500 WAP 680 WBMJ 1100 WHDA 870 WIAC 740 WIPR 940 WITA 1140 WKAQ 580 WKYM 810 WQBS 650 WRAI 1520</p> <p>San Luis Obispo, Calif. KATY 1340 KSA 1400 KVEC 1400 San Marcos, Tex. KKNY 1470 San Mateo, Calif. KOFY 1050 San Rafael, Calif. KTIM 1510 San Saba, Tex. KBAI 1410 San Sebastian, P.R. WFB 1460 KFWA 1480 KDB 1490 KGUD 990 KIST 1340 KMS 1250 KACL 290 Santa Clara, Calif. KEGL 1430 Santa Cruz, Calif. KSCO 1080 Sante Fe, N.Mex. KTRC 1400 KAPE 810 KVSF 1260 KUM 1440 KSMA 1240 KSEE 1480 KZON 1600 Santa Monica, Cal. KDAY 1580 Santa Paula, Cal. KQIQ 1490 Santa Rosa, Calif. KSR 1350 KVRE 1480 KJAX 1150 KSYX 1420 KREK 1550 WBYZ 1240 WKXY 930 WSAF 1220 WSPB 1450 WYND 1280 WSPN 900 Saratoga Springs, N.Y. WKAJ 900</p> <p>Sauk Rapids, Minn. WVAL 800</p> <p>Sault Ste. Marie, Mich. WSOO 1230 WBYG 1450 WY 900 WVA 630 WSGA 1400 WTOC 1290 WSOK 1230 WORM 1010 WAT 960 WVLF 1260 WVSH 1290 WGY 810 WSNY 1240 WYAL 1280 KFLA 1310 KNEB 960 KLS 1240 WCR 1050 WROS 1330 KDOT 1440</p> <p>Scottsville, Ky. WLCK 1250 Scranton, Pa. WSRM 590 WEJL 630 WGBI 910 WICK 14-0 WSCR 1320 WSUX 1280 KWCB 1300 KSW 930 KAYO 1150 KIXI 910 KING 1090 KIRO 710 KJR 950 KOL 1330 KOMO 1000 KNSD 1590 KTW 1250 KVI 570 KWB 770 KXLE 1050 KOL 1330 WSEB 1340 KDRO 1490</p> <p>Sedalia, Mo. KKSIS 1050 KQED 1580 KWSE 1240 WAW 1340 WHBB 1490 WTQX 1570 WBZB 1090 WDTM 1130 KIKZ 1250 WSAD 1550 Seneca Falls, N.Y. WSWF 1110 Seneca Township, S.C. WSNW 1150 WSEV 930 WJCD 1390 Seymour, Ind. WJED 1238 Shakopee, Minn. KSMN 1400 Shallotte, N.C. WVCB 1410 Shamokin, Pa. WISL 1480 Shamrock, Tex. KBYP 1580 Sharon, Pa. WPCF 790 Shawnee, Wis. WGSV 960 Shawnee, Okla. KGGF 1450 Sheboygan, Wis. WHBL 1330 WKTS 950 WHSF 1290 KSEN 1150 WHS 730 WNS 1390</p> <p>Shelbyville, Ind. WSVL 1520 Shelbyville, Ky. WCND 940 Shelbyville, Tenn. WHAL 1400 WLIJ 1580 KWA 1550 Shell Lake, Wis. WSLW 940 Shelton, Wash. KMAS 280 Shenandoah, Iowa KMA 960 Shenandoah, Pa. WMBT 1430 Sheridan, Wyo. WKYO 1510 KROE 930 KRRT 1500 KFTO 1500 Shippensburg, Pa. WSPH 1480 Show Low, Ariz. KVSL 1590 KVMW 970 KBCL 1220 KEEL 710 KOL 1650 KJOE 1480 KCIJ 980 KRMD 1340 KWKH 1130 KGX 1480 KSID 1340 Sierra Vista, Ariz. WVFR 1850 Sierra Vista, Ariz. KHFF 1420 Sikeston, Mo. KSM 1400 KMP 1520 Siler City, N.C. WNGA 1520 Siloam Springs, Ark. WJLD 1290 Silsbee, Tex. KMAS 300 Silver City, N.Mex. KMSL 1340 Silver Springs, Md. WQMR 1050 Simco, Ont. CFRS 1560 Sinton, Tex. KTD 1590 Sioux Center, Iowa KYDB 1090 Sioux Falls, S.Dak. KNSN 920 KTRI 1470 KSID 1230 KELO 1320 KNWC 1270 KMO 1140 KXRB 1520 KIFW 1230 KSEW 1400 WGMM 1150</p> <p>Sitka, Alaska KCGS 1050 KBGS 1560 WJLD 1290 WJLE 1480 WYNN 1550 KSNY 1450 KSRC 1290 KBRY 790 KSRM 920 WTD 1440 WTLO 1480 WVSC 890</p> <p>Skowhegan, Maine WGHM 1150 Slaton, Tex. KCGS 1050 Sider, La. WJLD 1290 Smithfield, N.C. WJLD 1480 Smithville, Tenn. WJLE 1480 Smyrna, Ga. WYNN 1550 Snyder, Tex. KSNY 1450 Socorro, N.Mex. KSRC 1290 Soda Springs, Idaho KBRY 790 Soldana, Alaska KSRM 920 Somerset, Ky. WTD 1440 WTLO 1480 WVSC 890</p> <p>Soddy, Tenn. WEDG 1240 Sonoma, Calif. KYML 1450 So. Beloit, Ill. WNDU 1480 So. Bend, Ind. WJVA 1580 WBSB 960 WESO 970 Wharf, W.Va. WHLF 1400 So. Weeb 990 South Charleston, W. WRDS 1410 WRDS 1410 S. Daytona, Fla. WELE 1590 So. Gastonia, N.C. WGAS 1420 So. Haven, Mich. WJOR 940 South Hill, Va. WJWS 1370 Southington, Cann. WNTY 990 So. Knoxville, Tenn. WSKT 1580 South Lake Tahoe, Cal. KOWL 1490 KTHO 590 WPFN 796 So. Paris, Mo. WJVA 1480 So. Pittsburg, Tenn. WEG 918 So. St. Paul, Minn. KDWB 630 WPKT 1370</p> <p>So. Williamsport, Pa. WMPT 1450 Spanish Fork, Utah KONI 1480 Sparks, Nev. KBUB 1270 Sparta, Ill. WHCO 1230 Sparta, N.C. WCOK 1060 Sparta, Tenn. WMSJ 1050 Sparta, Wis. WCDW 1280 Spartanburg, S.C. WHCO 1400 WORD 910 WSPA 950 WASC 1530 WJVA 1240 WVRC 1400 KGA 1510 KDNC 1440 KSP 1230 KPEG 1380 WKL 980 KJR 790 KREM 978 KXLY 920 KFGA 1330 KUDY 1280 KBS 1480 KSPR 1590</p> <p>Springdale, Ark. WMTX 1240 Springfield, Ill. WCVS 1450 WMA 970 WTAX 1240 WHPN 580 WRS 1450 WSPR 1270 Springfield, Mo. KGBX 1260 KICK 1340 KTTA 1400 KWT 560 WFE 1420 WBI 1600 Springfield, Ore. KGNW 1120 Springfield-Eugene, Ore. KEED 1450 KORE 1050 WDL 1586 WCF 480 Spring Hill, La. KBSF 1480 Spring Lake, N.C. WFBS 1450</p> <p>Spring Valley, N.Y. WKQW 1300 WTOE 1470 WSTC 1400 KDW 1400 WVRS 1520 WPK 1490 WSSO 1230 State College, Pa. WMAJ 1450 WVRS 1390 Statesboro, Ga. WVNS 1240 Statesville, N.C. WVIC 1400 WDM 550 WTO 1240 WAF 900 Staufford, Va. WAF 900 Stephenville, Tex. KSTV 1510 Sterling, Colo. KGEK 1250 WSDR 1240 Steuersville, Ohio WSTY 1340 Stevens Point, Wis. WSTP 1010 Stillwater, Minn. WAWN 1220 Stillwater, Okla. KSPI 780 Stockton, Calif. KJOY 1280 KSTN 1420 KRW 1230 KAYL 1300 WVZZ 1250 Stoughton, Pa. WVPD 840 Stuart, Fla. WSTU 1450 Stuart, Va. WHEO 1270 Sturgeon Bay, Wis. WDR 910 Sturgis, Mich. WSTY 1340 Sturgis, S.D. KBHB 810 Sturgis, Ark. KWAK 1240 Suffolk, Va. WPKM 1450 Sullivan, Ind. WKQV 1550 Sullivan, Mo. KTU 1560 Sulphur, La. KLS 1300 Sulphur Springs, Tex. KSST 1230</p>			

Location	C.L. kHz	Location	C.L. kHz	Location	C.L. kHz	Location	C.L. kHz
Summersville, Ga.	WGTA 950	Waco, Tex.	WKAC 1010	Wadena, Minn.	KWAD 920	Waukegan, Ill.	WKRS 1220
Summerville, S.C.	WAZS 980	Wadsworth, N.Y.	WVAF 1150	Wadesboro, N.C.	WADE 1210	Waukesha, Wis.	WAUK 1510
Sumner, Wash.	KDFL 1560	Wadena, Minn.	WVAV 1350	Wagoner, Okla.	KWLG 1530	Waukon, Ia.	KNEI 1140
Sumter, S.C.	WFIG 1290	Wadena, Minn.	WVBU 1260	Wailuku, Hawaii	KMY 550	Waupaca, Wis.	WDX 800
Sunbury, Pa.	WKOK 1070	Wadena, Minn.	WVCK 1230	Wailuku, Hawaii	KMY 550	Waupun, Wis.	WRIG 400
Sunnyside, Wash.	KREW 1230	Wadena, Minn.	WVDD 1270	Walla Walla, W. Wash.	KHT 1920	Wausan, Wis.	WVSO 550
Superior, Nebr.	KRFS 1800	Wadena, Minn.	WVDF 1270	Walla Walla, W. Wash.	KHT 1920		
Superior, Wis.	WDSM 710	Wadena, Minn.	WVDT 1270	Walla Walla, W. Wash.	KHT 1920		
	WAKX 1320	Wadena, Minn.	WVDP 1270	Walla Walla, W. Wash.	KHT 1920		
	WJWC 1270	Wadena, Minn.	WVDR 1270	Walla Walla, W. Wash.	KHT 1920		
	WAXK 1320	Wadena, Minn.	WVDS 1270	Walla Walla, W. Wash.	KHT 1920		
	WAXK 1320	Wadena, Minn.	WVDT 1270	Walla Walla, W. Wash.	KHT 1920		
	KSUE 1240	Wadena, Minn.	WVDF 1270	Walla Walla, W. Wash.	KHT 1920		
Susanville, Calif.	WWSJ 1480	Wadena, Minn.	WVDR 1270	Walla Walla, W. Wash.	KHT 1920		
Sutton, W. Va.	WSYL 1490	Wadena, Minn.	WVDS 1270	Walla Walla, W. Wash.	KHT 1920		
Swainsboro, Ga.	WYLR 1370	Wadena, Minn.	WVDT 1270	Walla Walla, W. Wash.	KHT 1920		
Sweet Home, Oreg.	WDEH 1240	Wadena, Minn.	WVDF 1270	Walla Walla, W. Wash.	KHT 1920		
Sweetwater, Tenn.	KXDX 800	Wadena, Minn.	WVDR 1270	Walla Walla, W. Wash.	KHT 1920		
Sweetwater, Tex.	WFEF 1340	Wadena, Minn.	WVDS 1270	Walla Walla, W. Wash.	KHT 1920		
Sylacauga, Ala.	WMLS 1290	Wadena, Minn.	WVDT 1270	Walla Walla, W. Wash.	KHT 1920		
	WMSJ 1480	Wadena, Minn.	WVDF 1270	Walla Walla, W. Wash.	KHT 1920		
Sylva, N.C.	WWSY 1490	Wadena, Minn.	WVDR 1270	Walla Walla, W. Wash.	KHT 1920		
Sylvanilla, Ga.	WAGA 1540	Wadena, Minn.	WVDS 1270	Walla Walla, W. Wash.	KHT 1920		
Sylvestor, Ga.	WHEN 620	Wadena, Minn.	WVDT 1270	Walla Walla, W. Wash.	KHT 1920		
Syracuse, N.Y.	WFBL 1390	Wadena, Minn.	WVDF 1270	Walla Walla, W. Wash.	KHT 1920		
	WNRD 1268	Wadena, Minn.	WVDR 1270	Walla Walla, W. Wash.	KHT 1920		
	WOLF 1490	Wadena, Minn.	WVDS 1270	Walla Walla, W. Wash.	KHT 1920		
	WSFR 570	Wadena, Minn.	WVDT 1270	Walla Walla, W. Wash.	KHT 1920		
Tabor City, N.C.	WTB 1370	Wadena, Minn.	WVDF 1270	Walla Walla, W. Wash.	KHT 1920		
Taoma, Wash.	KMO 1360	Wadena, Minn.	WVDR 1270	Walla Walla, W. Wash.	KHT 1920		
	KTAC 850	Wadena, Minn.	WVDS 1270	Walla Walla, W. Wash.	KHT 1920		
	KTNT 1400	Wadena, Minn.	WVDT 1270	Walla Walla, W. Wash.	KHT 1920		
	KVI 570	Wadena, Minn.	WVDF 1270	Walla Walla, W. Wash.	KHT 1920		
Taft, Calif.	KTGR 1310	Wadena, Minn.	WVDR 1270	Walla Walla, W. Wash.	KHT 1920		
Tahlequah, Okla.	KTLQ 1350	Wadena, Minn.	WVDS 1270	Walla Walla, W. Wash.	KHT 1920		
Tahoe-Valley, Calif.		Wadena, Minn.	WVDT 1270	Walla Walla, W. Wash.	KHT 1920		
	KTHO 590	Wadena, Minn.	WVDF 1270	Walla Walla, W. Wash.	KHT 1920		
Tallahadee, Ala.	WEY 1580	Wadena, Minn.	WVDR 1270	Walla Walla, W. Wash.	KHT 1920		
	WNUZ 1230	Wadena, Minn.	WVDS 1270	Walla Walla, W. Wash.	KHT 1920		
Tallahassee, Fla.	WMEN 1330	Wadena, Minn.	WVDT 1270	Walla Walla, W. Wash.	KHT 1920		
	WMNS 1410	Wadena, Minn.	WVDF 1270	Walla Walla, W. Wash.	KHT 1920		
	WTFY 1450	Wadena, Minn.	WVDR 1270	Walla Walla, W. Wash.	KHT 1920		
	WTNT 1270	Wadena, Minn.	WVDS 1270	Walla Walla, W. Wash.	KHT 1920		
Tallassee, Ala.	WTLS 1300	Wadena, Minn.	WVDT 1270	Walla Walla, W. Wash.	KHT 1920		
Tallulah, La.	KTLD 1160	Wadena, Minn.	WVDF 1270	Walla Walla, W. Wash.	KHT 1920		
Tampa, Fla.	WALT 1310	Wadena, Minn.	WVDR 1270	Walla Walla, W. Wash.	KHT 1920		
	WJWC 1270	Wadena, Minn.	WVDS 1270	Walla Walla, W. Wash.	KHT 1920		
	WYOU 1550	Wadena, Minn.	WVDT 1270	Walla Walla, W. Wash.	KHT 1920		
	WFLA 970	Wadena, Minn.	WVDF 1270	Walla Walla, W. Wash.	KHT 1920		
	WHBO 1050	Wadena, Minn.	WVDR 1270	Walla Walla, W. Wash.	KHT 1920		
	WINQ 1010	Wadena, Minn.	WVDS 1270	Walla Walla, W. Wash.	KHT 1920		
	WTMP 1150	Wadena, Minn.	WVDT 1270	Walla Walla, W. Wash.	KHT 1920		
	WSOL 1308	Wadena, Minn.	WVDF 1270	Walla Walla, W. Wash.	KHT 1920		
	WTOG 1340	Wadena, Minn.	WVDR 1270	Walla Walla, W. Wash.	KHT 1920		
Taos, N. Mex.	WCPS 760	Wadena, Minn.	WVDS 1270	Walla Walla, W. Wash.	KHT 1920		
Tarboro, N.C.	WESR 1330	Wadena, Minn.	WVDT 1270	Walla Walla, W. Wash.	KHT 1920		
Tasley, Va.	WPEP 1570	Wadena, Minn.	WVDF 1270	Walla Walla, W. Wash.	KHT 1920		
Taunton, Mass.	WIOS 1480	Wadena, Minn.	WVDR 1270	Walla Walla, W. Wash.	KHT 1920		
Tawas City, Mich.	KTAE 1280	Wadena, Minn.	WVDS 1270	Walla Walla, W. Wash.	KHT 1920		
Taylor, Tex.	WSSG 1290	Wadena, Minn.	WVDT 1270	Walla Walla, W. Wash.	KHT 1920		
Taylorville, Miss.	WSTH 860	Wadena, Minn.	WVDF 1270	Walla Walla, W. Wash.	KHT 1920		
Taylorville, N.C.	WTLK 1570	Wadena, Minn.	WVDR 1270	Walla Walla, W. Wash.	KHT 1920		
	WTIM 1410	Wadena, Minn.	WVDS 1270	Walla Walla, W. Wash.	KHT 1920		
	WNTT 1250	Wadena, Minn.	WVDT 1270	Walla Walla, W. Wash.	KHT 1920		
Tazewell, Tenn.	WTZE 1470	Wadena, Minn.	WVDF 1270	Walla Walla, W. Wash.	KHT 1920		
Tell City, Ind.	WTOG 1290	Wadena, Minn.	WVDR 1270	Walla Walla, W. Wash.	KHT 1920		
Tempe, Ariz.	KUPD 1080	Wadena, Minn.	WVDS 1270	Walla Walla, W. Wash.	KHT 1920		
	KTUF 1560	Wadena, Minn.	WVDT 1270	Walla Walla, W. Wash.	KHT 1920		
Tempe, Tex.	KTEM 1430	Wadena, Minn.	WVDF 1270	Walla Walla, W. Wash.	KHT 1920		
Terra Haute, Ind.	WBOW 1230	Wadena, Minn.	WVDR 1270	Walla Walla, W. Wash.	KHT 1920		
	WAAC 1300	Wadena, Minn.	WVDS 1270	Walla Walla, W. Wash.	KHT 1920		
	WCOC 740	Wadena, Minn.	WVDT 1270	Walla Walla, W. Wash.	KHT 1920		
	KTER 1570	Wadena, Minn.	WVDF 1270	Walla Walla, W. Wash.	KHT 1920		
	KITE 930	Wadena, Minn.	WVDR 1270	Walla Walla, W. Wash.	KHT 1920		
Ferrell Hills, Tex.	KEYR 890	Wadena, Minn.	WVDS 1270	Walla Walla, W. Wash.	KHT 1920		
Terrytown, Nebr.	KOSY 790	Wadena, Minn.	WVDT 1270	Walla Walla, W. Wash.	KHT 1920		
Texasarkana, Ark.	KTFB 1400	Wadena, Minn.	WVDF 1270	Walla Walla, W. Wash.	KHT 1920		
	KCMC 740	Wadena, Minn.	WVDR 1270	Walla Walla, W. Wash.	KHT 1920		
Texasarkana, Tex.	KATQ 940	Wadena, Minn.	WVDS 1270	Walla Walla, W. Wash.	KHT 1920		
Texas City, Tex.	KTLW 920	Wadena, Minn.	WVDT 1270	Walla Walla, W. Wash.	KHT 1920		
Thayer, Mo.	KALM 1290	Wadena, Minn.	WVDF 1270	Walla Walla, W. Wash.	KHT 1920		
The Dalles, Oreg.	KODL 440	Wadena, Minn.	WVDR 1270	Walla Walla, W. Wash.	KHT 1920		
	KACI 1300	Wadena, Minn.	WVDS 1270	Walla Walla, W. Wash.	KHT 1920		
	KADR 1490	Wadena, Minn.	WVDT 1270	Walla Walla, W. Wash.	KHT 1920		
Thermopolis, Wyo.	KTHB 1240	Wadena, Minn.	WVDF 1270	Walla Walla, W. Wash.	KHT 1920		
	WTWI 1480	Wadena, Minn.	WVDR 1270	Walla Walla, W. Wash.	KHT 1920		
Thief River Falls, Minn.	KTRF 1230	Wadena, Minn.	WVDS 1270	Walla Walla, W. Wash.	KHT 1920		
Thihodaux, La.	KTIB 830	Wadena, Minn.	WVDT 1270	Walla Walla, W. Wash.	KHT 1920		
Thomaston, Ga.	WWT 1220	Wadena, Minn.	WVDF 1270	Walla Walla, W. Wash.	KHT 1920		
	WTGA 1590	Wadena, Minn.	WVDR 1270	Walla Walla, W. Wash.	KHT 1920		
	WTHN 1500	Wadena, Minn.	WVDS 1270	Walla Walla, W. Wash.	KHT 1920		
Thomasville, Ala.	WJDB 630	Wadena, Minn.	WVDT 1270	Walla Walla, W. Wash.	KHT 1920		
Thomasville, Ga.	WPAX 1240	Wadena, Minn.	WVDF 1270	Walla Walla, W. Wash.	KHT 1920		
	WLDR 730	Wadena, Minn.	WVDR 1270	Walla Walla, W. Wash.	KHT 1920		
Thomasville, N.C.	WTNC 790	Wadena, Minn.	WVDS 1270	Walla Walla, W. Wash.	KHT 1920		
Thomson, Ga.	WTWA 1240	Wadena, Minn.	WVDT 1270	Walla Walla, W. Wash.	KHT 1920		
Three Rivers, Mich.		Wadena, Minn.	WVDF 1270	Walla Walla, W. Wash.	KHT 1920		
	WKLM 1510	Wadena, Minn.	WVDR 1270	Walla Walla, W. Wash.	KHT 1920		
	WTHU 1450	Wadena, Minn.	WVDS 1270	Walla Walla, W. Wash.	KHT 1920		
Thurmont, Md.	WIPS 1250	Wadena, Minn.	WVDT 1270	Walla Walla, W. Wash.	KHT 1920		
Ticonderoga, N.Y.	WTF 1690	Wadena, Minn.	WVDF 1270	Walla Walla, W. Wash.	KHT 1920		
Tiffin, Ohio	WTFI 1340	Wadena, Minn.	WVDR 1270	Walla Walla, W. Wash.	KHT 1920		
Tifton, Ga.	WWGS 1430	Wadena, Minn.	WVDS 1270	Walla Walla, W. Wash.	KHT 1920		
	KTIL 1590	Wadena, Minn.	WVDT 1270	Walla Walla, W. Wash.	KHT 1920		
Tilamook, Oreg.	KYGO 1090	Wadena, Minn.	WVDF 1270	Walla Walla, W. Wash.	KHT 1920		
Tioga, N.D.	WRMF 1050	Wadena, Minn.	WVDR 1270	Walla Walla, W. Wash.	KHT 1920		
Titusville, Fla.	WFV 2310	Wadena, Minn.	WVDS 1270	Walla Walla, W. Wash.	KHT 1920		
Titusville, Pa.	WLET 1420	Wadena, Minn.	WVDT 1270	Walla Walla, W. Wash.	KHT 1920		
Toconoco, Mo.	WNES 630	Wadena, Minn.	WVDF 1270	Walla Walla, W. Wash.	KHT 1920		
Toledo, Ohio.	WOHO 1470	Wadena, Minn.	WVDR 1270	Walla Walla, W. Wash.	KHT 1920		
	WSPD 1370	Wadena, Minn.	WVDS 1270	Walla Walla, W. Wash.	KHT 1920		
	WTOD 1560	Wadena, Minn.	WVDT 1270	Walla Walla, W. Wash.	KHT 1920		
	WCWA 1230	Wadena, Minn.	WVDF 1270	Walla Walla, W. Wash.	KHT 1920		
	KTOD 1230	Wadena, Minn.	WVDR 1270	Walla Walla, W. Wash.	KHT 1920		
	KRDS 1190	Wadena, Minn.	WVDS 1270	Walla Walla, W. Wash.	KHT 1920		
Tomahawk, Wis.	WELF 810	Wadena, Minn.	WVDT 1270	Walla Walla, W. Wash.	KHT 1920		
Thompsonville, Ky.	WTKY 1370	Wadena, Minn.	WVDF 1270	Walla Walla, W. Wash.	KHT 1920		
Toepele, Utah	KDYL 990	Wadena, Minn.	WVDR 1270	Walla Walla, W. Wash.	KHT 1920		
Tooele, Utah	WIBW 580	Wadena, Minn.	WVDS 1270	Walla Walla, W. Wash.	KHT 1920		
Topeka, Kans.	KFEI 1440	Wadena, Minn.	WVDT 1270	Walla Walla, W. Wash.	KHT 1920		
	WREN 1250	Wadena, Minn.	WVDF 1270	Walla Walla, W. Wash.	KHT 1920		
	KTOP 1490	Wadena, Minn.	WVDR 1270	Walla Walla, W. Wash.	KHT 1920		
	KENE 1490	Wadena, Minn.	WVDS 1270	Walla Walla, W. Wash.	KHT 1920		
	WTOR 610	Wadena, Minn.	WVDT 1270	Walla Walla, W. Wash.	KHT 1920		
	KGDS 1490	Wadena, Minn.	WVDF 1270	Walla Walla, W. Wash.	KHT 1920		
	WTOW 1570	Wadena, Minn.	WVDR 1270	Walla Walla, W. Wash.	KHT 1920		
	CJAT 610	Wadena, Minn.	WVDS 1270	Walla Walla, W. Wash.	KHT 1920		
	WBRR 1580	Wadena, Minn.	WVDT 1270	Walla Walla, W. Wash.	KHT 1920		
	WTCC 1400	Wadena, Minn.	WVDF 1270	Walla Walla, W. Wash.	KHT 1920		
	KCTN 1800	Wadena, Minn.	WVDR 1270	Walla Walla, W. Wash.	KHT 1920		
	WAT 1300	Wadena, Minn.	WVDS 1270	Walla Walla, W. Wash.	KHT 1920		
	WBUD 1260	Wadena, Minn.	WVDT 1270	Walla Walla, W. Wash.	KHT 1920		
	WTTM 920	Wadena, Minn.	WVDF 1270	Walla Walla, W. Wash.	KHT 1920		
	WTNE 1500	Wadena, Minn.	WVDR 1270	Walla Walla, W. Wash.	KHT 1920		
	KCRT 1240	Wadena, Minn.	WVDS 1270	Walla Walla, W. Wash.	KHT 1920		
	WTBF 970	Wadena, Minn.	WVDT 1270	Walla Walla, W. Wash.	KHT 1920		
	WHAZ 1330	Wadena, Minn.	WVDF 1270	Walla Walla, W. Wash.	KHT 1920		
	WTRY 980	Wadena, Minn.	WVDR 1270	Walla Walla, W. Wash.	KHT 1920		
	WXKW 1600	Wadena, Minn.	WVDS 1270	Walla Walla, W. Wash.	KHT 1920		
	WJRM 1390	Wadena, Minn.	WVDT 1270	Walla Walla, W. Wash.	KHT 1920		
	KTRT 1400	Wadena, Minn.	WVDF 1270	Walla Walla, W. Wash.	KHT 1920		
	KTMN 1530	Wadena, Minn.	WVDR 1270	Walla Walla, W. Wash.	KHT 1920		
	KCHS 1400	Wadena, Minn.	WVDS 1270	Walla Walla, W. Wash.	KHT 1920		
	WTYN 1550	Wadena, Minn.	WVDT 1270	Walla Walla, W. Wash.	KHT 1920		
	KTUC 1400	Wadena, Minn.	WVDF 1270	Walla Walla, W. Wash.	KHT 1920		
	KXEW 1600	Wadena, Minn.	WVDR 1270	Walla Walla, W. Wash.	KHT 1920		
	KAR 1400	Wadena, Minn.	WVDS 1270	Walla Walla, W. Wash.	KHT 1920		
	KCEE 790	Wadena, Minn.	WVDT 1270	Walla Walla, W. Wash.	KHT 1920		
	KIKX 580	Wadena, Minn.	WVDF 1270	Walla Walla, W. Wash.	KHT 1920		
	KCUB 1290	Wadena, Minn.	WVDR 1270	Walla Walla, W. Wash.	KHT 1920		
	KEVT 690	Wadena, Minn.	WVDS 1270	Walla Walla, W. Wash.	KHT 1920		
	KHOS 940	Wadena, Minn.	WVDT 1270	Walla Walla, W. Wash.	KHT 1920		
	KHYT 1330	Wadena, Minn.	WVDF 1270	Walla Walla, W. Wash.	KHT 1920		
	KXT 940	Wadena, Minn.	WVDR 1270	Walla Walla, W. Wash.	KHT 1920		
	KOPD 1450	Wadena, Minn.	WVDS 1270	Walla Walla, W. Wash.	KHT 1920		
	KUAT 1550	Wadena, Minn.	WVDT 1270	Walla Walla, W. Wash.	KHT 1920		
	KTNM 1400	Wadena, Minn.	WVDF 1270	Walla Walla, W. Wash.	KHT 1920		
	KTNR 1490	Wadena, Minn.	WVDR 1270	Walla Walla, W. Wash.	KHT 192		

WHITE'S RADIO LOG

Location	C.L.	kHhz
Williamsport, Pa.	WLYC	1050
	WRAC	1400
	WWPA	1340
Williamston, N.C.	WIAM	900
Williamstic, Conn.	WILI	1400
Williston, N.D.	KEYZ	1360
Willmar, Minn.	KWLM	1340
Willoughby, Ohio	WELW	1330
Willow Springs, Mo.	KUKU	1330
Willows, Calif.	KIGS	1560
Wilmington, Del.	WAMS	1280
	WDEL	1150
	WILM	1450
	WTUX	1290
Wilmington, N.C.	WMFD	630
	WHSI	1490
	WKLM	980
	WGNI	1340

Wilmington, O.	WMWM	1090
Wilson, N.C.	WGTM	590
	WLLY	1350
	WVOT	1420
Winchester, Ky.	WKYK	1380
Winchester, Tenn.	WCDT	1340
Winchester, Va.	WINC	1400
	WHPL	610
Windber, Pa.	WWBR	1350
Winder, Ga.	WIMO	1300
Windermere, Fla.	WVCF	1480
Windom, Minn.	KDDM	1380
Window Rock, Ariz.	KHAC	1300
Windsor, Colo.	KUAD	1170
Windsor, Conn.	WKND	1480
Windsor, N.C.	WBTE	990
Winnemucca, Nev.	KWNA	1400
Winfield, Ala.	WEZQ	1300
Winfield, Kan.	KNIC	1550
Winfield, La.	KVCL	1270
Winnier, S.Dak.	KWYR	1260
Winnisboro, La.	KMAR	1570
Winnisboro, S.C.	WKCM	1250
Winona, Minn.	KWNO	1230
	KAGE	1380
Winona, Miss.	WONA	1570
Winslow, Ariz.	KVNC	1010
	KINO	1230
Winston-Salem, N.C.	WAAA	980
	WAIR	1340
	WCFM	1850
	WSJS	600

	WTOB	1380
	WKBX	1500
Winter Garden, Fla.	WOKB	1600
Winter Haven, Fla.	WSIR	1490
	WABR	1440
Winter Park, Fla.	WABR	1440
Wisconsin, Delis. Wis.	WWDA	990
Wisconsin Rapids, Wis.	WFHR	1320
	WTMB	1460
	WSR	1420
Wolfboro, N.H.	WVCF	1480
Wolf Pt., Mont.	KVCK	1450
Woodburn, Ore.	KWRC	940
Woodbury, Tenn.	WBFB	1540
Wood River, Ill.	WRTH	590
Woodruff, S.C.	WSJW	1510
Woodville, Tex.	KVLL	1220
Woodward, Okla.	KSJW	1450
Woonsocket, R.I.	WNRI	1380
	WWON	1240
Wooster, Ohio	WWST	960
Worcester, Mass.	WAAB	1440
	WEB	1230
	WOCR	1310
	WTAG	580
Worland, Wyo.	KWOR	1340
Worthington, Minn.	KWOA	730
Worthington, Ohio	WRFD	880
Wynne, Ark.	KWYN	1400
Wyoming, Mich.	WERX	1530
Wytheville, Va.	WYVE	1280
Xenia, O.	WELX	1110

Yadkinville, N.C.	WGIC	1500
Yakima, Wash.	WYDK	1480
	KIT	1280
	KMWX	1460
	KBBB	1390
	KBOT	930
	KUTI	980
	KYAK	1390
Yankton, S.D.	KYNT	1450
	WNAX	570
Yaouo, P.R.	WKFE	1550
Yaouo City, Miss.	WAZF	1230
York, Nebr.	KAWT	1370
York, Pa.	WNOW	1250
	WSBA	910
York, S.C.	WYCL	980
Youngstown, Ohio	WBBW	1240
	WFMJ	1390
	WKBN	570
Ypsilanti, Mich.	WSDS	1480
	WYNZ	1520
Yreka, Calif.	KSYC	1490
Yuba City, Calif.	KUBA	1600
	KOBO	1450
Yuma, Ariz.	WYUM	1320
	KVOY	1400
	KYUM	560
Zanesville, Ohio	WHIZ	1240
Zarephath, N.J.	WAWZ	1380
Zebulon-Wendell, N.C.	WETC	540
Zephyrhills, Fla.	WPAS	1400
Zion, Ill.	WZBN	1500

White's World-Wide Shortwave Stations

Prepared by Don Jensen

I heard a country die!

For those who think of SWL'ing mostly in terms of DX programs and QSL's, the tragedy of Biafra, as reflected by its last few broadcasts, should have been an eyeopener. Short-wave radio, as a medium of immediacy, indeed was demonstrated during those days of mid-January. For those DXers, like me, who heard Radio Biafra's death throes, it was an experience not soon forgotten.

I had felt a special closeness to the station since researching the article, "Biafra's Incredible Radio," (Science and Electronics, Dec./Jan. 1969-70). So, with the word that Nigerian forces finally had broken through Biafran defenses, I began carefully monitoring the station's two frequencies, 6,143 and 7,307 kHz.

Sunday, January 11, found the 41-meter Radio Biafra programming normally. Texas DXer Del Hirst noted the foreign service, Voice of Biafra, doing well on 49 meters around 0600 GMT.

But the next day, the town of Orlu, site of

the two transmitters, was overrun, and with it, apparently, the semi-permanent 6,143 kHz. unit, which has not been heard since. Radio Biafra's second station, a portable, truck-mounted rig, was moved to Uga, near the key airstrip at Uli. From there, Biafran General Philip Effiong broadcast his country's capitulation. Throughout the day, the station remained on the air, playing somber music.

When Nigerian planes and artillery blasted the air field to rubble, the station-on-wheels moved again, this time to the remote village of Obolo-Uku, 17 miles southeast of Orlu. While surrender details were being negotiated, Radio Biafra aired mostly music, with a few futile pleas to its people to "keep calm."

I heard a country die!

It was early on the morning of January 14. Tuned to 7,307 kHz., I strained to hear what may have been the last free Biafran broadcast audible in the U.S. Weak and distorted, the uninterrupted program of Negro spirituals was the saddest thing I've heard in over two decades of DXing. Then, as I listened, the faltering signal faded to nothingness.

A few hours later, a column of the Nigerian Third Marine Commandos entered the village and took over the transmitter. Quickly it was incorporated into the federal network. The station continued to operate, but Biafra's incredible radio was dead!

Since then, in an attempt to heal the wounds of war, the government has rehired some 20 ex-Radio Biafra broadcasters. Back in Enugu, they are rebuilding a new network in what now is called Nigeria's East Central State.

"Namba Wan Wailis!" That, in Pidgin English, means quality radio (literally, "number one wireless"). And, today, there's some first class radio listening coming out of the Australian Territory of Papua and New Guinea, thanks to

This Issue's Shortwave Contributors

Bill Berghammer (New York); Gregg Calkin (Ontario); George Schnabel (New York); Gerry Dexter (Wisconsin); Richard Duncan (Arkansas); David Williams (Oregon); Jeff Smith (Michigan); Sam Rowell (Washington); Dan Ferguson (Florida); Bob Hagerman (Michigan); Del Hirst (Texas); Alvin Sizer (Connecticut); Marvin Robbins (Nebraska); Ed Shaw (California); Al Niblack (Indiana); Art Poulis (Massachusetts); Bill Sparks (California); Jack Perolo (Brazil); Craig Koukol (Illinois); Carroll Patterson (Georgia); Bob Wilkner (Florida); Alan Jeeves (Pennsylvania); Bruce Haines (Colorado); Mauri McCoy (Tennessee); Newark News Radio Club (215 Market St., Newark, N.J.); North American Shortwave Association (Box 989, Altoona, Pa.); Gladys Sienkiewicz (Brooklyn, N.Y.).

Science and Electronics Propagation Forecast for June/July 1970

Prepared by C. M. Stanbury II

LISTENER'S STANDARD TIME	ASIA (except Near East)	EUROPE, NEAR EAST & AFRICA (N. of the Sahara)	AFRICA (S. of the Sahara)	SOUTH PACIFIC	LATIN AMERICA
0000-0300	25	31, 41	41, (49), (60e)	41, (49), (60w)	49, 60
0300-0600	31, 41, (49w)	31 (poor)	nil	49, 60, (75), 90	49, 60
0600-0900	25, (41w)	(16), 19	19	25, 31	31
0900-1200	19, 25	(16), 19	19, 25	25	(16), 25
1200-1500	19	(16), 19	19, 25	19	(16), 25
1500-1800	19, (31e)	25, 31	31, 60e	19, 25	(16), 25, 31
1800-2100	16, 19	25, 31	25, 31e, 60, 90w	16, 19	49, 60
2100-2400	16, 19, (31w)	31, 41, 49	60, 90	19, (31w)	49, 60

a governmental agency known as the Administration Broadcasting Service (A.B.S.).

Currently, the A.B.S. operates nine different shortwave stations in the eastern end of New Guinea and neighboring islands. Their job is to broadcast entertainment and educational features to the people of the world's largest island. They program in such exotic languages as Tolai, Toaripa, Medipa, Police Motu, and, of course, Pidgin English.

Quite widely heard in North America are the three 10 kW stations, Radio Rabaul, on New Britain Island, Radio Western District, at Daru, and Radio Wewak, on the north coast of New Guinea. Radio Bougainville (2000 watts), in the Australian-administered part of the Solomons chain, also is being reported fairly regularly.

A brand new outlet, VL8BM, in Port Moresby, came on the air last November. Reportedly the network's key station, it will relay A.B.S. newscasts to the more remote transmitters. The remaining four stations, Radios Kerema, Goroka, Mt. Hagen and Milne Bay, 250-watts each, are rarely heard in the U.S.

CALL, LOCATION	kHz	GMT
VL8BM, A.B.S. Port Moresby	11,880	0100-0200 0430-0530
VL9BR, Radio Rabaul	3,385	0600-1300
VL9CD, Radio Wewak	3,335	0615-1230
VL8BD, Radio Western District	3,305	0645-1200
VL8BK, Radio Kerema	3,245	0700-1200
VL9BA, Radio Bougainville	3,322.5	0700-1200
VL8AS, Radio Milne Bay	3,235	0700-1200
VL9CH, Radio Mt. Hagen	2,450	0730-1130
VL9CG, Radio Goroka	2,410	0700-1200

Here's a rundown on the A.B.S. stations. How many of them can you log?

Eight other A.B.S. stations are on the drawing board, reports DXer Richard Wood in Hawaii. They're planned for Lae, Madang, Kavieng, Popondetta, Mendi, Kundiawa, Vanimo and Kimbe.

And that ought to be enough "namba wan" DX for anyone!

Three Cheers! New Zealand's Mr. DX, Arthur Cushen, who has won more awards than Aunt Martha's apple pies, has chalked up yet another honor, this one from Queen Elizabeth, herself.

In the Queen's New Year Honors, the blind listener from Invercargill was awarded the M.B.E. for community service in broadcasting, journalism and assistance to the visually handicapped. The M.B.E. is the fifth class in the prestigious Order of the British Empire, conferred upon subjects who render outstanding service to the Crown.

A top-ranked listener, Cushen also broadcasts DX programs over Radio New Zealand, and authors hobby articles for "Down Under" radio magazines. He has been active in social work for the blind in his country and serves as V.P. of the Dominion Association of the Blind.

Perhaps his best known humanitarian work has been the establishment of the prisoner of war monitoring service. In various conflicts since World War II, he has monitored POW messages aired by enemy stations and relayed them to loved ones. Often, Arthur's listening provided U.S. families with the first word that their sons and husbands were alive and well in enemy prison camps.

His achievements are too lengthy to list here. His award is well deserved! (Turn page)

WHITE'S SHORTWAVE SECTION

kHz Call Station Name Location GMT

90-Meter Band—3200 to 3400 kHz

3230	VRH8	R. Fiji	Suva, Fiji	0815
3260	—	R-TV Niger	Niamey, Niger	2130
3264	—	R. Clube	Lorenzo Marques, Mozambique	0300
3265	ZFY	R. Demerara	Georgetown, Guyana	0200
3300	—	R. Belize	Belize, Br. Honduras	0300
3316	—	R. Sierra Leone	Freetown, Sierra Leone	0600
3335	VL9CD	R. Wewak	Wewak, New Guinea Territory	1100
3339	—	R. Tanzania	Zanzibar	0330
3346	—	R. Zambia	Lusaka, Zambia	0400
3375	CR6RZ	Emis. Oficial	Luanda, Angola	2150
3380	—	R. Malawi	Blantyre, Malawi	0330
3385	YVQI	R. Barcelona	Barcelona, Venezuela	0330
3385	—	O.R.T.F.	Coyenne, Fr. Guiana	0030
3395	—	R. Clube Conquista	Bahia, Brazil	0100
3885	CR4AA	R. Clube Cabo Verde	Praia, Cape Verde Is.	2200
3905	—	R. Vila	Port Vila, New Hebrides Is.	0700
3999	—	Gronlands R.	Godthab, Greenland	1030

60-Meter Band—4750 to 5060 kHz

4724	—	Burma Bc. Corp.	Rangoon, Burma	1300
4738	HCBK2	R. El Mundo	Guayaquil, Ecuador	0400
4770	ELWA	—	Monrovia, Liberia	0700
4775	—	R. Afghanistan	Kabul, Afghanistan	1300
4785	OAX3V	R. Horizonte	Huanuco, Peru	0445
4800	—	All India R.	Hyderabad, India	1200
4820	—	R. Angola	Luanda, Angola	0500
4825	—	R. Ashkabad	Ashkabad, USSR	0330
4828	—	Rhodesian Bc. Corp.	Gwelo, Rhodesia	0415
4830	YVOA	V. del Tachira	San Cristobal, Venezuela	0130
4872	—	R. Republik Indonesia	Sorong, Indonesia	1320
4885	—	V. of Kenya	Nairobi, Kenya	2045
4920	VLT4	Australian Bc. Corp.	Brisbane, Australia	1315
4932	—	R. Nigeria	Benin City, Nigeria	0500
4976	—	R. Uganda	Kampala, Uganda	2030
5026	—	R. Uganda	Kampala, Uganda	2030
5040	—	R. Valparaiso	Part de Paix, Haiti	0135
5040	—	R. Tblisi	Tblisi, USSR	0200
5040	YVQH	R. Maturin	Maturin, Venezuela	1100
5045	—	Emis. Guine	Bissou, Port. Guinea	2100

49-Meter Band—5950 to 6200 kHz

5980	YSS	R. Nac. El Salvador	San Salvador, El Salvador	0400
5990	—	R. Sweden	Stockholm, Sweden	0100
6005	CP58	R. Progreso	La Paz, Bolivia	0500
6025	—	R. Portugal	Lisbon, Portugal	0200
6040	—	R. Sharjah	Sharjah, Trucial Oman	1500
6050	HRLP	R. America	Tegucigalpa, Honduras	0200
6055	XERM	R. Mexico	Mexico City, Mexico	0300
6060	—	RAI	Calтанisetta, Sicily	0300
6064	—	R. Singapura	Singapore	1100
6070	CFRX	—	Toronto, Canada	1600
6071	—	Thai Nat. Bc. Svc.	Bangkok, Thailand	1100
6085	—	R. Tallinn	Tallinn, USSR	2120
6105	XEQM	R. Yucatan	Merida, Mexico	1200
6125	—	R-TV Belge	Brussels, Belgium	0050
6140	—	V. Revolution	Bujumbura, Burundi	0500

6145	—	Forces Bc. Svc.	Athens, Greece	0500
6150	VLR6	Australian Bc. Corp.	Melbourne, Australia	0830
6155	—	Far East Network	Tokyo, Japan	1100
6165	—	Swiss Bc. Corp.	Berne, Switzerland	0730
6170	—	Philippine Bc. Svc.	Manila, Philippines	1200
6175	—	Vatican R.	Vatican City	0050
6195	4VHW	R. Haiti	Port au Prince, Haiti	1050
6199	—	V. Pathet Lao	Unknown	1130
6252	—	R. Pyongyang	Pyeongyang, N. Korea	1045

41-Meter Band—7100 to 7300 kHz

7043	—	R. Iran	Teheran, Iran	0330
7066	—	R. Tirana	Tirana, Albania	2030
7125	—	R. Warsaw	Warsaw, Poland	1930
7135	—	R. Monte Carlo	Monte Carlo, Monaco	0600
7140	—	R. Republik Indonesia	Ambon, Indonesia	1000
7140	—	British Bc. Corp	Cyprus	0300
7150	—	R. Moscow	Moscow, USSR	0200
7205	CR7RB	R. Pax	Beira, Mozambique	0500
7215	—	American Forces Net.	Taipei, Taiwan	1200
7255	—	V. America Relay	Okinawa	1130
7275	—	V. Nigeria	Lagos, Nigeria	0600
7330	—	R. Moscow	Minsk, USSR	0400
7345	—	R. Prague	Prague, Czechoslovakia	0130

31-Meter Band—9500 to 9775 kHz

9515	XEWW	L.V. de la America Latina	Mexico City, Mexico	0400
9520	VLT9	Australian Bc. Corp.	Port Moresby, Papua Territory	0600
9545	—	Deutsche Welle	Kigali, Rwanda	0330
9550	—	R-TV Belge	Brussels, Belgium	2200
9553	YSS	R. Nac. El Salvador	San Salvador, El Salvador	0230
9570	—	R. Kuwait	Kuwait	0400
9575	YSV	L.V. del Comercio	San Salvador, El Salvador	1300
9585	ZYR56	R. Excelsior	Sao Paulo, Brazil	0100
9600	—	R. Tashkent	Tashkent, USSR	1200
9605	—	Trans World R.	Bonaire, Neth. Antilles	0000
9610	V LX9	Australian Bc. Corp.	Perth, Australia	1130
9620	—	R. Belgrade	Belgrade, Yugoslavia	1600
9680	V LW9	Australian Bc. Corp.	Melbourne, Australia	1200
9700	—	R. Sofia	Sofia, Bulgaria	0030
9710	LRX2	R. El Mundo	Buenos Aires, Argentina	0330
9715	—	R. RSA	Johannesburg, South Africa	0345
9715	—	R. Nederland	Hilversum, Netherlands	2245
9720	—	Swiss Bc. Corp.	Berne, Switzerland	0430
9725	ETLF	R. V. of Gospel	Addis Ababa, Ethiopia	0430
9730	—	R. Berlin International	Berlin, E. Germany	0100
9770	—	Oesterreich R.	Vienna, Austria	0200
9833	—	R. Budapest	Budapest, Hungary	0100
9912	—	All India R.	Delhi, India	2230
9976	—	Yemeni Royalist R.	Unknown	0410
10225	—	V. of the N.L.F.	Unknown	1300

25-Meter Band—11700 to 11975 kHz

11700	—	R. Kiev	Kiev, USSR	0030
11700	—	Vatican R.	Vatican City	1700
11705	—	R. Japan	Tokyo, Japan	2300
11718	XERM	R. Mexico	Mexico City, Mexico	0215
11770	WNYW	R. New York	New York, USA	0200
11780	ZL3	R. New Zealand	Wellington, New Zealand	0600
11780	—	R. Baghdad	Baghdad, Iraq	2045
11790	—	R. Lebanon	Beirut, Lebanon	0230

kHz	Call	Station Name	Location	GMT
11795	—	R. Peking	Peking, China	0330
11796	—	R. Ceylon	Colombo, Ceylon	0215
11800	—	R. Nac. Espana	Teneife, Canary Is.	0345
11810	—	R-TV Algerienne	Algiers, Algeria	0145
11815	—	R. Japan	Tokyo, Japan	2100
11825	—	R. Tahiti	Papeete, Tahiti	0400
11840	—	R. Portugal	Lisbon, Portugal	0330
11850	LLK	R. Norway	Oslo, Norway	2330
11850	—	All India R.	Delhi, India	0200
11855	—	R. Saudi Arabia	Jeddah, Saudi Arabia	0500
11875	—	R. Nac. Nicaragua	Managua, Nicaragua	1730
11890	—	R. Berlin International	Berlin, E. Germany	0300
11905	—	RAI	Rome, Italy	1630
11935	—	R. Portugal	Lisbon, Portugal	0400
11940	—	R. Kuwait	Kuwait	1630
11948	ZPA5	R. Encarnacion	Encarnacion, Paraguay	0200
11975	—	Windward Is. Bc. Svc.	St. George's, Grenada	0100

19-Meter Band—15100 to 15450 kHz

15010	—	V. of Vietnam	Hanoi, N. Vietnam	2000
15095	—	R. Peking	Peking, China	2330
15095	ELWA	—	Monrovia, Liberia	2100
15105	—	R. Japan	Tokyo, Japan	2000
15115	—	Windward Is. Bc. Svc.	St. George's, Grenada	2130
15120	—	R. Ceylon	Colombo, Ceylon	0200
15125	—	ORTF	Paris, France	1830
15145	ZYK33	R. Jornal do Comercio	Recife, Brazil	0200
15160	TAU	R. Ankara	Ankara, Turkey	1300
15165	OZF7	R. Denmark	Copenhagen, Denmark	1300
15185	OIX4	Finnish Bc. Corp.	Pori, Finland	2330
15220	—	R. RSA	Johannesburg, South Africa	0300

kHz	Call	Station Name	Location	GMT
15274	CXA18	SODRE	Montevideo, Uruguay	0200
15315	ETLF	R. V. Gospel	Addis Ababa, Ethiopia	1430
15345	BED49	V. Free China	Taipei, Taiwan	0310
15345	—	R. Havana Cuba	Havana, Cuba	1830
15420	—	Southeast Asia R.V.	Manila, Philippines	0000
15432	—	V. Free Korea	Seoul, Korea	0330
15440	—	Far East Bc. Corp.	Manila, Philippines	2330
15570	—	R. Pakistan	Dacca, Pakistan	0200

16-Meter Band—17700 to 17900 kHz

17700	—	R. Peking	Peking, China	0100
17780	HCJB	V. Andes	Quito, Ecuador	1915
17805	—	R. RSA	Johannesburg, South Africa	0545
17810	—	R. Nederland	Hilversum, Netherlands	1800
17810	DZ16	Far East Bc. Corp.	Manila, Philippines	0100
17855	—	R. Havana Cuba	Havana, Cuba	2000
17900	—	British Bc. Corp. Relay	Tebrau, Malaysia	0030
17945	—	R. Pakistan	Karachi, Pakistan	1300

13-Meter Band—21450 to 21750 kHz

21480	—	R. RSA	Johannesburg, South Africa	1845
21485	—	Vatican R.	Vatican City	1200
21540	—	Swiss Bc. Corp	Berne, Switzerland	1830
21580	—	R. Cairo	Cairo, Egypt	1330
21585	—	R. Sweden	Stockholm, Sweden	1630
21605	—	R. Afghanistan	Kabul, Afghanistan	1200
21630	—	R. Kuwait	Kuwait	1630
21720	—	R. Ghana	Accra, Ghana	1600

White's Emergency Radio Station Listings for DETROIT AREA

SCIENCE AND ELECTRONICS furnishes this exclusive listing of emergency radio stations as an aid to our many readers now engaged in the fascinating and rapidly growing hobby of monitoring emergency radio communications. We have and will be publishing similar lists devoted to different metropolitan areas in forthcoming issues so that you'll be able to accumulate a sizable array of this difficult-to-obtain data. Refer to the index on page 79 for our 1969/1970 pro-

gram of emergency radio station listings.

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

All frequencies are megahertz (MHz) unless otherwise noted.

DETROIT CITY POLICE

Bases									
KDS289	37.06								
KLJ201	453.375								
KQA262	155.37								
KQA371	39.10 154.86 155.37 156.21 159.09 159.21 453.25								
	453.30 453.35 453.55 453.75 453.80								
KQA414	154.86 155.37 156.21 159.09 159.21 453.25 453.30								
	453.35 453.55 453.70 453.75 453.80								
KQB953	39.06 39.28 154.86 154.92 155.37 156.21 159.09								
	159.21 453.25 453.30 453.35 453.55 453.70 453.75 453.80								
KOE228	159.21								
KOE429	154.86 155.37 156.09 156.21 159.09 159.21								
KOE641	154.86 155.37 156.21 159.09 159.21 453.25 453.30								
	453.35 453.55 453.75 453.80								
KQI289	159.09 453.30 453.35 453.55 453.75 453.80								
Mobile unit channels:	37.06 37.38 39.06 39.10 154.65 154.92								
	155.85 156.03 156.09 156.15 158.91 158.97 168.625 458.25								
	458.35 458.375 458.55 458.70 458.75 458.80								

DETROIT CITY FIRE DEPARTMENT

Bases					
KQA205	154.31 154.40				
KQE664	154.31			KQF382	154.31
KQE911	154.37			KQF489-99	154.31
Mobile unit channels:	153.95 154.37 154.40				
Walkie Talkie channel:	153.83				

MUNICIPAL AGENCIES

Town	Police	Fire
Algonac	KI2333 154.815	KNG514 154.37
Allen Park	KQB291 155.49	KDB915 154.22
Almont	KCY556 39.10	KQB462 46.42
Ann Arbor	KQB271 155.55	KQJ322 154.25
Ann Arbor Twp		KQJ863 154.25
Armada	KQF234 39.90	KL5499 154.13
Ash Twp		KCX388 154.43
Atlas Twp	KGJ709 155.37	KQJ557 154.19

DETROIT AREA

Town	Police	Fire
Auburn Hts		KQC509 154.43
Augusta Twp		KQJ728 154.25
Bedford Twp		KQG247 154.43
Berkley	KQE771 155.01	
	KQE771 155.37	
Berlin Twp		KJS669 154.43
Birmingham	KQB232 155.655	KQC970 154.34
		KOE740 154.34
Blissfield	KQA278 42.58	KFB972 154.43
Bloomfield Hills	KQB325 155.655	KQJ733-4 154.43
Bloomfield Twp	KQD700 155.655	KCS992 154.43
		KQJ732 154.43
		KQD273 154.01
Brighton	KQA261 42.58	
Britton	KQH630 155.31	
Canton Twp		KQE971 154.37
Carleton		KCX388 154.43
Center Line	KCO352 39.78	KQG390 154.13
	KCO352 39.90	
Chelsea		KQJ520 154.25
Chesterfield Twp		KQG391 154.13
Clarkston		KQH448 154.43
Clawson	KQC428 155.595	KQG319 154.43
Clinton		KLP885 154.43
Clinton Twp		KQF484 154.13
Commerce Twp		KQF907 154.43
Comstock		KQD209 154.43
Davisburg		KCN662 154.43
Dearborn	KQA878 158.85	KAT353 154.16
Dearborn Hts	KLG482 155.37	KQF504 154.37
		KQG722 154.37
Deerfield Twp		KCI547 154.43
Dexter		KQJ831 154.25
Dundee	mobiles 37.02	KBG295 154.43
Durand	KBO754 155.37	
East Detroit	KQF238 155.91	KQD789 154.13
Ecorse	KQA480 155.49	KCI1473 154.22
Eloise	KQG781 155.37	
Erie Twp		KET204 154.43
		KQE213 154.43
		KJY710 154.43
		KQH268 154.37
Fair Haven		KDE251 154.43
Farmington	KQA549 155.37	KDJ576 154.43
	KQA549 155.415	
	KQA549 155.73	
Farmington Twp	KCX967 155.415	
Fenton	KQB515 154.80	
Ferndale	KQF367 154.74	KQF229-30 154.34
	KQF367 155.01	
	KET341 45.18	
Flat Rock		KQH289 154.43
Ft. Gratiot		KQD557 154.37
Franklin	KLE904 155.655	KQG259 154.43
Fraser	KDQ290 39.90	KQG867 154.13
Frenchtown Twp		KQD536 154.43
Gaines		KQD475 154.19
Garden City		KCN831 154.37
Gibraltar	KQH936 39.02	KQF474 154.43
Goodells	KQB272 39.10	
	KQF99 159.03	
Goodrich	KGJ709 155.37	KQJ557 154.19
	KJY903 155.37	
Grand Blanc Twp	KJ1586 155.61	KQF223 154.19
Grosse Isle	KQG740 32.02	KCY223 154.43
Grosse Pt Farms	KQA437 154.95	KDP974 154.445
Hamburg		KAY255 154.01
Hamtramck	KQA694 155.61	KCY634 153.89
	KQD705 155.61	
Harrison Twp		KBA633 154.13
		KQE537 154.13
Horsens Island		KQE718 154.37
Hazel Park	KQD400 155.01	KQE958 154.34
Highland Park	KQA329 155.25	KQP217 153.89
Hinmans Corners		KFD503 154.43
Holloway		KDG873 154.43
Holly	KQC671 155.73	KDQ235 154.43
Howell	KQG559 37.10	
Huntington Woods	KQD713 155.01	
Ida Twp		KQE481 154.43
Inkster	KJW486 154.815	KQE214 154.37
Keego Harbor	KCI608 155.73	KQD957 154.43
Kimball Twp		KQH445 154.37
		KQE716 154.37
		KBC207 154.43
Lake Orion	KQD498 155.37	
	KQD498 155.73	
Lambertville		KQH986 154.43
LaSalle Twp		KQI245 154.43
Lathrup Village	KQG546 158.79	
Lincain Park	KQC632 155.49	KQE762 154.22
Linden		KQF585 154.19
Livonia		KFA452 154.37
	KGL477 155.875	KF999 154.37
	KQB717 155.79	KFB999 154.205
		KQE262 154.37

Town	Police	Fire
Luna Pier		KQF616-7 154.37
Macomb Twp		KCU827 154.43
Madison Hts	KQD915 155.01	KQB864 154.13
Manchester Twp		KJP445 154.34
Marine City		KLJ242 154.25
Marysville		KQH269 154.37
Maybee		KQE350 154.37
Melvindale	KQB532 155.49	KOE538 154.43
Memphis	mobiles 39.10	KDN933 154.22
Milan	KL1261 37.10	KOE720 154.37
Milford	KQF485 155.73	KQH369 154.43
		KCI679 154.43
Monroe	KQA929 37.10	KQJ751 154.43
		KQB416 154.43
		KQF293 154.43
		KQD536 154.43
		KQG827 154.43
		KQF944 154.43
Mt Clemens	KQF238 155.91	KQB944 154.07
		KBA633 154.13
		KQB945 154.13
		KOE537 154.13
		KQF227 154.13
		KQF484 154.13
		KQF864 154.13
		KQG391 154.13
New Baltimore	KQB274 39.90	
New Boston	mobiles 42.58	
	mobiles 42.74	
New Haven	KGV354 39.90	KQF922 154.13
Newport		KJS669 154.43
Northfield Twp		KQJ729 154.25
Northville	KDX470 155.13	KET203 154.37
Novi	KQE809 155.73	KDK655 154.43
Oak Park	KQD361 158.79	
Orchard Lake	KQD806 155.37	KLS647 154.43
Orion Twp		KBC207 154.43
Ortonville		KQG353 154.43
Ottawa Lake		KQH295 154.43
		KJS555 154.43
Oxford	KQF800 155.73	KAP373 154.43
Petersburg		KQD717 154.43
Pickney		KGV244 154.01
Pittsfield Twp		KCW728 154.25
Pleasant Ridge	KQD711 155.01	
Plymouth	KQA379 155.13	KDA434 154.37
		KQE267 154.37
		KQK539 154.37
Pontiac	KQB233 155.37	KBX619-22 154.34
	KQB246 155.73	KDQ208 154.34
	KJH268 155.685	KQC472 154.43
		KQF909 154.43
		KLR459 154.34
Pontiac Twp		KQF709 154.34
		KQC509 154.43
		KQC427 154.43
		KQF909 154.43
Port Huron	KQB272 39.10	KQD557 154.37
	KQG20 155.07	KQD565 154.37
	KQF99 159.03	KQE721 154.37
		KGV244 154.01
Putnam Twp		KDG873 154.43
Raisin		KQF960 154.19
Rankin		KQE911 154.37
Redford		
Richmond	KQE285 155.37	
Ridgeway Twp	KQH630 155.31	
Riga Twp		KLL747 154.43
River Rouge	KQA970 155.49	KQF850 154.22
Riverview	KQH308 39.02	
Rochester	KQ8851 155.73	
Rockwood	KGN531 45.18	KQE407 154.43
Romeo	KQ8720 39.90	KSC990 154.13
Romulus		KBH353 154.43
Roseville	KQA465 155.91	KBE834 154.13
		KQD401 154.13
Royal Oak	KQA673 154.74	KQD233 154.34
	KQA673 155.01	KQE494-6 154.34
Royal Oak Twp	KQD916 155.01	
St Clair		KDK750 154.37
		KQD565 154.37
St Clair Shrs	KQF291 155.31	KQD450 154.13
	KQF291 155.91	KQE663 154.13
		KDN591 154.25
Salem		KQJ521 154.25
Saline	KDE702 37.10	KFD503 154.43
Sciofield		KQI288 154.13
Shelby Twp	KQF959 39.90	KQF445 154.37
Smiths Creek		KFD503 154.43
Southard		KCI474 154.22
Southgate	KQC815 155.49	
South Lyon	mobiles 42.74	
Sparlingville		KQE716 154.37
Sterling Hts		KQI251 154.13

Town	Police	Fire
Summerfield		KQD717 154.43
Superior Twp		KQE406 154.37
Sylvan Lake	KQG766 155.73	
Taylor Twp	KDX561 155.67	KDK371-3 154.37
	KQA897 155.67	
	KQB876 155.67	
	KOD712 155.67	
	KQE836 155.31	
Tecumseh		KBJ210 154.43
Temperance		KQE247 154.43
Trenton	KQA796 39.02	KCO337-8 154.22
Troy	KQD359 155.595	
Utica	KQW749 39.90	KQE449 154.13
	KQB865 39.90	KQF344 154.13
	KQF959 39.90	KQI251 154.13
		KQI288 154.13
		KBC657 154.43
Walled Lake	KJN633 155.73	
	KQF867 155.73	
Warren	KGB275 453.13	KQD459 154.13
		KQD459 453.45
		KQG471-2 154.13
		KQF689 154.13
		KQH451 154.13
		KHH33-7 458.45
Washington		KCO342 154.13
Waterford Twp	KQE246 155.73	KCX992 154.43
		KQC357 154.43
		KQC948 154.43
Wayne	KQE692 155.37	KQB747 154.37
W Bloomfield Twp	KGL582 155.415	KLS647 154.43
		KQD957 154.43
Westland	153.875	KCZ849 154.37
	KIZ656 154.815	KFG546-7 154.37
Whiteford Twp		KQH295 154.43
		KQJ555 154.43
White Lake Twp	KCX968 155.73	KQD499 154.43
Whitmore Lake		KQJ729 154.25
Whittaker		KQJ728 154.25
Wolverine Lake	KJN663 155.73	
Woodhaven		KJO207 154.43
Wyandotte	KQA971 155.49	KBD914 154.22
Ypsilanti	KDX474 37.10	KDL917 154.25
	KQA226 155.13	KQA976 154.37
		KQE406 154.37

COUNTY AGENCIES

Genesee County	Police	Fire
Flint	KQB863 155.61	KQF239 154.19
	KQB863 155.83	
Lapeer County		
Lapeer	KBH349 39.10	KBG529 46.42
	KBH349 39.14	
Lewancee County		
Adrian	KQA802 155.31	
Tecumseh		KQK352 154.43
Livingston County		
Howell	KQE758 37.10	KCF947 154.01
Macomb County		
Mt Clemens	KQA783 39.90	
	158.79	
Romeo	KFN552 39.90	

Town	Police	Fire
Monroe County		
Monroe	KQA929 37.10	KQG944 154.43
Oakland County		
Milford	KQC752 155.73	
Pontiac	KQF725 155.73	
St Clair County		
Port Huron	KDA721 39.10	KQD565 154.37
Shiawassee County		
Corunna	KDQ269 155.43	
Washtaw County		
Ann Arbor	KQH905 37.10	
Ypsilanti	KDX474 37.10	
Wayne County		
Detroit	KLE916 155.37	
	KQE653 155.70	
	KQE653 159.15	
	KQG781 155.37	
	KQE957 155.37	
	KFM343 155.58	
	KFM343 155.70	
	KFM343 159.15	
	KQE692 155.37	
	KQB611 155.70	
	KQB611 159.15	

STATE AGENCIES

State Fire Conservation networks: 44.64 44.72
 44.80 46.25 151.25 151.295 Repeaters: 171.425 171.575

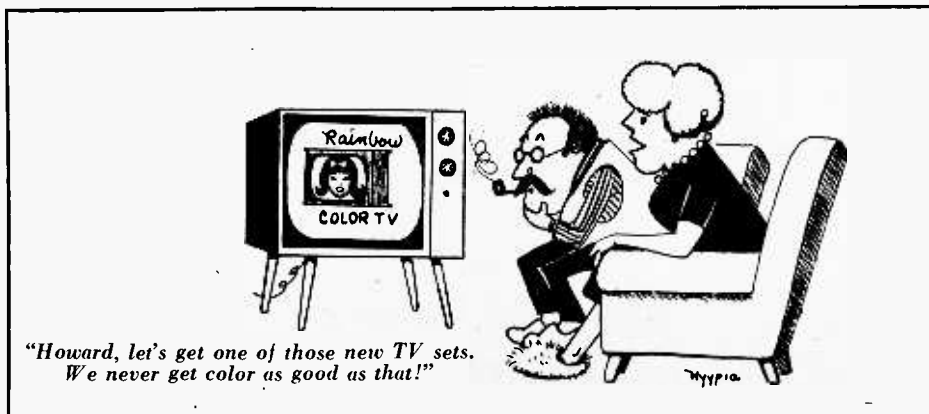
State Hospital Police

Ypsilanti 37.10

Michigan State Police (Detroit area)

Bad Axe KOA272 42.58 42.68
 Brighton KOA261 42.56 42.58
 Clinton KOA276 42.58 42.68
 Detroit KOA262 42.48 42.58 154.665
 KOA20 75.98
 Erie KOA277 42.48 42.58
 Flat Rock KOA266 42.48 42.58
 Inkster KJD940 154.935
 Pontiac KOA269 42.48 42.58
 Romeo KOA263 42.48 42.58
 St Clair KOA264 42.48 42.58
 Sterling Twp KOD796 42.58
 Warren KOA265 42.48 42.58
 Ypsilanti KOA267 42.48 42.58
 portable unit KOA931 42.48 42.56 42.58 42.68
 portable unit KQE228 37.10 39.10 39.42 39.58 39.82
 39.90 42.48 42.56 42.58 42.68
 155.01 155.07 155.19 155.25
 155.49 155.55 155.61 155.73
 155.79 156.21 158.85 159.09
 159.21

Mobile unit frequencies (Detroit area): 39.10 42.48 42.56
 42.58 42.68 154.92 154.935



Visulert

Continued from page 48

support them away from the metal to prevent shorts. Before soldering electrolytic capacitors and diodes, check to be sure that you have them properly polarized. Also, doublecheck that connections to Q1 and Q2 are correct before soldering to avoid application of too much heat, if you must unsolder and resolder them, since excessive heat can damage solid-state devices. In fact, we recommend that you use an alligator clip as a heat sink by temporarily clipping it to each lead being soldered.

Remote Lamp. In the event you require a brighter lamp than the standard bulb listed, or want the lamp located on a wall or site outside the area of the telephone—where it can be universally observed—make the following modification. Remove the bulb and connect the leads to terminal strip TB1 for connecting the remote lamp control leads. Mount a 6.3-VAC relay, a standard 110-V lamp socket, and TB2 in a container suitable for the remote location. Wire it as shown in the schematic. By using low voltage (6.3 VAC) the interconnecting remote control leads can be small-sized insulated wire. The 6.3 V that is switched by the SCR (Q2) to turn the low voltage lamp *on* and *off* will now be used to operate the remote relay, which will, in turn, control 117 VAC to the larger lamp bulb.

Checking Out Visulert. After doublechecking your hookup for possible errors, shorts, or cold soldered connections, plug the power

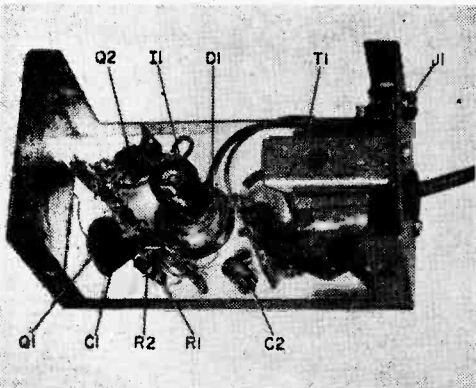


We used conventional round magnetic phone pickup. You may have a flat version available that can be conveniently placed under phone.

cord into an AC outlet, and plug magnetic pickup MPI into J1. Now bring the pickup near power transformer T1. If the unit is working correctly the radiated AC field around the transformer will produce a signal in the magnetic pickup device, triggering the SCR (Q2) to turn *on* lamp I1. Each time you move the pickup close to the transformer, the lamp will be lit; as you move MPI away from T1's magnetic field, the lamp will go out. When this checkup has been completed you can close up the mini-box and place Visulert in service.

Using Visulert. The suction cup on the pickup coil we used serves a dual purpose. It permits you to easily orient MPI into the magnetic field of the telephone ringer and also holds it in position once the ideal location is found. If the pickup you use is one of the flat types, place it under the phone near the exit of the handset cable.

Regardless of the type, you'll have to move the pickup around the base of the phone to locate the magnetic field of the ringer. Remember, of course, the only time you can locate the pickup is when the phone is ringing. Reason is that Visulert's operation is dependent upon the relatively high magnetic field of the ringer to develop a control signal to fire the SCR. ■



You can see how all of unit's parts are mounted either to tie strips or directly to mini-box in this opened up view of Visulert.

The Skies Above Us

Continued from page 16

following day, Sunday. This is the source of the solemn yet jubilant spring celebration of Christendom, Easter, as the Passover is solemn yet jubilant for Judaism, in the spring.

☆ Astronomers can date these events quite easily, by looking back to their records of the dates of full moons in those days. There is only one year during the later life of Jesus when the beginning of Passover fell on Thursday, and that was 30 A.D., in our present reckoning. The date was April 6. The Resurrection then, occurred on Sunday, April 9, 30 A.D.

☆ The early converts to Christianity were sharply divided between those of Jewish ancestry and the Gentiles. Those of the first group insisted that, inasmuch as the Resurrection had occurred three days after the Passover evening, the celebration of Easter should always be so dated. But the Gentiles insisted that it should always be on the day following the Sabbath after the Passover—that is, always on Sunday.

Finally, a compromise was adopted. Easter should be the first Sunday following the first full moon that falls on or after March 21. But this sometimes results in an Easter date before the Passover, as in 1970, when Easter is celebrated on March 29 and the Passover begins in the evening of April 20, which is the beginning of April 21, in the traditional Jewish daily

reckoning, sunset to sunset. Except for the tricky wording of the Easter rule, the date could have been even earlier in 1970, because there is a full moon on March 22. But that falls on a Sunday, and the rule states that Easter must be on the Sunday *after* that first full moon *on or after* March 21. So Easter had to be set on March 29.

☆ The dates of both the Passover and Easter (earliest on March 22, latest on April 25) can, as we have seen, wander through several weeks, yet the events they commemorate occurred on definite days. Because of its link with Passover during the life of Jesus, the dates of the Last Supper and the events that followed in the next few days have been definitely established. Perhaps scholarly archaeological and historical work will someday establish the exact date in the year of the seasons when the Israelites fled from Egypt. Is it too much to hope that we may settle on the full moon next after March 21 as the beginning of Passover and on the Sunday following that as the date of Easter, just as a beginning?

☆ Of one thing we can probably be sure. Our calendars, based upon primitive astronomy and the desire to preserve ancient traditions, have not completed their evolutions. As any other timekeeper, a calendar should appeal to the needs of the people, and irregularity and mystical jumping through the days of the year of the seasons is something that is distracting and sometimes even damaging in our tightly-gear'd modern world which would seem to thrive best on regularity. ■

DXers' Old Mexico

Continued from page 65

quencies (VHF), reception is ordinarily limited to line-of-sight range. TV and FM DXing is a whole story itself, but suffice it to say that during the early summer months, and to a lesser degree, during the post-Christmas period, long-haul logging is possible, via E-skip ionospheric propagation. With a single skip of up to about 1500 miles, the Mexican border FM-TV stations are possible catches for many in the States. At least two hops of the signals are needed to receive the Mexico City stations—and this is rare, indeed!

Another form of VHF propagation, tropospheric bending, can bring the border stations to American TV screens located up to 400-500 miles away. A word of caution, though. Don't be fooled into thinking that any FM-TV program you hear in Spanish

is from a Mexican station. It could be, but some U.S. stations have some Spanish-language programming, too. Moral: Don't jump to conclusions!

If you live in the southwest, your chances of logging Mexican TV or FM are pretty good. Elsewhere, you're up against the vagaries of ionospheric propagation. But, with luck, one day you may experience the thrill of seeing "XEFB-TV, Monterrey, canal 3," flash across your boob-toob! ■

Ham Traffic

Continued from page 66

lows in the Indianapolis area who wanted to obtain ham tickets, or to obtain higher class tickets than they already had.

Reports W9DIW: "It's much easier for a group to make progress than trying it by one's self. The credit must go to W9SFU for his patience and trouble." ■

Men of Science

continued from page 36

the Royal Society of London and a prize of 3000 francs from the Paris Institute—quite a bundle of honors for an apothecary's son.

Hans began working in his father's shop at 12, so had little formal schooling before he entered the University of Copenhagen in 1793. His father had hoped he would be a poet and found it hard to conceal his disappointment when the youth chose to study for a Doctor of Medicine degree.

He won his diploma but never established a practice. Instead he wandered about Europe for several years before returning home and accepting a post as Professor of Physics in the University of Copenhagen.

After his one shining hour, his life became rather drab. True, he instituted lectures to females in spite of community objections. And he managed to publish a few essays and a notably unsuccessful book on *The Soul in Nature*.

Oh, yes. In 1825 he claimed to have produced a new and rare metal by chemical process. Thing is, scientists discounted his report since they failed to get the same result when they went through the process briefly outlined in a published report.

Late in life he tried (without success) to measure the compressibility of water, reluctantly admitted to himself that his only significant achievement hinged on that classroom discovery made many years earlier.

When Oersted died, students honored him with a parade. As a special tribute, they laid a wreath of genuine silver on his coffin.

Had they been able to see into the future, however, they would have known that silver was totally inappropriate. For within months after his death, new techniques made it possible to actually produce a small quantity of the metal which Oersted had babbled about in 1825. The first object ever made of it was a rattle for Napoleon III's infant son; today, world production ranges above 6,000,000 tons annually.

With the light metal firmly established as a basic resource for modern technology, detailed notes by Oersted were rediscovered along about 1920. Repeating step by step the exact procedures he had followed nearly a century earlier, it was established that the father of electromagnetism was also the discoverer of aluminum. ■

NutZee

Continued from page 76

up a jack as shown in our drawing.

Suppose you have a component stereo system capable of driving low-efficiency speakers and you want to switch from them to your NutZees. In this case you would use a remote speaker switch and an L-pad. An L-pad is necessary because it cuts down the amount of watts delivered to NutZee. Without it, you stand a chance of burning out your NutZee the first time you switch from the component speaker system.

The L-pad, a Lafayette 99T6134 or equivalent, can be any wattage rating; just make sure that it will work with an 8-ohm speaker. You probably won't have to crack it open very far, owing to NutZee's ability to deliver bull-sized sound from flea-sized power.

When you're shopping for the remote speaker switch, pay particular attention to the switch's intended use. Some switches, like the Lafayette 99E01752, work with solid-state systems, but others, such as Lafayette's 99E00838, will mate only with tube-driven equipment. Here's the difference: transistorized amplifiers need a make-before-break switch but tubed amplifiers like to see a constant load at the output terminals. Our drawing explains the remote switch/L-pad arrangement.

You may wish to wall-mount your NutZees; the procedure is sheer simplicity. Merely locate another plastic top (from another peanut can) and thumbtack it to the wall. Now span NutZee's bottom in, and prepare yourself for a canned music treat. ■

Bookmark

Continued from page 12

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