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POSITIVE FEEDBACK

Julian M. Siemkiewicz, Editor

Moustache Wax, Anyone? I know it will happen! Someone will write the Editor, asking whether or not the moustache worn by Gene Cashman on our cover this issue is for real. In the interests of honest reporting I must state the moustache is not real. However, Gene was sporting the bristly ends of a rudimental moustache indicating he lost the original about election time. I tried to pry the truth from him as to why the upper lip was shorn clean, but Gene refused to reply with fingers pressed to our Fickle Finger Finder. To understand why Gene feared the Fickle Finger Finder you only have to put one together. Complete plans are given in this issue, starting on page 39. You'll find the Fickle Finger Finder fantastic for fun or fame!

It's The Greatest! Leafing through page after page of the latest Hi-Fi Buyers' Guide here in Big City Editor's office, my hurdle is how to convince my readers that this book is every bit as great as I think it is. I'll begin by saying that this is a magazine with a difference, designed to help you, the buyer, pick the hi-fi components that are right for you. It's packed with test reports on stereo equipment of all kinds, reports that tell you exactly how each and every piece of equipment chalked up when put through its paces in our lab. To round off fully 35 pages of test reports, this issue offers some first-rate features that are bound to be of interest to everyone who wants their true hi-fi dollar's worth.

You'll find the Fall/Winter 1968 Hi-Fi Buyers' Guide on your newsstand now. Price is $1.25, but don't look on the outlay as money spent. How come? Simple! The purchase price is peanuts compared to what you can save by using and applying the wealth of information it contains. But that's only my opinion—get a copy of Hi-Fi Buyers' Guide and agree with me!

Hey, Mr. Postman. This is not a letter column, but my regular readers know that I publish letters from time to time for various reasons. Here is a letter on a plea for information.

Calling Nimbus Followers

I'm a high school student in the senior year and now in the process of building an automatic picture taking reception station for the current Nimbus and ESSA series weather satellites. I should be operational this coming fall. This station is not of the commercial variety, but of the type now being built for amateur use, preferably the one designed by K2RNF in 1965. This is the one that can be built for less than $250.00 as opposed to the commercial type running in the $35,000 range. I would like to get in contact with other amateurs

(Continued on page 10)
Add a spectacular new dimension to the world of music and entertainment. Now, you can actually see your favorite musical selection translated into fantastic patterns of beautiful color—such individual note creating its own unique, twisting, radiating shape ... each shape dancing and prancing, whirling and swirling in perfect time with the music, science, art and electronics combined with dramatic results. Attaches in seconds to your radio, tape recorder, head or stereo with two alligator clips. Can be used on small screens, large walls, stages and whole auditoriums.

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Auditoriums.

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(Continued from page 8) with similar interests in this fascinating hobby. I would appreciate it very much if you would refer me to them, and, if possible, if you know of any groups that are being formed or have been formed with this hobby interest in mind.

Okay, out there in reader land, if you can lend a hand—get going. Drop a post card to Conrad J. Baranowski, 109 Peterborough St., Boston, Mass. 02215.

Only the real nosey reader, the kind of Joe who reads the small print in front of every issue, would have noticed that the offices of RADIO-TV EXPERIMENTER have moved. This Editor is proud of the change because our new offices are located on a famous site in the history of electronics—so famous, in fact, that a bronze plaque was affixed to the building near the entrance for all to see. It reads—

**LEE DE FOREST**

This building stands on the site of the old Parker Building destroyed by fire in 1908. In his small laboratory on the top floor of that building Dr. Lee De Forest in October, 1906 invented the grid “Audion” or three electrode vacuum tube on which our electronic era has been founded.

**DE FOREST PIONEERS**

**NOVEMBER 12, 1956**

Now, this would seem to be the time to dedicate our magazine, but that has already been done. Near the top of page six in this issue is the slogan of this magazine and its sister publication, ELEMENTARY ELECTRONICS, which reads “Dedicated to America’s Electronics Hobbyists.” The Editor and his staff do not take this slogan lightly. In each issue we dedicate not only the magazine but our efforts to you, our readers—America’s electronics hobbyists. Most of the time we do a good job of it, and when we do we would like to hear from you. Write to the Editor and give him a “pat on the back” with your pen. But, when we fail, or goof, or commit the crime of omission—write and let us have it. Further, everyone at one time or another comes up with a story idea that they would like to see in print. Well, drop us a line and you never can tell. Your post card may be the major subject of our next editorial meeting. Let’s hear from you.

**Here It Is, Flower Kids!** In our last issue we tossed a sticky little problem at our readers. All they had to do was reshape the left group of circles so they look like the group on the right. Well, the diagram speaks for itself. The problem is very simple once you see the center flower pattern and three outboarded circles (we show them shaded here to make your viewing easier.) Okay, now honestly—how many out there in reader land had to wait for this issue for the solution? Bet you don’t send in a post card telling me!

**Somebody, Tell the Russians.** Once they got a matched pair of space probes (one Russian and one American) complementing each other in the vicinity of Venus last October, scientists thought they had at last licked the cloud-shrouded planet’s two most tantalizing mysteries—the temperature and atmospheric pressure at the surface. But there was a hitch, it now develops.

The measurements assumed that Russia’s Venus 4 probe had, as claimed, zipped in to about 15 miles above the planet, then released a parachute-equipped instrument package which gathered and transmitted data all the way down to its collision with the surface.

But there is now reason to believe that the package was 30 miles above the surface when freed and 15 miles up when the transmissions stopped. If true, this could mean that the atmosphere at the planet’s surface is some five times as dense and almost 300 degrees warmer than the Soviet data indicated.

(Continued on page 12)
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A down payment of $15 and you're on your way. We'll rush your complete training program by return mail. Or enclose full payment ($99) with your application and receive in addition a portfolio of 24 schematics, the TV serviceman's "circuitry roadmaps"—you'll need them when you open your own shop.

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JANUARY, 1969
This possibility has come to light as a result of new radar measurements of the planet made from earth, combined with analysis of the trajectory of the U.S. Mariner 5 spacecraft as it curved around behind Venus two days after the Russian probe's arrival.

The analysis of Mariner's path, affected by Venus' gravitational attraction, revealed the distance to the planet's center of mass, and the last data from the Russian probe, fitted onto the imaginary line between the mass center and Mariner, presumably indicated the surface of the planet. Judging by the distance from the last Russian data to the mass center, the radius of Venus seemed to be 3780 miles: less than half of earth's.

But previous studies, by both U.S. and Soviet researchers, had indicated that the planet's radius was only 3766 miles—somebody was wrong.

Now it seems to have been closed, for the time, in favor of the old.

While Mariner 5 was in the vicinity of Venus, Dr. Von R. Eshleman of Stanford University in Palo Alto, Calif., together with colleagues from Stanford, the University of California's Jet Propulsion Laboratory and the 1000-foot radio telescope at Arecibo, Puerto Rico, used the giant telescope to bounce radar waves from the surface of Venus. By comparing Arecibo's distance with Mariner's distance from the planet's center of mass, the scientists were able to confirm precisely (and confidently), the earlier, smaller radar estimates of Venus' radius.

According to that calculation, the pressure and temperature data from both spacecraft were wrong, since the figures were assumed to be for altitudes some 14 miles higher than now appears to be the case.

The "new Venus," therefore, has an estimated surface temperature of 800 degrees F. and an atmospheric pressure 100 times greater than that of earth. The original Russian spacecraft data indicated a cooler, but still uncomfortable, 536 degrees, and a somewhat less crushing 22 atmospheres of pressure.

But why the error?

When the instrument package was released, its altimeter indicated that it was about 14 miles above the surface. However, says Dr. Eshleman, some kinds of altimeters give the same signal at multiples of a given height. If the spacecraft was really 28 miles up when it dropped its instrument package, the mystery is solved. All the data fit consistently together if that one, simple correction is made.
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BOOKMARK BY BOOKWORM

More on ICs. With all the amazing developments in electronics, few rival the introduction of the integrated circuit (IC) which may have the greatest influence on the design and application of electronics products and systems. Integrated Circuits—Fundamentals and Projects by Rufus P. Turner, Ph.D., of California State College at Los Angeles, covers in non-technical language the historic-technical development of the IC, its general features, types and applications.

The reader will learn how this device made of semiconductor material can contain, in an area as small as 1/20 of a square inch, a complete electronics circuit consisting of scores of transistors, diodes, capacitors and transistors, permanently connected and virtually indestructible.

Experimenters will be guided in the use of the device in inexpensive building projects. The book provides details on assembling a simple audio preamplifier, high gain preamplifier, quarter-watt audio amplifier, crystal oscillator/frequency standard, AF/RF signal tracer and DC Voltmeter. Published and sold by Allied Radio Corporation, 100 N. Western Ave., Chicago, Ill. 60680.

Got a Sick Peacock? Here's looking at Practical Color TV Servicing by Robert L. Goodman—a brand-new book designed to provide readers with the benefit of an expert troubleshooter's many years of practical experience, this comprehensive guide includes several dozen case-history analyses of color TV problems. In detailing ways to track down virtually any problem, the author discusses circuits for a
variety of makes and models, including new portables and solid state receivers only recently introduced! The book details new and helpful techniques for using everyday test instruments to greater advantage, in addition to many simplified methods of applying advanced troubleshooting procedures with more sophisticated instruments.

A special color photo section is included—with dozens of full-color illustrations—to show clearly what the author is talking about in his discussions on troubleshooting, alignment, convergence adjustments, etc. Each chapter is profusely illustrated (over 230 in all) to further explain the troubleshooting techniques involved. Get your copy direct from Tab Books, Blue Ridge Summit, Pa. 17214 today!

School Days! International Correspondence Schools has developed the first, low-priced, accelerated program of independent study to teach all practical aspects of color and black-and-white TV repair. Called TV Servicing/Repair, the course differs from other standard ICS courses in this field by dispensing with electronic theory not necessary for a comprehensive repair knowledge.

TV Servicing/Repair consists of six hardcover volumes (936 pages) written by electronics consultant Forest H. Belt, and takes a reader from tube-changing to bench servicing of virtually all TV set disorders—portable and console, tube and transistor, black-and-white and color. Each volume is indexed and profusely illustrated with line drawings, schematics and close-up photographs—many in full color. Each chapter concludes with a Check Your Learning section with answers included, by which a reader can test his grasp of subject matter just presented. At the end of the course is a comprehensive examination, which is mailed to ICS for correction. A diploma is awarded for successful completion. The course is priced at $99.

A specially prepared dictionary of TV terms and supplementary theoretical information, carefully keyed to text material, is included.
with the course. A portfolio of schematics of major manufacturer's most popular TV models also is made available.

Another feature of TV Servicing/Repair is that enrollees automatically become members of the ICS TV Servicing/Repair Association. This entitles them to purchase TV components at trade rates from many supply houses. Association members also receive a periodic newsletter on subjects of interest to the servicing trade. And annually, ICS will offer schematics on new TV models at special member rates.

ICS regards the program as broad enough to profit the fix-it-yourselfer, interested only in chopping his own set's servicing expenses. At the same time, it is deep enough to give a solid background and practical A-to-Z "how to" for the man interested in a career in TV servicing and repair.

R/C Is Still Here. You can now get the second edition of Radio-Control Manual—Systems, Circuits, Construction by Edward L. Safford, Jr. It's completely updated and revised, with 70% new material. This long-time favorite contains something of value for everyone with an interest in radio-control systems. While basically oriented for radio-controlled model hobbyists, much of the information and many of the circuits can be applied to practical applications such as garage-door openers, low-power communications devices (such as Citizens Band radio), amateur radio uses, or to any type of radio-control operation. Complete data is supplied on transmitters and receivers, encoder and decoder circuits, servomotors, etc. For the model builder, complete plans are included for constructing from scratch or from readily-available kits. One system is even designed to control a model airplane indoors! Contains complete information on circuits you can build, and assemblies you can buy, including sources.

The book explains all currently-used radio-control systems, including the digital type so popular among multichannel fans. Also included is a complete set of plans for the Digi-mite system. The book can and has served as a text for courses in radio control, and contains construction ideas that make fine laboratory-learning experiments.

You can get your copy of this valuable R/C text direct from the publisher—Tab Books, Blue Ridge Summit, Pa. 17214.

First Comes the Ground Floor. Before anyone can really understand electronics, he must understand the terms volt, ohm, ampere, etc.; the standards used to establish them; and how they are derived from the standards. Understanding Electronics Units and Standards, by Farl J. Waters, provides a basic, simple discussion of these units and their standards.

To provide a sound basis upon which to develop the primary standard of measurement, the book also gives the reader the fundamentals of atomic structure, electrostatic charge of the electron, and electron movement about the atom. Questions at the end of each chapter reinforce the reader's understanding of this basic subject.

Copies are available from electronics parts distributors and bookstores throughout the coun-
Throw 'em a Curve. Formerly engineers and technicians had to search through any number of sources to find needed facts on waveform measurements. This widely scattered information is now gathered together and organized in Rufus P. Turner's Waveform Measurements. This book is the first single source to provide complete instructions for measuring the common waveforms. From troubleshooting to signal synthesis, its how-to approach will prove invaluable to electronics personnel who must have practical data on hand in their day-to-day operations. Equal attention is given to the instrument measurement of frequency components which determine the particular shape of a wave as well as those which influence circuit behavior. Step-by-step "cookbook" procedures show proper use of various instruments, including the oscilloscope, waveform analyzer, distortion meter, and recorder.

Free of superfluous theory, fully illustrated, the book offers enough background for a working knowledge of electrical waves and harmonics. A special section shows how to check total distortion in modulated and unmodulated waves. In addition, practical methods of measuring modulated waves are set forth.

Rufus P. Turner is currently on the faculty of California State College at Los Angeles. For your copy visit your local bookshop, electronics parts dealer or contact the publisher directly—Hayden Book Co., 116 W. 14th St.; New York, N.Y. 10011. Tell 'em the 'ol Bookworm sent you.

Arvin a Good Time. Those of you out there in CB-land who are ancient enough to remember Blue Baron (no Fred, he wasn't a German Flying ace) will be familiar with the name Arvin. There wasn't a kitchen in this nation which didn't have a little radio bearing this trade name. In fact, Arvin broadcast radios have been familiar sights (and sounds) right through the years. Now Arvin's name should be a popular one with the CB crowd.

Arvin—you guessed, didn't you—just announced a new CB rig; in fact; three of 'em! For starters they have the Model 20Y55-19. Despite the rather un-exotic name for the set, it's got more goodies than Carter has liver pills brother, the 20Y19—the 1955Y—the Y55-20—(oh, forget it!)—the set also permits 9 channel operation. Main difference is the size, and the

(oops, there we go showing our age again!). The base/mobile rig can operate on any 9 CB channels via its 21-transistor circuitry and it offers really slick-as-a-slippery-sardine styling. It's a teeny-weeny thing which measures about 9 in. across, 3 in. high, and 6 in. deep; very un-obtrusive. The 20Y55-19 (they really must do something about that name) sells for $114.95.

In an even tinier package, Arvin presents its 20Y33-19, which is only 6 in. wide, 2¼ in. high, and less than 7 in. deep. Like its larger
fact that the smaller set operates only from a 12-volt power source. It’s a low $89.95.

For portable use, Arvin sends along their 10Y33-19 (you know, these are the only sets you’ve got to order with an area code) hand held unit. It’s an 11-transistor rig which runs 100 milliwatts for license-free Part 15 operation. The unit is $29.95 (now they’ve even got me doing it).

More details on these neat lookers can be obtained by contacting Arvin Industries, Inc., 1531 13th St., Columbus, Indiana 47201.

High Camp Antenna. Getting ready for that trip you didn’t get around to taking last summer? Well this coming summer you’ve got to plan on it definitely because you have no excuses about not having CB in your pick-up truck camper. Yup, Antenna Specialists says that their new M-189 camper antenna is based upon their now-famous “Maggie Mobile” concept which is so widely used by police mobile units.

The antenna has a precision wound loading coil at the base which will give an excellent match to any rig, and it’s got a hard-as-nails ruggedized mounting bracket which won’t have a nervous breakdown when you smash your camper’s roof into a low hanging branch. The whole she-bang mounts exter-
nally on the camper so you won’t have to mess up the decor inside.

You can get additional information from Antenna Specialists, 12435 Euclid Ave., Cleveland, Ohio 44106.

Testy CB Rig? An extended range antenna noise bridge is now ready, willing, and able to aid you in checking-out an antenna installation.

Made by Omega-T Systems, the Model TE7-02 is useful over a broad range of frequencies in measuring the resonant frequency of an antenna, measuring the input impedance of RF amplifiers and other networks.

If you’re a -mind to perking up a pooped -out CB installation you’ll find many uses for this thing. It comes with detailed instructions.

Price is $34.95 (a small price to pay for the salvation of a CB station) from Omega-T Systems, 516 West Belt Line Rd., Richardson, Tex. 75080.

"Okay, fellas—where’s this space miser computer you’ve been bragging about?"
towers, radar approaches, navigational beacons and all other VHF aircraft services can be heard. Either portable can be used as a primary navigational aid on small boats; their direction finders can tune sharp “nulls” of known stations, permitting cross bearings for position FIX or homing direction. The Ranger sells for $119.95; the Sea-Air for $99.95. For more info write to The Hallicrafters Co., 600 Hicks Rd., Rolling Meadows, Ill. 60008.

8-Track Cartridge Recorder

Kinematic’ new model 1000 has several features not previously available in an 8-track record/playback machine. Viz: the new Nortronics head which records and plays back utilizing a single Z-axis head. With this head the audio and bias signals are automatically combined. The 1000 will play and record both stereo and mono automatically. The unit shuts itself off after the fourth stereo channel or eighth monaural channel. On monaural you can put almost 200 minutes of program material on a standard 90-minute 8-track cartridge. This is the equivalent of 100 sides at 45 rpm. It’s ideal for logging radio stations, keeping track of telephone conversations, or what have you. The 1000 has separate VU meters for playback as well as separate inputs for tuners, magnetic

Kinematic Model 1000 Cartridge Recorder

"Hobby or not, you’re not papering my rec room like that. . . ."

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<td>GERMANIUM DIODES, 1N934, 1N45 no test</td>
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<td>PRECISION RESISTORS, 1/2 to 2W, 1% load values</td>
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<td>TRANSISTORS, ref. list, audio, etc. no test</td>
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<td>&quot;MICRO&quot; CONDENSERS, for transistor circuits</td>
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Checkin' Out Those Transistors

Now here we have an in-circuit transistor checker kit for only $24.95. This new Heathkit instrument, the IT-18, measures DC Beta in or out of circuit in two ranges from 2 to 1000. It also tests diodes in or out of circuit for forward and reverse current to indicate opens or shorts. It provides positive identification of pnp or npn devices and anode or cathode of unmarked diodes, and matches transistors of same or opposite type. It cannot damage either circuit or device even if connected improperly. The IT-18 has a big 4½-in. 200 μA meter; 10-turn calibrate control and complete portability (power supplied by a single “D” cell). There's a front panel socket for lower powered devices, and it's supplied with 3-ft. test leads and a rugged polypropylene case. For more info write the Heath Co., Benton Harbor, Mich. 49022.

For the Hard Rock Aficionado

This low-silhouette unit, the 44-485, is a solid-state microphone mixer/preamplifier, designed to amplify guitars and other electronic instruments (soupied-up sitar?). It's also useful, of course, for stereo tape recording, and up to three units may be paralleled to provide a total of 12 inputs, each with its own volume control. The 44-485 operates from a 117-V, 50-60Hz AC power source with a power drain of 1.2 watts. The output is 6 volts rms at 2% distortion; out-
ment locks, and Golden Armor coating. The impedance-matching transformer can be snapped over the boom of the antenna where it can be pushed into contact with two 300-ohm terminals. No special connector is needed for coaxial cable. The STO-83 transformer sells for $2.39. The VIP series 301 through 307, for metropolitan to deep fringe areas, have list prices ranging from $16.95 to $79.95. More information can be had from Distributor Sales Div., Jerrold Electronics Corp., Box A, Philadelphia, Pa. 19105.

Kits for Kids
A new line of educational radio kits designed to be built by individuals ages 12 and older has been introduced by Graymark Enterprises. There are two kits: model 2001 Comancho Transistor Radio sells for $19.95; model 202 Scallon Table Radio sells for $21.95. Each kit is complete in every detail, all necessary parts and fittings included, no extras to purchase. With the

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<td>3 Gun-units at</td>
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Extra boxes of ten tear gas shells at $1.50 per box (prepaid with gun order). Extra boxes of blanks at $1.25 per box.

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NEW PRODUCTS

kit comes a step-by-step instructional manual, with convenient testing procedures at various stages. For further details, write for an illustrated brochure to Grayback Enterprises, Inc., Box 54343, Terminal Annex, Los Angeles, Calif. 90054.

Here We Go 'Round the TV-FM
Cornell-Dubilier announces somethin' new in TV/FM antenna rotor design. The AR33 Autorotor has fully automatic pushbutton control, with ± 1° position accuracy. It uses the heavy-duty Bell rotor, with design origin stemming from the famous HAM-M amateur rotor. The Autorotor has completely silent operation, solid state circuitry, 360° compass dial operation, and contemporary styling by Raymond Loewy. Price is $79.95, and descriptive literature is free on request from Cornell-Dubilier Electronics, 50 Paris St., Newark, N. J. 07101.

Electronic Sky Watch
A new outdoor lantern conversion kit, designed primarily for post lanterns and incorporating a photocell switch that controls the lantern automatically, has been introduced by General Electric's Large Lamp Department. Named "Skywatch," the conversion kit combines the photocell adapter with a new distinctively shaped Tuff-Skin coated Flair Postlight bulb, allowing homeowners to turn the postlight on once and forget it. The bulb is inserted into the Skywatch adapter, and then the entire unit is installed into any standard socket used in post lanterns or other outdoor fixtures. After insertion of the Skywatch unit, the photocell control automatically turns the postlamp or other outdoor fixture on at dusk and off at daybreak by reacting to light and darkness rather than the time of day. The Skywatch unit is completely weather-proof and is designed to fit all standard sockets. No additional wiring is needed for the spring-loaded center contact device, and the light sensitive photocell eye can be positioned in any desired direction. Equipped with a time delay, the unit is unaffected by extraneous light sources such as automobile headlights, lighting etc. A specially designed telescopic tube adjusts to fit flush against the inside of the post lantern glass to guard against intermittent operation due to reflection. The unit exceeds Underwriter's Laboratory standards for up to 150-watts in enclosed fixtures, and is guaranteed for 3 years from date of purchase with full replacement of defective units when returned to the supplier. Currently available in all general merchandise stores, The General Electric Skywatch Flair Postlight outdoor lighting unit is offered only as a complete kit with a suggested retail price of $10.98.

Looking Inside Solid State
A new and improved all-solid-state transistor analyzer that is described as the ultimate in semiconductor analysis, provides a true small-signal AC Beta test, continuous instrument
monitoring, sets up easily and quickly, has three independent power supplies and large 4½” meters, makes H parameter, high current, high voltage, AC and DC Beta measurements, reads leakage current in the nanoampere region, tests both small-signal and power transistors, diodes, rectifiers, zener diodes, SCR’s and the latest FET’s in the collector current range of 100µa to 30 amperes, has been introduced by The Triplett Electrical Instrument Company, Bluffton, Ohio. The portable Model 3490-A, Type 2 provides the operator with maximum capability and flexibility for plotting complete transistor characteristic curves, taking single readings plus setting up any type of transistor test. It is ideally designed for use in electronic laboratories, re-

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search and development departments, quality control sampling, evaluation engineering and technical training schools. A new 30-page instruction manual enclosed with the unit also lets the operator set up his test easily and quickly, step-by-step. User net price is $441. It would be impossible to talk about all the specifications for this unit without using up the space allotted for this column. So get all the facts by writing direct to The Triplett Electrical Instrument Co., Bluffton, Ohio 45817.

**Machine and Mikes**

Recognizing the need for modern, high quality tape recorders to be used with microphones of matching performance levels, Telex’s Viking Tape Recorder Division, Minneapolis, and Electro-Voice, Inc. Buchanan, Michigan, are working together in a unique type of marketing program. Each purchaser of a new Viking 433W stereo tape recorder at $389.95, manufacturer’s suggested list, will receive free of extra charge a pair of Electro-Voice 631 dynamic omnidirectional microphones. The microphones, packed in an attractive and convenient carrying case, have phone plug connectors on the cables for immediate connection to the recorder. List price value of the microphones is $126.00. The sound and echo. E-V Model 631 microphones are rugged and reliable dynamic models for hand-held or stand use. A four-stage internal blast filter allows use close-up with no pops or distortion. The units have a unique silent magnetic on/off switch with a snap-off actuator which when removed leaves the mike in fail-safe “on” with no openings or gaps to degrade response. Want more info? Then write to Electro-Voice/Viking, Buchanan, Mich. 49107 for all the facts.

**Packed Full of Components**

Here’s a brand new kit, an all solid-state FM stereo compact, called the “Component Compact.” Designed to give “big system” sound in the small space of a stereo compact the Heathkit AD-27 Component Compact uses proven stereo components. The receiver is the highly praised Heathkit AR-14, modified only mechanically to fit the cabinet. And the automatic 4-speed turntable is the precision-crafted British BSR McDonald 500, with a Shure diamond stylus cartridge. The amplifier portion features 15 watts per channel music power output, all.

*Heathkit Model AD-27 Stereo Compact*

*Viking Model 433 Tape Recorder with Electro-Voice Microphones*

fine performance available from today’s superb tape machines is severely limited, practically speaking, unless the user has quality microphones to record with. Inexpensive microphones usually furnished with recorders simply will not take advantage of the quality inherently built into a well designed tape machine. This promotion should not only have immediate effects on sales by creating attention, but in the long run increase the overall market for tape products by simplifying the user’s purchase and allowing him to make substantially better quality recordings at a reduced overall price.

The Viking 433W is a 4-track stereo machine with three motors, three heads, three speeds, and monitor controls. It may be used for sound on...
solid-state circuitry, frequency response of ±1 dB, 12-60,000 Hz, 45 dB channel separation, harmonic & IM distortion of less than 1%, 4 to 16 ohm output impedance, tape output, and a front panel headphone jack with a speaker defeat switch for private listening. The FM stereo portion has 4 IF stages, 5 μV sensitivity, -45 dB hum and noise, less than 1% distortion, smooth inertia flywheel tuning, adjustable phase control for optimum channel separation, stereo indicator light, 20 dB channel separation and filtered outputs. The AD-27 is sold without speakers to allow the complete versatility necessary for outstanding performance in any situation (Heath recommends their AS-10, AS-16 and AS-37 speaker systems). The Heathkit AD-27 Component Compact sells for $169.95 mail order. For complete ordering information and specifications write to Heath Company, Benton Harbor, Michigan, 49022.

Always Make Them Better

Take your best solid state tape recorder, improve it with the latest OTL (output-transformer-less) circuitry, without boosting the price, and you have a potential winner. . . . so hopes Radio Shack, Boston-based nationwide hi-fi/electronics retail chain. Radio Shack has just introduced their re-designed Realistic-909 portable recorder; it plays and records 4-track stereo and monaural tapes, makes “sound-with-sound” recordings, and tapes FM-multiplex stereocasts, all with improved sound and longer life thanks to new-for-’69 OTL circuitry. Still priced like its predecessor at $159.95, the new model 909 offers many of the conveniences and operating features of costlier tape recorders: a die-cast mode selector, digital tape counter, three speeds without capstan change, two VU meters, an up-front stereo headphone jack and illuminated record pushbuttons. Its two wing speakers separate for optimum stereophonic effect. The new recorder is being offered under the company’s proprietary Realistic brand in all 300 Radio Shack stores. It comes complete with two dy-

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RTV-12

Don’t Miss the all new ELECTRONICS HOBBYIST 1968 Fall-Winter Edition at your Newsstand September 5th

Now you can reserve the newest, most exciting magazine for those whose interest in electronics is on the hobby level. The ELECTRONICS HOBBYIST contains easy to build, tested and proven construction projects of every description.

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January, 1969
How to Drown out the Instruments

For all you vocalists who're tired of having your sonic time beaten by amplified guitars, drums, organs, sitars, and all like that, Atlas Sound has produced the Banshee. It's a cobra-flare horn, and it will spray out the vocals with 125 watts of peak power. Frequency response of the Banshee is 100 to 12,000 Hz, and the sound intensity is claimed to be 131 dB! Man, that should drive your ear drums to the center of your head. Impedance is 16 ohms. Banshee has a built-in pre-wired phone jack; you just insert a speaker cable with a two-conductor phone plug and everybody can really dig those crazy lyrics. Atlas recommends a speaker stand to elevate the sound above the crowd. It's best to keep the audience below the sonic boom. Atlas has two models, the SS-4 for $25, the SS-2 for $48. The Banshee is $121.00, and for more poop, write Atlas Sound, Parsippany, N. J. 07054.

For the Two-Music-Center Family

Fisher has come out with a moderate-priced pair of compact home music systems; the Fisher 120, an FM-stereo phono system that sells for $299.95, and the Fisher 125, a complementary system that includes an AM tuner section as well as FM-stereo, which sells for $329.95. Their newly-designed FM front ends and IF amplifier sections incorporate FETs (field effect transistors) and ICS (integrated circuits). Baxandall feedback circuits are used in the bass and treble controls. A main/remote speaker switch, loudness contour and full tape and phono facilities are also included. Atop the receiver is a 4-speed automatic turntable with cue control, anti-skating, balanced tone arm and magnetic car-

Fisher 120 FM-Stereo Phonograph Music Center

tridge, and automatic shut-off. A pair of Fisher XP-55B speaker systems, which retail separately for $49.95 each, are included with each 120 and 125 package. The speaker systems feature an 8-in. free-piston bass speaker with heavy magnet structure and a 3-in. wide-range treble speaker. Anything else you'd like to know? Write Fisher Radio Corp., 11-40 45th Rd., Long Island City, N. Y. 11101.

Cover Six Bases at a Glance

The Heath Co. has put on the market the Heathkit IG-57 post marker/generator at $135.00. The IG-57 will display as many as six markers at a time, obsoleting the old time-consuming variable marker system. Markers are provided for color bandpass alignment; picture and sound carrier frequencies for channels 4 and 10; FM tuner, FM IF and discriminator alignment; and TV sound IF adjustments. 400 Hz modulation is built in for trap adjustment and checking and adjusting FM tuners. A variable voltage supply is provided for use as a source of positive or negative bias. The sweep generator portion has 5 linear sweep ranges, covering the sweep necessary for TV tuned-circuits in sound IF, color bandpass, video IF circuits and for proper overall RF/IF response. The IG-57 also has a trace reversing switch, a blanking switch and a phase control so the markers will appear as in the set manufacturer's alignment instructions, regardless of the scope used. For literature on the IG-57, write to the Heath Co., Benton Harbor, Mich. 49022.
Hot Line!
Could you give me a diagram for a combination 6- and 12-volt, 12-amp battery charger to work off a 117 VAC line?

Try this circuit. Transformers T1 and T2 are 20-A, 6.3-volt filament transformers and T3 is a variable autotransformer such as a Variac, Ohmite, or one sold by Allied Radio under its own brand name. Make sure the diodes are hefty enough to handle the current. The charging rate is controlled with T3. Additional filtering can be added if you ever decide to use this baby as a power supply.

Shrinking Power
When are integrated circuits for audio power amplifiers going to be available at low cost?
—R. F. P., Norwalk, Conn.

They're available now. The GE PA234 puts out 1 watt with a 600-millivolt input and its frequency response covers a range of 30 Hz to 100 kHz! The input voltage can be anywhere between 9 and 25 volts, and the device is a fraction of the size of a speaker. Price in large quantities is less than a buck; more at a parts store if you're buying only one. The whole amplifier costs less than a tube used in the output stage of a conventional amplifier. What more do you want?

Long Wires
How high and long should an AM radio antenna be constructed? I have an old radio set and can get a large pole for the body, but how high should it be? Also, how high and long should a shortwave antenna be? Can an FM antenna be used for either shortwave or AM reception?
—R. K., Nanaimo, B.C.

Your antenna should be as high as possible and about 100 ft long for AM if there are no stations nearby. You can use the same antenna for shortwave, but don't try an FM antenna. However, you can use an FM antenna for FM, AM, and SW if it's wired as shown. When using the antenna system for AM or SW, the transmission line (twin lead) functions as a vertical antenna.

Buzz Bomb
When I turn the volume all the way down on my Panasonic radio hum can be heard. What is the matter and how can it be fixed?
—J. S., N.Y., N.Y.

Offhand it sounds like a defective volume control. But, without knowing the model number, we can only guess. Why don't you try the Panasonic Service Center in New York City?

The longer the Wave...
I have a Grundig 500 transistor portable radio. How can I connect an outside antenna to the radio to receive long-wave transmissions? The range of the long-wave band is 150-260 kHz. What kind of antenna can I use? My
ASK ME ANOTHER

home is located deep in a valley where TV and radio reception is poor.
—R. K., Faristell, Mo.

Put up a long horizontal wire and connect it and a ground to a flat-loop antenna. Tape the antenna to the back of the set for inductive coupling to your radio's built-in antenna.

Facts of Life

In a past issue of Radio-TV Experimenter it was stated that Channel 7 TV sound was on 180 MHz, but on my shortwave receiver I get Channel 7 TV sound on approximately 4.2 MHz. Could you please explain why this is so?

Also, I receive Channel 4 TV sound at 4.4 MHz early in the afternoon but not in the evening. I receive Channel 5 TV sound at 28 MHz (approximately), but all these TV stations come in with distorted sound. Why? I use a 6-ft. length of wire for an antenna, but no ground.
—E. V., Boxford, Mass.

With a shortwave receiver, you receive all kinds of garbage depending upon the quality of your radio. Because of the multitude of signals on the air, you receive intermodulation products. It's like trying to drive through Boston on Saturday afternoon—the distorted sound is normal. Why should you expect to get good sound from an FM station with an AM receiver?

All receivers (regardless of cost) go through a balancing act with regard to sensitivity, selectivity, image rejection, intermodulation, noise, bandwidth, etc. These are all factors in the quality of a received transmission. A receiver will never be all things to all people, and unless you are willing to spend a fortune for a special design, you will have to settle for whatever your pocketbook can afford. But don't forget to install a ground!

Time Flys

Can you tell me where I might get a short-wave receiver for receiving time signals? I work in land surveying and it is essential that I have the correct time for calculation of bearings from a north-star observation.
—P. O'T., Peterborough, Ont.

Contact the Canadian Marconi Company, 2442 Trenton Ave., Montreal, and ask for information on their XH-13A and XH-14 receivers. Both operate from a 12-volt battery.

Ther-a-what?

Can you tell me where I can obtain a schematic diagram of a Theremin. It's a musical instrument invented by a Russian around 1920.
—D. R., Aberdeen, Wash.

We had a copy of a schematic but have mislaid it. We obtained it by writing to the Director of Public Relations, Radio Corporation of America, 30 Rockefeller Plaza, N.Y., N.Y. 10020. You might be able to get RCA to run off a Xerox copy of the schematic for you. They manufactured the instrument.

Stereo ain't Good Enough?

Can you please tell me how to modify your Stereo Compact (February/March 1966) to get mono operation?
—H. K. Kenmore, N.Y.

Add a switch as shown by the dotted lines in the diagram. When the switch is closed you have mono operation when using a mono cartridge. If you use a stereo cartridge and play mono records, forget the switch.
No Poop from PA
I recently built a public address amplifier which does not amplify. The diagram is enclosed. When I use the phono I get very little sound, while the microphone produces nothing. What's wrong?


The 470-ohm resistor connected to the center tap of the primary of the output transformer is incorrectly wired. Rewire the circuit as per the dotted line and you’re in business.

Whip and Peak
I have an antenna hook-up for BCB DX as shown. Antenna A is a whip; antenna B is homebrew. Whenever I connect these antennas, selectivity is decreased, but volume is increased. How can I improve selectivity without using a bandspread in the receiver?


Connect point X to ground. Add a 455-kHz mechanical filter ahead of the IF stage as shown in the block diagram. Wiring instructions should come with the filter. You can probably get one from Lafayette Radio, 111 Jericho Tpke., Syossett, N.Y. 11791. But don’t expect too much from such a patchwork setup.

Down the Slopes
I would like to know if it’s possible to convert a communications receiver from AM to AM and FM?


It isn’t necessary to convert the receiver to hear ham and land-mobile FM stations. Tune them in carefully, just off carrier. Your AM detector will demodulate the FM through slope detection. How about that?

How Big the Beat?
Can you furnish me with a circuit for a 250-300 watt transistor amplifier for an electric guitar. All I need is the driver and output stages, as I have a preamp circuit designed already. I have looked around at various places but have had no luck.

—M. C., Ames, Iowa

What do you want with 250 watts? Radio City Music Hall uses only 85 watts to fill a space equivalent to 1800 living rooms. Just get

(Continued on page 34)
141. Newly-designed CB antenna catalog by Antenna Specialists has been sectionalized to facilitate the picking of an antenna or accessory from a handy index system. Mail Antenna Specialists makes the pickin’ easy.

102. No never, mind what brand your CB set is, Sentry has the crystal your rig goes for ham rigs. Seeing is believing, so get Sentry's catalog today. Circle 102.

120. Last page of the CB catalog. Titles range from "ABC’s of CB Radio" to "99 Ways to Improve your CB Radio." So circle 103 and get the latest catalog.

107. Want a deluxe CB base station? Then get the specs on Turner's latest catalog. It's the SSB/AM rig you've been waiting for!

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

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

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

103. Squire-Sanders would like you to know about their CB transceivers, the "23er" and the new "555." Also, CB accessories that add versatility to their sets are available.

46. Pick up Hallicrafters' new four-page illustrated brochure describing Hallicrafters line of monitor receivers—police, fire, ambulance, emergency, weather, business radio, all yours at the flip of a dial.

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

118. Pop-up your CB rig's performance with Turner's M+2 mobile microphone. Get complete spec sheets and data on other Turner makes.

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

111. Get the scoop on Versa-Tronics' Versa-Tenna with instant magnetic mounting. Antenna models available for CBers, hams and mobile units from 27 MHz to 1000 MHz.

45. Get your copy of World Radio Labs 1969 CB Catalog No. 2. You've got to see to believe WLR's special CB bonus offers. This is the catalog for big CB buyers.

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

115. Get the full story on Polytelics Laboratories' latest CB entry Poly-Pup. Full 5-watts, great for mobile, base or portable use. Works on 12 VDC or 177 VAC.

100. You can get increased CB range and clarity with the "Cobra-23" transceiver with speech compressor—receiver sensitivity is excellent. Catalog sheet will be supplied by B&K Division of Dinanstan Corporation.

54. A catalog for CBers, hams and experimenters, with outstanding values. Terrible buy on Grove Electronics' antennas, mikes and accessories.

122. Discover 18 new and different professional-quality amplifiers, tuners, and preamps completely assembled on PC-boards now offered by Amperex. Prices will amaze you!

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

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

23. No electronics bargain hunter should be caught without the 1969 copy of Radio Shack's catalog. Some equipment hit kit prices are so low, they look like misprints. Buying is believing.

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

104. With 70 million TV and 240 million radios somewhere somebody will need a vacuum tube replacement—on the spot! Get Universal Tube Co.'s Troubleshooting Chart and facts on their $1 flat rate per tube.

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

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

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


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

120. Tab's new electronics parts catalog is now off the press and you're welcome to have a copy. Some of Tab's bargains and odd-ball items are unbelievable offers.

RETAILERS

28. Do more jobs with fewer tools. Double duty sets contain midget nut and screwdrivers plus special piggyback handle that gives midgets the power and reach of standard drivers. Xcelite's the name—they get their catalog 166.
118. Secure coax cables, speaker wires, phone wires, etc., with Arrow staple gun tackers. 3 models for wires and cables from 3/16" to 9/16" dia. Get fact-full Arrow literature.

TELEVISION

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

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

91. Interesting, helpful brochures describing the TV antenna discovery of the decade—the log periodic antenna for VHF and UHF-TV, and FM-stereo. Get it from JFD Electronics Corporation.

SCHOOLS AND EDUCATIONAL

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

*74. Get two free books—"How to Get a Commercial FCC License" and "How to Succeed in Electronics"—from Cleveland Institute of Electronics. Begin your future today!

*136. "Power Engineering," a new 32-page, illustrated brochure by ICS (International Correspondence Schools) describes seven ICS Power Engineering courses that may open a new career for you. Get a copy today!

114. Prepare for tomorrow by studying at home with Technical Training International. Get the facts today on how you can step up in your present job.

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

138. For a complete rundown on curriculum, lesson outlines, and full details from a leading electronic school, ask for this brochure from the Indiana Home Study Institute.

105. Get the low-down on the latest in educational electronic kits from Trans-Tek. Amplifiers, metronomes, and many more. Trans-Tek helps you to learn while building.


HI-FI/AUDIO

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

139. Altec Lansing covers both ends of the audio market—microphones and loudspeaker systems. Altec supplies the facts you do the asking. Circle 139 now!

19. Empire's new 16-page, full-color catalog features speaker systems in odd shapes for beautiful room decor. Also, rediscover Empire's quality turntable line and cartridges.


85. Write for the specs for an ideal 35amp and amp, and you've spelled out Dynaco's stereo 120 amp and PAS-3X preamp. So why not get all the facts from Dynaco?

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

131. Let Elpa send you "The Record Ominbook." It's a great buy and Elpa wants you to have it free. Your records will thank you when the mailman delivers it.

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

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

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

TAPE RECORDERS AND TAPE

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

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

32. "Everybody's Tape Recording Handbook" is the title of a booklet that Sarkes-Tartarion will send you. It's 24-pages jam-packed with info for the home recording enthusiast. Includes a valuable table of recording times for various magnetic tapes.

44. "All the Best from Sony" is an 8-page booklet describing Sony-SuperScope products—tape recorders, microphones, tape and accessories. Get a copy before you buy!

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

HI-FI ACCESSORIES

112. Telex would like you to know about their improved Sereenata Headset—and their entire line of quality stereo headsets.

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

RADIO-TV EXPERIMENTER

Dept. 169
229 Park Avenue South
New York, N.Y. 10003

Please arrange to have the literature whose numbers I have circled sent to me as soon as possible. I am enclosing 25¢

1 to 10 items; 50¢ for 11 to 20 items to cover handling. (No stamps, please.)

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maximum number of items=20
Continued from page 31

a solid-state, hi-fi amplifier kit (EICO, Heath, Knight, etc.). Unless you want to deafen everybody in Ames, you don't need 250 watts. Besides, unless you're loaded with money, you couldn't afford the transistors. So how do you like them apples, son?

Talkathon
How can I connect a 5-transistor amplifier so that I can use it as an intercom?

Connect the switch and speakers as shown at right. Transformer T1 is an output transformer connected backward.

Teutonic Efficiency
How can I improve the selectivity and sensitivity of my Grundig 2440U AM/FM, shortwave receiver? The AM and shortwave IF is 460 kHz and available selectivity filters are for 455 kHz.

—R. B., Cincinnati, Ohio

Your schematic reveals that your six-tube receiver has two RF stages and one IF stage and that one of the tubes is a tuning indicator. It looks like you have a cleverly designed receiver, but don't expect super-pro performance on shortwave with so few tubes. You can add a

455-kHz IF filter at the output of the mixer if you return the IF transformers from 460 kHz to 455 kHz, but dial calibrations would then be off.

Two for Code 15
Please give me a schematic for a 15-MHz WWV receiver. I would also like to know where I can get a 15-MHz crystal.

—R. M., Clayton, Ga.

The diagram is of a simple superhet receiver. Pick the coils from the J.W. Miller catalog at your parts store. Show the schematic to the salesman. For a 15-MHz crystal, write to Texas Crystals, 1000 Crystal Drive, Fort Meyers, Fla. Your parts store may carry these, too.

(Continued on page 37)
Well-balanced Stereo

Can you give me a circuit for a good stereo amplifier that will drive 8-ohm headphones from a crystal pick-up?

—G. B., Royal Oak, Mich.

Here's one that employs eight transistors in a standard push-pull circuit (see diagram above). The transformers are given in the schematic. The secondary of both T3 and T4 should be 8 ohms to match the phones. Solid-state amplifiers should operate with as little heat as possible, so use heat sinks wherever necessary.

Very High Fuzz

I am a police officer and would like to build a convertor for use with an auto radio to tune in a station on 158.88 MHz.

—T. J. E., Jersey City, N.J.

Here's a diagram for a vhf convertor. These circuits are tricky and wiring must be as short as possible. You may be able to find suitable coils (L1, L2) through a radio supply company or through someone who carries vhf equipment. Sentry Mfg. Co., P.O. Box 12322, Oklahoma City, Okla. has ready-to-install convertors on the market. Try them, and keep on saying you're a policeman.
"And that, dear, is my QTCD signal—third call to dinner."

"I told you that was a powerful antenna."

"I didn't know you'd gone mobile, Joe. What'd you do with the baby?"

"We've had complaints your signals are interfering with the normal flow of traffic along this street, miss."

"Whaddaya know! A ham radio retriever!"
Fickle Finger Finder

See through lies and have fun with a lie detector that tells you no tales.

By Ron Michaels

Do you have a credibility gap in your home? Are you getting wrong answers to what you think are the right questions? Would you like your next party to be the blowout you've always hoped for? Well, whether it's used for super-sleuthing, electronic instruction, or just plain ol' fun, our Triple F (Fickle Finger) (Continued overleaf)
Fickle Finger Finder

Finder) lie detector should turn out to be that one electronic construction project you've long been waiting for. No matter what the application, this pint-sized polygraph provides reasonable accuracy and excellent sensitivity so that you can put the finger on any or all who are willing to be examined.

Pro and Con. Although the Triple F lie detector is far simpler than a professional model—the kind used by law enforcement agencies—it works on much the same principle. It measures the subject's skin resistance before, during, and after he gives an answer to your question. When a series of questions are administered to him, changes in his skin resistance should reflect a change in his emotional state or psychological attitude.

Of course, professional devices sample several other physiological variables as well. Measurements of heart rate, breathing rate, and blood pressure are all necessary to obtain an indication of the subject's general condition under questioning. The polygraph is obviously so named because many graphs must be recorded at the same time.

While meter face was changed on cover photo, everything else is the same. Small chassis mounts on meter case via gooseneck stand.

Chances are, you've observed from the photos that our Triple F lie detector is like no other you've ever seen. This is because ordinary brass doorknobs have been used to connect the subject to the monitor. More conventional electrodes (explained later on) can be used, but the doorknob electrodes are easier to apply and are somewhat less frightening.

Now, while you may not be called upon to give family or friends the third degree, a gadget like the Triple F detector can turn a dull party into a real blast. That's why...
Brass doorknobs plug into banana jacks; plug assembly is then fixed in knob by tightening screw. Jacks must be insulated.

the doorknobs serve as electrodes. Have your subject place a finger on each knob and you're in business!

Not only is his skin resistance a factor in the meter reading, but the pressure of his fingers against the knobs introduces another variable. People can take turns lickety-split and there is no problem of changing leads or transducers. For more serious work, however, attaching electrodes are probably best.

Another feature is the built-in speaker. This will click—like a Geiger counter—at a rate which increases as the meter reading increases. Thus, an entire room full of people can monitor the goings-on and chime in on the verdict.

**Circuit Operation.** The device is built around a unijunction transistor (Q2) which is part of a variable-frequency pulse generator. The generator's output is a chain of pulses whose frequency depends on the total resistance in Q2's emitter circuit. This resistance is controlled by transistor Q1's resistance, which in turn depends on the amount of current flowing into Q1's base.

When your subject touches both doorknobs simultaneously, his body completes a Wheatstone bridge connected to Q1's base circuit and a tiny current (a few uA) flows through him into the transistor. The level of current flowing through him and into Q1 depends on his skin resistance.

Accordingly, the greater the current flowing into Q1, the lower its resistance becomes, and the pulse rate of the unijunction transistor generator increases. This causes more current to flow so that the reading on the meter increases.

The pulse output from Q2 and the meter reading are inversely proportional to your subject's skin resistance—the lower his skin resistance, the greater the current flowing in the lie detector's circuit. More important, small changes in skin resistance cause small changes in pulse rate. It's your job to detect these changes by monitoring either the meter, the speaker, or both.

The output pulses are fed to a discharge capacitor associated with a silicon-controlled rectifier (Q3). Each pulse causes the SCR to conduct momentarily. This discharges the electrical energy stored in capacitor C2 through the voice coil of the speaker, thereby producing a click. In between pulses, C2 recharges slowly in anticipation of the next pulse. Like the meter reading, the number of clicks depends on the pulse rate from Q2.

Polarity switch S1 reverses the direction of current flow through the subject. This counteracts the effects of electrolysis on the surface of his skin. Electrolysis can throw the reading off and negate your test. During a test, flip the switch back and forth every few minutes.

Potentiometer R1 (the rate control) is used to adjust the meter reading and click rate to a convenient level for monitoring. (About 4 on the meter scale is right; but note that the meter face was altered on cover photo.) This should be done at the start of a test; it will compensate for varying skin.

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**PARTS LIST FOR FICKLE FINGER FINDER**

- B1—9-V transistor battery (2N46, 246 or equiv.)
- B2—4.5-V mercury bias battery
- C1—1-pF, 200-V paper capacitor
- C2—10-pF, 10-V electrolytic capacitor
- J1—3-conductor phone jack (Switchcraft 12B, Allied 47B4696 or equiv.)
- Q1—Pnp transistor (Motorola HEP-51)
- Q2—Unijunction transistor (Motorola HEP-310)
- Q3—Silicon-controlled rectifier (Motorola HEP-300)
- R1—1,000,000-ohm, ½-watt resistor
- R2—270,000-ohm, ½-watt resistor
- R3, R9—100,000-ohm, ½-watt resistor
- R4—560-ohm, ½-watt resistor
- R5—270-ohm, ½-watt resistor
- R6—10-ohm, ½-watt resistor
- R7—1000-ohm, ½-watt resistor
- R8—100-ohm, hum-adjust, wirewound potentiometer
- S1—Dpdt toggle switch
- S2—Dpst toggle switch
- Misc.—6 x 4 x 4½-in. aluminum meter case, 3 ¾ x 1 ½ x 2-in. aluminum chassis box, 0-1 mA DC panel meter (Simpson 1212, Allied 52EB532 or equiv.), 8-ohm miniature speaker, brass doorknobs, banana plugs and jacks, phone plug, test leads, gooseneck mike stand, perf board, push-in terminals, spacers, rubber feet, decals, wire, solder, hardware, etc.

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resistances of different subjects under test.

Small Package. The circuitry is housed in a 6x4¾x4-in. aluminum meter case that has a sloping front panel. The doorknob/electrode assembly is built into a 3¾x1¾x2-in. aluminum chassis box. The small box connects to the main cabinet via a flexible microphone stand called a gooseneck. A heavy weight of some kind in the main cabinet should prevent the unit from tipping over if you desire greater stability.

Start out by mounting S1, S2, R1, the meter, and the gooseneck on the cabinet. Mount the speaker against one side and drill a few holes in front to serve as a grille. Potentiometer R8 (meter range adjust) mounts in the floor of the cabinet so that it is accessible from the underside. This will be used after the cabinet is closed.

The bulk of the circuitry goes on a piece of perf board. This should be mounted on the back of the case. Push-in terminals can be used as soldering points. Parts layout isn’t critical but check on the polarity of semiconductor leads and electrolytic capacitor C2 when you wire them in place.

Power is supplied by a large 9-volt transistor radio battery (B1). Since current drain is relatively low, you can dispense with a battery holder if you wish. Just cement the battery in place with a few drops of contact adhesive—it’s easy to break the bead loose during replacement. Also mount the 4.5-volt mercury bias battery (B2) in the same way. The batteries can also be secured with a piece of tape.

The doorknobs are connected to the circuit via insulated banana jacks mounted on the small chassis box. Discard the plastic sleeve from the corresponding banana plug and place the metal plug assembly inside each doorknob. Then tighten the knob’s setscrew to get a good electrical and mechanical connection. It’s important that neither of the jacks touches ground! (Since most brass doorknobs are supplied with a protective lacquer coating that acts as an insulator, this must be removed before mounting. Acetone or nail polish remover will do the job.)

Finally, phone jack J1 should be mounted in the small chassis (as shown), or in the meter case. This jack enables you to connect other types of electrodes to the circuit.

Electrodes. Various electrodes can be made from metallic transducers that make contact with your subject’s skin. The designs possible are limited only by your imagination. An inexpensive solution can
be had by using so-called adjustable rings sold in five-and-dime stores. Solder test leads to two rings and connect the free ends to a phone plug for J1.

When you make a test, adjust each ring's diameter to fit your subject's fingers and place them on adjacent fingers of the same hand. The advantage of the ring electrodes is that contact pressure between electrode and skin surface is more or less constant. The varying pressure will change the reading just like a change in skin resistance.

Regardless of what type of electrode you use, it is important that your subject doesn't touch the metal cabinet or any ground point during a test. This will short out the base circuit of Q1 and produce an artificial (and meaningless) high pulse rate.

Adjustment. The meter range adjust control (R8) must be set before you operate the instrument. Start by setting R1 (rate control) for minimum resistance. Next, moisten the thumb and forefinger of one hand (this insures minimal skin resistance) and place them simultaneously across both doorknobs. Now adjust R8 for just under full-scale deflection (approximately 9.5).

The most sensible approach is to adjust R1 at the start of each test so that the meter will read some standard value (4 is about right). At this setting the clicks from the speaker will be slow enough so that slight changes in pulse rate can be heard.

Stimulus-Response. It takes a good deal of skill to administer a lie detector test and then interpret the results. Even so simple a polygraph as your Triple F detector will be difficult to monitor in the beginning. However, the basic idea is simple. When a person knows that he is lying, his heart may beat a bit faster, he may breathe a bit deeper, and he may perspire more, thereby lowering his skin resistance.

The may is important. Many liars don't react much, especially when they are used to lying. An honest person may react simply because the machine and the circumstances
Fickle Finger Finder

make him nervous. All these variables make it clear why a lie detector test can't be used as evidence in a courtroom.

One oft-used technique is to ask the subject a long series of questions that can all be answered with a simple yes or no response. This helps put the subject at ease and establishes a reference before more strategic questioning. These first questions should be non-controversial and should cover general topics: "Are you a male?" "Have you ever been to Boston?", etc.

Keep track of the subject's reactions while these questions are being asked and try to determine what you think is a standard response. Then suddenly slip in a loaded question at some strategic point. Study the response carefully. Did the meter reading (or click rate) change in some way? Did it take longer to steady itself? Was there much movement?

Now you have an established questioning procedure. Continue to ask a series of neutral questions and then slip in one that is strategic. If you notice a markedly different response to the important question, you’re in the money. There is a definite possibility that your subject is lying as he answers, or that he is at least disturbed by the question. Once you have this kind of indication, you can determine a more direct line of questioning to get the goods on him.

Remember to flip the polarity switch during the test, and if you use contact electrodes, make sure they don't come loose. Naturally, the meter must face away from the subject. A cutout switch for the speaker can also be added to prevent any leakage of information during more serious work. For parties, however, keep things simple.

Here's a girl who's telling the truth! Mrs. Michaels seems to be an old hand at beating her husband's line of inquiry. She demonstrates correct position for your subject.

For more information on the capabilities of your Triple F detector, take a look at any textbook on experimental psychology. In the chapter on galvanic skin response you'll find lots of info on possible ways to use your equipment.

As we've said, it takes time to get squared away with testing procedures and develop some skill at interrogation. But you should do all right; all it takes is accurate monitoring and a willing subject.

Circuit board layout follows schematic closely. Leads are not critical, but don't get sloppy about wiring. Use some kind of heat sink when you solder semiconductor leads.
Tapping the Treasures of the Last Continent

Electronics helps turn the key to open Davy Jones' Locker
By Jorma Hyypia

The biggest treasure chest in the world has a volume exceeding 3.5 billion cubic miles. Crammed into it are treasures of infinite variety and mind-staggering value. The jealous custodian of this fabulous hoard: Davy Jones.

At long last, the greedy old sea devil is about to get
Left, cachalot diving chamber (Westinghouse stole name from deep-diving sperm whale) returns to mother ship. Note life-support oxygen and helium tanks strapped to side of chamber. Right, cachalot system utilizes two chambers—one for diving, another (at rear) for on-deck decompression. Men pass from one chamber to other through pressure locks.

Oxygen sensing and controlling device by Westinghouse is used in cachalot system. It makes automatic adjustments if gas mixture in deck chamber changes and signals crew should the diver's apparatus malfunction.

His come-uppance. Reason is the biggest safe-cracking job in history is in the making. The necessary tools, weapons, life-support systems and get-away vehicles are ready. Tactical plans for Operation Treasure Chest are being drawn up. All that remains is to pick just the right team for the job.

Master mind of the operation is the U.S. federal government. The Soviet Union may become a co-partner, or at least first lieutenant. To qualify as a leader, each of these nations must contribute from $3- to $5-billion for operational expenses. The rest of the team—consisting of volunteers from 45 other qualifying nations—would contribute an aggregate of several billions more.

The time table calls for a ten-year assault on Davy Jones' locker, beginning in 1970 or soon thereafter. The expected loot: scientific information, minerals, oil, natural gas, fish and other food materials.
Above, deep ocean work boat by AC Electronics is self-propelled, two-man sub designed for undersea research, placement and recovery operations, and general surveillance work. TV camera and direct optical systems provide 360-deg visibility. Below, interior of boat as pictured by fish-eye lens. Sub can carry payload (men and instruments) of 1021 pounds.

**Electronics Role.** Man has been dunking under ocean waters in all sorts of contraptions for hundreds of years, but the big plunge into oceanographic research has come only within the past few decades. In a relatively short time, oceanographic techniques have been developed to such degree that a major international decade of ocean exploration is now feasible.

Electronics plays a vital role in virtually every aspect of ocean exploration—from the simplest telephone communications between divers and surface support crews, to complex computerized data processing of scientific observations.

The accompanying illustrations provide the briefest sampling of the ways in which electronics is used in marine science.

**Hazardous Work.** Deep sea exploration is one of the most hazardous of man's occupations. The fact that remarkably few men
Used for seismic measurements, digital-air gun by Texas Instruments (above) is electromechanical device that forces air bubbles of predetermined sizes under water. Below, shipboard oceanographic system, also developed by Texas Instruments, digitizes, corrects, linearizes, arranges, and plots variety of data.

Bottom-scanning sonar by Westinghouse used ultrasonic sound to make picture of Atlantic bottom (above) at depth of 8000 ft. Device (below) operates at depths up to 20,000 ft.

lose their lives in this work is a testimonial to the ingenuity of scientists and engineers who place safety before daring.

As man goes ever deeper into this hostile environment, his problems of survival are compounded. Undoubtedly, a diver's two greatest worries concern breathing and coming back alive and well.

**Martini Law.** If ordinary air were to be used in dives deeper than 150 feet, the nitrogen in the air would produce a narcotic effect on the diver called "rapture of the deep." Divers describe the effects of nitrogen narcosis by stating "Martini's Law": every additional 50 feet of diving depth produces the same effect as one more martini.

Oxygen also becomes toxic at depths greater than 300 feet because the great pressure forces excessive amounts of the life-sustaining gas into the bloodstream. To com-
Sparkarray transducer by EG&G Inc. produces sound pulses for seismic profiling of ocean bottom. Signals from sparkarray can penetrate bedrock effectively at depths up to 7000 ft.

Undersea radioisotope generator by Martin Marietta will power oceanographic buoy for beaming data to ships and planes.

To compensate for these two effects, helium is substituted for nitrogen (it does not dissolve as easily in the bloodstream), and the proportion of oxygen to inert gas is progressively reduced with increasing depth. The helium produces one curious effect: it makes the voices of divers sound like Donald Duck over communications systems.

How does electronics enter into these problems? Automatic sensor systems now monitor diver's oxygen supplies and warn of malfunctions in the supply equipment even before the divers themselves feel adverse effects. And the quack is being taken out of the garbled Donald Duck speech by electronic de-scrambling.

Prolonged Submergence System. In the past, divers consumed more time going down and coming up than they spent on the bottom doing work. Now the men can be hauled up as fast as the winches can turn, without the slightest danger of the dreaded "bends."

A number of oceanographic research organizations are independently developing prolonged submergence systems in which the diving chambers remain pressurized after being surfaced. From these diving chambers the men pass into other on-deck chambers having equal pressures; here they can either be decompressed gradually, or they can remain fully pressurized until the next trip into the deep. In fact, divers can now live for weeks in a "deep sea" environment, right on the deck of the mother ship. Thus, in the course of a prolonged exploration project requiring many dives, they need to be decompressed only once—when the job is done.

The electronic devices associated with life-support systems are relatively simple, albeit of vital importance. The truly sophisticated and ingenious applications of electronics are in the area of instrumental data gathering.

Pingers, boomers, sparkarrays, digital-air (Continued on page 120)
Mohammed can't go to the mountain? Then send mountain to Mohammed—and pronto!

High-school students in the Greater New York area are now offered a helping hand found in few other places in the world. The hand, in this case, takes the form of a special FM radio station. Its purpose: to enable physically handicapped students to continue their education even though they can't go to school. What's more, there's even a special telephone system that lets students and instructors communicate with each other al-

Homebound student calls in question to his instructor over special telephone system. Instructor receives question from student at left, then files it with other queries.
In studio, students and instructor participate in High School of the Air round-table discussion, which is broadcast to homebound students who are physically unable to attend classes.

most as though they were in the same room.

Students who are participants in Homebound Instruction, a program for students who are unable to attend school because of permanent or temporary physical handicaps, are supplementing their education by means of High School of the Air. This special FM radio station, which has been set up to broadcast educational programs for the homebound student, helps him keep pace with his schoolmates and prepares him for his Regents and College Board Examinations.

As part of Homebound Instruction, a program which brings teachers to the students' homes for regular two-hour sessions, High School of the Air is a combination radio station and school. While students at the station participate in regular classes, homebound students listen to the classes and communicate with their instructors via a
Absentee Sit-In

Technician supervises equipment which broadcasts High School of the Air programs.

telephone broadcasting system. This free-flowing dialogue between instructor and Homebound students enables their teachers to answer questions as well as quiz their absentee students.

Safeguarding the handicapped student from an irretrievable academic set-back, High School of the Air ensures that the high-schooler will receive a well-rounded, college preparatory education despite his accident or illness. —Robert Levine

Tapes and tape recorders play important role in station's programming. Machines in foreground are professional RCA units.

Getting ready to record High School of the Air program, station technician loads tape on recorder mounted in large rack panel.
See what magnetism can really do, then freeze it for your friends!

By Erik Horneman

Fascinating as they are, two-dimensional magnetic field patterns (made by sprinkling iron powder on cardboard or glass placed over magnets) provide only a limited representation of what are actually three-dimensional phenomena. Force field patterns become doubly interesting and revealing when the missing third dimension is added.

Unfortunately, it's not possible to convey the unique characteristics of 3-D magnetic patterns in two-dimensional photographs. You'll have to use your imagination to visualize what the equipment described in this article will give you.

You can start experimenting using nothing more elaborate than a test tube, a couple of small magnets, a bit of iron powder, and some mineral or cooking oil. But your experiments will have more zip if you go to a little more trouble and set up the experiment properly.

Plastic Cell. The 3-D force fields are not easy to observe in a test tube because the curved glass distorts the image. A wide-mouth medicine bottle with flat sides is preferable to a test tube. However, a relatively tall plastic cell made from sheet plastic is best of all.

Make the cell from ⅛-in. thick acrylic plastic sheet (Lucite or Plexiglas) that can be obtained from plastic suppliers, or from craft or hobby stores. Cut four 1½ x 5½-in. pieces for the walls, and a 1½ x 1¾-in. piece for the bottom.

The plastic can be cut with a fine-toothed hand saw, or preferably, with a bench power saw fitted with a special abrasive cutting wheel designed for plastics and similar materials. In any case, all edges must be made perfectly square and smooth to get leak-proof joints. If the plastic is purchased from
Magnetic Forces

a supply house or a small plastics fabricator, you may be able to obtain the plastic pre-cut to the required sizes.

Clamp the four walls together firmly to form a rectangle. Using a small artists' paint brush dampened with adhesive solvent, feed a little of the solvent along the joints. Too much solvent, however, will spread out and spoil the cell walls by etching the plastic. Use just enough to wet the joints so that the ground glass look of the edges disappears. The solvent will run into the joint interfaces by capillary action.

The best solvent to use is ethylene dichloride. This can be obtained from chemical supply houses, or possibly from the dealer supplying the sheet plastic. Glacial acetic acid also works well though it takes a bit longer to set. Be sure the acetic acid is 100% pure. You can obtain it from a drug store or photosupply store.

Now set the cemented rectangle aside, still clamped, for an hour or two. The hardening time can be determined by cementing some plastic scrap together at the same time.

When this is done, check one end to see that the walls match perfectly. If they don't, use a sanding wheel to flatten and smooth the bottom edges, or rub them against sandpaper if a sanding wheel isn't available. Now clamp the bottom piece in position and cement it in place.

When the cell is finished, fill it with water and check for leaks. If a leak is discovered, dry the cell, re-clamp, and add more adhesive to the leaky spot.

Light Baffle. The field patterns are more visible if the cell is illuminated from the rear with a 150-watt bulb. To eliminate glare, make the simple cardboard baffle shown in the drawing. Any stiff cardboard will do. Better yet, try using photographic mounting board. It's easy to cut and shape and makes

Laboratory hardware comes in handy for holding magnets against plastic cell. Object in background is cardboard light baffle (see above) with window to illuminate filings.
an attractive baffle for display purposes.

Use the dimensions shown if you made the cell as specified. Cut only about a third of the way through the indicated lines (using a sharp knife or razor blade) and bend the board back to form two angled sides and a top. The window should be covered with a piece of ground glass, translucent artists' acetate, or even translucent paper—anything that will diffuse the light passing through the window.

The cell was designed for use with relatively small magnets such as cupboard door catches or small alnico horseshoe magnets sold by hardware stores. The magnets shown are about 1-in. long. Naturally, you can make larger cells for more dramatic displays if you have bigger and stronger magnets.

Make your own iron powder by filing or grinding ordinary nails. Iron powder can also be purchased from science supply houses. (Edmund Scientific Co., Barrington, N.J. 08007, sells a pound of powdered cast iron—catalog #60,176—for only 75¢ postpaid.)

A small amount of iron powder (start with about 1/4 teaspoon) is suspended in enough oil to almost fill the cell. Water will not do because the powder settles too rapidly. Almost any viscous material will do. Extra heavy mineral oil (Nujol) sold at drug stores is cheap and very good because it is thick and clear. Glycerine and thin cooking oils can be used as long as they do not have much color.

**Magnetic Bridge.** For your first experiment, try making a magnetic bridge. Position the small magnets on opposite sides of the cell, about a third of the way up from the bottom. Orient the magnets so that their opposite poles are facing and they will attract rather than repel one another.

Shake the iron/oil mixture vigorously to produce a uniform suspension and pour it quickly into the cell. As the iron powder begins to settle, the particles will be trapped by the magnetic field. Most of the particles should accumulate near the poles of the magnets in the form of radiating, fibrous rosettes. If enough powder is present, whole bridges will form across the cell along the dominant lines of force. The bridge will remain intact so long as the magnets are left in place, but it will collapse the moment the magnets are removed.

The cell must be tall so that there is a reservoir of suspended powder that can gradually precipitate into the magnetic field. If there isn't enough powder present to form a complete bridge, add more powder by sprinkling a little at a time on top of the oil. Try to avoid forming lumps.

Watch the settling process with the aid of a magnifying glass. The particles first form stringlike clusters while still distant from the magnet poles. These strings slowly become oriented into curved patterns that reveal the outlying, weaker regions of the magnetic field. Eventually, the more remote patterns disappear as the powder accumulates near the center of the field.

**Magnetic Tree.** Many different experiments can be performed with the equipment. Try using magnets of different sizes and shapes, or introduce iron objects into the cell where they can become magnetized by induction.

(Continued on page 118)
Super Speakers

Psychological warfare takes a new tack with airborne systems that

- The voices of diplomats engaged in Vietnam peace talks in Paris rarely carry beyond the heavy doors of the conference rooms. But over the battlefields of Vietnam the voice of Uncle Sam is so loud and clear it can penetrate enemy bunkers from flying podiums a mile or more in the sky.

   It's all part of psychological warfare made possible by modern audio electronics. Helicopters and other aircraft now flying over enemy territory carry high-power speaker systems capable of beaming anywhere from 250 to more than 2000 watts of solid audio at ground targets.

   In wars past, about the only electronic way to alert enemy troops to your side of the story was by means of normal radio broadcasts, which might be picked up by a few bootleg receivers in the enemy ranks. Such broadcasts could be easily jammed to make them virtually ineffective. Not so with the big voice in the sky. Every human being within range can't help but hear clearly. And about the only way enemy forces can hope to short-circuit this type of broadcast is with anti-aircraft fire.

   The Peace Front. Psychological warfare is only one of many possible uses for these super speakers. They should be very effective in the control of civil disturbances, for example, and rescue teams searching for trapped mountain climbers or for victims of air disasters can be given helpful information. Similarly, civilians trapped in flood or other disaster areas can be given vital survival instructions.

   The audio system can of course be used in ground-based installations as well as in aircraft. Since no single system could possibly meet all operational needs, one company—Applied Electro Mechanics, Inc. of Alexandria, Va.—has made provision for ganging several basic systems when broadcast conditions call for extremely high audio outputs.

   Choose Your Power. A glance at the specs for the AEM high-powered voice amplifier reveals that it is completely transistorized and capable of operating in a temperature range extending from -30 to +130°F, in relative humidity up to 97 percent, and at altitudes up to 12,000 ft above mean sea level. The maximum usable range is more than one mile under favorable conditions.

   Maximum rated audio output is 250 watts, but this can be increased to 350 watts under special conditions. Considerably more radiated power can be obtained by operating amplifiers in multiple combinations of two, four, or more. The amplifier is normally...
Go to War

blast out with 2000 watts of solid audio

/ By Carlos Gunzmann

powered by a lead-acid or nickel-cadmium 24- to 28-V storage battery. Lower voltage supplies can be used, but at a sacrifice of audio power.

Frequency response of the amplifier is flat within 3 dB over the 500 to 5000 Hz range —more than adequate for good voice intelligibility. Because the amplifier operates in a saturated state, its voltage waveform at full power approaches a square wave. Operating at 0.4 rated power, its amplitude distortion is 12 percent or less, measured at a frequency of 1000 Hz with sine-wave output.

Preamp, Driver, Output. Signal amplification is achieved with a two-stage preamplifier module consisting of a single-transistor linear amplifier feeding a two-transistor push-pull stage. The output from the preamplifier module is fed to a push-pull class-B driver stage, which drives a bridge-type power amplifier output stage. The output stage is directly coupled to speakers, connected so as to give a nominal 2-ohm impedance to the AC current flow.

The usual load is furnished by two 4-ohm speakers connected in parallel. However, higher directivity can be gained by paralleling four 8-ohm speakers to load one amplifier.

Because the transistorized system could easily be damaged by misuse, a protective circuit utilizing electronic switching has been added. It operates within microseconds to protect semiconductor components from such adverse conditions as reverse polarity or excessive current. When the trouble is cleared, or if it is only transitory, the protective circuit resets by simple operation of the power switch.

A noise-cancelling dynamic microphone having an output impedance of 50 ohms is normally used. This standard mike can be replaced with a newer type having 20-dB improvement in anti-feedback characteristics. It makes possible microphone operation in the immediate vicinity of high-powered speakers working under full gain. There is also improvement in the rejection of background noises.

As you might expect, the system isn't limited to live voice programming. Specially designed tape players can provide repeat transmissions of messages lasting as long as 25 minutes.

Airborne Systems. The projection of sound from fixed wing or helicopter aircraft is feasible up to two miles slant range with a one- or two-amplifier system. The way speakers are mounted on the aircraft depends on the type of flight pattern that's
Super Speakers

planned. If a target circling course is to be used, the horns are pointed horizontally abreast of the aircraft frame so that the bank of the aircraft or the downward thrust of rotor blades will direct the sound beam at the ground target.

Sometimes the speakers are mounted in an open doorway or are fitted into a stream-lined pod attached to a wing armament rack to reduce air resistance.

Ground Installations. Super speakers operated from ground-based installations can project sound over great distances if conditions are favorable. Since sound waves are strongly affected by wind, weather, time of day, and intervening objects, the operators of these outdoor sound systems must contend with unusual problems that the average hi-fi hobbyist never has to think about.

A line-of-sight beaming toward the target area is ideal, especially if the sound can be made to pass over rivers or lakes. Hillside locations can be excellent for sending messages into valley areas.

Echoes can both help and hinder message transmission. Ordinarily, echoes result in wasted power; hence the sound beam should be aimed so as to clear intervening masses such as hills or buildings. However, echoes can at times be used to advantage to reach targets which sound cannot be beamed to directly.

Sound projection is easy if the speakers can be located upwind of the target area so that the wind can help to carry the sound in the desired direction. If the sound must be beamed cross wind, the horns must be directed slightly upwind of the target. Though the degree of correction depends on the projection distance and the wind velocity, the average correction works out to about one degree for each 10 mph of cross wind.

Better Than Bombs? While the cross-currents of public opinion concerning the morality and military wisdom of bombing North Vietnam blow ever hotter, there can be little opposition to bombarding the enemy with words. Given a choice, even the enemy would surely prefer saturation with 2000 watts of audio power than with 2000 pounds of bombs!

But in war you do not ask what pleases the enemy. You ask what offensive and defensive tactics are effective. Is this type of psychological warfare worth the trouble? Does it really lower enemy resistance in any measurable degree? Even on this opinions will differ. But it's still worth a try.

In any case, the U.S. cannot be accused of waging only a shooting war. It's also waging a shouting war—on the battlefield as well as in the conference room.
A person who allows himself to be lulled to sleep by a quietly-playing radio may be harming himself without knowing it.

This is a preliminary finding of National Research Council of Canada scientists using a new high-speed method of analyzing the effects of noise, such as from traffic, on sleeping subjects. The NRC method permits eight hours of recorded brain wave patterns to be scanned in five minutes and is expected to eventually gain wide acceptance in other areas of sleep research.

While the number of subjects studied is still small, it is clear that levels of noise as low as 50 dB (the rating of a quiet radio) can disturb a sleeper without actually awakening him. The nature of the disturbance involves a change from a deep to a shallower sleep and this is known to be deleterious to a person’s well-being.

(Continued on page 113)
Look What's New In Your

Heathkit Solid-State Tachometer
The Professional Tach. That's the new Heathkit MI-18. In Design: breaker point, "tach" lead or unique inductive pickup connection; use it with any spark-type engine and any ignition system, 2 cycle 1-6 cyl. engines or 4 cycle, 2-8 cyl. engines. .. all electronics are in the tach itself. In Performance: 0-6000 & 0-9000 RPM ranges ... 290° edge-lighted dial ... temperature-compensated, ±4½% accuracy from 0° -120° ... adjustable red line pointer ... ±0.5 to 17.5 VDC operation. In Styling: stainless steel hardware, splash-proof black & chrome case and scratch-proof glass face for use in rugged conditions. The MI-18-1 mounts in your dash — requires only a 3½" hole & 2½" depth. The MI-18-2 comes with mounting case & hardware. Put a Professional Tach in your car, boat, dune-buggy, or bike now — the Heathkit MI-18! Shpg. wt. 3 lbs.

Heathkit AM-FM Portable Radio
Here's performance others can't match. The new Heathkit GR-17 portable has 12 transistor, 7 diode circuit with the same front end as Heathkit hi-fi tuners; 3-stage IF; big 4" x 6" speaker; tone control; AFC on FM and amplified AGC on AM; built-in AM rod antenna plus telescoping 34" FM antenna; 350 milliwatt output; and 200-300 hour battery life. Shpg. wt. 5 lbs.

Heathkit FM Stereo COMPONENT-COMPACT
This new Heathkit AD-27 stereo compact has features not found in other units costing twice as much for one very simple reason. It wasn't engineered to meet the usual level of compact performance. Instead, Heath took one of its standard stereo/hi-fi receivers, the AR-14, and re-arranged it physically to fit a compact configuration. The result is performance that is truly high fidelity without compromise. It has 31 transistor, 10 diode circuitry with 15 watts per channel dynamic music power (enough to let you choose any speaker systems you prefer), full-range tone controls, less than 1% distortion, and 12 to 60,000 Hz response. The pre-assembled FM stereo tuner section with 4-stage IF offers 5 uV sensitivity, excellent selectivity, AFC, and the smoothest inertia tuning. The BSK McDonald "500" turntable offers features usually found only in more expensive units — like low mass tubular aluminum tone arm, anti-skate control, cutting and pause control, plus a Shure magnetic cartridge with diamond stylus. It's all housed in a smart oiled walnut cabinet with sliding tambour door that disappears inside the cabinet. For value and performance choose the AD-27, the new leader in stereo compacts. Shpg. wt. 41 lbs.

HEATHKIT AJ-15 Deluxe Stereo Tuner
For the man who already owns a fine stereo amplifier, and in response to many requests, Heath now offers the superb FM stereo tuner section of the renowned AR-15 receiver as a separate unit. The new AJ-15 FM Stereo Tuner has the exclusive design FET FM tuner for remarkable sensitivity, the exclusive Crystal Filters in the IF strip for perfect response curve and no alignment; Integrated Circuits in the IF for high gain, best limiting; elaborate Noise-Operated Squelch, Stereo-Threshold Switch; Stereo-Only Switch; Adjustable Multiplex Phase, two Tuning Meters; two variable output Stereo Phone jacks; one pair variable outputs plus two fixed outputs for amps, recorders, etc.; front panel mounted controls; "Black Magic" panel lighting; 120/240 VAC operation. 18 lbs. *Walnut cabinet AE-18, $19.95.

HEATHKIT AA-15 Deluxe Stereo Amplifier
For the man who already owns a fine stereo tuner, Heath now offers the famous amplifier section of the AR-15 receiver as a separate unit. The new AA-15 Stereo Amplifier has the same superb features: 150 watts Music Power; Ultra-Low Harmonic & FM Distortion (less than 0.5% at full output); Ultra-Wide Frequency Response (+1 dB, 8 to 40,000 Hz at 1 watt); Ultra-Wide Dynamic Range Preamp (98 dB); Tone-Fat Switch; Front Panel Input Level Controls; Transformerless Amplifier; Capacitor Coupled Outputs; Massive Power Supply; All-Silicon Transistor Circuit; Positive Circuit Protection; "Black Magic" Panel Lighting; new second system Remote Speaker Switch; 120/250 VAC. 26 lbs. *Walnut cabinet AE-18, $19.95.
New Lower Prices On Heathkit Color TV
Make Them A Better Buy Than Ever!

Deluxe "295" Color TV...Model GR-295 $449.95
(less cabinet)

New improved phosphors and low voltage supply with boosted B+ for maximum color fidelity and operation - automatic degaussing - exclusive Heath Magna-Shield - ACC and AGC assures color purity. Flutter-free pictures under all conditions - preassembled IF with 3 stages instead of the usual 2 - deluxe VHF tuner with "memory" fine tuning - choice of installation - well, custom or optional Heath factory assembled cabinets - easy to assemble.

Big. Bold, Beautiful... With Advanced Features and Exclusive Heathkit Self-Servicing. Top quality, American brand color tube... 227 sq. inch viewing area. The built-in dot generator and full color photos and simple instructions let you set-up, converge and maintain the best color pictures at all times. Add to this the detailed trouble-shooting charts in the manual and you put an end to costly TV service calls for periodic picture convergence and minor repairs.

GRA-295-4, Mediterranean cabinet shown $119.50
Other cabinets from $62.95

Deluxe "227" Color TV...Model GR-227 $399.95
(less cabinet)

Has same high performance features and built-in servicing facilities as the GR-295, except for 227 sq. inch viewing area. The vertical swing-out chassis makes for fast, easy servicing and installation. The dynamic convergence control board can be placed so that it is easily accessible anytime you wish to "touch-up" the picture.

GRA-227-1, Walnut cabinet shown $69.95
Mediterranean style also available at $58.95

Deluxe "180" Color TV...Model GR-180 $349.95
(less cabinet)

Same high performance features and exclusive self-servicing facilities as the GR-295 except for 180 sq. inch viewing area. Feature for feature the Heathkit "180" is your best buy in deluxe color TV viewing tubes alone list for over $245. For extra savings, extra beauty and convenience, add the table model cabinet and mobile cart.

GRA-180-5, table model cabinet and cart $39.95
Other cabinets from $24.95

Now, Wireless Remote Control For Heathkit Color TV's
Control your Heathkit Color TV from your easy chair, turn it on and off, change VHF channels, volume, color and tint, all by sonic remote control. No cables cluttering the room... the handheld transmitter is all electronic, powered by a small 9 v. battery housed in a small, smartly styled plastic case... feather-light and contoured to fit comfortably in your hand for easy push-button operation. The receiver contains an integrated circuit (15 resistors, 10 transistors, 1 diode) and a meter for adjustment ease. Circuit board construction and plug-in wire harness make installation of receiver and control motors easy.

For greater TV enjoyment, order yours now.
kit GRA-295-6, 9 lbs., for Heathkit GR-295 and GR-25 Color TV's $69.95
kit GRA-227-6, 9 lbs., for Heathkit GR-227 and GR-180 Color TV's $69.95

FREE 1969 Heathkit Catalog
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HEATH COMPANY, Dept. 11-32
Benton Harbor, Michigan 49022

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3 HEATHKIT COLOR TV'S
NOW! ALL WITH 2-YEAR
WARRANTY ON PICTURE TUBE

NEW Wireless TV Remote Control
$69.95
Propagation Forecast

□ Probably the biggest surprise of this current sunspot cycle, and we have now just about reached its peak, is the continued abundance of DX on lower shortwave frequencies. This past summer, when reception below 6 MHz should have been at its worst, the DX continued to roll in, especially on 60 meters.

With the static level now reaching its annual low, 60-meter reception will be even better from Central Africa (see Forecast table), while 90 meters should also be watched closely for unusual Central African DX. And although South Pacific reception will have been reduced to a trickle (it is midsummer down there) both 60- and 90-meter bands will provide SWLs with some excellent Latin American loggings north of the Tropic of Capricorn. Why to listen? Why, check our Peak Listening Periods table and good DX to you!

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

PEAK LISTENING PERIODS

<table>
<thead>
<tr>
<th>Area</th>
<th>EST</th>
<th>PST</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASIA (except Near East)</td>
<td>0300-0900</td>
<td>2100-0900</td>
</tr>
<tr>
<td>EUROPE, NEAR EAST, &amp; AFRICA (N. of Sahara)</td>
<td>1500-2400</td>
<td>0300-0600</td>
</tr>
<tr>
<td>AFRICA (S. of Sahara)</td>
<td>1500-1800</td>
<td>1800-2300</td>
</tr>
<tr>
<td>SOUTH PACIFIC</td>
<td>0300-0900</td>
<td>0000-0900</td>
</tr>
<tr>
<td>LATIN AMERICA</td>
<td>1800-0800</td>
<td>1300-0500</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DEC. 1968/1969 LISTENER'S STANDARD TIME</th>
<th>ASIA (except Near East)</th>
<th>EUROPE, NEAR EAST &amp; AFRICA (N. of the Sahara)</th>
<th>AFRICA (S. of the Sahara)</th>
<th>SOUTH PACIFIC</th>
<th>LATIN AMERICA</th>
</tr>
</thead>
<tbody>
<tr>
<td>0000-0300</td>
<td>19, 25</td>
<td>41, 49</td>
<td>49, 60e, (90e)</td>
<td>25</td>
<td>49, 60</td>
</tr>
<tr>
<td>0300-0600</td>
<td>(25, 31), 41, 49</td>
<td>31</td>
<td>(31-poor)</td>
<td>25, 31, (41w)</td>
<td>49, 60</td>
</tr>
<tr>
<td>0600-0900</td>
<td>(25, 31), 41, 49</td>
<td>16, 19</td>
<td>19</td>
<td>25, 31</td>
<td>49, 60</td>
</tr>
<tr>
<td>0900-1200</td>
<td>19, 25</td>
<td>13, 16, 19</td>
<td>19, 25</td>
<td>19</td>
<td>31</td>
</tr>
<tr>
<td>1200-1500</td>
<td>16, 19</td>
<td>13, 16, 19</td>
<td>(19), 25</td>
<td>(25-poor)</td>
<td>19</td>
</tr>
<tr>
<td>1500-1800</td>
<td>16, 19</td>
<td>(19), 25, 31, (49)</td>
<td>31, 60e</td>
<td>(19-poor)</td>
<td>31</td>
</tr>
<tr>
<td>1800-2100</td>
<td>16, 19</td>
<td>25, 31</td>
<td>31, 60w, (90w)</td>
<td>16, 19</td>
<td>49, 60, 90</td>
</tr>
<tr>
<td>2100-2400</td>
<td>16, 19</td>
<td>25, 31</td>
<td>60, (90)</td>
<td>16, 19</td>
<td>49, 60, 90</td>
</tr>
</tbody>
</table>

To use the table put your finger on the region you want to hear and log, move your finger down until it is alongside the local standard time at which you will be listening and lift your finger. Underneath your pointing digit will be the shortwave band or bands that will give the best DX results. The time in the above propagation table is given in standard time at the listener's location, which effectively compensates for differences in propagation characteristics between the East and West Coasts of North America. Abbreviations: w—Western North America and e—Eastern North America. When w or e follow a band listing, it means the band is only good for that part of the continent. The shortwave bands in brackets are suggested as possible second choices. Refer to White's Radio Log for our world-wide Shortwave list.
Early on a Thursday morning in 1957, a 22-year-old airman sat alone in the living room of his house trailer near Malmstrom Air Force Base, Montana. He tuned his Hallicrafters shortwave receiver to the proper frequency and waited. At exactly 7:05 a.m., the set's speaker came to life. Quickly, the young man picked up a pencil and began jotting down the details of the transmission.

But Airman Second Class Robert Glenn Thompson was no ordinary shortwave listener. He was a Russian spy and the message he copied so carefully was a secret coded instruction from Moscow.

Was Thompson the only American to hear the transmission that Thursday? Perhaps, but conceivably the message, like dozens of similar ones aired every day, could have been picked up by any shortwave listener.

**Done with Digits.** Because these secret instructions are usually sent in a series of four- or five-digit code groupings, DX devotees of the game of "spy on the spies" have dubbed them the "numbers stations." While the "numbers" game, in its present form, is largely a Cold War phenomenon, spy stations have a long, though inglorious, past. They can be traced back as far as 1915, when the Imperial German government sent Morse signals by spark-gap transmitter to its agents in North Africa, instructing them to cause trouble among the Berber tribes.

Easily heard by the average SWL, today's espionage broadcasts, beamed in various languages from transmitters on both sides of the Iron Curtain, provide a tantalizing glimpse into the shadowy world of the cloak and dagger.

**In Steps Big Red.** Thompson's role as a spy began in 1956, when the young intelligence clerk at Berlin's Tempelhof airport, fed up with his commander's petty complaints, attempted to defect to the Communists. At first he was rejected by Russian intelligence officers, but later, threatened with exposure of his offer to defect, Thompson was recruited as an espionage agent. During a five-day furlough from his military
eavesdropping
duties, the airman slipped behind the Iron Curtain to attend a spy school on the Black Sea. There he learned a smattering of Russian, elementary cryptology and the operation of certain radio equipment.

When he was reassigned by the Air Force to the Montana Strategic Air Command base, his Russian masters were delighted. They gave him $1,000 and told him to buy a short-wave radio and a camera.

Thompson was given a code book and was told when and where to tune for his radio instructions. He was to listen for his special call sign, the names of two Russian rivers, “Amur ja Lena,” (not the more exotic, but erroneous, “Amour Lenin” call reported later by the press). The novice spy was taught to use his code book to decipher the “numbers” messages. But Thompson developed cold feet once back in the States and apparently never furnished his mentors with any more information.

In 1964, the FBI closed in and arrested Thompson, then a fuel oil distributor on Long Island. The following spring he was tried in Brooklyn federal court and was sentenced to 30 years imprisonment for “13 overt acts of espionage” while serving in Germany.

**Tune ’em In.** From Thompson and Soviet defectors like Reino Hayhanen, U.S. counter-intelligence specialists learned details of the “numbers” broadcasts. Further data came from government radio monitors.

Meanwhile, shortwave listeners built up their own unofficial file of data on the “numbers stations.” This research showed that a large group of them operate between about 3 and 8 MHz. Some of these transmitters show up on approximately the same frequency, night after night. Other pop up unexpectedly on off-beat channels. One study of about 100 transmissions indicated the best time to tune for these signals may be between 2300 and 0500 GMT.

DXers report hearing spy transmissions in Russian, Czech, Polish, German, Spanish, Chinese, English, and occasionally in a gibberish that has been described as an artificial language. One listener, fluent in East European languages, heard a woman, speaking in Czech, add a final “greetings to our friends in the CIA.” This barbed comment apparently was to let Western monitors know that those in charge of the transmission were aware of the eavesdropping.

American shortwave listeners have shown great interest in Spanish language “numbers stations,” widely heard on many frequencies since the early 1960s.

**TIME** magazine once noted some of these Spanish “numbers” transmissions “probably originate no farther south than ‘Little Havana,’ in southwestern Miami.” They have been attributed to anti-Castro exile organizations signaling sabotage teams within Cuba.

Others have theorized that at least some of these transmitters are operated secretly by the Central Intelligence Agency, possibly from locations near the nation’s capital and
Text typeset, originally appearing in the book entitled The Code Breakers, closely resembles original of one-time or "gamma" pad found on Communist spies captured in Japan in 1961. In use, one side is employed for enciphering (coding), the other for deciphering (decoding).

American spy Robert Glenn Thompson (center) is flanked by two FBI agents as he is led from FBI headquarters in New York for arraignment in Federal court for supplying data to U.S.S.R.

in Florida. Certainly some of these Spanish spy broadcasts are directed to clandestine agents inside Cuba and must originate, with the tacit approval of the government, from U.S. territory.

Still other Spanish "numbers" outlets are probably the work of the Castro regime, beaming instructions to insurgency teams throughout Latin America.

Ain't Crackable! DXers, inspired by Edgar Allan Poe's "The Gold Bug," a novel popularizing cryptography, tried their hand at deciphering the signals by studying the most frequently appearing digits. In English, for example, "e" is the most common letter, followed by "t," "r," "i," "n," "o," and "a." The most frequently used letter in Russian is "i." But they were on the wrong track. Today's espionage makes use of much more sophisticated enciphering techniques.

A favorite method of the Russian spy agency, KGB, makes use of the "gamma," or one-time code pads, together with special key phrases known only to the individual spy and his masters.

Thompson was required to memorize the phrase, "Die Buchhandlungen Wirtschaft," which translates to "the bookstores management," in German. Hayhanen's key included the Russian word for snowfall, "snegopa," and the first 20 letters of a folk song.

The heart of these cipher systems is the "gamma" code pad. Ranging from cigarette pack to postage stamp size, these tiny booklets contain as many as 250 pages of highly inflammable celluloid material, which can be destroyed quickly.

On each page there are scores of five-digit figures. Pages to be used for deciphering the "numbers" messages are printed in red. Others, printed in black, are used for enciphering outgoing messages. The spy's own reports, incidentally, are rarely sent by radio, due to the ease with which authorities are able to pinpoint (Continued on page 117)
Control box in hand, Saul readily convinces robot to demonstrate its spectacular feats. Robot can open its mouth, blink its eyes, walk, turn, wave its arms.

Above, Saul and his brother Lenny search through junkbox for parts for robot.
About Monsters

Not one, but two robots now lay in the creative wake of an ingenious Brooklyn boy, who may outdo Frankenstein himself with Monster No. 3!

Second success story for 19-year-old Saul Gottlieb of Brooklyn, N.Y., second robot was constructed of silver-painted plywood and junkbox parts. Working chiefly during his lunch hours, Saul put robot together in his school’s wood and metal shops over a three-month period. Completed monster was exhibited at American Institute’s Thirtieth School Science Fair.

When can a man be called mad about monsters? Why, when he’s built not one, but two, and both with his own brain- and brawn-power!

The man in this instance is actually still a teen-ager, Saul Gottlieb of Brooklyn, N.Y. First monster born of Saul’s penchant for robots saw the light of day while Saul was still in the ninth grade (it won its master second place in a city-wide competition). Not entirely satisfied with his earlier effort, Saul recently went one better to create the monster pictured here.

Constructed during his lunch hours, Saul’s latest robot is a silverish-colored plywood conglomeration of materials found in local junkyards and in the Gottlieb home. Bat-
MAD ABOUT MONSTERS

tery- and AC-operated, it includes relay switches concocted from coils of an Army telephone and a transformer lifted from an old road-racing set.

In addition to performing a variety of arm, leg, eye, and mouth movements, the completed monster also turns away from fire and follows an aluminum-foil track with the help of photoelectric eyes in the form of two cadmium cells. Could an even more sophisticated robot emerge from Saul's drawing board? “Sure will,” proclaims Saul, who's quick to admit he goes for monsters rrerrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrr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Want some instant VHF? Here's a 7-buck aircraft convertor that gets you airborne fast!

SONIC BOOMER
Herb Friedman, W2ZLF/KBI 9457

If you’re tired of the same old shortwave fare, why not join the airlift to the frequencies from 118 to 128 MHz? Assuming you live close to an airport (and who doesn’t?), you can ride along in the cockpit while the pilot chats with the control tower.

All it takes for instant vhf is a handy little device that converts vhf aircraft frequencies to around 1600 kHz on the broadcast band. Just set up your Sonic Boomer near a BC radio and you can tune in the planes and tower as easily as a local rock station.

Mighty Midget. The convertor shown in our photos costs under $7.00, or about $6.00 if you already have a toggle switch and battery in your junk box. Heart of the Sonic Boomer is a solid-state module which is supplied ready-to-go for only $5.00. All you add is the battery, power switch, and cabinet.

The Cordover module (see Parts List) works on the radiation principle. There is no need for a direct connection between the convertor and radio. You simply place an ordinary transistor radio next to the Sonic Boomer and vhf radio signals will be received at approximately 1600 kHz.

The module is amazing but no great mystery. Inside is a local oscillator that heterodynes the received vhf signal. A beat frequency results, and this is radiated as an RF carrier into your radio.

For a practical example, assume the desired aircraft signal is at 120 MHz. When you adjust the built-in coil slug, the convertor’s oscillator tunes to 119 MHz, the 120-MHz signal is heterodyned by the local oscillator, and the module’s output now contains both the sum and difference frequencies of 120 and 119 MHz. These are, respectively, 239 MHz and 1 MHz. Note that it is the difference signal which falls in the broadcast band, so if we tune our radio to 1000 kHz (1 MHz) we will receive the original aircraft signal.

Of course, there may be a radio station broadcasting at 1000 kHz, so you might get nothing but interference. In practice, the module’s oscillator frequency is adjusted so that the difference frequency is approximately 1.6 MHz (1600 kHz), which is a more quiet spot on the dial. When your BC radio is placed near your convertor it picks up the original modulation at this much lower frequency.

Construction. What there is, is very little indeed. The Sonic Boomer is mounted on the aluminum front panel of a Bakelite util-
SONIC BOOMER

Entire vhf convertor consists of only three parts: Cordover CM-A module, 9-V battery, and spst toggle switch. That's all that's to it!

ity case. The locking flange of the tuning coil holds the module in place. Proper size hole for the coil is 27/64 in.

Besides the module, you need mount only an insulated binding post, an spst toggle switch, and a battery holder. The battery holder is of the polarized variety and has a red plastic ring around the positive terminal. This ensures that the battery will not be installed incorrectly. While not absolutely necessary, the holder is a good idea if you want to avoid damaging the module.

No connection is made to the front panel. The negative lead from the battery goes to terminal C of the module. The positive connection is made at terminal B, while an insulated binding post is connected to terminal A. And that's it—just three components and three connections.

Tuning Tips. Your radio should be tuned to an unused frequency near 1600 kHz. Connect a 2-ft wire (nothing longer) to the binding post and turn power switch S1 on. Move the radio around the convertor until you hear maximum noise from the speaker. Then back the tuning slug all the way out and turn it in very slowly until you hear a signal.

You can trim the tuned signal for better reception by slightly turning the radio's dial. If you have an RF signal generator, set the generator to local aircraft frequencies and adjust the convertor until you pick up the generator's modulated output. Turn off the generator and then zero in on the desired station.

Keep in mind that aircraft transmissions are brief. Therefore, tune across the band very slowly when searching for a station.

To receive aircraft signals, simply place your BC radio near convertor and move it about slowly until the radio peaks at its maximum volume. Tuning it will be a slow process.
BCB MEANS BC BLASTER WHEN THE CHIPS START TO FALL!

BLUE CHIP PORTABLE

By Steve Daniels, WB2GIF

If you're like most people, you're on the go pretty much of the time. What with skiing trips, drives to the country, and visits to relatives who like the wilderness, it's pretty hard to stay in touch with the world at large. Sometimes this is a good thing, but often as not, world events and news from home demand that we keep at least one eye open.

Newspapers are a help, but it's usually our trusty pocket portable that tunes us in on human goings-on. And what is your radio tuning in lately? Not quite enough, you say? Well, if you're interested in getting more DX sensitivity from that little box so you can get more than country music from the
BLUE CHIP PORTABLE

next county, turn on our Blue Chip Portable and listen in big.

Chips Galore! This portable has a hybrid circuit that makes solid-state listening quicker than liquor for a real groovy time—and that isn’t an olive in there, son! An npn transistor and integrated circuit (IC) are placed back to back for a truly unique package.

The unusual sensitivity and selectivity of

![Circuit Diagram]

Reflex circuit uses npn transistor for both RF and AF amplification. An RCA integrated circuit provides final boost for volume to drive earphone. Transistor, coils, and tuning capacitor can be ordered from sources listed below.

PARTS LIST FOR BLUE CHIP PORTABLE

B1—9-V transistor battery (Burgess 2U6 or equiv.)
C1—H.H. Smith 2418-6 variable capacitor (see text)
C2, C5, C7—1-uf, 10-VDC disc capacitor
C3—.047 uf, 10-VDC disc capacitor
C4—10-uf, 10-VDC miniature electrolytic capacitor
C6—.01-uf, 10-VDC disc capacitor
C8—1-uf, 15-VDC miniature electrolytic capacitor
C9—100-uf, 15-VDC miniature electrolytic capacitor
D1—1N64 germanium point-contact diode (Sylvania)
J1—Miniature phone jack (see below)
L1, L2—H.H. Smith 2418-8 loopstick (see text)
L3—H.H. Smith 2418-7 choke (see text)
Q1—Npn transistor (International Rectifier TR-22C)
Q2—Integrated circuit (RCA CA3020)
R1—680,000-ohm, 1/2-watt resistor
R2—15,000-ohm, 1/2-watt resistor
R3—4700-ohm, 1/2-watt resistor
R4—0.6-ohm, 1/2-watt resistor (9 in. of Belden #8817 litz wire wound over and soldered to any value over 1000 ohms)
R5—510,000-ohm, 1/2-watt resistor
R6—5000-ohm miniature potentiometer with spst switch
S1—Part of R6
T1—125-ohm (CT) pri., 8-ohm sec., output transformer (Argonne AR-176, Lafayette 33H8571 or equiv.)
Misc.—4 1/2 x 3 1/2 x 2-in. utility box, perf board, flea clips, earphone with miniature phone plug and matching jack (Lafayette 99H2541 or equiv.), battery clip (Lafayette 99H6287 or equiv.), knobs, 1/4-in. spacers, wire, solder, hardware, etc.
Note—L1/L2, L3 and C1 are available from H.H. Smith, Inc., 812 Snediker Ave., Brooklyn, N.Y. 11207. Prices are $1.50, 35¢, and 90¢, respectively, not including postage and handling. The International Rectifier TR-22C transistor can be ordered from Arrow Electronics Inc., 900 Broad Hollow Rd., Rte. 110, Farmingdale, N.Y. 11735. Price is 90¢, not including postage and handling.
the front end is made possible by a high-Q tuned circuit and a reflex RF stage. Signals picked up by the special loopstick are inductively coupled to the base of Q1 where they are amplified. However, the combined RF and audio signals can't get past the reactance presented by R2 and L3, so they are shunted through C2 to D1 which detects the signal.

The RF carrier is bypassed to ground through C3 (due to its low high-frequency reactance) and the audio is fed back to the base of the transistor for reamplification. Audio appearing at the collector can now get past the R2/L3 combination since this combo presents much less reactance to low frequencies. C4 couples the signal to the audio stage, and C5 bypasses any remaining RF to ground.

The original circuit was developed by Philips-Norelco, and is the one used in the Norelco Electronic Educational kits. Use of the loopstick, variable capacitor, choke, and transistor listed (see Parts List) is recommended because the circuit is sensitive with regard to transistor gain and the Q of other parts (all are Norelco components).

The audio circuitry is in an RCA CA3020 IC. It consists of a class A preamplifier with a quasi-complementary emitter-follower output. It can deliver ½ watt at 3% distortion using a 9-volt source.

Building It. In order to prevent the high gain of this circuit from throwing the front end into oscillation, a tight wiring job in the RF stage is a necessity; and it's almost as critical in the audio, IC stage. Mount the pot, variable capacitor, loopstick, and phone jack in the case. The author used a 4½ x 3½ x 2-in. plastic box, but you can use whatever is best for your needs.

Connect the red lead from the loopstick, one terminal each from the switch and pot, and a 6-in. length of wire to the rotor of the variable capacitor. This goes to ground. The loopstick is best secured with a bit of epoxy cement. Wire the balance of the circuit on a piece of 2 x 4-in. perf board. The RF stage is straightforward, so just follow the photo and diagrams.

When you get to the audio stage, place 5 flea clips immediately after the B+ resistor R3 (see circuit layout). Put another (6 clips in a second row facing T1). Clip off lead 11 from the IC (see schematic).

Bend leads 7 through 12 for the IC toward the row closer to the RF stage, and bend the remaining 6 leads toward the second row. Clip, bend, and position the leads as required to mount the IC as shown in the photo. (Continued on page 112)

Components fit into plastic box with ease. Use spacers to mount perf board in bottom half of box, leaving space for earphone at left. Layout for perf board can be seen in drawing at top of page.
BETTER LUCK WITH LOCK
• Printed circuit boards are troublesome when it comes to checking component values with an ohmmeter, disconnecting and installing new parts, or just visually inspecting them. Next time you want to hold a board in place and leave both hands free, use the locking pli-wrench. Use just enough pressure to grip the board so it will stand up and stay put.
—Joe Gronk

CHART THE FUTURE IN PLASTIC
• That portable radio or hi-fi set may be new today, but a few years from now Father Time will see to it that parts replacement are needed. Unfortunately, the transistor or tube location chart or battery chart would have long since peeled away into brown dust. Laminate charts in plastic as you would important ID cards. Epoxy plastic inside unit.
—M. Stubblefield

TIPS ON CLEANING TIPS
• The soldering iron tip is the champion crud collector in your workshop. Just plug it in and watch the tip go to work. Even the plated types collect this crusty crud. Removing the crud is easy. Just wipe the tip lightly across the wet sponge surface of a finger moistener used in banks to count money. Stubborn scales can be removed with an ink eraser.
—Al Wise

RUBBER BUMPER IS BETTER
• Next time you’re drilling a hole in a pre-painted aluminum chassis or on a finished surface, don’t worry about the chuck scarring the metal as the bit drills through. Just slip a rubber grommet on the bit and push it up near the chuck. Now, as the chuck drops to the surface of the drilled material, the grommet will take the punishment.
—Harry Gray

Send your Imagineering Design Tips with full details and a photo or drawing to Radio-TV Experimenter, 229 Park Ave. South, New York, N.Y. 10003. The top ideas selected by the editors will win $10.00. Entries become the property of Radio-TV Experimenter and can’t be returned.
Though billed as a kit, the Scott LT-112B is more properly described as a semi-kit, intended to give a novice at construction the opportunity of obtaining a stereo tuner of broadcast-monitor quality at an extremely reasonable price. Featuring FM-only reception, the LT-112B offers several features not normally found on consumer-type FM tuners.

Three controls determine the mode of operation. The function switch selects either normal operation, a sub-channel filter to reduce noise which might appear on the stereo sub-channel, or a noise filter which reduces noise on both mono and stereo signals (such as might be required for fringe-area reception). The noise filter works by slightly reducing the high-frequency response.

A selector switch selects either the mono or stereo modes and also controls operation of the interstation muting circuits, which mute the receiver between stations to avoid sharp noise bursts. When the selector switch is set to mono-muting off or mono-muting on, both stereo and mono broadcasts are received mono. When the selector switch is set to the auto-stereo position, the tuner automatically switches to the stereo mode for stereo broadcasts. Again, this feature is available with muting on or off. A front-panel stereo indicator lamp shows when a station is transmitting a stereo program.

The third switch determines the function of the built-in meter, which can indicate signal strength, multipath, center tuning, or align (the align position being used only when the kit is initially adjusted by the builder).

The multipath meter is somewhat unusual and requires an explanation. Normally, when set to the multipath position, the meter will indicate the same as when set to the signal-strength position. If the signal is free from multipath reflections the meter will show no change in level. But should there be multipath interference the meter will kick downward, following the modulation. The greater the multipath interference the greater the downward deflection of the meter's pointer. Therefore, to orient an antenna for minimum multipath sensitivity, it's only necessary to position the antenna for minimum deflection of the meter pointer.

In and Out. Three antenna terminals allow connection of an external or internal antenna. The external antenna terminals are unbalanced to ground and match 300 ohms. A jumper bar can be used to connect the internal antenna—which is a capacitor to the AC line cord—to the "high" antenna terminal. Naturally, while the built-in line antenna might give adequate performance in an area of private homes, you can expect severe multipath if you rely on it for reception in an apartment house.

There is a total of four output connections for each channel. The direct AF output, which is fully adjustable from off to maximum output through internal controls accessible through the cover, has two jacks per channel. One is for driving an amplifier, the other for a tape recorder or second amplifier drive.

A third output is a panel-mounted headset (stereo) jack, intended for medium-impedance headphones. (Inserting a headset does not disable the amplifier outputs.) The fourth channel output is for an oscilloscope and is intended for observation of multipath interference (professional use).

In addition to the panel-selected noise filters, the LT-112B incorporates a special anti-noise circuit that switches the receiver to mono should the noise level be too high for good stereo reception. Essentially, the anti-noise circuit ensures that the unit is switched to stereo only when there is sufficient pilot signal level to ensure proper synchronization of the 38-kHz oscillator.

Performance. The LT-112B proved very sensitive, measuring 2.1 μV (IHF) for 30
**LAB CHECK**

dB attenuation of noise and distortion. Full limiting of 50-dB noise reduction required only 14 μV. The mono THD (total harmonic distortion) with a test signal of 1000 μV measured a low 0.54% mono and 1.1% stereo. The maximum AF output level measured slightly more than 1 V.

Both the stereo and mono signal-to-noise ratios measured slightly better than −60 dB. Stereo separation at 1 kHz was 26 dB and 15 dB at 15 kHz.

**Assembling the Kit.** If done with reasonable care, even a novice should have no difficulty with assembly. Most of the work consists of mounting the pre-wired solid-state assemblies and installing the interconnecting wires. To reduce the possibility of a wiring error to absolute minimum, the LT-112B's assembly manual section shows the wiring in the exact colors that appear in the unit itself; i.e., a red wire is shown in the pictorial as red.

Most of the circuitry is supplied factory-wired on printed circuit (PC) assemblies. The user installs the power-supply components, the interconnecting leads, and the switching facilities. The front end, which uses field effect transistors (FETs) for overload immunity, is supplied pre-wired and aligned. Only the IF amplifier, which is factory aligned, need be touched up, and no instruments are needed for so-called alignment.

The LT-112B, priced at $199.95 (kit), is supplied with a metal cover and an oversize

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**NEW HOPE FOR THE BLIND**

Radio Waves Replace Light

□ Steps toward electrical brain stimulation that could permit the blind to read are reported by two University of Cambridge scientists.

A number of electronic experiments in the U.S. and other parts of the world have given hope to the blind by showing that the visual cortex does not wholly lose its functional capacity even after years without visual input. The latest report, by British doctors G. S. Brindley and W. S. Lewin, describes how the idea was first tried on the motor cortex of 14 baboons. Achieving some success, the team then attached an array of electrodes connected to radio receivers in the right hemisphere of the brain of a 52-year-old blind woman. She was stimulated to experience sensations of light in the left half of the visual field.

Safety of the implant was demonstrated with the baboons, in which a fibrous membrane grew to separate it from the brain and its covering.

The model contains 80 receivers, but the researchers expect to increase the number of electrodes to at least 200 per hemisphere. Hopefully, this would permit a blind person to see printed letters. The present model permits sensations of a very small spot of white light, which the patient describes as like a star in the sky or a grain of rice at arm's length.
It was many years ago that we took that walk, my father and I. We were living on Winnemac Avenue in Chicago at the time. I was just a freckle-faced kid, home from boarding school for Christmas.

I didn’t know my father very well. There was more than years between us. He was riding the wave in vaudeville, a headliner on the Shubert circuit, a celebrity whose routing from city to city, and theater to theater, kept him away from home about ten months of every year.

Home was a ground floor apartment where mother lived with my younger sister and brother, and into which she had gathered all the Christmas spirit her meager income allowed. Father had arrived on the train from Minneapolis that afternoon, which was darkening into my first Christmas Eve with all our family in several years.

After dinner, while mother was still busy in the kitchen, and my sister and brother were clearing the table, father patted me on the head and asked me if I would like to take a walk. Somewhat in awe of that comparative stranger, that famous man who belonged to the theatrical world, I nodded enthusiastically, and scampered to the bedroom for my blue coat with brass buttons and stocking cap that shielded my ears from the biting cold.

While I was fastening my overshoes, I watched father put on the handsome great coat with brown fur collar, and the grey felt hat with snap brim that he wore with such jaunty grace. He seemed to me the very personification (Continued on page 114)
Ultra-exact people measure those old standbys—the volt, ohm, and ampere—again and again, but I = E/R still holds, fellows!

**U.S. Moves to Stop Volt Drain**

The increasing importance of precision measurements has made it evident—especially to the National Bureau of Standards (NBS) in Washington—that a more accurate definition of the volt is needed. New measurements of both the ampere and ohm in terms of basic units such as length, mass, and time have been made in laboratories throughout the world, and the U.S. has been found wanting.

While the U.S. ohm is accurate to better than 1 part per million (ppm), the ampere is smaller by 11 ppm than the ampere defined by equipment maintained at the Bureau International des Poids et Mesures at Sèvres, France (BIPM). The U.S. is one of ten countries participating in international comparisons of standards for electrical units. Naturally, each country wants the value of its volt to agree with the BIPM value.

Since no adjustment in the value of the ohm is called for, blame must be placed on the volt for the low value of the ampere measurement (I = E/R, remember?). According to the NBS, as of January 1, 1969, the U.S. standard (Continued on page 116)
These days people are getting more and more particular about sound quality in general and hi-fi systems in particular. A basic tactic in this campaign is to go after the components of a system and check them out against required performance characteristics. This can be done either before or after you purchase a piece of equipment. Usually, however, it’s a matter of seeing that what you’ve already got is really on the audio beam.

The best magnetic cartridges, dynamic mikes, and tape heads usually have extremely low outputs—way down in millivoltland. It’s the job of the preamplifier and power amplifier to boost these miniscule signals up to the level where your neighbors start complaining.

So far so good. But these low outputs can be a real problem when it comes time to measure the exact audio levels coming into your system. Your AC VTVM (if you have one) may not be able to give an accurate reading so far down the decibel scale. Most likely, it simply isn’t sensitive enough to gather in all those little millivolts.

**Meter Power.** What to do? Our Hi-Fi Supermeter can make a low-level audio frequency-response check, test a microphone, or check out a magnetic phono pickup. Full-scale frequency response measurements are possible down to $-70 \text{ dB}$; you’ll even be able to measure the output of 1-mV cartridges or mikes with a full-scale reading. Impedance is no problem ‘cause the Supermeter has a 2-megohm input impedance, high enough to prevent loading the most sensitive circuit.

The Supermeter is nothing more than a linear amplifier specifically designed to drive a low-cost vu meter. While the average, imported vu meter is notoriously non-linear (even $500$ recorders using these meters give unreliable readings), the Supermeter’s readings are within the accuracy of a professional unit.

For example, if the Supermeter’s gain is adjusted so that the vu meter indicates zero for an input signal, a 3-dB reduction in the signal will drop the meter reading exactly
3 dB. The same accuracy applies from full scale of +3 dB down to the bottom level of -20 dB.

Frequency response, however, depends to some degree on the value of C2. If C2 is 200 µF, the meter readings will be down -4 dB at 50 Hz and then ruler flat to 15 kHz. If C2 is 500 µF, the readings are ruler flat from 20 Hz to 15 kHz. The upper frequency limit will be determined by the quality of meter you buy.

To keep costs at a minimum, the Supermeter isn’t calibrated in terms of voltage—it’s only designed to make accurate frequency measurements at very low signal levels and to be used as a relative level indicator.

The meter has a three-stage linear amplifier. Q1 is an FET (field-effect transistor) whose input impedance is in the tens of megohms. Therefore, the Supermeter’s input impedance is determined by gain control R1, which has a value of 2 megohms. Q2 serves as an emitter follower and provides a high-impedance termination for Q1’s moderately high output impedance. It also functions as a low-impedance driver for Q3,

PARTS LIST FOR HI-FI SUPERMETER

C1, C7—.02-µF, 500-VDC disc capacitor
C2—100-µF, 6-VDC electrolytic capacitor
C3, C4—10-µF, 25-VDC electrolytic capacitor
C5—200- or 500-µF, 6-VDC electrolytic capacitor (see text)
C6—3000-µF, 30-VDC electrolytic capacitor (Sprague 39D, Allied 43E6525 or equiv.)
D1, D2—50-PIV, 500-mA silicon rectifier (HEP-161; Lafayette 19H4210 or equiv.)
J1, J2—insulated phono jacks (see text)
Q1—Field-effect transistor (Motorola MPF103)
Q2—Npn silicon transistor (GE 2N3393)
Q3—Npn silicon transistor with heat sink (RCA 40452)
R1—2,000,000-ohm, audio-taper potentiometer
R2—33,000-ohm, 1/2-watt 10% resistor
R3, R7—2200-ohm, 1/2-watt 10% resistor
R4, R10—4700-ohm, 1/2-watt 10% resistor
R5—68,000-ohm, 1/2-watt 10% resistor
R6—22,000-ohm, 1/2-watt 10% resistor
R8—18-ohm, 1/2-watt 10% resistor
R9—1000-ohm, 1/2-watt 10% resistor
S1—Spst toggle switch
T1—Low-voltage, 10-20 VAC (CT)/40 VAC (CT), rectifier transformer (Allied 54B4731 or equiv.)
Misc.—4 x 5 x 6-in. aluminum chassis box (Lafayette 12H8374 or equiv.), 3 1/2 x 4 1/2-in. perf board, push-in terminals (Vector T26, Lafayette 19H302 or equiv.), miniature vu meter (Lafayette 99H5024 or equiv.), AC line cord with plug, knob, solder lugs, solderless connector, grommet, wire, decals, solder, hardware, etc.
To avoid hum pickup from transformer, amplifier is assembled on right side of perf board. Meter screws hold it in place.

which serves as a medium-impedance amplifier for the vu meter.

**Construction.** The device is built into a 4 x 5 x 6-in. cabinet. All circuitry goes on a perf-board assembly that mounts directly on the back of the meter. The board is secured by the meter’s terminals. If you use a larger size meter than the one specified (see Parts List) you may need a larger cabinet.

First step is to drill holes for the meter, R1, S1, J1, J2, and the line-cord grommet. Temporarily mount the meter on the panel and cut a section of perf board to approximately the size of the front panel (about 3½ x 4½ in.). Position the board against the meter’s terminals, then mark and drill two holes in the board for the meter terminal screws. Take the meter off the case and then secure the board to the meter, placing the solder lugs supplied with the meter under the screws on the wiring side of the perf board.

Use push-in terminals as tie points and wire the amplifier on the right side of the perf board (see photo), away from power transformer T1. To avoid instability don't use multiple ground connections. All ground leads should be tied together in a line and finally connected to the grounded meter terminal. T1's center-tap (yellow lead) goes directly to the ground bus, not the cabinet. The shielded input provides the ground connection to the cabinet.

Transistor Q3 is somewhat unusual in that it is supplied with a heat sink. While an equivalent transistor is available without a heat sink, don't try to substitute it. Though it operates within the required ratings in your Supermeter, this version tends to run hot, so better stability is obtained with the specified model.

Capacitor C6 provides sufficient filtering for the Supermeter, but not enough for its use as a sound amplifier. Accordingly, don’t attempt to use the circuit as an amplifier unless you add an additional RC filter. And make certain the 3000-uF electrolytic capacitor you obtain will fit in the cabinet.

(Continued on page 116)
We first discovered the Dual 1019 at a hi-fi show where, between souped-up highs and lows emanating from assorted booths, we heard some truly great sound. Further investigation disclosed the fine sound was coming from some rather ordinary high-quality amplifier-and-speaker equipment...and a record changer! That's right, a record changer—the one item which, according to thousands of hi-fi pundits, is supposed to preclude really good sound quality.

But there it was, really fine sound quality from a changer.

The difference, of course, is that the Dual 1019 isn't really a record changer in the old sense of the term. As we see it, the 1019 is basically a quality turntable employing calibrated anti-skate and which can be used, if desired, to change records. And the 1019 even gets around the old changer problems of sliding record against record, or enlarging spindle holes, by employing a somewhat unique elevator mechanism which lifts the standby records completely clear of the one to be dropped.

As shown in our photos, the 1019 closely resembles a typical quality turntable. There is a speed control which selects either 16, 33⅓, or 78 rpm; a pitch control which varies the selected speed over approximately a 6% range; a cueing control which gently lowers or raises the tonearm; and a calibrated stylus (tracking) force adjustment.

Closer inspection reveals a 7-, 10-, and 12-in. record indexer (common to record changers) and a manual/start switch (which implies record changer). However, the spindle is a standard, player-only type. Where is the changer mechanism and what is the horizontal dial that appears to be a second stylus pressure adjustment?

The Dual 1019 is converted to a changer by simply pulling out the standard spindle and inserting a longer, "elevator" spindle. The horizontal dial is not for stylus pressure but for anti-skate, which is matched to the stylus pressure.

Better Stereo. In the simple type of tone-arm pivoting, the force exerted by the spinning record (in combination with the offset angle of the tonearm head) drives the tonearm toward the center of the record, forcing the stylus against the inner groove wall. While normally unnoticed with older, less compliant pickups, the sound quality and balance are somewhat degraded when using modern pickups, which exert very low stylus pressure.

To avoid the effects of this inward motion—called skating, the 1019 employs a calibrated horizontal spring that applies a reverse force to the tonearm (towards the outside wall). Because the anti-skate force is dependent on the stylus pressure, the 1019 has a calibrated anti-skate force control which is matched, by using a supplied chart, to the stylus pressure.

The practical effect is immediately apparent. If, when using high-compliance pickups, you have noted that the stylus is pushed toward the inside of the record (force against inner groove wall), you'll find it stays dead center on the 1019. The improvement in sound quality—when using a modern, high-compliance pickup—is readily apparent.

Features & Features. Built like a fine watch, the 1019 has just about every convenience imaginable, whether in the auto (manual) or changer mode. The player can be used in any of three ways: 1) by simply placing the arm on the record. 2) by positioning it over the selected cut and then gently lowering the arm with the cueing control lever, or 3) by pressing the lever which
starts the motor and swings the arm into the selected 7-, 10-, or 12-in. record indexing.

With the single-play spindle in position, the arm lifts up at the end of the record, returns to the rest, and the motor shuts off—regardless of how the player is started. During manual operation, if the arm is lifted and placed at the edge of the arm rest, the motor stays on. If the arm is placed directly on the rest, the motor shuts off.

For changer operation, you simply pull out the short spindle and insert the changer spindle, which works with an elevator action. With the records on the changer spindle, pressing the start level causes the motor to start and a set of spindle fingers to push up the record stack. Then a pressure finger grabs the second record in the stack, thereby retaining all the records except the bottom one. The fingers then retract, allowing the bottom record to fall to the platter. At no time do the records in the stack slide together, nor are they pushed out from under the stack's pressure by a cam in the spindle hole.

**User Adjustments.** The mechanism is completely jamproof; no matter how you try to jam the tonearm the mechanism will reset to either the rest or play positions. Should the lead-in groove indexing get out of adjustment or the arm fail to clear the top record of a changer stack, the user can easily make the correction via separate adjusting screws accessible through the top of the deck (a service technician won't be needed).

To set stylus pressure, the user first balances the pickup (the two-way adjustable counterweight balanced all the standard pick-ups we tried). Then, the user simply sets the stylus-pressure wheel to the desired pressure. A test between ½ and 3 grams indicated the 1019's pressure gauge to be phenomenally accurate; for example, when set to 1½ grams the stylus pressure checked out within 1/16 gram. Finally, the anti-skate force is set according to a chart supplied with the 1019, since the anti-skate force depends on the tracking force and the stylus radius.

One of the problems with any turntable (Continued on page 120)
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THE ONLY COLOR TV TOTALLY ENGINEERED FOR TRAINING
The Beauty Of Being Breathless

Tune across the ham fone bands that most of us are familiar with, and you find quite a mass (or mess) of long-winded characters. All give with yak, yak, and more yak before they finally take a breath and flip off the rig to give the other guy a chance to talk. Ninety-nine times out of a hundred, though, the guy who makes the next transmission turns out to be just as gabby.

Gets pretty tiresome, doesn't it? Wouldn't it be nice if there were some other type of hamming without the nuisance of these wind jammers? Believe it or not, there is!

It's known as FM (for frequency modulation, naturally), and it's become very popular on 6 and 2 Meters and is gaining followers on the 420-MHz band. Except for amateur TV or satellite communications or moon-bounce experiments, it's probably the most modern form of hamming. A lot of ops accustomed to more conventional forms of ham radio haven't caught up with FM yet, but it's definitely worth investigating.

Among other advantages you will find is the fact that most of the hams on FM have voluntarily adopted a short, snappy way of operating that's a pleasant change from the gabby style so common on the HF bands. Most ham FMers keep each transmission short. Information and comments are exchanged in a fresh, breezy style that is sometimes called "dispatch operating." It's not quite as clipped as the rapid chatter of a taxi cab dispatcher, but it leans in that direction.

It's not really unfriendly, either. It's just that the type of person who likes FM operating also seems to be one who takes pity on the ears of his fellow operators. He has his say, quick and simple, then gets off the air and gives the next man a chance. As for the few exceptions to this state of affairs, may their final plates turn cherry red and their antennas fall down on their empty heads!

Commercial Surplus. Virtually all the FM gear used by hams is commercial gear they've picked up second hand. This is the same stuff as used by the cops, cab drivers, and utility trucks, to mention only a few, for their two-way mobile communications.

Most of these outfits install new equipment every few years, so the old stuff can be picked up by hams who are sharp at bargain hunting. What's more, the frequencies this kind of gear is used on commercially are close to the VHF ham bands, so it's not difficult to convert this stuff to ham use.

A strong advantage to this equipment is the fact that each receiver is completely quiet when there's no input signal. This means you can put a rig in your car or your living room, and it won't bother anyone with continual hissing, scratching, and popping as do the receivers most of us are accustomed to.

Another strong plus for FM is the fact that certain standard frequencies are used all across the nation, and all equipment is crystal-controlled. As a result, there's no tuning knobs to twiddle for best reception, and you can drive anywhere and instantly find someone to talk to. Then, too, there are no squeals and howls caused by two or more stations beating together—on FM, you hear only the strongest signal; all others are wiped out.

Since VHF is ordinarily limited to so-called line-of-sight transmission distances, you'll find most of the activity in the large cities. Even so, there are stations out in the boondocks, as many a city ham has discovered as he drove along on vacation. Since an FM receiver is completely quiet unless there's someone talking on the frequency, a
lot of hams leave their rigs turned on all the time so they'll hear anyone who pops up.

**Bigger And Better.** Sounds like a dream, but hams have actually been granted some new operating frequencies and permitted higher-power operation than before. And don't groan when I tell you all this has happened in the 160-Meter band—those frequencies can be more useful than you think.

It's also a cheery feeling to realize that hams still have some friends among officials in our government. In this case, the U.S. Coast Guard gave us a helping hand by approving additional ham operating privileges in the 160-Meter band. The Coast Guard operates the LORAN (Long Range Navigation) stations along our coasts used by ships and ocean-hopping aircraft. Since these stations operate on 160 Meters, hams have been restricted to use of certain frequencies in the band. Simultaneously, they've also been required to use rather low power levels, both to prevent interference with the LORAN stations.

Because of installation of some new LORAN stations, plus a new engineering study of the whole LORAN setup, we hams now are permitted use of some frequencies in the band that formerly were denied us. Further, on most frequencies, we're allowed to use increased power levels, in some cases up to a full kilowatt. Each state is treated individually in the rules, which fill a full-page table in the FCC rule book. States near the coasts are restricted more than those some distance inland, as a general rule.

Right now, with sunspots at a relatively high level, 160 isn't much to work. But a few years from now, when a drop in sunspot numbers mean 10, 15, and sometimes 20 Meters will be much less useful, you can have a real ball on 160.

The rule change should also shake loose some new gear from the commercial manufacturers. Most store-bought rigs and receivers now available don't even include the 160-Meter band. But with the increased activity and power levels now permissible, equipment makers will likely produce some that does. Older gear, which conservative types have hung on to, does cover 160 and will doubtless take on additional value because of this band.

**Hot News For Hams.** "We interrupt this broadcast to bring you a bulletin from our newsroom." Long the standard opening for a hot flash aired by a radio or TV station, the phrase is also applicable to ham radio's own broadcast news service. You can make use of it every day to get the latest scoop you may not learn of elsewhere for several days or weeks.

How? Just tune in one of the many bulletin broadcasts from W1AW, the high-powered amateur radio station in Newington, Conn. operated by the American Radio Relay League. Brief, up-to-the-minute news items of interest to hams all over the world are transmitted nightly on all ham bands from 160 through 2 Meters. The transmissions are made simultaneously with a 1000-watt rig on each band.

Transmissions are made at different times during the evening on CW, fone, and tele-type. The CW is sent at 18 wpm, which makes it excellent practice material if you're getting ready to take the General Class exam. If you can copy W1AW, you'll have no trouble at all passing the 13-wpm test in front of a strict examiner.

If this speed is still too fast for you, don't despair—there's an easy way to beat the game. Just use a two-speed tape recorder. Record the W1AW transmission on the high speed, then play it back at the low speed! Tricky, eh?

**Big Brother Again.** Through the convenience offered by modern technology, another nail has been driven in the coffin of

(Continued on page 120)
This is the third and last part of White's Radio Log, which until now has been published in three parts twice each year. In this issue of White's Radio Log, we have included the following listings: U.S. AM Stations by Call Letters, U.S. FM Stations by Call Letters, Canadian AM Stations by Call Letters, Canadian FM Stations by Call Letters, Major Broadcast Stations in Mexico and the Caribbean, and the World-Wide Shortwave Stations section.

Beginning with the next issue of Radio-TV EXPERIMENTER, White's Radio Log will feature an entirely new format in order to enable the Editors to offer readers one of the most complete Logs ever. Here's what's in store.

First off, there will be increased coverage of World-Wide Shortwave Stations plus an all-new section on emergency broadcast services—police, fire, etc.—for major metropolitan areas throughout the U.S. Secondly, this expanded format will mean that a specific section of the Log will now appear in consecutive issues of RADIO-TV EXPERIMENTER throughout the year. Therefore, readers will want to save an entire year's issues of RADIO-TV EXPERIMENTER in order to have a complete volume of White's Radio Log. An updated, completely revised version of the first listing will appear in the first issue of the new year.

When collected, the entire volume of White's Radio Log will give you complete listings with up-to-the-minute station-change data not offered by any other magazine or book. And regardless of your listening interests—SW, BCB, FM, TV, or DX—you'll find the new, expanded White's an unbeatable reference.

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Every effort has been made to ensure accuracy of the information listed in this issue of White's Radio Log, but absolute accuracy is not guaranteed and, once again, only information available up to press time could be included. Copyright 1968 by Science & Mechanics Publishing Co., a subsidiary of Davis Publications, Inc., 505 Park Avenue, New York, New York 10022.

JANUARY, 1969
Are your home-town AM stations listed correctly in *White's Radio Log*? If you believe there is a correction called for in *White's* listings, please check first with your local station. For each call sign obtain the correct city, location, frequency, and power. (Remember, even though your local paper may list a station as a "home-town" station, it may be officially licensed by the FCC for operation in the next city.) Get all the facts on a piece of paper (be very brief), include your name and address, and mail to *White's Radio Log*, RADIO-TV EXPERIMENTER, 229 Park Avenue South, New York, N. Y. 10003. Your help in contributing to the accuracy and completeness of *White's Radio Log* will be sincerely appreciated.

—Editor
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<tr>
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<tr>
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<tr>
<td>Callsign</td>
<td>Location</td>
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<td>KMPX</td>
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</table>

Are your home-town FM stations listed correctly in White's listings, please check first your location and frequency. (Remember, even though your local paper may list a station as a "home-town" station, it may be officially licensed by the FCC for operation in the next city). Get all the facts on a piece of paper (be very brief), include your name and address, and mail to White's Radio Log, RADIO-TV EXPERIMENTER, 229 Park Avenue South, New York, N.Y. 10003. Your help in contributing to the accuracy and completeness of White's Radio Log will be sincerely appreciated. See page 110. —Editor
<table>
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<tr>
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<td>KXGF</td>
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<td>KRAY-FM</td>
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<td>KXIT-FM</td>
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<td>KXIR-FM</td>
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**January, 1969**
### Canadian AM Stations By Call Letters

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<tr>
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<th>Call Location</th>
<th>kHz</th>
<th>Call Location</th>
<th>kHz</th>
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<tr>
<td>CBB Sackville, N.B.</td>
<td>1070</td>
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<td>920</td>
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<tr>
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<td>WSGM -FM Hamilton, Ont.</td>
<td>950</td>
<td>WSGM -FM Hamilton, Ont.</td>
<td>950</td>
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<td>CBW Truro, N.S.</td>
<td>1360</td>
<td>WSGM -FM Hamilton, Ont.</td>
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<td>WSGM -FM Hamilton, Ont.</td>
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<tr>
<td>CBDR Scherffville, P.Q.</td>
<td>1230</td>
<td>WSGM -FM Hamilton, Ont.</td>
<td>950</td>
<td>WSGM -FM Hamilton, Ont.</td>
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<tr>
<td>CB AD Sudbury, Ont.</td>
<td>1260</td>
<td>WSGM -FM Hamilton, Ont.</td>
<td>950</td>
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<td>CBG Gander, Nfld.</td>
<td>1440</td>
<td>WSGM -FM Hamilton, Ont.</td>
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<td>CBI Sydney, N.S.</td>
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<td>CBK Regina, Sask.</td>
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<td>WSGM -FM Hamilton, Ont.</td>
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<td>CBL Toronto, Ont.</td>
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<td>CBCT St. John's, Nfld.</td>
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<td>WSGM -FM Hamilton, Ont.</td>
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### Call Location | kHz | Call Location | kHz | Call Location | kHz |
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<tr>
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<td>910</td>
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<td>WSGM -FM Hamilton, Ont.</td>
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<tr>
<td>CBM -FM Saint John, N.B.</td>
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### Major Broadcast Stations in Mexico and the Caribbean

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<tr>
<td>620</td>
<td>PWDR</td>
<td>Mavendale</td>
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<tr>
<td>720</td>
<td>PRTM</td>
<td>Montego Bay</td>
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<tr>
<td>770</td>
<td>PRTA</td>
<td>Kingston</td>
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<tr>
<td>790</td>
<td>PRTL</td>
<td>Port Maria</td>
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<tr>
<td>791</td>
<td>PWDR</td>
<td>Mavendale</td>
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### A THANK YOU NOTE FROM THE EDITORS

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

**Lewis Abrams**, Valley Stream, N.Y.

Bill Ashley, Chief Eng., Station WAVX, Arlington, Va.

Mrs. David Baldwin, Chicago, Ill.

Rusty Barton, San Jose, Calif.

Michael P. Bielecki, Amsterdam, N.Y.

Donald Bohn, Cass Lake, Minn.

Dave Bright, Muscatine, Iowa

David A. Bull, Edmonton, Alberta

John Caker, Peoria, Ill.

Master Control, Hammond, Ind.

Terri Cook, Missoula, Mont.

Joseph F. Dineen, Westwood, Mass.

Peter Erk, Park Falls, Wis.

Bill Frahm, Boise, Idaho


Robert E. Gersch, McKinleyville, Calif.

Howard Gayle, Jacksonville, Fla.

Morrie Goldman, Chicago, Ill.

R. Jay Goos, Council Bluffs, Iowa

Sgt. Wm. R. Hale, Mountain Home AFB, Idaho

Ron Harris, Flint, Mich.

Thomas E. Meors, Lawrence, Kansas

Dave Mobley, Toledo, Ohio

Thomas Mount, Red Bank, N.J.

Glen Neal, Sayre, Okla.

Gary Nuthals, Green Bay, Wisc.

Andrew F. Papa Jr., Fonda, N.Y.

Helen Parker, New York, N.Y.

Larry Potts, Fort Wayne, Ind.

Fred Powell, Carrollton, Ga.

Ed Price, Hamilton, Ontario

Walter L. Read, North Bend, Ore.

Peter Robinson, Johnstown, Pa.

Thomas B. Sherman, State College, Pa.

Gladys Sienkiewicz, Brooklyn, N.Y.


Danny Sys, Vancouver, B.C.

Bill Turner, Sugar Creek, Mo.

C. M. Wilkinson, Riverdale, Ill.

Cynthia Zirkle, Winchester, Va.

Max Zweig, Atlanta, Ga.

C. H. Zwierzy, Chicago, Ill.

### World-Wide Shortwave Stations

**On your mark**, get your set, and go get 'em in our really big contest! This month's prize is—are you ready?—absolutely nothing! How 'bout that, gang—a contest with no prizes, only the satisfaction you'll get in seeing how good you and your shortwave gear are functioning as a team. We'll give you the scoring scoop in a minute, but now for the big quizzers; take it way Pert Barks:

1. We hope you heard the *Voice of Hope*, it's a broadcaster in South Korea. The station has been reported on 6170 kHz at about 0815 GMT with tests. You can get a QSL from: ROK Army Broadcasting Station, Voice of Hope, Seoul, Korea.

2. You thought it was expensive to go to Europe, didn't you? Well somebody set up a bootleg broadcasting station which proves how inexpensive the place is. The station even calls itself *The Voice of Free*...
**France?** Free—that's even better than inexpensive! Station has been heard at irregular times on 13700, 27000, and 27560 kHz.

3. Here's one you'll have to put some hours into, but it's worth it. The station is VLV at Mawson Base in Antarctica and we'll bet you a penny that you haven't logged that rare place yet! The station has been heard at varying times around 0100 GMT on 12255 kHz trying to contact other stations with messages. The signal is for the Byrds (sorry about that).

4. Another place you've never heard is a minute speck of island which some folks call Tristan da Cunha. Guess what, they're now broadcasting on 3290 kHz with an antenna smashing 40 watts. Transmissions are in English on Wednesdays, Fridays, and Sundays at 1900 to 2200 GMT. They want reception reports.

5. Hey, we haven't done the 2182 kHz bit in a while; it's about that time again! The frequency is the calling and emergency channel for boats and it teems with stations every night. How many can you log in 15 minutes?

6. Lithuania is a tiny nation which was rescued from the Nazis by the USSR, except the Red fuzz remained on to "protect" them against any other possible invasions from Germany, Saturn, Andora, Czechoslovakia and other hostile armies. This has been going on for about 25 years now and, as a result, the country has almost vanished as a separate identity on the radio bands. You can now try for Radio Vilnius on 17740 kHz at 2245 GMT.

7. Spy, anyone? It's one of those mysterious "numbers" stations which are believed to be transmitting coded messages to spies. This one's been reported on 5755 kHz about 0220 GMT with numbers in Spanish.

8. Good news for those of you who drool with envy whenever someone else logs the tiny kingdom of Nepal. They've put some new and very powerful transmitters on the air and the country is now being reported by a number of listeners. Look for them on 9590 kHz at 0630 and 1530 GMT.

**Scoring:** You get 10 points each for 1, 2, 3, 6, 7, and 8. Number 4 earns you a gigantic 20 points and number 5 gets you 1 point per station. Did you rack up 20 points? If you did, you didn't try very hard. Did you get 50 points? You tried hard, keep it up. Did you get 70 points? Nice going, old chap! You got more than 70 points? Impossible! We didn't even do that good—and we cheated a little.

### Shortwave Contributors


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### Frequency Table

<table>
<thead>
<tr>
<th>kHz</th>
<th>Call</th>
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<th>GMT</th>
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<td>Latin American. BC</td>
<td>San Salvador</td>
<td>1000</td>
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<td>3200</td>
<td>VQG</td>
<td>Latin American. BC</td>
<td>San Salvador</td>
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</tr>
<tr>
<td>3400</td>
<td>VQG</td>
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<td>San Salvador</td>
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**This Issue’s Shortwave Contributors**


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**January, 1969**

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**This Issue’s Shortwave Contributors**


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**December, 1968**

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**This Issue’s Shortwave Contributors**


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**January, 1969**

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**This Issue’s Shortwave Contributors**


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**January, 1969**
### 25-Meter Band—11750-11975 kHz

<table>
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<td>DMQ11</td>
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<td>0100</td>
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<td>11800</td>
<td>RPL9</td>
<td>R. Nacional</td>
<td>Rio de Janeiro, Brazil</td>
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<td>ZY3Z6</td>
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<td>Rome, Italy</td>
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<td>11840</td>
<td>BED4</td>
<td>V. West</td>
<td>Lisbon, Portugal</td>
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<td>0045</td>
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<td>R. Hanoi</td>
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<td>1700</td>
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<td>Cologne, W. Germ</td>
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<td>Rotterdam</td>
<td>0230</td>
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<tr>
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<td>Prague, Czech</td>
<td>2345</td>
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<td>Kiev, USSR</td>
<td>2245</td>
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<td>London, England</td>
<td>0500</td>
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<tr>
<td>12016</td>
<td>V. America</td>
<td>Washington, D.C.</td>
<td>1800</td>
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### 13-Meter Band—21450-21750 kHz

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<td>0245</td>
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<td>21620</td>
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<td>0245</td>
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<td>R. Australia</td>
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<td>0200</td>
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<td>21890</td>
<td>¥. America</td>
<td>Greenville, N.C.</td>
<td>1900</td>
<td></td>
</tr>
</tbody>
</table>

### Blue Chip Portable

- Secure its leads by soldering each joint with a small, hot, and clean iron. An alligator clip makes a good heat sink.
- Mount R5 between pins 8 and 10 on the underside of the board and then wire in the other components of the stage. Connect the 100-uF capacitor C9 from pin 8 or pin 9 to ground and be sure to observe polarity.
- The space available on the board should suffice if you are careful and use the recommended parts. Bring fleas out as tie points for all mounted parts and connect them to the perf board. Connect a battery and turn the unit on. If you have trouble with feedback, check your layout and wiring.
- Total cost is about $15. This is a BC blaster you don't dare be without.

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**Blue Chip Portable**

*Continued from page 75*
Subways And Sleeping
Continued from page 59

In the NRC's studies, sleeping subjects are exposed to prerecorded sounds in the "nuisance" noise region below the 85-db level—the point above which hearing loss can be sustained and measured. An electroencephalograph is used to record the sleeping subject's brain waves, since this instrument is an excellent indicator of a subject's depth of sleep and hence of the degree to which noise can disturb this condition.

The EEG signals are recorded on magnetic tape rather than on the standard electroencephalograph chart. The tape is slowed down during the recording period. During the playback, the tape is run through at 50 to 100 times the recording speed and the EEG signals can be analyzed and recorded by a sound level recorder which retains the gross features indicating the depth of sleep. This procedure permits an investigator to take an 8-hour EEG recording and scan it for meaningful data in less than 10 minutes.

Because of the great contraction of time; not all the information on the original recording is retained. However, the continuity in time is retained and this provides a good picture of the progression of a person's sleep.

In scanning the tape recording, the investigator tries to determine when EEG signals change in ways that are characteristic of alterations in the sleep pattern. When the signals are fed to a speaker, changes in sleeping conditions are readily audible.

By studying the extent to which these rhythms can be interrupted by different types and intensities of sound, researchers hope to find new clues concerning the effect of noise on sleepers—effects which the subject is probably not aware of.

One such effect is expected to show up as psychological damage caused by noise disrupting dreaming. Dreaming takes up about one-third of everyone's normal sleep time and is deemed essential to mental health. People deprived of dreams become nervous and irritable and within 10 days their personalities begin to change.
of debonair sophistication, a leading man in his world and mine.

As I tucked my hand into his, and he opened the door, his mellow voice called to mother, "I'm taking our little boy for a walk, my dear . . . We'll be back shortly."

Winnemac Avenue in those days was lined on both sides with apartment houses, as I suppose it is now, and the architecture of them all was pretty much the same—red brick fronts, white stone steps, square living room windows, and sun porches paneled with glass storm windows. In just about every one of those glassed-in porches sparkled a lighted Christmas tree, glittering with ornaments, festooned with strings of popcorn, cranberries, gleaming metal floss.

As I trudged along at my father's side, his rubbers and my overshoes squeaking on the crusted snow, my eyes feasted on that procession of pretty trees, and at the gaily-wrapped packages around the bases of some of them—presents that would bring joy to the children and grownups who lived in those apartments.

I didn't mind the cold, even though it must have been close to zero. The air was so crisp and clear, and the stars gleamed like little Christmas tree lights all across the heavens. It was the most precious night of all the year, and I was home, far from the impersonal atmosphere and strict discipline of the school, and I was walking with the man who seemed to me the greatest in all the world—my father.

We came to the windy corner at Argyle Avenue and Sheridan Road. Father hadn't spoken much, perhaps because his pint-size boy seemed as strange to him as he did to me. Once or twice he asked if I was warm, and I nodded my head. Sometimes he pointed with gloved hand to a particularly beautiful Christmas tree.

There was a brightly-lighted candy store on that corner, and across the way rows of lights in a tall building were spangled against the deep blue sky. There, by the lamp post, standing by a metal tripod which held a kettle for donations from passersby, was a rather forlorn-looking Santa Claus. He wasn't plump and ruddy cheeked, as the pictures always show, but appeared gaunt and thin. His red suit with white trimmings hung from bony shoulders and seemed scant protection from the penetrating cold. But he kept bravely ringing the little brass bell and looking hopefully at people who were hurrying by.

Father paused and dropped some coins into the kettle. I still remember the clinking sound and the pride I felt at his generous gesture. He had a way of doing things with what theatrical people call flair.

I heard the muffled voice of the Santa Claus say, "Merry Christmas, and may God be with you."

After hesitating for a moment, father reached for my mitten and we started north on Sheridan Road, my short legs pumping along to keep up with his longer strides. About the middle of the block, he stopped and looked back.

"What is it, papa?" I asked.

"That voice," I heard him mutter. He went on as if talking to himself. "No, it can't be him . . . Floyd Sampson is dead . . . At least, that's what I heard."

"Who is Floyd Sampson?"

He looked down at me with an indulgent smile. "Who is Floyd Sampson? You never heard of him, my boy? Why, Floyd was just about the most popular jazz pianist who ever wowed an audience. Started doing a single in vaudeville, then plush night clubs, and wound up on radio. Top billing! Big spender! Too soft-hearted for his own good. Why, Floyd was up in lights when I was scratching for walk-on parts."

"Was he a friend of yours, papa?"

I felt his hand pat my head, as he turned and led me slowly back down the street. "A friend? I guess you could say he proved himself that. There was the time up in North Dakota—Bismarck, I think it was—when the Orpheum closed, and the management couldn't pay us off. It was just about the Christmas season, cold as it is tonight. I was hungry and stone broke. Sampson was on his way up then, headliner on our bill. I didn't know him very well, but I looked up to him like a tin god."

"You said he was on the radio."

"That came later, sonny boy. Radio was just beginning to put vaudeville out of business, and Floyd didn't begin broadcasting till later. Well, to go on with my story, that warm-hearted big shot saw I was up against it, and got me a room at his hotel—best place in town—and the next morning he staked me to money for meals and a ticket back to Chicago, where I had friends and
connections. I have never forgotten that.

We were nearly at the corner. "How do you know it's him, papa?"

"I don't. But I never forget a voice, especially a cultivated voice like his. And there's something about him—his eyes. I've got a hunch, and I'm going to play it."

I tugged at his sleeve. "If he was so popular on radio, why would he be working as a street corner Santa Claus now?"

He looked thoughtful, as he said, "That's a good question. I'm not sure of the facts, but there was talk about Sampson getting arthritis in his hands. Fingers got crippled up and he couldn't play anymore. And somebody told me he lost his wife and began drinking too much. Either way, or both, he didn't hold his own in the big time. Show business moves fast, and fame is fickle, my boy."

Father walked up to the bell-ringing Santa Claus, looked long and hard at him, then pushed back the stocking cap and pulled down his false beard a little.

"Why, Floyd Sampson, it's you! Do you remember me from vaudeville days—George Beane? We once played the Shubert circuit on the same bill."

The older man pushed my father's hand away, and rearranged his cap and beard, then said in husky tones, "Who'd you say I was? Never heard of Floyd Sampson. Now let me get on with my work here."

Father laughed shortly. "Oh, you're Sampson all right. Think I could forget the greatest jazz pianist of them all—and the man who gave me shelter, and food, and railroad fare back to Chicago, that time up in North Dakota when I was stranded?"

There was no answer. The Santa Claus shook his head and turned away.

For a few moments the two men just stood there, saying nothing and doing nothing. Then father spoke up again. "Well, whoever you say you are, I think you used to be Floyd Sampson, and I'm backing my hunch." He reached for his billfold, and took out all the money he had, folded it into a tight roll, and pressed it into the other man's hand. "Just repaying a loan, long overdue," he said, and led me away. "Merry Christmas, and good luck, Floyd."

I heard the brass bell begin tinkling again as we turned the corner.

As we walked up Winnemac Avenue, father began talking again. "You know, son, people sometimes say actors have a lot of ham in them, even when they're old and can't get bookings anymore. They say applause is like dope, and once you've heard it you never stop craving for it. Well, that isn't exactly the way it is. The really talented performers, like Floyd back there, have pride—you saw that in him—and they have hope. Pride for what they were, and hope for another chance to show what they can do. What else have they got to live for?"

I wasn't very old, and didn't know very much, so I didn't know how to answer him. So I just nodded my head, and pressed his hand, and kept trying to keep up with his long legs. But I remembered what he said, even to this day.

And I shall never forget the soft, white blankets of snow that made the world look new that night, and the bite of the cold, and the warm security of my father's hand.

I had always looked up to my dad, but that night I began to understand him. He may not always have been right, but the way he said things made them seem so. For instance, the next morning when we opened our Christmas presents, we found that mother had stretched her budget by investing in a superheterodyne radio in a mahogany cabinet with one of those cone-type speakers. The new radio was playing softly when father made his entrance in a red silk robe.

He looked, listened, and said to mother—"Mabs, my dear," (her name was Mable, but he always called her Mabs, except when they were arguing about something) "where'd that come from?"

"I bought it, George, as a present for the whole family."

He frowned, "Don't you know those infernal noise boxes are closing theaters and putting performers out of work?"

Mother didn't answer—just stood there with folded arms, looking uncertainly from the radio to her declaiming husband. "Besides," he said with a wave of his arm, "radio is just a fad. It will never take the place of real, live entertainment."

As I said, father wasn't always right. Radio is still with us, and he is now a memory. But, right or wrong, he was always lovable—he was lovable because he gave generously of himself and what he had.

And during the passing years I think I have never seen lovelier Christmas trees than in those glassed-in porches along our street, and I never see one of those street-corner Santas without thinking of Floyd Sampson.

JANUARY, 1969

115
Power transformer T1 is a multi-voltage type (see Parts List). Use only the color-coded leads shown in the schematic. Cut short all unused wires. Also, make certain all components are mounted securely on the board, including silicon rectifiers D1 and D2, and input capacitor C1. While C1 connects to the input jack and R1, its mounting terminals provide convenient tie points.

The input lead and AC line cord from the rear apron are routed to the front panel underneath notches at each lower corner of the perf board. The input lead must be shielded cable, with the shield connected to the chassis at J1 and to R2's ground lug. This lug is also connected to the perf-board ground bus.

**Final Steps.** After the board wiring is complete, remove the vu meter and install it on the front panel along with R1 and S1. Then mount the board assembly onto the meter's terminals. Make the board connections to S1 and R1 and then mount T1, J1, J2, and the line cord. J1 and J2 can be any model jack which matches your existing equipment connectors. Finally, hook up the line cord and the jack connections.

Note that R1 should always be turned off, full counterclockwise, before S1 is turned on or when connecting or removing plugs! When you apply power, place your finger on J1 or J2's hot terminal and advance R1. The meter should indicate the hum induced by your finger.

Individual transistor characteristics can prevent proper operation. The normal circuit voltages measured with a VTVM are shown in ovals on the schematic. The most probable trouble spot will be the drain electrode of Q1 (FET). If the voltage is appreciably lower than 10 V, disconnect Q2's base from Q1's drain and decrease R2's value in small increments (about 20%) until 10.5 V is measured at the drain electrode. Then reconnect Q2's base.

The parallel input jacks, J1 and J2, allow your Supermeter to be used with 4-channel microphone mixers. Simply connect the mixer's output to J1 and the recorder input to J2. Adjust the recorder's gain control for normal recording level and then advance R1 until the meter indicates zero on program peaks. From now on, channel mixing can be referred to the meter reading, thereby ensuring proper recording levels from all mixer inputs.

Last but not least, the Supermeter helps to signal-trace low-level transistor amplifiers whose signal voltages are often so small that they are unmeasurable on ordinary meters, either VOMs or VTVMs. If desired, a pair of high-impedance (crystal) phones can be connected across the meter terminals for monitoring. Be sure not to use low-impedance phones (5000 ohms or less).

There is virtually no commonly used audio level that won't produce a 100% meter reading. Just make certain all input leads are shielded to avoid having the signal reading masked by hum. Then you'll know just how hi the fi really is!

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volts will differ by about 10 ppm from its previous value. This should help to bring everything in line with the BIPM ampere.

The top photo on our lead page shows a capacitance standard used in the recent determination of the NBS ohm. The capacitance reactance of the capacitor at a known frequency is balanced against the resistance to be determined.

The photos at the bottom of the page show a complex electrodynamometer (an instrument for measuring mechanical force) which was used to determine the NBS ampere. When direction of current in the large coils is reversed, torque is induced into a small rotating coil so that it pulls against a balance arm and upsets the equilibrium of the equipment. Balance is restored by adding weights to the balance arm by means of a rod and pulley arrangement at the outer end of the housing; this factor, along with others, leads to a new calculation for the ampere.

Talk about wheels within wheels! The outer framework of coils compensates for the earth's magnetic field—so putting the amper back on its feet is obviously one heck of a business. All of this equipment is so ultra precise that even adding weights to the balance arm is a major design problem. Oh well, all in day's work. —Hans Richter
an illegal station operating within the U.S. There are only two copies of each "gamma" pad—one kept by the agent, the other by his superiors. Each page is used once, then destroyed. At the start of each broadcast, a special indicator, often a three or five-digit number, tells the spy which page in his "gamma" booklet to use.

How It's Done. Thompson revealed how he deciphered his instructions from Moscow: If, for example, the seventh group in the message was 27406 and the seventh group on the proper page of his "gamma" pad was 27410, he would subtract the digits and obtain the answer, "4." The same method would be used with all the number groups received.

Other techniques, instead of subtraction, call for modular addition, in which the sums exceeding 9 are not "carried over" into the next column.

Thompson arranged his key phrase in the shape of a "T" and numbered the letters starting at the bottom of the shaft, then across from left to right.

```
11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26
DIE BUCHANDLUNGEN
W 10
I 9
R 8
T 7
S 6
C 5
H 4
A 3
F 2
T 1
```

In this case, "4" would stand for "H." If the number had been "14," it would mean "B." Each set of five numerals would give a single letter of the message. This system required that Moscow's instructions be carefully phrased, since Thompson's key words contained only 16 different letters.

Even Spies Have Class. Actual use of the cipher pads and key phrases apparently varies a great deal depending on the status of the secret agent and the degree of security required.

Lesser agents like Thompson used relatively uncomplicated systems. Hayhanen and KGB master spy, Rudolf Abel, who was nabbed by the FBI in 1957, but later

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<th>Language</th>
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<td></td>
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<td></td>
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<td></td>
<td></td>
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Note: Frequencies, especially those of Spanish speaking stations, may vary as much as 50 kHz or more. Many additional frequencies have been observed with "numbers" broadcasts. It has been postulated that four-digit groupings may be of American origin.

"swapped" for U-2 pilot, Francis Gary Powers, used more complex techniques. These involved the "gammas" and a complicated matrix of numbers and letters.

If you're still thinking about cracking the "numbers" game, forget it! Since each cipher is used only once, then destroyed, these messages are "fracture-proof." One team of expert government analysts tried for four years without success to unscramble a page of 207 five-digit numbers.

The "numbers stations" have even stymied the multi-million dollar "electronic brain" computers at the Ft. Meade, Md., home of the National Security Agency, our official espionage eavesdroppers. So, if the big boys can’t crack the nut, why try? Just keep logging these spy broadcasts and someday, when we get one of our boys inside the Russian KGB, you may be eligible for some crazy verifications.

"It's what they call total involvement."
Frozen Magnetic Forces

Continued from page 55

... have to add plastic pattern.

Incidentally, the rod plus plastic base makes a handy agitator for dispersing the iron powder throughout the oil after experiments. Simply move it up and down like a plunger to mix the powder and oil.

How are the two palm tree growths on the upper part of the rod to be explained? These are obviously regions having concentrated fields. They were created accidentally when the rod was tested with a horseshoe magnet.

The momentary contact with the testing magnet was enough to magnetize the rod at these points. This fortunate accident served to underscore the fact that bar and cylinder magnets need not be limited to a north and south pole at the magnet’s opposite ends. You can see that it is possible to have more than one pair of poles on the same bar magnet. If the rod had been touched in two places with the horseshoe magnet, two more intermediate poles would have been formed and the magnetic tree would have been even more elaborate.

Other effects can be achieved by suspending smaller iron bars either between the outside magnets or elsewhere in the cell. The 3-D patterns produced by the powder will reveal the induced magnetism in these iron pieces and will show how magnetic fields can be distorted by metallic objects.

This oil system might also be used to demonstrate 3-D field patterns produced by electric currents. The coils could be immersed either in the oil or wrapped around the outside of the cell.

Frozen Fields. These 3-D patterns as well as two-dimensional ones can be preserved permanently by locking them in slabs or blocks of plastic. First try making a permanent mold of a simple two-dimensional pattern.

Obtain a bottle of embedding and casting plastic sold by craft and hobby shops. You have to add a few drops of a catalyst solution to the clear liquid just before it is used.

Mix some of the catalyst with enough plastic liquid to fill a polyethylene lid swiped off a coffee can. Stir in enough iron powder to obtain a uniform suspension. To determine the correct amount, make preliminary tests using mineral oil instead of the plastic liquid.

When you’re ready, pour the suspension into the plastic lid and place it over one or two small magnets. The usual patterns should develop immediately. When the pattern looks right (before too much powder has been drawn to the poles), remove the lid and set it aside to harden.

When the plastic is thoroughly hardened, just pop it out of the lid. You now have the force field permanently frozen inside the molded plastic disc.

Having gone this far, you will surely be tempted to mold some 3-D patterns of your own. Don’t use your plastic cell for this purpose because it would be impossible to remove the molded plastic without destroying the cell!

Instead, make a take-apart cell from sheet glass and fasten the walls and bottom together with adhesive tape.

The liquid plastic has about the same viscosity as mineral oil, so the iron powder will behave just as it did in the oil. When the 3-D pattern has formed in the liquid plastic, let the cell and magnets stand undisturbed at least overnight to ensure hardening. Then remove the glass walls, trim off any excess plastic, and polish if necessary.

If you don’t pour too much catalyst into the liquid plastic there will be plenty of time to get the desired pattern—even if the powder must be dispersed for a second try.

Besides all the heavyweight, scientific applications, these frozen fields (as discs or blocks) would make novel paperweights to give to your friends as Christmas gifts. Could there be any better way to convince them that you do, indeed, have a magnetic personality?
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JANUARY, 1969
personal freedom by the computer builders. Over in the Netherlands, residents must buy a license to operate a TV or radio receiver. Just to make sure this is done, the good folks at the Netherlands' equivalent of our FCC have bought a computer to keep track of the names and addresses of everyone who has paid his fee for having a receiver.

According to the manufacturer, the computer will replace bulky card files and make it easier for authorities to investigate homes where no radio or TV sets are registered. The computer people seem proud of their achievement, which, they say, could see use in several European countries which charge fees of set owners to pay for the government broadcasting networks. What they fail to explain is why folks who don't have receivers should be investigated by the authorities.

Coming, perhaps, is the time when a knock on the door in the middle of the night will be the Feds checking to see if you have a license for your electric wrist watch. Progress, it's wonderful.

Our Shrinking World? We all know that most of our ham bands are crowded, and it's no surprise that commercial bands are jammed, too. Thing is, the big Decision Makers who cluck their tongues over such matters thought they had a pretty good way to wipe out some of this congestion. Synchronous satellites were to be the answer and some have already been used to a limited degree. (In all justice, it should be noted that hams were among the pioneers in using satellites for long-range relay of VHF.)

One proposed commercial project was use of synchronous satellites to relay VHF transmissions from aircraft on transoceanic flights. However, the future of this project is somewhat uncertain. It's possible technically and has, in fact, already been effected by some airlines. Catch is that there are already so many satellites in orbit (or about to be launched) that choice locations will soon be overcrowded or unobtainable.

Think of it: the Space Age is only a little over 10 years old, and already there's a traffic jam up there!

Tapping The Treasures
Continued from page 49

guns, ultrasonic generators and like systems are used to create electrical explosions or to otherwise send probing signals deep into the ocean; the returning signals take pictures of the ocean bed and probe rock structures thousands of feet below the ocean floor.

In remote areas of the world, fully automatic instruments floating on platforms measure environmental factors and relay the data to satellites passing hundreds of miles overhead; the satellites in turn relay the information to ground stations thousands of miles distant. Deep in the ocean, below the instrument platforms are atomic power plants to produce electricity to run the data gathering and telemetry-radio systems.

We have the Key. Poor old Davy Jones hasn't a chance against such technologic onslaughts. His bountiful locker is cracking, and before long it will burst wide open.

But for man, the technologic challenge will only be beginning. He will know what is in the ocean. The next job will be to find ways to get it out. We will tell you all about that—maybe twenty years from now.

Ham Traffic
Continued from page 91

Dual 1019 Lab Check
Continued from page 85

arm is getting the correct stylus overhang and correct cartridge height. The 1019 eliminates the guesswork with an unusually large selection of mounting hardware and aspecial gauge that clamps to the pickup shell. With the gauge in position, the user simply selects the hardware which places the pickup stylus dead center in the gauge; no measurements or guesswork are needed.

Overall Observations. As you've probably already surmised, we were highly impressed with the Dual 1019: it performed flawlessly both as an automatic turntable and as a changer. Even with the platter loaded with ten 12-in. records, the Dual 1019 exhibited no evidence of noticeable wow or speed change.

Supplied complete with manual and changer spindle, pickup shell, pickup gauge, and strobe disc, the Dual 1019 lists for $129.50. A base and dust cover are available as optional accessories.

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Furniture—Step-by-step details for building, repairing and refinishing furniture the way the experts do—for every room in the house as well as outdoor use. Projects range from colonial to ultra modern stylings.

Home Workshop—Rewarding projects for the craftsman with full detailed text and profuse illustration for working in wood, metal, plastics and other fields.

Radio-TV Repair—Eliminate costly repairs. For the man who enjoys repairing and maintaining his and his neighbor's home entertainment equipment, b&w and color TV, AM & FM stereo systems, tape recorders, antennas and table radios.

Wood Projects—Syndicated columnist Steve Ellington is sure to excite the home handyman with this collection of projects which can be built with common hand and power tools. Thrill family and friends by your easily gained "expertise" in creating new and unusual furniture for your home.
The "Edu-Kit" offers you an outstanding Practical Home Radio Course at a tremendous saving. It is designed to teach Radio & Electronics technicians fundamentals in the use of the most modern methods of home training. You will learn radio theory, construction, practice, and servicing. The "Edu-Kit" is a COMPLETE RADIO COURSE, IN EVERY DETAIL. You will learn how to build radios, using regular schematics; how to wire and solder in a professional manner; how to construct and wire printed circuit boards. You will work with a standard type of punched metal chassis as well as the latest development of Printed Circuit chassis.

You will learn the basic principles of radio. You will construct, study and work with radios and radio equipment, learn and practice as well as learn and practice code, using the Progressive Code Oscillator. You will learn and practice trouble-shooting, using the Signal Tracer. Progressive Signal Tracer, Progressive Dynamic Radio & Electronics Tester, Square Wave Generator and the accompanying instruction material.

You will receive training for the Novice, Technician and General Classes of F.C.C. Radio Amateur license. Kit will build Receiver, Transmitter, Square Wave Generator, Code Oscillator, Signal Tracer and Signal Injector circuits and learn how to operate them. You will receive lessons in electronics and radio, worth many times the low price you pay. The Signal Tracer alone is worth more than the price of the kit.

THE KIT FOR EVERYONE

You do not need the slightest background in Radio & Electronics because you want an additional income, pay for your bills, or to build your own radio business or to work on a job with a future, you will find the "Edu-Kit" a great value at a fraction of the cost.

Many thousands of individuals at all ages and backgrounds have successfully learned the "Edu-Kits" and are now leading successful careers in Radio & Electronics. The "Edu-Kit" has been carefully planned and designed in such a way, so that you cannot make a mistake. The "Edu-Kit" follows your own self at your own pace. No instructor is necessary.

PROGRESSIVE TEACHING METHOD

The Progressive Radio "Edu-Kit" is the foremost educational radio kit in the world, and is universally accepted as the standard in the field of electronics training. The "Edu-Kit" uses the modern educational principle of "Learn by Doing." Therefore you construct, learn schematics, study theory, practice trouble-shooting— all in a closely integrated program of radio work. You build commercially useful radio equipment that is necessary to the proper functioning of your home, business and daily life.

You begin by examining the various radio parts of the "Edu-Kit." You then learn the functioning of each part and how to use it. When you build a simple radio, with this first set you will enjoy listening to regular broadcast stations, learn theory, practice testing and trouble-shooting. Further lessons will expand your background in electronics training and techniques. Gradually, in a progressive manner, and at your own rate, you will find yourself a fully qualified professional Radio Technician.

In addition to the "Edu-Kit," you receive a Printed Circuit manual, including Printed Circuit chassis, complete tube sockets, hardware and printed circuit instructions. You also receive a useful set of tools. A professional electric soldering iron, an all-purpose Dynamic Radio and Electronics Tester. The "Edu-Kit" also includes Code Instructions and the Progressive Code Oscillator. In addition to F.C.C. Radio Amateur License training, you will also receive lessons in many other important aspects of radio and electronics training.

THE "Edu-KIT" IS COMPLETE

You will receive all parts and instructions necessary to build twenty different radio circuits, each guaranteed to operate. Our kits contain tubes, tube sockets, variable, electrolytic, mica, carbon and paper dielectric condensers, resistors, tie strips, hardware, tubing, punched metal chassis. Instruction Manuals, hook-up wire, solder, selenium rectifiers, coils, volume controls and switches, etc.

In addition, you receive Printed Circuit materials, including Printed Circuit chassis, special tube sockets, hardware and instructions. You also receive a useful set of tools, a professional electric soldering iron, and a self-powered Dynamic Radio and Electronics Tester. The "Edu-Kit" also includes Code Instructions and the Progressive Code Oscillator. In addition to F.C.C. Radio Amateur License training, you will also receive lessons in many other important aspects of radio and electronics training.

UNCONDITIONAL MONEY-BACK GUARANTEE

Please rush my Progressive Radio "Edu-Kit" to me, as indicated below:

Check one box to indicate choice of model:

- Deluxe model $31.95 (same as regular model, except with superior parts and finish)
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- Complete course $43.95

I enclose payment of $________

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Send me "Edu-Kit" C.O.D. I will pay postage.

Send me FREE additional information describing "Edu-Kit."

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Address

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1186 Broadway, Dept. 551NN, Hewlett, N. Y. 11557

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- TESTER INSTRUCTION MANUAL
- ALUMINUM TELEPHONE ZIPPER
- TELEVISION BOOK
- RADIO MAGAZINES
- MEMBERSHIP IN RADIO-TV CLUB
- CONSULTATIVE SERVICE, F.C.C. AMATEUR LICENSE TRAINING
- PRINTED CIRCUITRY

SERVICING LESSONS

You will learn trouble-shooting and servicing in a progressive manner. You will practice repairs that you will construct. You will learn symptoms and causes of troubles in home, automobile and car radios. You will learn how to use the professional servicing tools, that is, the Progressive Signal Tracer, Progressive Code Oscillator and, Progressive Dynamic Radio & Electronics Tester. While you are repairing radios, you will be able to do many a repair job better than you have ever done before. You will find yourself the envy of your neighbors, and charge fees which will far exceed the price of the "Edu-Kit." Our Consultative Service will help you with any technical problems you may have.

FROM OUR MAIL BAG

J. Stetzel, of 223, Poinset Pl., Water town, N. Y. — After receiving the "Edu-Kit," I have no need any longer for the one I was attending. The "Edu-Kit," paid for itself, though I could not have afforded it, but I found your ad and sent for your "Edu-Kit," and I am glad that I did so.

Ben Valenza, P. O. Box 21, Malaga, N. J. — I have been practicing radio in the evenings in order to get in a little extra money. The "Edu-Kit" paid for itself. I worked it out, learned the trouble-shooting and purchasing parts, and found my own and sent for your "Edu-Kit," but I am glad that I did so.

Robert L. Shutt, 1534 Monroe Ave., Huntington, W. V. A. — Thought I would drop you a few lines to say that I received my "Edu-Kit," and was really amazed that such a bargain can be had at such a low price. I have already started re- pair work, the "Edu-Kit" paid for itself. I am very glad that I ordered the "Edu-Kit." I have found it to be a wonderful and useful kit, and wish that I had got one years ago.

PRINTED CIRCUITRY

At no increase in price, the "Edu-Kit" now includes Printed Circuitry. You build a Printed Circuit Signal Injector, a unique servicing instrument that can detect many radios and TV troubles. This revolutionary new technique of radio construction is now becoming popular in commercial radio and TV sets.

A Printed Circuit is a special insulated chassis on which has been deposited a conductive material which takes the place of wiring. The various parts are merely plugged in and soldered to terminals. Printed Circuitry is the basis of modern Automation Electronics. A knowledge of this subject is a necessity today for anyone interested in Electronics.