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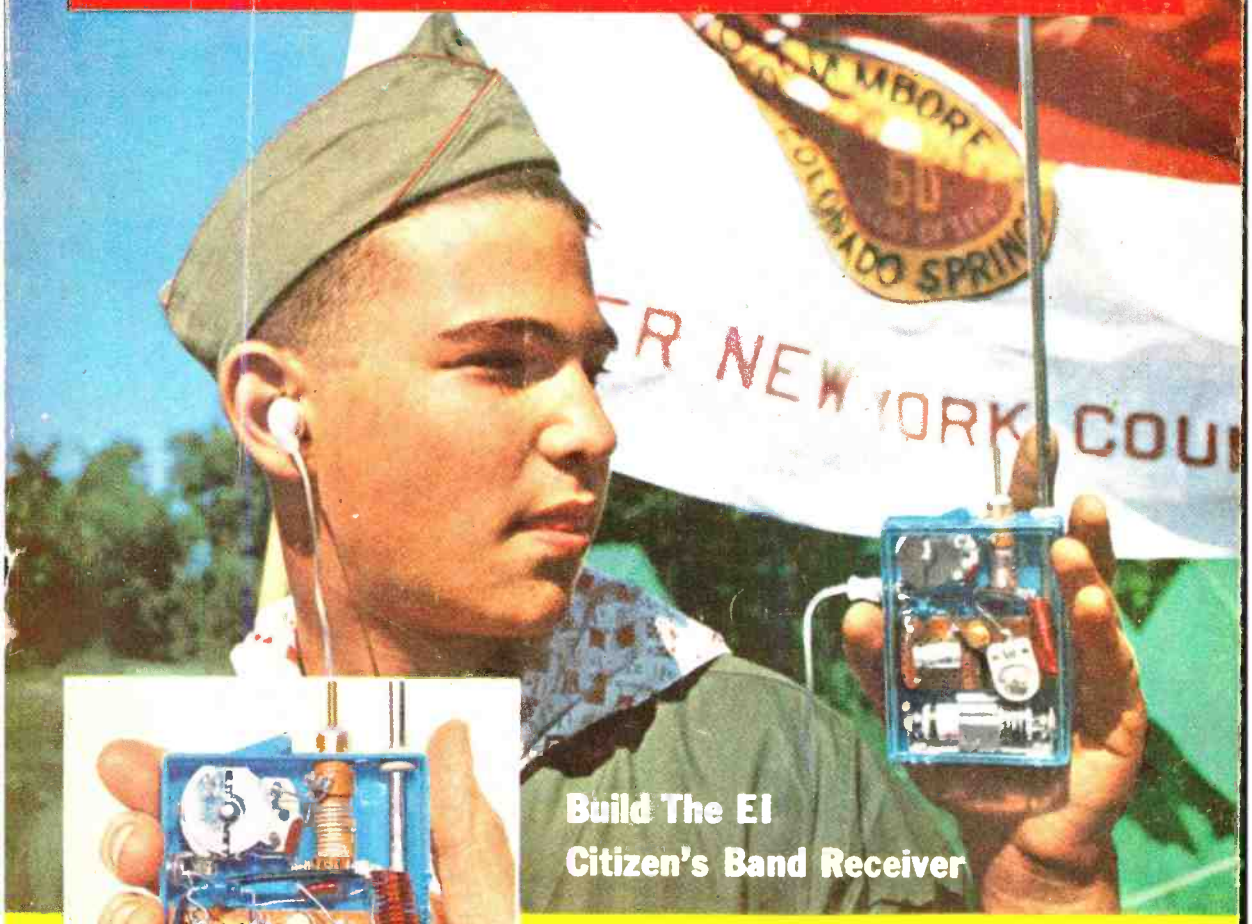

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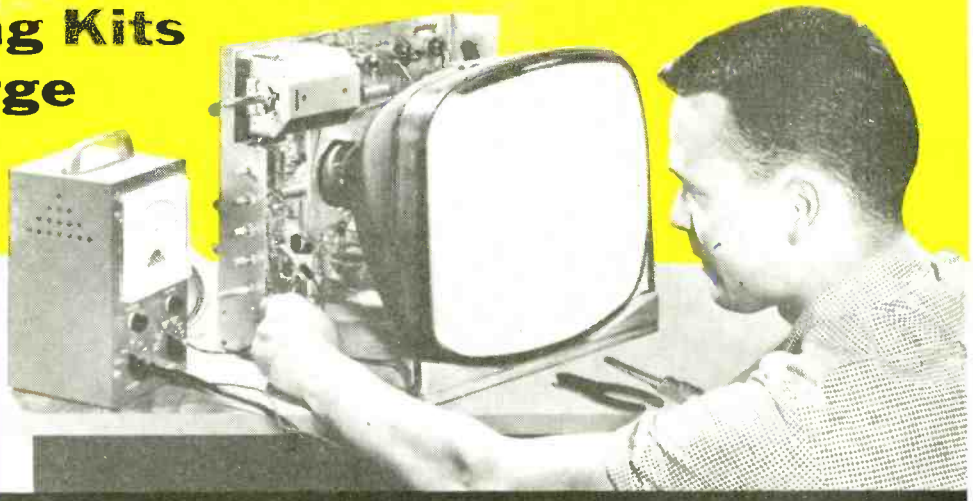

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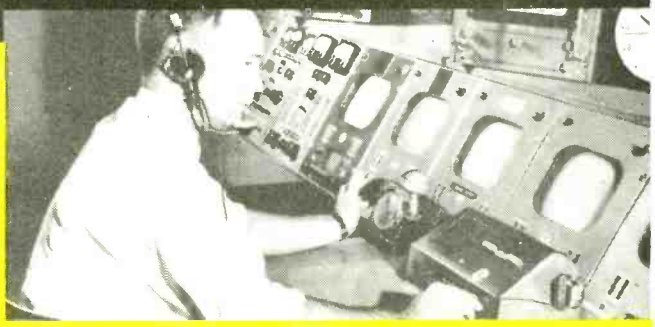

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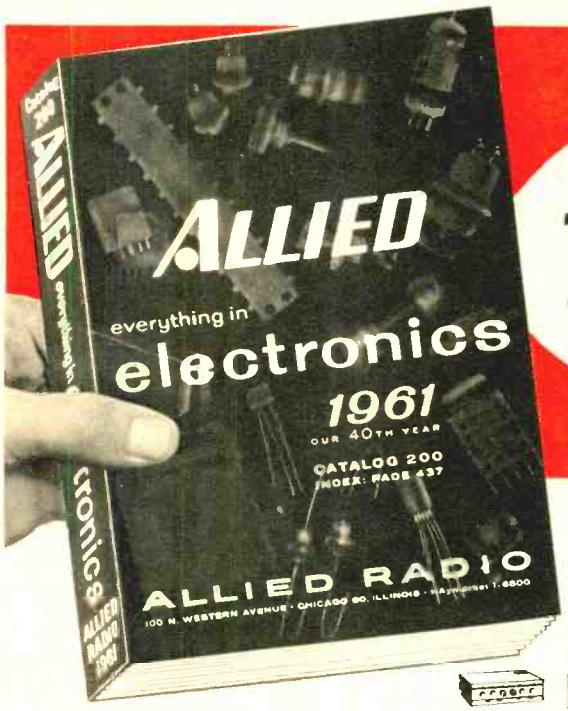

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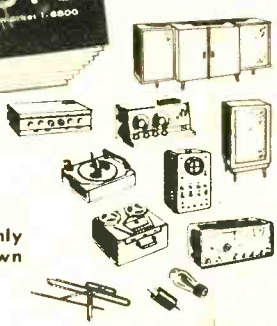

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November, 1960 Vol. 3, No. 11

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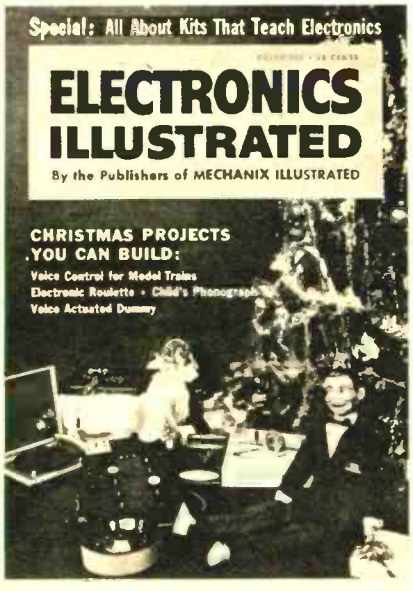
A Message From the Editor

Echo 1, a huge shiny ball designed to bounce radio signals from the East to West Coast and vice-versa, is now circling the Earth. *Tiros 1*, our weather satellite has telemetered important data on cloud formations and weather movements to its receiving stations. *Transit* has proved a valuable navigational aid to our seamen.

This is a very exciting age we live in: a period in which we anticipate sending a man far into space; an era in which planes are flown many times the speed of sound; a time when man is climbing higher and higher into the atmosphere and diving to the floors of the deepest part of the oceans.

This is a "golden age" of progress for the world. And we, the electronics enthusiasts, by our knowledge and understanding of these events, feel partner to them.

Some time ago, *Electronics Illustrated* decided to encourage amateur rocketry in the hope that more young scientists would apply their electronic know-how to this subject. We are happy to say that we have contributed some important information to this field and we are even now working on future contributions. Recently there was an amateur rocket shoot held at Fort Knox, Kentucky. We thought this would be an important event and assigned Lloyd Mallan to attend and get us an exclusive story on the progress of amateur rocketry to date. His story starts on page 48 of this issue. It does not make for happy reading—we frankly are disappointed in the caliber of the rockets and equipment that were presented. However, our story does not end here. Major Bertrand R. Brinley, whom many of you know as a lecturer and inspirer of many amateur rocket societies throughout the country, is now preparing his side of the story. Major Brinley says that there *is* a great deal of original and worthwhile rocket research being done by amateurs in this country and he has proof. We eagerly await his article, to be presented in our December issue.



Speaking of the December issue, it will be chock full of exciting *EI*-simplified projects for you to build for your Christmas fun and gift giving. There will be a voice control for model trains, an electronic roulette game, a child's phonograph which we defy any child to break, a voice activated ventriloquist dummy whose mouth opens and closes in synch with your speaking, and more. If you pick up your December issue early, you will have plenty of time to build these items before Christmas.

In the photo on page 6 you see part of the *Electronics Illustrated* staff poring over some of the many kits that teach electronics. When we decided to do a survey on these, we had no idea there were so many. Nevertheless, through hard

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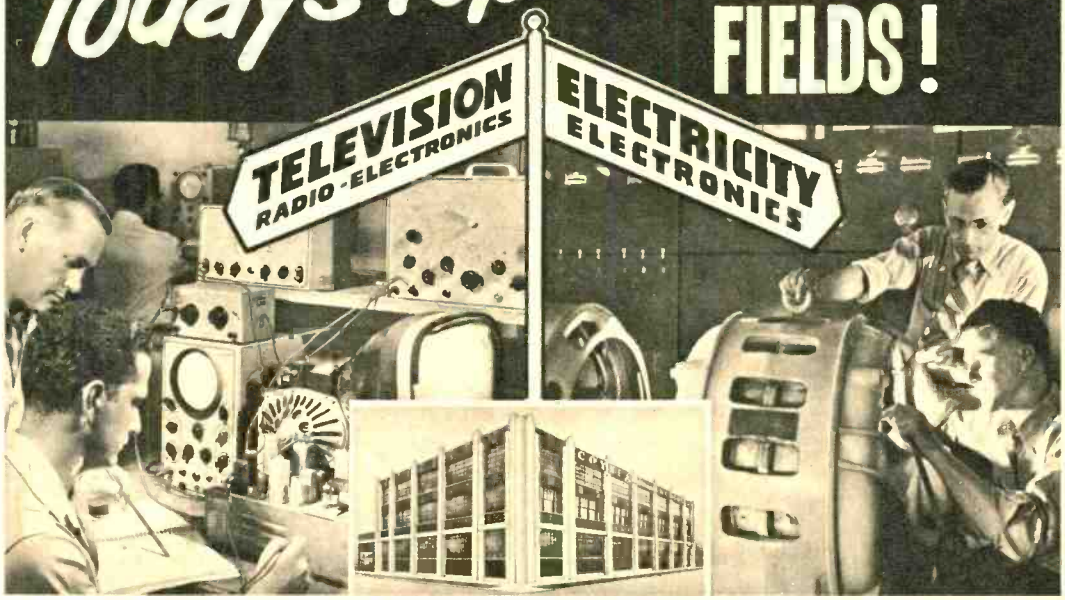

Instructor helping students check the wiring and trace the circuits of television receivers.

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work by all the staff, we have been successful in evaluating all of these and Nicholas Rosa, our Feature Editor, will present the results in our next issue. If you are interested in giving such a kit as a gift, or buying one for yourself, be sure to read this article.

Our Technical Editor, Larry Klein, got so enthused while preparing the special section on loudspeaker enclosures in this issue, he went overboard and came up with more material than we could possibly get into one issue. In the belief that you can't ever have too much of a good thing, (except for sour apples and liquor) we will publish how to build loudspeaker enclosure articles in many of our future issues.

In our September issue, on page 83, *EI* stated that any amateur radio operator may operate a transmitter licensed to a Novice. Actually, the holder of a Technician license may operate a Novice's transmitter only in the 145 to 147 mc band under the usual Novice conditions.

Once again be sure to be with us next month for those special Christmas projects.

Charles Tepfer

....electronics in the news

This is the "ear" of the most sensitive voice receiver yet built. Bell Laboratories proposes a network of these receivers, and high-powered UHF transmitters, to be used with a system of 50 private-enterprise communications satellites in 3000-mile orbits. These would be active relay stations, carrying receivers and transmitters for repeating telephone and TV transmissions for world-wide distribution. House at small end of horn holds receiver which has a ruby maser amplifier cooled to minus 456°F., near Absolute Zero.

• • • • • •

A settlement of $1,000,000 was made by the National Aeronautics and Space Administration and the Army, Navy, and Air Force with the widow of rocket pioneer Dr. Robert H. Goddard and the Guggenheim Foundation, for use of the inventor's basic patents. The Foundation and Mrs. Goddard filed their claim in 1951...

• • • • • •

At Lockheed Aircraft Corp.'s avionics laboratory at Marietta, Ga., a scale-model jet plane is used to determine best location for antenna. The new lab is for development and testing of antennas, radomes, transmission lines, and components for high speed and special mission aircraft...Equipment to be tested rides on track to a distance from test-signal antenna in concrete shelter. Model-support pylon is non-reflecting for radio waves.

• • • • • •

An ultra-tiny rocket-borne television system, to fit in the 4½" diameter nose cone of the Navy's ARCAS surveillance rocket, is being developed by Dage Television Division, Thompson Ramo Wooldridge, Inc. Unlike satellite TV cameras, or rocket movie cameras which must be recovered, Dage unit will be expendable...

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Using the well-known Doppler Effect principle, Cornell Aeronautical Laboratory has developed a radar method of measuring wind velocity, turbulence, and rainfall rate in storm areas.

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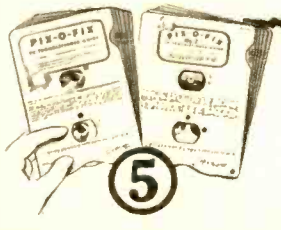

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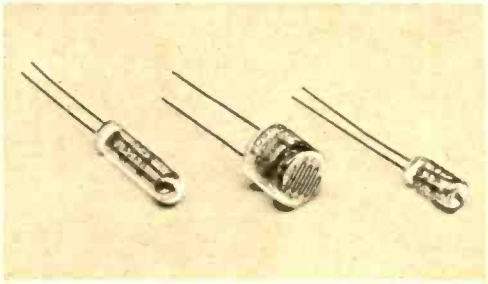

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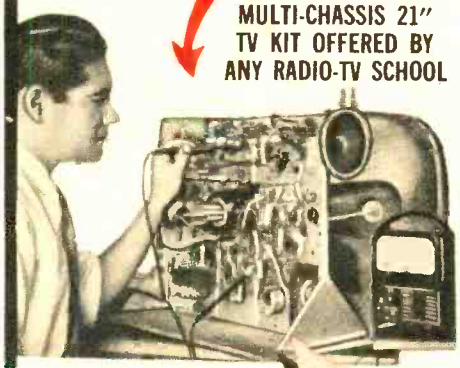

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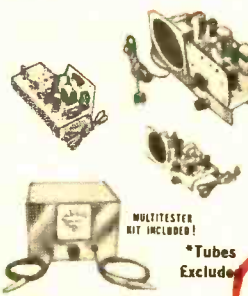

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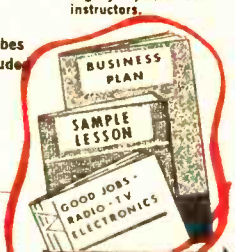

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. . . News

A new method of cooling, developed in France, is being used in the Voice of America's new 250,000-watt short wave transmitters being built by General Electric. Called "Vapotron cooling," the system cuts the amount of water needed to cool a transmitter tube from 40 gallons a minute to one gpm. The excess heat is carried away by steam, which is then condensed and returned to the tube.

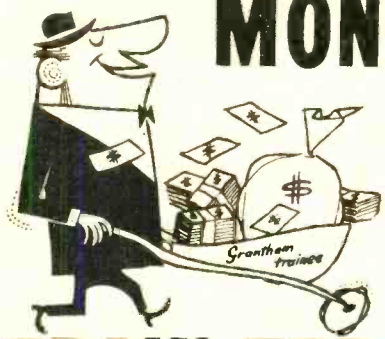
—o—

The new Model TX-86 transmitter by Ameco covers 6 through 80 meters, fixed or mobile, can handle up to 90 watts input on CW, 90 watts peak input on phone. Cabinet size only 5"x7"x7". Crystal controlled, pi-network output, TVI-suppressed, 6146 final, provision for external VFO. Power requirements, 600 volts at 150 ma. for maximum output. 6146 may be replaced by 2E26 for 300 volt, 100 ma. supply. External power supply, Model PS-3, available. Price: TX-86, kit, $84.95, wired, $109.95; PS-3, wired, $44.95. American Electronics Co., 178 Herricks Road, Mineola, N. Y.

—o—

New Fords coming off the assembly line at the River Rouge plant have their engine RPM checked without any direct connection to the engine. The process for checking engine speed and automatic transmission linkage takes two minutes. Unit uses an induction coil which picks up magnetic pulses from the car's ignition coil.

MAKE MORE MONEY



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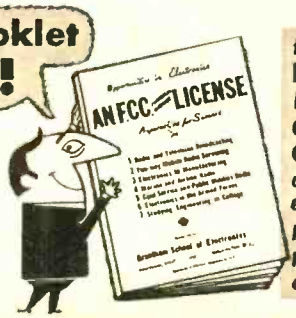

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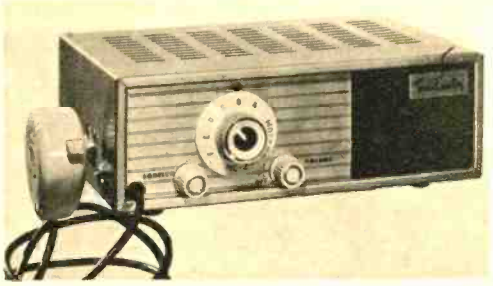
. . . News

"Classics That Made The Hit Parade" are part of a special Audiotape promotion package. For the price of two 7" reels of blank Audiotape plus one dollar, the customer will receive one blank and one pre-recorded reel of tape. Selections on the tape are by Borodin, Tchaikovsky, Rachmaninoff, Chopin, and Waldteufel and are the sources for recent popular hit tunes. Available in two-track stereo, dual-track monaural, and four-track stereo, on 1200-foot reels at 7½ ips. Audio Devices, Inc., 444 Madison Ave., New York 22, N. Y.

—o—

RCA now has a broad-scale leasing plan under which big, complex scientific instruments, such as the electron microscope, and X-ray diffraction apparatus, may be rented by schools, colleges, and other institutions on a year-to-year basis.

—o—



Utica's new Model MC 27 "Town and Country" Citizens Band transceiver features six channel operation, and a double-conversion superhet receiver section with a sensitivity of .7 microvolts for a 6 db signal-to-noise ratio. A 1946 kc precision crystal in the second oscillator circuit increases stability under extreme variations in temperature. A double-gated series noise limiter clips both positive and negative peaks of ignition and other noise without audio distortion. 6, 12, and 117-volt models. 12x7x4". 1 set of crystals, 1 power cable supplied. Price, $189.50. Utica Communications Corp., 1834 W. Foster Ave., Chicago 40, Ill.

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Absolutely no previous knowledge of radio or science is required. The "Edu-Kit" is the product of many years of teaching and engineering experience. The "Edu-Kit" will provide you with a basic education in Electronics and Radio, worth many times the complete price of $26.95. The Signal Tracer alone is worth more than the price of the entire Kit.

THE KIT FOR EVERYONE

You do not need the slightest background in radio or science. Whether you are interested in Radio & Electronics because you want an interesting hobby, a well paying business or a job with a future, you will find the "Edu-Kit" a worth-while investment.

Many thousands of individuals of all ages and backgrounds have successfully used the "Edu-Kit" in more than 79 countries of the world. The "Edu-Kit" has been carefully designed, step by step, so that you cannot make a mistake. The "Edu-Kit" allows you to teach yourself at your own rate. No instructor is necessary.

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You begin by examining the various radio parts of the "Edu-Kit." You then learn the function, theory and wiring of these parts. Then you build a simple radio. With this first set you will enjoy listening to regular broadcast stations, learn theory, practice testing and trouble-shooting. Then you build a more advanced radio, learn more advanced theory and techniques. Gradually, in a progressive manner, and at your own rate, you will find yourself constructing more advanced multi-tube radio circuits, and doing work like a professional Radio Technician.

Included in the "Edu-Kit" course are twenty Receiver, Transmitter, Code Oscillator, Signal Tracer, Square Wave Generator and Signal Injector circuits. These are not unprofessional "breadboard" experiments, but genuine radio circuits, constructed by means of professional wiring and soldering on metal chassis, plus the new method of radio construction known as "Printed Circuitry." These circuits operate on your regular AC or DC house current.

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You will receive all parts and instructions necessary to build 20 different radio and electronics circuits, each guaranteed to operate. Our Kits contain tubes, tube sockets, variable, electrolytic, mica, ceramic and paper dielectric condensers, resistors, tie strips, coils, hardware, tubing, punched metal chassis, Instruction Manuals, hook-up wire, solder, selenium rectifiers, 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.-type Questions and Answers for Radio Amateur License training. You will also receive lessons for servicing with the Progressive Signal Tracer and the Progressive Signal Injector, a High Fidelity Guide and a Quiz Book. You receive Membership in Radio-TV Club, Free Consultation Service, Certificate of Merit and Discount Privileges. You receive all parts, tools, instructions, etc. Everything is yours to keep.

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FROM OUR MAIL BAG

Ben Valerio, P. O. Box 21, Magna, Utah: "The Edu-Kits are wonderful. Here I am sending you the questions and also the answers for them. I have been in Radio for the last seven years, but like to work with Radio Kits, and like to build Radio Testing Equipment. I enjoyed every minute I worked with the different kits; the Signal Tracer works fine. Also like to let you know that I feel proud of becoming a member of your Radio-TV Club."

Robert L. Shuff, 1534 Monroe Ave., Huntington, W. Va.: "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 repairing radios and phonographs. My friends were really surprised to see me get into the swing of it so quickly. The Troubleshooting Tester that comes with the Kit is really swell, and finds the trouble, if there is any to be found."

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. . .News

A new programming system for electronic computers uses simple English words, rather than complicated number codes, to feed "instructions" to a computer. COBOL, for "Common Business Oriented Language," was developed by a committee of computer manufacturers at the request of the Department of Defense, largest computer user in the country. RCA's new 501 computer is equipped for the new system.

—o—

The "Dyna-Twin," a lightweight, high-fidelity headset for stereo or monaural use, has been introduced by Telex, Inc. Weighing nine ounces, the Dyna-Twin has a microphone-equipped model (any type of microphone, specified by customer) for two-way work. The earpieces feature self-supporting voice coils, air-filled neoprene muffs, nominal impedance of 6 ohms each side. Response of 30-15,000 cycles is claimed. Telex, Inc., 1633 Eustis St., St. Paul, Minn.

—o—

A free 4-page booklet, "Stereo and High Fidelity," is available from EICO. It explains stereo principles, stereo components, and suggests stereo and mono equipment combinations. Electronic Instrument Co., Inc., 33-00 Northern Blvd., L. I. City 1, N. Y.

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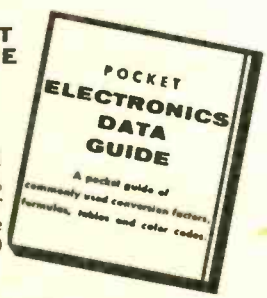

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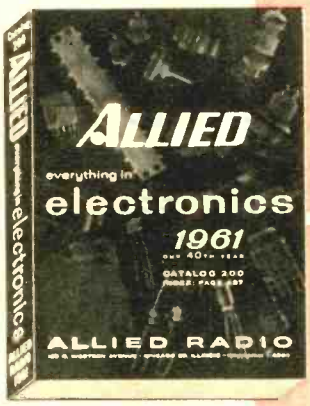

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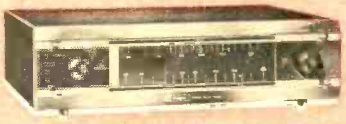

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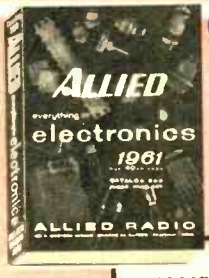

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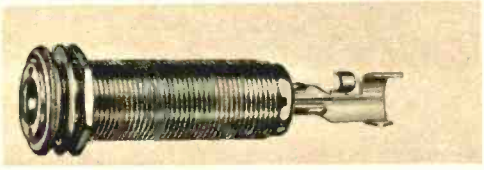
. . . News

A new transformer design, the "Flexicore," up to 30% smaller and lighter than conventional types with identical operating characteristics, is announced by Sylvania. The core consists of laminations of steel strips from a continuous roll, instead of "E" and "I" shaped pieces as in conventional designs. Two "U" shaped nests of strips, fitted together with the tops of the "U's" interleaved, make a hollow rectangle. To form a shell-type transformer, with a center post like that of the "EI" type, two cores are placed side-by-side. The company says the lines of magnetic force flow continually with the grain of the core steel, rather than across the grain as occurs in "EI" laminations. This reduces the magnetic circuit's resistance, enabling unit to operate as efficiently as bigger, heavier conventional types.

—o—

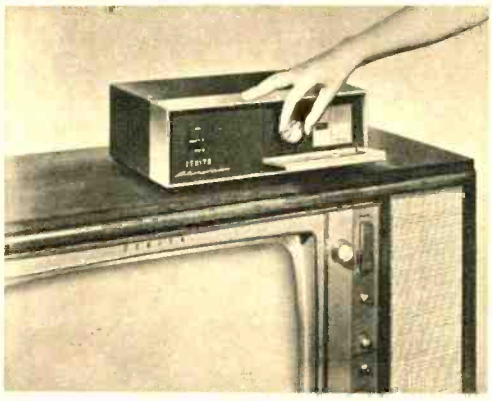


A new jack for thick-panel mounting is introduced by Switchcraft. It can be mounted in any panel up to 1¼" thick. It mates with the company's "Littel Plugs," and is suited to microphone use because it is shielded. The thick panel jack is mainly intended for wall paneling, speaker enclosures and other applications using heavy materials. It is available in two types, two-conductor (No. 151, list price $1.35) and three-conductor (No. 152B, list $1.50). Switchcraft, Inc., 5555 N. Elston Avenue, Chicago 30, Illinois.

—o—

Sonotone's new ceramic model "9T" stereo cartridge, a turnover type which plays all speeds and either stereo or monophonic records, features a prewired terminal plug for simplified installation. Prices: $16.50 with sapphire styli, $19.50 with diamond styli. Sonotone Corporation, Elmsford, N. Y.

. . . News



Pay-TV . . . . A three-year test of pay-TV is scheduled for the Hartford, Conn., area, using station WHCT, Channel 18. Although the system to be used is called "Phonevision," no telephone wires or cable will be needed. A small decoding device that can be installed on any TV receiver will accept the program, make a billing record for the subscriber, and permit the subscriber to switch from pay-TV to regular television and back during the course of a subscription program without extra charge. WHCT will operate as a commercial station most of the day, put on at least one and probably two subscription features (first-run movies, prize-fights, etc.) during prime evening time. Application to make the test was filed with the FCC by Zenith Radio Corp., Hartford Phonevision Co., RKO General, and Teco, Inc.

—o—

A free-piston, three-speaker system is being sold by Fisher. Called the XP-2, it is rated for use with amplifiers of ten watts or more output. Containing two 8-inch speakers and a 5-inch tweeter, the cabinet is completely filled with Acoustiglas to eliminate panel resonance. Crossover network uses air-core coils, oil-filled capacitors. Dimensions: 22" wide, 12" high, 11¼" deep. Prices: Unstained birch, $79.50. Mahogany, walnut, cherry $84.50. For further information, write Fisher Radio Corp., 21-21 44th Drive, L. I. City 1, New York.

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Edgar Wesatzke

As field director of Berean Mission Inc., I have complete charge of our radio work. With the expert advice and training I am receiving from you I can do my own repairs on our recorders and P.A. systems, besides keeping our radios going. My training from N.T.S. helps keep us on the air. I feel privileged to be a member of such a fine institution.

Rev. Enoch P. Sanford

Thanks to N.T.S. I have a business of my own right in my home. I am still in the Air Force but I have paid for all my equipment with money earned servicing TV sets. Yes, N.T.S. gave me my start in television.

Louis A. Tabat

I have a TV-Radio shop in Yorkville, Illinois, about 4 miles from my home, and it has been going real good. I started part-time but I got so much work that I am doing it full-time. Thanks to National Technical Schools.

Alvin Spera

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Listeners flock to FM as exciting new programming, good hi-fi music overshadow tired AM and TV fare.

By J. K. Locke

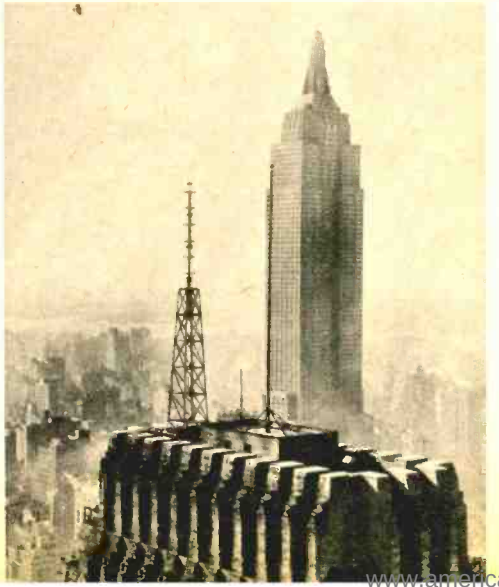
Madison Fielding

Blonder-Tongue Laboratories, Inc.

EARLY in 1956, Max Rothman, an employee of Holloman Air Force Base, got fed up with the wailing hill-billy ballads and pounding rock 'n roll songs that made up the entire radio fare available in New Mexico's Tularosa Basin. Max set up an FM transmitter in a remodeled chicken house, borrowed records from his friends and neighbors to supplement his own modest library of classical music and show tunes, and went into business. At the time there were just 50 FM receivers within range of his station.

Max played records and did the announc-

WQXR



Above, Maj. E. H. Armstrong (center), FM's inventor, installs original station antenna on New York skyscraper, 1935.

WQXR, New York, pioneer "high fidelity" station, put 1000-watt FM outlet, WQXQ, on air in 1939. Call is now WQXR-FM.

Today, WQXR-FM's high-power antenna is center of famous "QXR Network," made up entirely of FM stations in Northeast U. S.

WQXR

ing chores at night and on week ends. His wife, Sima, handled daytime broadcasts while Max was at work, wrote copy, watched the kids, and relieved Max while he went out and sold time to local merchants.

Listeners responded, and FM receiver sales in the area began to soar. Max's cash register, as well as his radio station, began to make sweet music. Two years after he went into business Max quit his job to become a full time broadcaster.

Although Max's success story has a few unique twists, his career is typical of what has been happening to FM broadcasting in general. After being assigned to the scrap heap by some short-sighted broadcasters in the early 1950's, FM has made a striking comeback. It is today expanding more vigorously than either AM radio or TV.

The rebirth of FM means good news for you—the listener. No matter where you live, there is probably an FM station near you, or there soon will be. Chances are you can hear things on it you won't find anywhere else.

As everyone knows, good music—the classics, light classics, show tunes, and the like—form the main diet of FM stations springing up from coast to coast. But that's not all. FM broadcasters, freed from the stifling pressure of wooing the largest mass audience all of the time, are showing a flair for original, fearless programming that makes broadcasting's roughest critics sit up and take notice.

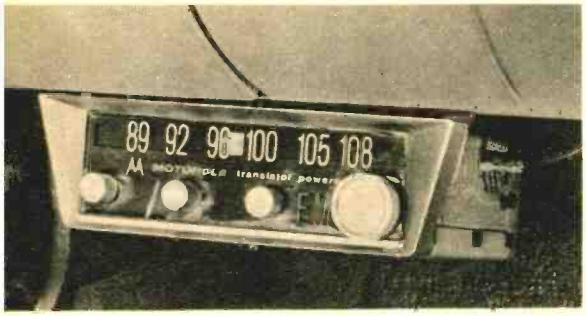
KPFA in Berkeley, California, for example, has broadcast Sir John Gielgud's production of Sophocles' "Oedipus at Colonus," and novelist Aldous Huxley moderating a gourmet series that wound up with a discussion of cannibalism. WBAI-FM in New York casually schedules no-holds-barred programs controversial enough to send a network vice president scurrying for his Miltown. One example: a lecture by sexologist Albert Ellis giving highly unconventional advice on premarital sex relations. WBAI has also broadcast one hour lectures on the Gregorian chant, and the first uncut (five-hour) version of Wagner's "Die Meisteisinger" ever heard in this country. WGBH-FM in Boston and KFMB in San Diego, among others, are broadcasting large chunks of authentic jazz—Dixieland to Thelonious Monk. This field of music has been neglected by AM radio even more than the classics. KBIQ in Los Angeles has aired a series of two hour FM spectaculars. A recent example: Mel Torme narrating

Al de Bat, Printer's Ink

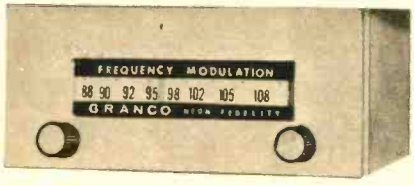
WFMT, Chicago; Studs Turkel interviews celebrity for his "Wax Museum" program in record library. WFMT has never been offshoot of an AM station; note records stacked on shelves.

WQXR

Heart of WQXR's programming is giant card file, listing 65,000 discs, 500 tapes. Director of Recorded Music Martin Bookspan here scans file. QXR Net uses WQXR-AM for stereo.



Motorola, Inc.



Granco Products, Inc.

The FM boom is on the road. Motorola and Granco offer complete car receivers. Gonset (bottom of page), and others have tuners.

"From Benny Goodman to Gerry Mulligan," a modern history of popular music.

WFMT in Chicago puts on "soap opera" with a new twist: instead of intimate glimpses into the lives of Helen Trent or Our Gal Sunday, they offer serialized dramatic versions of Tolstoy's "Anna Karenina," Thackeray's "Vanity Fair," and Dickens' "Old Curiosity Shop."

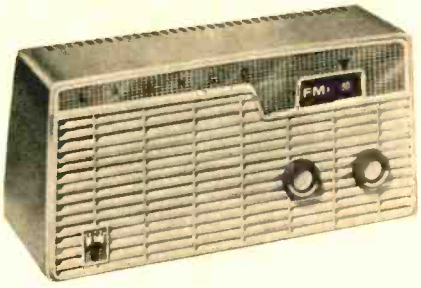
WFMT may be singled out as an example of the highly successful all-FM operation. It is not tied to an AM station; we usually expect an FM station to have a call like "WXXX-FM." It is, however, a major entertainment, cultural and advertising force in the Chicago area. Its program guide booklet is really a thick little "slick" magazine, which not only lists WFMT's programs in detail, but covers everything cultural in greater Chicago: art exhibits, plays, non-broadcast concerts, etc., and runs feature articles on personalities and performers. Many stations have followed suit, expanding their program guides into complete entertainment magazines.

WQXR, in New York, perhaps the best-known good-music station in the world, seems to have led the way with the program guide idea, and its monthly guide, while not as complex as WFMT's, has always included short feature articles of interest to good-music listeners. WQXR has pioneered in two other important fields: Stereo broadcasting, and FM or good-music networks.

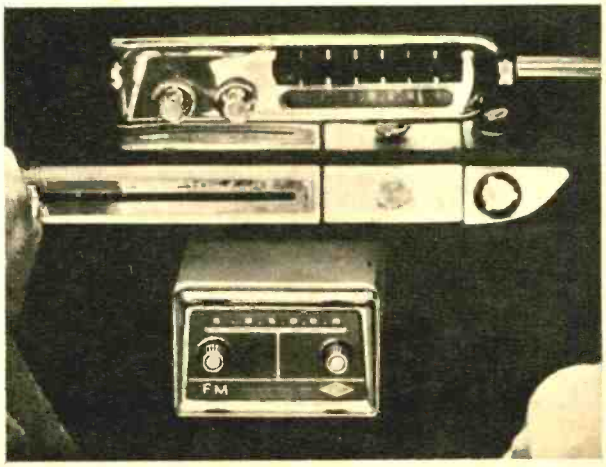
For more than eight years, using its 1560-kc AM transmitter as the source for one stereo channel, WQXR has used its FM outlet as the source for the other. Listeners within range of any QXR Network FM station (about 20 stations in eight Northeastern states) who can also get WQXR's AM transmitter can have both live and recorded stereo sound. For those who can tune in only one channel, the AM or the FM, steps have been [*Continued on page* 103]

FM receivers and tuners were once expensive, but Granco receiver (below) costs less than $30.00. Tuners are used with hi-fi equipment.

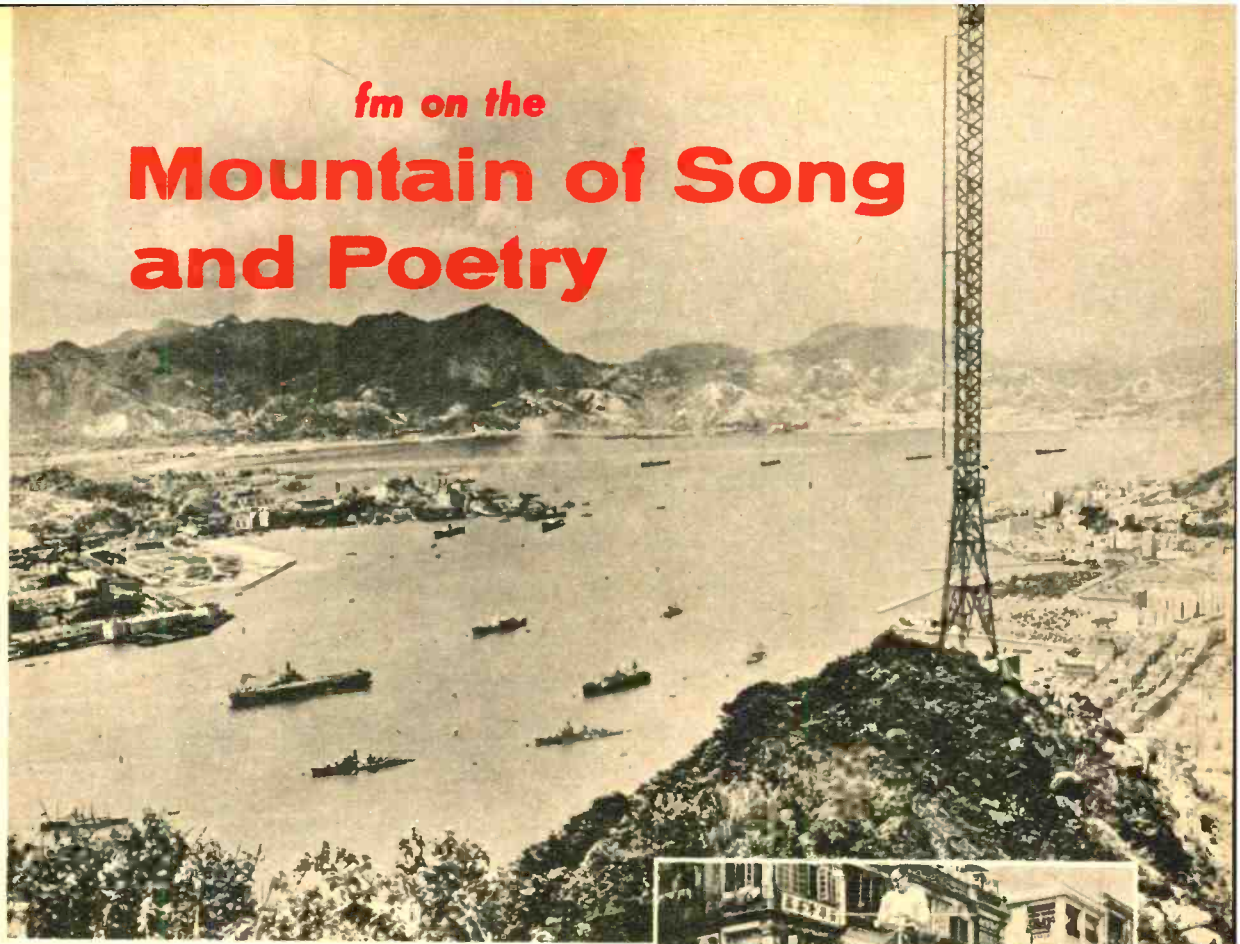
Granco Products, Inc.



Gonset



fm on the Mountain of Song and Poetry



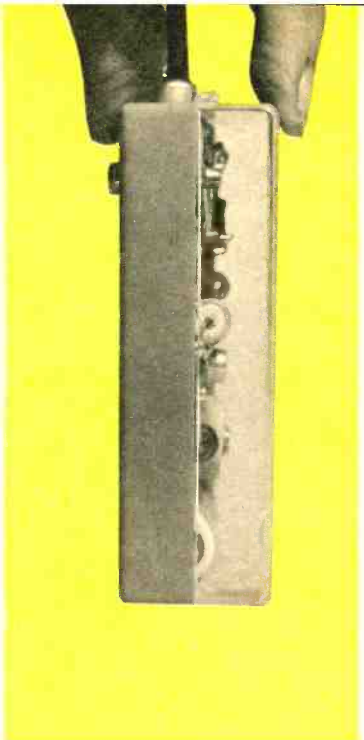
After years of listener demand, Hong Kong FM stations rise on appropriately named mountain.

Photos by Eastern Publishers Service.

GOOD broadcast coverage has always been a problem in Hong Kong. The Nine Dragon Hills of Kowloon and The Peak on Hong Kong Island blocked reception in large parts of this British Crown Colony on the China Coast. Industry has contributed much electrical noise, and new stations in nearby Red China have made matters worse.

Long proposed were more AM transmitters, placed to fill in "dead spots," but the local Chinese geomancers protested. Now a Chinese geomancer does not merely divine the future. He is concerned with the balance of the Earth. Hong Kong's geomancers predicted dire misfortune if antenna towers were placed at any of the sites proposed. The British respectfully raised no towers.

Then someone suggested FM. Experiment showed that one tower on Mount Gough, on the Bay, would reach almost everyone. The geomancers approved, and two FM transmitters now share a 135-foot tower there. An FM mobile unit handles programs originating away from the studios. High fidelity, static-free, all-day programming in Chinese and English blankets the colony. Now, students, Mount Gough is called that by the British only. The Chinese have always called it *Koh fu san*, and "Koh fu san," students, translates as "Mountain of Song and Poetry."



Pocket Size CB Receiver

Here's a Citizens Band unit designed for the Boy Scout on a hike, the doctor in a hospital, the construction worker out on the job . . . or the average citizen anywhere.

By Herb Cohen

General Transistor

CITIZENS Band communication equipment is great. You can set yourself up with a pair of CB transceivers for less than $150 that will neatly fill the bill for personal communications within the limits of their power. However, take the case of the individual who only needs to *receive* CB signals. This may be a Boy Scout out on a hiking expedition who wants to tune in home camp, a doctor who has to be paged on the grounds of one of the spread-out modern hospitals, or perhaps a TV serviceman installing a roof antenna who must hear instructions from someone hundreds of feet away. With the *EI* pocket CB receiver, your imagination (and the FCC rules) set the only limits to the jobs it will do.

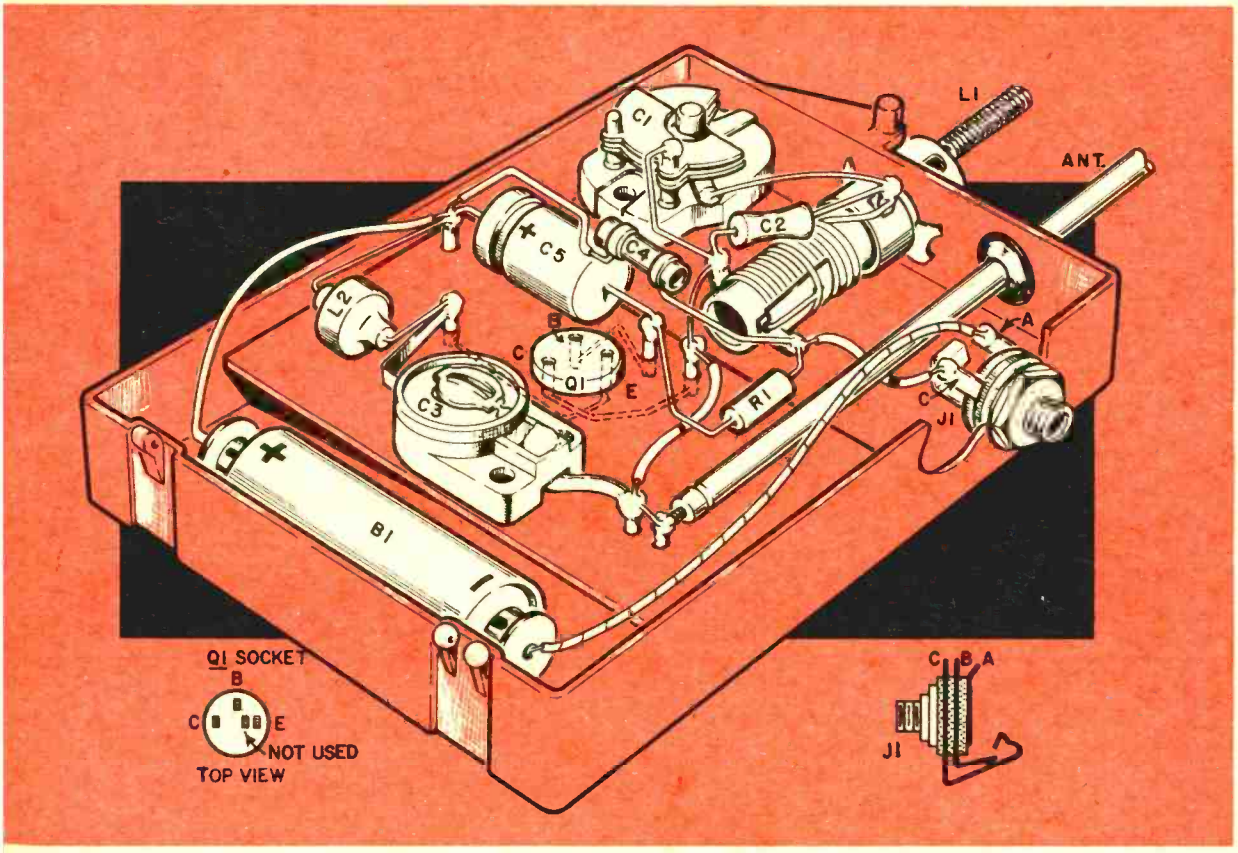
The receiver shown, uses a single transistor in a highly sensitive super-regenerative circuit with a parts cost of about $10. When first assembled, the unaligned unit turned out to be tuned to the middle of the 10-meter ham band and we picked up a 100-watt station operating out of Dallas. The "skip" must have been working well that night.

When we realigned the unit for Citizens Band, good, clear reception was achieved up to three miles without fading (since Citizens Band is basically ground wave propagation, atmospherics do not change reception conditions). Usable reception up to five miles had been noted and occasionally a 10-mile signal would swing in.

Construction

The receiver should be housed in a small *plastic* case. Mounting holes are easily cut, either by a slow speed drill or by pushing the tip of a hot pencil iron through the plastic and then reaming the hole to size. The phone jack J1, L1 and the tuning capacitor C1 are mounted directly to the plastic

Photo by Simon Nathan



Dotted lines indicate wiring connections on the underside of the perforated Bakelite board.

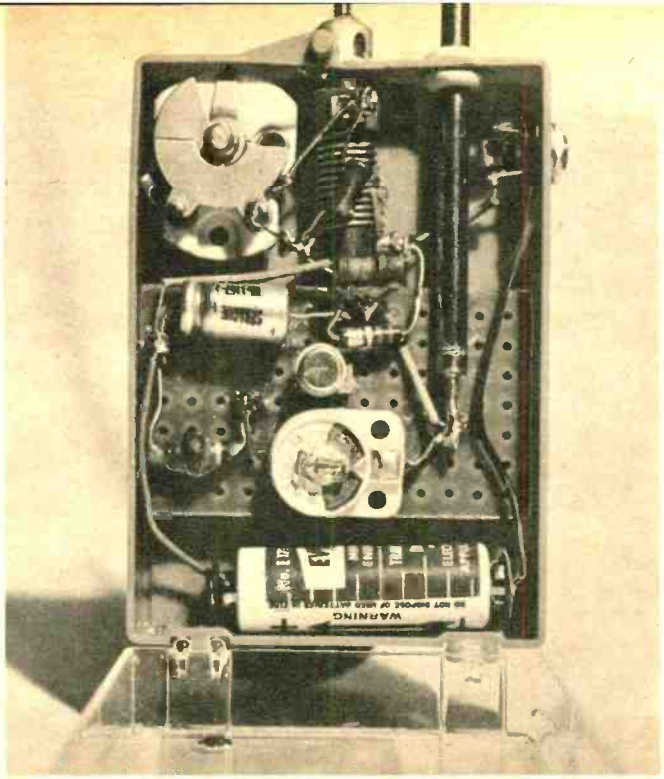
PARTS LIST

R1—220,000 ohms, 1/2-watt carbon resistor
C1—2.9 mmf-10 mmf variable capacitor (E. F. Johnson 10K10 or the equiv.)
C2—33 mmf mica or ceramic capacitor
C3—3-12 mmf trimmer capacitor (Centralab 822-FZ or the equiv.)
C4—68 mmf mica or ceramic capacitor
C5—20 mf @ 15-volt miniature electrolytic capacitor
L1—27 megacycle tapped RF coil (GR-1, Gyro Electronics, 36 Walker St., N. Y.)
L2—73 microhenry peaking coil (Miller 6172)
Q1—Transistor, Amperex OC 170 (or the equiv.)
B1—9-volt battery (RCA VS309A or Eveready mercury cell E177)
Antenna—27 mc collapsible 36" whip (Lafayette F440)
J1—Miniature phone jack (comes with earphone)
Phone—Earphone 3,000 ohm (Argonne AR-46)
Misc.—A rubber grommet (1/4" I.D.), flea clips, perforated Bakelite board, plastic box approx. 1" x 2 1/2" x 3 1/2", battery clip, transistor socket
A complete kit of above parts available from Gyro Electronics @ $9.95 plus postage (address above)
Earphone, perforated board and flea clips are available from Lafayette Radio, 165-08 Liberty Avenue, Jamaica, New York.

case. The transistor socket and components are mounted on a small strip of perforated board and "flea clips" used as terminals for the mounted components. You have a choice of batteries. The mercury cell costs more, but lasts longer, and is more reliable.

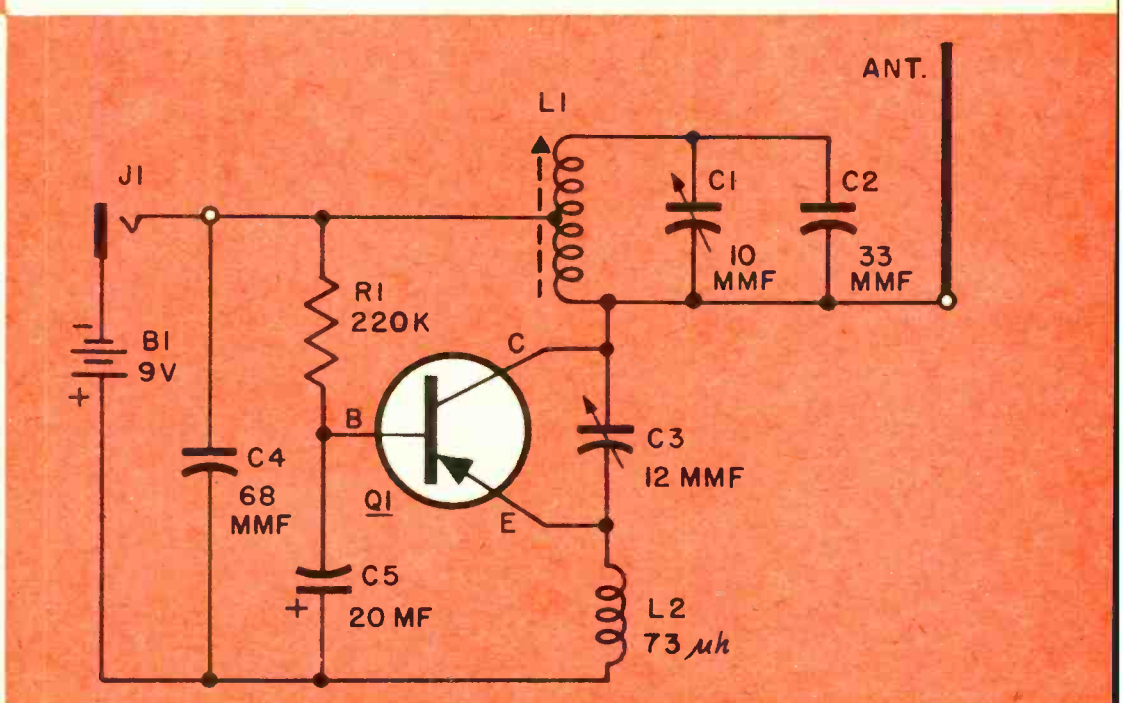
After the board is wired and installed, the antenna is slid through the rubber grommet mounted on the plastic cabinet and soldered to the flea clip.

After all components are mounted, the receiver is ready to fire up. Extend the whip antenna to its full length and plug in the earphone at J1. A hissing will be heard which is the conventional super-regeneration noise. Set tuning capacitor C1 to half mesh with a small insulated screwdriver and adjust the slug of L1 slowly until a known CB station is received. (A CB call consists of two figures, a number, followed by a letter.) In the New York area the first two figures are 2W, whereas the first two figures of a [*Continued on page* 109]

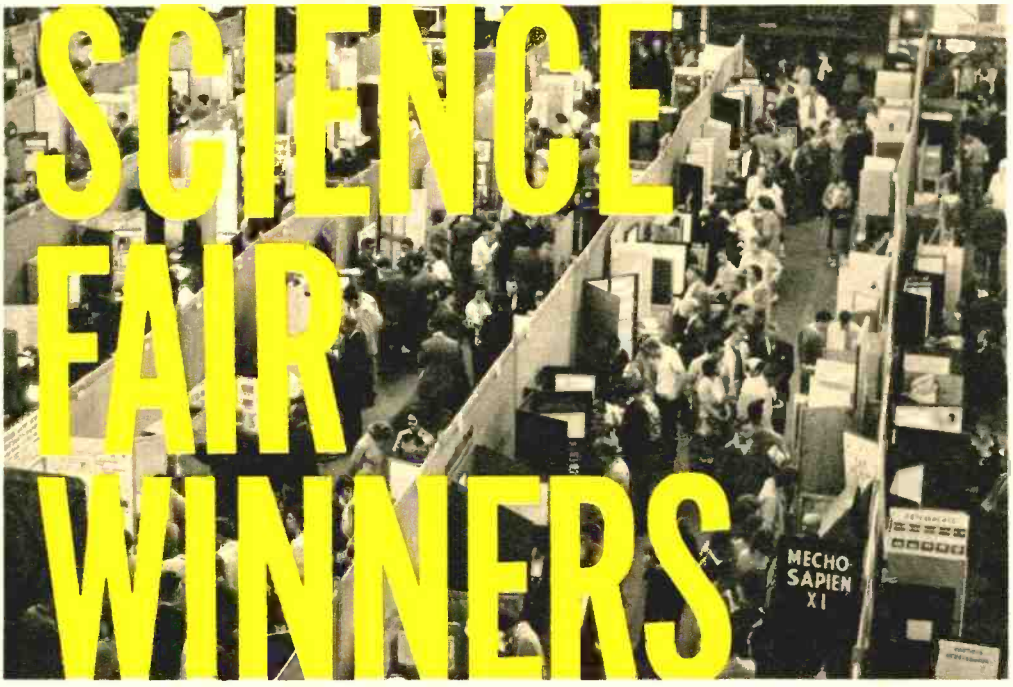


For clarity, leads in pictorial (opposite page) are shown slightly longer than necessary. Photo above shows actual parts layout. Unit shown on cover with extra coil is an earlier model.

Simple super-regenerative detector circuit may employ any one of a number of available high-frequency transistors as Q1.



SCIENCE FAIR WINNERS



Originality, freshness, imagination are featured in both "complex" and "simple" winning exhibits.

By Ken Gilmore

ALL Science Fair projects are divided into two groups—and we don't mean physical sciences and biological sciences. We mean those which show original or creative thought as opposed to others that merely illustrate a textbook principle.

There is certainly nothing *wrong* with the second category. A display explaining electromagnetism or thermoelectricity, for example, serves its purpose. But we are always impressed by projects of the first category, which show original thought.

At the last National Science Fair, held in Indianapolis, we were pleasantly surprised at how many electronics exhibits displayed an original turn of mind—a clever innovation, a unique approach, a new idea. Some we thought outstanding for the comprehensive research and the design and construction skills that obviously went into them.

Here are a few of the projects that impressed us. We don't mean to say that there were no others. There certainly were. But space limitations being what they are, we had to narrow down our list. We suggest that students planning future science fair projects consider these as examples, not to be imitated, but to be studied as models of careful planning, originality of conception and approach, and skillful construction. These, we believe, are the ingredients of a truly successful project.

bramblett...

JAMES Bramblett decided to try to increase the magnification of a microscope by using ultra-violet rather than visible light. Since ultra-violet light has shorter wavelengths than visible light, it can be used to view smaller particles. But there were two difficulties. First, our eyes cannot see ultra-violet light (although they can be damaged by certain intensities of it), and second, bacteria and other biological specimens which are best viewed alive are quickly killed by ultra-violet. Jim got around both problems by using a flying-spot scanner system similar to those used by television broadcasting stations for showing slides. The iconoscope tube on which the image is picked up is sensitive enough to allow the use of a very low intensity ultra-violet scanning beam —low enough so that the specimens are not killed. Since the tube is sensitive to ultra-violet, it does not matter that our eyes are not. The only thing left for Jim to do, once he had decided on this basic plan of operation, was to design and build a complete closed-circuit television system to the necessary specifications. As the photograph shows, the magnified image is presented on a 17-inch TV picture tube.

Jim's Ultra-violet Flying Spot Microscope impressed the judges in Indianapolis. He won a Science Cruise Award and a pair of precision binoculars from the Navy; an Army Science Award and a trip to the Army Ballistics Missiles Agency at Huntsville, Alabama; and an Air Force Space Education Foundation Citation plaque and a trip to the Aerospace Panorama Exposition in San Francisco. Jim is 17 and attends Jefferson High School in his home town of Lafayette, Indiana. He took a Second Place award at the National Science Fair and received $75 in science books and materials.

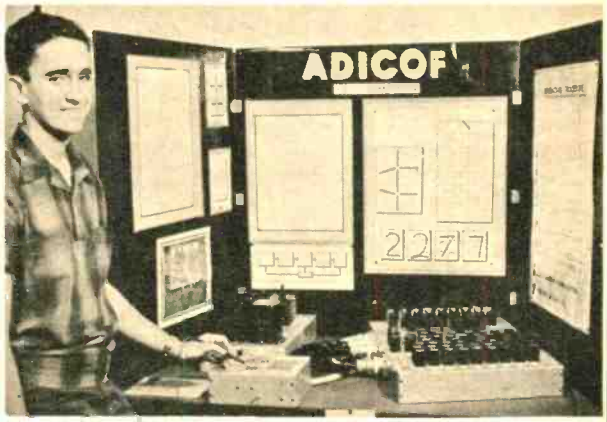
milne...

DAVID Milne of San Diego, California, got the idea for an automatic English-to-Braille translator when it appeared that his little brother, Stephen, was going blind. The result was "BETA," for "Braille Electronic Translator, Automatic." While Braille can be printed with one character for every English letter, everyday Braille uses a system of contractions. Combinations like *sh, th, ed,* etc. are printed as one symbol, making the final text shorter and easier to read. David had to design a complete circuit that would recognize standard two-letter combinations when keyed from a typewriter keyboard, and print them as one symbol. The only other machine that does this uses the giant IBM 704 computer. David has built a second BETA, fully portable, for the San Diego Blind Recreation Center, under Lions Club sponsorship. BETA earned David a third place award and $50 worth of books and science materials at Indianapolis, and also a 4-year scholarship to Stanford University. By the way, it now looks as if Stephen's sight can be saved.

hutt...

A MANUFACTURER of electron microscopes once advised Marvin Hutt that he could perform simple experiments with a cathode ray tube that would illustrate the principle of the electron microscope, but that construction of an actual high-magnification instrument was beyond the resources of an individual. Unwilling to give up easily, Marvin built one anyway and won an Army Science Award and a one-week, expense-paid trip to the Air Ballistics Research Laboratory at Aberdeen, Md., along with a fourth place award and $25 in books and materials at this year's National Science Fair. He had to design an oil-diffusion pump capable of producing a hard vacuum, since an electron microscope is, in effect, a giant vacuum tube that must be opened to insert the specimen, then pumped "hard" again. Marvin was unable to approach his instrument's theoretical magnification of 50,000 diameters because both his parents and his teachers vetoed his plan to build a necessary 100,000-volt power supply. He ran the machine at 20,000 volts with good results. Marvin attends Jamaica High School, Flushing, N. Y.

frisbee . . .



"I WAS doodling on a piece of graph paper in math class one day," says Belmont Frisbee of China Lake, California, "when I began to wonder if there wasn't some way of feeding numbers into a computer just by writing them on a panel by hand." Belmont took a fourth place award at the 1960 National Science Fair for that idea and for "Adicof," his machine that proves it can be done. The number to be recognized is "written" with a metal stylus on an insulating panel inlaid (Fig. 2) with copper strips. When the stylus touches a strip, a circuit is closed to a relay connected with that strip. Fig. 1 shows part of the circuit with the relays in their normal positions. When strip 1 is touched, relay 1 swings down; strip 2 activates relay 2, and so on. Each relay has twice as many contacts as the one before it, so relay 7 (not shown) would have 64 contacts (1x2x2x2x2x2x2). Since few relays actually have 32 or 64 contacts, Belmont wired several small ones in parallel for these circuits.

Now, just using the three relays shown in Fig. 1, let's see how the circuit works. If we touch strip 1, bulb 5 will light. If strip 2 is touched, bulb 3 will light. If strips 1 and 3 are touched, bulb 6 glows, and so on. Every different relay combination thus lights a different bulb. Expanding this basic system to use all seven strips, drawing a "2" on the panel would close relays 1, 2, 3, 4, 5, and 7. A "9" would close 1, 2, 3, 4, and 6. An "8" would close them all. All that remains is to figure out which relays would close as each number is written. Belmont worked out the circuits to allow some variation, so that a "4" with either an open or a closed top works equally well. He included a computer in his final project, which he feeds with his panel. Belmont is 17, and attends Burroughs High School in China Lake.

Fig. 1.

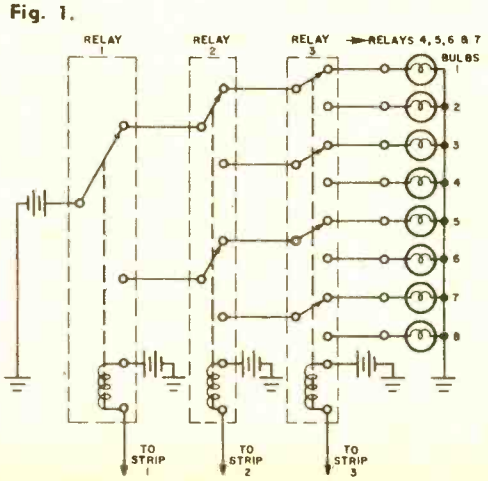
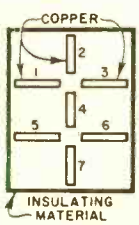


Fig. 2



SCIENCE PROJECT
EI
OF THE MONTH

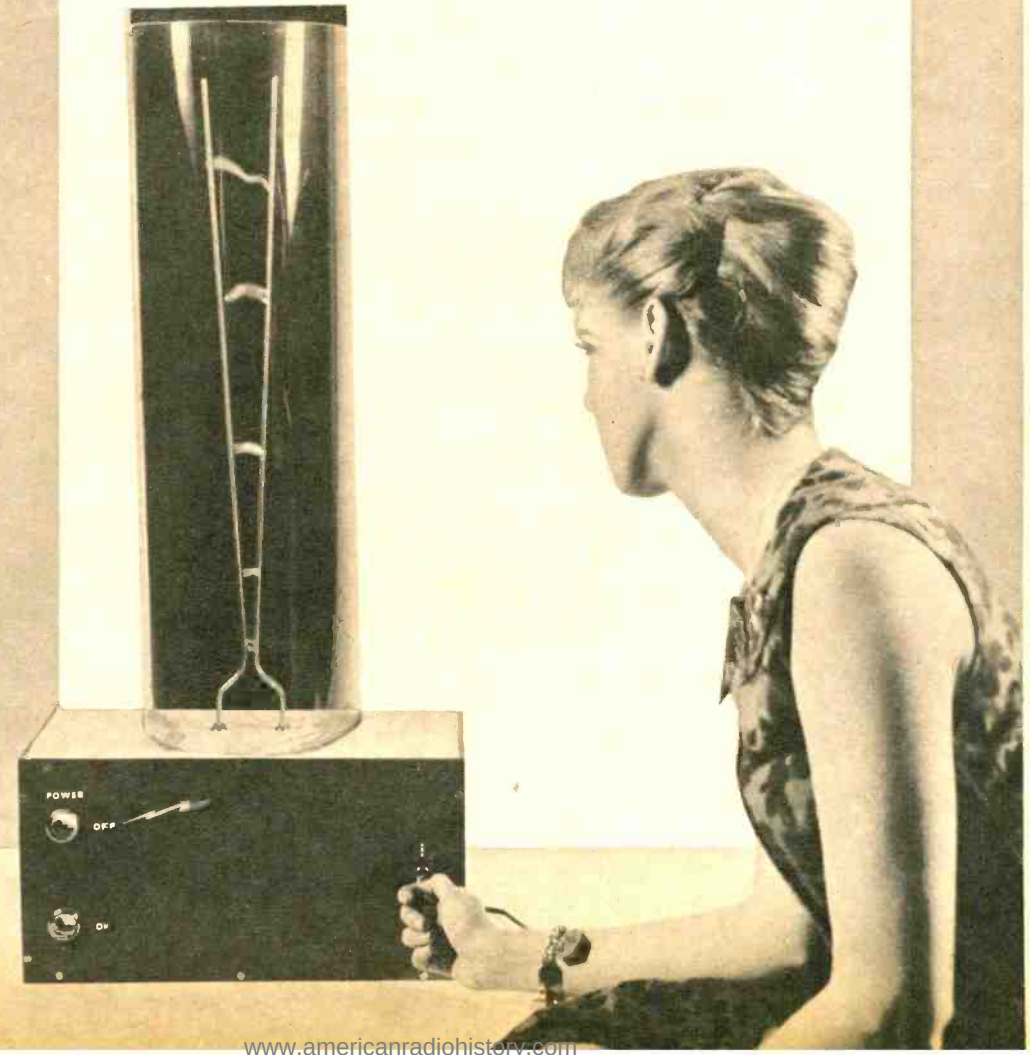
Jacob's Ladder

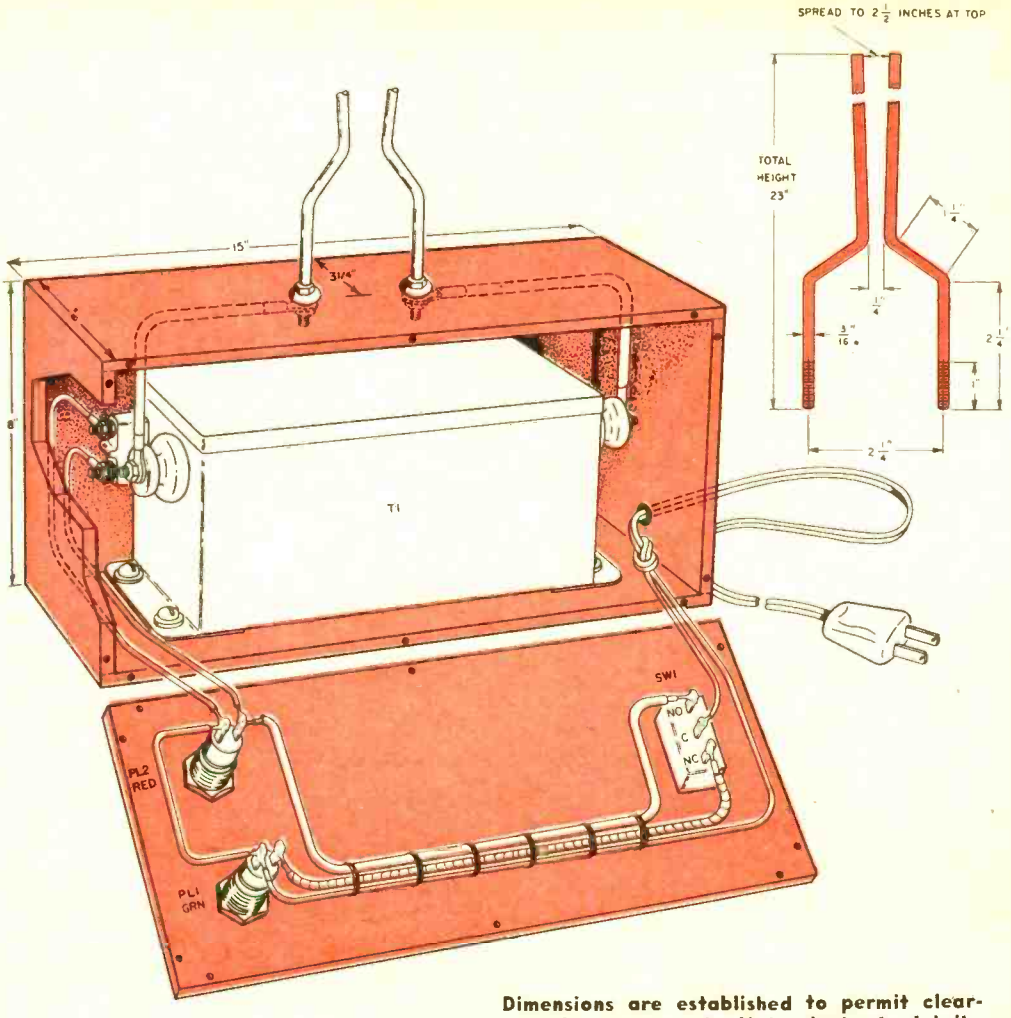
Modern electronics simulates Patriarch Jacob's vision of the fiery stairway to Pearly Gates.

By Harvey Pollack

EVERY mad scientist (Hollywood version) building a time-machine, death-ray or a Frankensteinian monster, ultimately makes use of an arc-emitting device known as a Jacob's Ladder.

Of course the Jacob's Ladder can do none of these things, but it does make up a spectacular and educational display suitable for science fairs and for demonstrating the action of a transformer with a large primary-to-secondary turns ratio. It can also produce ozone, an allotropic form of oxygen having germicidal properties; show ionization of air and the movement of ionized particles produced by the heat of an electrical arc.





Dimensions are established to permit clearance for components. Note electrode details.

It must be emphasized that high voltage is developed by the Jacob's Ladder and it must be treated with respect. If the directions given in this article are followed to the letter, there is no danger of shock. *Don't take short-cuts* or omit the built-in safety features of this model; it is poor economy to leave out relatively inexpensive components that might prevent a nasty shock.

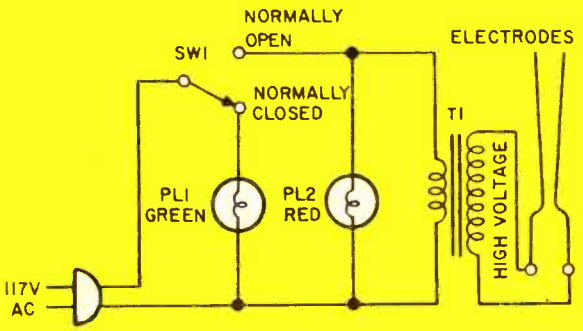
Construction

The cabinet that houses the high-voltage transformer T1 should be made sufficiently large to permit mounting two 1" pilot light assemblies PL1, PL2 and safety switch (SW1) on the front panel without danger that these parts will accidentally come in contact with the metal casing of T1.

The electrodes are made of a pair of $\frac{3}{16}$" diameter drill rods, each initially 24" long. Drill rods are made of soft steel and can be bent and threaded with ease. They are available at most hardware stores. First thread one end of each rod about 1" using a 10/32 die. (Your hardware man may do this for you.) After threading, bend the rods in your vise to the dimensions and angles shown. Drill two ¼" holes in the top of the cabinet, centered

PARTS LIST

T1—High-voltage transformer, 12,000 volts @ 30 ma. (Model H-1230 Ace Transformer Co., 146-51 Horace Harding Exp. Flushing, N. Y.) $12.00 plus shipping.
2 Electrodes—24" long, 3/16" soft steel drill rods with tapped ends. 4—10/32 nuts to fit.
Cabinet—10 ft. of 8" wide, ½" pine or fir, common stock.
Front Panel—¼" fir plywood, approx. 15" x 8".
PL1, PL2—Two 1" pilot lamp assemblies (Dialco series 74), 1 red, 1 green; 2—S6 lamps, 117V candelabra base.
SW1—Spring-return SPDT toggle switch with safety cover. Gyro Electronics, 36 Walker St., New York, New York, $1.50
Wire—2' high-tension wire. Available from transformer source.
Half-sheet 1/32" clear acetate—measures approx. 24" x 25". Available from Industrial Plastics Supply Co., 324 Canal St., New York, N. Y. Mention this article when ordering.



After the wood cabinet has been built, wiring the pilot lamps to T1 is easy. Note SW1 contacts.

between the two sides and slip a nut and washer all the way up on the threaded section of each drill rod. Pass the rod through the hole, and secure with another nut under the top of the cabinet. With the electrodes in place, carefully trim the bends with pliers to the spacing shown.

The transformer T1 is a 12,000 volt, 30 ma unit normally used with neon signs. This particular unit is very convenient because connections to its primary and secondary terminals can be made without special connectors. Mount T1 on the base of the cabinet with 10/32 machine screws and nuts.

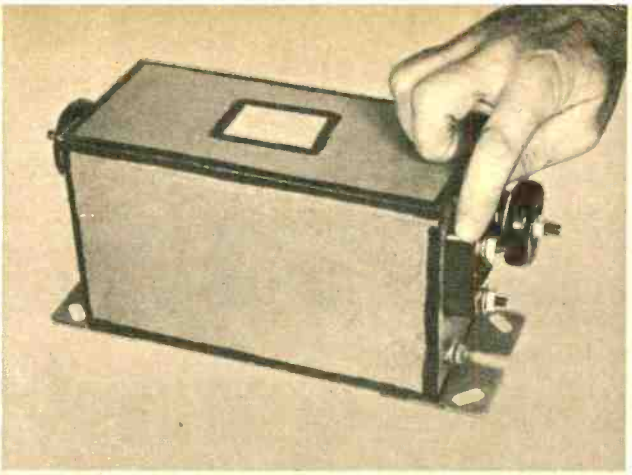
Front Panel

At the right side of the panel is a special spring-loaded single-pole, double-throw toggle switch (SW1) with a safety cover (see Parts List). This is one of the important safety features mentioned previously. When the line cord is plugged into a 117 volt AC receptacle, the green pilot light PL1, comes on instantly, showing that the plug is in but that secondary power has *not* been applied to the electrodes. To apply power, the safety cover must be lifted; thus *the switch can never be thrown accidentally*. The toggle of SW1 may now be lifted. This turns on the Ladder and causes PL1 to go out and the red pilot (PL2) to flash on indicating that full power is now present. Removing your finger will return SW1 automatically to the "off" position, with a corresponding change in the lights.

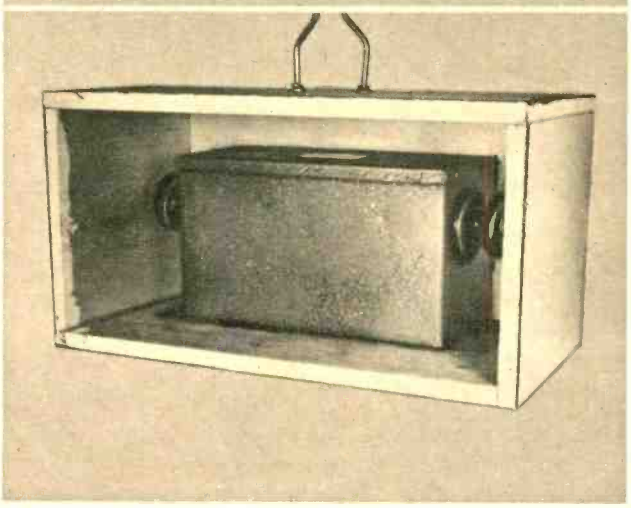
High tension ignition cable is used for the connections between the secondary of the transformer and the electrodes. All the remaining wires should be well insulated. Before you connect SW1, determine which terminal is normally open (NO) and which is normally closed (NC).

Protective Shield

The Jacob's Ladder should not be operated without its protective shield at any time; furthermore, the shield provides a convection air column that makes the equipment independent of air motion on the outside, thereby improving its reliability. Fasten the backboard to the back of the cabinet, using two or three wood screws. A so-called "half-sheet" of acetate clear plastic (or vinyl sheeting, if so desired) is then formed into a semi-circular shield held to the sides of the backboard with three wood screws on each side. The shielding plastic should be brought right down to the top of the cabinet. Trim away the excess and set the backboard in place permanently so that the arc is centered in the shield.



High-voltage transformer T1. Primary winding terminal block is indicated. Secondary terminals are those with heavy insulators.



Interior view. Ample room is left at sides of transformer to permit panel mounting of the pilot lamps PL1, PL2, and switch SW1.

Theory of Operation

What makes the arc climb and break at the top of the electrodes? With 12,000 volts applied, an arc will tend to jump from one rod to the other, but it will always choose the shortest path. Thus, the initial arc appears where the rods are closest to one another—i.e., down near the bottom. The glow seen in the arc is produced by atoms of oxygen and nitrogen (mainly) that have been smashed by high speed electrons flying between the rods; these atoms lose one or more of their orbital electrons due to electron collisions and become ions, and in the process, heat and light.

Ions are charged particles, hence are current carriers. Thus, once the arc is formed, current carriers exist between the rods so that the resistance is reduced and quite a large current flows. At this time, the heat produced in the arc causes the surrounding air to become warm and decrease in density. It rises as a result of its expansion, carrying with it the ions previously formed. As mentioned, the ionic path has a lower resistance than the non-ionized air resulting in the arc following the ions upward to the top of the rods. At the top of the electrodes, the rising air current carries the ions away from the field of action and the condition of the air between the electrodes is once more completely de-ionized. The arc, therefore, reforms between the rods at their closest point and the process is repeated.

Electronic Brain

Have you a question on electronics? Send it in and the Electronic Brain will provide the answer.

Tesla Coil Theory

Having built the Tesla Coil described in your October 1959 issue, I should like to know what causes all the spectacular effects I see.
Margaret Jungers, West Concord, Mass.

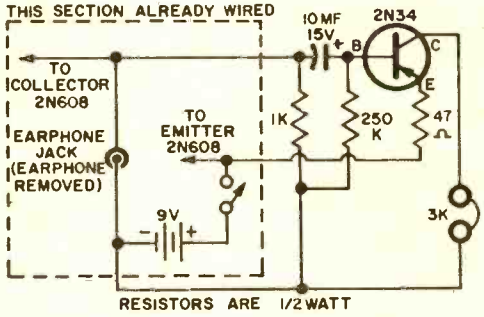
A Tesla Coil is essentially a high-frequency, high-voltage transformer. Its operation may be described as follows:

The 811A vacuum tube is set up in a circuit called an *oscillator*. All this means is that the power from the big iron core transformer is changed to an alternating current and voltage whose frequency is around 2500 *kilocycles* per second (instead of 60 cycles per second as we obtain it from the regular power lines). This creates a powerful magnetic field around and inside the primary coil (the squirrel cage coil) which grows and decays at the tremendous rate of 2,500,000 times each second! As the field alternates, it cuts through the wires of the tall, cylindrical secondary coil, inducing a voltage of the same frequency. Since the secondary coil has many, many more turns of wire than the primary, we obtain a voltage step-up action in which the initial oscillatory voltage—which, by the way, is already very large—is multiplied thousands of times. This extremely high voltage at a very high frequency produces the corona effect in which electrons leap off into space, causing the air to ionize and glow with a violet-blue color.

Pocket Radio Amp

I should like to add one stage of audio amplification to the AM pocket radio described in the October 1959 issue of EI. Can you provide the circuit?
David White, Canandaigua, N. Y.

The little AM radio you mention uses a 2N608 transistor in a reflex circuit. Since this transistor is a PNP type, we



will provide you with an amplifier circuit that uses another PNP transistor so that you will not need to add batteries for the second stage.

Induction Heating

In induction heating, why is the heat generated in the heated object not radiated to the heating coil, thus causing it to burn out or melt? Also, what precautions must be observed to avoid violating FCC regulations when using induction heating equipment?
Chester Bex, Baton Rouge, La.

An object heated by the induction process develops an elevated temperature within its own substance by increased intra-molecular energy. Since the heat is built up within the body, its development is distributed throughout the mass without the formation of hot spots on the surface. Actually, even if the body becomes red hot, its rate of thermal radiation could never become great enough to burn out or melt the induction coil. It should be remembered that the waves that cause the heat are of the radio wave type (long waves) while heat feedback from the body would have to be infra-red (very short waves) that is governed by entirely different physical laws.

The FCC stipulates that all induction heating equipment must be shielded.

Photoelectric Devices

How many different types of photoelectric devices are there? How do they differ? Can they be substituted for one another in electronic circuits?

Peter Jutro, Forest Hills, New York

In general, all photoelectric light-sensitive devices will usually fit into one of the following classifications: (1) *photoemissive*—in which light causes the emission of electrons from a sensitive surface. Vacuum and gas-filled phototubes are based upon this principle; (2) *photogenerative* or *photovoltaic*—a photoelectric device that generates a difference of potential between its electrodes under the stimulus of light; and (3) *photoconductive*—a light cell whose resistance varies as a function of the illumination.

In modern photoelectric circuits, it is usually not feasible to substitute one type for the other. For example, many vacuum phototubes normally operate with more than 100 volts of anode potential; application of this voltage to either a photoconductive or photogenerative type of cell would be almost certain to ruin it. Solar batteries fall into the photogenerative class and do not require any external voltage source at all. On the other hand, the very popular cadmium sulfide and cadmium selenide cells that appear in so many constructional articles are photoconductive types. Such cells are intended for low voltage circuits and cannot be applied in devices intended for either phototubes or photovotalic cells.

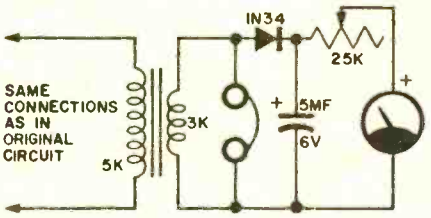
Count-Rate Meter

How can I add a count-rate meter to the Geiger Counter (Harvey Pollack, September 1958) circuit you have published in Electronics Illustrated.

Stanley Moroz, Shamokin, Pa.

A count-rate meter may be added to the supersensitive Geiger counter as shown in the accompanying figure. The present output transformer should be replaced by one having a primary impedance of 5,000 ohms and a secondary impedance of 3,000 ohms such as the Argonne type AR-173.

The speaker should be disconnected by means of a switch when the count-rate meter is used. The headphone jack should be re-connected in the position shown in the diagram.



The meter is a 0-20 microampere movement. The 25K potentiometer is used for calibration purposes. When setting this circuit up for the first time, be sure that the full resistance of this potentiometer is in the circuit. Then, reduce the resistance gradually to avoid overloading the meter.

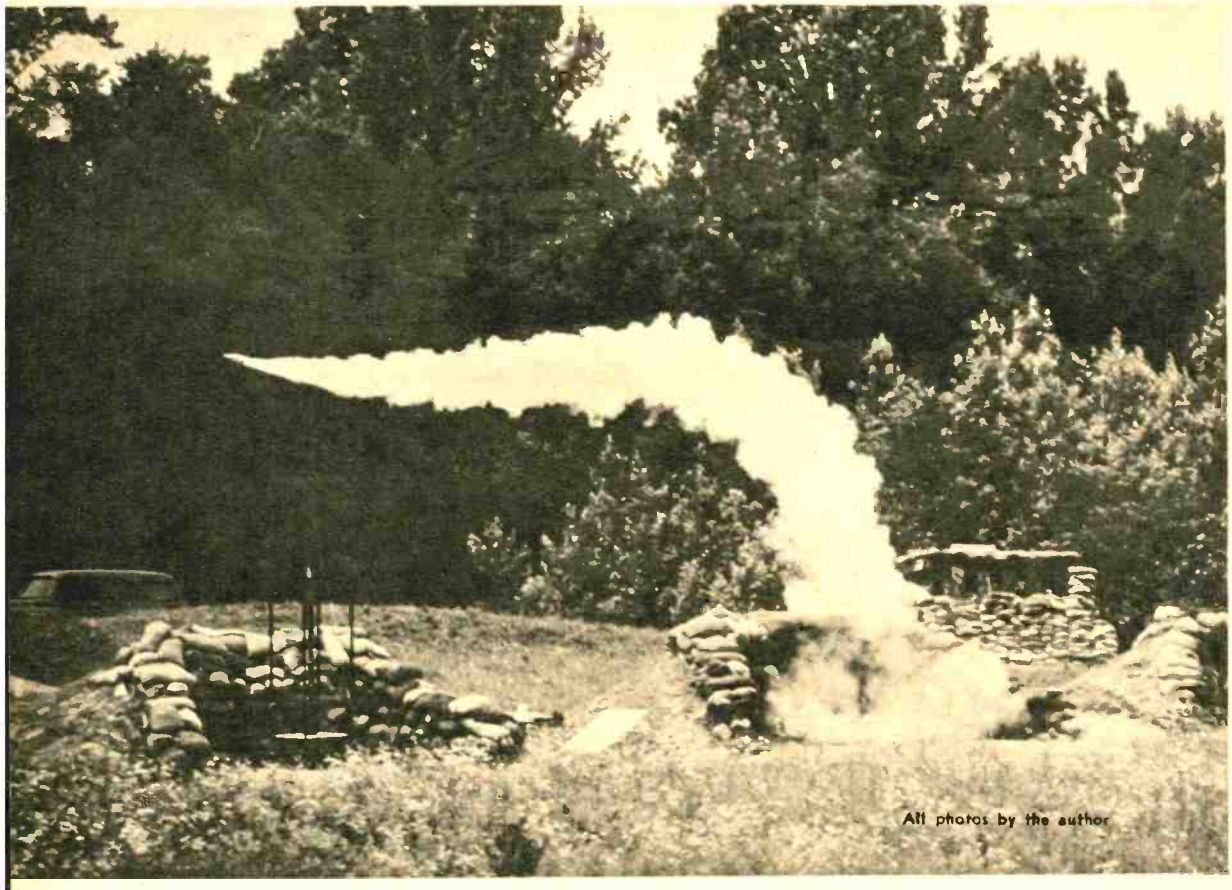
Transistor Radio Distortion

My 6-transistor radio distorts badly at high volume. Could I substitute a power transistor for the two 2N1059 output transistors now in the radio?

A. Brickman, State College, Penna.

The general tone of your question leads us to believe that you have evidence that the output transistors are at fault. Assuming that this is true, you still cannot substitute a power transistor for the 2N1059's indiscriminately. These transistors are rated at a collector dissipation of 180 milliwatts maximum and, assuming 75% efficiency, the maximum audio output you could expect is in the order of 135 milliwatts. Thus, the batteries that normally operate this receiver could not possibly supply the current required by a power transistor even when it is "idling."

Perhaps the distortion is not due to the output transistors at all. Among the possible sources of this kind of difficulty are improper bias on any of the transistors, a defective audio driver transistor, a leaky capacitor, or even a resistor that has changed value. The only certain way to find the trouble is through the use of standard servicing procedures. If you would care to try this yourself, you might refer to the section starting on page 84 of the 4th edition of the G.E. Transistor Manual. This gives details on transistor radio servicing.



is

America's Amateur Rocketry

a fiasco?

EI sends noted science reporter to Fort Knox shoot.

"Advanced" efforts show no research, no progress.

By Lloyd Mallan

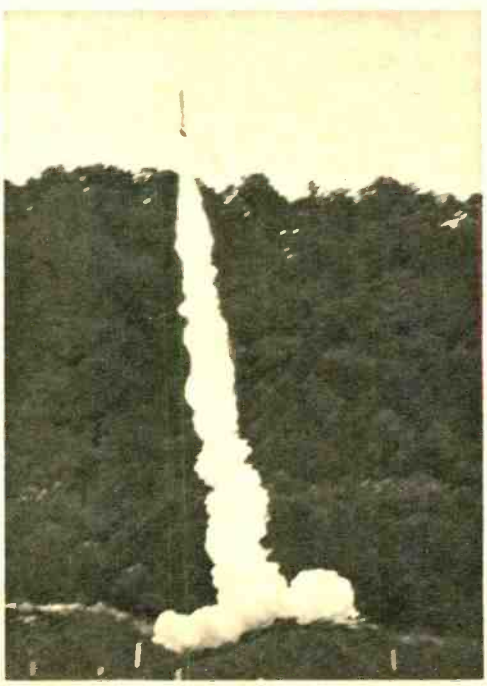
RECENTLY, the combined armies of the United States Army conducted a detailed survey of amateur rocket activity in America—and came up with some startling figures. Here's a direct quote: "Investigation by the armies revealed that there exists in the excess of 5,000 amateur rocket societies and groups in the United States, representing a minimum of 40,000 individual rocket enthusiasts."

That's a lot of enthusiasts—and their number is increasing daily.

One of the major purposes of the Army's survey was to find

Rocketeers make rueful humor out of fizzled rocket. Picture was taken at Army-sponsored Advanced Rocket Shoot at Fort Knox's Armor Center, Kentucky. Rocket instrumentation was unknown, approach unscientific.

The only "electronics" at the Advanced shoot was this battery box, left, with mercury switch (tripped by thread tied to rocket) to actuate a camera. Right, a successful launching, the exception rather than rule at shoot.

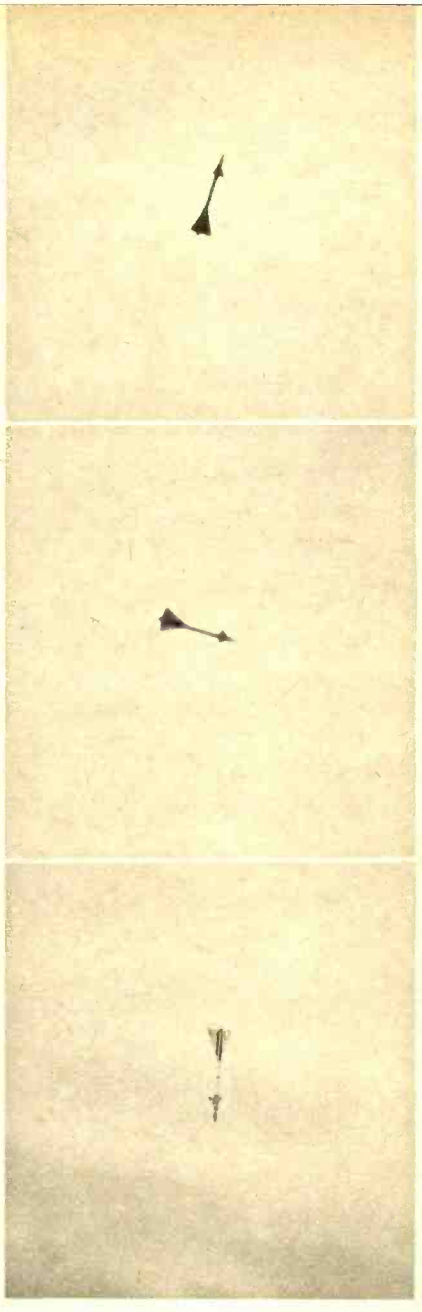


ways of encouraging and safely supervising amateur rocket research. This is vitally important to the future security of our nation. Again, quoting official sources: "The problem of improving the technological position of the nation, to compare more favorably with that of our competitors in space and national defense, gave impetus to proposals for development of a program to encourage youth to pursue scientific interests and education."

How well has this urgent aim succeeded? What are its hard chances for ultimate success? The editors of *EI*, equally concerned with the problem, assigned me the task of digging out some objective answers to these questions. The answers are not encouraging. Through no fault of the Army—which has many dedicated officers trying their level best, even beyond the call of duty—amateur rocket research in America is a fiasco. In fact, the word "research" in this context should most certainly bring a smile, if not a guffaw, from most of the great rocket pioneers of this country. The most glaring fact that I uncovered is this: the average amateur rocketeer is far more interested in "fireworks" than in science.

This is one side of the rocketry story. An authority disagrees, and an early issue of EI *will carry a rebuttal by Russ Brinley, who was officer-in-charge of one of the Army's amateur liaison programs and is known to rocketeers for his excellent book, "Rocket Manual for Amateurs," and many other works on rocketry. Watch for it—you won't want to miss Brinley's remarks on a subject so important to our nation.* —The Editors.

Certainly there are exceptions among the many thousands of amateurs. It is equally certain that a high proportion of them are misled by the glamour of space research into thinking they are really interested in more than the fireworks. Many of these have gone to the trouble of acquiring a rudimentary



Flight, flopover, fall. Why did it fail? Most rocketeers are years behind plane modelers; neglect testing, study. Plane modelers pioneered missile control.

Spectacular! But the rocket didn't fly: it destroyed itself. Yet simple rockets like it have been around since 1000 A.D. Pre-tests, understanding were lacking.

background in basic aspects of rocket engineering. This, of course, will pay off in one way or another—if not in actual contributions to the science of rocketry. But it's the science of rocketry that the Army—and every other military department as well as the aerospace industry—is worried about.

The flint-hard fact is: you don't train yourself scientifically merely by shooting rockets into the sky or having them explode in front of you on the ground. *Instruments* are required to understand why a rocket flies well or goofs on the launching pad.

The second big fact that blared out to me was: most amateur rocketeers know nothing and care less about instrumentation.

Electronics is at the core of almost every conceivable kind of information system concerned with rockets. Other basic sciences involved are telescopic and photographic optics, but even their instruments are controlled electronically. Unless the average rocket amateur pays a great deal more attention to electronics and much less to fireworks, the Army's fine program of encouraging safety and scientific rocket research will be tragically wasted.

Foremost among the Army's officers dedicated to its program is Lieutenant Colonel Charles M. Parkin, Jr., formerly of the Engineer Research and Development Laboratory at Fort Belvoir, Virginia. With his background, he should know better than most men the sheer importance of the scientific approach. The one man who fought hardest for official approval of an amateur rocket program, he has the widest experience in the field of contemporary amateur rocketry. When I asked him how America's amateur rocket builders stacked up against the nation's model airplane builders before World War II, he [*Continued on page* 106]

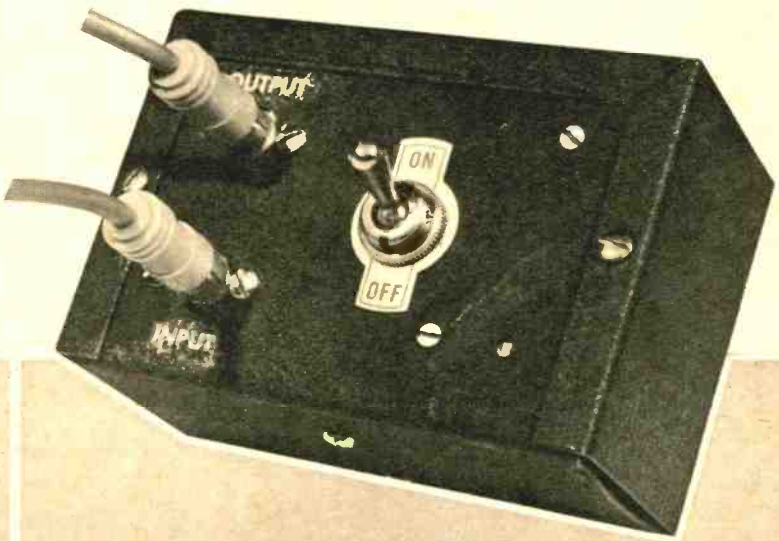
transistorized

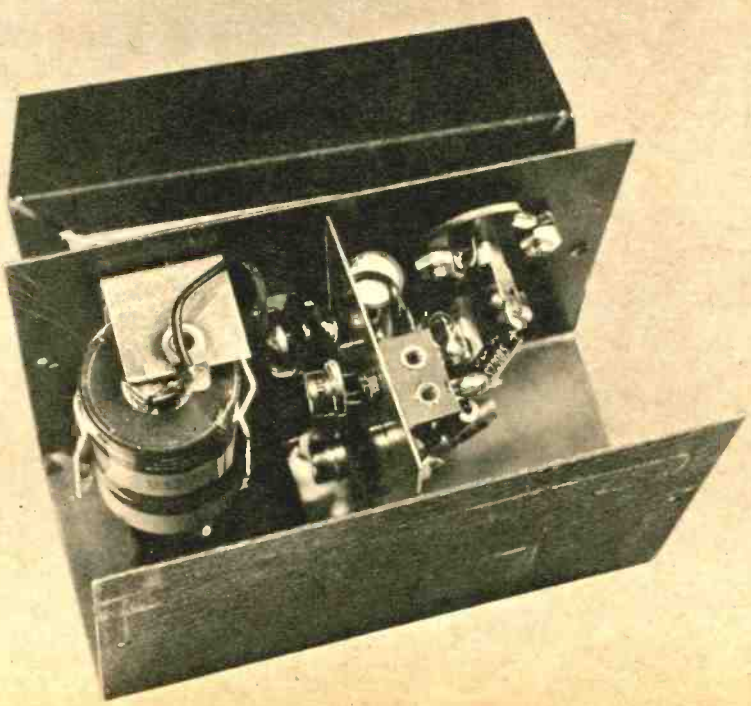
Microphone Preamp

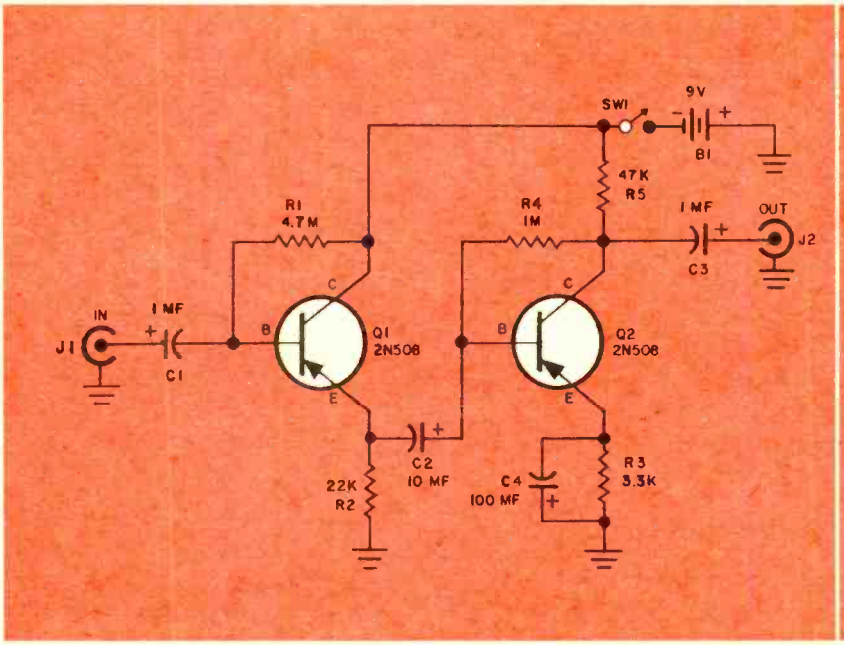
For boosting low level mikes and adapting hi-fi to PA

By M. Horowitz and M. Schecter

Electronic Instrument Company







Audio from mike is fed to transistor Q1 which is wired as an emitter follower. Low impedance at output jack J2 permits using long shielded cable to amplifier.

MANY excellent preamplifiers or integrated amplifiers presently in use in hi-fi setups are not equipped with a microphone input. This function has gained considerable importance because of the increasing popularity of tape deck recording through these rigs. Or if you want to use a basic amp as part of a high quality public address system, this preamp may be just what the doctor ordered. Its low cost (less than $10), simplicity and excellent quality make this the ideal unit for the audiophile.

The preamplifier circuit was designed around two transistors which drain only 300 microamps from the built-in battery power supply. Under these conditions the battery should last the length of its shelf life.

In building a low-noise preamplifier, careful attention must be paid to the component parts. Low-noise carbon-deposited resistors *or* Stackpole brand units are desirable for use throughout the unit to keep the noise level down, although ordinary resistors can be used.

The unit was built into a standard steel 2″ x 2¾″ x 4″ cabinet with a sub-chassis constructed of a piece of 20 or 22 gauge metal as shown in the pictorial.

Mount the sub-chassis, toggle switch SW1, battery bracket and input and output jacks J1 and J2 as shown. Scrape off enough paint inside the box to make sure the jack grounds make electrical contact with the box.

The three transistor leads are cut to about ¼″ and go into the three corresponding socket pins, with the fourth (middle) socket pin remaining unused. Fill the terminals of battery B1 with melted solder before inserting it into the battery holder.

Applications

A dynamic microphone should be connected to the input jack J1 (a jack to

PARTS LIST

Resistors: ½ watt, 10% (see text)
R1—4.7 megohm
R2—22,000 ohms
R3—3,300 ohms
R4—1 megohm
R5—47,000 ohms
Capacitors: miniature electrolytics
C1,C3—1 mf, 10 volts
C2—10 mf, 10 volts
C4—100 mf, 6 volts
Q1,Q2—2N508 or TR508 transistors or the equivalent
B1—battery, 9 volts, NEDA #1600
SW1—SPST toggle switch
J1,J2—phono jacks
Case—Bud Handi-box HB-1622, sub-chassis, 1¾″x3⅛″ #20 gauge steel (see text)
Misc.—Size C battery holder, 2 transistor sockets, Assorted #2 and #4 screws, terminal strips, nuts and lockwashers, etc.

match the connector on your mike can be used here) and the output from this preamplifier (J2) connected to a low gain input (auxiliary, tuner, TV, etc.) on the preamplifier you are now using. Because the gain of this unit is 47 db, an average (about .005 volt) input signal from the microphone will result in about 1 volt at the output. This is more than sufficient voltage to drive any hi-fi system to full output.

Frequency Response

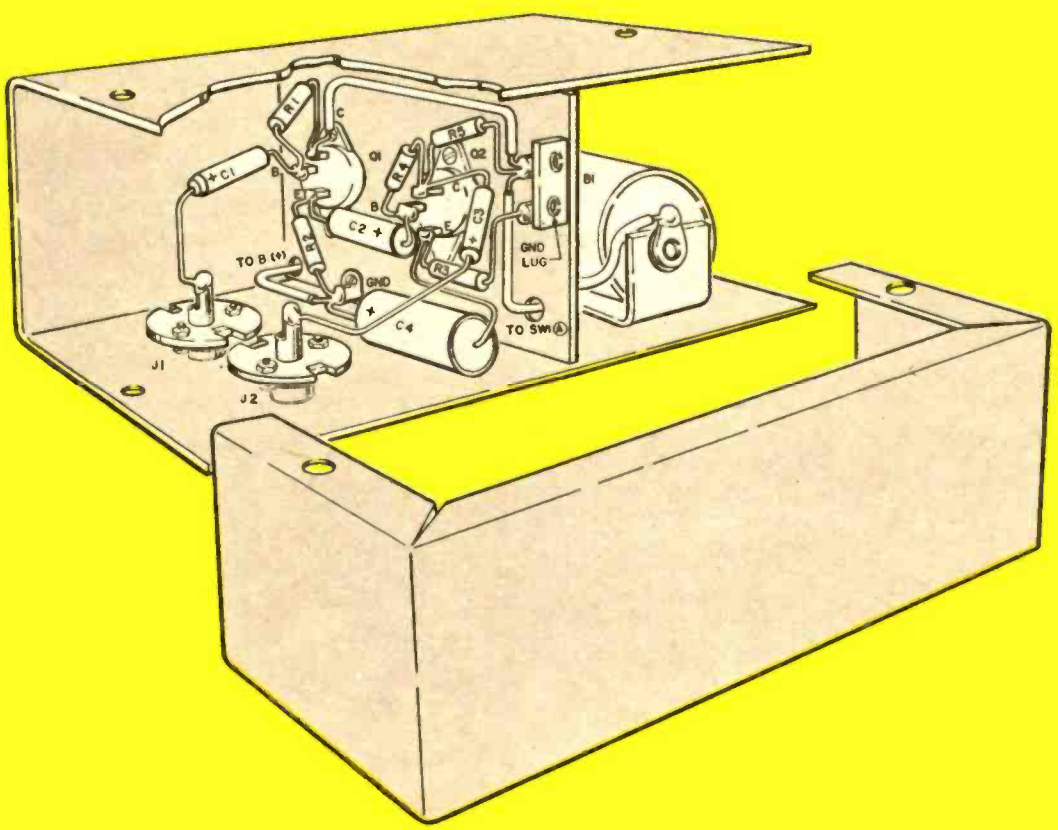
As shown by the frequency response curve, the microphone preamplifier will in no way limit the fidelity of your setup. The harmonic distortion is less than .5% and the noise level is 53 db below the 1-volt output level. No hum originates from within the unit.

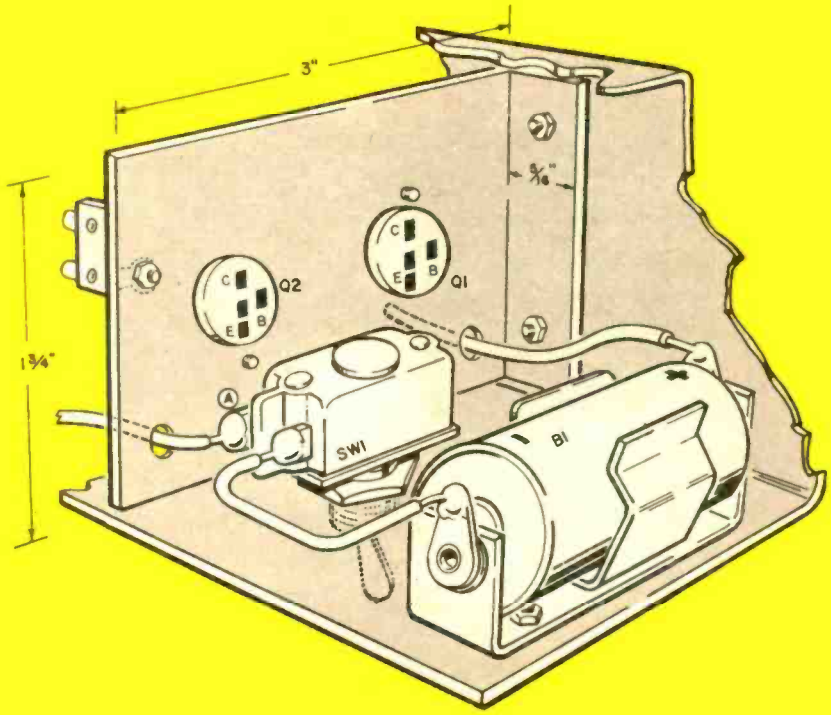
The preamplifier was designed for use with a dynamic microphone because excellent low cost units of this type are available. A crystal microphone can be used with this unit, but some of the low frequency response will be attenuated due to the relatively low input impedance of transistor Q1.

Installation

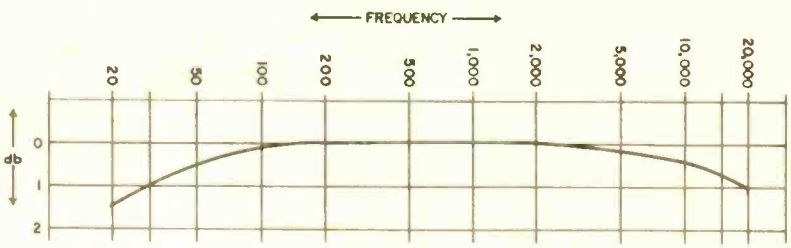
In the installation, the shielded lead between the microphone and this preamplifier should be moderately short; 6 feet or less. Between the preamplifier and the control preamplifier, however, the approximately 40,000-ohm output impedance enables 20 feet or more of low-capacity cable to be used without excessive high-frequency rolloff or hum pickup.

Compact interior dimensions enable use of short leads. Jacks J1, J2 are grounded to chassis.





Letter A at switch SW1 in this view of the unit corresponds with A in pictorial on preceding page. Carefully observe the dimensions of sub-chassis.



Frequency response curve for unit shows a flat response within —1.5 db.

THE CIRCUIT

Output from the microphone is fed through the 1 mf electrolytic capacitor (C1) to the base of the first transistor Q1. Operated as an emitter follower, Q1 provides a 200,000 ohm input impedance. The output is fed through the coupling capacitor C2 to the base of transistor Q2, which is operated in the standard common emitter mode. The output, appearing across the collector resistor R5, is fed through coupling capacitor C3 to output jack J2.

Temperature stability is an important consideration in transistor circuitry. While R1 and R4 serve to provide bias for the base regions of Q1 and Q2 respectively, R4 serves the additional functions of negative voltage feedback and stability. The stability of Q2 is further increased by the current feedback in the emitter circuit involving R3. The large value of R2 results in negligible stability problems with Q1.

polygraphy –

Measure of Your Emotions

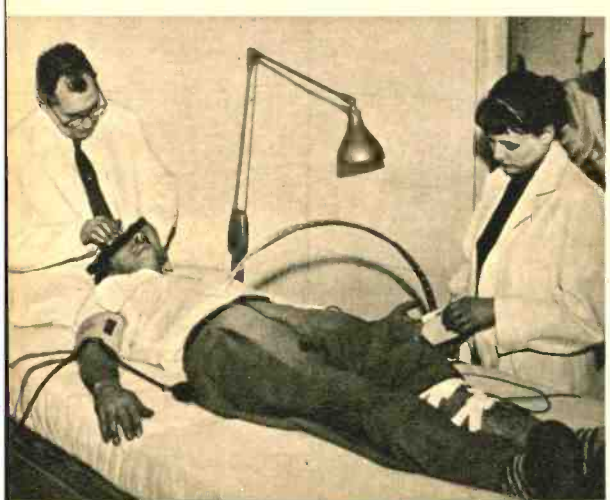
By O. Thomas Law

The versatile polygraph is used as lie detector, mental illness monitor and outer space reporter.

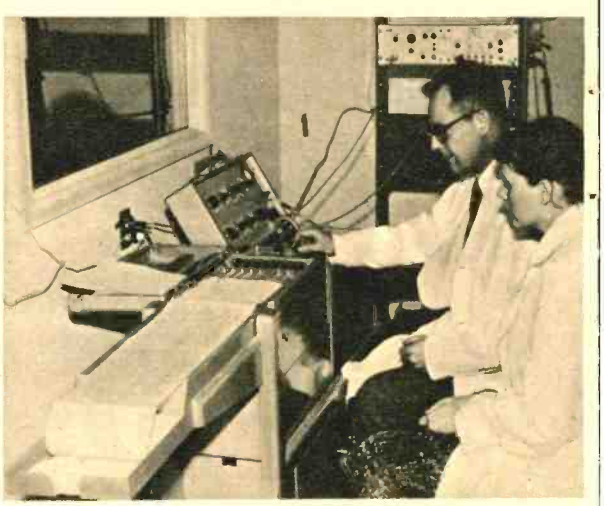
EVERY day electronics is called upon to provide sensing devices capable of detecting events beyond the range of sight and sound—from cosmic rays in outer space to microscopic disease germs within the human body. Electronics has now taken its place alongside one of the most specialized branches of medicine, coming to the aid of the physician-psychiatrist, the psychologist and the psychiatric social worker in their studies of mental illness.

In modern psychiatric thinking, mental illness sooner or later is the result of a distorted emotional response, much as a hi-fi system might be fed a pure undistorted sine-wave and produce the most incredible distorted porridge at the speaker. Just as in the hi-fi system, distortion may come from improper equalization (the "input"), from harmonic or intermodulation distortion (the "through-put"), or from undesirable output characteristics (poor damping, speaker resonance, etc.).

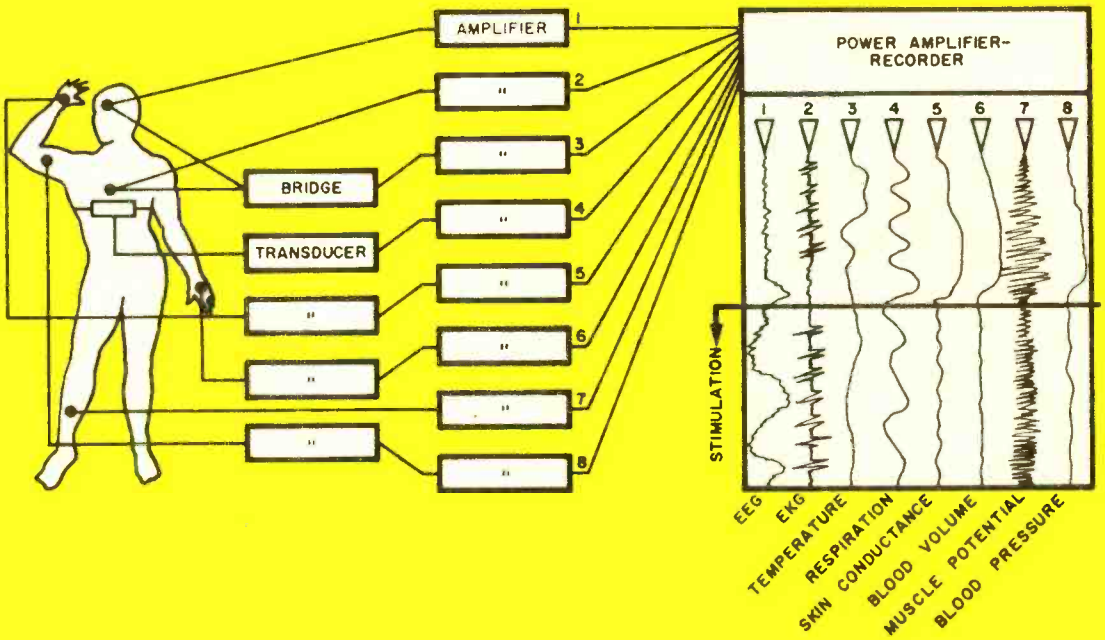
Actually the analogy is nowhere as simple as this. But it serves to point out the three main sources of "distortion" which underlie mental illness—lack of "fidelity" of the input, distortion by the "amplifier" (whatever intervenes between the input and input-coupling system, and the output and output-coupling system),



Dr. Lloyd Beck and assistant, working under a mental illness research grant by the Public Health Service, affixes polygraph's sensing devices, electrodes and transducers, to subject.



Here is the polygraph's console—far more elaborate than those normally used in police work as lie detectors. Medical polygraph, made by Offner Electronics, is transistorized.



Above is flow diagram of typical polygraphy system which measures eight physiological variables simultaneously. Subject's "normal" emotional level is established on graph, stimulus is applied, results recorded.

and the further reduction in fidelity which the output transducer (speaker) "contributes" to the whole system.

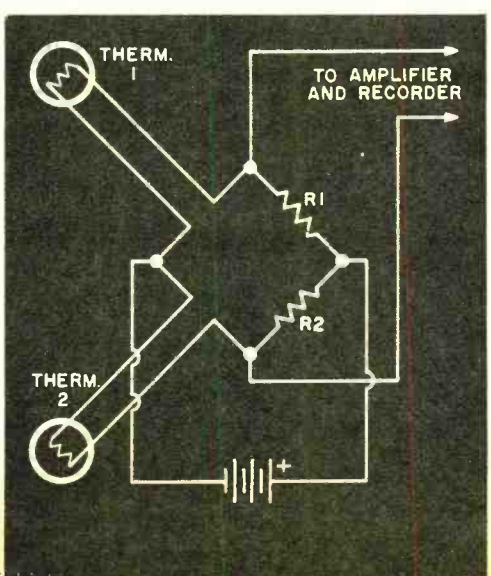
Scientists have gone beyond analogy in applying electronics to the study—and prediction—of emotions.

Physicians have long recognized that strong emotions are accompanied by marked physiological changes. For example, if you should be looking over the shoulder of a friend engrossed in the testing and repair of an intermittent high-voltage circuit, and if you should (for shame) shout: "Look out! Look out!"—no matter what he may do to you afterward, his body will almost instantly undergo most or all of these changes:

His heart rate increases.

Blood [*Continued on page* 110]

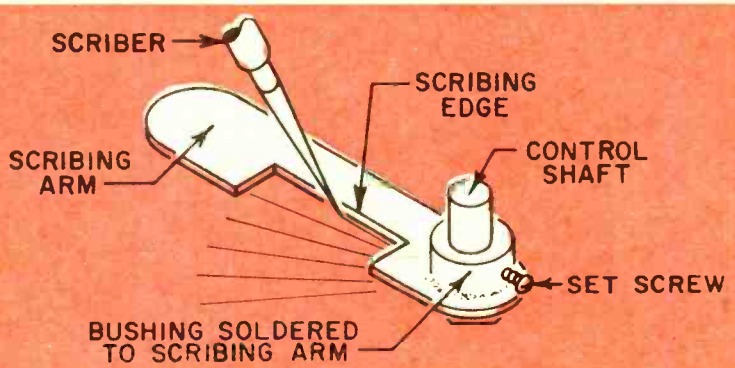
All resistances in bridge input used in differential skin temperature pickup are equal.



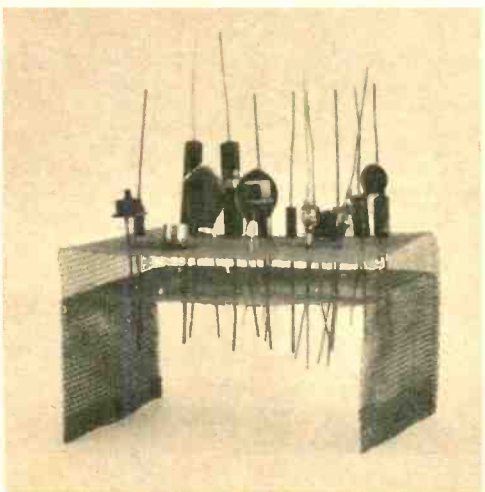
ELECTRONICS ILLUSTRATED Fawcett Building, Greenwich, Conn.

Try These

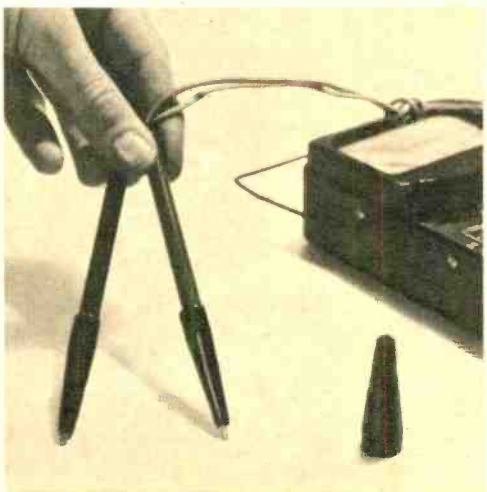
Colorless fingernail polish is a valuable accessory to your tool kit. Its handy brush dispenser makes it ideal for repairing rips in speaker cones or fixing dial pointers to cords.



A dial calibration device can be made by soldering a thin piece of metal shaped as shown to a ¼" shaft coupler. The coupler is mounted on the shaft of the control to be calibrated and held in place with a set screw. Set the coupler on the control shaft at the zero position, mark the dial, then repeat.



Two pieces of wire screening arranged as shown above will serve nicely as holders for small parts while putting together a kit.



If your test leads tend to short out adjacent parts when working in a tight chassis, try sliding alligator clip insulators over the tips.

Learn Code the Easy Way

The agony of learning code is abolished forever. Try this simple direct method and learn quickly.

By N. A. Rosa, W1NOA
Feature Editor

WHY work hard to learn the code? Learning anything takes work, and from time to time, hard work. But why make it harder than it actually is? When it comes to code, almost everyone does.

Follow our instructions, and with Lesson One you will be *copying SENTENCES within five to ten minutes* after you first start practicing. Yes, first lesson, first day, first ten minutes. This is guaranteed, or your Feature Editor will eat a code-practice oscillator (transistorized)

You have already heard, of course, about code letters being made up of "dits" and "dahs." Sure enough, the code-alphabet we print here (see box) is the dit-dah kind. In a moment we'll tell you why we didn't just give you the code from A to Z, instead of mixing it up that way.

Now, in your eagerness to learn code, you may resolve to carry a "practice card" in your pocket. And to save space, you may de-

cide (like thousands before you) to translate those "dits" and "dahs" into dots and dashes. DON'T! Don't carry a practice card, and NEVER write dots and dashes.

Learn the code by ear. You will be using it by ear, so practice with *sound*. If you have no code practice oscillator or key-and-buzzer, try whistling. If you are self-conscious about whistling, then think (and talk) of the letters as patterns of dit, didah, dididit, etc. as given in the box.

Learn it *directly* by ear. Don't try to memorize anything, and always make the association with sound. We insist on this, and to illustrate why, we ask you to look at this letter A.

Now, you don't bother to analyze a printed letter. Not any more, not since kindergarten. You don't think, "it has a line slanting up to the right, which joins a line slanting down to the right, with a horizontal line connecting them about two-thirds of the way down from the top. . . ." You see A, and your mind registers "A" without hesitation

Listening to code, in Lesson One or on the air, you should hear "didah" and your mind should register "A" likewise without hesitation. IT WILL, if you don't bother to put any analyzing or translating steps in between.

That is why the "dot" and the "dash" are hereby abolished forever. After this short paragraph they will be mentioned no more. If you try to learn code from an "alphabet" of dots and dashes, you introduce at least one step of translation: from sounds to dots and dashes (which are *visual*) and from them to the letter. This slows you down and gets in your way.

Why have we broken down the alphabet and arranged it in lessons that seem to be made up of randomly-chosen letters? The letters in our lessons are arranged according to *frequency of use* in the English language. You will notice that the most commonly used letter, *E*, is simply one short sound, or "dit." The next most commonly used letter, *T*, is one long sound, "dah." For *A*, dit and dah are combined, NOT to form "a dit and a dah," or even "dit-dah," but *didah*. The group *ETAOINS* rings the changes on simple combinations.

Using this group alone, you can make up a staggering number of words of all types, using [*Continued on page* 108]

Letters in code lessons are grouped by frequency of use. Most common letters are simplest.

THE INTERNATIONAL CODE

LESSON ONE: E T A O I N S

E	dit	I	didit
T	DAH	N	DAHdit
A	diDAH	S	dididit
O	DAHDAHDAH		

LESSON TWO: H R D L U C

H	didididit	L	diDAHdidit
R	diDAHdit	U	dididAH
D	DAHdidit	C	DAHdiDAHdit

LESSON THREE: M F W Y P

M	DAHDAH	Y	DAHdiDAHDAH
F	dididAHdit	P	diDAHDAHdit
W	diDAHDAH		

LESSON FOUR: V B G K

V	dididiDAH	G	DAHDAHdit
B	DAHdididit	K	DAHdiDAH

LESSON FIVE: Q J X Z

Q	DAHDAHdiDAH	X	DAHdidiDAH
J	diDAHDAHDAH	Z	DAHDAHdidit

LESSON SIX: PUNCTUATION

PERIOD	diDAHdiDAHdiDAH ($\overline{AAA}$)
COMMA	DAHDAHdididiDAHDAH (MIM)
QUESTION	dididAHDAHdidit (IMI)
ERROR	dididididididit (8 dits)
VIRGULE (/)	DAHdidiDAHdit (DN)
BREAK	DAHdidiDiDAH (BT)
HYPHEN	DAHdidididiDAH (THT)

LESSON SEVEN: 1 2 3 4 5

1	diDAHDAHDAHDAH
2	dididAHDAHDAH
3	dididiDAHDAH
4	didididiDAH
5	dididididit

LESSON EIGHT: 6 7 8 9 0

6	DAHdididididit
7	DAHDAHdididit
8	DAHDAHDAHdidit
9	DAHDAHDAHDAHdit
0	DAHDAHDAHDAHDAH

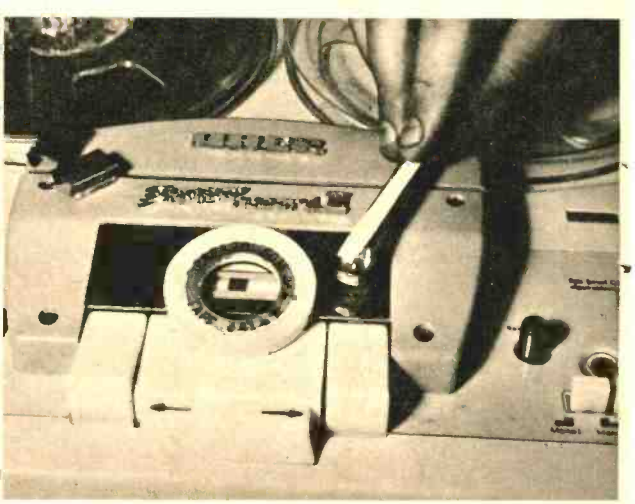
Tape Tricks

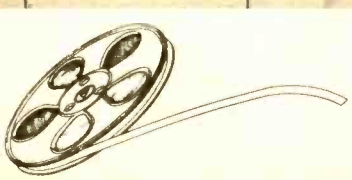
By Art Zuckerman

Simple tricks to get more out of your home tape recorder.

TAPE recording is fun, but it can be a lot more fun if you adopt a few simple tricks of the trade. The four ideas in this article will make your everyday use of your recorder more convenient, and will help you to create special effects.

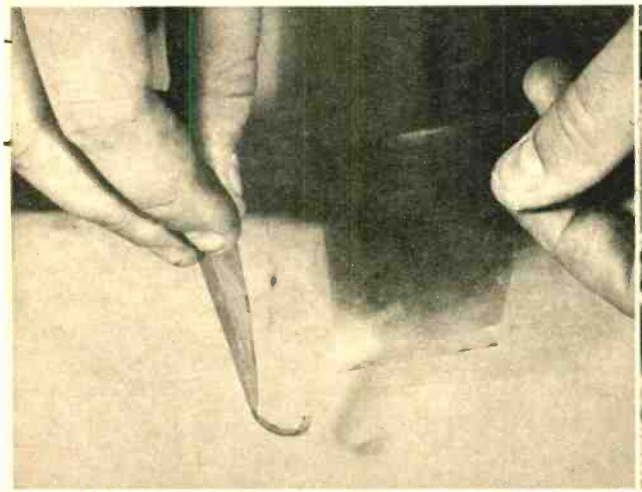
There isn't much to these tricks. You may own one of the foreign-made recorders equipped with electrical contacts for automatic tape stopping, such as the Uher, or for automatic rewind-replay systems as found on the Wollensak 1600 series and again the Uher. At this writing, American-made tapes have no conducting-material inserts to close the electrical circuit between a pair of contacts. Recently the W. H. Brady Company of Milwaukee, has put out self-adhesive, pressure-sensitive "Quik-Cue" contact tabs that should be at your distributor's soon. But in the meantime or in a pinch [*Continued on page* 112]

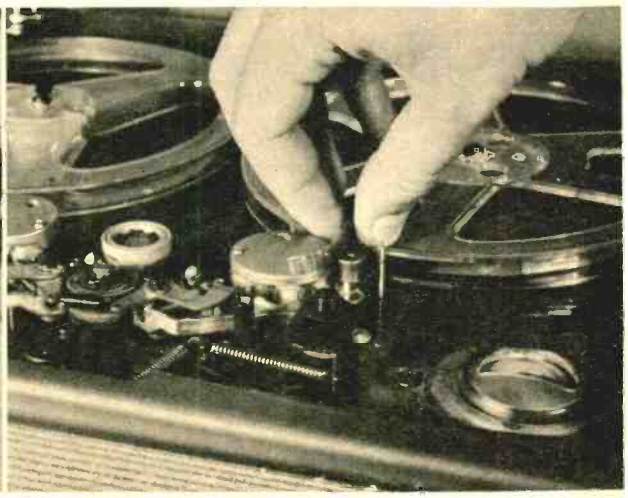




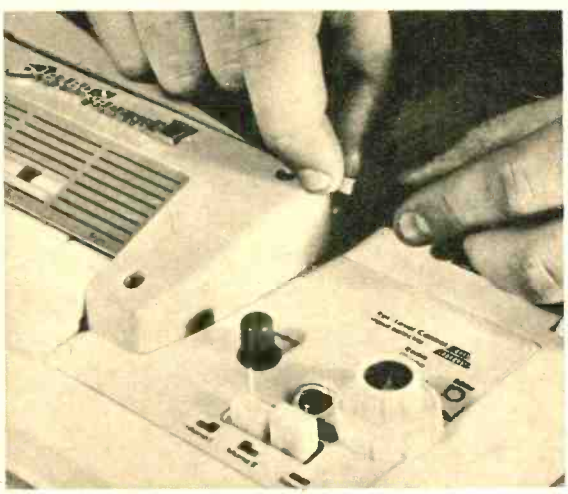
Foil leader for electrical tape-stopping (on machines having this feature) can be made from household aluminum foil. Cut out a strip of foil in tape splicing block, the length of the block (left). Back it with splicing tape (right) and splice to recording tape. Add a length of blank leader.

For dubbing sound-on-sound, you must isolate tape from erase head. One way is to cut a half-inch strip of photographic film, double it to ¼" width, bend into a hook. Remove head cover, place film hook around erase head, and job is done. Another method is switch to disable erase circuit.

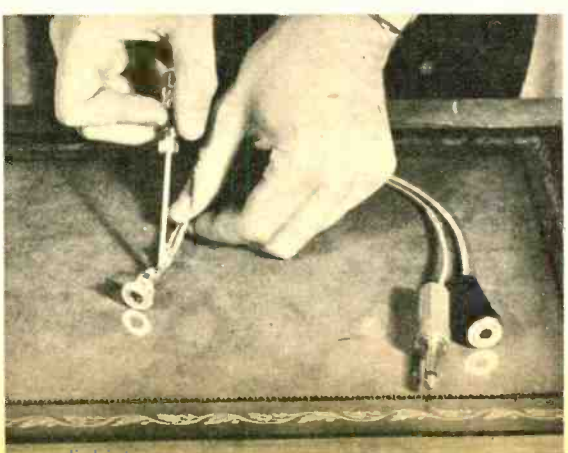




A small piece of splicing tape stuck to the shiny, non-magnetic side of a recording tape and lined up with edge of head is cue mark for zero setting.

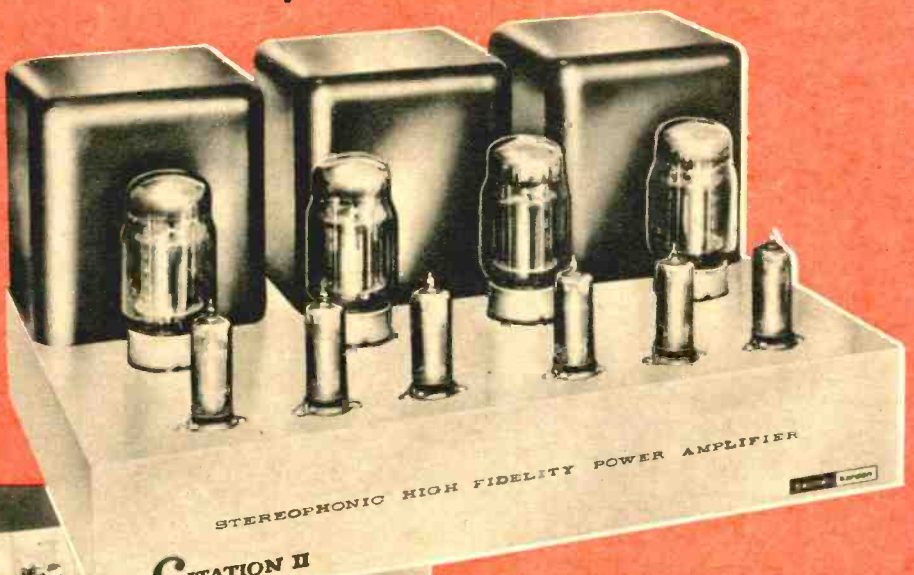


Two phone jacks wired in parallel across phone plug permit recordist and assistant to monitor material. Use one jack or the plug as "terminal strip."

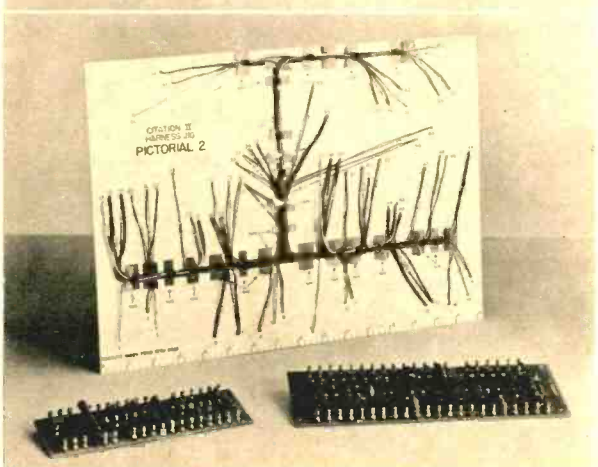


Citation II

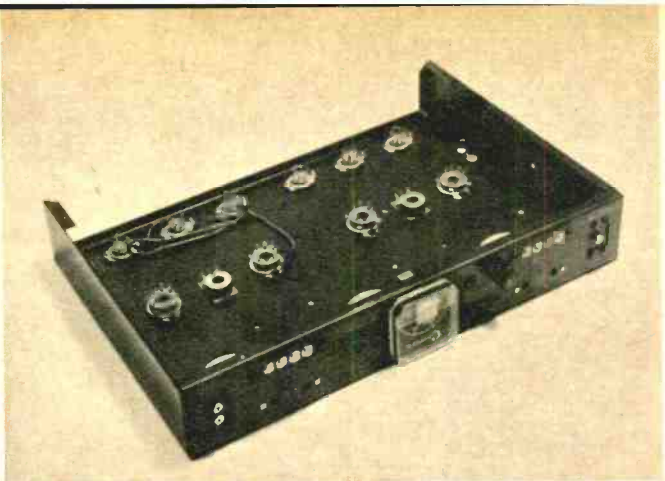
an EI kit report



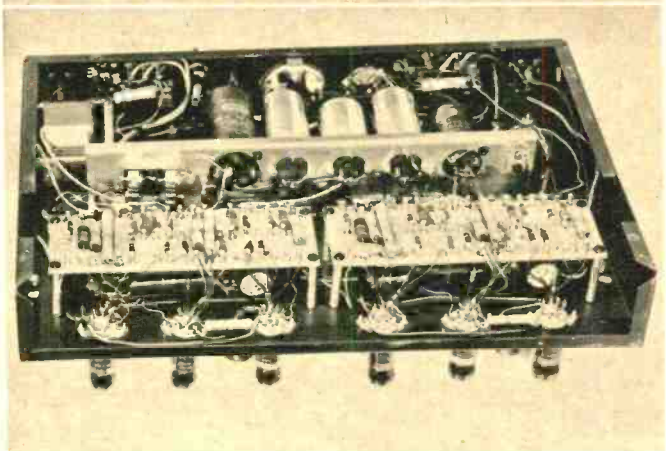
Completed amplifier (above) has gold front panel. Hardware is packaged in transparent bags on identifying cards, as at left. Wire stripper is supplied.



To impart a professional look to the amplifier, terminal boards are used for much of the circuit. Also, the subassembly interconnections are harnessed.



Top right, bottom view of chassis with tube sockets and AC balance controls. The meter is on the rear panel. Tube filaments are wired together in this early stage.

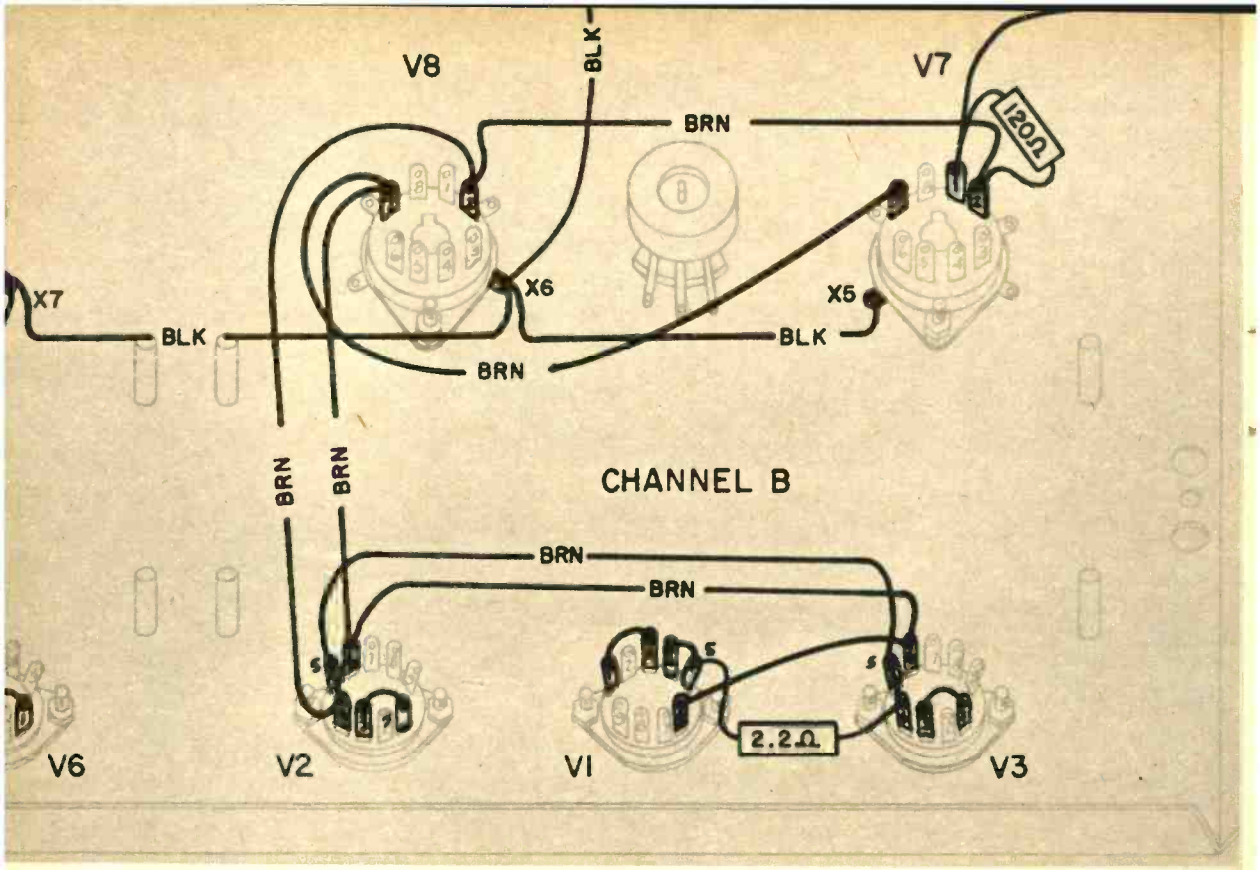


The completed bottom view is at right. Note the three subassemblies in place. The parts are mounted on the terminal boards and wired before the latter are added to the chassis.

No electronic kit was ever issued with as much fanfare as Harman Kardon's Citation II power amplifier. No hi-fi kit ever excited the knowledgeable hi-fi fan as much as this one. EI mentioned it in an editorial when it was first announced. We said then that we would watch its sales with interest. We were interested to know who and how many would buy a stereo power amplifier in parts for $159.95 and then embark on all the work it would take to put it together. Well, evidently enough people have bought this kit to encourage Harman Kardon to release a complete line of Citations, including an FM tuner, speaker system, two preamplifiers and a less powerful basic amplifier.

The equipment is elegant, no unnecessary frills but all the clean power you could want (60 watts per channel at less than ½ percent harmonic and IM distortion from 18 to 40,000 cycles the ads claim and independent testing labs have verified). In putting the kit together we had the feeling that there was always someone there before us, anticipating our every question and possible error. All the parts needed for each major step are enclosed in a plastic bag together (except for the resistors and capacitors)—how sensible and why hasn't this been done before? If you slit the front of each plastic bag with a razor you can keep all the bags on the cardboard panels to which they are stapled for easy identification.

There is a lot of wiring to do, but that is why the kit costs $70 less than the factory wired version. Since there are a considerable number of joints to solder, the assembler should be certain that he knows how to solder correctly—this isn't as elementary as it



Part of a large wiring guide furnished with the kit. Note how wiring stands out against parts.

sounds. "Of course I know how to solder," you say, but it is a fact, that the single most often found kit defect is the cold solder joint. Read the how-to-solder instructions in the kit assembly book before you start.

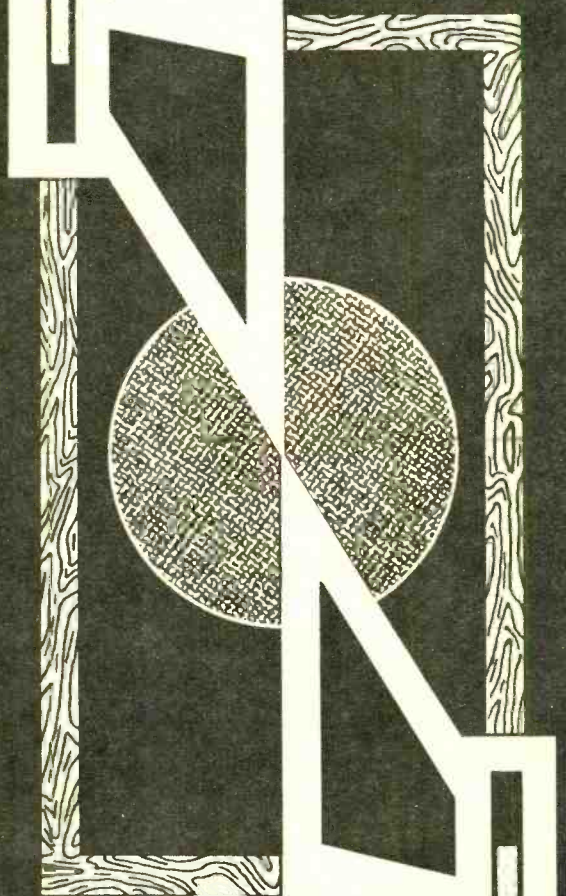
After all the wiring is completed, (a good portion of it consists of a harness which the builder lays out on a special pattern furnished with the kit) and all subassemblies are in place, the final step is adjusting the AC balance. The signal needed is available from the amplifier itself and, as you might suspect, the Citation's own meter is used as the indicator.

The kit goes together easily, no special ingenuity or particular aptitude, mechanical or electronic, is needed to complete the job – just patience. The fact that this kit is now being used as a standard in many laboratories speaks well for the way it behaves electronically. This is no accident, heavy duty parts are used throughout and the transformers themselves, so important for superior frequency response, have been specially designed for this unit.

It is difficult to remember, when the kit is all finished, that it is only a basic amplifier and that you need a preamp to get the signal through from the source to the speaker.

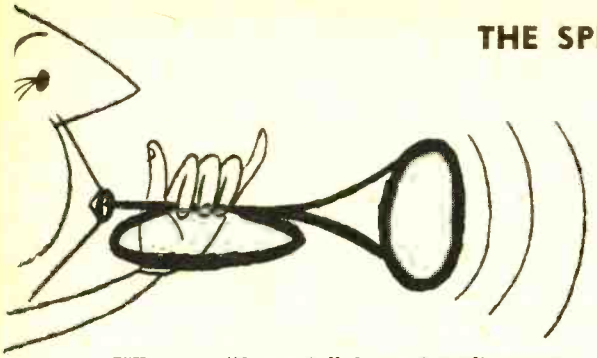
We posed the question earlier – who would buy the Citation? Well, we've discovered that people who ordinarily would never spend so much for an amplifier are buying it and plan to buy other units in the line too. They are convinced that with this hi-fi equipment they have reached the top, their rigs cannot be surpassed or become obsolete. They are prepared for any innovation in hi-fi. Whether this is so, no one will dispute that this is one of the finest engineered and executed designs available. It's almost like having a Rolls Royce in your hi-fi cabinet. For those who have it (money, that is) EI rates the Citation II a Good Buy.

all about Loudspeakers and Enclosures



CONTENTS

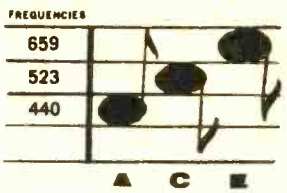
THE SPEAKER STORY



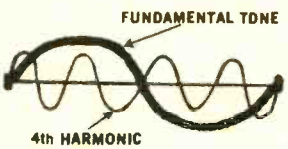
SOUND

An instrument, let's say a trumpet, vibrates air particles, setting up a wave motion in the air. The ear drum vibrates "in time" with these sound pressure waves. A "message" is then sent through the auditory nerve into the brain which translates these impulses into a recognizable sound pattern.

Why Do "Sounds" Sound Different?

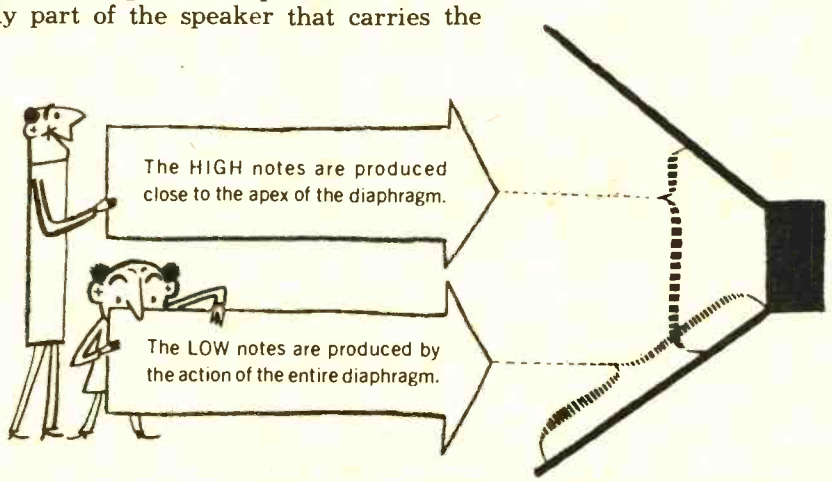


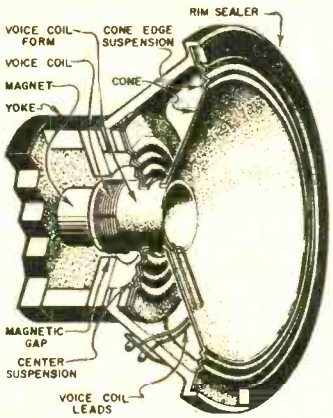
The rate at which an object vibrates determines the rate at which the air is caused to vibrate. For instance, a violin string vibrating 440 times per second is said to have a frequency of 440 cps (cycles per second). Each musical sound has its own frequency—from the 40 cycles of a bass viol to the 18,000 cycle component in the sound of a snare drum. Now, why do tones of a similar frequency sound different? For instance, a 1000 cycle note on the clarinet sounds different from a 1000 cycle note on the piano. That's because even a single tone is comprised of more than a single frequency. Harmonics of varying vibrations "color" and "shade" the basic tone giving it character and an individuality of its own. The number and general characteristics of these harmonics make the difference in the final sound.



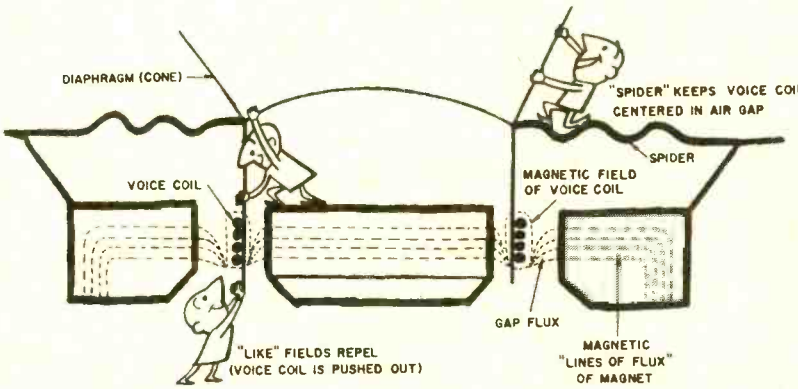
LOUDSPEAKERS

A cone of special paper (diaphragm) vibrates at various frequencies to produce all kinds of sounds—music, voices, etc. Cone shape, construction and material vary with the individual design of the speaker. The voice coil is the only part of the speaker that carries the electrical current from the amplifier. It consists of a number of turns of wire (copper or aluminum) wound around a cylinder usually made of thin strong paper, dural, glass, or other material that can be relied upon to keep its shape. The magnet assembly is the heart of the speaker. Most "PM" (permanent magnet) speakers derive magnetic energy from Alnico 5, a special alloy composed of aluminum, nickel and cobalt. In each of the three





magnet designs in common use, quantities of soft iron (*Armco*) structures are used to complete the circuit path for the magnetic energy of the Alnico to follow. The magnetic energy in the air gap (where the voice coil will be) is called the *gap flux*. The more magnetic material and the better the magnet design, the greater the flux gap density. All the action originates in the air gap; the voice coil travels back and forth within the air gap's magnetic field, in relation to the current fed into it from the amplifier. The interaction between the magnetic fields of the air gap



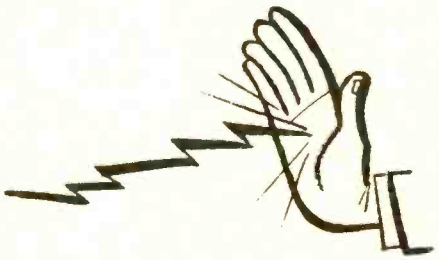
and of the voice coil creates a magnetic attraction and repulsion (a push and pull). This results in movement of the voice coil/diaphragm assembly to produce sound. The flexible *spider* is used to help keep the voice coil assembly centered within the air gap as it moves axially. The *suspension* centers the diaphragm and is a flexible area around the outer rim of the diaphragm which behaves like a spring. It is often treated with a special compound to aid its operation. Or it may be cloth or foam rubber. The quality of a speaker depends upon the interaction of all the elements of which it is built. Proper design of the magnet assembly, centering elements, cone shape, weight and material, all have their role to play in the production of high fidelity sound.

Transient Response

This refers to a speaker's ability to faithfully reproduce a high impact signal of short duration (the crash of cymbals or other percussion instruments). A well-damped speaker will faithfully follow the impulses of the signal current, starting and stopping simultaneously with the electrical signal. If the speaker diaphragm continues to vibrate after the signal has stopped, hangover and distortion result. The design of the speaker and the enclosure used with it are the important factors in achieving proper damping and distortion-free transients. Use of burlap over the port of the Stereo Satellite System (p. 72), for example, achieves optimum damping for the particular speaker employed.

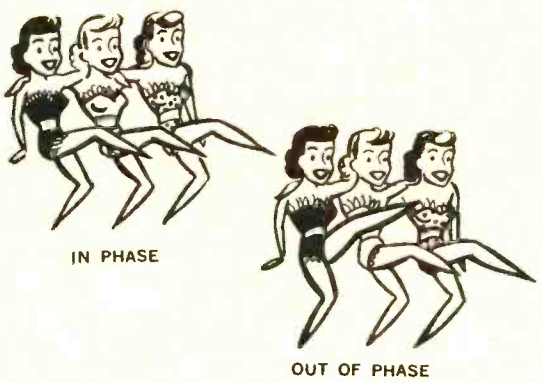
Resonance
A speaker cone, like a tuning fork, has its own point at which it prefers to vibrate (due to its mass and compliance) which is called the cone resonance. The resonance point is established during design of the speaker on the basis of such things as power handling capacity, frequency response characteristics, type of enclosure most likely to be used, etc.

Voice Coil Impedance
This is simply opposition to input electrical current and its measure indicates a speaker's operating current characteristics. The amplifier should be so matched to the speaker so that sufficient driving power is available. There is no necessary relation between the impedance and quality of a speaker.



Intermodulation Distortion
A single cone is often called upon to reproduce a tremendous range of frequencies. When the diaphragm tries to reproduce a low note and a high note at the same time, the mechanical interaction of the two frequencies sometimes produces this type of distortion.

Phasing
When more than one speaker is used in a system, they are connected so that sound from one works to aid the sound coming from the others. When the electrical connections to the speakers are arranged so that diaphragms push and pull at the air simultaneously, that is known as "in-phase" connection. The dispersion and frequency response characteristics (particularly in the bass) of a multi-speaker system are affected by the phasing.



ENCLOSURES

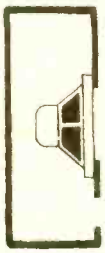
At the same time that the speaker diaphragm moves forward, pushing a pulse of sound into the air in front of it, the rear of the diaphragm creates a momentary vacuum in the back, thereby drawing in the air that the front of the diaphragm is trying to push out. This cancels, or "short circuits" the sound waves, resulting in a loss of low frequencies. The speaker housing is designed to prevent this.

There are Many Ways to House a Speaker

The *flat open baffle* is the simplest type of baffle and consists of a board onto which the speaker is mounted.

The *open back* cabinet increases the distance rear waves must travel before reaching the front. This is generally used in the ordinary radio set.

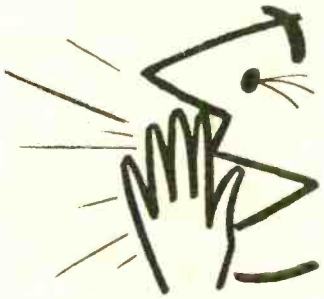
A completely enclosed cabinet or *infinite baffle* seals off all the rear waves. Unless a special speaker is used, the baffle must be fairly large.

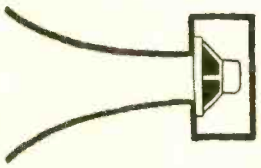


The *bass reflex* enclosure is described elsewhere in this special 16-page section.

Horn-Type Enclosures

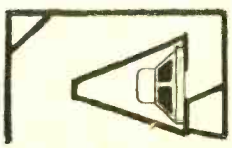
The horn-type baffle is one of the oldest devices for directing sound. When you cup your hands in front of your mouth, you are "front horn-loading" your mouth, because the sound is generated behind the horn. There are three types of horns; the *straight horn,* the *folded horn* and the *rear-loaded horn.*

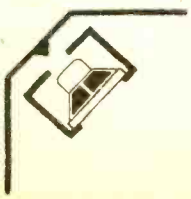




A slowly expanding horn with a large mouth opening produces better low frequency responses. This, of course, results in a rather long horn. The longer the horn, the better the low frequency response.

Naturally it would be impractical to fit a horn several feet long into a living room, so horns can be bent, or "Folded" to meet the space requirements.





There are also folded horns that are rear-loaded, operating with the sound emitted from the rear of the speaker.

Cartoons and text
Courtesy University Loudspeakers, Inc.

build the EI

Front-Loaded Satellite Stereo Speaker System

To simplify construction, butt joints are used throughout. Nails and glue achieve rigidity.

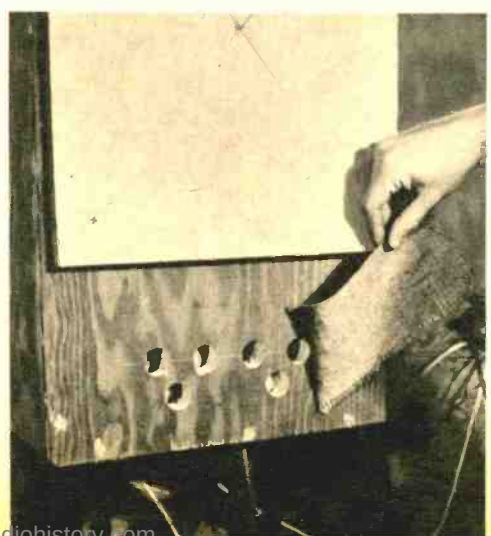
SPACE and satellites are the big news. And satellites can solve your space problem—your *stereo* space problem—that is. If you have no room for that additional large speaker system, a Stereo Satellite setup is the answer to an audiophile's prayers. Using the *EI* design, you can put together a complete stereo speaker system for less than $60, rivaling those costing several times more.

The theory of Satellite Stereo is simple. It has been found that audio directionality obtains only at the upper frequencies; below 350 cycles it is almost impossible to localize a sound source. Therefore, if the *above* 350 cycle frequencies of each stereo channel are fed to properly spaced speakers, stereo results. Since speakers handling 350 cycles and up require very little in the way of a baffle, any small cabinet will provide an adequate acoustic housing for the Satellites.

The bass speaker is more of a problem. It must be able to accept the frequencies *below* 350 cycles from *both* channels and push a composite bass signal out into the air. There are various techniques for achieving mixed bass. It can be done with a matrixing crossover setup, or by housing two woofers (one for each channel) in a single box, or by using a special woofer with two voice coils.

We chose the latter course: 1, because it is the least expensive, and 2, there were some new ideas for enclosure designs we wanted to try out.

Strip of burlap about to be installed over the 1" tuning holes drilled in the front panel.



The Woofer

The dual voice coil woofer selected for the mixed bass unit, the Lafayette SK-133, has a free air

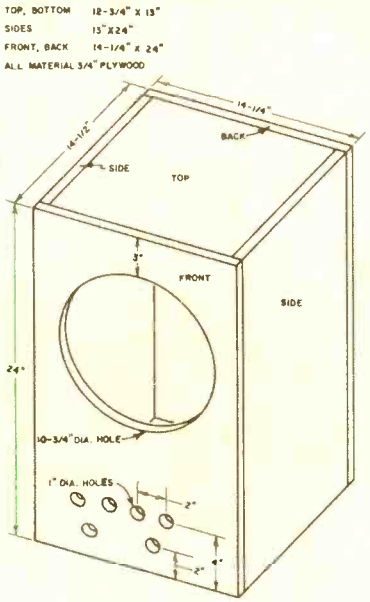


Fig. 1. Basic dimensions and assembly of cabinet. Front loading panel is 14¼" by 16½".

resonance of about 36 cycles—which is quite good for a 12″ speaker. As we shall see, it is possible to house a low resonance speaker in a fairly small cabinet and still retain substantial bass.

The cabinet size was chosen more or less arbitrarily and has an internal volume of about 2 cubic feet. Weldwood ¾″ fir plywood was used throughout to insure a rigid resonant-free construction. Liberal use of wood glue and 6d (penny) finishing nails every 3″ make the butt joints tight and secure. Wood screws may be used instead of nails, but it is doubtful that any improvement in rigidity would be realized. All joints *must* be air tight; force plastic wood into any joint or crack that looks like it might be a source of air leakage.

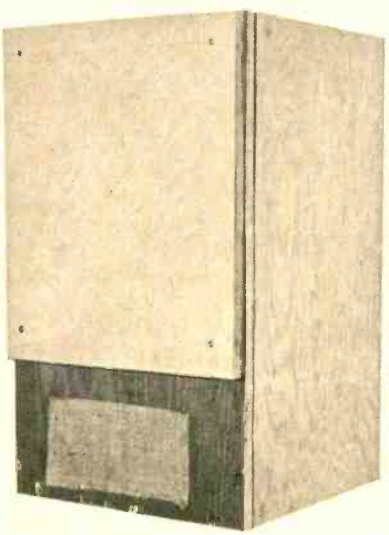
After the six 1″ holes are drilled in the front panel area shown (the exact placement is not critical), the speaker is mounted using four 1½″ #10 nuts and flat head bolts. Four color-coded leads about 2′ long should be brought from the speaker's terminal posts, passed through a small hole drilled in the rear panel of the cabinet and connected to a terminal strip.

Large hardware stores stock 1-inch thick, 2-foot wide rolls of Fiberglas which they sell by the yard. About 6 feet (12 square feet) is needed for proper cabinet damping.

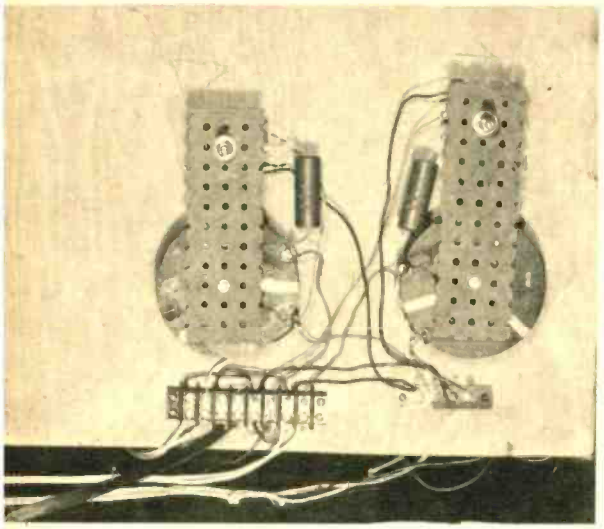
Wear rubber gloves to protect your hands and tear up the Fiberglas into 3″ or 4″ pieces which should be packed *loosely* into the cabinet until full.

Drill guide holes in the speaker panel so it may be mounted with 1½″ #8 flat head wood screws. To insure a tight fit, install a screw about every 4 inches on all four edges. Masking or adhesive tape is applied at the seam to achieve a further seal of the cabinet against possible air leakage. Then staple a strip of burlap over the holes to complete the woofer.

Positioning of the completed woofer unit is not at all critical. You can stand it on end or even lay it



Completed "utility" woofer. Loading panel is mounted on ¼" spacers. Spacing is critical.



Author's dual 350-cycle crossover. Assembly may be mounted inside the woofer cabinet.

on its back or side behind a sofa. When the system is playing no sound seems to be coming from the area of the woofer. However, if you get within a couple of feet of the woofer, the bass will override the treble and a "muddy" effect is heard. This is not a flaw in the speaker, it's just that all the transients have been shunted over to the satellites, leaving nothing for the woofer to reproduce but deep bass fundamentals.

It is extremely important that the woofer connections be phased correctly. If out of phase, the bass response will practically disappear. A stereo test record such as the Westminster Recordings Company's WSS-2 is highly recommended for checking the phasing and balancing of the system.

The Satellites

As was mentioned earlier, housing the Satellite speakers is no great problem. The speakers used should have a smooth response from about 200 cycles up to work well with a 350 cycle crossover. Since most tweeters are designed for operation with a 1000 cycle or higher crossover, they cannot be used *alone* as Satellite reproducers. However, any standard 8" speaker that has a good treble response will serve nicely in the Satellite. If desired, you can add a tweeter to the 8 incher using the circuit of Fig. 2.

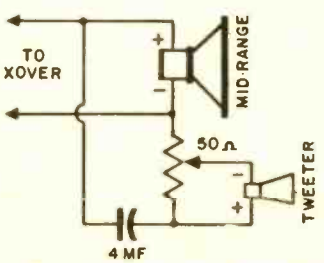


Fig. 2. Simple circuit used with a two-way Satellite speaker.

Phasing of the Satellites is not critical, except if you use a mid-range plus tweeter setup as above. If the connections to the tweeter are not phased correctly with regard to the mid-range unit, some cancellation will occur at the crossover frequency. To check this, simply reverse the leads to the tweeter and see if any improvement results.

As far as the placement of the Satellites is concerned, that can be done "to taste." Since it is easy to shift their relative positions, you can afford to experiment for the best stereo effect in your particular listening room.

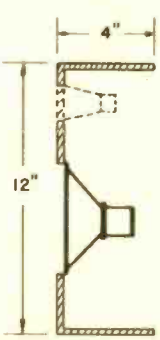


Fig. 3. Small baffle is adequate for Satellite speaker.

There are several precautions to be observed in the construction and installation of the Satellite units. Do *not* use a small totally-enclosed (or even a deep open-back) cabinet. If resonances are set up in the satellite units, a lot of the quality will be lost. Since the length of a 350 cycle wave is about 3 feet, 2 inches, the front to back distance of the Satellite cabinet should be at least 20 inches. (Cancellation starts where baffle dimen-

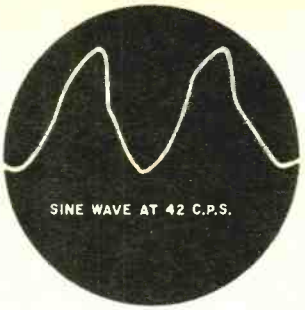


Fig. 4. Moderately clean sine wave as picked up by a mike and shown on scope.

sions equal ½ wavelength.) An open back baffle with at least a 12" square frontal area and 4" sides will serve nicely here. (Fig. 3) You can build your own, or buy one ready made. There's no objection to the use of ¼" plywood in its construction. Don't place the open back too close to a wall or a sort of "hollowness" may result.

Since the crossover point is quite low, be careful that you don't exceed the power rating of the mid-range tweeters in the Satellite. The speakers used must have a power rating of at least 10 watts or distortion and breakup will occur on loud musical passages.

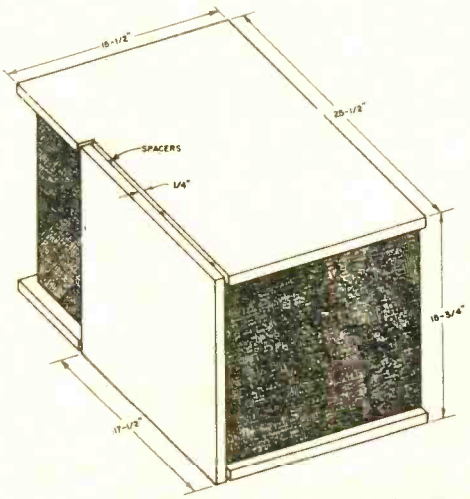


Fig. 5. Cabinet with finishing panels. Note change in dimensions of front-loading panel.

The Crossover

The crossover used for the system differs only slightly from standard crossover design. In effect, it comprises *two* crossover networks with a large air-core inductance (3.7 millihenrys) in series with each woofer and a 50 mf capacitor in series with each Satellite speaker.

Each inductor has 470 turns of #18 enamelled or Formvar wire wound on a 1" thick *wooden* core over a 1½" area. The crossover capacitor is made by connecting two 100 mf @25-volt capacitors in series, plus to plus. (See Quadflex article for further crossover construction details.)

If you want to save yourself some work, crossover kit KT161 designed for the woofer is available from Lafayette Radio for $7.26.

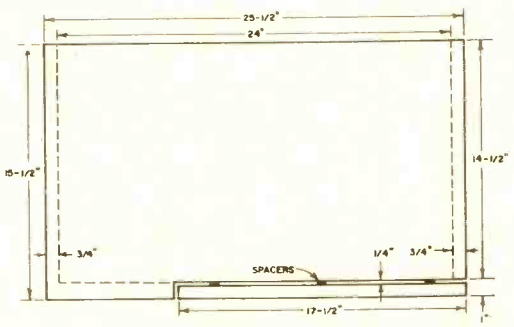
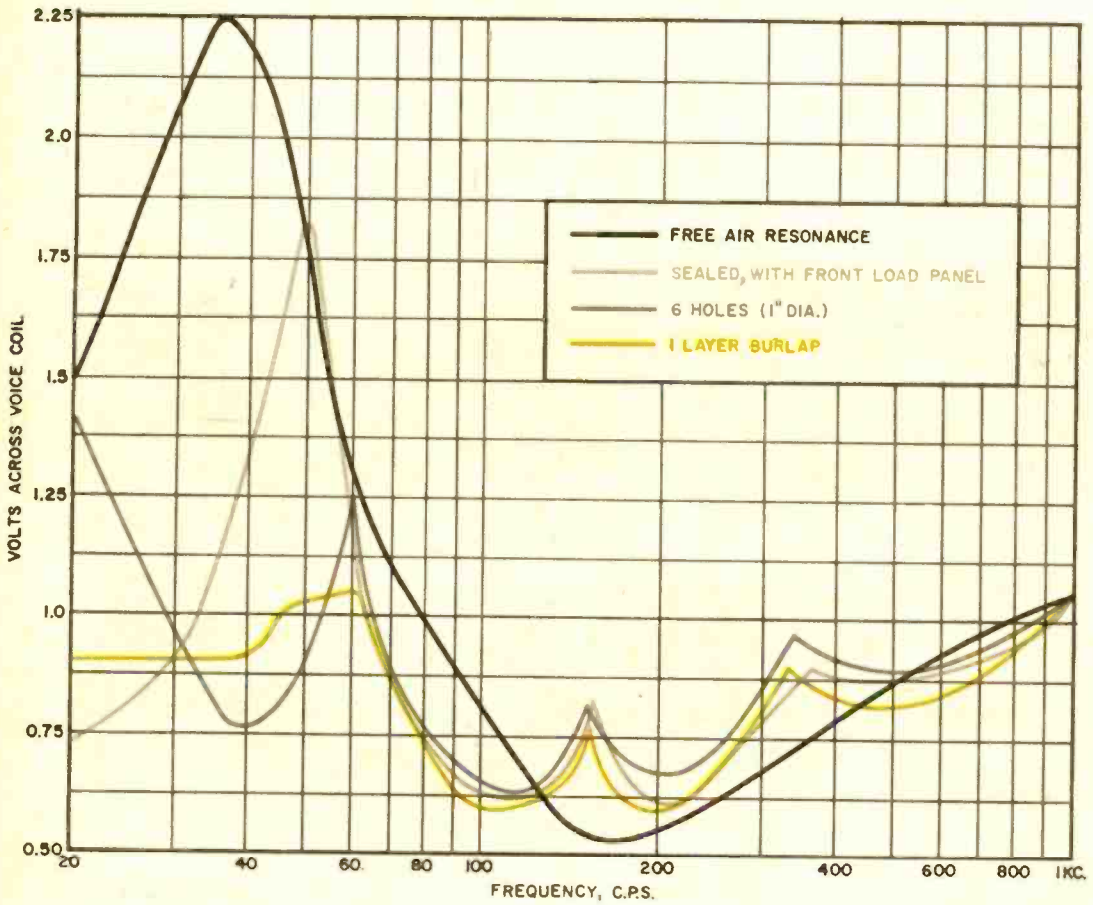


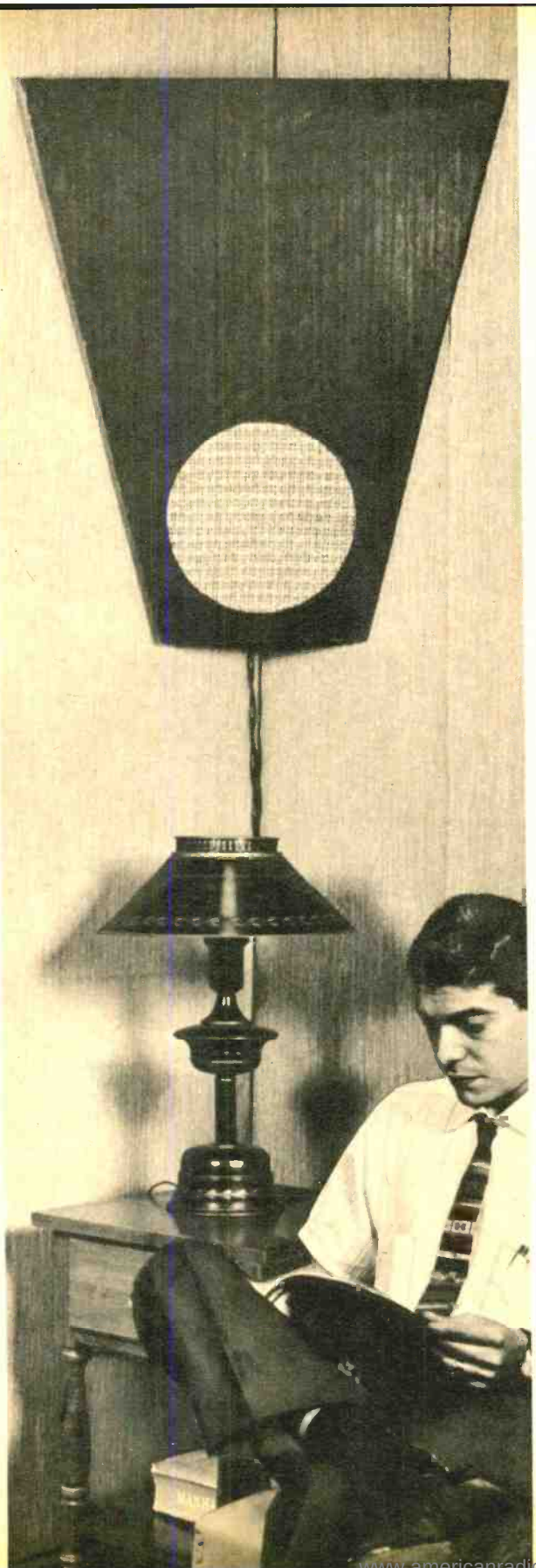
Fig. 6. Top view of unit with finishing panels. Overhang is ¾" at sides; 1" at the front.

Depending upon the efficiency of the tweeters, L-pads may be necessary to drop their output to the level of the woofer. Instructions for connection of the pads will also be found on the woofer data sheet.



Satellite Woofer Impedance Curves

The free air resonance of the 12″ dual voice coil speaker is about 36 cycles (black curve). When installed in the sealed enclosure, the resonance goes up to 68 cycles (light grey curve). Drilling six 1″ holes tunes the cabinet to approximately 40 cycles (dark grey). The upper speaker peak is now about 58 cycles and the lower peak is somewhat below the range of the audio generator used. The general shape of the curve, however, would indicate that the lower of the two peaks is of higher amplitude than the upper one. This is intentional because, in addition to damping the port, the installation of the burlap tends to effect a reduction in port size. The peak in the final curve (yellow) is of lower amplitude than in any of the preceding curves and the smoothness of the bass response is readily apparent to the ear. The sine wave output of the woofer at 42 cycles (as picked up by a Dynaco B & O microphone connected directly to the vertical input of a high-gain oscilloscope) appears quite clean. **(See page 75.)**



The Hanging Horn

speaker system

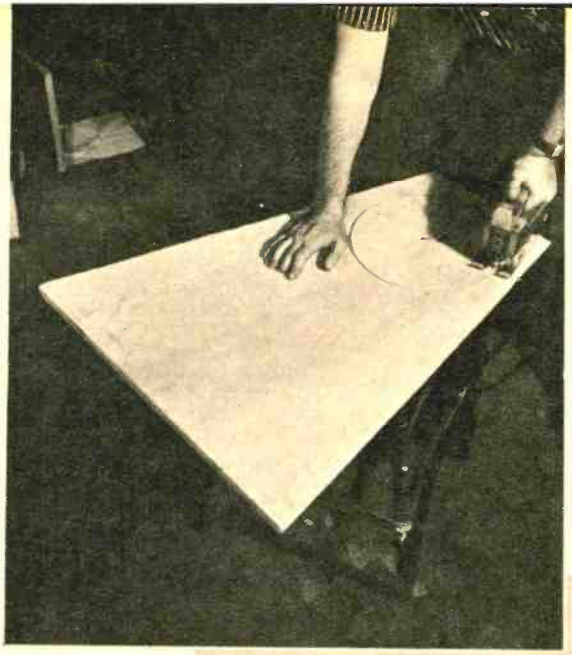
A HI-FI loudspeaker that takes up no floor space can be a real boon in today's crowded apartments. If the complete system costs less that $30 *including* a Sonotone coaxial speaker, can be hung in any convenient corner, and has a construction time of less than an hour—why then you've got a genuine bargain!

The operating principle of this speaker system is novel, but simple. When mounted in a corner, the panel, in conjunction with the two walls, forms a horn of triangular cross section coupled to the rear of the woofer. This horn improves the loading on the speaker cone (in our tests cone movement was barely visible, even on loud passages), and enables the speaker to push more air with less effort. In other words, you get cleaner bass—and more of it.

Construction

Since the hanging horn is put together from only two pieces of plywood, extensive construction information is not required. The author's model was constructed of Weldwood lumber core walnut plywood. The only angle cuts to be made are on the two sides of the baffle. The top and bottom edges of the baffle and the three edges of the triangular bottom piece are all standard 90° cuts.

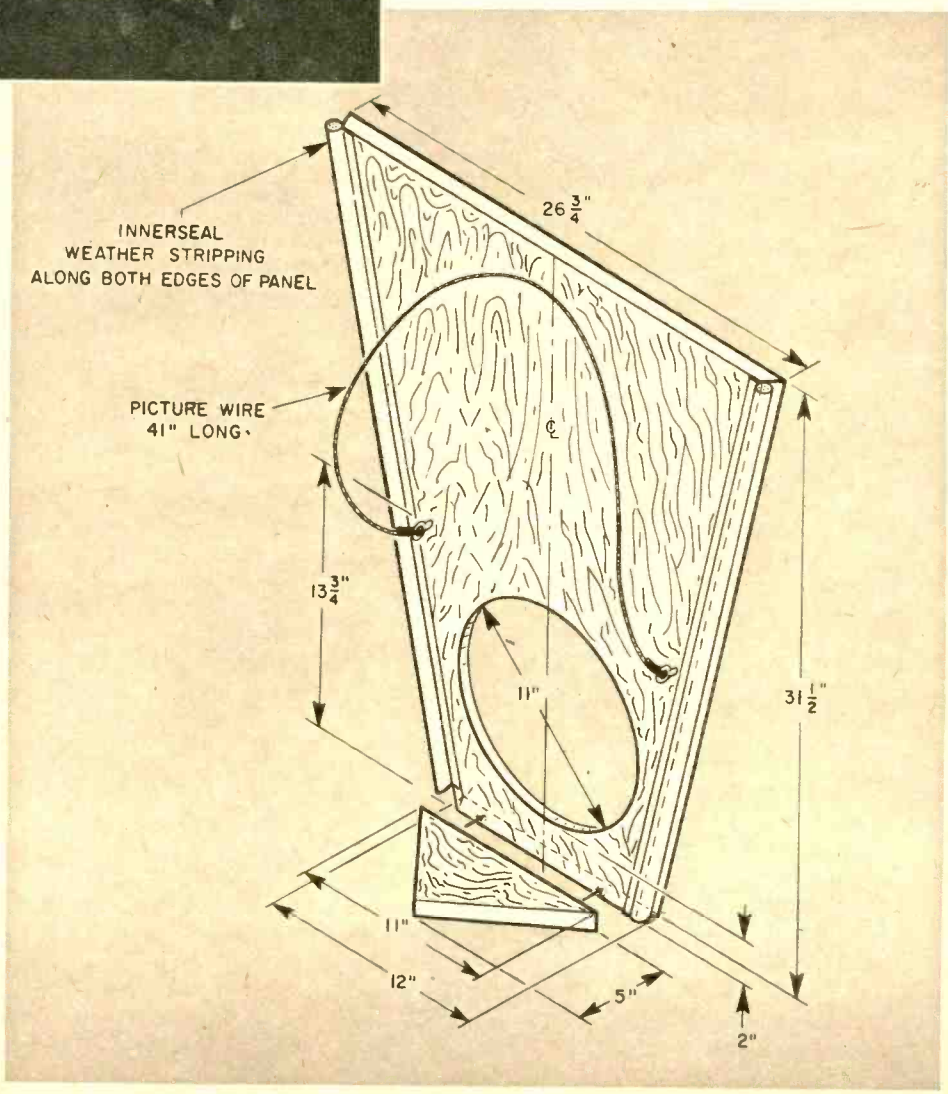
The speaker hole should be cut out carefully with a keyhole or jigsaw. To flush mount the grill cloth as shown, a ¾″ split ring is cut from the edge of the speaker hole disc. A 15″ square of grill cloth is placed over the speaker cutout from the rear of the panel and pressed into place with the split ring. The grill cloth should be stretched taut and a couple of nails can then be driven

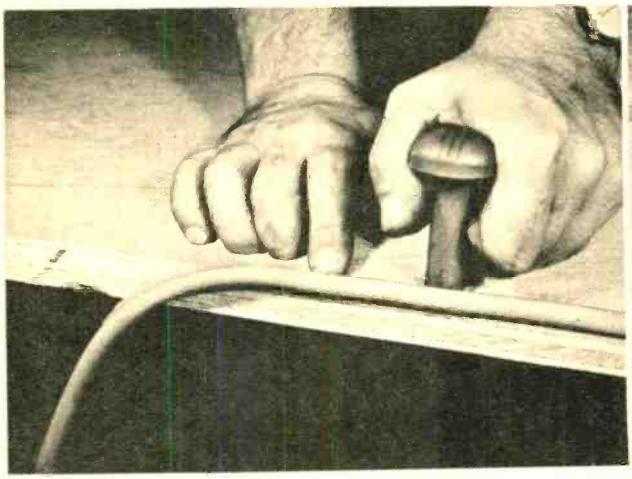


BILL OF MATERIALS

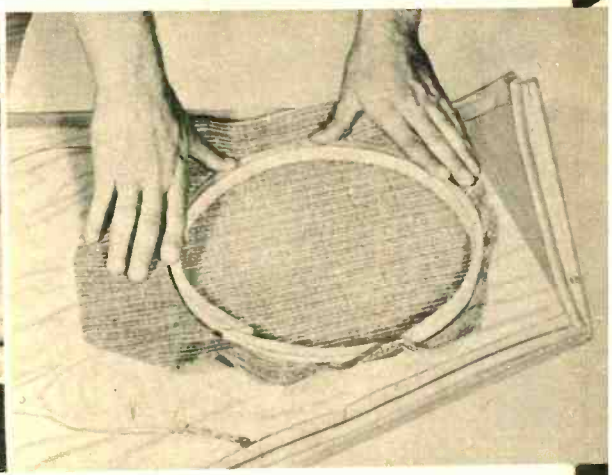
¾ inch plywood cut to the dimensions shown. Finish as desired.
41 inches of picture hanging wire.
15 sq. inches of speaker grill cloth.
2—screw eyes.
7 feet of Inner-Seal weather stripping.
1—12" Sonotone speaker (CA 12A)

Front panel should be cut with its two long sides beveled. Speaker opening is cut out with jigsaw or keyhole saw. All dimensions are shown below. Triangular bottom piece is attached with wood screws and requires weather stripping to insure a good seal to the walls.



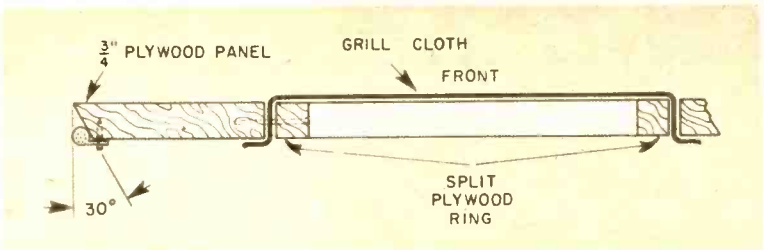


Weather stripping is stapled and glued on all baffle edges that will touch the corner walls.



Split plywood ring is forced into speaker opening and holds grill cloth securely in place.

Cross section of baffle showing the various construction details.



through the ring to hold it in place. The grill cloth edges can be stapled down.

The Sonotone speaker is then mounted with four No. 10 wood screws and washers. Make sure that the speaker is mounted with the long axis of the tweeter vertical.

The triangular bottom piece should be glued and screwed into place. It may be necessary to construct a small overhang or weather strip extension on the rear edges to insure proper seal to the corner.

The picture wire has to be the correct length and the screw eyes mounted at the points specified or the speaker may not hang properly. When everything is correct, the low center of gravity of the unit will tend to pull it into the proper corner position.

Any type of lead-in wire may be used to connect the speaker to your amplifier. Either lamp cord or 300-ohm TV flat line is fine. Follow Sonotone's instructions on speaker connection and impedance.

To insure proper response from the speaker, keep the top edge of the panel at least 6″ away from the ceiling. You can adjust the bass response of the system somewhat by moving the panel closer or further away from the ceiling. The weather stripping stapled to the edges and bottom of the panel serve to seal the unit to the wall. Any type of stripping that will do the job may be used. If the walls are slightly irregular, it may be necessary to apply additional material to insure a good seal. Make sure that the picture hook or nail on which the speaker will hang is driven in directly at the corner or the unit will not hang correctly.

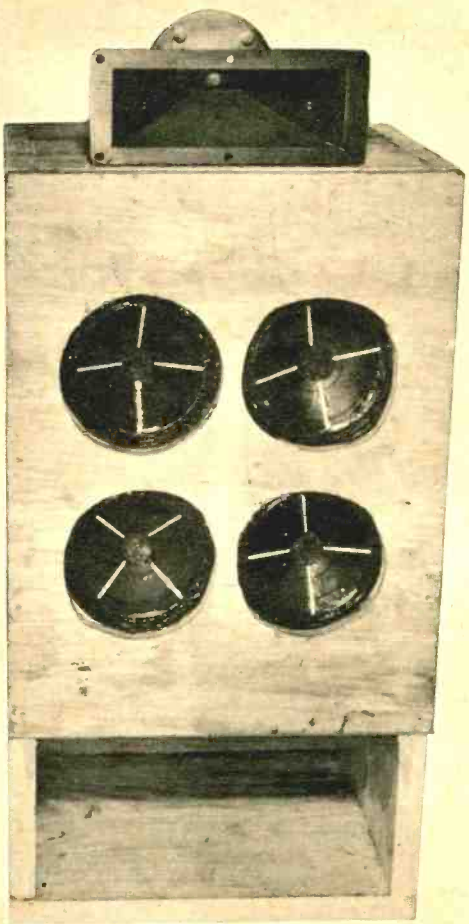
Consult your lumber dealer for appropriate finishes for the plywood used. If desired, the panel can be constructed of ordinary ¾″ fir plywood and painted or wallpapered to match its surroundings.

the best of El

The Quadflex

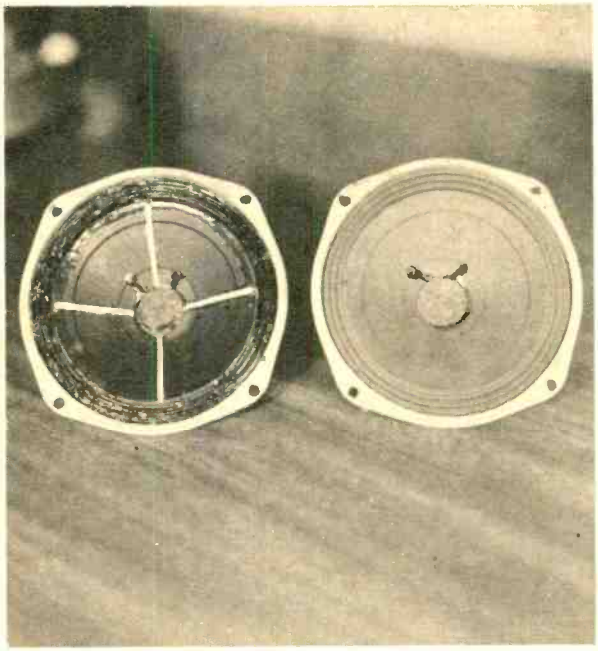
an experimental speaker system

By Ernest Wayland

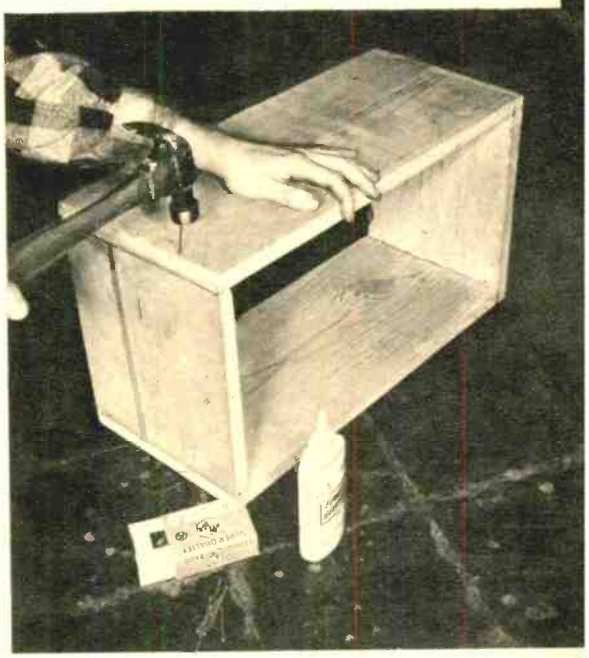


Four inexpensive replacement type 5" speakers make up the bass unit of this system. The speakers are modified to improve their bass response as described in the text. The photo above shows slits being cut along the rim of the speaker. The next step is to stiffen the speaker cone by adding toothpicks to the cone itself. Everything needed to modify the speakers is shown in photo.

The complete speaker system is shown at the left. This unit may be inserted into a piece of furniture already in the room or it may be covered with grill cloth and Contact paper. The horn tweeter may be positioned in opening at bottom.



Inexpensive speaker on the right has its rim loosened and its cone stiffened as on left to improve its frequency response for system.



The sides of the speaker enclosure should be glued first and then nailed together to furnish a stiff, rattle-proof speaker box.

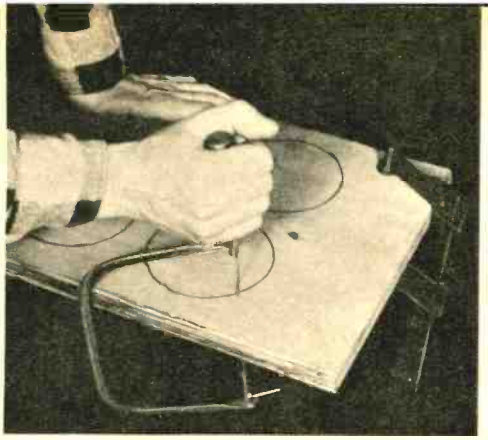
IF YOU'VE had a yen to fool around with speakers and see what can be done to improve them, here's your chance! Obtaining good sound from 5" replacement-type speakers selling for less than $1.50 is a real challenge and they have to be extensively modified. Matched speakers need not be used; units salvaged from AC-DC radios are fine. Since only 5" speakers were tried, plans cannot be provided for any other size speakers or cabinet.

The tools needed to adapt the 5" speakers to woofer service are a razor blade, glue, Vaseline, light machine oil, sixteen flat toothpicks, and a can of crystal clear Krylon spray. Follow the procedure in the order given as a step out of turn may ruin the speaker.

First, considering the speaker as a clock face, make twelve cuts with a sharp razor blade (each on an hour position) running from the innermost suspension corrugation (C) to the outer rim (D).

Now break each toothpick to a length which will extend from the edge of the voice coil (A) of the speaker to the point where the first ripple of the rim suspension is encountered (C). Cement four toothpicks into place with the glue as per the photograph. (The glue used should be of the type which does *not* contract on drying. A Borden's product, "Elmer's Glue-All," proved to be ideal.) Now form a ¼" wide circle of glue along the inner edge (C) of the same rim ripple. The purpose of the glue is to prevent the edge slits from extending themselves and to act as a barrier to the spread of the oil, which is next applied.

After the glue dries, a few drops of oil should be spread lightly on the rim suspension between the glue barrier at (C) and the outer edge of the speaker (D). Immediately after the oil, a moderately heavy coating of Vaseline should be applied over the same area, taking care that neither substance is allowed to leak by the glue barrier. The acrylic spray is now brought into action and two coats are applied to the front and rear of the speaker cone. It doesn't matter if the frame of the speaker interferes



The front of the enclosure should be made from ¾" plywood so that it will not split when the four speaker holes are cut into it.

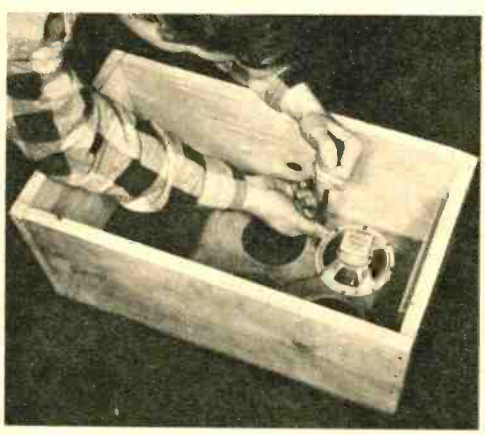
Tack Fiberglas insulation, old towels, etc., to the inside of the back and sides of the enclosure to damp undesirable sound waves.

with a thorough rear spraying. Now with the aid of a pipe cleaner or swab, remove the excess Vaseline (and hence the Krylon on the rim), leaving a thin layer, and the modification is complete. Each of the four speakers should be treated similarly.

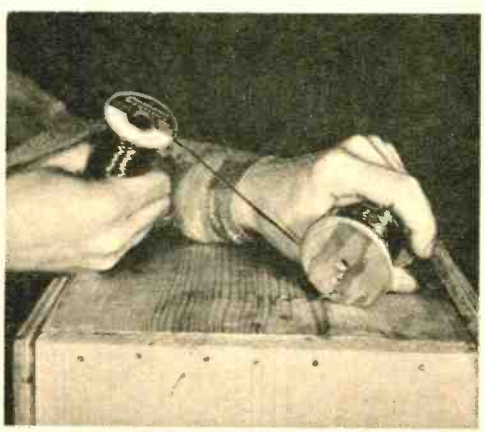
Building the Cabinet

The construction of the cabinet is simplicity itself. Since butt joints are used throughout, no difficult mitering or other fancy woodworking is required. A 6′ pine board of 10″ width and ¾″ finished thickness will provide the top, bottom, and side pieces. The front and back sections of the cabinet are made of ½″ or ¾″ plywood. Note that the cabinet dimensions are only accurate for 5″ replacement type speakers modified as suggested. Drill a $\frac{3}{16}$″ hole in the back panel for the leads to the amplifier, and a series of $\frac{3}{16}$″ pilot holes for the 2″ No. 8 flathead panel mounting screws. Fiberglas insulation, rug backing, old towels or any other handy coarse material can be used for cabinet damping. Tack it loosely to the back panel and walls of the cabinet. If the bass sound when the speaker is tried out seems "wooden" or "hollow," add an extra layer or two.

After the four modified 5″ speakers are installed in the cabinet, they'll have to be connected *in series, in phase.* Sim-



Screw the speakers to the inside of the front panel. When all are installed, they are wired in series as explained in text.



Wind the coil for the crossover network fairly tight. Make certain that you fill up the coil form evenly with 400 turns of wire.

ply connect the right hand terminal of each speaker to the left hand terminal of its neighbor, leaving the left hand terminal of the first speaker and right hand terminal of the last speaker open. Connect a 2′ length of wire to each terminal and touch the end of each wire to one pole of a flashlight battery. Watch the speaker cones at the moment of contact, you'll notice that they all either move in or out. If one speaker does not move in the same direction as the others, reverse the leads going to the terminals of that particular speaker. Then make the flashlight battery test again until all speaker cones move in the same direction at the same time.

Crossover

A simple coil and capacitor combination will serve to feed the high frequencies to the separate tweeter used in this speaker system. For another dollar you can add a "brilliance" control. Any 8 to 16 ohm tweeter will work with the woofer described here provided it has been designed to operate with a 1000 cps crossover network.

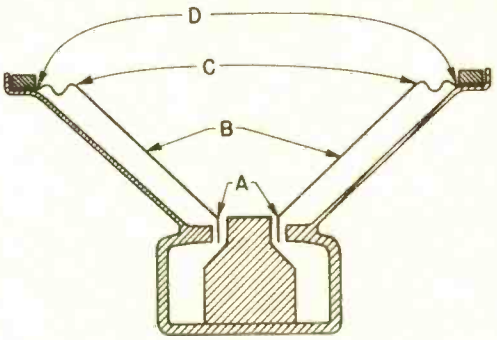
The capacitor is a dual 20 mf, 150-volt electrolytic. Simply cut off its negative lead and use the remaining two positive leads as terminals. Its effective capacity is now equal to *one half* of one section—or 10 mf.

The coil is wound on a 1½″ length of 1″ wooden dowel. The end pieces can be made of Masonite, plywood or any nonmetallic flat material. Wind 400 turns of No. 18 enameled copper wire on this form. It is not necessary that the wire be accurately layer-wound, provided that the coil form is evenly filled.

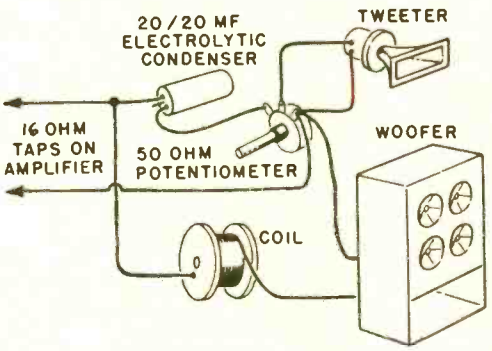
If a 2000 cps tweeter is to serve with the woofer, the coil and capacitor specifications must be changed. Use a 5 mf capacitor and a coil with 300 turns.

The "brilliance" control, needed for balancing the higher frequencies, is a 50- to 100-ohm, 2 watt wirewound potentiometer.

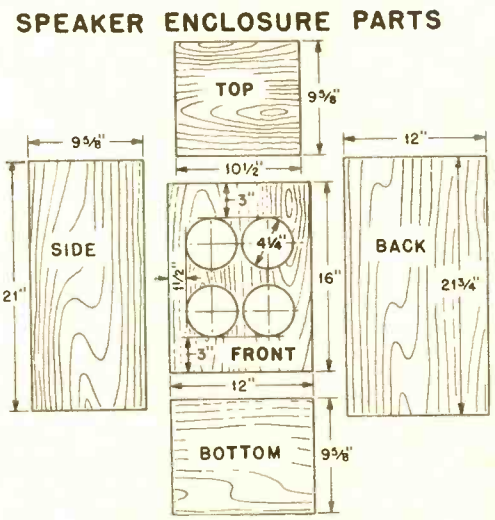
The bass power packed in this little job will amaze you. However, since the individual speakers used were rated at only 2 watts each, no more than a 10 to 15 watt amplifier should be used in driving it.



Cross section of a typical replacement type speaker. The letters refer to parts modified.



Wiring diagram showing how the tweeter and bass unit (woofer) are connected together through the homemade crossover network.



Dimensions of the various parts of the enclosure. Don't change these sizes since they have been carefully determined for 5" speakers.

EI's Hi-Fi Doctor . . . .

In answer to the many requests we have had for do-it-yourself speaker cabinet information, we have compiled a list of manufacturers publications on the subject. Many are available free, others may be obtained for a nominal charge. Write directly to the manufacturer, mentioning *Electronics Illustrated* for prompt response.

ALTEC-LANSING CORP., 161 Sixth Avenue, New York 13, N. Y. A pamphlet discussing enclosure theory; includes designs for several cabinets.

AUDAX, INC., 38-19 108th Street, Corona 68, New York. Booklet with plans for 6 enclosures, 25¢.

THE R. T. BOZAK SALES CO., P. O. Box 1166, Darien, Connecticut. Detailed drawings for 5 different infinite baffles.

ELECTRO-VOICE, INC., Buchanan, Michigan. Detailed instruction booklets for home construction of a number of the E-V enclosures. 75¢-$1.50.

GENERAL ELECTRIC COMPANY, Audio Products Section, 2200 North 22nd Street, Decatur, Illinois. Several plans for corner, bookshelf and standard "distributed port" enclosures.

GOODMANS (Rockbar Corp.), 650 Halstead Avenue, Mamaroneck, N. Y. Detailed booklet of recommended enclosures.

HARTLEY PRODUCTS CO., 521 East 162nd Street, New York 51, N. Y. Provides information on "Soundsorber" "boffles" for use with their own and other speakers.

JANSZEN (Neshaminy Electronic Corp.), Easton Road, Neshaminy, Pa. Cabinet construction data for speaker models 350 and 250.

JENSEN MANUFACTURING CO., 6601 South Laramie Avenue, Chicago 38, Ill. Complete guide to design and theory of numerous enclosures. Manual A-1060. 50¢.

JAMES B. LANSING SOUND, INC., 3249 Casitas Avenue, Los Angeles 39, Calif. Plans free, blueprints from $3-$7.50.

QUAM-NICHOLS COMPANY, Marquette Road & Prairie Avenue, Chicago 37, Ill. Catalog No. 69-9A provides enclosure plans for their speaker line.

SONOTONE CORPORATION, Elmsford, N. Y. Instruction sheets enclosed with each speaker. Also see page 77 of this issue.

STENTORIAN (Barker Sales Co.) 339 S. Broad Avenue, Ridgefield, N. J. Cabinet data leaflet to be available shortly.

STEPHENS TRUSONIC, INC., 8538 Warner Drive, Culver City, Calif. Instruction sheets and plans free. Blueprints are available @ $1.00 a set.

UNITED AUDIO PRODUCTS (WIGO) 12 West 18th Street, New York 11, N. Y. Bass reflex enclosure designs.

UNIVERSITY LOUDSPEAKERS, INC. 80 S. Kensico Avenue, White Plains, N. Y. Detailed discussion of wide range of speakers. Some drawings available.

WHARFEDALE (BRITISH INDUSTRIES CORP.), 80 Shore Road, Port Washington, N. Y. Numerous enclosure plans can be found in G. A. Briggs' book *Loudspeakers*. $4.50.

and Clinic

Hi-fi questions are all answered by mail. If of general interest they will appear in this column.

FM Drift

After my FM radio is turned on for a while, the signal begins to fade away. Then when I retune it, it remains at good level for several minutes, then fades again. After this is repeated several times, the radio stabilizes. Why does this happen? What is the remedy?

Henry Dziardziel
Lima, Ohio

This is a rather common effect and is almost always due to temperature drift of the local superheterodyne oscillator. In most FM tuners, a pentagrid converter is used as a mixer-oscillator to beat with the incoming radio-frequency signal so that an intermediate frequency (IF) is produced. If the oscillator section of this tube does not maintain constant frequency, the IF frequency slowly changes and the strength of the signal decreases. In most cases, slow frequency drift is due to the temperature changes that follow the warm-up period of the receiver.

Replacing the converter tube with a new one may help. The drift may be due to poor tuner design; well-built tuners use temperature compensating capacitors and/or Automatic Frequency Control (AFC) circuits.

Loudspeaker Books

Can you suggest some books which will give me the facts on loudspeakers and loudspeaker enclosures?

George Wright
New York, N. Y.

We can heartily recommend the following four books as presenting a down-to-earth, understandable approach to the subject; *Sound Reproduction*. Third Edition, by G. A. Briggs, published by Wharfedale Speakers, British Industries Corp., Port Washington, N. Y. 368 pages, $3.50. *Handbook of Sound Reproduction*, by Edgar M. Villchur. Published by Radio Magazines, Inc., Mineola, N. Y., 218 pages, $6.50. *Loudspeakers*. Fifth Edition, by G. A Briggs, published by Wharfedale Speakers, British Industries Corp, Port Washington, N. Y., 336 pages, $4.50. *Hi-Fi Loudspeakers and Enclosures*, by Abraham B. Cohen. Published by John F. Rider, New York, N. Y., 368 pages, $4.51. These publications are available at most large electronic supply houses, libraries, or technical book stores. You may also write to the publishers.

Faulty Output Tubes

Recently the elements in one of the output tubes (EL 34's) in my 60 watt amplifier started glowing bright red. I had the tubes checked and they appeared to be all right. What do you think is the trouble?

John Robertson
Tacoma, Washington

Although your tubes checked out okay with a tube checker, one or both may still be at fault. First check your bias setting and balance control (if present). Then interchange the tubes and see if the same tube glows in the other socket. If this is the case, it would indicate that the tube is at fault and should be replaced—it is preferable to replace both tubes with a matched pair. However, if the "good" tube glows in the bad tube's socket, a component connected to the tube socket causing the trouble, may be faulty. My guess is a leaky coupling capacitor. This can be checked simply by clipping the capacitor out of the circuit and replacing it with a new one of the same value.

If you have an amplifier with a separate balance control and the tubes balance only with the control all the way over to one side or the other, a leaky coupling capacitor may be the trouble-maker here also.

Nassau CB Club members get pointers on assembly of a transceiver kit. Club has lab facilities available to all members.

The club's membership card. With over 100 members, club is fully organized, aims at getting permanent headquarters.

A Citizens-Band Club

Board of Directors, left to right: Ed Weingart, Sr., 2W4119, Ed Weingart, Jr., 2W5009, Don Lehr, 2W3911, Stan Gorecki, 2W2582, Paul Price, 2W3768. Members represent a gamut of occupations.

Best use of equipment, order out of chaos result when Citizens Banders form local organization. By Dohn Lehr, 2W3911

THE lone Citizens Band licensee often has a hard row to hoe in making the most effective use of his license and equipment. He has technical problems, and he has to keep up with new FCC regulations and apparent changes in policy. (Often there was no change—the thing he is doing wrong was always wrong! Somewhere he missed the point of Citizens Band operation.) Since so many Citizens Banders are not technically inclined, they are apt to be at a loss when it comes to installing equipment, or dealing with malfunctions.

The answer to this is, of course, a local Citizens Band club. Once a group of local Citizens Banders get to know each other, they can work together to get the most out of Citizens Band's possibilities. Newcomers to CB, coming into contact with experienced people, learn quickly what it is all about, what they may and may not do (Citizens Band is definitely NOT a "no-license-exam" amateur band!), how to install, use, and understand their equipment, and how to get maximum use for their investment.

The Nassau CB Club (Nassau County, N. Y.) has been in existence little over a year, but it has well over a hundred active members, with a good number of prospective members attending each meeting. It even has a Ladies' Auxiliary which holds its own monthly meetings. It has a legal adviser (a member who is an attorney). Within months after its formation, the Nassau CB Club was testing prototype units for equipment manufacturers, and manufacturers were also paying attention to complaints about equipment relayed through the Club.

The Club also boasts licensed [*Continued on page* 113]

The author, a professional news photographer, gets assignments quickly on mobile CB set.

Mrs. Lehr at conveniently placed home station. Standby receiver, right, has many good uses.

Are You Destroying Transistors?

By Robert Tomer

CBS Electronics

Part 1

WHEN transistors were first announced, one of their outstanding characteristics was said to be their unusually long life. They were hailed as the successor to the vacuum tube and the end of all that was unreliable in electronics. Yet, twelve years after their invention, there are still quite a few vacuum tubes in service and new ones are appearing almost every day. The question naturally arises—"How come?"

To begin with, it is essential to realize that while the transistor may be much more rugged in many respects than the vacuum tube, it has its own set of weaknesses and these must be respected. Transistors are mechanically much tougher than vacuum tubes. You can drop them on a concrete floor and do them no damage whatsoever. And since they have no heater to burn out; repeated cycling "on" and "off" has little or no effect on their life span.

Transistors Have Weaknesses

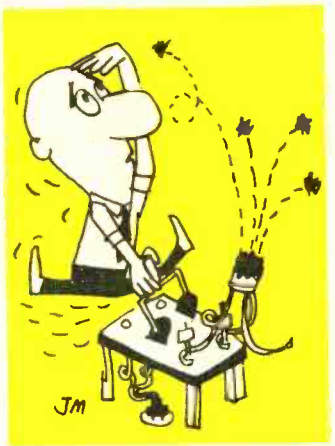
But, as we said before, transistors have their own special weaknesses. These are primarily sensitivity to heat and voltage.

Transistors all have maximum voltage ratings in addition to maximum current and wattage ratings. Of these, the voltage rating is the most critical because it must never be exceeded even for an instant. Failure to observe this rule will cause transistors to short circuit and become permanently damaged. They are much like electrolytic capacitors in this respect. They have great strength and endurance up to their voltage rating. However, exceed the maximum rating by even a small amount and a puncturing of the dielectric will occur, ruining the device.

Transistors have no physical space be-

tween their elements, as have vacuum tubes. The two metal alloys, of which the sandwich is made, are in contact with one another. Only a molecular layer separates the two conducting electrodes. This insulator or dielectric has a critical breakdown voltage. As soon as that is exceeded, the metals become one solid conducting element—a short circuit.

Exceeding the current ratings will also destroy a transistor, but usually not as quickly, unless the excess current is several times the rating. This is because it is not the current itself which damages the transistor, it is the product of this current and the internal resistance of the transistor which produces heat. It takes time to raise the temperature of the transistor element to the point where damage is sustained. It may take seconds, or it may take minutes, depending upon the degree of overload.



The heat which results from the normal collector current must be conducted away and radiated into the surrounding air, if the transistor is to operate reliably. When the collector current develops heat at a rate faster than it can be conducted away, the collector temperature will rise. This rise in temperature affects the collector resistance and its leakage current. As the collector becomes hotter, its resistance to the flow of current in the reverse direction decreases. This leakage current goes to the base element where it adds to the base current and acts much the same as reducing the bias of a vacuum tube—the collector dissipation increases still further. This becomes additive and will cause *runaway* and eventual destruction of the transistor.

Damage May Be Accidental

Now that we know the sort of thing that transistors can't take, let's see how some of these conditions might develop in improperly functioning equipment, or in experimentation.

It is a good idea *never* to remove transistors from the circuit while it is functioning or while power is turned on. The reason behind this rule is quite simple. Since the order in which the elements become disconnected when removed from a socket is largely chance, a momentary voltage may appear across the two remaining leads as a result of having interrupted one of the elements. This voltage may be enough to destroy the transistor instantly. Of course the damage won't occur every time, but it's sensible not to take chances.

Another good rule to practice is never to make resistance measurements within the set while the transistors are still in their sockets. Ohmmeters contain batteries or power supplies, and the voltage provided by these sources may exceed the ratings of the transistors and destroy them in their sockets. If that doesn't happen, the chances are you will get confusing readings because the battery will probably cause the transistors to become activated. If possible, remove all transistors before making circuit resistance measurements.

Don't Operate Without Load

A precaution that applies especially to hybrid auto radios is never to operate the set with its loudspeaker load disconnected. When a set is removed from the car, the loudspeaker quite often remains in the car. With the set on the bench, connect a similar loudspeaker to the output terminals, or use a resistor. If the set is operated without a load, very high AC voltage may develop across the output transformer and these voltages may be sufficient to cause a short circuit to develop between the collector and base of the transistor.

Speaking of hybrid auto radios, never operate the power transistor unless it is firmly bolted to its heat "sink." The heat sink is usually made of aluminum and is generally on the outside of the main chassis. This is really a radiator. It serves the same purpose as cooling fins on an air-cooled motor, or as the radiator in a liquid cooled engine. Just as we would never operate either of these engines without their radiator, so we must never operate a power transistor without its heat sink. Overheating and permanent damage will result if this rule is not observed.

Be Careful When Soldering

If it becomes necessary to remove transistors which are soldered into the circuit, use extreme caution not to overheat leads. Grip the lead with a pair of pliers where it enters the transistor's case and then use as little heat as possible. Work quickly and carefully when soldering or unsoldering. The reason obviously is to prevent the heat from traveling up the wire to the transistor element where it could do permanent damage. The same warning applies to diodes.

Servicing Techniques

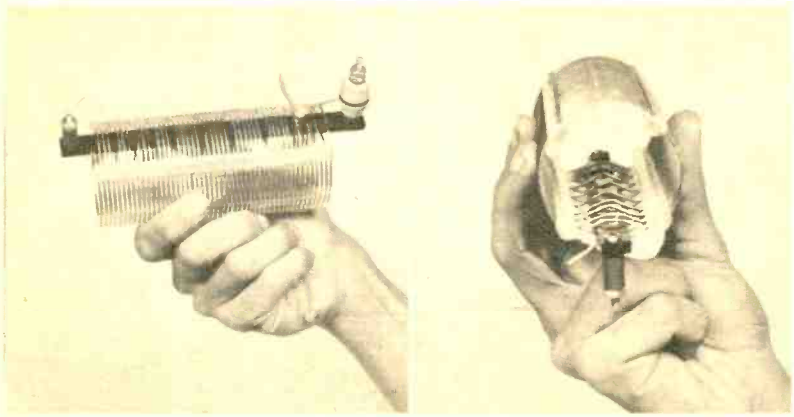
Most standard servicing techniques work just as well with transistor equipment as they have always done with vacuum tube equipment. There is one trick we have to teach ourselves *not to do*, however. That is the one where we poke around in the wiring with a small screwdriver and short grids and plates to ground to note the sound in the speaker. If you short the collector of a transistor to ground, you run the risk of placing the entire collector voltage across the input diode and this may destroy the transistor at once. You will also find that you cannot use your finger, even though it is not "grounded," to produce hum in the audio system as occurs when you touch the grid of an audio tube. This is because the equivalent circuits in transistor equipment have too low an impedance to readily pick up noise. You will have to rely upon either a low impedance source of AC such as a filament transformer, or more appropriately, an audio generator.

[*Continued next month*]

Air-Wound Coil Mounting

MOUNTING space-wound air coils can be easy if you use the right technique. First insert a cardboard mailing tube with a diameter about ½" smaller than the inside diameter of the coil. Then starting at the approximate center of the winding, push one of the turns down against this temporary "bumper" with a small screwdriver. If it's a short coil (under 3"), push down every other turn; if more than 3" long, every 3 to 5 turns is adequate.

Next, remove the temporary "bumper" and insert a ½" wide, ⅛" thick strip of plastic, Bakelite, Formica or similar insulating material, through the humps as shown. It should protrude ½" or ⅝" beyond the winding at each end. Drill both ends of the strip and mount to the chassis as you choose.



If you are going to solder taps along the coil, push down a support wire on each side of the turn you intend to tap.

—Howard Pyle W7OE

Electrical Parts for Projects

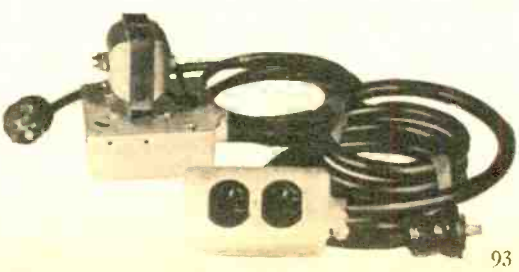
MANY electronics experimenters are prone to overlook electrical suppliers as a source of construction materials. You'll find there is a very wide range of boxes, fittings and connectors available to meet the varied needs of the trade.

The large transformer assembly shown is a convenient voltage source. A 4" square surface-mount electrical outlet box serves as the chassis with the transformer mounted on its blank cover plate. The AC line cord is secured by ½" non-metallic cable box connector. All of these items are readily available at a total cost of about fifty cents.

The second unit shown, provides a safe, convenient means of mounting a bell transformer.

These and other items of electrical hardware can result in a substantial reduction in the haywire which is all too often a part of experimental projects.

—Roy E. Pafenberg



Underwater DX

The "Silent World" isn't so silent. You can log and verify elusive signals from "liquid space."

By C. M. Stanbury II

The atomic submarine "Triton." Inset, author's pre-typed QSL signed by one of the Triton's radiomen. Subs are rare sport but not hard for good hunter.

CHANCES are, your first DX targets were on the surface of the Earth: broadcast stations, or maybe amateurs. Later, if you moved into the utilities, you probably began tracking aircraft, anywhere from 1 to 12 miles above the Earth's surface. Then in October 1957, with the launching of Sputnik I, DX literally reached even greater heights. A few listeners even monitored Lunik signals in the vicinity of the moon.

But how far *down* have you gone?

That's right, have you logged and verified DX below the earth's surface? Or more specifically, under the surface of the ocean? We are of course referring to submarines. It may surprise you but reception is not difficult if you know where to listen and for what. Further, though all submarines are military, most will verify.

The U. S. Navy has a multitude of channels but only a few will produce underwater loggings. More than half of all USN channels are for CW use and unless the DXer can read code, must be scratched off immediately. Next, many voice channels fall into

the tactical category. There is absolutely nothing to stop you from listening, but all identifications are in code ("Streamer," "Wide-awake," etc.) and just to make sure, the Navy periodically alters them. Finally, a number of the remaining frequencies are point-to-point circuits, for communication between fixed shore stations. Likely short-wave channels are at or near 4250, 4280, 5123, 8506, 8578, 8985, and 12,870 kc, all CW.

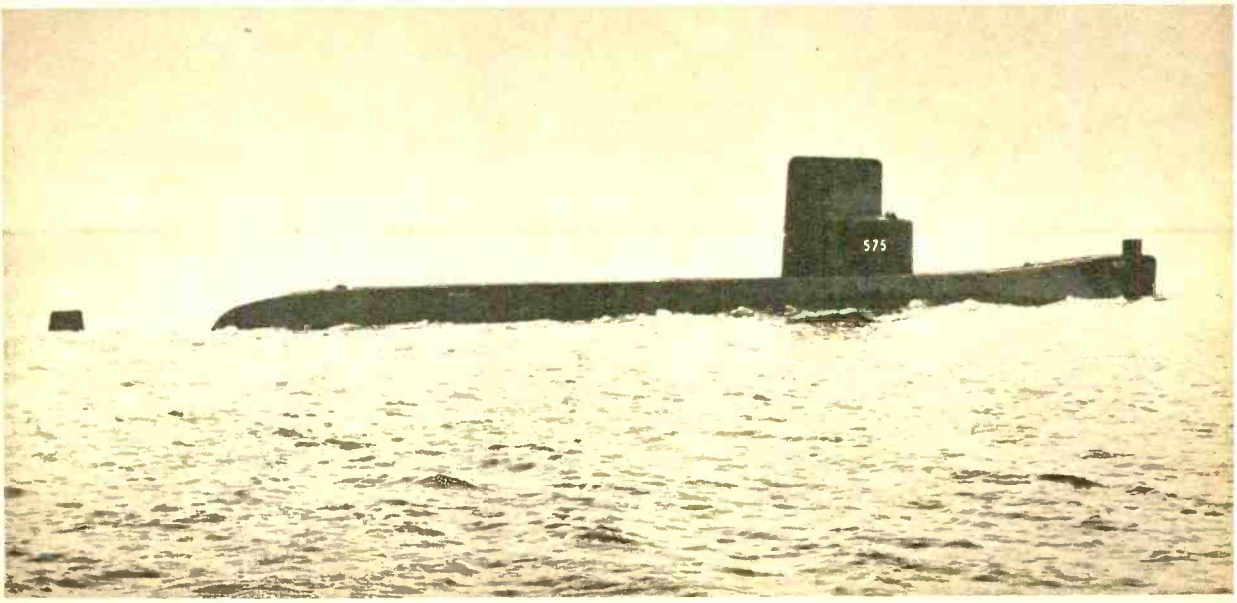
What's left? Principally 2716 kc. This is for short range ship-to-shore contacts. But don't let that "short range" fool you. DX listeners can regularly hear ships and shore stations a thousand miles away.

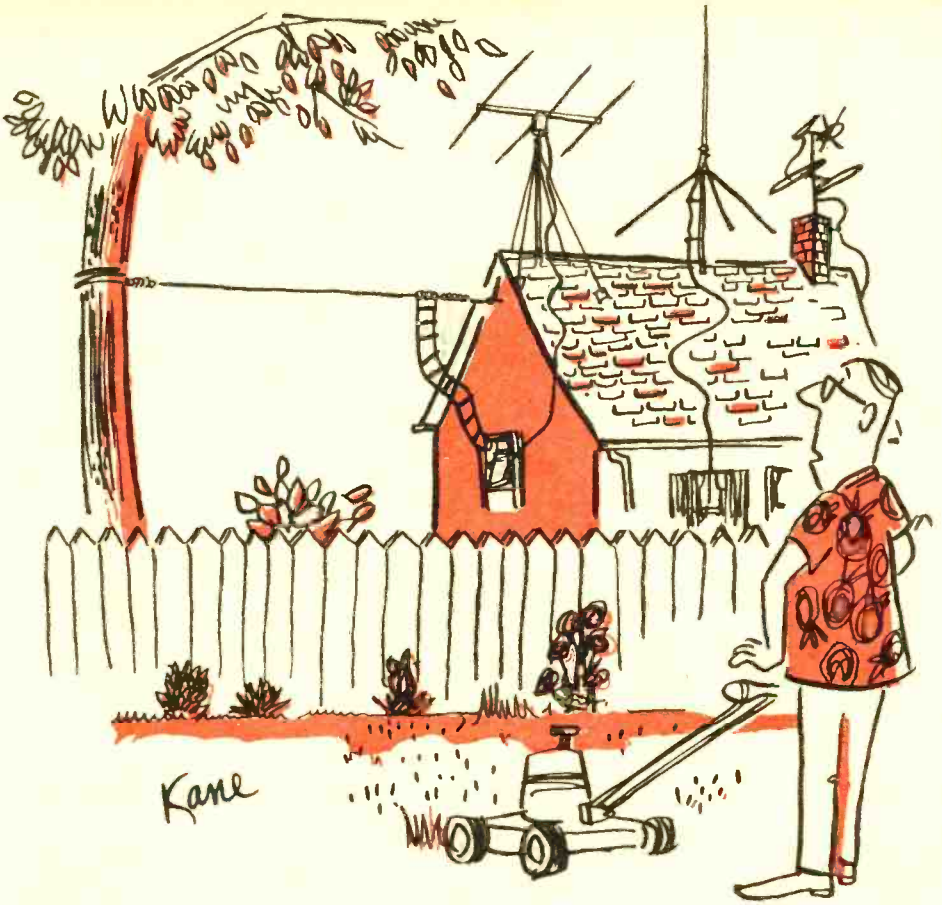
As 2716 kc is actually a medium wave frequency (below 3000 kc), darkness will be the DX period almost exclusively. Within 300 miles of the coast one may start listening at sunset (except during summer). Further inland, things will open up a little later. The only interference on the channel will be Spanish-speaking vessels in the Central American seas. 2708 kc has military radioteletype and 2724 the Texas Civil Defense Network. While these may also provide minor interference, they come in handy when tuning onto 2716.

A second possibility is 2285 kc (approximate). However, this is primarily a ship-to-ship channel and for reasons we'll explain in just a moment, such an operation makes underwater DX more difficult to spot.

This brings up an unavoidable question: how do you know when a signal is coming from a sub? On non-tactical voice channels, vessels identify by name. Thus you can't miss such famous atomic subs as the *Triton*, which recently completed a record breaking 40,000 mile around-the-world cruise, submerged the entire time. Or the *Sea Wolf*, record [*Continued on page* 112]

The "Sea Wolf," world's second atomic sub, also a DX target. Non-atomic subs may also be heard on voice and CW channels working submarine bases.





have you a

HAM for a Neighbor?

Mysterious, isn't he? Is he a menace? Should you move? Call out the FCC? What's going to happen?

By Bill Walker, K2RUK

. . . he strung a wire to the big elm. . . .

WHEN your new neighbor was moving in your wife peeked from behind the blinds and commented that their furniture was rather nice but they sure had a lot of radios. The house already had a television antenna on the roof, but to your amazement the new neighbor spent all of his first weekend putting up another antenna—similar to the TV antenna but higher and wider.

And then, wonder of wonders, he strung a wire from the garage to the

[*Continued on page* 100]

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FROM HEATH...
MORE NEW HOBBY KITS!

AD-10 $33.95

STEREO RECORD PLAYER KIT (AD-10)

Made by famous Garrard of England to superb specifications. "Plug-in" cartridge feature. Rubber matted heavy turntable is shock-mounted, and idler wheels retract when turned off to prevent flat spots. Powered by a line-filtered, four-pole induction motor at 16, 33⅓, 45 and 78 rpm. Supplied with Sonotone STA4-SD ceramic stereo turnover cartridge with .7 mil diamond and 3 mil sapphire styli. Assembles in minutes; mechanism and vinyl covered mounting base pre-assembled, arm pre-wired. With 12" record on table, requires approximately 15" W. x 13" D. x 6" H. Color styled in cocoa brown and beige. 10 lbs.

Mechanism Only: Less cartridge, base and cables. Model AD-30, 8 lbs., ... **$22.95**

AA-50 $79.95

HI-FI RATED 25/25 WATT STEREO AMPLIFIER-PREAMPLIFIER KIT (AA-50)

A complete 25/25 watt stereo power and control center (50 watts mono) . . . 5 switch-selected inputs for each channel . . . new mixed center speaker output . . . stereo reverse and balance controls . . . special channel separation control . . . separate tone controls for each channel with ganged volume controls . . . all of these deluxe features in a single, compact and handsomely styled unit! Five inputs for each 25 watt channel are provided: stereo channel for magnetic phono cartridge (RIAA equalized); tape head input; three high level auxiliary inputs for tuners, TV, etc. There is also an input for monophonic magnetic phono cartridge, so switched that monophonic records can be played through either or both amplifiers. The automatically mixed center speaker output lets you fill in the "hole-in-the-middle" found in some stereo recordings, or add extra monophonic speakers in other locations. Nearly all of the components are mounted on two circuit boards, simplifying assembly and minimizing possibility of wiring errors. Handsome cabinet features new "visor" effect, with vinyl-clad steel cover in black leather-like texture with gold design. 30 lbs.

AA-20 $34.95

AA-30 $45.95

ECONOMY PREAMPLIFIER KIT (AA-20)

Although these two new Heathkit models are designed as companion pieces, either one can be used with your present stereo system. The preamplifier (AA-20) features 4 inputs in each stereo channel (RIAA "mag" phono, "xtal" phono, and two auxiliary inputs). A six-position function selector switch gives you instant selection of "Amplifier A" or "Amplifier B" for single channel monophonic; "Monophonic A" or "Monophonic B" for dual channel monophonic using both amplifiers and either preamplifier: "Stereo" and "Stereo Reverse". Self-powered. (AA-20) 8 lbs.

HI-FI RATED 14/14 WATT BASIC STEREO AMPLIFIER KIT (AA-30)

Two 14-watt high fidelity amplifiers, one for each stereo channel, are packaged in the single, compact, handsomely styled amplifier (AA-30). Suitable for use with any stereo preamplifier or with a pair of monophonic preamplifiers, it features individual channel gain controls, speaker phase reversal switch and convenient pilot light. Output accommodates 4, 8 and 16 ohm speakers. Handsome satin black expanded-metal cover, gold colored chassis. (AA-30) 21 lbs.

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first of a series designed to teach the fundamentals of electronics . . .

EK-1
$19.95

EDUCATIONAL KIT (EK-1)

Youngsters and oldsters alike will find this kit a priceless introduction into the wonderful world of electronics. Now, at less than the cost of several standard textbooks on the subject, Heath offers a complete basic electricity course, resulting in a finished test instrument of a thousand and one uses. The EK-1 is a combination kit and text-workbook designed to teach the principles of voltage, current, and resistance —the basic "yardsticks" of electronics to students of junior high level. Adults also will find the project beneficial as a beginning or refresher course in electronics. When finished with the project the student will have learned the theory and construction of direct current series and parallel circuits, voltmeter, ammeter and ohmmeter circuits and the application of ohms law to these circuits. The completed meter will then be used to verify ohms law and the maximum power transfer theorem, one of the most important theorems in electronics. The finished kit, a practical volt-ohm-milliammeter, may be used to make measurements of voltage, current and resistance in a wide variety of applications.

Procedures for checking home appliances and automobile circuits are included with the kit. The EK-1 will serve as a prerequisite to following Heathkit Educational Kits. Get started NOW in this new and exciting series. 4 lbs.

XR-2P
$29.95
(6 lbs.)

XR-2L
$34.95
(7 lbs.)

6-TRANSISTOR PORTABLE RADIO KIT (XR-2 series)

Dependable portable entertainment wherever you are —wherever you go! Choose the gleaming, two-tone molded plastic model or the handsome simulated leather-and-plastic combination—both feature a gracefully curved grille in smart beige plastic. The XR-2P complements the handsome grille with a mocha colored case of high-impact plastic, while the XR-2L encases the grille in sun tan color Sur-o-Lon simulated leather. Vernier tuning control gives you smooth, precise station selection. Six Texas Instrument transistors are used for quality performance and long life; a large 4" x 6" PM speaker provides "big set" richness of tone. Ready to play after simple assembly—transformers prealigned. Six flashlight batteries used for power (500-1000 hrs.) (batteries not included).

HW-19 (10 meter)
HW-29 (6 meter)
$39.95

10 & 6 METER TRANSCEIVER KITS

Complete ham facilities at low cost! Ideal for beginning and veteran hams for "local" net operations. Transmitter and receiver are combined in one easy-to-use instrument. Features neat, modern styling, press-to-talk transmit/receive switch, built-in AC power supply, variable gain control and built-in amplifier metering jack. Operates mobile using vibrator power supply. Microphone and two power cables included. Styled in mocha and beige. Less crystal. 10 lbs.

Vibrator Power Supplies: VP-1-6 (6v.), VP-1-12 (12v.). 4 lbs. kit; $8.95 ea., Wired; $12.95 ea.

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*The convenience of Local Heathkit Sales and Service costs but a few dollars more.

big elm. A queer sort of wire ladder dropped into the house from the middle of it.

"What the devil," you thought. "This guy must have a really old radio if he needs that kind of an antenna for reception."

Sunday night it happened. Your daughter was up in her bedroom playing records. She came running downstairs saying something was crazy because she could hear a pool room on her record player and one of the players kept repeating; "See cue ten. See cue ten." You smirked and wondered what this generation was coming to.

. . . you check your television. . . .

A little later your wife came in from the kitchen complaining that the little shelf radio had the same man's voice all over the dial and he seemed to be talking to a soldier in Alaska.

It hits you like a ton of bricks. This new neighbor must be a ham radio operator!

One of the fellows at the office lives near a ham and is forever complaining about all the interference on his radio and television. Will you put up with one in your neighborhood? Certainly not. Nosiree. NO!

You start to see red and build up a

. . . he looks like everyone else. . . .

splendid mad. You must keep calm, and put the ham next door to the ultimate test. You turn on the television and watch impatiently for wavy lines.

Nothing. Your television is beautiful. You dash to the kitchen and turn on the little AC-DC radio.

Nothing.

Hah. Must be the ham is not transmitting right now. He's listening to the fellow in Alaska. You wait restlessly.

Sure enough. In a few minutes back he comes on your radio; "OK KL7AA in Anchorage. Hang right on and I'll connect you with your father here in town by telephone . . . Mr. Schmidt, here is your son in Alaska via short wave radio . . ."

You are taken aback. You know Joe Schmidt. What a thrill it must be for him to talk with this boy who has been in Alaska for two years with the Air Force.

But sentiment be doggonned. You rush into your living room and look at your television. [*Continued on page* 102]

. . . his wife—what a shock! She's wired! . . .

It's up to you! The Army's new "Choose-it-Yourself" System lets you pick valuable training before you enlist. Here's how it works: **1. Choose** before enlistment. Choose your training from fields like Auto Mechanics, Missiles, Aircraft Maintenance, Meteorology, Surveying—and many more. **2. Qualify** before enlistment. Take aptitude and physical exams to qualify for the training you've chosen. **3. Know** before enlistment. If you qualify, you know you'll get the training you want. Your choice is written into your future Army record—guaranteed before you enlist. **Choose, qualify, know—this week!** Ask your Army recruiter to show you his complete list of available training fields.

Want training in Auto Mechanics? Construction? Electronics?

choose-it-yourself

before enlistment

Auto Mechanic and Instructor

CHOOSE IT YOURSELF VOCATIONAL TRAINING SYSTEM

US ARMY

Beautiful! Not a line or wave or anything that shouldn't be there. You know the ham is transmitting because you recognize Joe Schmidt's voice from the kitchen radio. Your anger subsides.

Your wife and daughter are not angry either—on the contrary. They are shiny-eyed listening to Mr. and Mrs. Schmidt talk with their boy. Your daughter says, "We ought to have a short wave radio, Daddy, so we can hear both sides . . ."

The next morning when your neighbor leaves for work you note that he carries a brief case and looks like everyone else in suburbia. You grin to yourself. You didn't really expect to see horns, but an antenna on his hat would not have surprised you.

Early that evening he's on the little radio again. This time he is relaying a message to a college student several hundred miles away. You listen with growing interest. Janie will be away at school next year and this guy could save you money in telephone calls.

Your wife and daughter are entreating, "Why don't you call on our new neighbor? Don't you believe in being neighborly?" And finally they admit; "We want to see his ham radio contraption."

So over you go and ring his doorbell.

His wife answers. What a shock. She's wired! You look closer and it turns out to be a hearing aid. You explain that you are the man who lives next door, come to say hello. She is very glad to meet you and summons the man of the house. He's wired too, but it's only earphones hanging around his neck.

After formalities and pleasantries you are finally ushered into "the room." Even worse than you thought. Electrical boxes all over the place; certificates all over the walls. When your new friend explains them they make sense.

". . . And I sit in on a state-wide 'phone net almost every night," he says. "We send messages to other nets all over the country. Let me know when you have any non-commercial messages to go anyplace. I'll be glad to send them."

Your enthusiasm has been building up and you catch yourself saying, "What a wonderful hobby . . . Almost a way of life."

"This is the emergency power supply," your new friend is saying. "When I pull the starter rope this gasoline motor starts generating and I'm back in business."

"What do you mean, 'back in business'?"

"Well, in case of any kind of an interruption to the local electrical supply—an interruption which might be caused by a lightning storm, a wind or ice storm, an earthquake, or even an enemy attack—I'll have power. We hams are usually part of the Civil Defense organization and we have our own C. D. frequencies to carry emergency messages. We're always practicing. It is known as Radio Amateur Civil Emergency Service. RACES for short. Many of us also belong to the Military Affiliate Radio Service. MARS network we call it, to carry messages for the armed forces. There is also AREC, Amateur Radio Emergency Corps . . ."

Finally you say, "What about interference to my radio and TV set?"

"I won't interfere unless your set is not well-engineered. You said you heard me on your AC-DC radio. That's not unusual because they don't have too much selectivity. But if you hear me spilling in on your big radio let me know. We don't cause all of the interference but a lot of it is blamed on us. Come on, let's give the band a whirl."

He sets a couple of knobs on the receiver and transmitter and speaks into the microphone. In a few minutes he makes a contact in a far city. You are all fascinated.

"I have a guest in the shack," he is saying—and you suddenly find yourself speaking into the mike. Then your wife and daughter timidly mumble a few words into it.

What a thrill when the distant voice comes back loud and clear, calling you by name and saying how glad he is to meet you!

When you finally leave you can't help but think, "And for a minute I thought it would be a pain in the neck to have a ham for a neighbor—wonder what you have to do to get a license."

The Boom In FM Listening

Continued from page 32

taken to provide high-quality "compatible" reception of all the music.

With its heart at WBCN in Boston, the Concert Network also blankets the Northeast with good music, adult programming, and interesting fare, using a string of FM stations whose call letters usually end in "CN."

The famous Pacifica Foundation has pushed the FM-network idea to its farthest frontier: a coast-to-coast network. The key station, KPFA in San Francisco has an effective radiated power of 75 kilowatts (10,000 watts actual transmitter power, on a par with WQXR-FM and others) and is the equivalent of an AM network key in power and coverage. Pacifica's New York outlet is WBAI, mentioned before, and the off-beat, adult-centered programming is typical of the network.

The FM idea has come full circle. Whereas FM stations were once passive repeaters of their owners' AM programming, WPAT in New York puts on provocative FM-type programming on its AM outlet!

FM's new found success is, in most cases, based on this simple formula: 1) forget about the mass audience that has so long dominated radio and television; 2) pick a *special interest* audience; and 3) zero in on it. The result in most cases is a bulls-eye. Thus, while FM audiences may not be the largest, they are frequently the most enthusiastic. R. David Kimble, a senior account executive at Grey Advertising Agency, calls the new approach "*narrow*casting," instead of "*broad*casting."

FM is enjoying the first signs of prosperity in its 27-year history. It has always been radio's "problem child" ever since the brilliant radio pioneer, Major Edwin H. Armstrong, invented it in 1933. Armstrong had trouble promoting FM. It got nowhere until just before World War II. Finally, in 1941, the FCC authorized commercial FM broadcasting. But before more than a handful of stations could be on the air, the War came along and stopped all new construction. Immediately after the War, just as FM was ready to expand, the FCC switched all commercial FM operations from the 50-55 mc band to the 88-108 mc band. In one stroke, every piece of receiving and transmitting equipment in the country was obsolete.

Slowly, manufacturers developed hardware to operate in the new band. Then, just as FM was getting a new start, TV swept the country and FM went down, it seemed to many, for the count.

Through the late 1940's and early '50's, stations all over the country turned off their FM transmitters and surrendered their licenses. Some kept them but "duplicated," that is, they broadcast the same program on FM that was going out over AM. By 1955, interest was so low that only one manufacturer, Zenith, was still making receivers regularly and in quantity. According to most people in the business, FM was dead.

Just as hope was almost gone, along came the hi-fi boom. Those interested in good sound began listening to FM. Even if the same program was being broadcast, it sounded better on FM. Any FM station can easily broadcast a signal flat to 15,000 cps, an accomplishment difficult, if not impossible, with AM. Unlike AM listening, there is no bothersome interference or noise: FM is static-free. It has a wider dynamic range: soft sounds can really whisper without "going into the mud," while loud passages can roar and shriek without distorting.

Soon the broadcasters began to be aware of the new FM listenership as set sales soared. A few of the progressive ones stopped duplicating the tired AM fare and began to program especially for discriminating listeners. With a growing audience they were able to sell FM time separately instead of just throwing it in as a bonus to AM advertisers.

About this time, people were beginning to get fed up with "The Top 40" and similar programming that had turned most of AM radio into one gigantic monotonous juke box. The word got around that there was a new, better kind of programming on FM, and the boom was on in earnest.

Only one thing more was needed—a low priced receiver. And it was supplied by a brash young newcomer to the field, Granco, Inc., which had originally specialized in converters for UHF-TV. Granco put on the market a complete receiver selling for under $30, less than half the cost of the cheapest competing model, and soon captured 40% of the FM receiver market, competing with such giants as Westinghouse, General Electric, Emerson, and Zenith. Since then other firms have produced inexpensive sets.

Industry-wide sales have soared ever since. Production jumped from about 200,000 to this year's estimated 2,000,000—a one thousand percent increase in five

[*Continued on page* 106]

NEW! LAFAYETTE HE-15A 2-WAY SUPERHET CITIZENS BAND TRANSCEIVER!

57.50

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- **5 Crystal Controlled Transmitting Positions:** Operates at a maximum FCC legal power input of 5 watts fully modulated.
- **Superheterodyne Tuneable Receiver Over Full 23 Channel Band:** RF stage in both Transmitter and receiver, 3 watts audio output plus large 4" speaker.
- **Complete with Transmitting Crystal:** Removable front plate for easy accessibility of crystals. Channel 9 crystal supplied.
- **4 Dual Function Tubes, plus 2 Single Function Tubes, plus 2 Rectifiers for 12 Tube Performance:** Compares with units costing 3 times as much. Unexcelled reception on land and sea with coverage up to 20 or more miles depending on antenna height and terrain.
- **Planetary Vernier Tuning:** Controls include 3 position function switch (transmit, receive, plus transmit with spring return) and effective Full-Wave Variable Noise Limiter.
- **High Output Crystal Microphone:** 2 position push to talk slide switch plus 5-prong microphone jack makes conversion to a push-to-talk relay a cinch.
- **Adapts for use Anywhere:** Modern compact styling. Brackets are supplied for easy mounting of unit in auto, truck or boat. Addition of 6 or 12 volt power supply (separately supplied) adapts transceiver for mobile operation. Only 10¾Wx6⅞Dx5⅞"H. Shpg. wt., 11 lbs.

Anyone Can Operate: No examination or technical knowledge required — Any citizen 18 years or older is eligible for a license. Simply fill out FCC application supplied with HE-15A Transceiver.

HE-15A Factory Wired and Tested (less antenna) 5.00 Down	Net **57.50**
HE-19 Whip Antenna	Net **3.95**
HE-16 Power Supply for 12 Volts	Net **10.95**
HE-18 Power Supply for 6 Volts	Net **10.95**

SENSATIONAL LAFAYETTE CITIZEN BAND MOBILE ANTENNA

6.95

Includes—

- CHROME SWIVEL BASE
- STAINLESS STEEL SPRING
- 102½" STAINLESS STEEL WHIP FOR OPTIMUM 11 METER PERFORMANCE

THE SCOOP BUY FOR CITIZENS BAND MOBILES

Chrome swivel ball mount base designed to be mounted on any surface. Stainless steel spring holds rod in properly adjusted position and prevents rod damage from shocks and blows. Stainless steel whip for maximum resiliency and strength. Shpg. wt., 4 lbs.

HE-800WX ..... Net **6.95**

NEW! LAFAYETTE TELESCOPIC CITIZENS BAND WHIP ANTENNA

3.95

- Chrome Plated
- Telescopes From 16½ to 40"
- Mounts Vertically or Right Angle

An outstanding antenna value. This high quality three section telescoping antenna is designed for attachment directly to your citizens band transceiver. Ideal for point to point service over short distances. Molded base loading coil has a threaded stud with a PL-259 plug-connector for vertical or right angle mounting. Shpg. wt., 1 lb.

HE-19 ..... Net **3.95**

10,000 OHMS PER VOLT MULTITESTER

NEW! **9.95**

Outperforms Instruments Many Times Its Size

- Extra Large 3½" Meter Face
- Completely Wired and Tested
- All Accessories Included

Convenient pocket size with single range selector switch. First capacity range requires 120V AC, second range requires 6V AC. Durable Bakelite case and panel. Complete with leads and battery. 4½x3½x1⅛". Shpg. wt., 1½ lbs.

TE-10 ..... Net **9.95**

TE-14 Pigskin Carrying Case, Shpg. wt., 8 oz. ..... Net **1.95**

NEW! LAFAYETTE RADIO FIELD INDICATOR

- Provides a Continuous Indication of Transmitter Output
- Rugged 200ua Meter Movement with Variable Sensitivity Control
- Requires No Electricity, Batteries or Transmitter Connection

7.95

Measures the RF field generated by any marine, mobile or fixed transmitter. Rear phone jack accepts earphones. Antenna extends from 3¼" to 10¾". Bottom plate magnet allows mounting on any metal surface. Measures 3⅛Wx2¼Hx2"D (less antenna). Shpg. wt., 2 lbs.

TM-14 ..... Net **7.95**

PLEASE INCLUDE SHIPPING CHARGES WITH ORDER

LAFAYETTE RADIO

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Continued from page 103

years. Some industry sources predict that 4,000,000 sets will be sold per year by 1963. There are already 15,000,000 sets in American homes.

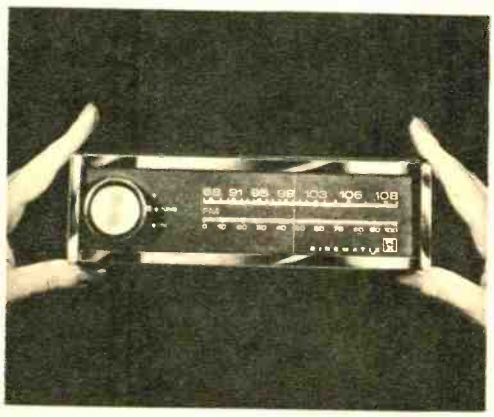
New stations are going on the air at the rate of better than one a week. At the beginning of 1956, 540 stations were on the air. As of August 1, 745 were on the air (including those broadcasting under construction permits); another 181 were being built. In all, 926 FM stations are now authorized.

Whether or not FM forces AM out of the picture, it is a cinch that the main part of its growth is yet to come. Multiplex stereo will kick off the next growth cycle.

Until now, stereophonic broadcasting has required two separate transmitters, sending one signal on FM, the other on AM. To hear the program in stereo, you tune in on both AM and FM radios. (A recent survey showed that at least 186 stations are broadcasting AM-FM stereo now; another 326 are planning to start soon.) The new system—multiplexing—will allow *both* signals to be transmitted by *one* FM transmitter. You tune in on one FM receiver, just as you tune in monophonic FM today. A decoder in your receiver will unscramble the signals and send one to each speaker for perfect, high fidelity stereo.

There are several systems by which multiplexed signals can be sent and received. The FCC is studying them now and will decide which one to license, probably within less than a year.

If you now have an FM receiver or tuner, or if you buy one before a multiplex system is standardized, you won't be out of luck. First, the stereo broadcasts will be fully compatible. You will hear the programs *monophonically* with no loss of quality, even if you don't convert to stereo. If you *do* convert, your tuner will be able to handle the stereo signals with the help of a simple device that will plug into the back of the set. Such adapters should be available for about $20.



As we go to press, Kinematix, Inc. announces "Skylark" FM radio tuner for automobile use.

If you haven't joined the growing group of FM'ers yet, you're missing a lot. Several makers now have receivers on the market for less than $30. They aren't hi-fi but you will get the programs. If you have an AM radio, a phonograph, a hi-fi set-up, or even an electronic organ, you can add a tuner for under $20. Other tuners, available with a wide range of features, can cost $100 or more. If you have a really good hi-fi amplifier and speaker system, a good tuner will open the door to the rich and thrilling world of FM music in all its glory. But no matter which way you choose, or what equipment you buy, there's a new world of entertainment, instruction, and pleasure waiting for you on the FM dial.

America's Amateur Rocketry

Continued from page 51

answered: "They're thirty years behind."

Why are the rocket amateurs of today 30 years behind the model plane builders of 15 years ago? Colonel Parkin elaborated. Too many of them are so anxious to shoot a rocket into the sky they don't have the patience to develop foolproof vehicles. It's not because of a lack of intelligence: many of the kids are brilliant. The Colonel recounted a little anecdote to make his point.

Shortly after he had received an official "go ahead" on a coordinated amateur rocket program in 1958, he was startled late one afternoon at Fort Belvoir to see five teen-agers trudging toward him with a huge rocket on their collective shoulders. "The thing had big fins of solid three-eighths-inch steel plate. It was about a half-foot in diameter and around nine feet high. Filled with explosive propellants that rocket could have destroyed a city block if it wasn't designed and launched correctly."

The five boys plunked the giant weapon down in front of Colonel Parkin. "What do you intend to do with that?" he asked them. "Launch it," they answered. "Where's your launching tower?" They pointed to the rocket sitting on its fins. "Don't need one. We just ignite it and it takes off."

Needless to say, the boys had to swing their giant "firecracker" back onto their shoulders and take it home.

The incident is significant. I can quote a few of my own.

Not long ago, I attended an amateur rocket "shoot" at the Army's Armor Center, Fort Knox, Kentucky. Amateur groups from various parts of the country were participating. One of the participants had traveled all the way from the east coast with a section of rusty-looking pipe about four or five feet long. One end was sealed with concrete. The other end was open, but had no fins for stability in flight. There was no nose-cone in evidence. The "fuel" consisted of about eight pounds of a powdered zinc and sulphur mixture. The participant had not even brought along an igniter, which may have been just as well —since the contraption was much more a bomb than a rocket. Naturally, the Range Safety Officer refused to permit its launching—unless certain technical standards were met. The boy then scrambled about trying to improvise a nose-cone from the branch of a tree, among other things. Fortunately, I left the meet before *that* "rocket" was fired—if it ever was.

By general amateur standards it was a successful meet. Before I left, late in the day, three rockets had been fired successfully; one went off course into a horizontal trajectory and came within 10 feet of blasting a CBS-TV news photographer into Kingdom Come, not to mention the crew of the armor-plated vehicle from which he was working; four rockets exploded or misfired; and one refused to ignite.

The closest thing to an electronic device in the whole meet was a small wooden box containing batteries and a mercury switch. A thread attached to the rocket tripped the switch upon taking off. The switch actuated a solenoid that tripped the shutter of a camera placed about 50 yards away and focused above the launching pad. At least this was a scientific research approach to rocketry: the camera could record the exhaust-stability of the rocket. This could then be studied for information on future corrections.

This more-than-commonly painstaking amateur group beat the average for successful firings that day: they had two out of the three. Even their third rocket, which aborted in mid-flight, was worthwhile in that they had a photographic record of the goof for analysis.

The fundamental reason for America's great success in professional rocketry today was small amateur groups of yesterday, of course. But those groups and individuals of the 1930's and even earlier rarely ignited a rocket merely to see if it would go off like a skyrocket. They improvised

instruments, perhaps crude ones—*but instruments*—to test and learn from their failures as well as successes. A notable example is the late Dr. Robert Goddard, the father of successful rocketry, who ingeniously devised pressure-recording devices from old alarm clocks and remote-control ignition systems from clotheslines. Out of inconceivable patience in studying the reasons for many failures, Dr. Goddard achieved his major success—the world's first gyroscopically stabilized liquid-fuel rocket. Along the way, he contributed a storehouse of knowledge that has made America the scientific leader in space research. And *that* was Dr. Goddard's dream, not fireworks or vehicles shooting aimlessly into the enigmatic sky. The German experts who fashioned the V-2—ancestor of all of today's ICBM's—honored the name of Goddard from the beginning.

At the Fort Knox national meet, a small mobile radar unit was used to track the rocket flights. It was only partially successful. The solid-fuel rockets accelerated too rapidly. Of the three completed launchings, one rocket was tracked to 4,000 feet of altitude and lost while it was still climbing; another was lost at 7,000 feet; and the third was lost immediately after take-off. If a miniaturized oscillator alone had been aboard each of these rockets, that would have been enough to determine maximum altitude by triangulation with two or three ground receiving stations strategically placed. Simple accelerometers could be designed to transmit data on the G-forces, or rate-of-change of acceleration, acting upon the rocket. This, in turn, could be compared with the burning rate of the fuel and thus give some idea of the rocket's exhaust-velocity—all-important information in terms of perfecting even an amateur rocket.

A group of amateur rocketeers was basically responsible for the first level flight through the sound barrier. But they didn't accomplish this unprecedented historical feat by shooting rockets at the sky. In fact, they shot nothing. One of them, John Shesta, designed and built a test stand; another, James Wyld, designed an engine—the first practical regeneratively-cooled rocket engine; another, Franklin Pierce, helped to machine the parts; and a fourth, Lovell Lawrence, Jr., found an isolated area in New Jersey where the engine could be tested time after time, and persuaded an influential Naval officer to be present at the final test. The four men were later awarded funds to build a more powerful engine. It was also the start of Reaction Motors, Incorporated—now one of this nation's most valuable defense contractors in rocketry.

America is not in such bad shape when it comes to rocketry as such. Only the amateur aspect has altered. Now that amateur rocketry has become incredibly popular—because of the glamour that success has given it—the techniques of the great pioneer amateurs are all but forgotten. It's about time that they are remembered if this nation is to maintain its scientific leadership. For, as the Army recognizes all too well, the future vitality of the rocket and space sciences depends greatly upon how intelligently amateur interest is encouraged and guided.

With this vividly in mind, the editors of *EI* have planned future issues that will carry detailed advice and construction plans for a variety of electronic amateur rocket instruments.

Learn Code the Easy Way

Continued from page 61

two, three, four, five, six, seven or more letters. From these, short and long sentences come easily. They may sometimes be nonsense sentences ("NO NETS SEEN IN SEASON") but they will be grammatical.

It will take no effort to graduate from individual letters to sentences. You won't be able to stop yourself.

First, try Lesson One's letters one at a time. Make that *dit* for *E* very short. Make the *dah* for *T* definitely longer (ideally, "three dits" long). Trying a few *didah A's* and *dahdit N's* will quickly give you the hang of getting a definitely long *dah*, but not too long.

After running down the list in the initial *ETAOINS* order a few times, start scrambling it. Contrast *A* and *N*, *S* and *O*, do anything your imagination suggests.

Then, before you have time to think about it, you will be tapping out words.

You will use the code later on by *rhythm*, and by rhythm alone, and the only easy way to learn it is by rhythm. Nobody has ever learned it any other way, no matter what he may think.

Don't try to learn the whole alphabet at once. Master the lessons one at a time. If you can learn one lesson a day, that's fine, but go at your own speed. DO practice with someone else if you can find anybody.

Let your partner send to you for at least half the time. Like most beginners you may think you "send pretty good but can't receive too well yet." Well, that FCC exam

is going to *begin* with receiving code, and if you flunk that part, you don't even get to take the sending part. Furthermore, *nobody* sends well unless and until he can receive well. You won't let your partner send badly, and he or she won't let you send badly. You will each insist that the other send *understandably*.

Just before you begin Lesson Two, briefly review Lesson One—by sending and receiving all its letters. Then tackle Lesson Two. When you come to where you want to send words, incorporate the letters from Lesson One in them. You will have a hard time forming words without them, anyway. For Lesson Three, review One and Two first, and so on.

Keep your practice sessions short—say twenty minutes at a time—but try to have one a day. The punctuation and number lessons aren't ironbound, by the way: you and your partner may decide to start throwing periods and commas into almost any lesson. You may want to learn *W* and *Q* a little early, too, for listening practice on the ham bands. Go to it, and 73—or *dahdahdididit, didididahdah*.

Pocket Size CB Receiver

Continued from page 37

ham station call for the New York area are either K2 or W2, exactly the reverse. The trimmer capacitor C3 is a sensitivity control. Once a station is received, C3 should be adjusted for maximum gain and left thus. To turn the unit off, simply unplug the earphone.

Theory of Operation

The unit employs a super-regenerative type detector with one or two circuit variations. The base biasing resistor (R1) is returned to the junction of coil L1 and the earphone. This introduces both negative feedback and enough phase shift to allow the earphone to control the quench frequency. This vastly increases the stability of the circuit, and affords a sharp increase in sensitivity. The use of a 20 mf base bypass capacitor (C5) decreases the noise level and increases bass response.

Measure of Your Emotions

Continued from page 57

pressure rises.
Muscles tense.
Blood is diverted from internal organs to the muscles.
The pupils dilate.
Sweating increases.
Skin resistance drops sharply.
Hairs on the back of the neck stand erect.
Skin temperature of different body parts alters markedly.
Breathing stops, then speeds up.
Gastro-intestinal activity slows down.

Nor does this exhaust the list. Don't blame your friend if he takes a dim view of your "joke!"

Though we are seldom aware of these tremendous adjustments of our bodies to emotions, they surely influence our conduct. Some theories say that these disturbances are the *cause* of emotions; others claim that they are the direct result of an "emotionally disturbing" experience. Whatever their role, they exist; and what exists can probably be measured electronically.

The electronic scientists involved in measuring emotions usually call themselves "polygraphers," from the Greek "many writings." Polygraphy has come to mean the writing of many responses; for example, ink recordings of blood pressure, heart rate, respiration, etc., on one piece of chart paper.

Like the person being studied, the polygraphic system has a heart. In fact, two hearts. The first of these is a low frequency amplifier. The second, and equally important, is a low frequency paper recorder. The "equalization network," or "input coupler" will vary from a Wheatstone bridge to a simple high impedance input, depending on what is to be recorded.

The drawing accompanying this article shows a typical system used to measure the many responses the body may give to an emotional stimulus such as fear. EEG (electroencephalogram) is the "alerting" reaction of the brain, signified by the cessation of the slow, steady rhythm of drowsiness. EKG is the measure of the beating rate of the heart and, in the diagram, shows the abrupt arrest of the heart beat followed by a compensatory increase in its rate.

Temperature of the skin may be a comparative reading—such as the forehead temperature compared to the chest temperature. These measurements are usually taken by means of a thermistor, whose minute variations of resistance with changes in temperature are fed to a bridge and there detected as an imbalance.

This bridge input system is widely used in conjunction with physiological transducers to sense small electrical changes and present them in suitable amplitude to the amplifier.

Respiration, which is nothing more than the rate and depth of breathing, can be converted to a voltage change by any number of devices ranging from the distention of the crystal in an ordinary phono cartridge to delicate pressure-sensitive transducers which respond to changes in the pressure of a column of air in a tube stretched around the patient's chest.

Similar bridge-input systems are used to detect skin resistance changes, pressure changes, etc.

The photos accompanying this article show a system in use by the staff of the Joint Research Project in Schizophrenia at the Ypsilanti (Mich.) State Hospital. Researchers use the polygraph to study the differences in emotional responses between schizophrenic and non-schizophrenic patients.

Other research workers throughout the country have found characteristic predictable changes in the recordings which identify not only the emotion (such as fear or anger) which a person is undergoing, but patterns of changes under a given emotion which are unique to the person who has them! Dr. J. I. Lacey, now at Fels Research Institute, found that such measures as heart rate and skin resistance showed the same pattern of changes in each of his subjects when he placed them under stress, *regardless of how he produced that stress!* Dr. Albert Ax, at Detroit's Lafayette Clinic, showed how fear and anger changed the pattern of responses in different ways. By some ingenious methods (how would you feel if a foot-long high voltage arc suddenly and unexpectedly jumped between two poles a few inches above your head!) he produced intense feelings of fear in his subjects. He found that changes in the conductance of the skin, muscle potentials (EMG), and respiration were all considerable and that they were different from the recordings taken during anger.

Besides its role in basic medical and psychiatric research, the science of polygraphy has found important practical uses. The familiar lie detector is a simple form of polygraph, stripped to bare essentials.

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	1AX2	.62		4CS6	.61		6AW8	.89		6DG6	.59		12AF3	.73		12CU5	.58		17DQ6	1.06
	1B3GT	.79		4DE6	.62		6AX4	.65		6DQ6	1.10		12AF6	.49		12CU6	1.06		17L6	.58
	1DN5	.55		4OK6	.60		6AX7	.64		6DT5	.66		12AJ6	.46		12CX6	.54		17W6	.70
	1G3	.73		4DT6	.55		6BA6	.49		6DT6	.53		12AL5	.45		12DB5	.69		19AU4	.83
	1J3	.73		5AM8	.79		6BC5	.54		6EU8	.79		12AL8	.95		12DE8	.75		19BG6	1.39
	1K3	.73		5AN8	.86		6BC7	.94		6EA8	.79		12AQ5	.52		12DL8	.85		19T8	.80
	1L6	1.05		5AQ5	.52		6BC8	.97		6H6GT	.58		12AT6	.43		12DM7	.67		21EX6	1.49
	1LN5	.59		5AT8	.80		6BD6	.58		6J5GT	.51		12AT7	.76		12DQ6	1.04		25BQ6	1.11
	1R5	.62		5BK7A	.82		6BE6	.55		6J6	.67		12AU6	.50		12DS7	.79		25C5	.53
	1S5	.51		5BQ7	.97		6BF6	.44		6K6	.63		12AU7	.60		12DZ6	.56		25CA5	.59
	1T4	.58		5BR8	.79		6BG6	1.66		6S4	.48		12AV5	.97		12EL6	.50		25CD6	1.44
	1U4	.57		5CG8	.76		6BH6	.65		6SA7GT	.76		12AV6	.41		12EG6	.54		25CU6	1.11
	1U5	.50		5CL8	.76		6BH8	.87		6SK7	.74		12AV7	.75		12EZ6	.53		25DN6	1.42
	1X2B	.82		5EA8	.80		6BJ6	.62		6SL7	.80		12AX4	.67		12F5	.66		25EH5	.55
	2AF4	.96		5EU8	.80		6BK7	.85		6SN7	.65		12AX7	.63		12F8	.66		25L6	.57
				5J6	.68		6BL7	1.00		6SQ7	.73		12AZ7	.86		12FM6	.45		25W4	.68
	3AL5	.42		5T8	.81		6BN4	.57		6T4	.99		12B4	.63		12K5	.65		25Z6	.66
	3AU6	.51		5U4	.60		6BN6	.74		6U8	.78		12BA6	.50		12SA7M	.86		35C5	.51
	3AV6	.41		5U8	.81		6BQ5	.65		6V6GT	.54		12BD6	.50		12SK7GT	.74		35L6	.57
	3BA6	.51		5V6	.56		6BQ6GT	1.05		6W4	.57		12BE6	.53		12SN7	.67		35W4	.52
	3BC5	.54		5X8	.78		6BQ7	.95		6W6	.69		12BF6	.44		12SQ7M	.73		35Z5GT	.60
	3BE6	.52		5Y3	.46		6BR8	.78		6X4	.39		12BH7	.73		12U7	.62		50B5	.60
	3BN6	.76		6AB4	.46		6BU8	.70		6X5GT	.53		12BL6	.56		12V6GT	.53		50C5	.53
	3BU8	.78		6AC7	.96		6BY6	.54		6X8	.77		12BQ6	1.06		12W6	.69		50DC4	.37
	3BY6	.55		6AF3	.73		6BZ6	.54		7AU7	.61		12BY7	.74		12X4	.38		50EH5	.55
	3BZ6	.55		6AF4	.97		6BZ7	.97		7A8	.68		12BZ7	.75		17AX4	.67		50L6	.61
	3CB6	.54		6AG5	.65		6C4	.43		7B6	.69		12C5	.56		17BQ6	1.09		117Z3	.61
	3CF6	.60		6AH6	.99		6CB6	.54		7Y4	.69		12CA5	.59		17C5	.58			
	3CS6	.52		6AK5	.95		6CD6	1.42		8AU8	.83		12CN5	.56		17CA5	.62			
	3CY5	.71		6AL5	.47		6CF6	.64		8AW8	.93									
	3DK6	.60		6AM8	.78		6CG7	.60		8BQ5	.60									
	3DT6	.50		6AN4	.95		6CG8	.77		8CG7	.62									
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	3S4	.61		6AQ5	.50		6CN7	.65		8CN7	.97									
	3V4	.58		6AR5	.55		6CR6	.51		8CX8	.93									
	4BC5	.56		6AS5	.60		6CS6	.57		8EB8	.94									
	4BC8	.96		6AT6	.43		6CU5	.58		10DA7	.71									
	4BN6	.75		6AT8	.79		6CU6	1.08		11CY7	.75									
	4BQ7	.96		6AU4	.82		6CY5	.70		12A4	.60									
	4BS8	.98		6AU6	.50		6CY7	.71		12AB5	.55									
	4BU8	.71		6AU7	.61		6DA4	.68		12AC6	.49									
	4BZ6	.58		6AU8	.87		6DB5	.69		12AD6	.57									

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Often it consists of no more than two or three channels for recording heart rate, respiration, and skin resistance. The lie detector test relies on the assumption that the telling of an untruth is accompanied by emotion—probably guilt or remorse—and that the emotion in turn induces the sorts of physiological changes we've been talking about. Unfortunately, some people with criminal tendencies (such as psychopaths, or pathological liars) feel no guilt whatsoever about telling the most outrageous lies. So the test is far from infallible in establishing someone's innocence. Also, some people are so laden with feelings of guilt that even the thought they *might* have lied will lead to the wildest kinds of emotional disturbances. But for the majority, the test serves as a valuable index of guilt or innocence.

Polygraphy has found important uses in the space age as well. Physiological measurements akin to those we've been talking about are routinely taken on animals and men subjected to actual or simulated conditions of space flight. Russia's satellite-borne dog, as well as our own space travelling monkeys and mice, reported back via telemetry to our earthbound scientists and medical men. In fact, our first human venturer into space can rest assured he's not likely to flip his lid under the stresses and strains of the voyage. Man, the uniquely adaptive animal, will probably take the unfamiliar environment of space as casually as he does the interior of a coal mine.

Tape Tricks

Continued from page 63

you can make your own as shown in the illustrations. All you need is household aluminum foil, some splicing tape, and a splicing block—there's nothing to it.

Nor is there anything to the film-strip isolator for the erase head, if you want to record sound-on-sound. Dubbing voices over previously recorded music or sound effects is interesting and fun, however most non-professional recorders lack provision for disabling the erase circuits so that the same tape can be "recorded twice at once." You can, if you are able and ambitious, tear into your recorder's circuitry to install a disabling switch. However this involves some risk. Why not use the method shown in the pictures? It is very easy and takes no time at all. You ought to leave a blank frame on the next roll of film in your camera, and use that once it's developed. Unexposed film is "cleaner" and easier to work with. The length of the strip isn't critical—a few inches will do, but the finished strip should be one quarter inch wide. Cut a half inch strip and double it for strength and ample thickness.

Your recorder probably has a footage counter, but you may not have been able to make the most of it, because it is hard to cue the beginning of the tape to the counter's zero. All you do, as the picture shows, is stick a tiny piece of splicing tape to the recording tape or leader, and always line this up with the edge of the head cover as you set the counter to zero. You can use "cue tabs" anywhere in the tape for dubbing purposes if you don't want to go back to the beginning every time. Be sure and stick it on the shiny, non-magnetic side so it won't foul the magnetic heads.

Our caption tells you to wire two headphone jacks in parallel across a phone plug, so that two sets of monitoring earphones may be used if you are working with an assistant. Using one of the jacks as a "terminal strip" is the neater, more convenient way to do it, though both could be wired to the plug instead.

These four tricks will be indispensable for making movie and slide-show sound tracks, or sound-effects tapes for the local dramatic society, etc., and will give your recorder some of the flexibility of a professional machine.

Underwater DX

Continued from page 95

holder for the longest time under water.

What about less famous DX quarries? The trick here is to listen for vessels communicating with submarine-only bases. In North America there are two: New London, Connecticut (NBL) and Coco Solo, Panama Canal Zone (NEZ). There is also an air station at the latter but it only operates on aeronautical channels, and furthermore, the air station is closed at the moment. West Coasters should watch for stations contacting San Diego Control; however, conventional ships use this base too. Finally, under good conditions, DX listeners in the Western U. S. will be able to log submarines working Pearl Harbor Control.

Unofficially, most naval radiomen will verify. That is, if you include a self prepared confirmation card along with your report, they will sign it, fill in the call letters should the DXer request them, and

mail it back to you. The only other information which may safely appear on the card is *time, date, and frequency.* Some listeners also request location and power. Often the operator will supply such data, but should it fall into the classified category, as it does occasionally, you run the risk of getting no QSL at all.

To prove your reception you must mention the station called or contacted. If the DXer can log a sub while no traffic is being handled, during a communications check, etc., so much the better. But in any case, the contents of messages should never be mentioned, either in the report or anywhere else. Remember the radio secrecy laws—and remember they have teeth.

Of course reports should be as interesting as possible. Include signal strength and describe interference if any. You might also list your equipment, tell something about the receiving location. Address reports to: Technician in Charge, Radio Facilities, U. S. Submarine . . . (name of vessel) . . ., c/o FPO, at the base contacted. If you heard the *Triton* working New London Control, you would send it c/o FPO, New London, Conn. But for submarines working foreign bases, make it FPO, New York, or FPO, San Francisco.

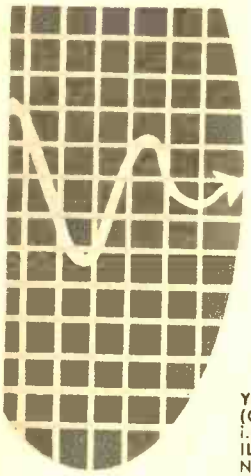
A Citizens-Band Club

Continued from page 87

technicians among its members. They can help members with repairs or adjustments that are affected by the FCC's rule requiring the services of a Second Class Commercial Radio Operator.

The Nassau CB Club levies dues on its members, one purpose of which is the purchase of test equipment and other necessities. The "lab" thus being assembled is at the disposal of any member for test, calibration, and repair of his equipment.

As any Citizens Bander knows, the channels are apt to be a babel made up of serious communications, the chatter of frustrated would-be hams, and occasional calls for help from mobile stations in cars disabled on a highway somewhere. The Nassau Club members have agreed to set aside Channel 11 as an emergency calling frequency. At least three member stations monitor this frequency 24 hours a day. The club members are spreading the word among other CB licensees they may meet or contact. This helps bring order into the use of the channels, and gives everyone within range the security of knowing he



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will be heard and be able to raise another station when he must.

Operation of CB equipment and use of the channels in the spirit of FCC policy and regulations are stressed by the club. This pays off in keeping the channels uncluttered and enabling everyone to get maximum use from them.

Many times in the last year, the Club or one of its members has been instrumental in getting help to scenes of accidents or to stranded motorists. Either an involved vehicle had CB gear and was heard by a Club monitor, or a Club member passing the scene stopped and sent out the call.

This year, the Club gave a demonstration before the Coast Guard Auxiliary that involved 30 mobile units. Its purpose was to show the CGA how Citizens Band would aid boating safety and convenience. Proper use of low-power CB transmitters, for instance, would take some of the heavy load off the 2-3 mc Marine Band.

All these members don't merely attend monthly meetings, hear technical and legal talks, have their equipment tuned up, and pay dues. There are frequent social events —dinner dances, picnics, etc.—and these bring members and their families together and help form a closer association.

The Nassau CB Club was the brainchild of several members who saw the necessity for such a group if the Citizens Band was to serve its intended purposes.

The club idea has worked so well that Nassau urges Citizens Banders everywhere to get in touch with local clubs where they exist, or to organize them where they do not.

Answer to Electronic Crossword

on page 92 in October EI

Q	R	M			T	R	A	N	S	I	S	T	O	R
S		E	M	F		F		C		M		U		E
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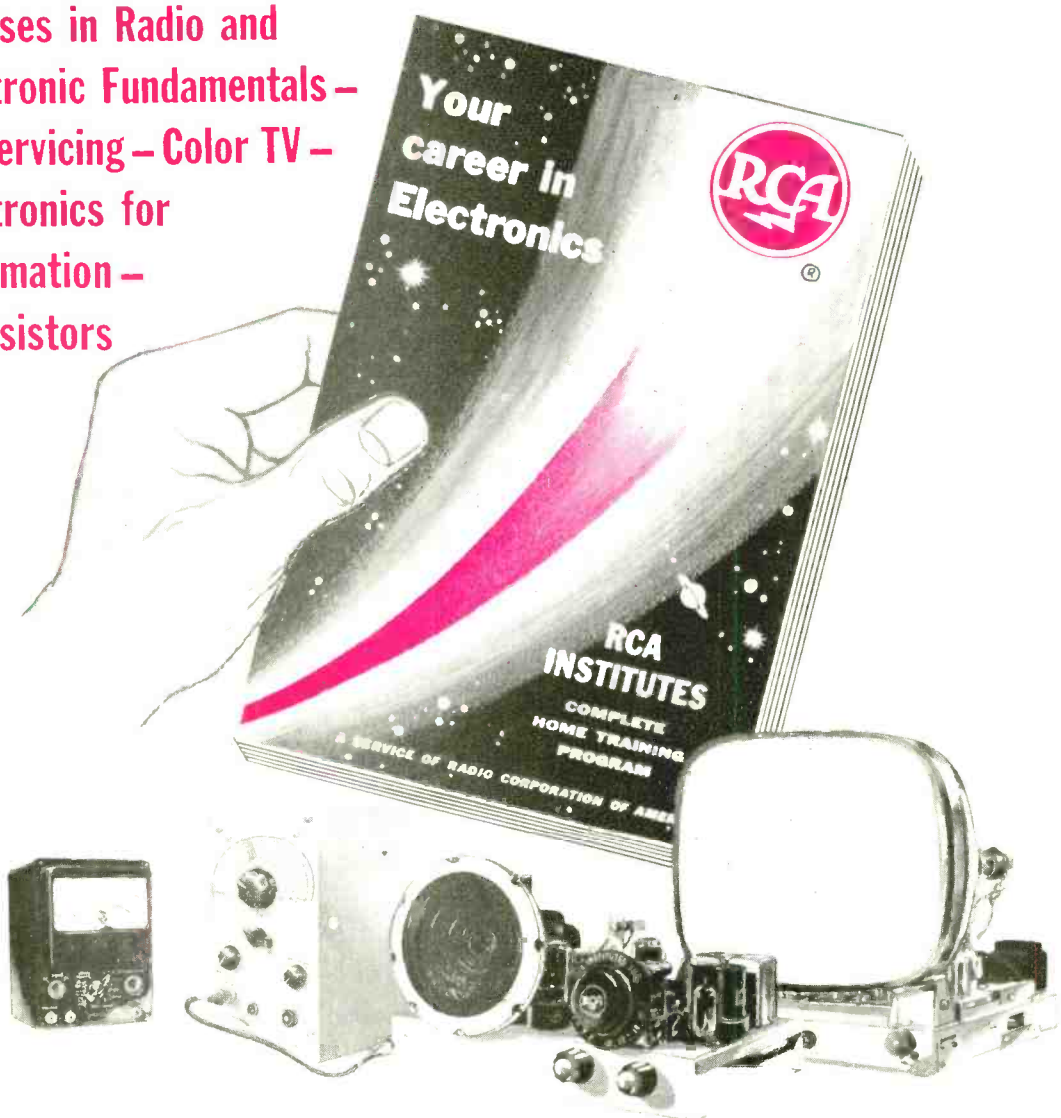

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