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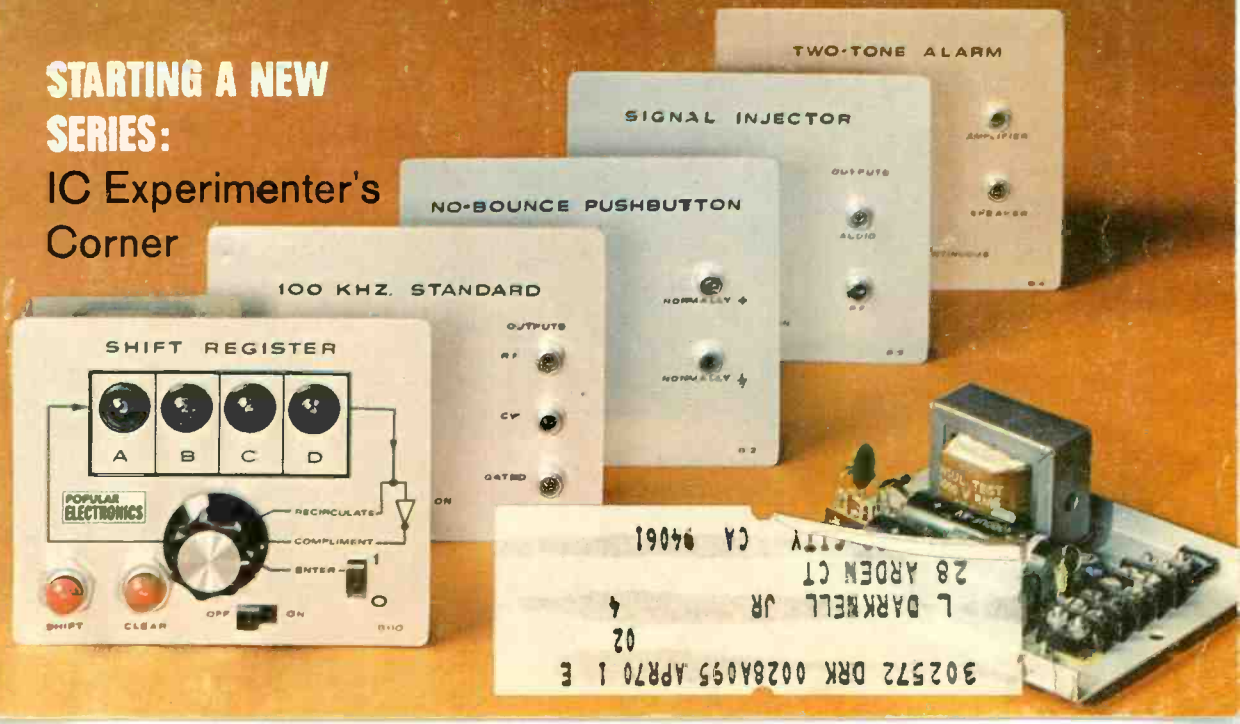

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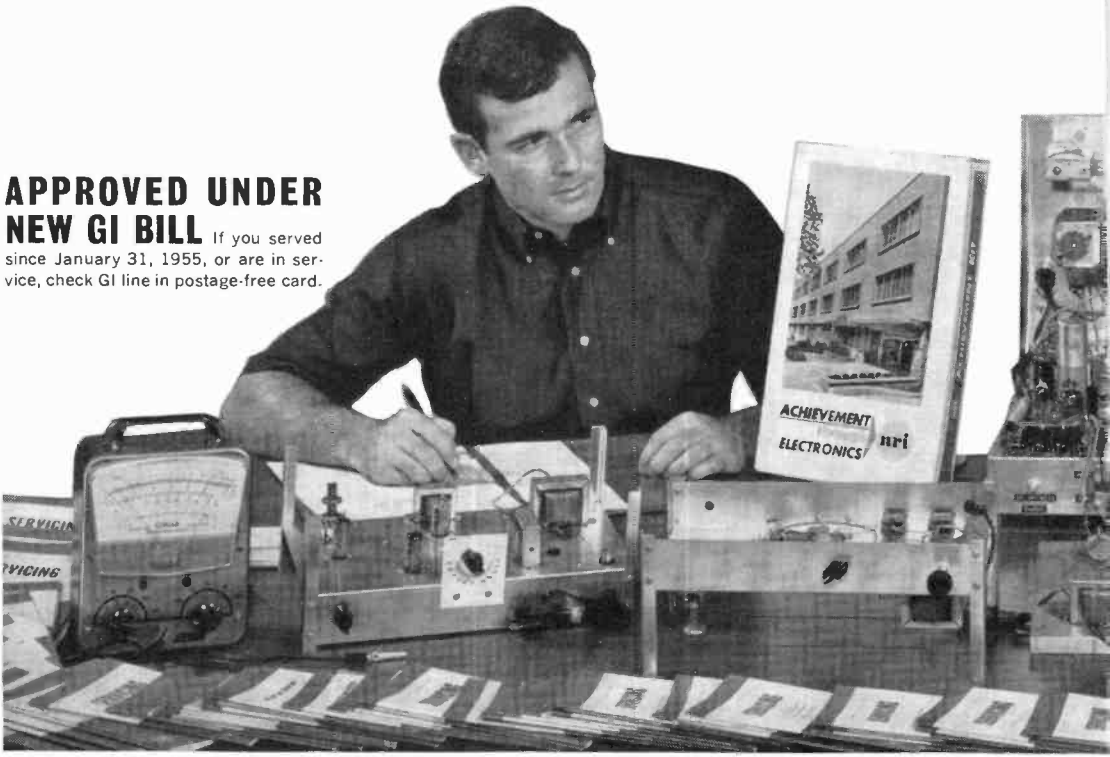

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POPULAR ELECTRONICS

VOLUME 32 NUMBER 2 **FEBRUARY, 1970**

WORLD'S LARGEST-SELLING ELECTRONICS MAGAZINE

FEATURE ARTICLES

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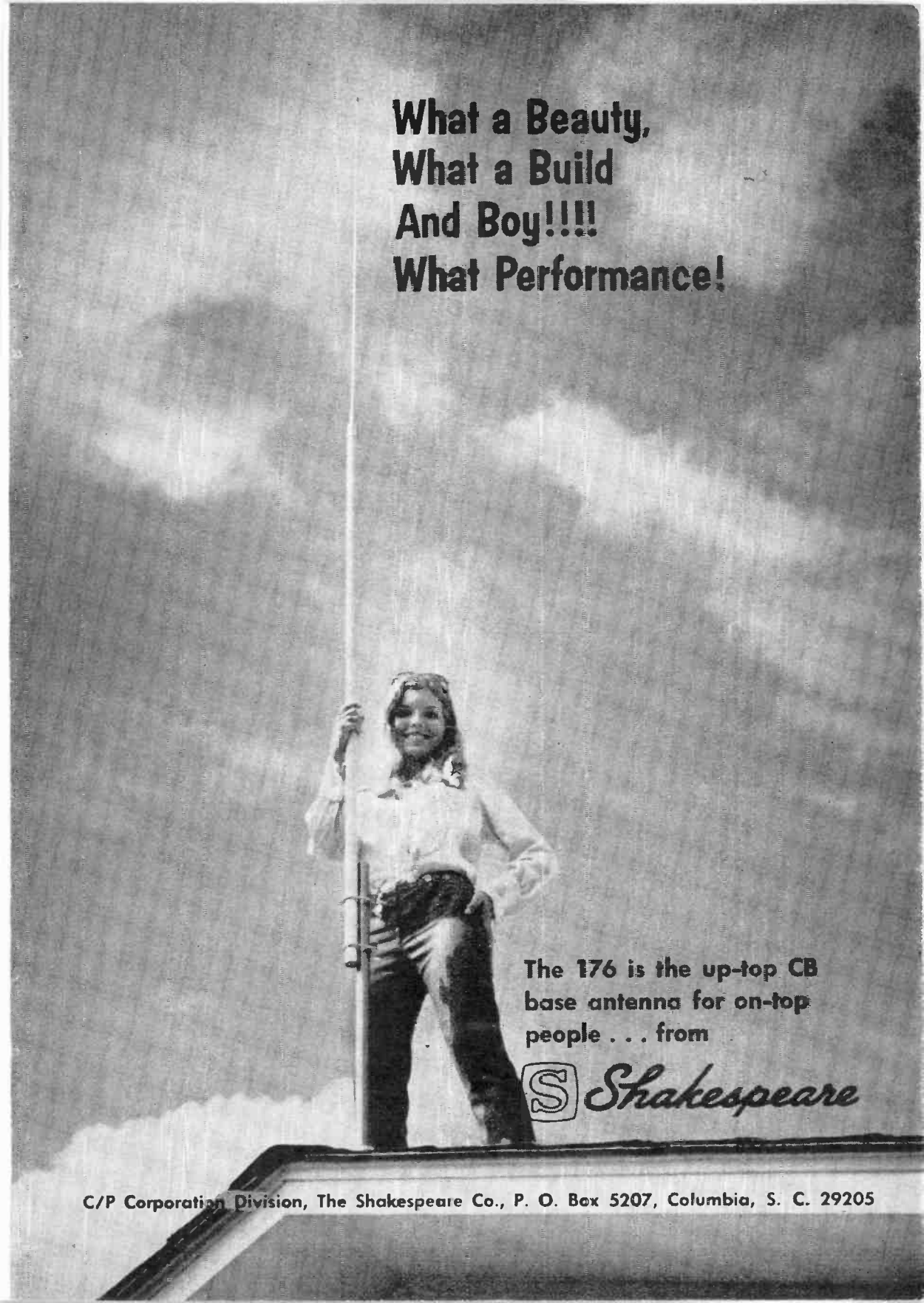
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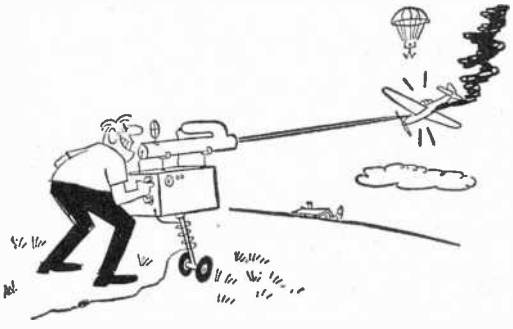
letters

FROM OUR READERS

LASERS AND SAFETY—AGAIN!

—Send me any information on where I can obtain plans for a high-power, small-beam divergence, pulse or continuous laser—

—I require a more powerful laser. Please



send information for this type of tube, the maximum power without getting overheated—

—I would greatly appreciate . . . a medium-priced laser of mild burning capabilities (say through a piece of cardboard) and a visible range of several miles—

The extracts above are from only three of the many letters we have received requesting information on how to obtain or build a high-power laser, or how to boost the power of the one described in the article "Experimenters' Laser" in our December 1969 issue.

The dangers involved in working with high-power lasers were mentioned several times in the December issue, but apparently many readers choose to ignore them.

If a laser is to be capable of burning or producing physical damage to a target, it must be capable of producing many watts of beam power. Unfortunately, when you reach the vicinity of about 3 milliwatts, the eyes of any observer, either directly in the laser beam or receiving a reflection of the beam from a shiny surface are endangered. Even at this relatively low power, permanent blindness is a real possibility—and only a fraction of a second of exposure is necessary to produce this total and irreparable damage.

The output of the laser described in our December article cannot be made to exceed 0.5 milliwatt—far below the danger point. (Though a beam of this intensity should not

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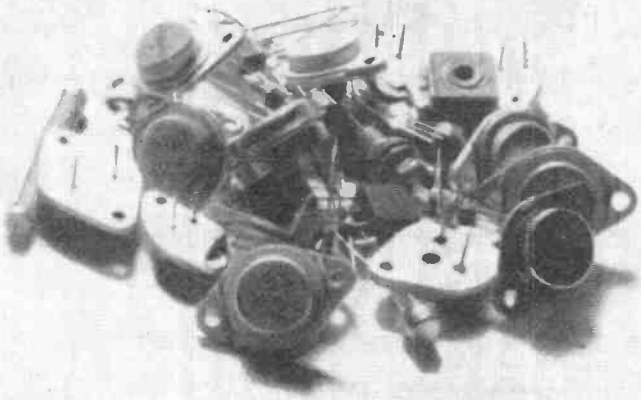
This is 30,000 solid state replacement parts.

So is this.



It used to be if you wanted to satisfy everyone, you had to stock over 30,000 different solid state replacement parts.

Well, everyone realized that was ridiculous. So some enterprising people came up with a bunch of universal replacements.

Then you only had to stock about eleven or twelve hundred.

That was a lot better, but we still thought it was a little ridiculous.

So two years ago (when we went into this business), we figured out how to replace all 30,000 with only 60.

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And you operate more efficiently.

To make life even easier, we've got a new book that gives you all the cross references you need to figure out which part replaces which.

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If the whole thing sounds rather incredible, you're right. But why not give your distributor a call and let him narrow the incredibility gap.

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LETTERS (*Continued from page 8*)

be looked into directly.) This cannot be said of the semiconductor or gas lasers that are available for use in research laboratories under controlled conditions.

We would like to repeat also that dark glasses, unless they are specifically made for the laser involved, are of no help. Do not depend on them for protection.

Out of responsibility and concern for our readers, POPULAR ELECTRONICS cannot suggest or recommend a laser of any higher strength than the one described in the article.

SKY KING IDENTIFIED

To answer your questions: SKY KING, is an unclassified collective callsign used for all airborne SAC aircraft; SKY BIRD, is an unclassified collective callsign used for all SAC ground radio stations; LOOKING GLASS is the unclassified name of the SAC airborne command post.

LT. COL. G.F. HENNRIKUS, JR.
Offutt AFB, Nebraska

UN-MUDDYING THE WATERS

There is no doubt that laser light has and will continue to play a significant role in the field of ophthalmology. It has been used to seal retinal holes, treat very small retinal detachments and in some instances has played a role in the treatment of diabetic retinopathy and other retinal problems. Xenon light has also been used for photocoagulation and many ophthalmologists prefer its use over laser light.

However, your statement that "one pulse from a laser and the retina is a 'spot welded' back in place" ("The Lively Laser," December 1969) is not only misleading, but adds to the confusion about complex medical problems in an already overexpectant lay public. By far the great majority of retinal detachments, unfortunately, cannot respond to photocoagulation alone. And even now, detached retinas require "complex surgery and a long recuperative period." Retinal detachment surgeons already have a difficult time explaining to patients that the "magic light" will not perform miracles in their eyes.

Now to further "muddy the water" you state that "micro-surgical treatment of glaucoma using a laser to remove a portion of the iris of the eye is showing great promise." You forgot to add, however, that this is a highly experimental procedure performed, as far as I know, only in animals. There are still some problems to iron out before this can become a safe procedure to perform in humans.

M. M. COHEN, M.D.
Resident in Ophthalmology
Univ. of Mich. Medical Center

Many thanks for straightening us out on these highly technical and important aspects of the subject.

FREE BOOKLET AVAILABLE

I'm positive that we were unintentionally "dropped" from Dave Weems' fine December issue article on bass reflex enclosures. Please tell your readers to write me for a free copy of our bass reflex design handbook.

BILL SUTHERLAND
Electro-Voice
Buchanan, MI 49107

APPRECIATION APPRECIATED

Please keep coming out with your excellent projects such as "Microwaves For The Beginner" (November issue) and that great "Experimenter's Laser" (December).

KEN REID
Independence, Kansas

STATION ADDRESSES

As a brand-new short-wave listener I'm perplexed about writing to the various hams and broadcasters. Should I report that I heard them? If so, how do I find their addresses?

R. J. MILLER
Montvale, N.J.

Most radio stations still appreciate receiving accurate reception reports. The addresses of ham stations are contained in two separate Radio Amateur Callbooks available at most radio stores. International broadcasters are listed in the "SWL Address Book" ($2.95) mail-order from Gilfer Associates, P.O. Box 239, Park Ridge, NJ 07656.

OUT OF TUNE

"Experimenters' Laser" (December 1969). Many readers see what appears to be a discrepancy between Figs. 1(B) and 6 where none actually exists. Four resistors are shown in Fig. 6 for *R22-R24*, while only three are shown in Fig. 1; and the location of the junction between resistors to which *C12* is to be connected is in question. The difference between the two figures is explained on page 110 under the heading "Troubleshooting." The figures are correct.

"Psychedelia I" (September 1969). In Fig. 3 on page 30, change *R8* to *R9*. Then, in the upper right of Fig. 4 on page 32, the 6.3-volt, center-tapped secondary of *T2* should read to "PCU"—not "QFU." In Fig. 6 on page 35, change *C15* to *C16*; *R10* to *R40*; *Q3* to *Q5*; and *R22* to *R27*.

ELECTRONICS library

QUIET

FUNK & WAGNALLS DICTIONARY OF ELECTRONICS

This book, more of a desk-top encyclopedia than a simple dictionary, will appeal to a wide variety of people. Particular attention has been paid to the interests of the non-electronics professional (such as physicians, biologists, and psychologists) who find it necessary to deal with electronic equipment and concepts. The dictionary defines in sophisticated yet clear and precise language the basic terminology of electronics, aided by formulas, graphs, and component and schematic diagrams. Mathematical descriptions, which can be skipped at the reader's discretion, are given where they help to clarify concepts. In addition, an entire section in the back of the book is devoted to tables of logarithms, trigonometric function, and other useful information.

Published by Funk & Wagnalls, 380 Madison Ave., New York, N.Y. 10017. Hard Cover. 230 pages. $6.95.

HANDBOOK OF TRANSDUCERS FOR ELECTRONIC MEASURING SYSTEMS

by Harry N. Norton

This is the first applications book ever written about transducers and their use in measuring systems. The first three chapters provide background in telemetry and measuring systems, transducer basics, calibration, and testing. The remaining 14 chapters cover all physically measurable quantities, from acceleration and attitude to pressure and temperature. The information given with each group of devices covers design, operation, specifications, applications, calibration, and testing—all preceded by basic definitions and explanations of physical laws. Numerous sectional and exploded illustrations show the internal construction and elements of transducers.

Published by Prentice-Hall, Inc., Englewood Cliffs, N.J. 07632. Hard Cover. 704 pages. $26.

ELECTRONIC CIRCUITS FOR THE BEHAVIORAL AND BIOMEDICAL SCIENCES

by Mitchell H. Zucker

Even readers with little prior experience in electronics can read and understand this

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(*Continued from page 14*)

book, the first of its kind to explain how to build and repair solid-state circuits for use in the behavioral and biomedical sciences. The first four chapters discuss the basic principles of circuit design and explain how to understand circuit diagrams. The major portion of the book consists of diagrams of circuits that have applications in typical laboratory experiments—including a few that were picked up from POPULAR ELECTRONICS. Each schematic diagram is accompanied by a parts list and construction tips. Principally a reference work for those possessing limited knowledge of electronics, this book can also be used as a text for courses in circuit design and construction.

Published by W.H. Freeman and Co., 660 Market St., San Francisco, Cal. 94104. Hard cover. 241 pages. $9.75.

FUNDAMENTALS OF ANALOG COMPUTERS

by Robert C. Weyrick

This book is an up-to-date introduction to both the theory and equipment associated with electronic analog computers and their application. The first chapter describes the evolution of computers, their uses and limitations, and relates analog computers to digital and hybrid systems. Subsequent chapters cover linear computing circuits, operational amplifiers, computing servomechanisms, function generators and multipliers, control and auxiliary devices, differential equations, programming, and simulation examples.

Published by Prentice-Hall, Inc., Englewood Cliffs, N.J. Hard cover. 289 pages. $10.50.

INTEGRATED CIRCUITS
(A Basic Course for Engineers and Technicians)

by Robert G. Hibberd

This sequel to the author's previous book, *Solid-State Electronics,* will provide anyone who has a high school education with an understanding of the structures of various integrated circuits—digital, linear, bipolar, MOS, MSI and LSI—and how they are used. The ten clearly illustrated lessons of which the book is comprised include titles such as Solid-State Technology, Digital Logic Circuits, Digital Integrated Circuits, Standard Catalog IC's, and Use of Integrated Circuits in Electronic Control. Each lesson ends with a glossary to terms and review questions.

Published by McGraw-Hill Book Co., 330 West 42 St., New York, N.Y. 10036. Hard cover. 177 pages. $9.95.

TRUE-FALSE QUIZ ANSWERS

(*Quiz appears on page* 32)

1. False. LSI stands for Large Scale Integration.

2. False. The third band on a resistor always designates a multiplier. When the third band is silver, the multiplier is 0.01; gold is 0.1. For instance, a red-red-gold-silver resistor would be 2.2 ohms with 10% tolerance.

3. True. Increasing the distance between the plates on any air-spaced capacitor decreases its capacitance.

4. True. The Seebeck and the thermoelectric effects are the same.

5. False. A dynamically balanced tone arm will not correct skating force. A slight opposing force, proportional to stylus pressure, is normally used to counter the skating force.

6. True. Magnetostrictive materials (nickel, stainless steel, iron) are used as transducers in ultrasonic equipment.

7. True. Just as a magnetic field causes a change in size, so can a change in size of the cone cause a magnetic field. The field, of course, generates a voltage in the coil.

8. False. The Curie Point is the temperature above which a ferromagnetic material becomes practically non-magnetic.

9. False. Tungsten's resistance is directly proportional to temperature but carbon is inversely proportional.

10. True. Each resistor in a series circuit absorbs half the total power. Either configuration will have the same power rating.

11. False. Most infrared missile systems are test-fired on desert ranges. These systems operate on a temperature differential, not ambient temperature.

12. True. In both cases, the power must be removed from the device so that it "unlatches" and a pulse is all that is required to energize them.

13. False. Radio communication with submerged submarines is carried on in the VLF band.

14. True. Most rare earths are not now considered rare.

15. False. A 50-ohm coaxial cable is now available measuring only 0.0104 inches in diameter. Losses are increased with the reduction in size, however.

15. False. An anisotropic magnet has an axis with preferred characteristics over other axes. An isotropic magnet has no preferred axis.

17. True. After the flyback, the damper tube charges the boost capacitor which forms the first half of the sweep.

Second in a series...

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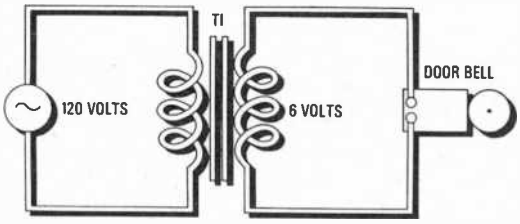
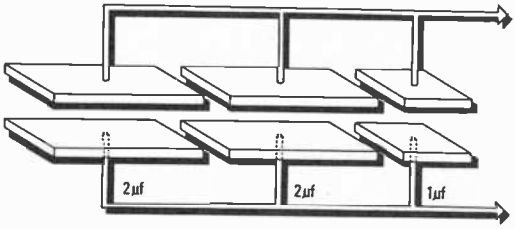


In this door bell circuit, which kind of transformer is T_1 — step-up or step-down?

Note: if you had completed only the first lesson of *any* of the RCA Institutes Home Study programs, you'd easily solve this problem.

This one is more advanced.



What is the total capacitance in the above circuit?

Note: you'd know the solution to the problem if you'd taken only the first two lessons in RCA's new Communications Electronics Program.

These are the lessons that prepare you step-by-step for an FCC License.

This license is a requirement for servicing all types of transmitting equipment and can help open doors to jobs commanding high income in communications, radio and broadcasting, aerospace, industrial automation and many others.

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Answers: Step-down.
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NEW PRODUCTS

Additional information on products covered in this section is available from the manufacturers. Each new product is identified by a code number. To obtain further details on any of them, simply fill in and mail the coupon on page 15 or 115.

REFLECTIVE SPEAKER SYSTEM

A reflective speaker system, the Model W80, utilizing a dramatic new concept in sound dispersion and stereo fidelity, was recently introduced by the Wharfdale division of *British Industries Co.* The W80 differs from other reflective and omnidirectional speaker systems on the market in that the sound dispersion is fully controlled by means of a unique moveable variplanar reflector. The sound can be adjusted specifically for the acoustical characteristics of the listening room and decorating layout. Technical specifications: 20 Hz to beyond audibility frequency range; 15 IHF watts minimum, 50 IHF watts maximum power input; 4-8 ohm impedance; 1000-Hz midrange, 3500-Hz sub-treble tweeter, and 5000-Hz ultra-treble tweeter electrical crossovers; 12½" woofer with 9½-lb magnet assembly, 5" midrange, 3" sub-treble tweeter, and 1" domed ultra-tweeter speaker complement; 85-lb sand-filled cabinet.

Circle No. 75 on Reader Service Page 15 or 115

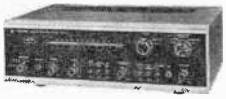
SOLID-STATE GENERAL-COVERAGE RECEIVER

The GR-78 receiver recently introduced by the *Heath Company* provides AM, CW, and SSB coverage from 190 kHz to 30 MHz in six switch-selected bands. The all solid-state circuit employs FET's in the r.f. section and four ceramic i.f. filters for excellent sensitivity and selectivity. The built-in bandspread tuning can be calibrated for either the shortwave broadcast or amateur radio bands, and a switchable 500-kHz crystal calibrator insures accurate dial calibration. The receiver has a rechargeable nickel-cadmium battery pack and built-in charging circuit. An automatic noise limiter cuts down ignition and static interference, and the automatic volume control keeps the volume level constant under changing signal conditions. Additional features of the GR-78 include a headphone jack, built-in speaker, external antenna terminals, receiver muting for use with a transmitter, and S meter.

Circle No. 76 on Reader Service Page 15 or 115

STEREO RECEIVER EMPHASIZES "NEW LOOK"

A high-cut filter, tape monitor, loudness control, and FM muting are a few of the features available with the *Pioneer Electronics U.S.A. Corp.* Model SX-770 AM/stereo FM receiver. In addition, the receiver features a black front panel with illuminated blue tuning scale, the "new look" favored by interior decorators. A FET front end and IC i.f. strip provide a 1.8-μV sensitivity, 60 dB at 98 MHz image rejection, and 70 dB IHF signal-to-noise ratio. For stereo reception, the multiplex section employs a time-switching demodulator. Output audio power is 70 watts IHF into a 4-ohm load, while harmonic distortion is less than 0.8% at full rated output. The use of low-noise silicon transistors throughout ensures complete stability and absolutely quiet operation. And monolithic construction of the multiplex section results in stable wide-channel separation over a broad frequency range.



Circle No. 77 on Reader Service Page 15 or 115

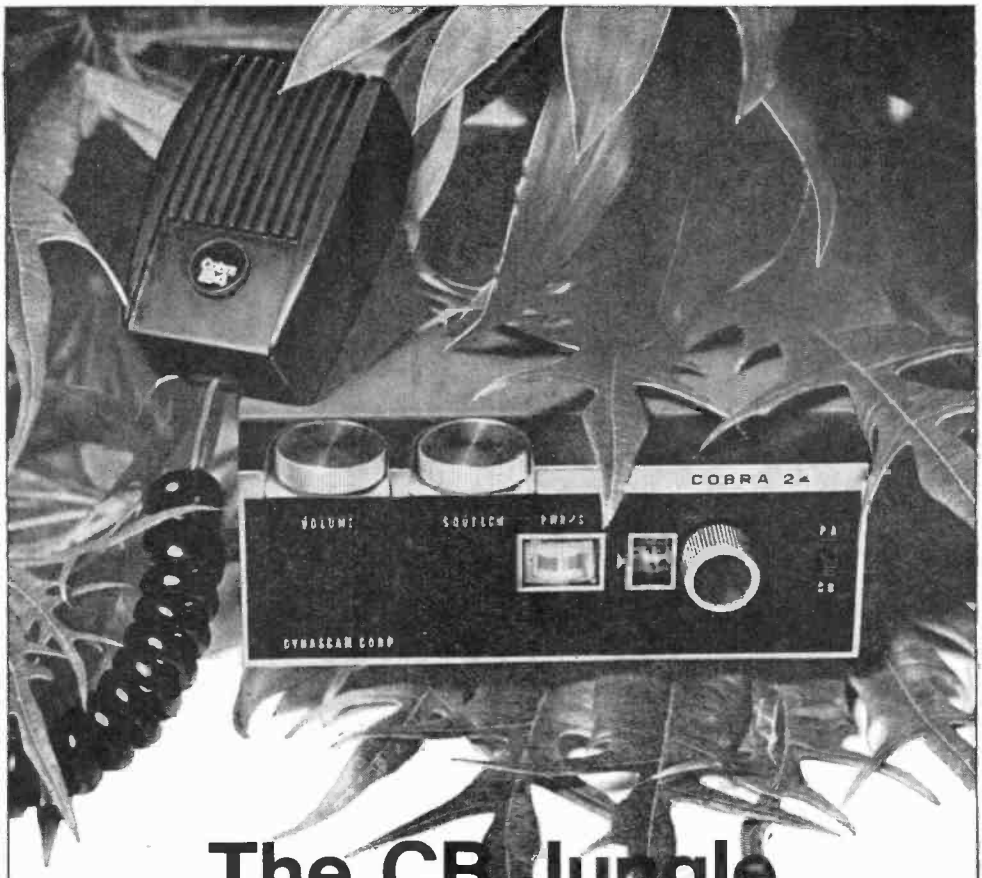
ELECTRONIC PROJECTS KIT

Two transistors and a solid-state diode are included in the more than 40 electronic parts that make up *Radio Shack's* Science Fair "50-in-1 Project Kit." This safe kit is designed for the beginning experimenter to put together 50 or more battery-powered projects. Provided with the kit is a manual that describes how to put together the circuits and how the circuits operate. The beginner's problem of reading schematic diagrams is given special attention, and parts connections on the board are numbered for easy location. A chart comes with each circuit diagram, indicating which numbers should be connected together. The 50 projects described in the manual include radio receivers and transmitters, test instruments, rain and burglar alarms, and a tachometer circuit.

Circle No. 78 on Reader Service Page 15 or 115

MONITOR RECEIVER FOR EVERYONE

Foresters, doctors, and movie makers are just some of the possible users of the Model PRO-2 business and emergency communications receiver made by *Radio Shack.* In fact, just about everyone interested in communications—even if it is just listening to the weather forecasts on 162.55 MHz—will find use for this re-



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The Cobra 24 preys on the others' weaknesses. With *more talk power*—a full, legal-limit 5-watt input and exclusive Dynascan DYNA-BOOST Speech Compression. And a selective dual-conversion superhet receiver with ceramic filter to give outstanding selectivity and gain.

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Cobra 24 **Net $169.95.**

Product of DYNASCAN CORPORATION
1801 W. Belle Plaine, Chicago, Illinois 60613

CIRCLE NO. 2 ON READER SERVICE PAGE

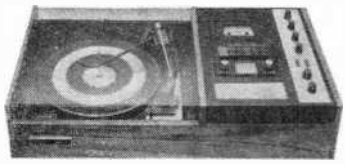
PRODUCTS (*Continued from page 22*)

ceiver, considering that the receiver tunes the 30-50-MHz and 152-174-MHz bands. The PRO-2 is a specially designed high-frequency FM receiver, containing a complete tuning system with a color-coded scale for each band. Sensitivity of the receiver is better than 0.5 μV, and output power to the built-in speaker or 8-ohm external phones or speaker is 2 watts of audio. A squelch control limits noise nuisance, and an audio signal for tape recording or external audio system is available on the rear panel. The receiver can be a.c. line powered or operated from a 12-15-volt d.c. source.

Circle No. 79 on Reader Service Page 15 or 115

STEREO/HI-FI MUSIC CENTER

The most recent advances in electronics for listening pleasure are said to have been combined in the *Allied Radio Corp.* Model 1450 stereo hi/fi music center. It contains a solid-state receiver, automatic turntable, cassette recorder, and walnut base. The 55-watt $\pm$1 dB (into 4 ohms) stereo amplifier has separate bass and treble controls, mono-

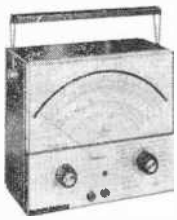


stereo switch, and loudness control. Microphone inputs and a stereo headphone jack, as well as tape and auxiliary inputs are provided. Frequency response is 20-30,000 Hz $\pm$1 dB. The stereo FM/AM tuner employs FET's in the front end, IC's, and a.f.c. for finest reception. The dial has a unique point-of-light tuning indicator. The four-speed automatic turntable and stereo cassette recorder have all of the features needed for maximum versatility.

Circle No. 80 on Reader Service Page 15 or 115

MAXIMUM-ACCURACY VOM

Simpson Electric's Model 202 "Accu-Log" VOM eliminates the need to keep reading at the high end of the scale or to worry about "percent-of-full-scale" accuracy ratings. The 202's quasi-logarithmic scale gives consistent percent-of-*reading* accuracy to within 2% for d.c. and 3% for a.c. values. The instrument has six d.c. and four a.c. voltage, five d.c. current, and five resistance ranges. Two of the resistance ranges are for low-power testing. The 7" antiparallax mirror scale reduces reading error; and the taut-band movement is overload protected, shock resistant, and self-shielding.



Circle No. 81 on Reader Service Page 15 or 115

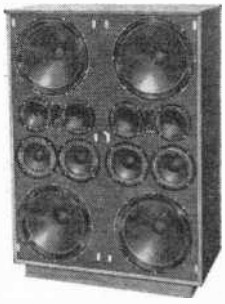
SOLID-STATE METAL LOCATOR

An all-solid-state metal locator capable of detecting buried metal objects down to a depth of 6′ was recently introduced by *Heath Co.* Called the Heathkit Model GD-48, the new metal locator employs the induction-balance method of detection. As the sensing head of the instrument comes near a metal object, a loud tone is heard, from a built-in speaker or through headphones. For more accurate indications, a meter monitors relative imbalance between the two induction coils. The on-off/sensitivity control can be adjusted to detect an object as small as a dime buried at a 6" depth. The search head is supplied with both coils already accurately aligned and cemented in place; everything else is in kit form.

Circle No. 82 on Reader Service Page 15 or 115

FOUR-WAY SPEAKER SYSTEM

The LWE IV, a new 14-speaker, high-efficiency four-way, non-resonance speaker system is being introduced by LWE Division of *Acoustron Corp.* The system is designed and engineered with inverse feedback electronic suspension and room gain control for improving sound reproduction in large listening rooms. The transducer complement of the LWE IV consists of four 15" woofers, four each 8" and 6" midrange speakers, and two 5" horn-type tweeters. Frequency response of the system is 20-20,000 Hz $\pm$3 dB with crossover points at 150, 1000, and 4000 Hz. Nominal impedance is 4 ohms. Power handling capacity is 200 watts rms with 100 watts minimum power required to drive the system. The control panel contains high-frequency, high-midfrequency, low-midfrequency controls; phase switch; auxiliary amp jack; main input connector; and exclusive gain control.



Circle No. 83 on Reader Service Page 15 or 115

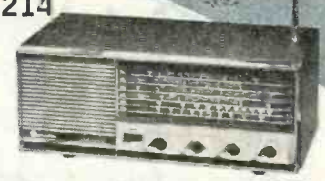
FOUR-TRACE OSCILLOSCOPE PREAMP

A four-trace oscilloscope preamplifier, the first in a new line of kits, has been announced by the *Phase Corp.* The preamp is designed for use with any a.c. or d.c. oscillo-

(*Continued on page 26*)

S-120A,
"Star Quest"

SX-133

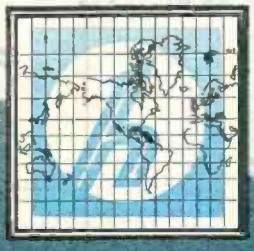


S-214

SHORT-WAVE
General coverage and special frequency receivers. A range of models stretching across every known frequency used in communications and entertainment. Prices range from $59.95

SX-122A

S-240



CR-44A,
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SR-2000

OUR SHORT-WAVE RADIOS COVER THE WORLD

SR-400

CRX-101,
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Table model and hand-held tunable solid-state receivers. High-performance superheterodyne units of high sensitivity and selectivity for aviation, marine, and industry/public service coverage. Prices from $39.95

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CRX-103A, -104, -105A

HA-20

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CIRCLE NO. 14 ON READER SERVICE PAGE

hallicrafters

600 HICKS ROAD
ROLLING MEADOWS, ILLINOIS 60008

NEW PRODUCTS

(*Continued from page 24*)

scope, providing the capability of observing as many as four waveforms simultaneously. Individual centering control is provided for each of the four inputs to the preamp. With an input impedance of 1 megohm/channel, the sensitivity of the preamp is limited only by the sensitivity of the scope with which it is used. The preamp is compact, facilitating mounting inside the scope housing or in an optional case. The circuit of the preamplifier employs four FET's and nine silicon transistors. Included in the kit is a printed circuit board that comes etched and drilled.

Circle No. 84 on Reader Service Page 15 or 115

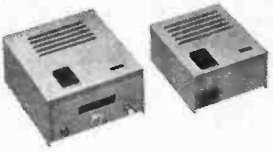
EMERGENCY/PSB MONITOR RECEIVERS

A new line of police/fire monitor receivers available from *Courier Communications, Inc.*, includes the Model COP-20H (148-175 MHz) and Model COP-30L (20-50 MHz). Both models are three-channel, pocket-size receivers that tune the bands indicated plus the AM broadcast band. An adjustable squelch control is incorporated to minimize hum and noise. An exclusive feature of these receivers is that the three crystal-controlled channels can be monitored with no coil changes. A built-in battery-level indicator, earphone and carrying strap, and built-in telescoping antenna are standard items with the receivers.

Circle No. 85 on Reader Service Page 15 or 115

WIRELESS SMOKE AND FIRE ALARM

The *Olson Electronics, Inc.*, Model SW-440 smoke and fire alarm features solid-state circuitry for reliable and economical home and business protection. The alarm is equipped with sensitive smoke and heat detectors, with provisions for adding an external heat sensor, emergency pull chain, and an extra a.c. outlet for additional signal devices. The detector can be located in the probable fire area and the alarm anywhere in the same building (on the same electrical system to provide a closed path for the wireless system, of course). The heat sensor activates the alarm at 135° F, sounding a loud buzzer.



Circle No. 86 on Reader Service Page 15 or 115

DUAL POLARIZATION ANTENNA

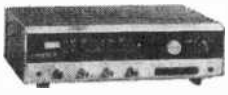
The *Mosley Electronics Inc.* Model DMS-3D is a deluxe 12-element "Saser Beam," a combination of two MS-3D beams stacked. It has the sturdy construction of a beam plus a choice of polarization usually found only in

the quad design. Each of the six horizontal and six vertical elements has two deluxe high-Q coils that are so powerful they can be used on a 10-meter ham antenna. A double-T matching system provides balanced feed horizontally and vertically; and a polarization switching control, located at the transceiver, permits selection of polarization at the turn of a dial. Technical specifications—10.5-dB compared to reference dipole, 12.6-dB over isotropic source forward gain; 25-dB front-to-back ratio; 30-dB polarization isolation; 1.5/1 or better SWR; 52-ohm feed impedance; 166-lb EIA standard 80 mi/h wind load.

Circle No. 87 on Reader Service Page 15 or 115

100-WATT AM/STEREO FM RECEIVER

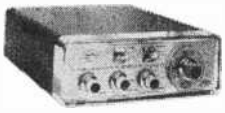
Solid-state design, with four FET's, is used in *Lafayette Radio Electronics'* recently introduced Model LR-775 100-watt solid-state AM/stereo FM receiver. The LR-775 has automatic stereo FM switching and stereo indicator light; an illuminated tuning meter; main and remote speaker switching; front- and rear-panel jacks for tape output; and rear-panel stereo inputs for magnetic and ceramic phono, auxiliary, and tape play. Other standard items include switched and unswitched a.c. outlets. Technical specifications: 50 watts/channel dynamic power into 4 ohms; less than 1% at rated output, 0.07% at 1 watt harmonic distortion; 20-20,000 Hz ±1 dB frequency response; 15-30,000 Hz power bandwidth; 1.7-μV IHF usable sensitivity; 1.5 dB capture ratio; 40 dB at 400 Hz stereo multiplex separation.



Circle No. 88 on Reader Service Page 15 or 115

TWO MONITOR RECEIVERS IN ONE

The brand new *Courier Communications, Inc.*, Model COP-5OHL is a deluxe 12-channel, crystal-controlled high- and low-band monitor that is actually two receivers in one. Six high-band and six low-band channels can be monitored with crystal-clear reception with an exclusive r.f. peaking control that provides greater receiver sensitivity for each channel than was possible before. An exclusive tone control in the COP-50HL emphasizes highs or lows at the listener's discretion, and greater efficiency is obtained through the use of an IC in the audio section. Technical specifications: 25-50 MHz FM low-band, 150-175 MHz FM high-band frequency ranges; 10.7 MHz and 455 kHz i.f.; 0.5-μV sensitivity for 50 mW output on both bands; 0.5-μV and 0.3-μV sensitivity for 20 dB signal-to-noise ratio on high- and low-band, respectively; 46 dB minimum image rejection; 6 dB ±12 kHz and 60 dB ±20 kHz selectivity; 117-volt a.c./12-volt d.c. operation.



Circle No. 89 on Reader Service Page 15 or 115

New RCA WV-500B VoltOhmyst® only $88.00*

It measures AC volts, DC volts, resistance, current! It's portable, stable, accurate! It's all solid state!

RCA's new WV-500B VoltOhmyst is a completely portable voltmeter that's just right for the shack. It's battery-operated (no AC line to stretch to that unreachable outlet). No more warm-up time! No more "zero-shifting" (which sometimes happens with vacuum-tube voltmeters). WV-500B measures: DC voltages from 0.01 to 1500 volts; DC current from 2μA to 1500mA; AC voltages (RMS) 0.1 to 1500 volts; AC peak-to-peak voltages from 0.5 to 4200 volts; resistances from 0.2 ohm to 1000 megohms.

AC, DC, and resistance measurements are selected by a convenient switch in the single-unit probe. The probe is wired-in and equipped with fully-shielded input cable. Test leads are included for measuring current. An accessory slip-on, high-voltage probe is available for measuring up to 50,000 volts, DC.

Think of it! A solid-state RCA VoltOhmyst for only $88.00*. Get complete specs from your Authorized RCA Test Equipment Distributor. Or write Commercial Engineering, Sect. BW-113, RCA Electronic Components, Harrison, N.J. 07029.

*Optional distributor resale price

RCA

CIRCLE NO. 23 ON READER SERVICE PAGE

COVER STORY

BUILD THE

TWO-TONE "WAVERLY" ALARM

AUDIBLE WARNING OF MANY USES

BY DON LANCASTER

HAVE YOU EVER needed an audio tone source that was really loud, absolutely distinctive, or even downright annoying? If so, the Two-Tone Alarm is for you.

The circuit of the Alarm automatically switches the audible output from 500 to 1000 Hz five times a second, producing a *"twee-dell, twee-dell"* sound that can't be missed anywhere and positively can't be ignored. By adding an optional potentiometer to the circuit, the sound level can be changed from a high tweet to a low growl.

The Alarm can be set to run continuously or it can be turned on with a local switch or a remotely operated contactor. There are two outputs; a low-level one which can be amplified in any audio amplifier and a high-level one that can be used to drive a conventional speaker directly.

You can use the Alarm as a panic button, a novelty audio device, an electronic doorbell, a selective call, a Science Fair multivibrator demonstrator, a burglar alarm, or as a signalling device for high-noise industrial environments.

IC EXPERIMENTER'S CORNER

Construction. A schematic diagram of the Alarm is shown in Fig. 1. While it is not essential, a printed circuit board greatly simplifies the assembly. If you want to make your own, use the foil pattern and drilling details shown in Fig. 2. Mount the parts as shown in Fig. 3. The integrated circuit polarity is identified by a notch (between pins 1 and 14) and a dot. In the illustrations it is shown

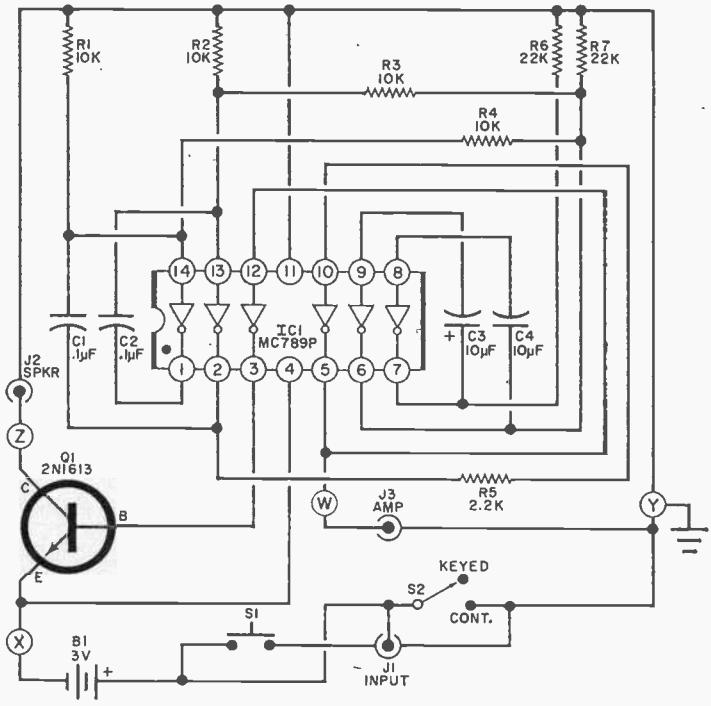


Fig. 1. The circuit is essentially a pair of audio oscillators that interact with each other to produce the strange sound. Note that the positive side of the battery is grounded to the chassis to ease the wiring.

PARTS LIST

B1—D cell (2)
C1,C2—0.1-μF, 10-volt disc ceramic capacitor
C3,C4—10-μF, 10-volt electrolytic capacitor
IC1—MRTL hex inverter (Motorola MC789P)
J1-J3—Phono jack
Q1—2N1613 npn medium-power transistor (or similar)
R1-R4—10,000-ohm, ¼-watt resistor
R5—2200-ohm, ¼-watt resistor
R6,R7—22,000-ohm, ¼-watt resistor
S1—S.p.s.t. normally open pushbutton switch
S2—S.p.s.t. slide switch
Misc.—PC terminals (4), 3" x 4" x 5" case, mounting hardware, battery holder (Keystone 176), PM speaker and enclosure (optional), wire, solder, etc.
Note—The following are available from Southwest Technical Products, Box 16297, San Antonio, Texas, 78216: etched and drilled circuit board, $1.50; complete kit of all parts including prepunched, vinyl-clad case, but less batteries and speaker, $6.90, postpaid in U.S.A.

HOW IT WORKS

The integrated circuit used here is called a hex inverter and contains six separate inverting amplifier stages. Two of these stages are combined with *R6, R7, C3,* and *C4* to form a 5-Hz astable multivibrator (square-wave oscillator). Two more inverters are combined with *R1* through *R4* and *C1* and *C2* to form a second astable multivibrator that can operate at either 500 or 1000 Hz, depending on the state of the 5-Hz multivibrator and feedback through *R3* and *R4*.

The remaining inverters provide load isolation, while transistor *Q1* provides enough drive to handle a permanent-magnet speaker.

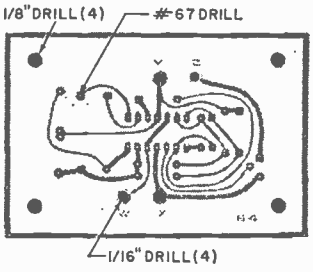
Power for the Alarm is obtained from two D cells. Any other medium-current d.c. supply with a voltage from 1.5 to 6 volts can be used. Switches *S1* and *S2* and jack *J1* are all in parallel to energize the Alarm. To simplify the assembly, the case is connected to the keyed positive supply level (PC terminal Y).

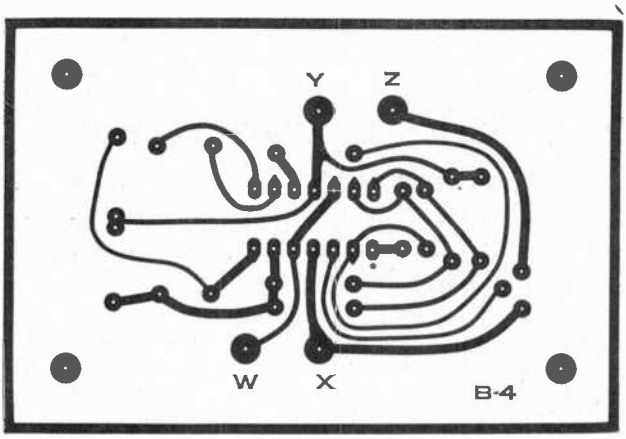
from the top. Be sure to orient it properly and use a small soldering iron and fine solder when installing it. Also, be careful about the polarities of electrolytic capacitors *C3* and *C4*.

Assemble the Alarm in a 3" × 4" × 5" metal box. The battery holder is mounted on the bottom with pop rivets or #6 hardware, while the PC board goes on the top with suitable spacers or #6 hardware.

Operation: To test the Alarm, either connect the amplifier output (*J3*) to a suitable amplification system or attach

Fig. 2. Actual-size foil pattern for the Two-Tone Generator. The IC is oriented so that pin 1 is adjacent to the small dot on the foil pattern. After fabrication, the board can be drilled as shown below, and PC terminals can be used at the four lettered locations. The board is supported by spacers at each corner location. Component location is shown in Fig. 3.





COVER FEATURE

This is the first in a series of simplified integrated circuit projects. In addition to the Two-Tone Alarm, the series includes a Signal Injector, a Bounceless Pushbutton, a Shift Register, and a 100-kHz Standard. The last four will appear in future issues of POPULAR ELECTRONICS. In these articles, the author demonstrates a variety of uses of commonly available integrated circuits. The projects themselves may be used for classroom or Science Fair demonstrations, or they may be repackaged and put to more constructive uses. Each project will be complete and will include details on circuit operation.

a low-impedance (4-, 8-, or 16-ohm) speaker to the speaker jack (*J2*). The Alarm should operate immediately.

To vary the output sound, add a 500- or 1000-ohm potentiometer in series with *S1*.

Capacitors *C1* and *C2* determine the frequency of the lowest note, while *C3* and *C4* determine the switching rate. The difference between the highest and lowest notes is determined by *R3* and *R4*. You can experiment with any of these values to get different audio results.

Volume should be more than enough for most applications. If you want more, however, try using a higher supply voltage (up to 6 volts). You can also use an output matching transformer or a high-efficiency horn-type speaker. -30-

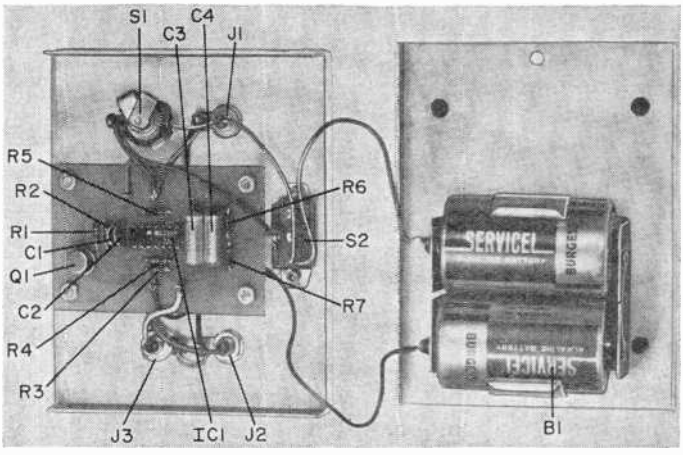


Fig. 3. Although the alarm can be built in almost any type of case, the prototype was built within a small metal enclosure. Install the components on the PC board as shown at left and mount batteries on other side.

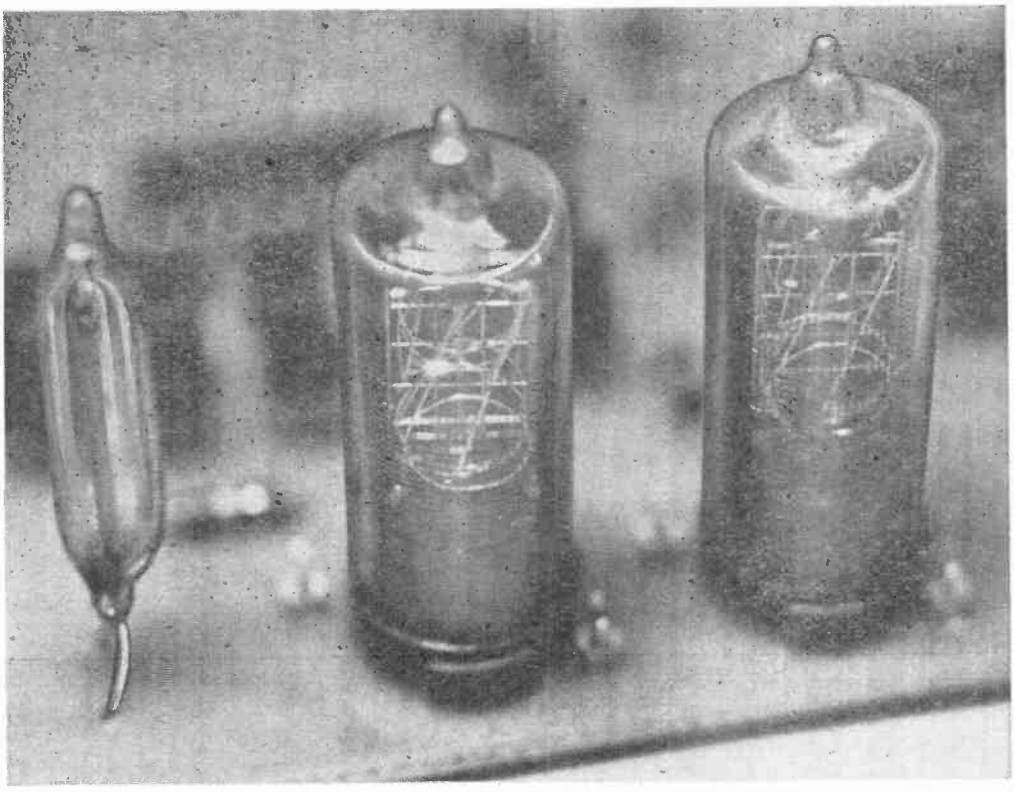
LSI Gives Semiconductors a "Trip"

A TRUE-FALSE QUIZ THAT COVERS THE ELECTRONICS WATERFRONT

(*Answers on page* 17)

BY VIC BELL

1. LSI is being used to "dope" many new types of semiconductor materials. TRUE____ FALSE____
2. If the third color band on a resistor is silver or gold, the resistor is either a 10% or a 5% unit and is less than 100 ohms. TRUE____ FALSE____
3. Spreading the outside plates on a variable air capacitor decreases its maximum capacitance. TRUE____ FALSE____
4. When two dissimilar metals are joined and heated, a voltage is developed across their junction. This is known as the Seebeck effect. TRUE____ FALSE____
5. "Skating force" is the side pressure exerted on a phonograph tone arm by the record groove spiral. It can be eliminated by using a dynamically balanced tone arm. TRUE____ FALSE____
6. A magnetostrictive material is one that changes its physical dimensions when magnetized. TRUE____ FALSE____
7. When a coil is wound around a magnetostrictive material core, a voltage is developed across the coil if a pressure is applied to the core. TRUE____ FALSE____
8. The Curie Point of a material is the temperature where it becomes radioactive. TRUE____ FALSE____
9. The resistances of both tungsten and carbon are inversely proportional to temperature. TRUE____ FALSE____
10. The combination of two 10-ohm, ½-watt resistors in series will have the same power rating as the combination of two 40-ohm, ½-watt resistors in parallel. TRUE____ FALSE____
11. Infrared detection systems are of little use in desert areas because of the high sand temperature. TRUE____ FALSE____
12. The SCR is the solid-state equivalent of the d.c. latching relay. TRUE____ FALSE____
13. Submarines are capable of radio communications while submerged by using the SHF band. TRUE____ FALSE____
14. Rare earths now being used in color picture tubes are not really rare compared to many other elements. TRUE____ FALSE____
15. Coaxial cable cannot be made substantially smaller because frequency response dictates its size. TRUE____ FALSE____
16. An anisotropic magnet is one which has the same magnetic characteristics along any axis or direction. TRUE____ FALSE____
17. The first half of the horizontal sweep in a normal TV receiver (left side of the screen) is formed by the damper circuit. TRUE____ FALSE____



Build Numeric Glow Tube DCU

Nixie Readout at $15 per Decade

BY DON LANCASTER

NOW IT IS possible to build a high-speed, decimal counter module (complete with logic and Nixie® tube readout) at a cost of $14.90 per decade. This counter, with speeds from d.c. to either 8 or 12 MHz (depending on the type of logic used), can be built with 2½ decades (0-199), 3½ decades (0-1999), or 4½ decades (0-19999) using a single printed circuit board. No mounting or front brackets are needed and there is a minimum of interconnections to be made.

The design provides an overflow indicator and latch which operate when full scale is exceeded. This function is useful for overrange indication or as a "turn-around" command on dual-slope DVM designs. Display blanking, in which the readout can be turned off or on by an external 0-2-volt d.c. control signal is also available. This feature eliminates display bobble or blur and back-and-forth numeral motion during rapid counting.

There is also a self-contained "gate" input that permits turning the counters on and off and is useful for period or frequency measurements. This feature eliminates quite a bit of external circuitry.

You have a choice of the type of logic you use in building the DCU. If RTL is used, the unit is fully compatible with previous POPULAR ELECTRONICS projects. Or you can use Utilogic® (Signetics Corp.), a faster type of logic with a higher voltage swing that is compatible with industrial TTL and DTL circuits. Both types of logic cost the same.

The IC counters are "weighted" in the industrial 1-2-4-8 manner to provide electrical as well as visual outputs if de-

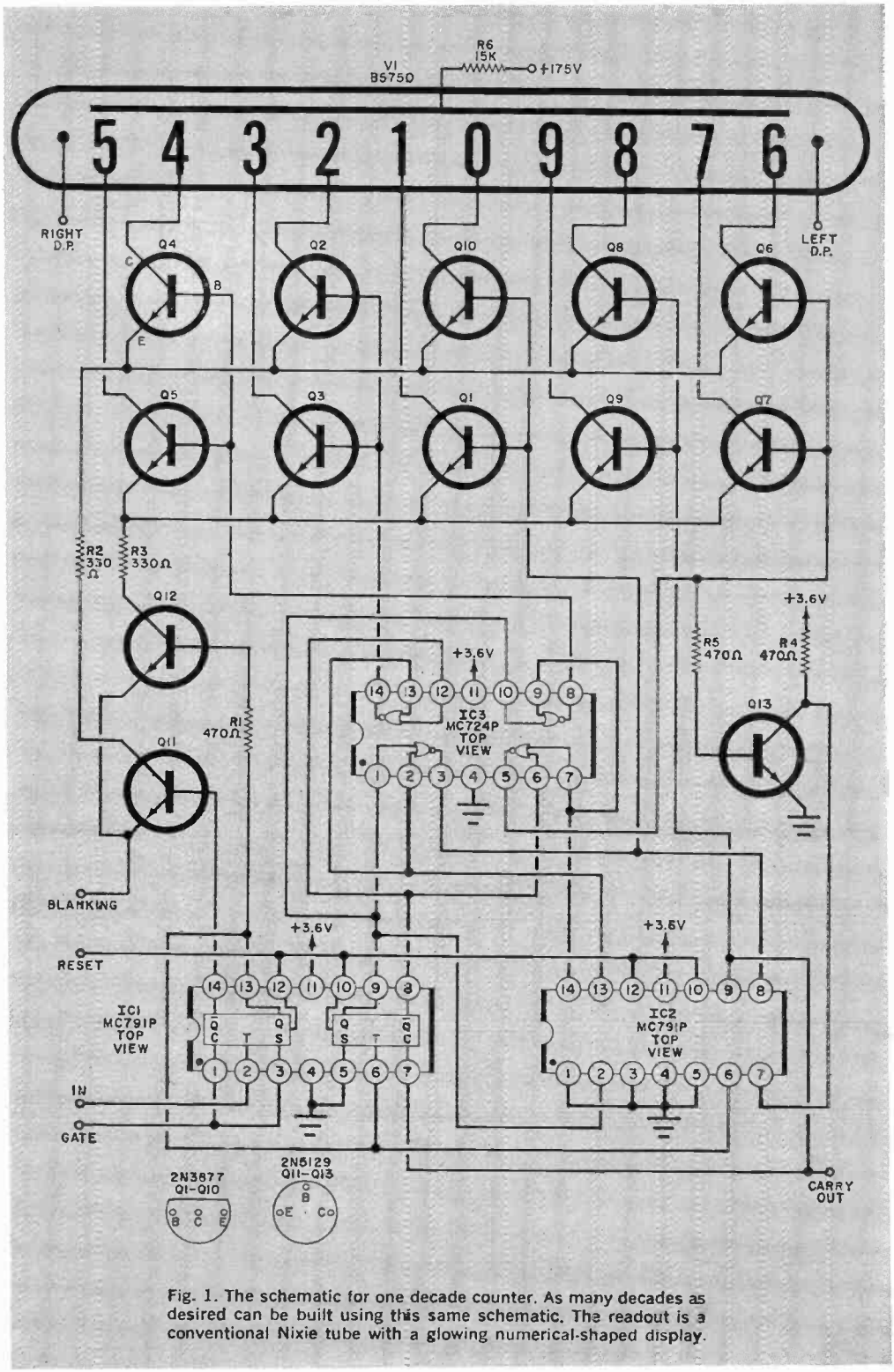
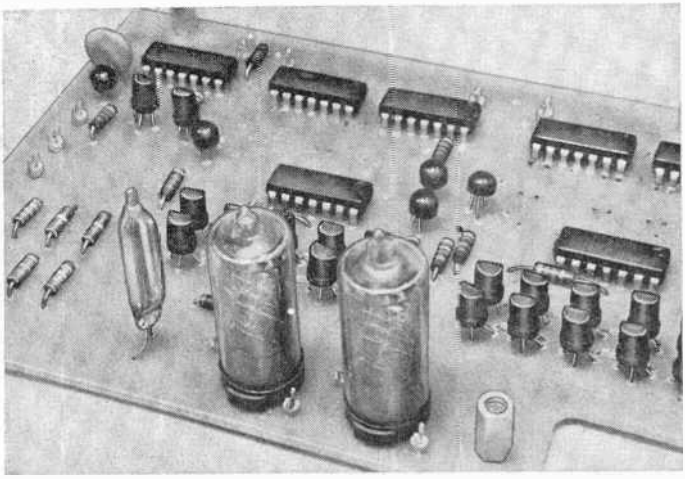


Fig. 1. The schematic for one decade counter. As many decades as desired can be built using this same schematic. The readout is a conventional Nixie tube with a glowing numerical-shaped display.



The 2½-decade board. Each Nixie indicates up to 9, and at the 100th count, both Nixies indicate zero while the special "1" neon lamp comes on. The combination indicates to 199. At 200th count, a special over-range neon lamp (not shown) glows indicating that counter has progressed beyond its limits.

sired. A simple modification and an external adapter can be used to convert the RTL version of the DCU into an "add-subtract" counter which operates in either direction. The units are useful in computers, calculators, and positional controls.

When RTL is used in this new DCU, the unit can be used in POPULAR ELECTRONICS projects such as the "Digital Voltohmmeter," the "Universal Frequency Counter," the "Sports Timer," and the "Electronic Stopwatch." In fact, with a few mechanical changes, the new 2½-digit assembly can be dropped into the "Digital Voltohmmeter" without adding any new parts. This makes a DVM that looks like the industrial models that cost many times as much.

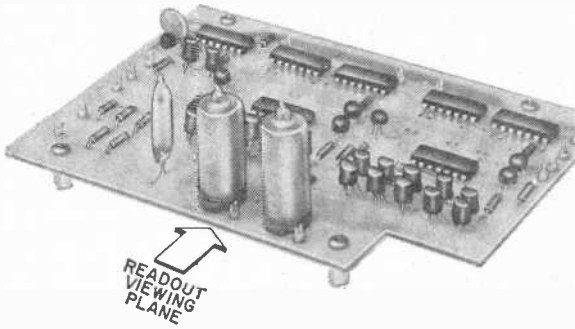
PARTS LIST
DECADE COUNTER

IC1,IC2—MRTL dual JK flip-flop (Motorola MC791P)
IC3—MRTL quad two-input gate (Motorola MC724P)
Q1-Q10—2N3877 transistor (Allied Electronics 49D30 2N3877 SPR, no substitute)
Q11-Q13—Transistor (National Semiconductor 2N5129)
R1,R4,R5—470-ohm, ¼-watt resistor
R2,R3—330-ohm, ¼-watt resistor
R6—15,000-ohm, ¼-watt resistor
V1—Nixie tube (Burroughs B5750)
Misc.—#24 wire jumpers, insulated sleeving, solder, spacers, mounting hardware, etc.
Note—The following are available from Southwest Technical Products, Box 16297, San Antonio, Texas 78216: Etched and drilled PC boards—2½-digit, $4.00; 3½-digit, $5.75; 4½-digit, $7.50. Complete kit of all parts—2½-digit, $43.50; 3½-digit, $59.50; 4½-digit, $75.00. Write for a complete list of related circuits, kits, and instruments. All prices postpaid in U.S.A.

Because of space limitations, construction details are given here for the RTL counter only. Complete information, including PC layouts, for the Utilogic version is available without cost from the source given in the box.

In deciding whether you want to use RTL or Utilogic in your DCU, consult the Table.

The circuit for one decade of the DCU is shown in Fig. 1 and that of the overflow counter is shown in Fig. 2. Although these are shown as separate circuits, in practice, one overflow counter and as many decades as are necessary are mounted on one PC board. Interconnections for the units are shown in Fig. 3. Note that the Gate connections of all decades except the first are grounded. In this way, if the input (units) decade is turned on or inhibited, the counter operates or not accordingly.



Overall view of the 2½-decade board. When mounted in enclosure, only the readouts will be visible.

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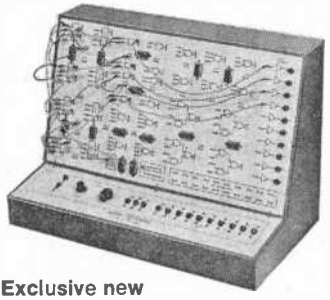

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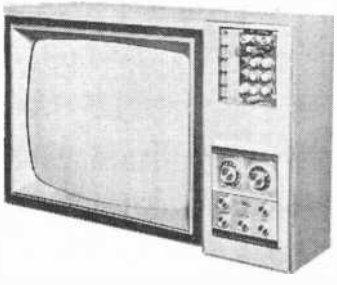

COLOR TV 295 SQ. IN. PICTURE

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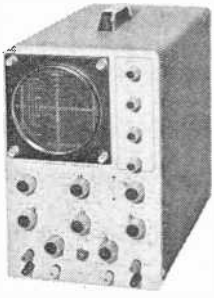

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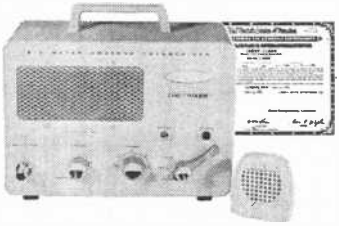

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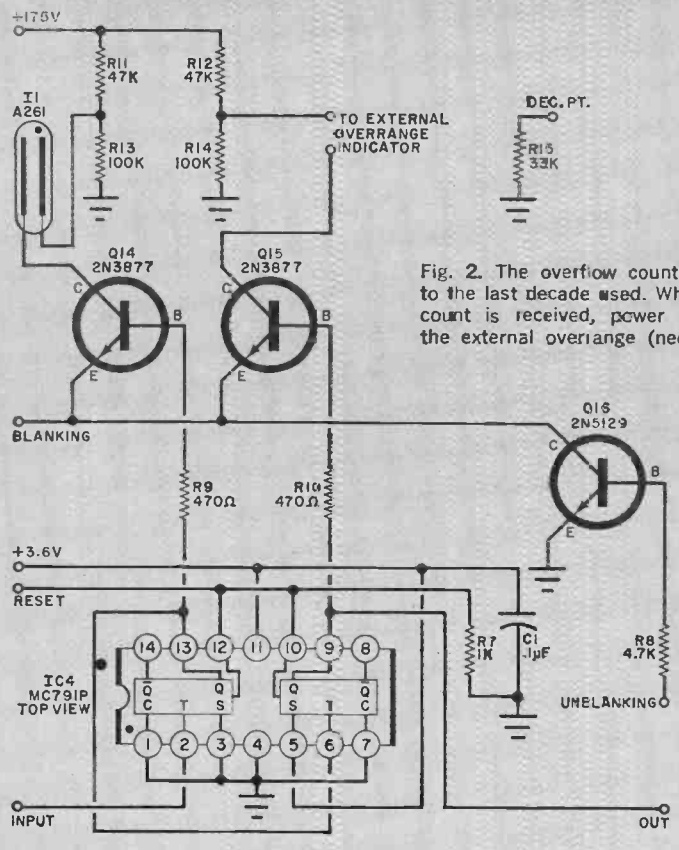


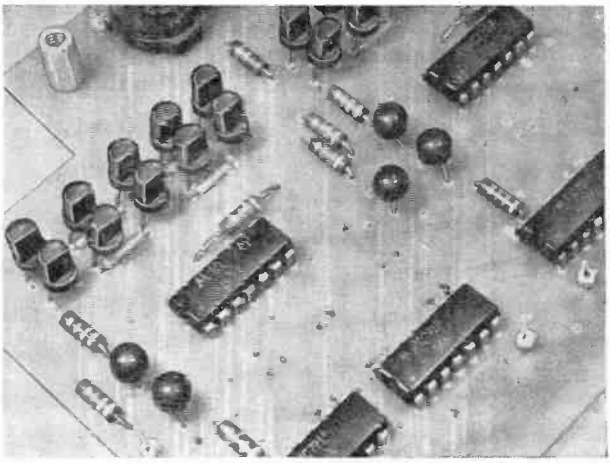
Fig. 2. The overflow counter is coupled to the last decade used. When an excess count is received, power is applied to the external overrange (neon) indicator.

PARTS LIST OVERFLOW COUNTER

C1—0.1-μF, 10-volt disc ceramic capacitor
IC4—MRTL dual JK flip-flop (Motorola MC 791P)
Q14,Q15—2N3877 transistor (no substitute)
Q16—Transistor (National Semiconductor 2N5129)
R7—1000-ohm,
R8—4700-ohm
R9,R10—470-ohm
R11,R12—47,000-ohm
R13,R14—100,000-ohm
R15—33,000-ohm
(All resistors ¼-watt)
I1—Numeral "1" neon readout (Signalite A-261)

Construction. Decimal counting units can be built in a number of configurations: 1½ (counting to 19), 2½ (to 199), 3½ (to 1999), 4½ (to 19999), etc. In each case the ½ stands for the "1" of the overflow counter, while the whole number stands for the number of decade counters (each counting to 9).

Construction details are given here for the popular 2½-digit assembly. Because of the complexity of the circuit, a printed board is mandatory. A board is shown actual-size in Fig. 4. A commer-



General view of a portion of a 2½-decade board. This view shows the correct way to install the ten switching transistors for the Nixie drive.

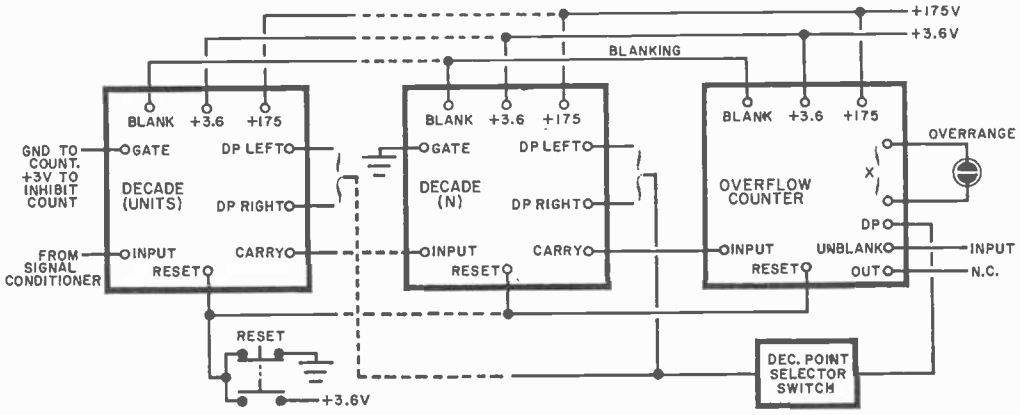


Fig. 3. Interconnection of decades, overflow, overrange indicator and decimal-point selector. Note that all decade gate inputs, other than the first one, are grounded. First gate is used to start and stop counting.

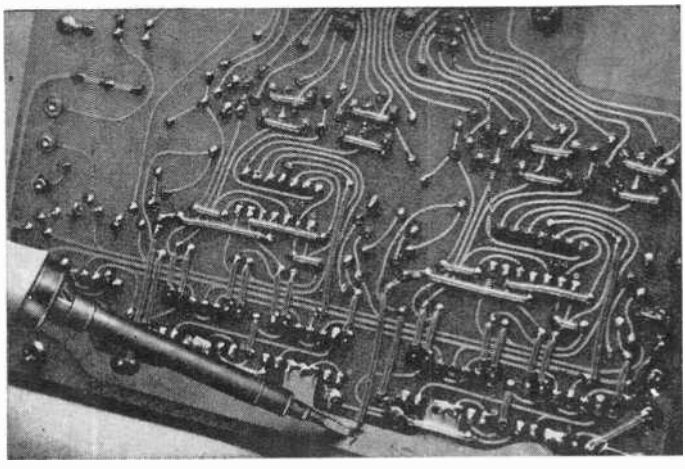
cially made board is available (see Parts List for Fig. 1). If you prefer to make your own, it is recommended that you use the better-grade, G-10 fiberglass.

Besides drilling details, Fig. 5 shows the location of the 32 jumpers located on the component side of the board. In addition, there are four jumpers that are "sewn" through the board, so that they alternate from one side to the other and pick up five connections each. Details of this are also shown in Fig. 5. The long bare jumper is soldered at one end and then threaded through the holes in the board. Use insulated sleeving over the exposed parts to prevent shorts to the transistor leads.

Once the various jumpers have been installed, the components are inserted in accordance with the layout shown in Fig. 6. Use a low-power (40-watt) soldering iron and thin solder to make all connections. The IC's are identified by a notch and dot code for positioning. To insert the 20 driver transistors, hold them with the flat facing away from the readout tubes. Then bend the center lead back toward the tubes and insert as shown.

In inserting the Nixie tubes, put the leads in two at a time. Before soldering, make sure that all leads are tight, none are doubled over or shorted to each other and the viewing face of the tube is aimed in the correct direction. Also be certain the tube is vertical.

Mount the neon lamp (for numeral 1) so that the metal rods within the tall narrow bulb are at the same height as the numerals in the Nixie tubes.



Underside view of the PC board showing how some jumpers are connected. These below-board jumpers must all be insulated.

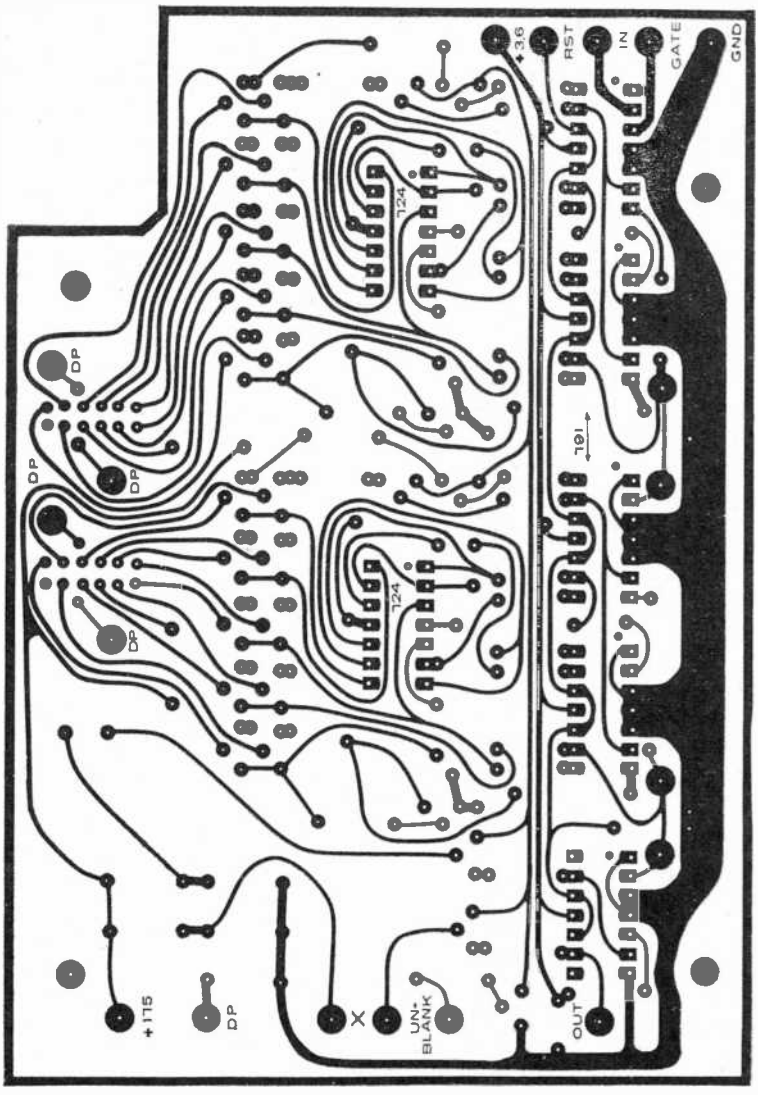
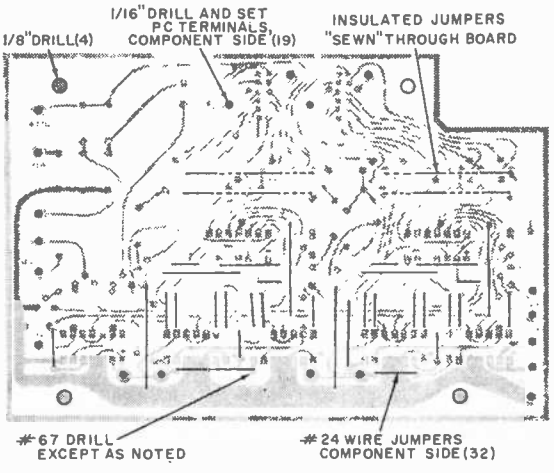


Fig. 4. Actual-size foil pattern for the 2½-decade board, with associated overflow counter. By judicious re-arrangement of the foil pattern the number of decades used can be extended. Boards for multi-decade readout can also be purchased.



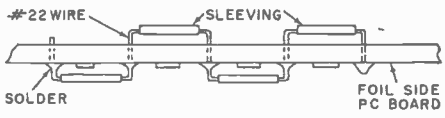


Fig. 5. Board drilling and jumper installation. Some jumpers are "sewn" through the board as illustrated above. Start at one end, and pass the wire through the respective holes, inserting the insulation at the required places.

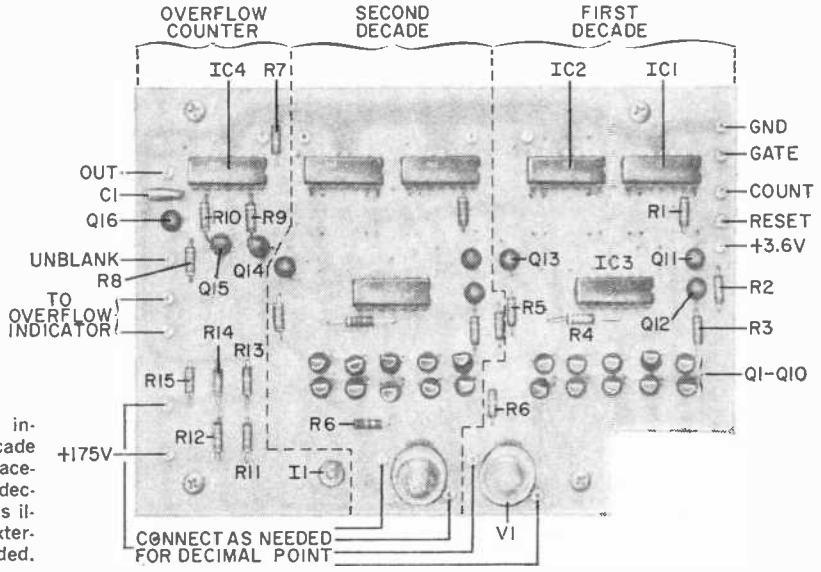


Fig. 6. Component installation of 2½-decade board. Other than placement of R6, both decades are similar. This illustration shows external connections needed.

Use. The 2½-digit module can be used in any one of a variety of chassis styles —as long as it has a rectangular front-panel cutout for the two Nixie readout tubes and the neon light. A special polarized optical filter is available (see Parts List for Fig. 1) to improve readout visibility. This filter should be oriented to produce the blackest instrument interior when viewed and illuminated through the filter. Once the correct orientation has been found, glue the filter in place behind the front-panel cutout.

External connections to the module are shown in Fig. 6. The 2½-digit module requires +175 volts at 5 mA for the readouts, and +3.6 volts at 340 mA for the remainder of the circuit. A power supply (such as the one shown in Fig. 7) is required. It has low ripple with high-frequency bypassing—an essential.

Ground leads should be short and of

PARTS LIST
POWER SUPPLY

C1—100-μF, 250-volt electrolytic capacitor
C2—6000-μF, 10-volt electrolytic capacitor
C3—200-μF, 6-volt electrolytic capacitor
C4—0.1-μF, 10-volt disc ceramic capacitor
D1,D2—1-ampere, 600-volt silicon diode (1N4005 or similar)
D3—1-ampere, 50-volt silicon diode (1N4001 or similar)
D4—4.2-volt (RTL) or 5.6-volt (Utilogic) 1-watt zener diode
F1—0.5-ampere fuse and fuse holder
Q1—2N5190 transistor and suitable heatsink
S1—Power switch (usually a part of other instrument or circuit switching)
*T1—Power transformer; secondary 135-0-135 V at 50 mA, 6.3 VCT at 1 A (Southwest Technical #TR-DVM or similar)**
Misc.—Mounting spacers, hardware, wire, solder, terminals, line cord and strain relief.
**Available at $6.50 plus 4 lb postage from Southwest Technical Products, Box 16297, San Antonio, Texas 78216.*

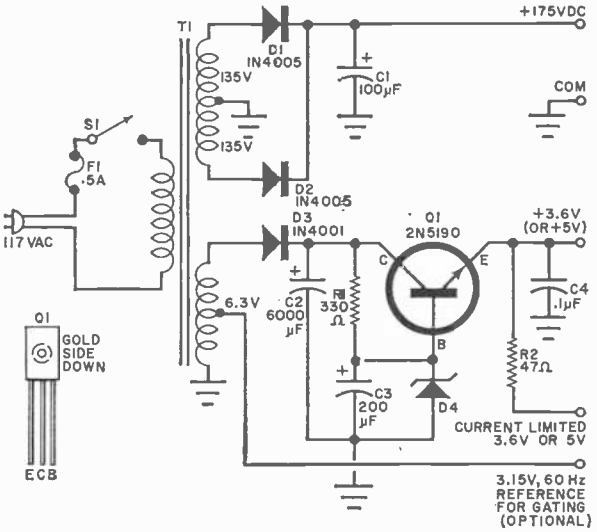


Fig. 7. Low-ripple power supply for the 2½-decade board. By changing D4, the supply can be used for either RTL or Utilogic circuits.

FOR UTILOGIC DCU DETAILS

Complete construction information, including full-size PC layout replicas and all other details, is available free upon request from:

Alvin R. Smith, Section Head
Digital Design Group
Southwest Technical Products, Inc.
Box 16297
San Antonio, Texas 78216

Please limit free requests to single copies.

heavy gauge wire (at least #16). The "Out" terminal on the board is used only in some special DVM circuits and is normally left unconnected. The terminals along the rear of the board are for use in the future with an add-subtract adapter and are also left unconnected for routine applications.

The "Gate" input, if used, goes to an RTL-derived signal that is positive when the counter is to be inhibited and ground when the counter is to count. If you are not going to gate the assembly, the Gate terminal should be connected to the ground terminal.

To provide a blanking feature, connect the "Unblank" terminal to an RTL-derived signal that is positive when you want the display to light and ground when you want it off. Remember that the Unblank input does not stop the

CHOOSING THE RIGHT LOGIC FAMILY

RTL	UTILOGIC
Supply: 3.6 volts.	Supply: 5 volts.
Compatible with all previous POPULAR ELECTRONICS projects.	Compatible with industrial DTL and TTL circuits.
Typical maximum speed: 8 MHz.	Typical maximum speed: 12 MHz.
Grounding and supply leads relatively critical.	Grounding and supply leads less critical.
May be converted to an add-subtract counter assembly.	Conversion difficult.
Input toggle must be bounceless and fall faster than 200 nanoseconds.	Input toggle must be bounceless, but may have considerably longer fall time.
External monostables, astables, crystal oscillators using RTL easy and cheap.	External circuitry often much more complex and expensive.
Recommended for student and home experimenter.	Recommended for industrial technician or engineer.

HOW IT WORKS
DECADE COUNTER

One decade counter can be divided into four sections: the actual counter, the decoder, the readout driver, and the readout.

The counting portion (at bottom of diagram) consists of four JK flip-flops arranged to count to 9 before reverting back to zero and simultaneously delivering a "Carry" output to the next decade. To force the counter to count only to 9, an inverter in a feedback loop is used. The voltage levels, which are unique for each count, are taken from the Q and $\overline{Q}$ outputs of each flip-flop for use in the decoder. The flip-flop outputs are in the common 1-2-4-8 code. If more than one module is to be used in an instrument, the "Gate" input terminal of the counter is connected to ground in all but the first counter. When the gate is grounded, the counter operates normally. When it is made positive, the counter is inhibited. In this way, an externally generated signal can be used to determine when the counter is to operate.

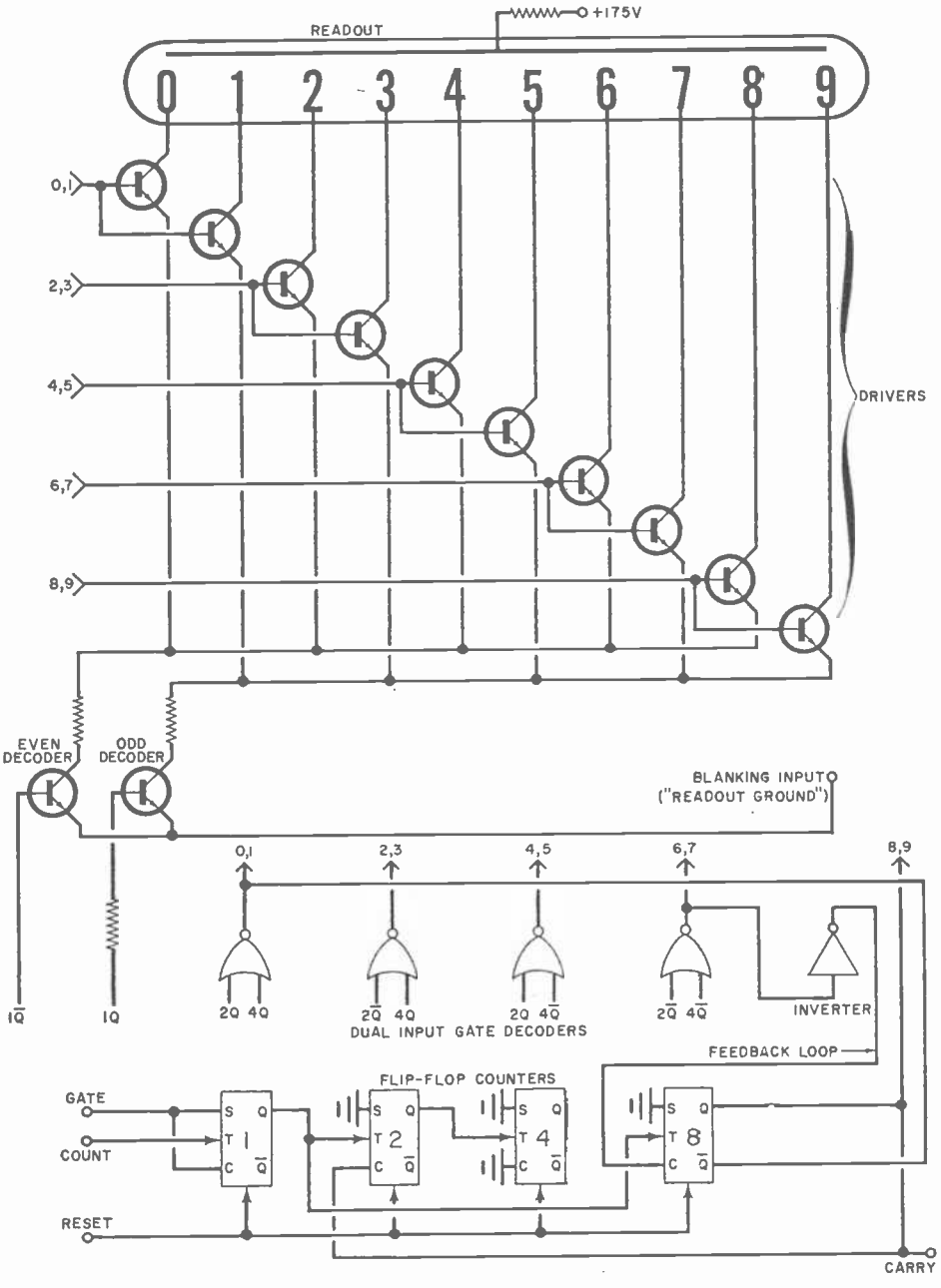
In the decoder, consisting of four gates and two discrete transistors, the 1-2-4-8 output of the counter is converted into a *biquinary* (divide by 2, then by 5) code. It has seven outputs: even, odd, 0 and 1, 2 and 3, 4 and 5, 6 and 7, 8 and 9. These form the input to the readout drivers.

The readout (Nixie tube) is a gas filled tube with one common anode and 10 discrete metal cathodes, each formed into the shape of a number (from 0 to 9). When B+ is applied to the common anode and any of the cathodes is grounded, the gas around that particular piece of shaped metal glows causing a number to appear in the viewing plane.

The readout drive consists of 10 high voltage transistors, driven in pairs by the decoder outputs. The transistor collectors are connected to the 10 cathodes of the Nixie tube. The emitters of all of the odd-numbered transistors are connected together and to the "odd" buss, while the even-numbered transistors have their common emitters connected to the "even" buss. The even and odd busses are driven by the two transistors in the decoder.

The system can be considered to operate like a switching network. When, for example, the even transistor in the decoder is saturated (with its emitter grounded), the even buss is essentially at ground. Then, if a signal is applied to the bases of one pair of driver transistors, only the one whose emitter is connected to the even buss saturates and acts as a switch to close the circuit to the appropriate cathode on the readout. Suppose, for instance, that the count is 7. Since 7 is an odd number, the odd decoder transistor is saturated and the odd buss is grounded. Simultaneously, the 6 and 7 output of the decoder applies signals to the 6 and 7 driver transistors. Because only the 7 transistor is connected to the grounded odd buss, only the 7 transistor saturates, causing the number 7 to glow in the readout.

Note that we said previously that the odd or even buss must be grounded for the decoder transistors to work. The grounding is made external to the counter through a connection to the "Blanking Input" terminal. A circuit in the overflow counter determines when this terminal is grounded for display viewing. In this way, rather than have a blur of numbers while the counter is counting, the blanking input keeps the display off until the counting is complete. Then a steady display is shown.


READOUT
+175V
0 1 2 3 4 5 6 7 8 9
0,1
2,3
4,5
6,7
8,9
DRIVERS
EVEN DECODER
ODD DECODER
BLANKING INPUT ("READOUT GROUND")
0,1
2,3
4,5
6,7
8,9
1Q̄
1Q
2Q 4Q
2Q̄ 4Q
2Q 4Q̄
2Q̄ 4Q̄
DUAL INPUT GATE DECODERS
INVERTER
FEEDBACK LOOP
FLIP-FLOP COUNTERS
GATE
COUNT
RESET
S Q
T 1
C Q̄
T 2
T 4
T 8
CARRY

HOW IT WORKS
OVERFLOW COUNTER

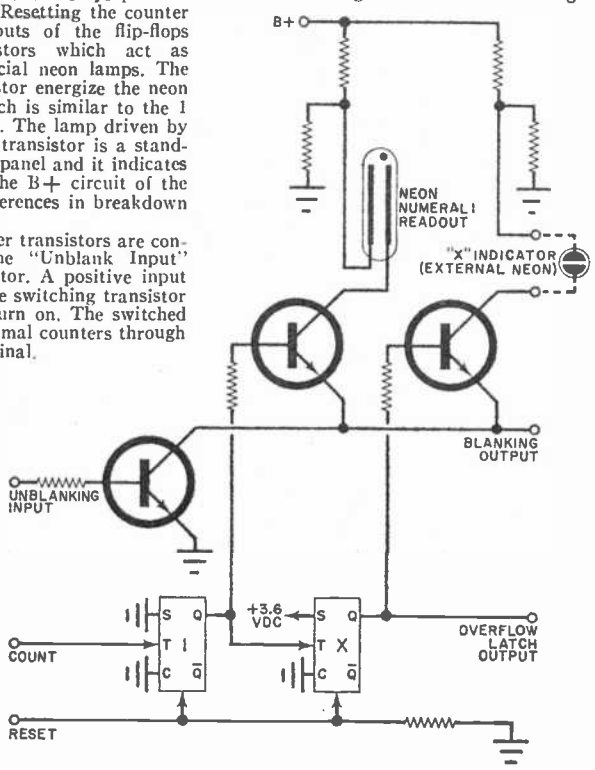
The overflow counter consists of a counting section, a display driver, and a display.

The counter contains two JK flip-flops the first of which is a divide-by-two and the second a latch. The latch flips positive and stays positive when there is an overflow. Resetting the counter resets the latch. The outputs of the flip-flops drive high-voltage transistors which act as switches in series with special neon lamps. The first flip-flop and its transistor energize the neon lamp that displays a 1 which is similar to the 1 displayed by the Nixie tube. The lamp driven by the second flip-flop and its transistor is a standard neon lamp on the front panel and it indicates "Overrange." Resistors in the B+ circuit of the neon lamps provide for differences in breakdown voltages.

The emitters of both driver transistors are connected together and to the "Unblank Input" through a switching transistor. A positive input to this terminal saturates the switching transistor and causes the display to turn on. The switched signal is supplied to the decimal counters through the "Blanking Output" terminal.

Remember that counting continues whether or not the display is lit. The blanking merely controls whether or not the display is on.

The overflow counter also contains a bypass capacitor for the supply, resistive loading for the reset buss, and a decimal point resistor. These elements are connected to their respective circuits through the instrument wiring.

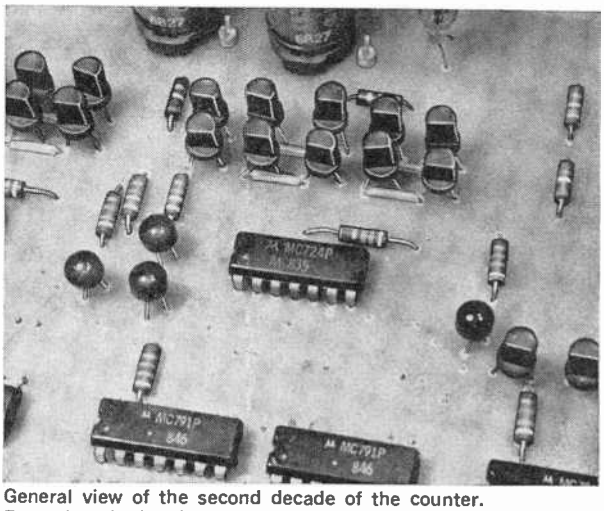


counter from working—it just determines whether or not the display can be seen. If you do not want to turn the display off, connect the Unblank terminal to the +3.6-volt source.

The two terminals marked "X" are connected to a neon overrange indicator (usually mounted in a red holder). If you don't want the overrange indication, leave these two terminals unconnected.

Decimal points are activated by connecting the selected decimal point terminal beside each Nixie tube to the "DP" terminal on the overflow counter through an external switch. Decimal point operation is independent of display blanking.

The "Reset" terminal is normally connected to ground through an external switch. Raising the buss to +3.6 volts momentarily resets the assembly to zero.



General view of the second decade of the counter. Even though the three portions extend across the board, the three readouts are very closely spaced.

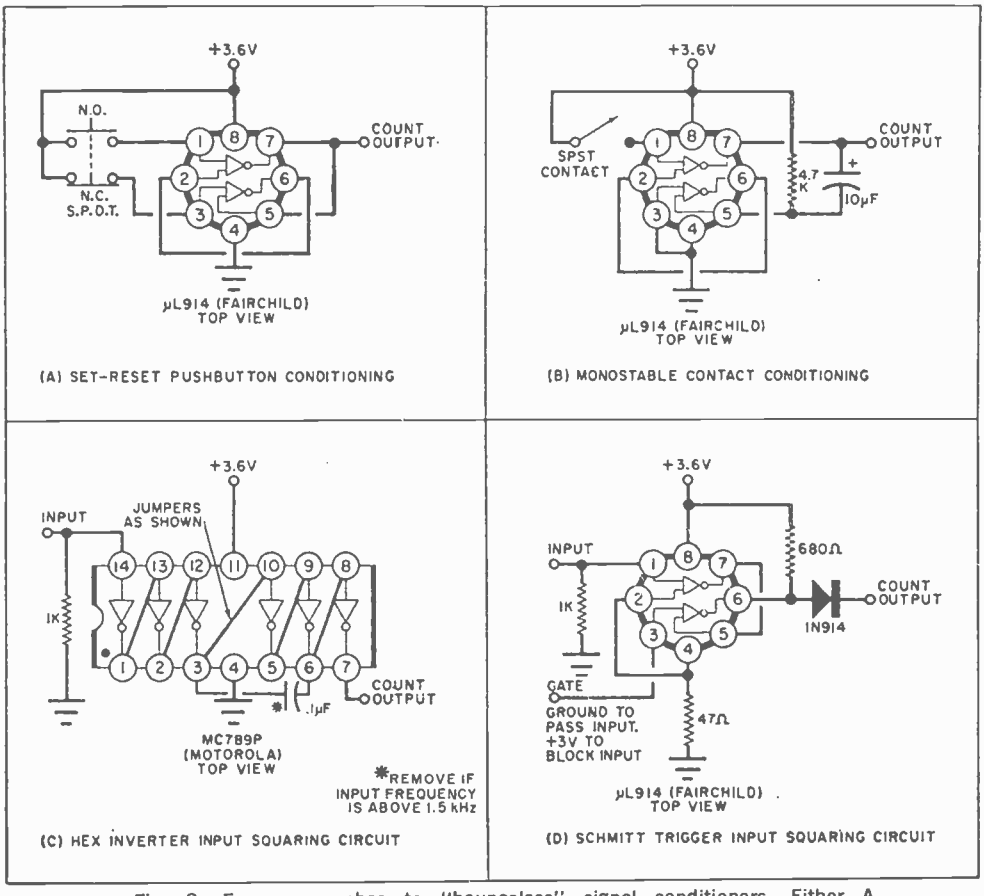


Fig. 8. Four approaches to "bounceless" signal conditioners. Either A or B can be used for mechanical switching, while either C or D can be used if the input signal comes from a conventional audio generator.

The Reset button need not be bounceless. If you use an electronic reset, a 2-microsecond pulse with a fanout of 30 is required.

Input. The input must be a waveform that changes abruptly from +3.6 volts to ground each time a count must be registered. For the counter to operate properly, the input must be both noiseless and bounceless and have a fall time less than 0.2 microseconds. Thus it is absolutely mandatory that the input be properly conditioned. Four possible signal conditioners are shown in Fig. 8. Circuits (A) and (B) are used for mechanical-contact inputs, while (C) and (D) are for electronic inputs. Circuit (C) is used for input levels of about 2 volts r.m.s. If the input frequency is below 1500 Hz, the capacitor must be included. For higher frequencies, omit the capacitor. Circuit (D) is a Schmitt squaring circuit.

Any of the circuits used in previous POPULAR ELECTRONICS DCU projects have the proper conditioning circuits built in. Thus, if you have built or are considering building the Digital Volt-ohmmeter (December 1968), besides making the mechanical modifications that are necessary to use this new counter module, connect the "Unblank" input to the existing "Gate" terminal on the V/F module in the Voltmeter. Should the brightness of the display be inadequate, the original DVM transformer should be replaced with the one called for in Fig. 7.

Power Supply. A recommended power supply with sufficient regulation is shown in Fig. 7. This supply is wired point-to-point after all parts have been mounted in a suitable chassis. -30-

THE GREAT ELECTRON-PEDANTIC PROJECT

BY CARL KOHLER

I ALMOST made it.

Sneaking from the car to the workshack, my arms loaded with stacks of books borrowed from the public library, I was doing just fine until one of the larger, heavier tomes toppled—hitting the pavement with an echoing smack.

Friend Wife, Peggy, immediately peered out the back door, hearing the sound and spotting me going tippytoe lugging the books. She came through that doorway and was upon me before I could stagger another step. So I stood stockstill, deciding to play it totally cool.

"What's with all the books?" she demanded.

"Going to do a little reading," I murmured from behind the wavering stacks I was balancing. "Just going to do a little reading, that's all."

Her face appeared around one of the unstable stacks, sheer disbelief gleaming in her eyes, complete suspicion quirking her mouth. I stared back with what I hoped was the most innocent and appealing expression this side of that overweight infant on the babyfood tins.

"You always do your reading in the house," she said flatly. "How come you aren't bringing them into the house?"

"Uh . . . not *this* time."

"What are they—dirty novels?"

"Certainly not!" My voice trembled with indignation. "Why, these represent some of the most profound concepts that the finest minds of mankind ever sustained long enough to put on paper!"

"Oh, yeah?" Her eyes roved over several titles. "Hmmmm. They *look* dull enough to be as high-brow as you claim. *First Principles—"* she read aloud, *"Abstract Mathematics—History Of Philosophy—Grey's Anatomy—The Natural Sciences—Profiles Of Classical Artists."* She glanced at me with a tight little smirk. "Isn't all this stuff slightly over your head? I always figured you were more a 'MAD' magazine buff!"

I sighed. A long, shuddering sigh of defeat.

"All right," I muttered dully. "Tote some coffee out to the workshack and I'll wire you in to the whole plan. You'll find out sooner or later, anyway."

While she went sprinting away to bring the requested brew, I carried the teetering towers of books into the workshack. letting them spill to the floor. Restacking them neatly alongside all the other books earlier sorties had produced, I bitterly meditated upon my fond and chronic illusion of secrecy. Sometimes I actually managed to bring a project pretty well along before she chanced upon it. Once, I even came within twenty minutes of completing a project in delicious secrecy. But a malicious fate sent her blundering into the workshack while I was still bolting a chassis into its casing.

"Ah, well," I sighed again. "At least I'm gifted with a glorious verbal-defensive ability. Things *could* be worse. I could be slow-spoken. Or have the handicap of a stammer."

She waltzed into the workshack, holding the tray skillfully aloft. It bore a pot of coffee and two cups. She lowered it with a flourish, not spilling a drop.

"Exhibitionist!" I sneered.

"Now," she chirped brightly, "tell me all about what's going on! Why you're suddenly bringing books in here by the ton."

I gestured at the books. "Those gems of knowledge," as I gestured again at the nearby object covered with a dust-sheet, "are to be fed painstakingly and efficiently into *that* veritable jewelbox of scintillating information."

Her face followed my gestures, swinging back and forth with an expression of immense bewilderment.

"Let's have that again?" she giggled.

I inhaled deeply enough to get slightly dizzy with the intake of oxygen. "Here we go again," I thought tensely, "all my defensive resources gathering against the onslaught I knew was coming. If she doesn't recognize the instrument immediately, one of us is slipping."

I yanked the dust-sheet from the computer.

"I'm going to feed the contents of those books and more into the memory banks of this sensitive, superbly conceived and constructed instrument." My chin went a trifle higher. "In short, sister, I intend to transfer all known facts and theories and reasoning into this newly modified digital computer."

Recognition oozed over her face as she stared transfixed with happy derision at the bulk of the computer which had been disconnected and hidden from the world for a long, long time. But not long enough for her to forget what it *had* been when I originally built it.

"Ooh, *I* know *that* crazy gismo!" she trilled. "Sure! *That's* the nutty *thingamuhcallit* you were so positive was going to make us wealthy beyond our wildest dreams because it would be able to *analyze* the *future!* Or *something* like that!"

I nodded grimly, pouring scalding-hot coffee down a throat constricted with humiliation. *"Go ahead,"* I thought glumly. "Go ahead and get every last grain of salt into the wound! Really squeeze it for all it's worth. Have a ball!"

She spewed merry laughter all over me, the books, and the computer. "Oh, I never thought you'd *ever* have the gall to bring that costly flop out of hiding!"

"It's not the same instrument," I murmured softly. "Not the *same* at all. Been modified. Brought up to date. Completely redesigned, except for the housing, to do something entirely different. Something practical. Functional. *Patriotic* even."

"Oh, *go ahead* and make it clack out that wonderful 'Cross my palm with silver line!' Please make it do that again! The last time I laughed until I thought I'd split! All that hokey science talk—about a gadget that turned out to be nothing more than a greedy, metal Gypsy fortune-teller!"

Bile rose to meet the descending scorch of the coffee. I swallowed with difficulty. "It simply can't *do* that again!" I desperately assured her. "The whole computer has been revamped and rewired. Wholly new circuits. Integrated circuits that give it a brand new purpose. A *splendid* function that—scoff if you like—could just very well make me a most wealthy man, at least, and possibly even save the country from a generation of imbeciles, cretins and savages!"

"Huh?"

I patted the dully gleaming casing of the computer fondly. "UNIversity, here, will replace all archaic notions of formal education."

"Uni-what?"

"UNIversity. That's its name and its purpose! To be a complete university! Why, the impact of this advance in the

"What are they—dirty novels?" she asked, as the stack began to waver.

educational field will probably be felt around the globe!"

"Eh?"

"Certainly! By merely replacing the old fashioned college campus—that has proved to be so terribly vulnerable to student violence—UNIversity will enable serious, ambitious students to achieve a full and enriched formal education without being subjected to the vagaries and disruptions currently found on university campuses everywhere!"

"Wait a minute!" she protested, jerking a thumb at the computer. "Are you trying to tell me that this reformed gypsy is going to dispense education?"

Head held high, nostrils flared with pride, I looked down my nose at her, but smilingly, and I accorded her a brief nod. A firm, confident nod.

"How?" she demanded.

"Simplicity itself! Once I demonstrate this prototype model to colleges and universities—showing how the best minds of all eras have been locked within its memory banks, how every possible subject is completely recorded, how the arts, the sciences, business, the humanities and even theoretical research in every imaginable field have been captured, needing only selective operation to deliver as fine an education as has ever been available anywhere—those higher institutions of learning will *beg* to buy them in carload lots. Educational history will be made! The serious students will be assigned one instrument to an individual or perhaps even a small class. No longer will there be a need for huge campuses, expensive buildings and the fantastic overhead necessary to maintaining a full university!"

"You gonna give 'em away?"

A sly smile played about my mouth which had gone thin-lipped with resolution. "Absolutely not. I'll *lease* hundreds of thousands of UNIversities. Oh, the jolly profits will flood in! I'll be a multimillionaire many times over!" I tweaked her cheek roguishly. "I may even spend a few dollars on you!"

"Where's all these millions coming from?"

I shook my head sadly at her. "Don't you know that almost every university in the country receives Federal aid as well as state and private funds? No need to worry about the *money!* It'll pour into the coffers of UNIversities, Unlimited in torrents of fat, lovely sums. I may even have to buy one of the smaller foreign countries for a tax write-off!" I yawned elaborately. "Why, there will probably be millions in gratitude gifts from the parents of UNIversity-taught pupils who have saved considerable sums of money by not having their children write asking for money from distant campuses!"

"How do you figure that?"

"Easy. UNIversity can be installed and operated just as efficiently in the home as anywhere else." I assumed a humble posture. "Think of all the innocent youth who will be spared the riotous living and sinful ways of dwelling far from their native hearths. Yes, I can see a definite moral fiber in this plan. The world will eventually get around to bestowing its honors upon UNIversity and me for bringing back a stout moral tenor to its precious younger generations."

She stared hard at me. "You really believe all this guff you been handing me?"

I cleared my throat, ignoring the jibe. "You'll have to excuse me now. I must contact all of the electronics schools and institutes, and the trade schools, of course. Mustn't delete *any* form of knowledge once I begin programming it into the instrument. I may even include some frivolities for comic relief. Just for *balance,* you understand!"

"Yeah," she yawped, heading for the doorway. "I *knew* you'd dream up an excuse to read a few issues of "MAD" into that screwy machine!"

"Not a bit," I retorted, drawing myself up with frosty dignity. "Actually, I was thinking of something with *more* humor—such as the *Congressional Record* or the minutes from a few meetings of the D.A.R. This is a *class* operation, y'know!"

"Puns yet!" she wailed, departing swiftly.

The months that followed were exhausting ones as I proceeded to work my way methodically through subject after subject—basing my programming upon standard college texts—until I'd concisely read hundreds of books, pamphlets, essays and technical papers aloud into UNIversity who smoothly filed all the material away into its memory banks, diverting it according to classification with my help at the master control panel.

Finally, I realized this was a somewhat larger task than I had originally estimated. Even so, I figured it was about time to make a demanding test of UNIversity—to find out if it could indeed give information—both literally and analytically—when selected playbacks were delved from its memory banks. This being a rather awesome moment, I felt the need for company, graciously inviting Friend Wife to be a witness at the first lectures and seminars delivered by my brainchild.

"Well, this is it!" I announced in a voice hoarse and thickened from hours of reading educational facts into the computer aloud. "How would you like the honor of selecting a test subject?"

"It ain't gonna *work* anyways," she stated sourly. "None of your gadgets *do* what they're *supposed* to do. So I guess it don't matter what I pick, huh?"

I favored her with a tired, condescending smile that made a shambles of her jibe.

"Just choose a subject—*any* subject," I suggested patiently. "Never mind all the sunshiny thoughts and utterly blind faith in my meager genius."

She thought intensely, her face working with the effort of her mental straining. "Okay, have it tell me all about Mars!"

"The mythological god or the planet?"

"Huh?"

"Let it pass. I assume you mean the planet Mars."

"That's what I said!"

I sighed. "So you did, and that's what you shall have—a comprehensive lecture upon every known aspect of that red and mysterious planet!" Deftly making a few simple adjustments upon the Master Control Panel, UNIversity glowed into activity—muted bleepings, minor clickings and sequences of flashing lights indicating that the instrument was ready to function.

"How come it ain't going *clack-clack-clack* and popping out those little pieces of paper?" she asked, nervously stepping back from the light patterns now sparkling madly across the computer's traceboard. "It looks like it's gonna blow-up!"

"Relax. This baby is a far cry indeed from that admittedly crude and ineffectual item that preceded it." I peered intently at the Control Panel, making several more corrections with the cold mien of the true scientist, murmuring incoherently to myself for added dramatic impact. "Actually, UNIversity not only absorbs facts but has been designed to draw *meaningful conclusions* from all programmed data. Additionally, UNIversity can recognize human voice patterns."

"Why?"

"Well, each of the kids has a differing mental capacity. I figured if UNIversity could instantly recognize each kid by his

"Listen!" I roared. "I demand that you select college level delivery of data pertaining to Mars!"

or her voice, it could immediately channel a vocabulary understandable to each child's mental-level—and I had the foresight to program all data in various age-range vocabularies which was a chore mildly comparable to inscribing a decade of income tax information on the head of a very small pin."

"Gee!" she said in an awed tone. "Then, this thingie is really pretty *smart,* huh?"

"Not really but almost."

"I AM READY," announced UNIversity in a cultured tone with undeniably refined accents. "KINDLY GIVE YOUR CHRONOLOGICAL AGE AND PRESENT GRADE IN SCHOOL."

"Holy Solid State!" whispered Friend Wife. "It talks real *classy* yet!"

"Odd," I muttered. "Doesn't *sound* like me but I distinctly recall—oh, well, per-

haps I'm too tired to recognize my own recorded voice. Possibly some of that economy priced tape accounts for the tonal difference."

"Go ahead—talk *back* to it!" she urged delightedly.

"My age is forty-five. I no longer attend any institution of learning, having completed—"

"SUBJECT DESIRED?" invited UNIversity smoothly.

"Uh—the planet Mars," I stated.

"MARS IS A PLANET. MARS IS IN SPACE. SEE THE PRETTY RED PLANET IN SPACE. SEE THE PRETTY RED PLANET IN ORBIT! ORBIT, MARS, ORBIT!"

There was a terrible moment of silence.

"What the old hell is *happening* here?" I croaked, frantically checking everything and finding nothing wrong. "I just cannot understand—"

"I knew it!" she howled merrily. "I just *knew* that crazy pile of blabbermouthy parts would *hassle* you! Oh, this is marvy! Your brain of a machine reading primer-level facts to you!"

"MARS IS FAR, FAR AWAY," droned UNIversity in clipped precision. "MARS IS TOO FAR, FAR—"

I snapped a recycling-switch, cutting into the taped dissertation and bringing the instrument back to "Initial Communication."

"KINDLY GIVE YOUR CHRONOLOGICAL AGE AND—"

"Listen!" I roared. "I demand that you select college level delivery of data pertaining to Mars! I may be only a high school graduate but I read a lot and I've programmed enough material into—"

"YOU DO NOT QUALIFY FOR COLLEGE-LEVEL DATA," it informed me flatly. "HOWEVER, A SUGGESTED ALTERNATIVE IS OBTAINING A MINIMUM OF FOUR YEARS AT ANY ACCREDITED—"

That's when I pulled the plug.

"Can't understand it!" I stared dazedly at my happily smirking wife. "I was so *careful!* Why, I even included each of the kids' voice-patterns and a plethora of essential statistics that should have prevented anything like *this* from—"

"I was sure *wrong* about this thingamajig!" she yawped joyously.

"Wrong? In *what* way?"

"It can't be *all* bad," she gasped, between disgusting fits of vulgar laughter, "if it's *smarter* than *you*—and it *is!*"

She was still shrieking with nauseating hilarity when I sulked away to consult a dictionary. I doubted that I would find the word 'overteach' in it, having just contributed that nefarious term to the English language in the form of an academically snobbish computer. But I thought I'd look anyway. -30-

NASA TO LAUNCH AUSTRALIS-OSCAR 5

The National Aeronautics and Space Administration (NASA), in a letter to the Radio Amateur Satellite Corporation (AMSAT), has agreed to launch the Australis OSCAR-A satellite as a secondary payload on the TIROS-M mission scheduled for January 9, 1970. The amateur satellite will be ejected into orbit from the second-stage engine compartment of the Thor-Delta launch vehicle in the same manner as previous Delta secondary payloads have been launched.

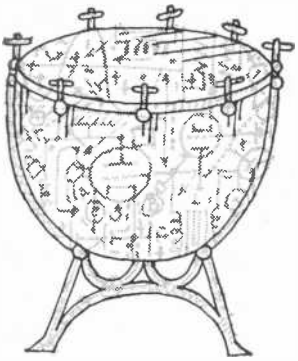
The planned orbit will be nearly polar at an inclination of 101.56 degrees to the earth's equator, at an altitude of approximately 790 nautical miles (910 statute miles). This will result in an orbital period of about 114 minutes.

Australis OSCAR-A, which is to be known as Australis-OSCAR 5 once it is in orbit, is a 12" × 17" × 6", 39-pound spacecraft constructed by a group of amateur radio operators at Melbourne University in Australia.

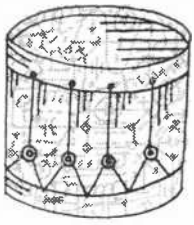
This will be the first launch for AMSAT, which was formed in March 1969 to foster radio amateur participation in space search projects. AMSAT is preparing the satellite for launch, performing the necessary tests for proper functioning, conducting liaison with NASA and assisting in the collection of data.

Australis-OSCAR 5 will transmit at 29.45 MHz in the 10-meter band and at 144.05 MHz in the two-meter band. A transmitting life of about 2 months is expected from the 20 pounds of batteries which the satellite carries. This lifetime is based on continuous operation of the 2-meter transmitter and weekend operation of the somewhat higher power 10-meter transmitter. The latter can be turned on and off by commands from the earth.

JOHN S. SIMONTON, JR.



THE THUMPA-THUMPA BOX



RHYTHM DRUM ACCOMPANIMENT

THE ELECTRIC GUITAR sounds best when accompanied by a tempo-setting, rhythm drum. Unfortunately, few amateur guitarists are lucky enough to find drummers who are willing to accompany them day and night. There are, however, electronic drummers that fill the bill nicely. If the $200-up price tags on commercially made electronic drummers do not appeal to you, try building the "Thumpa-Thumpa Box" for about $17.

The Thumpa-Thumpa Box, or TTB, employs low-cost UJT pulse-generator, divider and simplified "drum" circuits to produce a wide variety of percussion sounds. In fact, the TTB can duplicate most of the tricks of the expensive commercial electronic drummers—and a few that commercial units can't produce.

Just set the TTB's divider and rate controls, and you have automatic bass and wood-block accompaniment. If you are the adventurous type, you can even adjust the circuits so it sounds as if you are being accompanied by anything from a pot lid to J. Arthur Rank's gong!

Construction. Layout of the TTB circuit (see Fig. 1) is not critical; but, while any method of assembly will give acceptable results, a printed circuit board will go a long way toward guaranteeing a successful project. The printed circuit board can be obtained commercially (see Parts List), or you can etch and drill

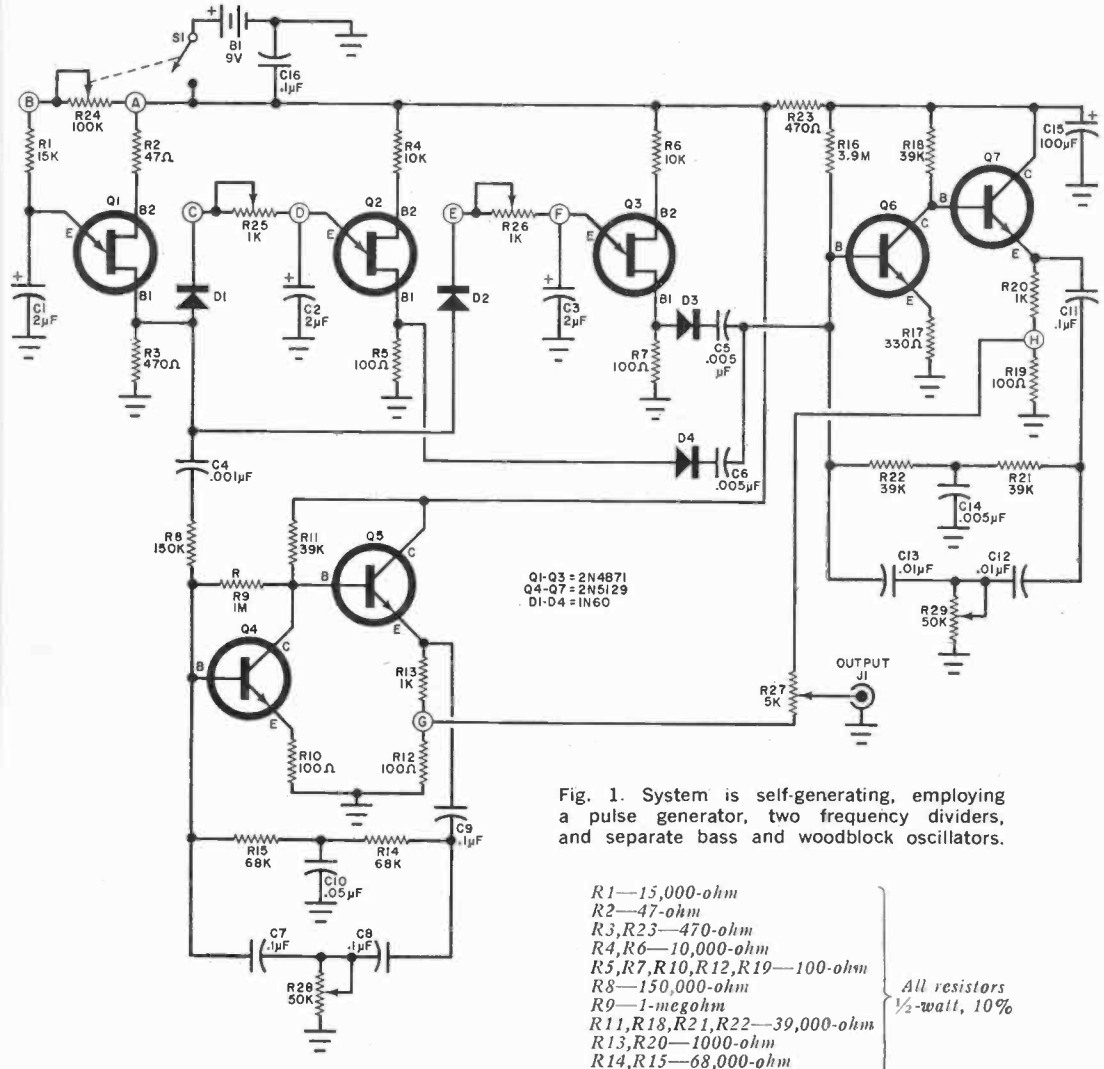


Fig. 1. System is self-generating, employing a pulse generator, two frequency dividers, and separate bass and woodblock oscillators.

PARTS LIST

B1—9-volt transistor battery
C1,C3—2-μF, 6-volt electrolytic capacitor
C4—0.001-μF ceramic disc capacitor
C5,C6,C14—0.005-μF ceramic disc capacitor
C7,C8,C9,C11,C16—0.1-μF ceramic disc capacitor
C10—0.05-μF ceramic disc capacitor
C12, C13—0.01-μF ceramic disc capacitor
C15—100-μF, 10-volt electrolytic capacitor
D1-D4—1N60 diode
J1—Miniature phone or standard phono jack
Q1-Q3—2N4871 unijunction transistor
Q4-Q7—2N5129 bipolar transistor

R1—15,000-ohm
R2—47-ohm
R3,R23—470-ohm
R4,R6—10,000-ohm
R5,R7,R10,R12,R19—100-ohm
R8—150,000-ohm
R9—1-megohm
R11,R18,R21,R22—39,000-ohm
R13,R20—1000-ohm
R14,R15—68,000-ohm
R16—3.9-megohm
R17—330-ohm

All resistors ½-watt, 10%

R24—100,000-ohm, linear-taper potentiometer
R25, R26—1000-ohm, linear-taper potentiometer
R27—5000-ohm, linear-taper potentiometer
R28, R29—50,000-ohm, linear-taper "trim-pot"
S1—S.p.s.t. switch (part of R24)
Misc.—Metal chassis case; printed circuit board; battery holder; battery connector; control knobs (4); rubber feet; #6 machine hardware; hookup wire; solder; etc.

Note—The following items are available from PAIA Electronics, Inc., P.O. Box 14359, Oklahoma City, OK 73114: etched and drilled printed circuit board for $3.50 postpaid (specify #8690); complete kit of parts, including pre-punched, unpainted case, but less battery, hookup wire, and solder for $16.75 plus postage for 2 lb. Oklahoma residents add 3% sales tax.

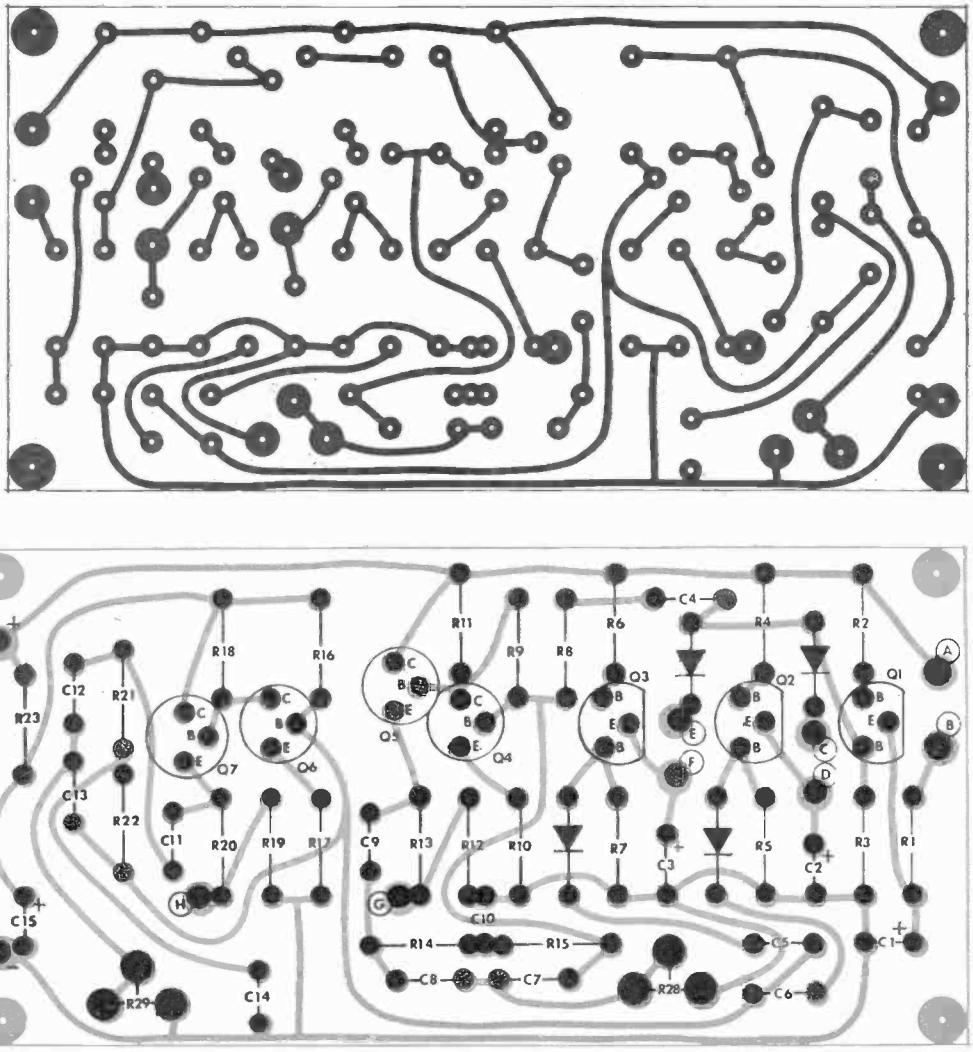


Fig. 2. Actual-size printed circuit board etching guide is shown at top. Directly above are component placement and orientation on circuit board after etching and drilling.

Battery can be conveniently mounted inside chassis with dual AA cell holder; use a conventional snap-on connector. Holes drilled directly in line with R28 and R29 (see top center of photo) provide access for tuning bass and woodblock oscillators. Mount output jack on rear.

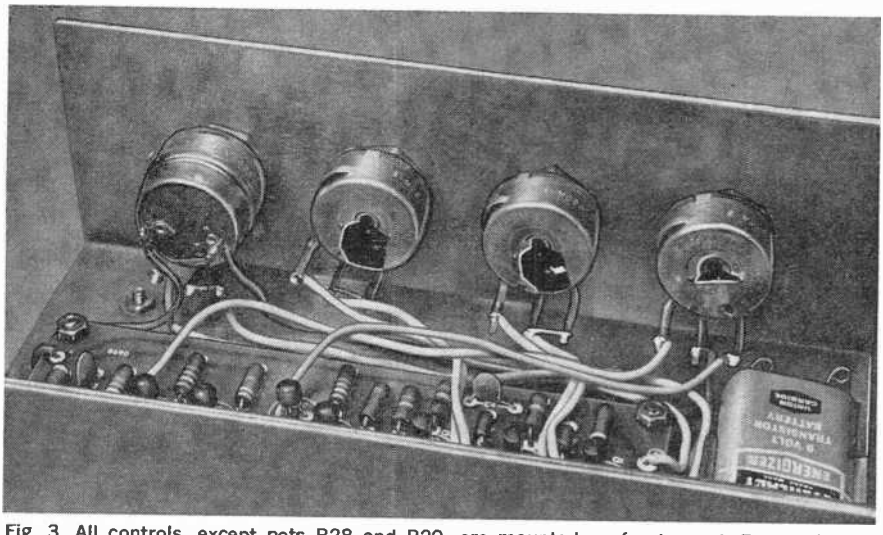


Fig. 3. All controls, except pots R28 and R29, are mounted on front panel. Battery holder and printed circuit board are mounted inside the chassis; use rubber feet on under side.

your own board by following the actual size etching guide shown in Fig. 2. In either case, mount the components on the board as shown, paying particular attention to the polarities of the electrolytic capacitors and lead orientation of the diodes and transistors. Also, when soldering the transistor and diode leads to the foil pattern, use a heat sink and a soldering iron rated at 35 watts or less.

The project can be assembled inside any metal enclosure that will accommodate the circuit board, battery, and controls. It is a good idea to decide on the locations of the components and drill the mounting holes first. Deburr the holes; then spray paint the cover or cover it with self-sticking vinyl, and just spray paint the front and back of the box.

Now mount the dual-AA-cell holder, jack, and potentiometers in their respective locations (see Fig. 3). Then mount four rubber feet to the bottom of the case.

Solder an 8″ length of wire to the circuit board at locations A through H and the hole marked with a + sign. The completed circuit board should be the last item mounted inside the case. Use 4-40 machine hardware and ⅜″-long insulated spacers and make sure the holes in the rear of the case line up with *R28* and *R29*.

Connect and solder the free ends of the circuit board wires to the controls and *S1* as shown in Fig. 4, removing and discarding any excess wire as you go. Then finish wiring together the circuit, referring back to Fig. 1 as needed. Finally, slip the battery into its holder, use a dry-transfer lettering kit to letter the functions of the controls on the front panel, and assemble the case.

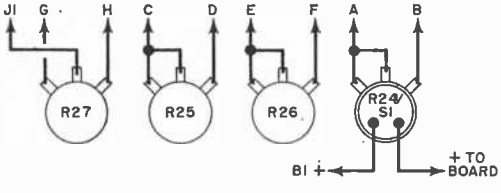


Fig. 4. Diagram shows the connections between pots and S1 lugs to lettered holes on circuit board.

How to Use. Connect a cable from the output jack of the TTB to the input of a hi-fi or instrument amplifier. Rotate the BALANCE control fully counter-clockwise, turn on the amplifier and TTB, and adjust the RATE control for a slow-tempo beat. Then rotate both DIVIDER controls fully clockwise.

Adjust the setting of *R28* for the most pleasing sound. Rotate the BALANCE control fully clockwise, and adjust the setting

HOW IT WORKS

The Thumpa-Thumpa Box consists of five basic sections: a pulse generator, two frequency dividers, and two ringing oscillators. As shown in Fig. 1, unijunction transistor *Q1* and its associated components make up a simple relaxation oscillator that serves as the "clock" generator for the system.

With *S1* closed, *C1* charges up through *R1* and *R24*. When the potential across the capacitor exceeds the threshold of *Q1*, the UJT fires and allows *C1* to discharge rapidly and produce a voltage spike across *R3*. The rate of charge and discharge, or frequency, of the clock generator can be varied by changing the setting of *R24*.

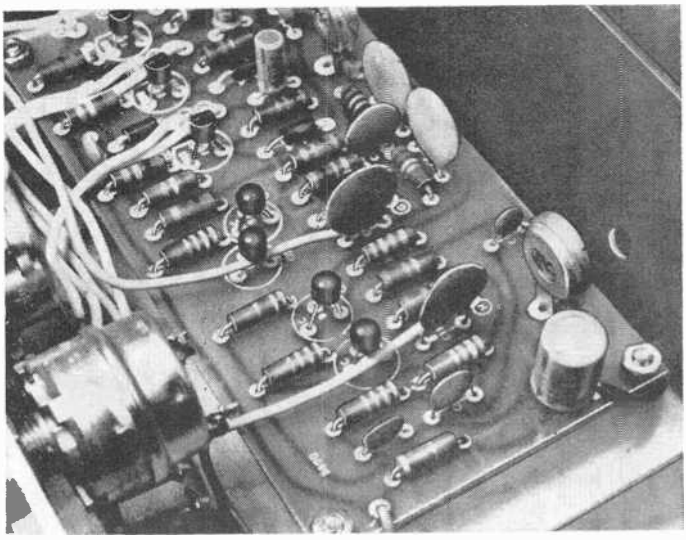
Each clock pulse does several things simultaneously. First, it triggers the ringing oscillator formed by *Q4* and *Q5* to produce a tone similar to that of a bass drum. Second, it is coupled through potentiometers *R25* and *R26* to deposit charges on *C2* and *C3*, respectively. Diodes *D1* and *D2*, normally reverse biased, prevent the charges from leaking off.

The amplitudes of the charges across *C2* and *C3* increase with each successive pulse from the clock generator. At some point during the voltage build-up, *Q2* and *Q3* fire, either simultaneously or independently, and rapidly discharge *C2* and *C3*, respectively. The resulting pulses that appear across *R5* and *R7* are then coupled to the base of transistor *Q6* in the "wood-block" oscillator. (Potentiometers *R25* and *R26* can be varied independently so that frequency dividers *Q2* and *Q3* fire at different rates to produce a wide variety of syncopated rhythms.)

The wood-block (*Q6* and *Q7*) and bass (*Q4* and *Q5*) oscillators are almost identical, each being composed of common-emitter gain and emitter-follower buffer stages. Feedback for the individual oscillators through the parallel-T filters (shown below each pair of transistors) is such that the amplifier is held just below the point of oscillation.

When a pulse is coupled to the input of either of these two oscillators, the circuit immediately breaks into a rapidly decaying oscillation. So, by properly selecting the gain of the amplifier and time constants of the parallel-T networks, the period and decay of the oscillating signals can be made to simulate the sound of practically any percussion instrument.

The output of the Thumpa-Thumpa Box is fed to an external amplifier. And potentiometer *R27* serves as a balance control to provide the desired mixture of bass and wood-block beats.



Bolt assembled circuit board to chassis via short spacers and #6 hardware. Note proper method of neatly dressing hookup wires.

of *R29* for the most pleasing sound. Now rotate the BALANCE control back and forth to make sure the mixing, or balancing, action takes place.

In operation, the DIVIDER controls are used to produce the rhythm pattern desired. Tempo can be set by adjusting the RATE control. The BALANCE control is used to accentuate your choice of either bass or wood-block sounds. (Once *R28* and *R29* are set, they do not need to be touched again.)

A final note: the cover of the TTB case is held in place by the pressure of the sides against the front and rear of the box. However, if the TTB is to be subjected to rough handling, it is a good idea to bolt the halves of the case together with the aid of four L brackets. The mounting screws for the rubber feet can be used to anchor the brackets to the bottom of the case, and self-tapping sheet metal screws can be used to bolt the top to the brackets. -30-

One Second METRONOME TIMER

VISUAL AND AUDIBLE INDICATIONS FOR YOUR DARKROOM

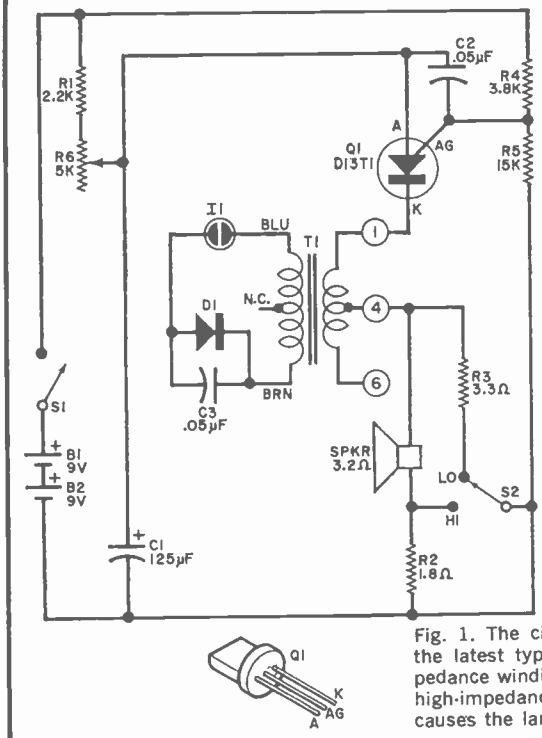
BY A. A. MANGIERI

ONE THOUSAND AND ONE . . . one thousand and two . . . one thousand and three . . . that's the familiar method of counting off the seconds for camera and enlarger exposures when a mechanical or electrical timer is not available. This method is not very accurate. For example, if you are in a big hurry, your count may speed up; or if you are tired, it may slow down. What you really need is a timer that is insensitive to emotions and fatigue.

The photographer's visual/audio One-Second Metronome Timer fills the bill. It paces your second count so that your film and paper exposures can be uniform. To accomplish this, the timer provides an audible "click" and a simultaneous flash of light every second. All you do is count the number of clicks and/or flashes.

How It Works. Transistor *Q1*, in Fig. 1, is a General Electric Type D13T1 "programmable" unijunction transistor, a special type of SCR. The anode gate (AG) of *Q1* is at a voltage determined by voltage divider resistors *R4* and *R5*. When *S1* is closed, *Q1* is initially in the non-conducting state.

Voltage at anode A begins to build up as timing capacitor *C1* charges up



PARTS LIST

B1,B2—9-volt battery
C1—125-μF, 35-volt electrolytic capacitor
C2,C3—0.05-μF disc capacitor
D1—1-ampere, 200-volt silicon diode (Motorola HEP-156 or similar)
I1—NE-51H high-intensity neon lamp
*Q1—D13T1 programmable unijunction transistor**
R1—2200-ohm
R2—1.8-ohm
R3—3.3-ohm
R4—3800-ohm
R5—15,000-ohm
All resistors ½-watt
R6—5000-ohm potentiometer (Clarostat Type U39, or similar)
S1—S.p.s.t. slide or toggle switch
S2—S.p.d.t. slide or toggle switch
SPKR—3.2-ohm, 2½"-square speaker
T1—8-watt universal speaker transformer; do not substitute (Allied Radio No. 54C2021)
Misc.—Dialco No. 95-9110 lamp socket with red dome, less resistor for I1; 4½" x 3¼" x 3" aluminum chassis box; perforated phenolic board and push-in solder terminals; rubber feet; hardware; hookup wire; solder; etc.
**Available for 87¢ from Allied Radio Corp., 100 N. Western Ave., Chicago, Ill. 60680. Specify No. 49F3-D13T1-GE.*

Fig. 1. The circuit is essentially a relaxation oscillator using the latest type of UJT. The turns ratio between the low-impedance winding (connected to the UJT cathode lead) and the high-impedance winding (connected to the neon lamp) of T1 causes the lamp to flash with each audible "tick" of speaker.

through timing resistors *R1* and *R6*. When the voltage at the anode builds up to slightly more than the voltage at AG, *Q1* goes suddenly into conduction and allows *C1* to discharge rapidly through *T1* and the speaker's voice coil.

The sudden discharge of *C1* through *T1* generates a high-voltage spike across the secondary of the transformer, briefly lighting *I1*. Diode *D1* and capacitor *C3* enhance the brightness of the lamp's glow and the duration of the flash. The speaker produces an audible click simultaneously with the flash of *I1*.

As each click and flash occur, the voltage across *C1* drops to a low level and *Q1* ceases to conduct. The cycle then repeats itself as long as *S1* is closed.

Resistors *R4* and *R5* set the *Q1* stand-off ratio and valley current for high circuit efficiency. Capacitor *C2* is an r.f. or noise bypass to prevent premature turn-on of *Q1* by nearby electrical interference. Switch *S2* provides HI and LO level audio selection.

Construction. It is imperative that a metal case be used to house the timer circuit to shield it thoroughly from electrical noise pickup. A 4½" × 3¼" × 3" aluminum chassis box easily accommodates all parts.

First perforate the front of the box with a ¼" drill (or cut out a 2¼" opening and use a screen grille) for the speaker. Then determine how and where you plan to mount each part and assembly, and machine the box accordingly. A suggested layout is shown in Figs. 2 and 3.

Start assembly by mounting *T1* and the battery clamp on the rear wall of the box. Then mount the components on a 2½" × 2¼" piece of perforated phenolic board with push-in terminals, and bolt the board in place.

Mount the lamp socket, switches, and speaker in their respective locations on the front of the box. Wire together all components, referring to Fig. 1. Make sure that the leads of *C3* and *D1* in the high-voltage secondary side of *T1* do not touch other wires or components. Lengths of plastic tubing slipped over

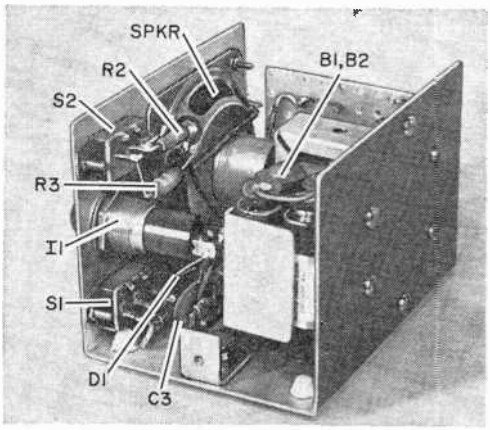


Fig. 2. If you arrange the components properly, they will easily fit within small metal chassis. Metal is used to prevent external noise from false triggering of the UJT, causing timing errors.

these leads will prevent accidental short circuits.

When the circuit is completely assembled, set *R6* for about mid-range. Set *S1* to ON and listen for the click and observe the brightness of the flashes, with *S2* set in the LO position. If the click is too loud or the flash level is too bright, you can omit battery *B2* and operate the circuit on only one 9-volt battery. In either position of *S2*, if the flash level is not bright enough, try reversing the diode. Use the connection that provides the brightest flash. Also, if you prefer an audio-off position, omit *R2*.

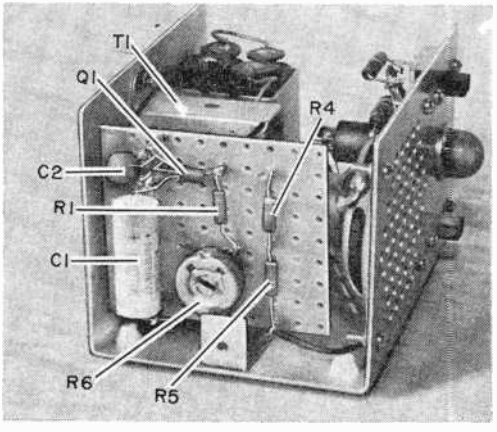


Fig. 3. Most of small electronic components can be directly mounted on piece of perforated board.

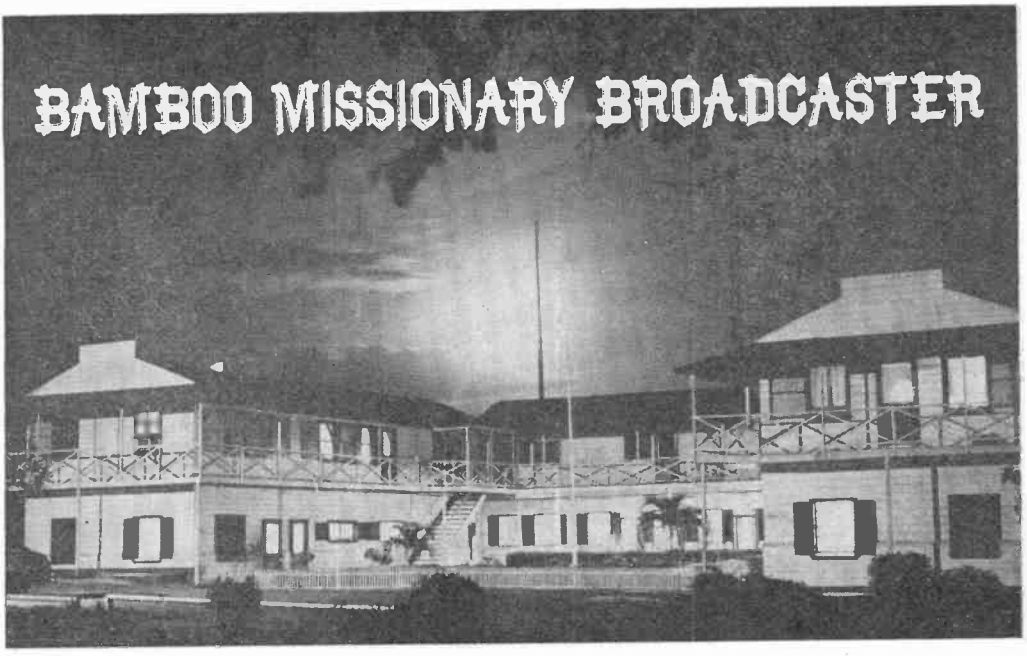
Calibration and Use. With the circuit operating, use an electric clock with a sweep second hand to adjust *R6* until you hear ten clicks and see ten flashes in exactly ten seconds. This is all there is to calibration, and you can now assemble the metal box.

Use the timer to pace your count for both timed camera and enlarger exposures. With a few practice runs, you will quickly acquire the knack of operating the camera cable release or enlarger switch at exactly the right moment.

If you incorporated the audio-off feature and have the timer set in this position when working in your darkroom, pace your count by lamp flashes, and rely on that pace because you might miss a lamp flash between eye blinks.

You can expect considerable battery life due to the low drain circuit of the metronome timer. As a rule of thumb, replace the batteries when either the audio or light output drops below your preferences; the count rate is affected very little by battery ageing. Also, recheck the count rate occasionally and adjust *R6* if needed to compensate for any long-term change in *C1*. -30-

BAMBOO MISSIONARY BROADCASTER



GOSPEL VS CHAIRMAN MAO

BY JOHN KIMBERLEY

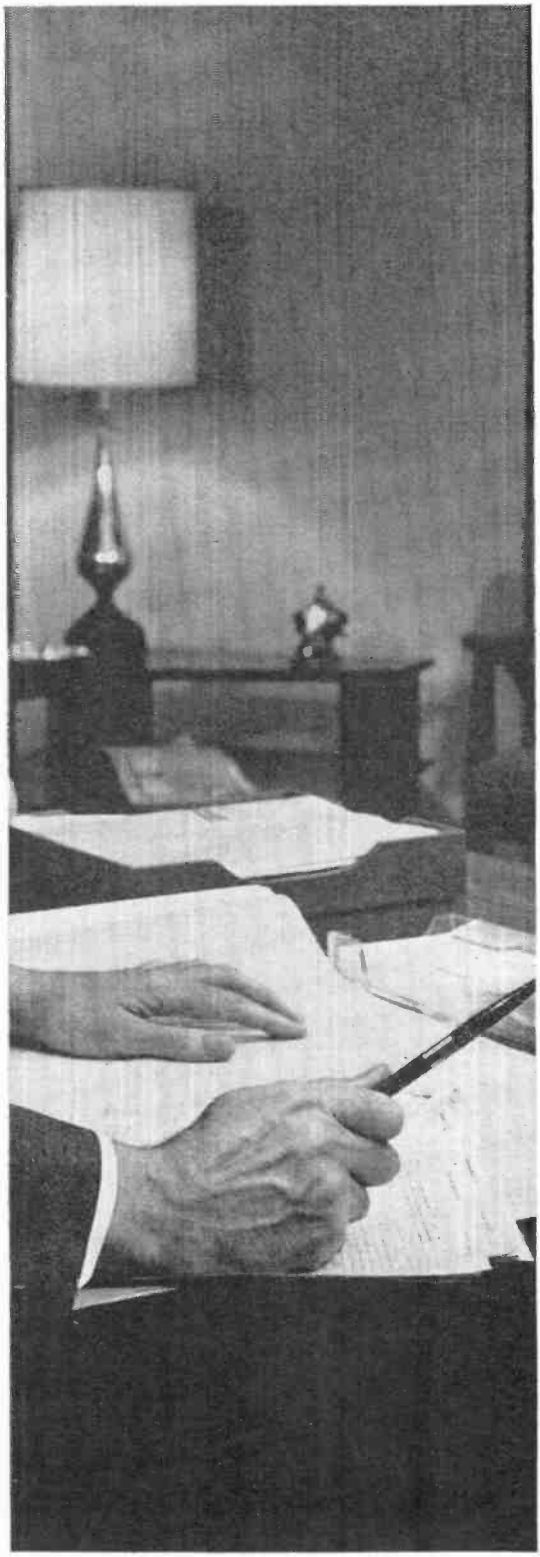
THE Far East Broadcasting Company is a name that few in the radio world in the United States have ever heard of. That in itself would not be so unusual were it not for the fact that the FEBC —as the company likes to abbreviate itself—is the largest private international broadcasting operation in the world. It also would not be so strange if that were the only unique thing about the FEBC. But it is not. The FEBC is undoubtedly one of the most, if not *the* most, unusual large-scale broadcasting ventures in the world.

From humble beginnings with a 1,000-watt transmitter more than 20 years ago, the FEBC has grown into a giant with 20 stations using more than a half dozen medium and 15 international broadcasting frequencies. Its transmitters are interspersed half way around the world from San Francisco across the Pacific Ocean to the Seychelles islands in the Indian Ocean near the East Coast of Africa. The FEBC message is broadcast nearly 4,000 hours a month to a potential audience of more than 2 billion persons.

One of the things that makes the FEBC unusual is its message. Unlike the other giants of the international broadcasting world (Radio Moscow, Radio Peking, Voice of America, Radio Cairo, BBC, etc.), the FEBC has no political line or national interest to sell. Nor is it backed by government funds, a truly unique situation in large-scale international short-wave broadcasting. In fact, the FEBC message is a simple, familiar one to Americans: that of the Bible and the Christian faith.

The Far East Broadcasting Company is an entirely private, non-commercial, non-profit organization financed by church groups and interested individuals throughout the world. It serves interdenominational interests, with headquarters in Whittier, California. As its name suggests, the FEBC's principal activities are in the Far East. In fact, an estimated 90% of the company's broadcasting hours are directed to Asian points (the remaining 10% consists of daily broadcasts to South America from the Company's largest—250,000-watt—transmitter located at the old Voice of America site in Belmont, Calif.

The Far East Broadcasting Company got its start back in 1945 as a result of the vision of three men: Robert Bowman, who was formerly connected with the religious "Haven of Rest" radio se-



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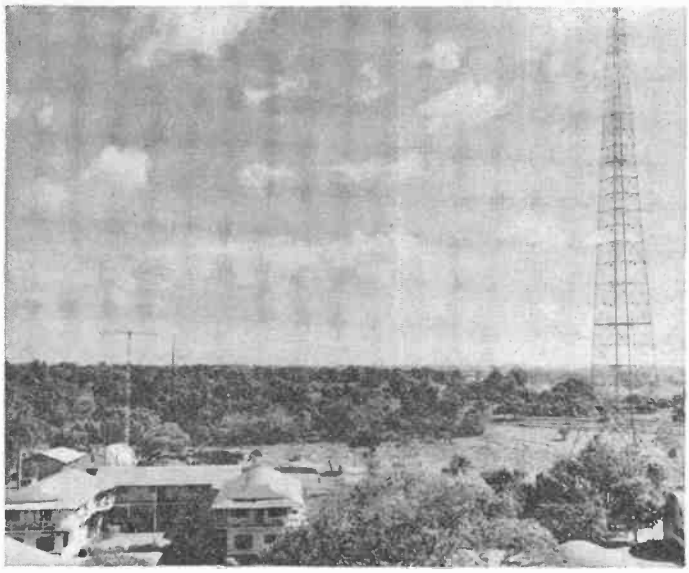


Overall view of one of main stations of the Far East Broadcasting Company, located just outside Manila, the Phillipines.

ries; the Rev. William J. Roberts, who was pastor of a large church in Los Angeles and broadcast a daily local program called "The Family Bible Hour"; and John Borger who had just been discharged from the Navy after service in the Far East. Bowman remains actively involved in FEBC today and is president of the company. Roberts is vice-president for public relations. Broger is no longer associated with the company.

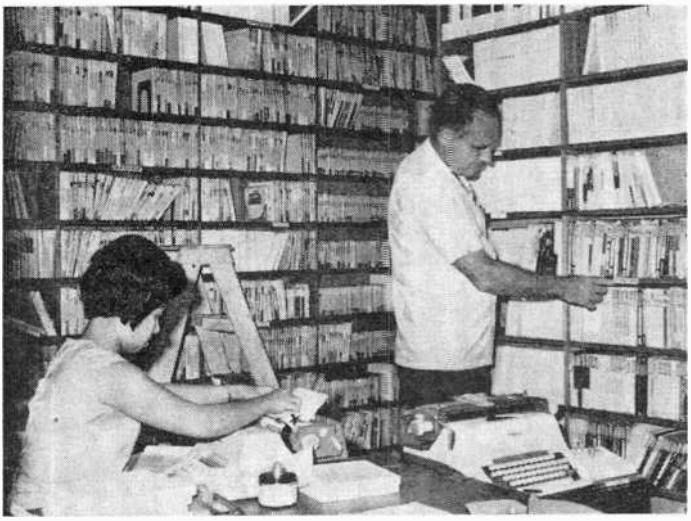
It Started in Manila. Although FEBC was incorporated on Dec. 20, 1945, it took several years of fund-raising and other preparation before the company's first broadcast went out over the air waves. That long awaited moment came in June 1948 when their first 1,000-watt transmitter hummed into life in Manila, the Philippines, sending out its signal on 680 kHz with the callsign DZAS.

In the years that followed, the activities of the FEBC grew enormously and the transmitter capacity also rocketed. One year after getting DZAS on the air, the company's first "Call of the Orient" short-wave operation—DZH6, on 6.030 MHz—began, also from Manila and also aimed at a Philippines audience. A second short-wave station, DZH7 on 9.730 MHz was started in 1950. The following year saw the addition of DZH8 on 11.885 MHz, DZH2 on 3.345 MHz and DZH9 on 15.300 MHz. By this time the FEBC was broadcasting in 30 languages and dialects and rapidly gaining recognition in international broadcasting. Along with the VOA and the "Voice of Free China," the FEBC broadcasts to Communist China and the Soviet Union were being jammed.

In 1952, the FEBC's sixth short-wave station, DZL6 on 17.805 MHz was added. And in 1954, DXFE medium-wave transmissions on 1030 kHz began in Manila employing a new 10,000-watt Collins transmitter. A second 10,000-watt Collins was put on the air in 1955.

One of the big developments in the history of the FEBC was the acquisition in 1956 of two 50,000-watt giants. These transmitters were purchased in San Francisco and shipped to Asia. The same

Technician at studio for short-wave broadcasting.



Part of FEBC's extensive tape and record library which is used by all system stations.

year, DZI8, FEBC's seventh short-wave "Call of the Orient" station was added. In 1957, the company made its first move outside the Philippines. That year a station with the call letters KSAB began operations on 1020 kHz from Naha, the capital of American-administered Okinawa. This station provided an English and Japanese language service. That same year a 100,000-watt transmitter was shipped to Okinawa and a 50,000-watt transmitter to the Philippines.

Thus when the FEBC celebrated its 10th anniversary of broadcasting in 1958, its list of facilities included nine stations on the air in Manila, and a growing network on Okinawa, plus recording facilities in Hong Kong and Taiwan.

The next 10 years proved no less important, with the constant expansion of services and improvement of equipment and programming. Today, the FEBC has joined the ranks of the broadcasting giants. Measured in terms of the number of weekly hours broadcast to international audiences, the FEBC (with 900 hours weekly) trails only Radio Moscow (1,898 hours weekly), Radio Peking (1,451 hours weekly) and the Voice of America (932 hours weekly). FEBC is now on the air to overseas listeners more hours weekly than Radio Cairo (779 hours) or the BBC (695 hours). Its 20 stations broadcast in 40 languages and dialects. Needless-to-say, the Far East Broadcasting Company is in a completely unchallenged position as a private international broadcaster.

Review of Facilities. A review of FEBC's facilities and operations today tells better than anything else the significance and scope of its operations:

San Francisco: The FEBC operates one of only three privately operated short-wave stations licensed to broadcast from the United States. It is station KGEI which, using a recently acquired 250,000-watt transmitter, beams its programs to South America. (The FEBC has applied to the FCC for permission to broadcast to the Expo '70 exposition, which starts in Osaka, Japan on March 15, radiating off the back of the KGEI beam.)

Okinawa: The main broadcasts to Communist China—some 14 hours daily—are made from the 100,000-watt transmitter located at Okuma, some 50 miles north of Naha, the capital city. This transmitter on 1360 kHz has the call letters KSBU. In Naha itself are two FEBC-operated transmitters, the 1,000-watt KSBA broadcasting in English to American forces on Okinawa and the 5,000-watt KSDX broadcasting in Japanese to the native Okinawans.

The Philippines: Without doubt the most important broadcasting and transmission center in the FEBC operation is the Philippines. Currently, FEBC operates 14 stations in the Philippine archipelago, including new stations in Jolo, Sulu islands, and Fuimaras Island in the Southern Philippines. The company has six 50,000-watt transmitters used to beam broadcasts to the rest of South and Southeast Asia as well as the So-

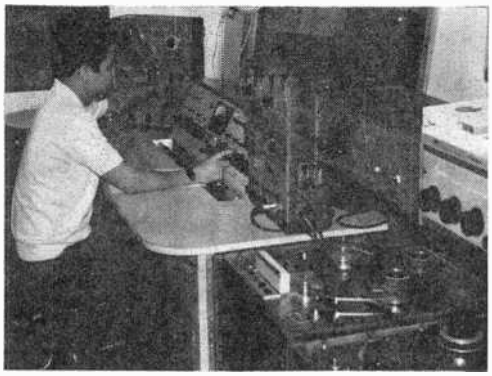
viet Union, Australia and New Zealand. The importance of the FEBC operations in the Philippines is reflected in the fact that Philippine President Ferdinand Marcos uses FEBC stations when he wants to broadcast a message to his people.

The Seychelles: From these British-administered islands in the Indian Ocean off the East Coast of Africa, the FEBC will soon begin using two 100,000-watt transmitters targeted for India, Pakistan and Ceylon. Later the company also hopes to beam its signal to the East Coast of Africa and the Middle East. The approval for these two transmitters on Seychelles is the first time the British government has allowed a private organization to broadcast short-wave from a British colony. Just another in the list of unique achievements of the FEBC.

Widening Scope. The scope of the FEBC goes much further than that of its broadcasting stations. More than 300 persons are employed in FEBC activities. The company operates seven recording studios to help supply the 4000 hours of programming required each month. These are located in Tokyo, Japan; Bangkok, Thailand (where programs in Thai, Burmese, Laotian, Cambodian and Vietnamese are produced); Bangalore, India; New Delhi, India; Singapore; Manila; and Hong Kong. The Hong Kong office also is involved in preparing communications studies in the FEBC Research Center. In addition, the company has an office in Djakarta, Indonesia. Some 35 other studios in Asia cooperate in making programs for FEBC.

Some indication of FEBC's effectiveness in reaching its potential audience is provided by the mail that pours into FEBC offices. Mail from 58 countries has been received, at an average rate of 12,000 letters a month. The company even receives an occasional letter from Communist China, despite the tight controls slapped on the people living in that country. In fact, last year 58 letters were received from behind the Bamboo Curtain. During the previous 15 years, only 47 letters had been received from China.

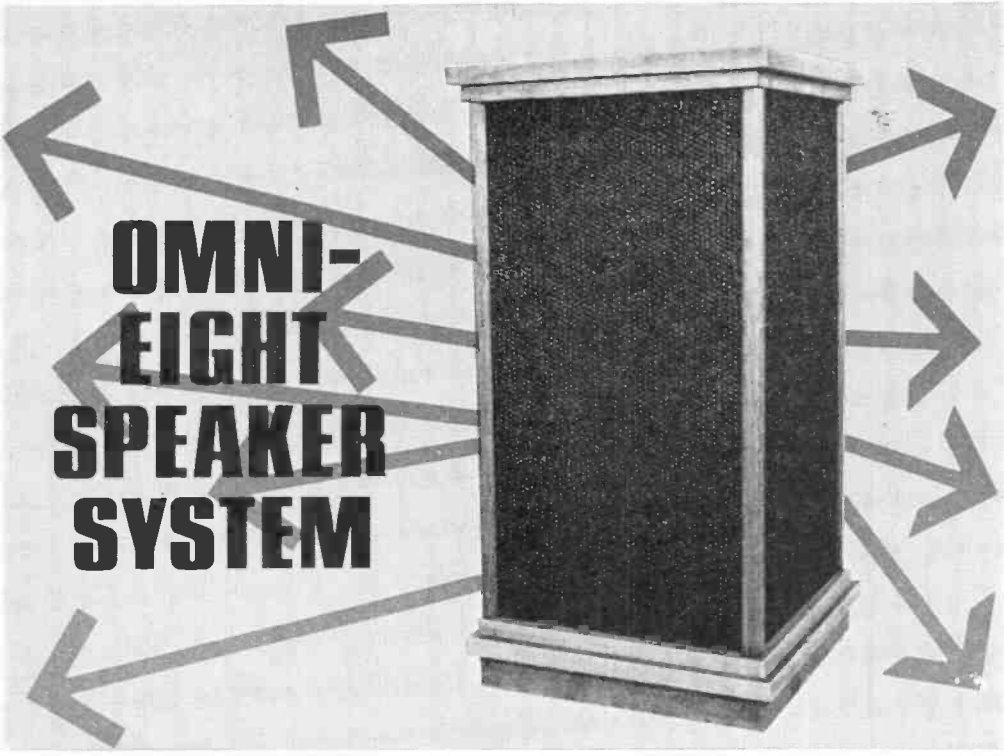
All of this activity is underwritten by contributions from church groups and individuals. Those contributions range from one to several thousand dollars.



Above, another short-wave transmission studio and below, a view of shop where equipment is repaired.

The FEBC solicits contributions in a kind of personalized fashion: "Many are now feeling a closer tie with the broadcasting ministry by personally sponsoring the broadcasts in the language of their choice for $5.00 (U.S.) for a 15-minute broadcast to Asia or Latin America over FEBC's powerful facilities." The choice of languages is indeed large, ranging from Amoy (a Chinese dialect) to Ukranian. As an added inducement to contributors, the FEBC points out that "gifts" are tax deductible.

Thus the Far East Broadcasting Company has grown, quietly but effectively, into one of the giants of international broadcasting. Today, one of the greatest challenges to the FEBC is to get its message into the increasing number of countries that are banning missionaries and missionary activities. It is one of the FEBC's mottoes, in fact, that men may stop the missionary but they cannot stop the message. -30-



MULTI-DIRECTIONAL LOW-COST SOUND

BY DAVID B. WEEMS

THE GENERATION GAP has reached stereo speaker systems. Last year, a floor-standing speaker was invariably placed near a wall or in the corner of a room. Those positions gave better "loading" at the important bass frequencies. Now, suddenly, there are free-standing, column-type speaker systems everywhere —even standing in the middle of the room. Old-timers shake their heads and mutter comments about doing things the hard way. But advocates of the new systems counter with talk about "multi-directional sound," "reflection ratios," and the elimination of "standing waves."

Although some of the current approaches are new, the history of hi-fi is littered with memories of multi-directional speaker systems. One early example was the Columbia "360", a compact monaural phonograph with two opposing 6″ speakers. The name was derived from the idea of a full 360° of sound dispersion, realized mainly in the low frequencies.

Another ploy, recommended by G. A. Briggs, the English authority, was to face the speaker upward, directing the sound onto a diffusing cone or spherical reflector. These upturned speakers were usually located at the top of a 4′ ported column. They produced true omnidirectional sound, but the low frequencies from the bottom port and the treble notes from the high reflector were sometimes noticeably divided.

The first of a new breed of column-shaped enclosures (still with us) puts the woofer at the base, facing downward. The mid-range speaker and the tweeter are more conventionally located on one side. The moderate height of this enclosure makes it more acceptable to the lady of the house, and the sound is better integrated than that possible from the tall columns. However, only the bass range is completely omnidirectional.

The latest development in the "sound-all-around" game places multiple speakers facing outward in several directions.

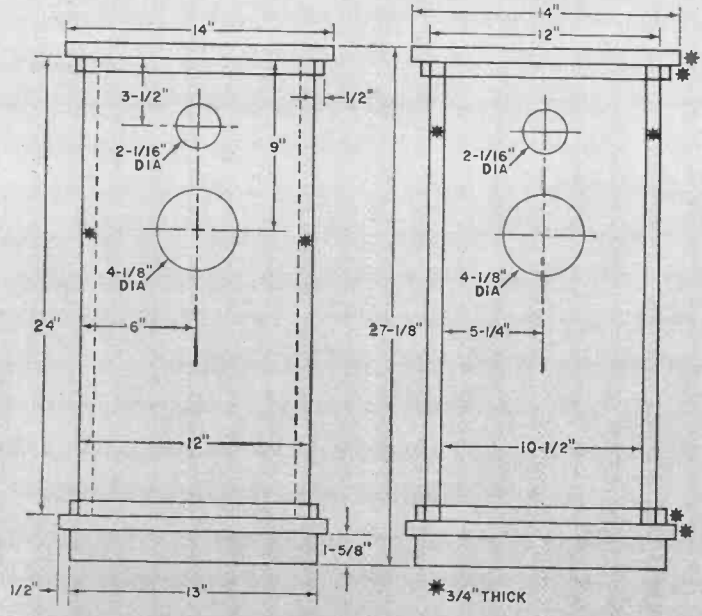


Fig. 1. While only front and one side are shown in drawings, opposite sides are identical in dimensions; ¾"-thick plywood is used for sides.

These systems produce multi-directional, full-range sound that reaches the listener largely by sound waves reflected from room surfaces. These new speaker systems appear to have some distinct advantages over conventional systems—enlargement of the optimum listening area for stereo effect, for example, and a feeling of "depth" imparted by the reflected sound.

There are several possible ways of producing an omnidirectional speaker system. One is to use a collection of full-range speakers; another is to couple an omnidirectional woofer to multiple mid-range speakers and tweeters. Or several small woofers can be used in conjunction with the multiple high-frequency speakers. The choice depends on such factors as cost and the amount of space that is available. For a relatively low-price system—and one that takes up very little floor space—you will want to try the "Omni-Eight."

About the System. The Omni-Eight speaker system uses the multiple-woofer approach to multi-directional sound. It

BILL OF MATERIALS

*4—5" woofers (Olson No. S-845)**
*4—2 ⅜" horn tweeters (Olson No. S-846)**
*1—Two-way crossover network (Olson No. HF-102)**
*1 pkg.—Acoustical fiberglass (Olson No. HF-17)**
2—24" x 12" pieces of ¾" fir plywood for sides
2—24" x 10½" pieces of ¾" fir plywood for sides
2—14" x 14" pieces of ¾" hardwood plywood for top and bottom
4—13" x 1 ⅝" pieces of ¾" hardwood plywood for foot pieces (miter cut ends to 45°)
1—9' length of ¼" x ½" trim for top and bottom (see text)
1—8' length of ½" outside corner hardwood molding for corner trim
1—144" length of ¾" x 1/48" wood veneer (Shurwood wood tape or similar) for plywood edges
4—10½" length of 1" x 2" pine for top and bottom cleats
4—7¼" lengths of 1" x 2" pine for top and bottom cleats
Six-penny finishing nails for attaching sides
Three-penny finishing nails for attaching trim
32—#8 x ¾" panhead sheet metal screws for mounting speakers
8—#8 x 1½" flathead wood screws for attaching top
8—#10 x 2" flathead wood screws for attaching foot pieces
Misc.—Grille cloth (see text); wood glue; flat black paint; stain; sandpaper; wire; solder; etc.
**Olson Electronics, Inc., 260 S. Forge St., Akron, Ohio 44308*

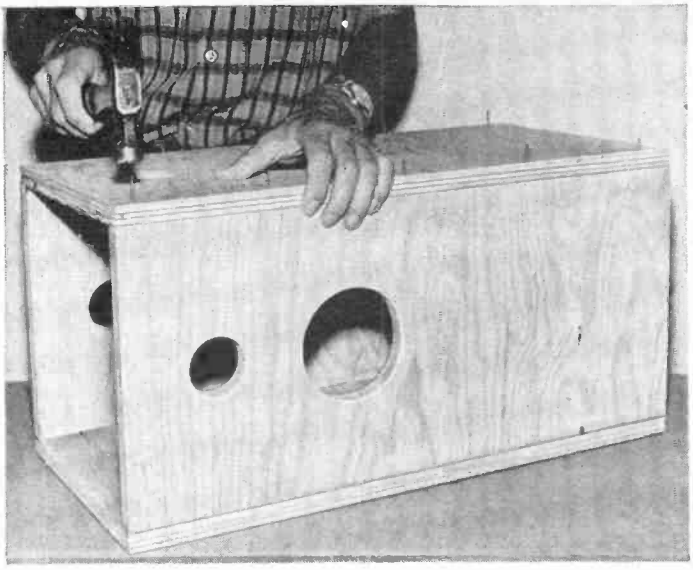


Fig. 2. Start construction of column by gluing and nailing together front, sides and rear. Note that speaker cutouts must all be in a common direction.

has four woofer-midrange speakers connected through a 3000-Hz crossover to four horn-type tweeters. Thus a woofer-tweeter pair faces each of the four walls or the corners if desired. The use of four small woofers results in an enclosure of modest dimensions that occupies only about 1⅓ sq ft of floor space. A control on the bottom-mounted crossover network balances the tweeter output to that of the woofers.

The bass response of the Omni-Eight is clean and true, due to the 50-Hz free-air resonance of the woofers. It isn't the same kind of bass response you get from a 12″ woofer, but you will find a degree of naturalness not present in many large speaker systems. The sound quality of the Omni-Eight can be described simply as "refined."

The total effect of the system is one of diffused sound, due to the multi-direc-

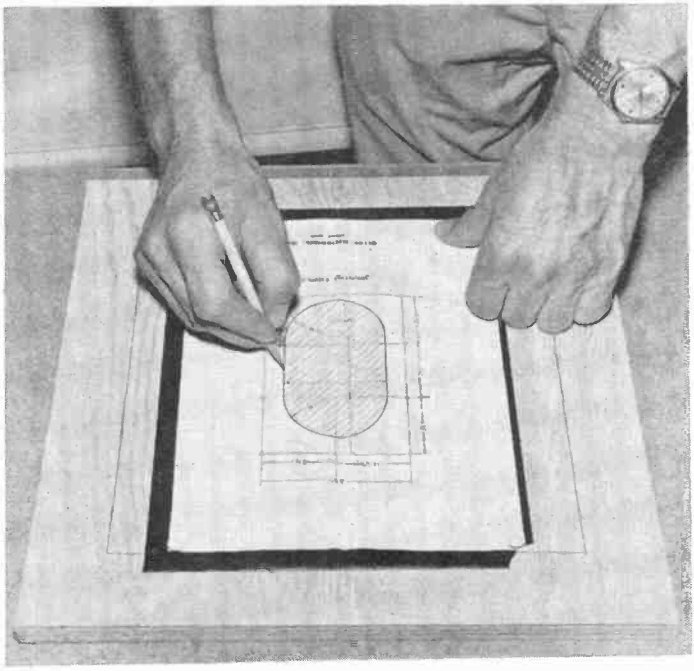


Fig. 3. Provided with crossover network is template that determines dimensions of cutout on bottom of enclosure. Use carbon paper to transfer dimensions to bottom plate.

tionality. The ear can still identify the location of a multi-directional speaker due to the fact that direct sound reaches the ear before the reflected sound; but the placement of the column is less critical than that of conventional systems.

The music power rating of the Omni-Eight is on the order of 30 watts, but it can be driven to good room volume by a 10-watt amplifier.

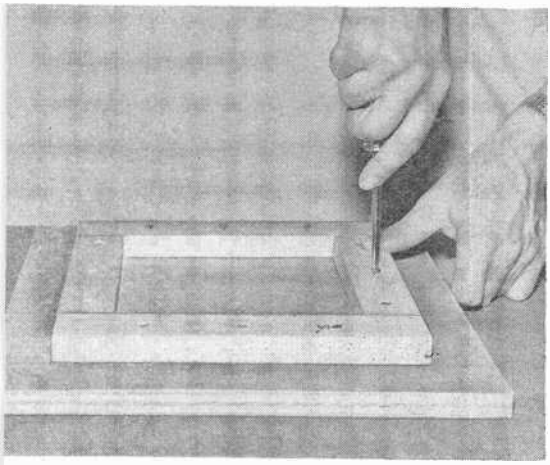


Fig. 4. Prior to mounting top plate on column, attach 1⅝" x ¾" pine cleats as shown in photo.

Construction. The enclosure can be built with common hand tools, though 45° miter cuts for the "foot" pieces and trim will improve the appearance. Cut out the parts to the dimensions shown in Fig. 1. In addition to the speaker cutouts, drill two guide holes for screws through each side piece about ⅜" from the top edge and 5" apart. Glue and nail together the sides to form the column as in Fig. 2. Then coat the exterior surfaces of the column with a flat black paint.

Prepare the 14" square top and bottom pieces. Use the template supplied with the crossover network and a piece of carbon paper to make the cutout for the crossover on the bottom (see Fig. 3). Remove the cutout with a sabre or keyhole saw. Center the top and bottom on the open-ended column and outline the position of the sides against the end plates with a pencil.

Attach 1" × 2" cleats with glue and #8 × 1¼" flathead wood screws on the interior surfaces of the top and bottom plates as shown in Fig. 4. The cleats should fit within the space outlined by the pencil marks to allow screws to be driven through the enclosure sides into the cleats.

Next, cover the plywood edges of the top and the bottom with wood veneer edging to match the veneer on the plywood. Use a razor blade to cut a piece of ribbon veneer slightly longer than the panel. Coat the plywood edge and the rear surface of the veneer with contact cement. Allow the cement to dry for 10 to 20 minutes until it is tacky but does not stick to your finger. Then apply the veneer, but don't let the surfaces touch until the veneer is in exact position. The cement will adhere on contact; but to make sure the entire surface is tightly bonded, place a small block of wood against the veneer and tap with a hammer. Move the block and tap it along the entire length of the veneer. With a razor blade, trim the ends of the veneer to the proper length. Then sand the edges, using a small wood block covered with fine (4/0) sandpaper, slightly rolling the top edge to blend the grain of the veneer with that of the plywood.

Coat all matching surfaces between the bottom cleats, the bottom plate, and the bottom edges of the column with wood glue. Attach the bottom by driving

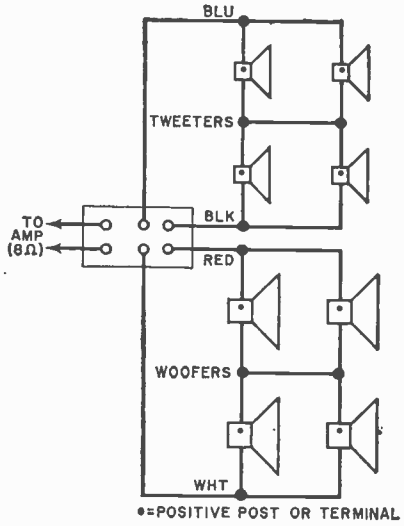


Fig. 5. Tweeters and woofers are wired in series-parallel to present 8-ohm impedance to amplifier.

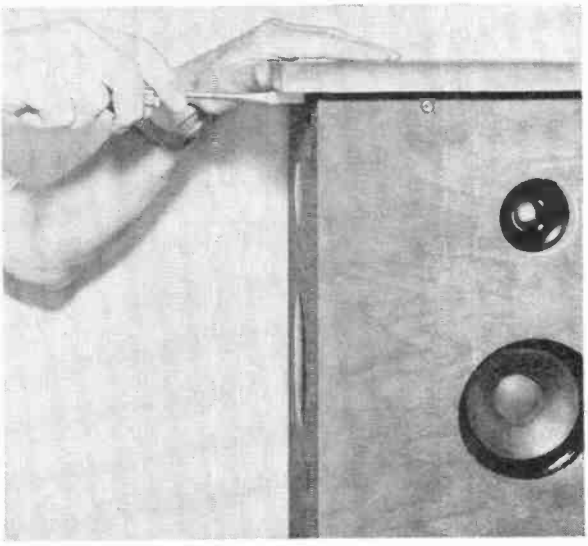


Fig. 6. Screws driven through column walls and into cleats secure top plate in place on enclosure.

nails through it into the lower edges of the four sides. If you have a good fit between the parts, the glue will be sufficient for proper sealing. If not, add screws through the sides into the cleats. Then check for air leaks and caulk the corner joints if necessary.

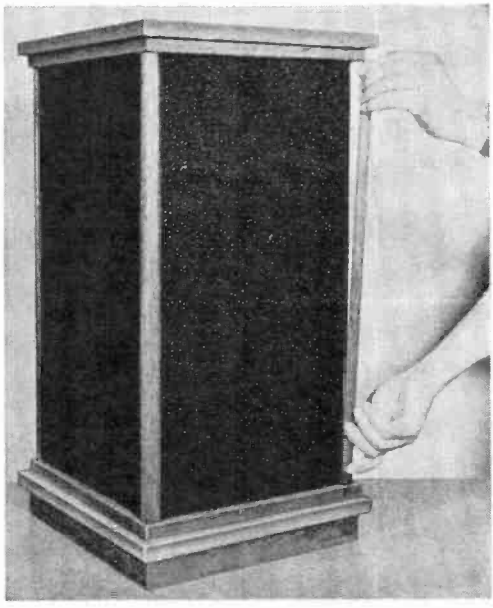


Fig. 7. Staples or tacks securing grille cloth at corners of column are hidden by corner molding.

Install the four miter-edged foot pieces on the bottom plate with glue and eight #8 × 2″ flathead wood screws. Feed the wires from the crossover network into the enclosure and install the network on the bottom, using the ten screws supplied with it.

Now mount the woofers with #8 × ¾″ panhead screws. Locate the positive terminal of each woofer (may be identified by a red insulating washer between the terminal and the speaker frame; negative terminal has white washer). Wire the woofers according to Fig. 5. Then check the polarity of the system by connecting a flashlight battery to the crossover terminals. For proper phasing, all woofer cones should move together in one direction, either outward or inward.

Next, mount the tweeters with panhead screws; wire them according to Fig. 5; and follow the instructions supplied with the network to complete the speaker hookup. Connect the system to an amplifier and check the operation of the tweeter control; clockwise rotation should increase the sound level of the tweeters.

Fill the enclosure with loose fiberglass. One 72″ × 18″ sheet of Olson fiberglass is the minimum amount that should be used. Cut the batting into pieces about 18″ × 10½″, and insert them through the openings at the corners of the enclosure to fill the lower part up to the woofers. Then cut smaller pieces, about 3″ × 10″, to fit in the space between the woofers. The level of the fiberglass should extend to the level of the tweeters.

Set the top in position, and mark the correct positions for screws on the inside cleats. Remove the top and drill ⅛″ guide holes in the cleats. Cement a thin gasket of polyfoam or felt along the top edges of the sides. Then replace the top and anchor it with screws driven through the sides and into the cleats as in Fig. 6. The screws will be in the proper position to draw downward on the top, compressing the gasket. If necessary, weight the top to bring the guide holes in line with the screws.

A piece of grille cloth 2′ × 4′ will fit the enclosure column, wrap-around style. However, if the grille cloth you select does not have a strong vertical or horizontal pattern, you might be able to

(*Continued on page* 113)

FIRST PERSON DX'ing

MR. SWL—

ARTHUR CUSHEN—CIRCLES THE GLOBE VISITING BROADCASTERS

First of the ten international broadcasting stations visited by my wife, Ralda, and me was the VOA 250,000-watt installation at Dixon, Calif. We were interviewed for a VOA broadcast to Asia. The antenna site occupies 800 acres.

Radio Canada maintains an active club and our second interview was conducted by Elaine McMaster (club secretary) and Duncan Nicholson (club vice president). These interviews gave me an opportunity to tell listeners what it was like to DX on the shortwaves from New Zealand.

Arriving in England we were cordially greeted by the staff of the BBC. While in London I gave a first-hand report of New Zealand DX'ing to Henry Hatch, who moderates many of the World Radio Club programs. Since I am blind I did a program for "Radio 4" for blind listeners.

On to Denmark, only to be greeted by the sad news that Radio Denmark was considering cessation of its English-language programs. Christion Flagstad is addressing Ralda and me with Luise Berald and Dick Platt of Radio Denmark, right, joining the conversation.

At Halmstad, Sweden, the European DX Council held an International Parliament to discuss matters of common interest. At left is J. Vastenhoud of Radio Nederland; at right, renowned Radio Sweden Editor, Arne Skoog.

On our way home, we stopped at Radio RSA, Johannesburg, South Africa. We were interviewed again(!) by Dorianne Berry and Arthur Hanna, two more well known announcers. Unfortunately, these few photos cannot possibly show all the wonderful people we met nor express our deep thanks to all who were so cordial to us.

—Ralda and Arthur Cushen

Engineering Level Opportunities

FOR YOU

HOME STUDY IS THE ANSWER

BY ALEXANDER W. BURAWA, Associate Editor

THE PHENOMENAL PACE at which electronics has developed in the last few years—and the ever-increasing complexity of the technology—have precipitated an unprecedented demand for engineering level electronics technicians. In the aerospace and communications industries, in sophisticated computer centers, and in scientific and medical electronics—all areas where the most lucrative job opportunities exist—training on the level of the radio-TV repairman is no longer sufficient. Technicians in these job situations are actually associate or assistant engineers; and it takes engineering training on the college level to get these jobs—something you can now do with home study.

If you can't take the time or haven't the money to spend for two to four years of college what do you do? Do you know that four nationally accredited *home study schools* are now offering engineering courses on the college level? If you have the prerequisites, two years or less of leisure-time home study could put you well on your way toward one of these engineering technician positions.

The college-level courses offered by home-study schools have gained wide-spread approval in industrial and educational circles. In most cases, the student receives an industry recognized diploma upon completion of one of the courses. One home study school offers the opportunity of earning a degree.

Home study courses in electronics actually started in the 1920's. The earliest courses were highly specialized, tending to focus on certain areas in a technology which was then only in its infancy. Gradually, coverage was expanded and today's home study engineering courses are as up-to-date and cover as much ground (in the technology) as those offered in many technical colleges.

Schools accredited by the National Home Study Council* and offering engineering programs are: Capitol Radio Engineering Institute (CREI), 3224 Sixteenth St., NW, Washington, D.C. 20010; Cleveland Institute of Electronics (CIE), 1776 East 17 St., Cleveland, Ohio 44114; Grantham School of Engineering (GSE), 1505 North Western Ave., Hollywood, Calif. 90027; and National Technical Schools (NTS), 4000 S. Figueroa St., Los Angeles, Calif. 90037.

**The Accrediting Commission of the National Home Study Council has been approved by the U.S. Office of Education as a "nationally recognized accrediting agency." Its purpose is to establish educational, ethical, and business standards; examine and evaluate private home study schools in terms of these standards; and accredit (only) those schools which qualify.*

"General acceptance of correspondence study as a legitimate technique has been developing for years. Recently, however, the growth of that acceptance has been phenomenal. Hundreds of private companies are using home study to enable their employees to do a better job. Colleges and universities are becoming more willing to give formal credit on the basis of personal interviews and qualifying examinations.

"No study of correspondence education has shown it to be appreciably inferior to classroom instruction, while a number of studies have shown correspondence students do measurably better on examinations."

L. M. Upchurch, Jr.
President, CREI

Prerequisites for engineering level home study courses are obviously high. The applicant must be a high school graduate (or possess a high school equivalency certificate) and have studied, or had previous job experience in, the electronics industry. Applicants without the electronics prerequisite but who have a firm grasp of theoretical and practical physics and intermediate mathematics are good potential candidates.

There are very practical reasons for setting these high prerequisites. The courses provide studies only in electronics theory; there are no gimmicky training kits or home-built TV receivers. The schools sense that no engineering level home study course can possibly provide the exposure to all the test equipment, circuits, and systems required for a full resident laboratory course. Since home study programs feature low cost, this is a sound principle and the study programs have been adjusted accordingly.

Thus, even though home study engineering courses have no costly kits and training aids, nothing has been sacrificed in the quality of educational materials provided. Such items as tube and transistor manuals, special textbooks, and slide rules are included in the basic tuition.

The home study concept of education is geared for individual attention. Each lesson is written to provide maximum clarity. But even the clearest written text might confuse some students. So, all of the schools maintain a full-time consultation service, staffed with engineers and educators who are experts in home study problems, to which the student can turn for help. This service is available even after graduation.

Textbooks are broken up into bite-size lessons for easy assimilation and to allow the student to pace his progress. Within each lesson are answer-keyed questions that are designed quickly and immediately to check the student's comprehension of the material covered. At the end of each lesson is an exam which must be completed and sent to the school. All questions asked are of the thought-provoking essay type.

At the school, the student's exams are reviewed and graded by professionals. In grading the exams, several things are looked for: The correct answer, of course, is one, but more important are the techniques used in answering math questions and the method of presentation. If an incorrect method or answer is given, the person grading the exam will supply corrective hints that show where the student went wrong, and refer him to the

WHAT IS AN ENGINEERING TECHNICIAN?

The entire technical work force in electronics can be divided into two broad, but not necessarily well defined, categories: technicians and engineers. Technician in this sense refers to the person who operates, maintains, troubleshoots, and repairs electronic gear. Engineer refers to the designer of new devices, circuits, and systems. Between the two categories lies a growing force of engineering technicians (sometimes referred to as associate engineers). The engineering technician's duties and responsibilities overlap both categories.

Engineering technicians usually work directly with scientists and engineers with degrees. They analyze and solve engineering problems and occasionally prepare technical reports. Consequently, the engineering technician must have a thorough grasp of the scientific principles of his particular field and a good understanding of mathematics and physics. Generally, to be entitled to the title of associate engineer, the person is expected to be a graduate of a two-year college. However, the growing recognition of home study by the industry does entitle the home study graduate to apply to his name the title of engineering technician.

"Many people are now realizing that everyone can't go to college; and, more important, many individuals should definitely not seek a college education. Home study is an ideal alternative—not a substitute but an excellent opportunity to obtain specialized education quickly, effectively, and economically.

"At CIE, we have some 775 industrial and commercial clients, and this roster is growing daily."

Ralph J. Schmotzer
CIE

Angelo Vaccaro came to the U.S. from Italy 15 years ago and went to work as a machinist. When he enrolled in CREI in 1953, he could hardly speak English, and he gives the lessons credit for helping him learn the language. Today he is Vice President of Columbia Controls Research Corporation in Glen Cove, N.Y. He holds in his name or in the name of the company 15 patents for devices such as an electronic scanner, an electronic tensioning control device, and a reader for a computer system. Some of these devices have been sold or licensed, and negotiations are under way for others.

ON THESE PAGES

An interesting item that appeared in the August 1969 Supplement of the "National Home Study Council News" under the heading "Recent Research Developments in Correspondence" cites a further example of the effectiveness of home study training: "In representative examples of correspondence students at the University of Minnesota, every twentieth card in the current student card file was selected to give a 5% sample . . . In terms of grade points, students in correspondence study rated higher than those in day school, evening school, or in summer sessions. Only in the Graduate School was the average higher."

Although David J. Chestnut is not a "typical" graduate of home study electronics engineering, his story does show how far a person with initiative can go. Mr. Chestnut began his CREI studies in 1932 and is now Managing Editor of Technical Communications of Raytheon Company's Wayland Laboratories in Massachusetts. In his ten years with Raytheon, he has supervised many areas of technical communications, including cinematography and in-plant engineering writing seminars. Since his CREI studies, Mr., or rather, Dr. Chestnut has added B. Mus., M. Ed., and Ph. D. titles to his name, has had several papers published, and has been a prominent speaker on the subject of technical publications in this country and abroad—an impressive number of achievements by any yardstick.

Joseph W. Pieczynski enrolled at CREI in 1963 and is currently manager of the EPC Division of Artisan Electronics Corporation in Parsippany, N.J. The EPC Division was formed by the acquisition of Electronics Products Corporation, of which Mr. Pieczynski was founder and president. Among his achievements is the patent he holds for a self-powered timer. He also received honorable mention in the 1963 Gustav Johanson Awards for his contribution to timer technology.

SOME SUCCESSFUL STUDENTS

Maurice T. Swinnen graduated from CREI in 1962 shortly after he arrived in the U.S. from Belgium. Not long after graduation, he joined the Division of Neuropsychiatry at Walter Reed Army Medical Center in Washington, D.C. Starting at Walter Reed as an equipment repairman, Mr. Swinnen rapidly rose to electronics technician and, finally, to supervisor of the electronics shop facility of the Division of Neuropsychiatry. He is in charge of seven technical support personnel, two of whom are graduate electronics engineers. He has contributed well over 100 technical reports about the instruments he has devised during the past seven years and more than 20 publications have appeared under his name in both medical research and electronics journals. He is often called upon to attend the various technical and medical conventions around the country—to learn as well as to teach.

"Our home study degree program is relatively new, but already quite a few firms and agencies are paying tuition in this program for their employees. And many others are reimbursing their employees who complete correspondence 'semesters.' Some of the firms and agencies who have paid tuition directly to the School are: Naval Ordnance Station of Indian Head, Md.; the WDL, E&TS, and C&TS Divisions of Philco-Ford; Sprague Electric Co.; Consolidated-Bathurst, Ltd., of Canada; ESSA Research Labs; and NASA Flight Research Center, Edwards, Calif."

D. J. Grantham
President, GSE

page or section in the lesson that should be reviewed.

When the student is through with his course, he must complete a comprehensive examination that touches on every area studied. The end-of-course exams are usually proctored (taken in the presence of a qualified person). Then upon passing the comprehensive exam, a diploma, which is the school's statement of the student's competence, is awarded.

Although basically similar, the exact content of the home study engineering courses offered by the various schools varies.

At CREI, the master, or principal, course on the college-engineering level is the Electronic Engineering Technology Base Program with Major Electives. It has two objectives: to provide a broad basic foundation in electronics and to equip you with specialized knowledge in a particular field of your choice. The Base Program covers the theory and application of advanced electronics in relation to circuits, components, and systems. The electives in which you can specialize include: Communications; Aeronautics and Navigation; Television; Computers; Nuclear Instrumentation and Control; Automatic Control; Missile and Spacecraft Guidance; Radar and Sonar; and Digital Communications.

CIE and NTS also offer master courses in electronics engineering. No electives are available as such, but the courses are designed to prepare the student for a career in one of a wide variety of specialties in the electronics industry. Typical basic subjects include steady-state and transient network theory, solid-state physics, magnetics, etc.

GSE's program consists of five sections and includes an "incidental" preparation program for an FCC First Class Radiotelephone License with Radar Endorsement. Emphasis is on mathematics and physics (as it is in all home study courses). The course sections are: Basic Electronics with Mathematics; Communications Circuits and Systems; Engineering Mathematics and Computers; Classical and Modern Physics, and Technical Writing; and Engineering Calculus, Electrical Networks, and Solid-State Circuit Design.

A very important benefit of these courses for those students who plan to go on to college to earn their associate and bachelor degrees in electronics engineering is that many colleges allow considerable advance-standing credit for material covered (depending on the college and the results of tests). In addition, Grantham has oriented its program toward the obtaining of a degree. After completing his home studies, the student attends a two-week resident class at the school, for which he earns an Associate in Science in Electronics Engineering (ASEE) degree. -30-

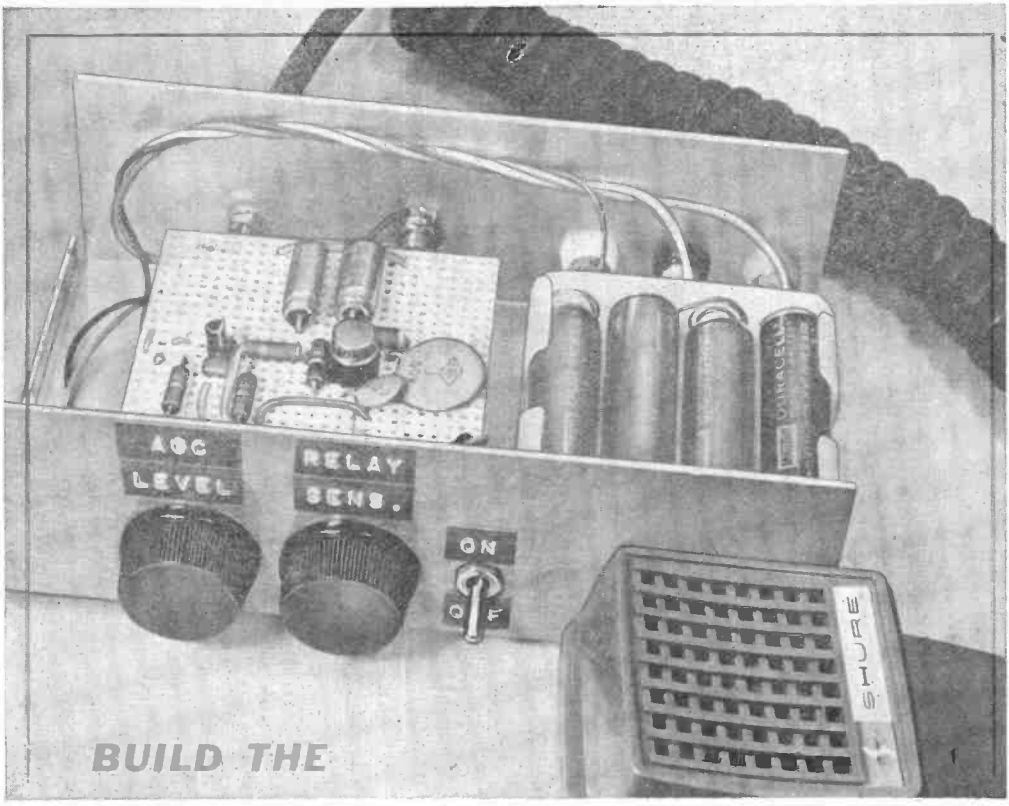
"It has been said that education is the mother of leadership; and by encouraging education, the National Home Study Council helps build leaders to guide America through the tests and trials of this critical and complex time. . . . Never has your mission been more timely or more imperative than now. Your high academic standards promise quality education to all who pursue correspondence study. I commend your distinguished and enduring service to America."

—Excerpt from a telegram sent by President Nixon to the NHSC at its 1969 Annual Conference.

"Recognition of home study programs in direct conjunction with college-level education is distinctly on an upward swing. As an indication that industry does accept home study graduates, our own experience has been that major firms throughout the world have sought and value our graduates.

"Data involving motivational research has proven that self-directed independent study is more effective than resident training. One obvious reason for this is that the home study student must research his own material as sent by the school without someone at his side. While he is guided, supplied with accurate and tested study material, and counseled as needed, he is not spoonfed information, nor is he held back in a class of students with a variety of achievement skills."

Robert Parma
Director of NTS



BUILD THE VOXOR

A VOICE-OPERATED MICROPHONE WITH SPEECH COMPRESSION

BY ROBERT A. HIRSCHFELD

HOW WOULD YOU like a microphone system that operates without a push-to-talk switch and compensates for differences in voice levels automatically? Whether you are using a tape recorder, ham or CB rig, these are real advantages. You can get both of them by building the "Voxor," a unit that has a voice-operated relay (VOX) and speech compression (audio a.g.c.)—features that are normally found only in expensive military and commercial equipment.

The Voxor uses the new National Semiconductor LM370 integrated circuit and is connected between your microphone and recorder or transceiver. All you do is start to talk and the system turns on immediately. When you stop talking, and if you're using a transceiver, it will switch immediately to the receive mode. In the meantime, while you are talking, the Voxor output will be at a nearly constant, high-modulation level.

Construction. The circuit of the Voxor (see Fig. 1) can be built on either perf board or on a printed circuit board. A possible layout is shown in Fig. 2. Components not shown in the figure are below the perf board. To make wiring easier, it is suggested that a 10-pin integrated circuit socket be used for *IC1*. Once the board is complete, it can be mounted on standoffs and connected to the external components.

On the prototype shown in the photos the a.g.c. level potentiometer *R2*, the relay sensitivity potentiometer *R9* and the power on-off switch *S1* are mounted on the front of the chassis. The micro-

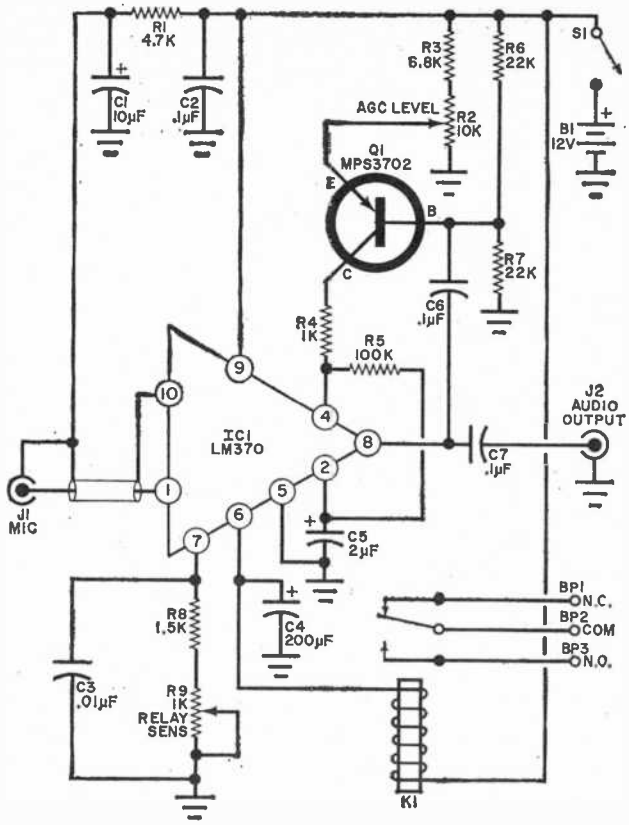


Fig. 1. The circuit is not a speech clipper but a legitimate speech compressor. When connected to a radio telephone transmitter or a tape recorder, the circuit will maintain a high modulation level with the speech clarity of the original input. As a bonus, the circuit will also operate a relay that can be used to switch the transceiver on or start a tape machine when speech does.

PARTS LIST

BP1-BP3—Insulated binding post
B1—12-volt d.c. battery or power source
C1—10μF, 25-volt electrolytic capacitor
C2,C6,C7—0.1-μF capacitor
C3—0.01-μF capacitor
C4—200-μF, 25-volt electrolytic capacitor
C5—2-μF, 10-volt electrolytic capacitor
IC1—Integrated circuit (National Semiconductor LM 370 or Sylvania ECG370)
J1,J2—Phono jack
K1—1640-ohm relay, s.p.d.t., 1-ampere contacts (Sigma 65F1A-12DC or similar)
Q1—Npn silicon transistor (Motorola MPS3702 or similar)
R1—4700-ohm
R3—6800-ohm
R4—1000-ohm
R5—100,000-ohm
R6,R7—22,000-ohm
R8—1500-ohm
All resistors ½-watt
R2—10,000-ohm linear potentiometer
R9—1000-ohm linear potentiometer
S1—S.p.s.t. switch
Misc.—Metal chassis, perf board, standoffs, microphone (Shure 401A), battery holder, knobs, 10-pin IC socket (Cinch-Jones 10-ICS), mounting hardware, etc.

phone input *J1*, audio output *J2*, and the three relay contact binding posts are on the rear. As with any high-gain amplifier, leads should be kept short and direct to prevent feedback and high-frequency oscillations.

While almost any dynamic microphone capable of delivering up to five millivolts can be used, the one specified in the Parts List works especially well with this circuit. Certain microphones, including the one used here, have push-to-talk switches that close the circuit when the microphone is in use and also short out the microphone element itself when it is not in use. Such microphones must be rewired so that the element is never shorted.

To use the Voxor with an input other than the signal from a dynamic microphone, rewire the input circuit as shown in Fig. 3. This can be used as long as the maximum input level does not exceed about 50 millivolts. Larger inputs will

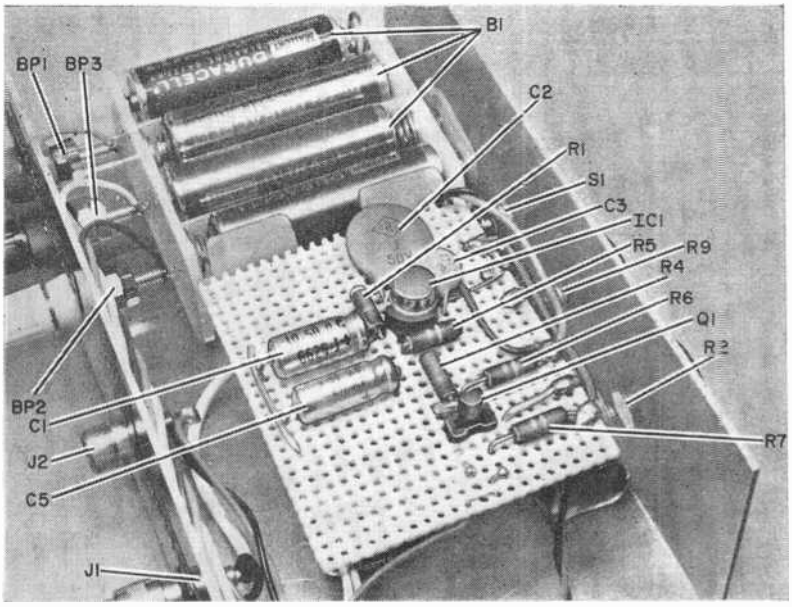


Fig. 2. The author constructed his Voxor on a section of perf board, although any other type of construction may be used. Sockets were used for both IC1 and Q1.

produce distortion. Inputs of less than one millivolt do not give reliable operation of the relay.

While the Voxor can be used with any d.c. supply from 9 to 24 volts, it works best with a 12-volt supply.

The attack and release times of the Voxor are determined by the value of capacitor *C4*. With the value prescribed in the Parts List, the timing is just about right for normal speech. Doubling the capacitance doubles the attack and

HOW IT WORKS

The integrated circuit—containing a complex combination of 34 transistors, diodes, and zeners, plus 20 resistors—performs two separate functions. The first is preamplification, with gain controlled by an external d.c. voltage (applied to pin 4). When this potential is less than 2 volts, the gain of the preamplifier is a maximum (about 100 with a 12-volt supply). With higher voltages, the gain decreases; until, with 2.6 volts or more, there is an attenuation of 100.

The second function is performed by a very high-gain amplifier-detector that receives the same input as the preamplifier but is otherwise independent. A potentiometer, external to the IC, sets the desired "squelch" threshold at pin 7. The output stage of the amplifier-detector is a medium-current *npn* power transistor. This transistor is normally off when only low-level inputs are present; but when the threshold is exceeded, pin 6 provides nearly a short circuit to ground, and the current is sufficient to operate the relay.

The input from the microphone is applied directly to both sections of the IC with d.c. bias derived from *R1* and *C1*. Sensitivity for the VOX section (the second function of the IC) is set by *R9* and the relay is driven directly by the output at pin 6. Normally, *C4* is charged up to the positive supply voltage through the relay coil. When a microphone input occurs, the relay is energized and *C4* discharges. Thus, the relay remains closed even after the input disappears—until *C4* has had time to recharge. This provides a "fast attack" so that early speech won't be lost, and a "slow release" so that the relay won't cut out between normally spaced words in a sentence. Capacitor *C3* makes the VOX less sensitive to high-frequency noise, so that sensitivity to speech frequencies is retained and false triggering made less likely.

Speech compression is performed by detecting the negative audio peaks at the output of the preamplifier (pin 8) through capacitor *C6*. With no audio present, the potential at the base of *Q1* is half of the supply voltage, as determined by the voltage divider made up of *R6* and *R7*. A negative-going audio peak causes *Q1* to turn on momentarily, which quickly brings the control input (pin 4) above the voltage where the preamplifier begins to turn off. This, in turn, charges *C5*, the a.g.c. smoothing capacitor. The net effect is that the first excessive peak seen by the detector causes the gain to be reduced just enough so that succeeding peaks of the same signal strength no longer activate the detector. A nearly constant amplitude of the output voltage is the result. Capacitor *C5* discharges more slowly than it charges so that the a.g.c. action also has a fast attack and slow release. If the speech level drops below the desired level, the amplifier gain increases as *C5* discharges until the preset level is reached.

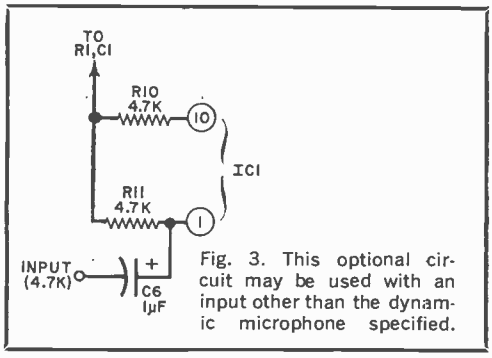


Fig. 3. This optional circuit may be used with an input other than the dynamic microphone specified.

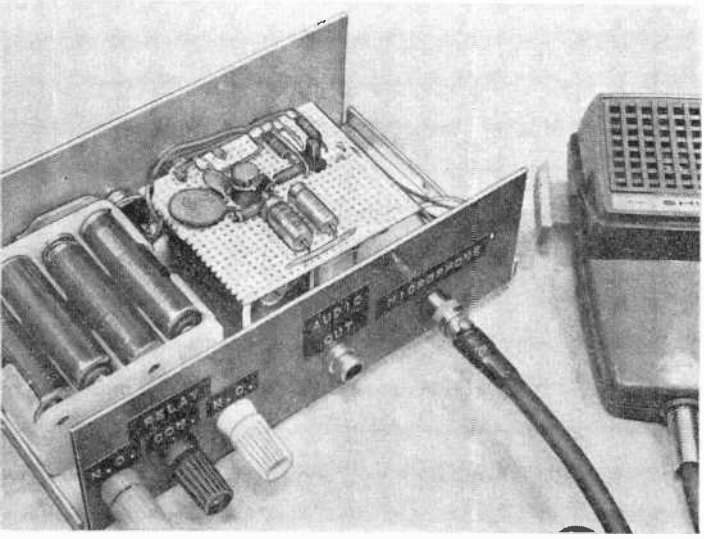
release times; reducing the capacitance, reduces the times.

Operation. After checking the circuit, connect the power supply and microphone and set *S1* to ON. Set the RELAY SENS. control for maximum resistance and note that relay *K1* is de-energized. Decrease the resistance of *R9* until the relay picks up and then back off slowly until it drops out again. Speaking into the microphone should cause the relay to be energized rapidly, with dropout occurring about one second after speech has ended. Setting *R9* closer to the "threshold" point increases relay sensitivity, while increasing *R9* resistance makes the relay less sensitive.

Connect the audio output of the Voxor to the input of the equipment with which it is to be used and set the equipment audio gain to the desired level. Set potentiometer *R2* for minimum resistance (rotor to grounded end). Speaking in a normal voice, the correct distance away from the microphone, adjust *R2* until the audio output of the Voxor decreases to the desired level. Note that changing the voice level or moving closer to or farther from the microphone does not change the audio level. In this way, it is possible to modulate fully a radio transmitter or tape recorder without overloading it.

For use with a transceiver, connect the relay common and normally open contacts to the wiring that formerly went to the microphone push-to-talk switch and the audio output of the Voxor to the mike input. Adjust the relay sensitivity so that the Voxor is not activated by the sound from the speaker during the listening interval. To operate the transceiver, just speak into the mike and the switching is done automatically. If the Voxor a.g.c. level and transceiver audio modulation level (if any) controls have been properly set, you will notice an increase in the talk power due to the constant high level of modulation.

The relay in the Voxor can handle most battery or low-voltage tape recorders. Connect the relay common and normally open contacts in series with the recorder motor and associated power supply. Speaking into the Voxor will automatically start the recorder. As with the transceiver, the tape recorder and Voxor controls are set to provide maximum modulation of the tape. —30—



The three relay contacts—normally open, normally closed, and armature are terminated in three binding posts on the rear apron. These are connected as required by the external equipment being controlled, which can be either a tape recorder or transceiver.

The Stereo Scene

MAGNETIC TAPE: HANDLE WITH CARE

BY CHARLES H. DODSON, Ampex Corporation

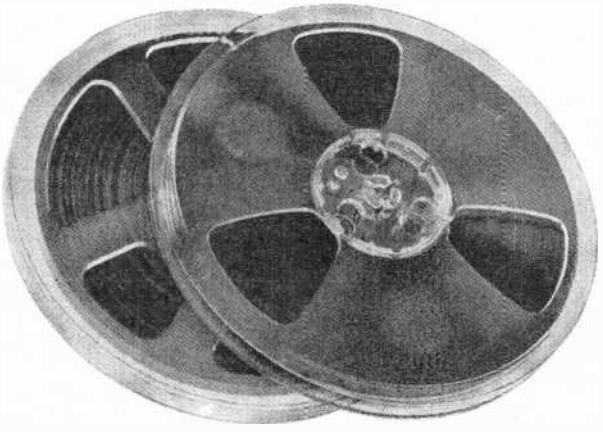
POSSIBLY the most overlooked aspect in the routine of a tape recording hobbyist concerns the tape itself. While he is usually very concerned with the maintenance and operation of recording hardware, not enough serious thought or attention is given to the proper care and handling of the tape that plays such a vital role in all magnetic recording operations.

Proper care is essential to the long life and high quality of tape and is an important preventive step in assuring maximum performance from recorders.

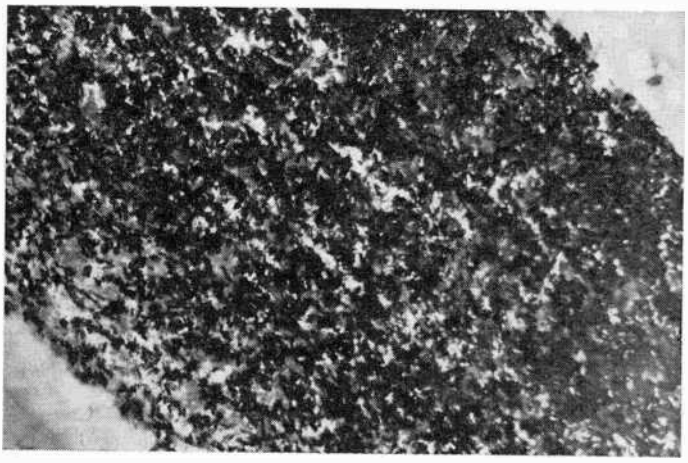
Scores of different types of audio tapes are manufactured for use by home hobbyists, recording companies and broadcasting stations. Tapes are packaged in a variety of ways, including plastic and metal reels, cassettes, cartridges and 11½-inch mats (called cue mats). For the home audiophile who wishes to get the best available recorded sound on a consumer-quality reel-to-reel recorder, the tape he wants is that which is available on 3″, 5″ and 7″ plastic reels. This tape is 0.246 inch wide with a tolerance of ±0.002 inch. Total thickness ranges from less than 0.0007 to 0.0019 inch, the length from 150 feet to 3600 feet.

Composition of Tape. Magnetic tape consists of three principal elements—base material, binder, and oxide. The main properties and functions of each are as follows:

Oxide. The oxide particle is the heart or working part of all magnetic tape. In virtually all precision tapes, the oxide used is gamma ferric oxide in cigar-shaped particles approximately 0.1 micron thick and 0.7 micron long. These particles are suspended in the binder in much the same manner as almonds are in a chocolate bar. During manufacture of the tape, the oxide particles are ori-



Even after several passes, a high-quality tape reel played on a good machine retains a smooth tape pack. Uneven winding (left) is a result of an imperfect reel or a recorder needing adjustment, or both.



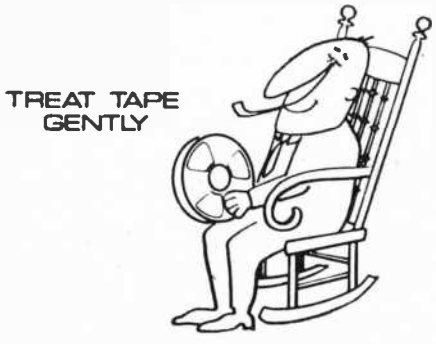
Cross-section of a piece of audio tape magnified 30,000 times shows cluster of oxide particles with tape coating on one side, epoxy on other.

ented on the tape in uniform patterns. Size and distribution of the particles vary with the manufacturer and the type of application for which the tape is made. Some formulations, for instance, use slightly shorter oxide particles in the production of "low noise" tape, a tape which when played through a recorder adapted for the low noise characteristic, provides less unwanted and foreign sounds than standard audio tape. Shorter particles are also used in formulations for slow-speed tape, which yields improved performance over standard tapes at the slower recording and playback speeds (1⅞ in./s and 3¾ in./s).

Binder. The binder joins the oxide to the base material. It must provide even dispersion of the oxide particles and confine them within a thin layer. It must provide an efficient adhesion of the oxide coating to the backing material and an effective cohesion of the magnetic particles to each other.

Base Material. The base material provides a means of holding the iron oxide and moving it past the head of a recorder in a controlled manner. It must magnetically separate one layer of oxide coating from another to minimize print-through, a condition that occurs when adjoining layers of tape on a reel pick up the magnetic characteristics of their neighbors, causing noise on the affected segments of tape. It also must have enough strength to resist breaking during starting, stopping and high-speed rewinding and yet be pliable enough to provide good tape-to-head contact.

Polyester and cellulose acetate are the most commonly used base materials. Generally, polyester has the best characteristics for high-quality audio applications and for storage of prized recordings. It has strength, long life, and relative stability in varying conditions and environments. Cellulose acetate, frequently used in less demanding audio applications, does not possess the stability and durability required for high-quality recording. It is less expensive, however, and does not stretch as much as polyester. Typically, cellulose acetate tape costs about 15% less than a similar reel of polyester tape.



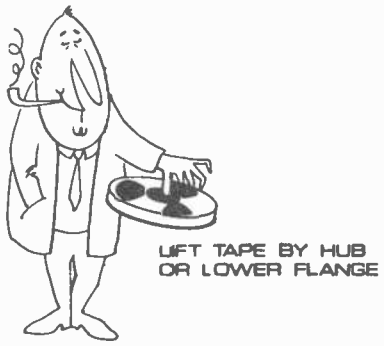
Purchasing Tape. Since the magnetic characteristics of a reel of tape cannot be "seen" by a prospective buyer, there is no simple way of determining the recording quality of tape. It is recommended, therefore, that the serious audio hobbyist confine his tape purchases to brand name products.

Since most tapes include a lubricant in the formula, the buyer should not be

misled by claims of special lubricants contained in the product. A "lubricated" tape, however, is one with a lubricating coating which allows it to move easily within its container. This lubricating is required only in cartridges—where the tape is packaged as a continuous loop. On a reel, lubricated tape tends to leave an oily residue on recording heads and may cause problems with the equipment, requiring frequent cleaning and causing poor performance. So buy lubricated tape only in cartridges where the lubricated coating permits the layers of tape to slide against each other more easily.

The reel itself often reflects the overall quality of a tape. By comparing several tape reels for balance and rigidity of the plastic, it is easy to determine which reels are best. Cheap reels are often made of thin plastic which loses shape easily.

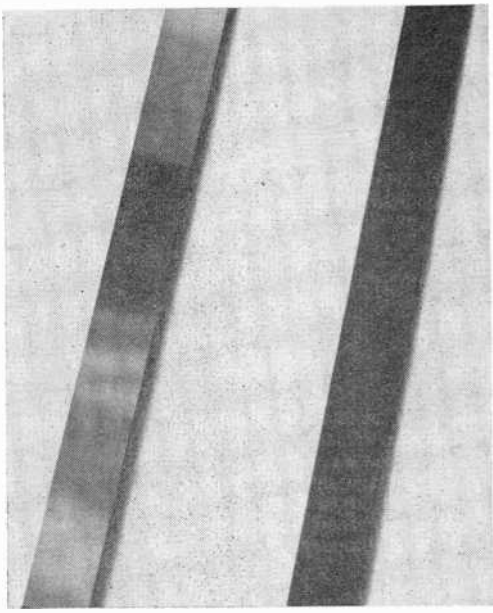
General Handling and Storage. When tape is exposed to *excessive* fluctuations of temperature and humidity the base material expands or contracts, causing tremendous internal stress in the tape pack. This stress can induce distortion beyond the elastic limits of the base material, which in turn can render the tape useless. Generally, it is advisable to store and use tape in an environment where the temperature is between 50 and 90°F and the humidity ranges from 40 to 60 per cent. Under ideal circumstances, temperature should be about 70°F and humidity 50 per cent. If a reel of tape is temporarily exposed to unfavorable temperatures or humidity, it should be stored in the proper environment for at least 24 hours before recording or playing.



Because of the magnetic properties of tape, it should be stored in an area which is not in any stray magnetic fields. It is not necessary for the user to build special protective shelters in his home and attempt to measure magnetic fields. It is simply suggested that he avoid storing tape next to electrical appliances which have motors or transformers (such as refrigerators, air conditioners, amplifiers, television sets, washing machines, and radios).

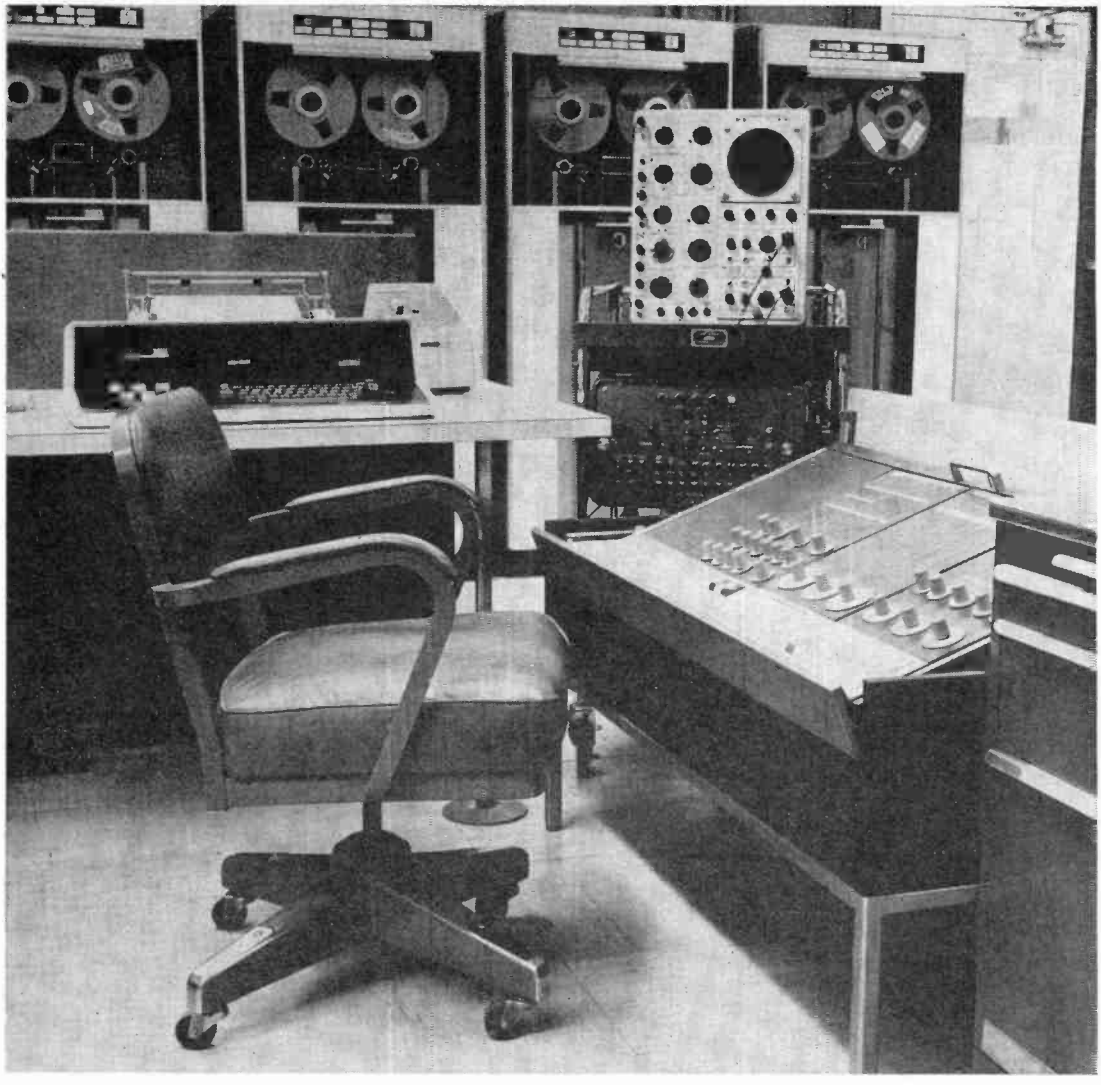
Reels of tape should be handled gently and by the hub whenever possible. Never pinch the flanges as this squeezes them into the tape pack and can cause tape damage.

When threading andio recorders, the tape should be placed around the recording heads carefully. Leave enough slack to prevent unnecessary pulling or stretching of the tape as it is threaded. The tape should remain completely threaded while on the machine and should be rewound to one reel before being removed.



Lubricated tape at right can be identified by the dull finish. Non-lubricated tape (left), with a bright surface, is better for reel-to-reel jobs.

Care of Equipment. Because of the close operating relationship between tape and



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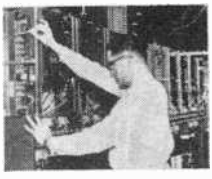

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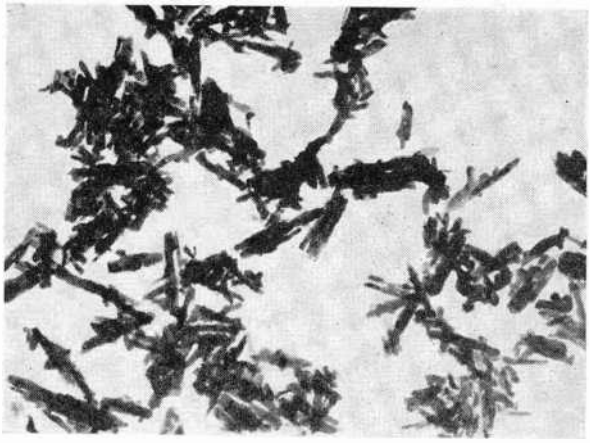

This electron microscope photograph of a piece of audio tape shows the oxide particles; magnification, 60,000 times.

equipment. proper care of tape requires good maintenance of recording hardware. Tape recorders vary in design and there are no set rules for their maintenance. Procedures for cleaning and checking recorders are carefully explained in the manuals that come with new machines.

A poorly functioning recorder may harm the tape used with it. Worn parts with rough edges along the tape path can damage the surface of the tape. Metal parts which come in contact with the tape, including heads, capstans, and guides, have a tendency to become magnetized and cause partial erasure of the tape.

To avoid tape damage, the recorder should be checked visually periodically to make sure that all surfaces that contact tape are smooth. A crease, nick or scratch on a strip of tape usually indicates a worn part along the tape path. When discovered, worn or broken parts should be replaced immediately.

Also, splice out wrinkled and damaged portions of a tape. or duplicate the tape and throw away or shelve the original. Failing to do so may result in still further tape damage.

Loss of quality in high-frequency notes often indicates some demagnetization of the tape. An inexpensive degausser (under $10), available from most consumer audio equipment suppliers, should be used each time the recorder is cleaned to demagnetize its parts.

Shipping and Storing. When magnetic tape is shipped by the manufacturer, it is placed in a container designed to protect it from dust and humidity. Usually this shipping case or a special tape mailing case is the best and safest container for storing and mailing tape.

Tapes placed in the mail are at the mercy of postal and shipping clerks and should be packaged in appropriate containers to prevent tape or reel damage due to rough handling. If a valuable tape is to be mailed, it is suggested that a duplicate be made in case the original is lost or subjected to extreme environmental conditions.

One of tape's virtues is its durability. But in order to realize the potential long life of tape (good recording and playback performance for hundreds of passes), it is necessary to take the extra time and effort required for the proper care of tape and recorder. -30-

the product gallery

REVIEWS AND COMMENTARY ON ELECTRONIC GEAR AND COMPONENTS

EQUIPMENT CABINET (LMB)

THE HOME experimenter faced with the dilemma that his pet project is finished and works like a charm soon realizes that the metal working shops and metal box makers have left him out in the cold. There are just too few good looking equipment cabinets available.

However, there is an exception to the rule and this reviewer believes that one company (LMB, 729 Ceres Ave., Los Angeles, CA 90021) deserves a pat on the back for continuing to offer experimenters several fine looking sturdy equipment cabinets. In fact if you look closely you will probably see that the cabinet in these photos has been used by a dozen different manufacturers.

The cabinet pictured is only representative of a whole line—we suggest getting a catalog or seeing them for yourself at your local radio parts dealers.

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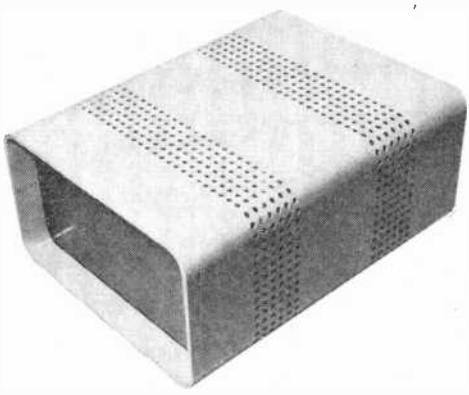
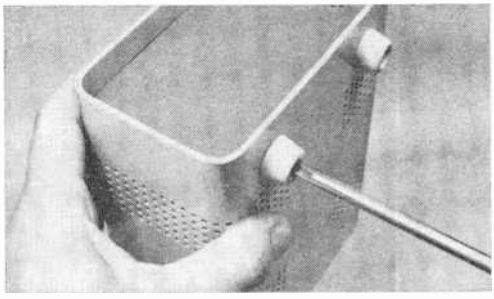
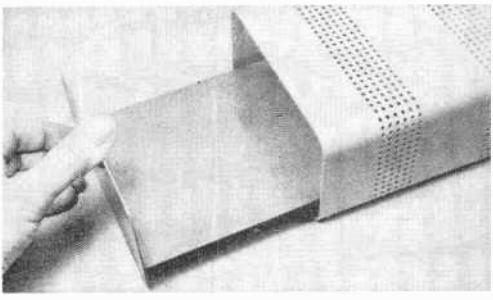


Popular LMB equipment cabinet model CO-3 measures (overall) 7¼" in length, 5½" in width, and 3⅛" in height. It sells for under $6.00. Releasing the four Phillips head screws in the mounting feet frees the interior chassis deck. Rear and front panels are welded to the chassis. The wraparound is very sturdy and painted shipboard Navy gray.





SCREW-HOLDING SCREWDRIVERS (Kedman Company)

THREE ULTRA-MINIATURE and midget size "Quick-Wedge" screw-holding screwdrivers made by the Kedman Company (762 South Redwood Rd., Salt Lake City, UT 84110) recently underwent revision to make them more efficient. Without removing any strength from the screwdriver blades, the manufacturer has eliminated a surplus portion of the previously thick grind of the split blades of the Models 1253-B Ultra-Miniature and 1253-A and 1258-A Miniature size drivers.

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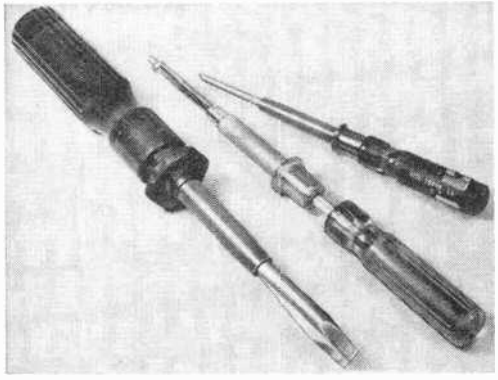

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CONTINUED

SHARPENING HEATHKIT COLOR TV

The design of any television receiver involves hundreds of compromises—some to counteract possible wiring and misalignment errors, some just the product of subjective analysis.

In the recent Heathkit color TV receivers (Models GR-25, GR-180, GR-227, GR-295, GR-481, GR-581, and GR-681) certain elements were selected that insured uniform picture quality at a very modest sacrifice of vertical resolution.

Continuing experiments by the Heath Company engineers have shown that three component values can be changed in the video detector stage to improve picture sharpness. These changes are shown in the accompanying wiring diagram. The Heath Company is now making a modification kit available (free) to all color TV set owners —it is labelled the Model GRM-681-1.

We installed a kit in our model GR-681 —it took about 15 minutes—and were duly impressed by the noticeable improvement in vertical test pattern resolution and general off-the-air picture sharpness. If you have a Heathkit color TV, we recommend getting one of the kits.

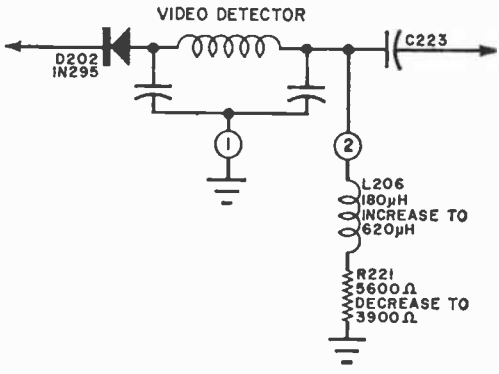
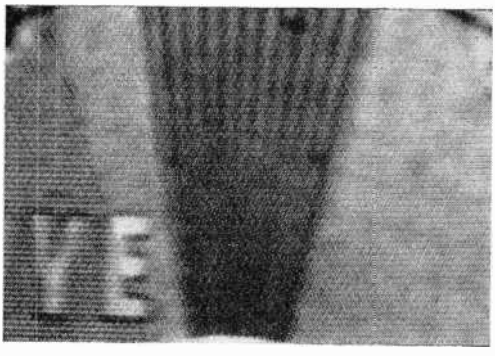
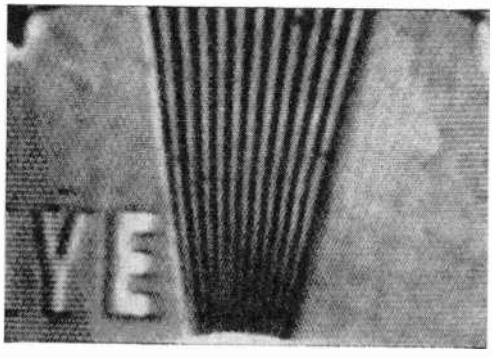


Diagram above shows parts in video detector that are modified to improve color picture resolution. Photos below illustrate improvement—at left is before installation of the kit; at right, after.





HAM BAND RECEIVER
(Allied Radio Co. A-2516)

AT TODAY'S prices the radio amateur lacking a dual-conversion high-selectivity receiver is not "really with it". Of course, you can get something selling for around $750.00, or look at it more realistically and shoot for a receiver at about $190.00 complete ($169.95 for the receiver and $19.95 for a matching speaker). The Model A-2516 (Allied Radio Corp.) is a prime example of a fairly decent import—nicely constructed with smooth operation, lacking only the refinements you would expect to get when you pay top dollar.

We used a Model A-2516 for several weeks and found it to be reasonably stable on SSB (we would have preferred some sort of fine-tuning "clarifier" control); very selective with good modulation recovery on AM; very, very good on CW; easy to operate; and with a fairly high order of "resetability."

Circuit. The A-2515 is a 7-tube receiver with a crystal-controlled first mixer and transistorized tunable second mixer. There are 2 i.f. stages both using mechanical filters to give a selectivity curve that's about 3 kHz wide at the top and 10 to 12 kHz wide at 60 dB down. Sideband selection (upper or lower) is manual and is a little fussy to deal with. Receiver sensitivity appears to be excellent and we had no diffi-

culty holding ON4BT, KZ5BR, etc. on 15 meter SSB over a period of several hours.

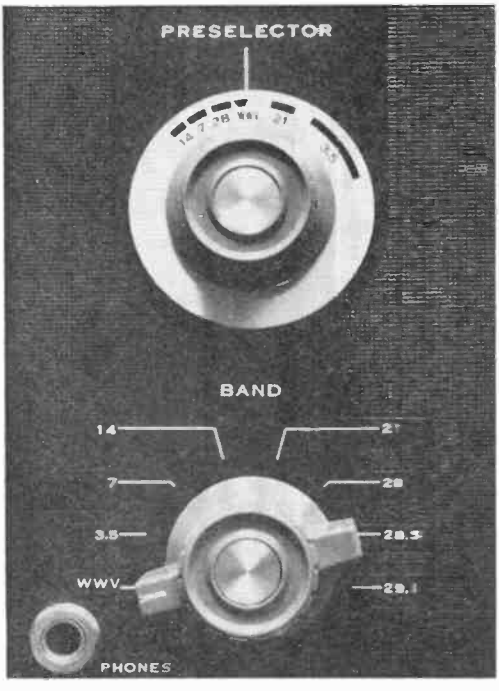
Summary. The A-2516 is a good receiver at a modest price. It's not the receiver for the avid DX'er, but it will prove worth every cent of its investment for the Novice and General class ham with a limited budget.

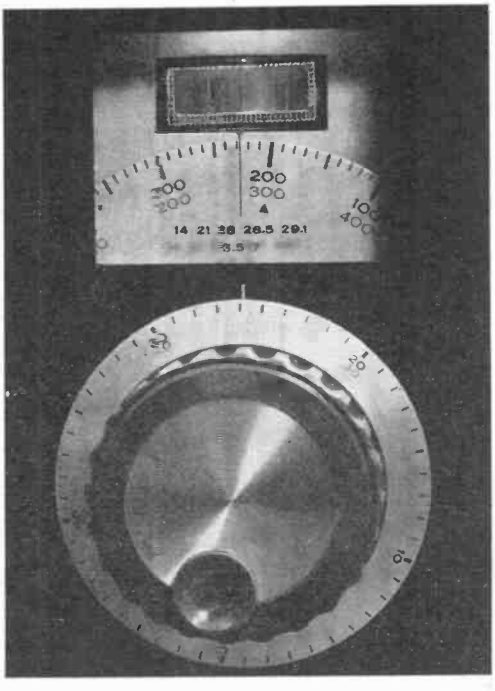
Circle No. 93 on Reader Service Page 15 or 115

Allied Radio model A-2516 is a Japanese import internationally marketed as the Trio JR-500SE. Due to its inherent stability and excellent selectivity, the receiver has won wide acclaim.

Each crystal-switched tuning range is 600 kHz—wide—including the mysterious WWV—permitting tuning outside the edges of ham bands. However, in the model tested, direct frequency readout varied from band to band and sometimes was 5 to 6 kHz out of calibration. The preselector is reasonably broad and requires only minor re-tuning.

Near direct-frequency readout of the A-2516 receiver is accomplished by adding switched crystal frequency to the reading on the rotating wheel (behind escutcheon) and the reading on the dial skirt. Thus frequency here is either XX.226 MHz or XX.244 depending on band The S-meter is poorly illuminated and far too small for easy viewing.





Only Pickering offers Dynamic Coupling Factor... your assurance of greater listening pleasure

A sophisticate who can afford the finest in stereo components and equipment, would select the Pickering XV-15 Cartridge labeled 750E, 400E or 350. They're the proper ones to deliver "100% Music Power."

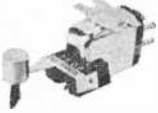
With the more simple equipment that characterizes today's informal living, the XV-15 with a DCF of 150 or 200 will assure "100% Music Power."

A Pickering XV-15 Cartridge with a DCF of 100 or 140 will guarantee "100% Music Power" on the type of set up that the young in your house use for dancing or listening.

The Dynamic Coupling Factor is an index of maximum stylus performance when the cartridge is related to a particular type of playback equipment. This resultant number is derived from a Dimensional Analysis of all the parameters involved. To select a pickup for a professional manual turntable, with its sophisticated, dynamically balanced tone arm, tracking at an ultra-light force, a higher DCF index would be required than, say, for a pickup to be used in an ordinary record changer. For maximum distortion-free response, this index to application relationship properly determines maximum stylus performance in your playback equipment. 100% music power is assured at all frequencies — linear response from 10 to 20,000 Hz virtually a straight line — due to the extremely low mass of its moving magnetic system — 1/5 to 1/10 of ordinary pickups.

There are seven DCF rated XV—15 models. Each is equipped with the famous patented V-Guard "floating stylus" — the easily replaceable stylus assembly that protects the diamond and record while it plays. In addition each model includes the DUSTAMATIC™ brush that automatically cleans the record groove while it plays.

PICKERING



For those who can HEAR the difference

THE NEW PICKERING XV-15/750E. PREMIER MODEL OF THE XV-15 SERIES. TRACKS AT ½ TO 1 GRAM. DYNAMIC COUPLING FACTOR OF 750 FOR USE IN FINEST TONEARMS. $60.00. OTHER XV-115 CARTRIDGES FROM $29.95. PICKERING & CO., PLAINVIEW, L.I., N.Y.

CIRCLE NO. 31 ON READER SERVICE PAGE

TWO WAY REACTIONS

BY G. H. REESE, KCN6990

EXCLUSIVE CHANNEL 9

DESIGNATION of channel 9 of the Citizens Radio Service exclusively for emergency communications involving the immediate saving of life, protection of property, or assistance to motorists has been proposed by the Federal Communications Commission. This action is the result of years of effort on behalf of REACT National Headquarters, publishers and other interested Citizens Radio groups. The proposed ruling was announced late in October with favorable or adverse comments and replies to be filed through December 31, 1969. It is anticipated that the Commission will rule that channel 9 be reserved for emergency communications within the next few months. While designating channel 9 for emergency communications, the Commission plans to add one channel now reserved for intrastation communications (among units of same licensee only) to replace channel 9 in the interstation group. This would be either channel 8 or 15. The Commission will determine which of the two channels will be advanced to the interstation category (that is, for calling between licensees) on the basis of the comments received favoring either channel 8 or channel 15.

Reservation of channel 9 for emergency communications will mean that CB radio operators must restrict communications on channel 9 to actual emergencies. Any communication that does not fit this requirement should be shifted to some other channel. The absence of all non-emergency traffic will significantly increase the value of the Citizens Radio Service in emergency situations. It will remove the necessity of a caller having to "break" the communications of others to clear the channel for an emergency message.

The official designation of channel 9 will also provide a single channel for all who are interested in serving as emergency communication monitors with a single channel to monitor. In this way, many official agencies such as police, Civil Defense, Coast Guard, etc., will find it more desirable to monitor channel 9 as it will be free of extraneous communications.

New Dawn for CB Radio! A new era in CB radio will be forthcoming when the FCC makes channel 9 the official emergency channel. Traveling salesmen, transcontinental truckers, families on vacation, and sportsmen will consider CB a necessary accessory for their automobiles. Should they become stranded on a turnpike, confused by a cloverleaf, or uncertain about where to stay the night, a channel 9 monitor can provide the necessary information. This increase in the value of Citizens Two-Way Radio is recognition of the potential that is inherent in this radio service. It is a fact that there are more two-way radios in the CB category than all others combined. With an effective system of monitors across the country, and a clear channel for emergencies, it may be possible to realize the potentials that two-way radio offers in reducing traffic fatalities and mobilizing communications in case of disasters and emergencies of every kind. The essential ingredient is cooperation. All users of CB radio must cooperate to clear channel 9 for emergency communications. It would be a good idea to start this practice immediately and not wait for the official pronouncement by the FCC.

The Commission has indicated that the success of this program will require consid-

Yuma, Ariz. REACT has posted three of these large signs on highways surrounding the city. Such signs were cited by FCC in proposal to make channel 9 exclusively for use in emergency communications.

Oliver Yonker and Harold Pippel, of Tulip City (Holland, Mich.) search and rescue unit, with P. Barron, president of sponsoring insurance group.

erable self-policing activity. This means that a voluntary compliance with the emergency channel concept is essential to the success of the program. All CB radio users can benefit from this emergency channel ruling only if they divert their normal calling to other channels. Current CB radio users should regard the Commission's action as recognition of the good works they have performed in the past. They may take pride in this further recognition of the potential for the future.

The second essential element is the availability of trained and effective 24-hour monitors. This is the concept of REACT—to provide a voluntary system of 24-hour monitors for emergency communications. It stands to reason that those who are now using channel 9 for routine communications will find it more advantageous to comply with the emergency channel restrictions if they are aware of an effective monitor serving their area. Thus. we are embarking on a concentrated program to expand both the monitoring services of present REACT teams and the number of teams so that 100% coverage of the United States can be achieved. Never before has the opportunity for service through emergency communications groups using the Citizens Radio Service been so great. Never before has the *need* for an effective monitoring service such as REACT been greater! If you or your CB club is interested in learning how they can participate in this program, contact REACT National Headquarters at once. Write to: REACT National Headquarters, 205 West Wacker Drive, Chicago, Illinois 60606. We will send you complete information on how your group can become a REACT team. Organize now so that you will be ready when channel 9 becomes the official emergency channel.

New Canadian Rules. It has been learned that Canada's Department of Communications has instituted a new application form and intends to tighten up on present licensees. The Department points out the General Radio Service equipment may not be used for diversionary or recreational purposes. This would appear to mean that almost all GRS Club activities would be stopped. The DOC rules about collecting money are also being examined. They appear to be interpreted that any use of GRS equipment for any function which collects money from the public, for any reason, or pays any money to GRS operators for the use of their equipment and time is strictly illegal.

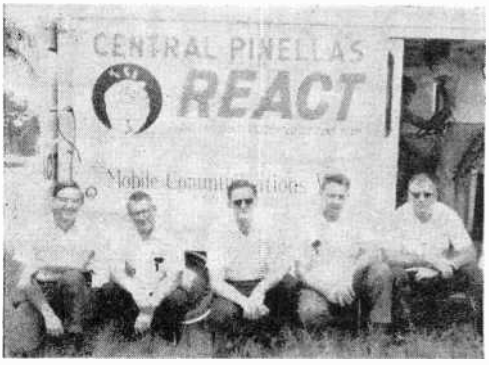
Traffic Reports. The FCC has recently carried through on a rule proposal to permit class D citizens radio station licensees to transmit information on highway conditions to "persons or emergency organizations furnishing such information to the motoring public by way of radio broadcast facilities." Thus road information furnished by a citizens radio station can be compiled and edited by the broadcaster and then announced over the air. The rule change was requested by National Capital REACT, Inc. Communications transmitted under the new rule are required to be addressed to specific persons or stations. The new rule became effective last Nov. 26.

CURRENT EVENTS

Asheville, N.C. . . . The Tri-County REACT Team was recently awarded a Certificate of Merit by the American Cancer Society for aid during a recent fund drive. Chief Arnold B. Robinson reports, "We have had and do receive excellent cooperation from local CB operators in keeping channel 9 clear in emergencies and enjoy not only the respect of local law enforcement authorities, but our private citizens as well."

Battle Creek, Mich. . . . Cereal City Citizens Band Radio Club co-sponsored a post-Halloween program in their city with radio station WBCK. The CB'ers picked up candy left over from Halloween and distributed it to orphans.

(*Continued on page* 117)



Members of Central Pinnelas REACT (Clearwater, Fla.) Jack Sager, Dave Yarger, Doug Day, Tommy Thompson, and Don Williams with the team's van.

AMATEUR RADIO

By **HERB S. BRIER**, W9EGQ
Amateur Radio Editor

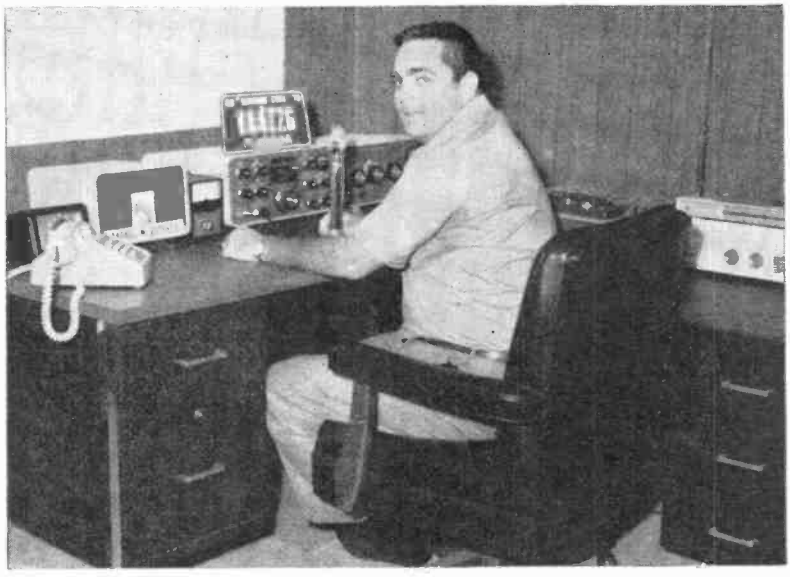
NEWS FROM AUSTRALIA

THE YEAR 1970 marks both the 200th anniversary of Captain Cook's discovery of Australia and the 60th anniversary of the founding of the Wireless Institute of Australia. In recognition of these events, the Australian government has authorized Australian amateurs to use the prefix *AX*, instead of *VK*, during 1970 if they wish.

Also, the WIA will issue the "Cook Bi-Centenary Award," free of charge, to amateurs who work 100 different AX stations during 1970 according to the following schedule: 3 AX1's, 30 AX2's, 30 AX3's, 11 AX4's, 11 AX5's, 6 AX6's, 4 AX7's, 1 AX8, 3 AX9's, 1 AXØ. Any overseas amateur who meets these requirements will really have earned his award. Applicants must list the stations worked by call area, date, time (GMT), band, mode, and signal report. The list must be accompanied by statements from two other licensed amateurs that they have seen the appropriate entries in the applicant's logbook. Mail to "Cook Award," Awards Manager, W.I.A., P. O. Box 67, East Melbourne, Australia 3002, before December 31, 1971.

Last July, a plane with five people aboard disappeared in the mountains near Ararat, Australia. VK3ZG and VK3ADS set out to the suspected crash area in VK3ADS's 2-way radio-equipped car. Keeping in contact with the Ararat police on 2-meter FM

AMATEUR STATION OF THE MONTH



From 1957 to 1961, Rafael M. Estevez, P.O. Box 2442, Hialeah, Fla. 33012, was CO2ZQ in Cuba. Coming to the United States cut short his amateur career until he became a citizen. He is now WA4ZZG and has worked 95 countries and 30 states. He uses a Heathkit SB-101 transceiver, SB-200 amplifier, tri-band Quad, and 80 and 40-meter dipoles. Rafael gets a 1-year subscription to POPULAR ELECTRONICS for winning this month's Amateur Station Photo Contest. You can enter the contest by sending a picture (preferably black and white) of yourself at the controls of your station with some details about your amateur career to: Amateur Contest, Herb S. Brier, Amateur Radio Editor, P.O. Box 678, Gary, Ind. 46401.

Ralph Cooper, ZL1AZN, Auckland, New Zealand, often works the United States on the 80-meter band.

via VK3AAQ, they quickly found the downed plane and two bodies. Leaving VK3ZG at the crash scene, VK3ADS returned to the nearest crossroads to lead the rescue crews to the scene. By the time they arrived, VK3ZG had located two more bodies and soon found the fifth one. VK3SE and VK3SQA monitored the entire operation to assist if needed.

Keeping the Station Log. Or what time is it? One problem facing amateurs is the time in which they should keep their station logs. Use local time, and you quickly learn that not every operator's time is your time. Furthermore, most sponsors of amateur contests and awards specify using Greenwich Mean Time (GMT).

One solution to the problem is to set a 24-hour, electric clock to Greenwich time and put it beside the regular station clock. Keep your log according to the new clock and keep in step with the home folks on the old one.

To help you set the new clock, Eastern Standard Time is five hours behind GMT, Central Standard Time is six hours behind, Mountain Standard Time, seven hours, and Pacific Standard Time, eight hours. Thus, if you live in the Central Time Zone, and a local broadcast or TV station announces the time as, say, 10:00 a.m., simply set your GMT clock to 1600. It will then be in step with every other GMT clock in the world.

F.C.C. and Allied News. The Federal Communications Commission recently introduced a new simplified form 610 amateur radio license application blank. The new form—yellow in color—is simpler than the old form to fill out: In addition, it contains spaces for use by volunteer examiners of applicants for Novice, Technician, and other by-mail licenses. Thus it saves the volunteer examiner the necessity of writing a letter to the FCC setting forth his qualifications to act as a volunteer examiner.

The FCC is considering revising all radio license application fees in an attempt to recoup more of the costs of operating the agency. Nothing definite on this, yet. Also under consideration are a number of relatively minor petitions. W6ARM wants the 6-meter CW assignment moved from 50-50.1 MHz to 53.5-54 MHz. He also wants the Advanced/Extra class segment of the band reduced from 50-50.1 MHz to 50-50.05 MHz. (There undoubtedly will be some modification of the 6-meter Extra/Advanced assignment. At present, as a result of the FCC's decision not to extend the segment to 50.25 MHz on November 22, 50 to 50.1 MHz is usable only on CW by Advanced and Extra class licensees.)

While not strictly an amateur matter, as a result of a petition by George Nims Raybin, WA2GWB/KBI0854, the FCC proposes to make CB Channel 9 an exclusive emergency channel. WA2GWB has also requested that the FCC allow more time for filing comment on its proposals. He points out that by the time the average person learns about an FCC proposal in a radio magazine, the time for filing comment on it has usually passed.

Contests. The American Radio Relay League's 18th Annual "Novice Roundup" is scheduled between 0001 GMT, February 7, and 2359 GMT, February 22. Novices work all comers; others work only Novices. Operate up to 40 hours and earn one point for each complete exchange of serial numbers, signal reports, and respective ARRL "section" names with each station worked. Your total score equals your contest points, plus the highest code speed indicated on

(*Continued on page* 118)

Craig Smith, WB6ZXP, San Carlos, Calif., handles messages on 40 meters and also likes to ragchew.

SHORT-WAVE LISTENING

By **HANK BENNETT,** W2PNA/WPE2FT
Short-Wave Editor

EDDIE STARTZ — THE END OF AN ERA

LISTENERS to the always-popular "Happy Station Program" from Radio Nederland, Hilversum, are noting a new voice on the program. Our good friend and former Master of Ceremonies for the program, Eddie Startz, has retired.

Eddie Startz has taken a most well-deserved rest from the program that he originated 41 years ago. With the exception of the World War II years, the program has been broadcast continuously and has been heard and appreciated by listeners in virtually every country of the world. All of us will miss Eddie's voice, the barnyard animals, the "nice cuppa", and the "University of Light Learning", and we offer him a rousing vote of thanks for his untiring efforts through the years and wish him well in any future endeavor that he may undertake. With nearly a half century of broadcasting behind him, though, we are fully confident that Eddie will return to the air some day in the not too distant future, possibly from an entirely different location.

Eddie Startz, former MC of Radio Nederland's "Happy Station Program", is well-known to all SWL'ers.

As we prepare this story, we have not obtained the name of Eddie's replacement (the program, itself, is to be continued) but we feel certain our readers will offer the new Master of Ceremonies the cooperation that has been prevalent in the past.

For the present, Eddie, take a good rest; you have certainly earned it!

Time and Standard Frequency Stations. During the past few months we have received many reports of a new time station operating on 6100 kHz. From a source that we cannot precisely pinpoint we heard that the station was in Portugal and operated by the Naval Observatory of that country. It would seem now, however, that this information was incorrect. A letter from the Observatorio Naval Portugal, signed by Sr. Jose da Cruz Moura da Fonseca, informs us that extensive monitoring by their own staff has found the station to be Observatorio Naval de Cagical located in Venezuela. For the moment we have no further positive information but as soon as we do get definite data, we shall pass it along to our readers.

National Bureau of Standards. WWV is considering a change of format. All interested persons who wish to take part in a survey are asked to write directly to National Bureau of Standards, WWV-1969, Boulder, Colorado 80302, requesting a survey form to be filled out and returned to them.

CURRENT STATION REPORTS

The following is a resume of current reports. At time of compilation all reports were as accurate as possible, but stations change frequency and/or schedule with little or no advance notice. All times shown are Greenwich Mean Time (GMT) and the 24-hour system is used. Reports should be sent to Short-Wave Listening, P. O. Box 333, Cherry Hill, N. J. 08034, in time to reach us by the fifth of each month; be sure to include your WPE identification and the make and model number of your receiver.

Albania—*R. Tirana* was noted on a new frequency of 11,844 kHz from 2130 in Portuguese.

Angola—Listed as tentative last month, this one is still uncertain; best information tends to indicate it as being *R. Clube do Moxico*, Luso, 5126 kHz, heard from as early as 2300 to 0100 s/off. The ID is one gong, programming is a variety of music and the language is Portuguese.

Antilles, Netherlands—*R. Nederland*, Bonaire, has been logged on 6020 kHz at 2300-0000 in Dutch beamed to the Caribbean areas with news, talk, light music, a documentary and music of India. This xmsn continues until 0030.

Australia—VLI6, Sydney, 6090 kHz, is heard well around 1100 in the Home Service with music, news, and regional weather. *R. Australia's* evening service to N.A. now s/on at 0100 on 15,195 and 21,640 kHz. The new Darwin relay on 9620 kHz is often noted from 1330 s/on to 1400 s/off with nonstop orchestra music.

Austria—*Osterreichischer Rundfunk*, Vienna, has this new schedule to the Americas: to N.A. at 2300-0400 on 6155 and 9770 kHz, to Central America at 0000-0200 on 15,145 kHz, and to South America at 2300-0000 on 9525 kHz, 0200-0400 on 11,875 kHz and 1800-2100 on 15,210 kHz. Numerous monitors report hearing the 9770-kHz xmsn with signal strengths ranging from "terrible" to "excellent."

Bolivia—*R. La Cruz del Sur*, La Paz, has moved from 4985 to 5025 kHz. This station celebrated its 25th anniversary recently. CP87, *R. San Rafael*, Cochabamba, 5055 kHz, has a s/off time of 0200 but it is often noted to 0230 with music, time checks and all Spanish. CP66, *R. Centenario*, Santa Cruz de la Sierra, is on 4850 kHz and is noted at 0200-0300 in Spanish but not without severe QRM at times from a teletype station.

Brazil—Two rarely heard stations that might prove a challenge to your ability include ZYA1, *Radiodifusora Roraima*, Boa Vista, 4835 kHz, best, when audible at all, around 0000 in Portuguese, and ZYD9, *R. Acreama*, Rio Branco, tentatively heard on 4882 kHz with music and talks to s/off at 0303.

Burma—Rangoon has been noted with fairly good signals in the U.S. Southwest around 1300 on both

DX COUNTRY AWARDS PRESENTED

To be eligible for one of the DX Countries Awards designed for WPE Monitor Certificate holders, you must have verified stations in 25, 50, 75, 100, 125, or 150 different countries. ("Letters of Certification" will be issued to those who have over 150 countries verified in steps of 10.) The following DX'ers recently received their awards.

25 COUNTRIES VERIFIED

Tim Ohrman (WPE3HHA), Monroeville, Pa.
Michael Macken (WPE1GYR), Winthrop, Mass.
Richard Stevens (WPE2OVS), Rochester, N. Y.
Dottie Weatherby (WPE2QRF), Hornell, N. Y.
Michael Wheeler (WPE7CSY), Portland, Ore.
Chris Gabanski (WPE9JGN), Lake Forest, Ill.
Mike Mickes (WPE7CVF), Gooding, Idaho
Bruce Roberts (WPE4KAH), Waynesboro, Va.
William Murray, Jr. (WPE7CLX), Eugene, Ore.
Peter Rudolph (WPE6GOR), Sylmar, Calif.
Arthur Skopec (WPE2PQJ), Whitestone, N. Y.
John Petrykowski (WPE9JKP), Milwaukee, Wis.
Don Cassel (VE3PE2NT), Don Mills, Ont.
James Daley, Jr. (WPE4JVR), Atlanta, Ga.
Scott Moeller (WPE3HLS), Villanova, Pa.
Stephan Goldstein (WPE1HNM), Providence, R. I.
Robert Rothberg (WPE2QQO), Long Beach, N. Y.
Diana Loomis (WPE6HLT), Sherman Oaks, Cal.
Michael Gouthro, Jr. (WPE2QJC), Buffalo, N. Y.
Brian Begg (WPE2JPR), New Brunswick, N. J.
Jim Kehoe (WPE9IUQ), Chillicothe, Ill.
James Farrell (WPE2QIJ), Ridgefield Park, N. J.
Edward Tafel (WPE2QBG), Syracuse, N. Y.
Daniel Girard (WPE2QEY), Utica, N. Y.
Brian Caldwell (WPE1HPG), Glastonbury, Conn.
David Reichelt (WPE4JWU), Mary Esther, Fla.
Donald Williams (WPE7CVW), Salem, Ore.
Moiz Mutlu (WPE1HME), Worcester, Mass.
Doug Stark (VE3PE2OY), London, Ont.
Sherman Wing (WPE6HBJ), Hanford, Cal.
John Costa (WPE2QAR), Massapequa, N. Y.
William Coleman (WPE4JNW), Jacksonville, Fla.
Marvin Robbins (WPEØMW), Omaha, Nebr.
Benjamin Botvenek (WPE2QQX), New York, N. Y.
Harold Hollabaugh (WPE8AHX), Toledo, Ohio
David Wessel (VE5PE6S), Prince Albert, Sask.
Robert Olson (WPE4JZF), Winston-Salem, N. C.
David Gale (WPE2QHB), Brooklyn, N. Y.
Mark Maersch (WPE3HEK), Severna Park, Md.
Nelson Doane (WPEØEYB), St. Clair, Mo.
Ken Olson (WPE4KBU), Lenoir, N. C.
Michael Mlotkowski (WPE8KAV), Troy, Mich.
E. Gordon Collister (WPEØEZK), Lawrench, Kan.
Rick Heavey (WPE8JYR), Detroit, Mich.
Bill Thompson (VE3PE2BE), Windsor, Ont.
Jim Peltz (WPE6HDR), Riverside, Cal.
Charles Mohr, Jr. (WPE2MKI), White Plains, N. Y.

50 COUNTRIES VERIFIED

Arnold Rosett (WPE3HIF), Philadelphia, Pa.
Vincent Geraci (WPE1HMP), Shelton, Conn.
Alan Harris (WPE8JQY), Oak Park, Mich.
Mike Macken (WPE1GYR), Winthrop, Mass.
Ron Miller (WPE9HCG), Peoria, Ill.
William Murray, Jr. (WPE7CLX), Eugene, Ore.
Woodrow Ferris (WPE5DYG), Anadarko, Okla.
Tan Yew Chong (9V1PE1C), Raffles Park, Singapore
Greg Scoggan (WPE6HIU), Costa Mesa, Cal.
Mitchell Stern (WPE2QIA), Brooklyn, N. Y.
Bob Estand (WPE5FAV), El Paso, Texas
William Blue (WPE7CTW), Seattle, Wash.
Fred Lynch (WPE9JHD), Girard, Ill.
Donald Mahler (WPE1HOK), Newton, Mass.
Benny Loveless (WPE9JLQ), Frankfort, Ind.
Robert Rothberg (WPE2QQO), Long Beach, N. Y.
Frank Moczulewski (WPE9JAU), Chicago, Ill.
Francis Wheeler (WPE6HLK), Sacramento, Cal.
Walter Miscichowski (WPE2BEH), Buffalo, N. Y.

75 COUNTRIES VERIFIED

Richard Shawyer (WPE6CFL), San Francisco, Cal.
Bill Migley (WPE8JEL), Lancaster, Ohio
David Conder (WPE9IHV), Centralia, Ill.
Vincent Geraci (WPE1HMP), Shelton, Conn.
Jack Bacon, Jr. (WPEØFDJ), Bloomington, Minn.
Gajendra Pal Singh (VU2PE1G), Meerut, India
Ann Parker (WPE9JJC), Chicago, Ill.
Craig Koukol (WPE9JLN), Naperville, Ill.
Mark Koukol (WPE9JKV), Naperville, Ill.

100 COUNTRIES VERIFIED

Donald Gross (WPE7CQX), Roseburg, Ore.
Robert Combs (WPE2PJU), APO, New York
Don Billingsley (WPE6GXM), Sacramento, Cal.
Martin Tarnowsky (WPE2PZD), Montvale, N. J.
Paul Mayo (WPE2NSG), Brooklyn, N. Y.
Bill Kaiser (WPE8JLL), Paw Paw, Mich.
Jeff Wilson (VE3PE2NL), Sarnia, Ont.
Del Hirst (WPE5CFU), Snyder, Texas
Leo Baca (WPE5CLR), East Bernard, Texas
B. L. Manohar (VU2PE1D), Lucknow, India
J. R. Hawkins (WPE8GDP), La Vergne, Tenn.
Roger Camire (WPE1GEK), Hudson, N. H.
Bob Emery (WPE3HFZ), Allentown, Pa.
Thomas Creery (WPE2PHZ), Conklin, N. Y.

A private pilot and avid DX'er, Loren K. Davis, WPE6HMA, Hayward, Calif., has DX Awards for 20 zones, 30 states and 25 countries. He uses a Hallicrafters S-108 and Mosley all-wave trap dipole.

5040 and 4725 kHz but the programs are different.

Ceylon—The Commercial Service of *R. Ceylon,* Colombo, can be found on 15.120 kHz from 0130 s/on in English. Their IS is a dandy: wild animals roar and native drums beat. (Editor's note: this is a Midwest logging. Are East Coast monitors hearing it? We had no luck whatever with it).

Colombia—Further to the listings last month: *Emisora Atlantico,* Barranquilla, has definitely left the inactive category: it's being heard on 4905 kHz from 0220 to 0500 s/off. Also, the 5943 kHz listing for *Transmitte Horizonte, Emisora Colombia,* as the ID is now being given, has moved up to 5950 kHz and is often good from 0100. *Este Onda Del Meta* seems to have moved from 4885 kHz to 6115 kHz and is being heard at 0225. QRM is provided by *R. Union,* Peru. Some say that *Onda del Meta* has moved into *La Voz del Llano's;* however, the latter is definitely on 6117 kHz.

Conakry—*Radiodiffusion Nationale,* Conakry, is fair to good on 7125 kHz at 2206 with native, 2216 news in French, then native and instrumental music to 2250.

Czechoslovakia—Prague's new English schedule is: To Europe at 1200-1230 on 9560, 11,960 and 15,285 kHz, and at 1630-1700 and 1900-1930 on 5930 and 7345 kHz. To Africa at 1530-1630 on 6055, 9605, 11,990, 15,285, 17,840 and 21,735 kHz (also to Europe on 6055 kHz and to S. Asia on 11,990 and 21,735 kHz), and at 1730-1830 on 5930, 7345, 9605, 11,990 and 17,840 kHz. N.A. service in English is at 1400-1500 (Sunday only) on 15,445, 17,840 and 21,735 kHz, 0100-0200 and 0300-0400 on 5930, 7345, 9540, 9630 and 11,990 kHz. To Far East and Australia at 0700-0800 on 6055, 9505, 9575, 11,800, 15,310, 21,485 and 21,700 kHz (also to Europe on 6055 and 9505 kHz).

Ecuador—A new frequency for HCJB is 21,460 kHz, heard at 1245-1500 (Saturday and Sunday to 1615) with "Call of the Andes" and "Morning In The Mountains". It is also heard at 1815 in a Nordic language, 1830 in French, and 1845 in English. This channel is scheduled 1800-2145 to Europe. Other stations reported include *R. Progreso,* Loja, 3270 kHz at 0315, *R. Nacional Espejo,* Quito, 3295 kHz at 0355, and *La Voz Del Dorado,* Pelileo, 3265 kHz at 0400; music, talks, and all Spanish language.

Egypt—Cairo has English at 2200-2300 s/off with news to 2210, talks, and periods of music to 2300. This is on 9740 kHz. Another channel, 9475 kHz, is noted in English at 0200-0330.

Ghana—Accra has this English schedule in effect: To N.A. and Caribbean at 2000-2100 on 9760 and 11,850 kHz; to South Africa, Central Africa and Australia at 1445-1530 on 17,870 and 21,545 kHz; to West Africa at 1400-2215 on 6130 kHz; to Europe at 2045-2215 on 9545 and 15,285 kHz; and to East Africa at 1400-1430 on 17,870 kHz, 1445-1530 on 21,720 kHz, 1645-1730 and 1815-1900 on 15,285 kHz. Additionally, the National Service is often good on 4915 kHz from 2230 to 2300 s/off. (We are monitoring the 4915 kHz channel while typing this column; the signal is great!)

Greenland—A very tentative logging is that of Godthaab, 3999 kHz, at 0005-0017 with a girl announcer, pop and light music and in an unknown language. This was logged in the Midwest at a location just ahead of a cold weather front.

Holland—*R. Nederland* has this current English schedule in effect to N.A.: (L-100—kW xmtr at Hilversum, Holland; B-300—kW xmtr at Bonaire, Netherland Antilles) Tuesday and Friday only at 1525-1545 on 21,570 (L) and 17,810 (L) kHz, 1725-1745 on 17,810 (B) kHz, and 1755-1815 on 17,730 (B) kHz. Monday through Saturday at 2125-2250 on 11,730 (L) and 9715 (L) kHz. Daily at 0155-0320 on 11,730 (B) kHz and 0455-0620 on 11,730 (B) and 9715 (B) kHz.

India—For those DX'ers who can tune beyond the signals provided by American 50-kW xmtrs on medium-wave 1130 kHz, *All India Radio,* Calcutta, has a 1000-kW station on this frequency.

International Waters—The Abie Nathan project, called *The Voice of Peace,* apparently is not on the air as indicated in this column last month. Late information reveals that the ship headed for the U.S. and was last reported docked at 59th Street and the East River in New York City for the purpose of raising funds and obtaining donated equipment including two 500-watt xmtrs.

Iran—A recent schedule from *R. Iran* included listings for some low-power regional stations. They are *R. Rezaieh,* 6940 kHz, 500 watts, *R. Sanandaj,* 5818 kHz, 400 watts, and *R. Gorgan,* 6520 kHz, 400 watts. Listed operating times are generally from 0245 to 1730. Has anyone logged any of them?

(*Continued on page* 116)

Tom Phillips, WPE1HQE, Rutland, Vt., uses a Heath GR-64 (with a Bradford tape recorder on top of it) and a Sears 2278 portable. He has DX Awards for 10 zones, 20 states and 25 countries verified.

SOLID STATE

By LOU GARNER, Semiconductor Editor

CASSETTES ENTER VIDEO SCENE

THE BIG THING in recording today is cassettes. Just about every manufacturer of audio equipment is going this way, while recording companies are also getting on the bandwagon.

With this great interest in cassettes, it didn't come as a great surprise when Sony recently introduced their Videoplayer and Videocassette system, which they hope will put home video tape playing in the same living room as conventional high-fidelity sound systems.

The Videocassette, measuring 8" × 5" × 1¼" is a similar-looking but somewhat larger version of the conventional plastic audio cassette, and carries up to 90 minutes of monochrome or color video and two sound tracks on its ¾"-wide magnetic tape. It fits into a slot in the solid-state Videoplayer which in turn is 15" × 16" × 8" and weighs 32 pounds. The player is connected to the TV set via the antenna terminals, and the outdoor antenna is connected to the player. An internal relay automatically switches the external antenna to the TV set when the cassette is removed from the player. Both the Videoplayer and TV set have to be tuned to an unused local TV channel to operate without interference.

Electronically the Videoplayer is a two-head helical video playback system, similar in operation to other video machines. Tape speed is 3¼ in./s while head to tape speed is about 400 in./s. Color resolution is 250 lines; monochrome, 300 lines. Audio frequency response is to 12 kHz.

Although the system was demonstrated in this country, it is not expected to make its commercial debut until 1971. The cost of the Videoplayer is estimated at about $350, while each Videocassette will run about $20 unrecorded. After a tape library has been built up by Sony, customers can send their tapes to their local Sony dealer, with their program selection. The tapes will be recorded at a modest cost. Each tape can be played several hundred times before resolution suffers; and of course, tapes may be erased and new programs recorded.

Sony also hopes to market a video converter that will enable owners of the Videoplayer to record what they like directly off

In new Sony system video tape cassette fits into Videoplayer which is connected to TV antenna. Due to be available in '71, Videocassette can be erased and new programs recorded at will.

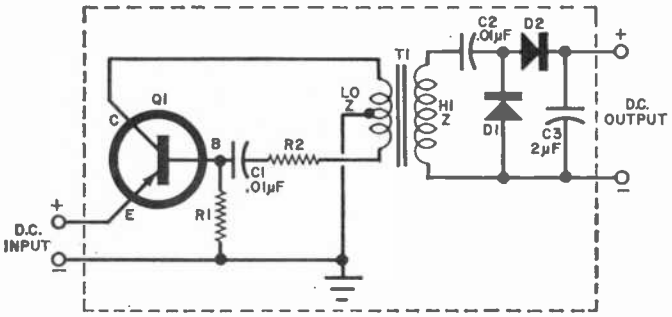


Fig. 1. A d.c./d.c. converter can be modified to provide a variety of output voltages for various low-current and high-voltage supply applications.

the air, and are also giving consideration to a miniature closed-circuit camera for recording "home tapes".

Reader's Circuit. Sometimes called a d.c. transformer, the d.c./d.c. converter circuit illustrated in Fig. 1 was developed using "junk-box" parts, according to its contributor, David Sharp, WA9RRJ (14715 Magnolia Blvd., Apt. #4, Sherman Oaks, California 91403). With minor modifications to meet individual requirements, the basic design can be used as a low-current, high-voltage power supply in small oscilloscopes, neon lamp displays, electric fences, Geiger counters, and similar projects.

Referring to the schematic diagram. *Q1* is used as a power oscillator in a modified Hartley circuit, with *T1*'s tapped primary providing the feedback needed to start and maintain oscillation. Voltage divider *R1*-*R2* determines the optimum feedback signal level, while *C1* serves as a simple d.c. blocking capacitor. Resistor *R1* also establishes *Q1*'s base bias.

The a.c. voltage developed by the oscillator is stepped up by *T1*'s transformer action and changed to d.c. by a conventional voltage-doubler network made up of series capacitor *C2*, rectifier diodes *D1* and *D2*, and filter capacitor *C3*.

Having used surplus "junk-box" parts in assembling his model, Dave did not specify component type numbers on the project. Instead he suggests that the individual builder use available components, adjusting circuit values experimentally as needed to obtain optimum performance. Transistor *Q1* is a general-purpose, medium-power *pnp* type. Transformer *T1* has a small iron core with both high impedance and tapped low-impedance windings. Typically, a small power transformer or "universal" tube-type audio output transformer could be used here. Rectifiers *D1* and *D2* are high-voltage diodes.

With relatively high voltages developed in the output circuit, *D1, D2, C2* and *C3* should have appropriate ratings. The diodes should have a PIV rating at least twice *T1*'s output voltage while *C2* and *C3* can be 3000-volt units, although the minimum ratings needed will depend on the d.c. supply voltage and *T1*'s step-up ratio.

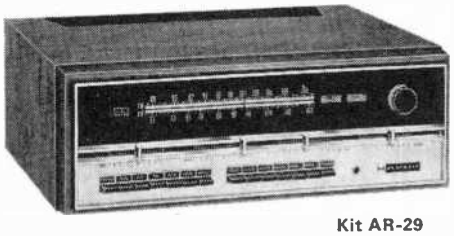
The resistor values (*R1* and *R2*) are determined experimentally. Breadboard the circuit and use 500k rheostats for *R1* and *R2*, preset for maximum resistance. A light resistive load of from 4.7 to 10 megohms (1 watt) should be connected across the circuit's d.c. output terminals for stability. With a suitable d.c. source connected (from 1.5 to 18 volts, depending on the supply to be used in the final model), adjust the rheostats to *lower* values until the circuit oscillates. In some cases, oscillation can be detected by a "whine" or hum from the transformer, but a scope, signal tracer, or similar test instrument may be used to check operation. Afterwards, disconnect the power source and measure the rheostat values, substituting appropriate fixed half-watt resistors for these units. After a second check for operation, the circuit can be reassembled in its final form.

Neither final layout nor lead dress are critical and, therefore, any construction technique may be used. The power transistor should be heat-sinked if it became warm during breadboard tests; and, of course adequate insulation and component spacing should be used in the high-voltage output circuit to avoid arcing.

Manufacturer's Circuit. One of over a half-dozen designs featuring photocell applications, the automatic barrier lamp circuit shown in Fig. 2 was abstracted from the *Application Notes* published by Clairex Electronics, Inc. (1239 Broadway, New York, N. Y. 10001). In operation, the lamp (*I1*) goes on at dusk, off at dawn, with the daylight current drain less than one percent of the night drain. The basic circuit can be used in a variety of useful projects—in an automatic signal light for a driveway or boat dock, for example, or even for a "night light" on camping trips.

Referring to Fig. 2, *Q1* and *Q2* form a complementary direct-coupled amplifier.

5 New Better-Value Kits From Heath

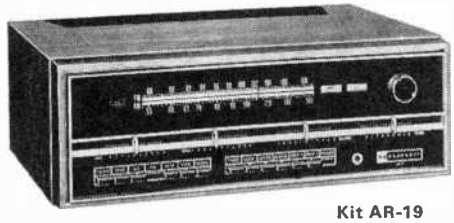


Kit AR-29
$285.00*

New Heathkit 100-Watt AM/FM/FM-Stereo Receiver

World's finest medium power stereo receiver ... designed in the tradition of the famous Heathkit AR-15. All Solid-State ... 65 transistors, 42 diodes plus 4 integrated circuits containing another 56 transistors and 24 diodes. 100 watts music power output at 8 ohms — 7 to 60,000 Hz response. Less than 0.25% distortion at full output. Direct coupled outputs protected by dissipation-limiting circuitry. Massive power supply. Four individually heat sinked output transistors. Linear motion bass, treble, balance and volume controls. Push-button selected inputs. Outputs for 2 separate stereo speaker systems. Center speaker capability. Stereo headphone jack. Assembled, aligned FET FM tuner has 1.8 uV sensitivity. Two tuning meters. Computer designed 9-pole L-C filter plus 3 IC's in IF gives ideally shaped bandpass with greater than 70 dB selectivity and eliminates alignment. IC multiplex section. Three FET's in AM tuner. AM rod antenna swivels for best pickup. Kit Exclusive: Modular Plug-In Circuit Boards ... easy to build & service. Kit Exclusive: Built-In Test Circuitry lets you assemble, test and service your AR-29 without external test equipment. The AR-29 will please even the most discriminating stereo listener.

Kit AR-29, (less cabinet), 33 lbs.....$285.00*
AE-19, Assembled oiled pecan cabinet, 10 lbs.....$19.95*



Kit AR-19
$225.00*

New Heathkit 60-Watt AM/FM/FM Stereo Receiver

The AR-19 circuitry reflects many of the advanced concepts of the AR-29. It uses 108 transistors and 45 diodes including those in 5 integrated circuits. It delivers 60 watts music power at 8 ohms. At any power level, Harmonic and IM Distortion is less than 0.25%. Frequency response ranges from 6 to 35,000 Hz. Direct coupled outputs are protected by dissipation-limiting circuitry. A massive power supply includes a section of electronically regulated power. The assembled, aligned FET FM tuner has 2.0 uV sensitivity.

A preassembled and factory aligned FM IF circuit board gives 35 dB selectivity. The multiplex IC circuit provides inherent SCA rejection. It features two switched noise muting circuits; linear motion controls for bass, treble, volume and balance; input level controls; outputs for 2 separate stereo speaker systems; center speaker capability; two tuning meters; stereo indicator light; front panel stereo headphone jack. The Modular Plug-in Circuit Board design speeds assembly. Built-in Test Circuitry aids assembly, simplifies servicing. "Black Magic" panel lighting, black lower panel, chrome accents. Compare it with any model in its price range ... the AR-19 will prove itself the better buy.

Kit AR-19, (less cabinet), 29 lbs.....$225.00*
Assembled AE-19, cabinet, 10 lbs.....$19.95*

Kit GD-109
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New Heathkit Deluxe 18-Watt Solid-State Stereo Phono

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Kit GD-109, 38 lbs.....$74.95*

Kit MI-29
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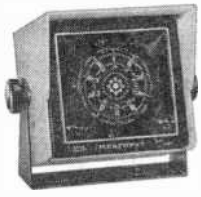
New Heathkit Solid-State Portable Fish-Spotter

Costs half as much as comparable performers. Probes to 200 ft. Spots individual fish and schools ... can also be used as depth sounder. Manual explains typical dial readings. Transducer mounts anywhere on suction cup bracket. Adjustable Sensitivity Control. Exclusive Heath Noise-Reject Control stops motor ignition noise. Runs for 80 hrs. on two 6 VDC lantern batteries (not included). Stop guessing — fish electronically.

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

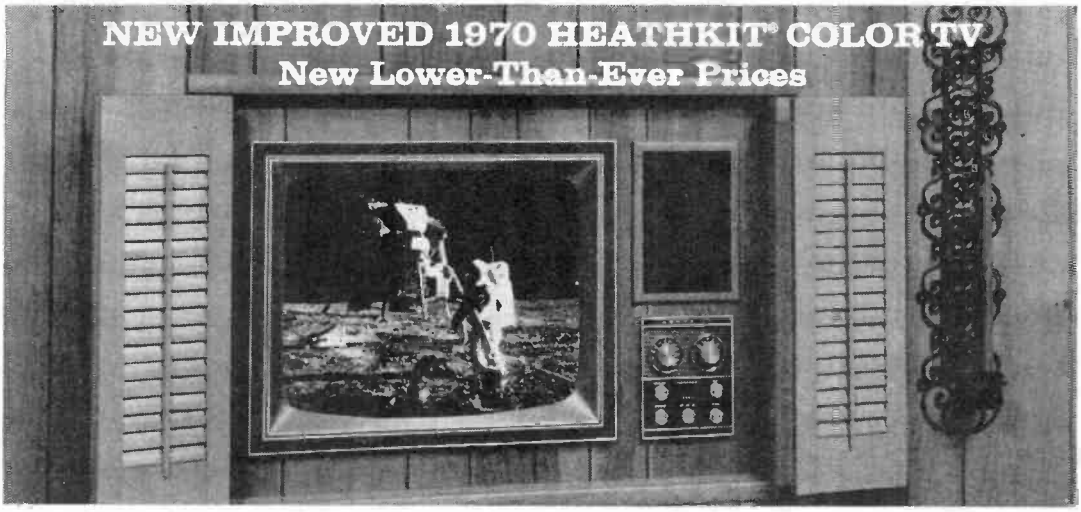


Kit MI-19
$69.95*

New Heathkit Solid-State Depth Sounders

Let its flashing indicator light guide you through strange waters ... day or night. Sounds to 200 ft. Has Noise Rejection and Sensitivity controls. Operates from your 12 VDC boat battery. Sun-shielded dial. All solid-state.

Kit MI-19-1, (with thru-hull transducer), 7 lbs.....$69.95*
Kit MI-19-2, (with high speed transom mount), 7 lbs.....$69.95*



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

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

ADVANCED PERFORMANCE 320 BY HEATHKIT DESIGN

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

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

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

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

All Heathkit Color TV's Have These Superior Features

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

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CIRCLE NO. 15 ON READER SERVICE PAGE

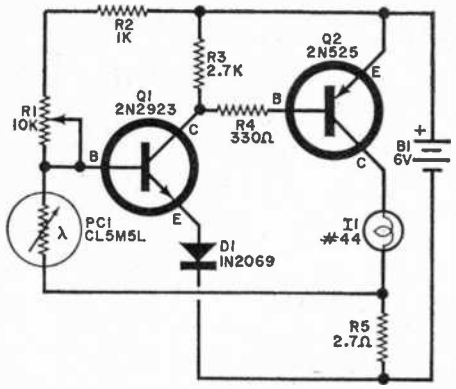


Fig. 2. Photocell circuit is used to turn a lamp on at dusk, off at dawn with low current drain.

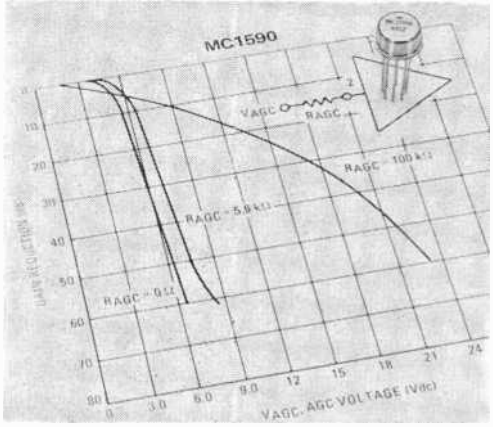
Base bias of *Q1* is established by a voltage-divider made up of sensitivity control *R1*, current limiting resistor *R2*, and photoconductive cell *PC1*. Transistor *Q1*, in turn, acts to control *Q2*'s collector load. The photocell, *PC1*, has a relatively low resistance when illuminated, a high resistance when dark.

During daylight hours, *PC1*'s low resistance effectively shorts *Q1*'s bias, holding this device in a high resistance state and preventing the application of base bias to *Q2*. Neither *Q1* nor *Q2* can conduct and the lamp remains dark. When dusk arrives, *PC1*'s resistance increases, permitting the application of base bias to *Q1* through *R1* and *R2*. As *Q1* shifts to a conducting state, base bias is applied to *Q2*, permitting a flow of collector current and lighting *I1*. The situation reverses, going back to the initial conditions, when *PC1* is once again illuminated.

With neither parts placement nor wiring arrangement critical, the project can be assembled using any method of construction. Naturally, the completed circuit should be housed in a weatherproof cabinet or case if the unit is used outdoors. Once the wiring is completed, all connections should be double-checked for errors *before B1* is connected. Sensitivity control *R1* is adjusted for optimum performance after installation in the selected location.

New Devices. A new monolithic IC recently introduced by Motorola Semiconductor Products, Inc. (P.O. Box 20912, Phoenix, Arizona 85036) is useful as a general purpose amplifier from d.c. to 150 MHz and has an a.g.c. capability of 60 dB minimum from d.c. to 60 MHz. Identified as Type MC 1590, the new unit can supply a typical gain of 45 dB at 60 MHz. The device's wide-range a.g.c. permits its use in audio circuits as a speech compressor as well as in the more familiar r.f. amplifier applications. Packaged in an 8-lead TO-99 case, the MC 1590 requires a single-polarity power source in the 6- to 15-volt range.

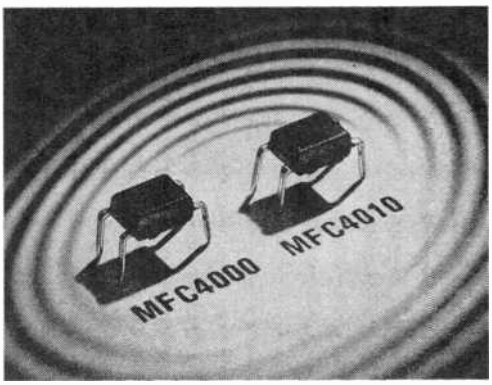
Motorola also has announced a new line of integrated circuit "gain packages" designed specifically for consumer products. Coded MFC, these plastic-packaged monolithic devices use smaller chips and contain fewer circuit elements than standard IC's and, therefore, are less expensive than



Monolithic IC type MC1590 can supply a gain of 45 dB at 60 MHz. Has wide-range a.g.c. for audio.

the more elaborate units. In addition, they are offered in special 4-lead packages with wide pin spacing to accommodate the printed circuit board layouts used by large-volume manufacturers.

The first two devices in the new line are Types MFC4000 and MFC4010. The MFC-4000 is a low-power audio amplifier containing six transistors, three diodes and five resistors. Designed for use with a 9-volt power supply, it can furnish up to 250 mW and has a low harmonic distortion of only 0.7% at 50 mW output.



New line of integrated circuits for consumer products includes an audio and a wide-band amplifier.

A wide-band amplifier, the Type MFC-4010 has high gain (60 dB min.) and is intended for general-purpose applications. It contains three transistors and five resistors and, typically, can be used as a 455-kHz AM i.f. amplifier, as a driver for the MFC-4000, or as a gain-block in microphone amplifiers or tape recorders.

If microwaves are your bag, then there's good news tonight. Firms on both the East and West Coasts have announced several new high performance—and high priced—devices.

First, TRW Semiconductors, Inc. (14520 Aviation Blvd., Lawndale, California 90260) has introduced two new 1-GHz transistors—the 3-watt type 2N5764 and the 5-watt type 2N5765. Designed to withstand severe mismatch under various load or phase conditions, both units are assembled in ultra-ceramic stripline packages, and are intended for operation from a 28-volt source.

The Microwave Semiconductor Corp. (100 School House Road, Somerset, N. J. 08873) has three new 2-GHz devices—the 1-watt type MSC 2001, 2.5-watt MSC 2003 and 5-watt type MSC 2005. Assembled in MSC's exclusive *Stripac* packages, all three are epitaxial *npn* units with 50-volt maximum ratings. Each can supply 7-dB gain in amplifier applications.

(*Continued on page* 113)

ENGLISH LANGUAGE NEWS BROADCASTS FOR THE MONTH OF FEBRUARY

Prepared by ROGER LEGGE

TO EASTERN AND CENTRAL NORTH AMERICA

TIME-EST	STATION AND LOCATION	FREQUENCIES (MHz)
7:00 a.m.	Peking, China	11.685, 15.095
7:15 a.m.	Montreal, Canada	9.625, 11.72
7:30 a.m.	Melbourne, Australia	9.58, 11.71
7:45 a.m.	Copenhagen, Denmark	15.165
12 Noon	London, England	21.61
4:30 p.m.	Hilversum, Holland	11.73, 15.425
6:00 p.m.	Montreal, Canada	9.625, 11.945, 15.19
6:45 p.m.	Tokyo, Japan	15.445, 17.825
7:00 p.m.	London, England	6.11, 9.58, 11.78
	Moscow, USSR	7.15, 9.655, 9.685
	Sofia, Bulgaria	9.70
	Tirana, Albania	7.30, 9.78
7:30 p.m.	Johannesburg, So. Africa	9.705, 11.875, 15.22
	Stockholm, Sweden	5.99
7:50 p.m.	Brussels, Belgium	6.125
	Vatican City	6.145, 9.615, 11.725
800 p.m.	Berlin, Germany	5.955,9.73
	Budapest, Hungary	6.234, 9.833
	Havana, Cuba	9.525
	Madrid, Spain	6.14, 9.76
	Peking, China	15.06, 17.715
	Prague, Czechoslovakia	5.93, 7.345, 9.54, 9.63
	Rome, Italy	6.01, 9.575
8:30 p.m.	Berne, Switzerland	6.12, 9.535, 11.715
	Cologne, Germany	6.075, 9.735
	Melbourne, Australia	15.17, 17.775
9:00 p.m.	Hilversum, Holland (via Bonaire)	11.73
	Lisbon, Portugal	6.025, 9.68, 11.935
	London, England	6.11, 9.51, 9.58
	Moscow, USSR	7.15, 9.685, 9.70

TO WESTERN NORTH AMERICA

TIME-PST	STATION AND LOCATION	FREQUENCIES (MHz)
7:00 a.m.	Tokyo, Japan	9.505
8:00 a.m.	Stockholm, Sweden	15.315
5:30 p.m.	Melbourne, Australia	15.17, 17.775, 21.74
	Tokyo, Japan	15.235, 17.825, 21.64
6:30 p.m.	Johannesburg, South Africa	9.715, 11.875, 15.22
7:00 p.m.	Madrid, Spain	6.14, 9.76
	Peking, China	15.095, 17.673, 21.735
	Prague, Czechoslovakia	5.93, 7.345, 9.54, 9.63
	Seoul, Korea	15.43
	Tokyo, Japan	15.105
7:30 p.m.	Berlin, Germany	5.955, 6.08
	Stockholm, Sweden	5.99
	Tirana, Albania	6.20, 7.30
8:00 p.m.	Budapest, Hungary	6.234, 9.833
	Havana, Cuba	9.525, 11.76
	Lisbon, Portugal	6.025, 9.68, 11.935
	London, England	6.11, 9.51, 9.58
	Moscow, USSR (via Khabarovsk)	11.85, 15.18, 17.88
	Sofia, Bulgaria	9.70
8:30 p.m.	Kiev, USSR (Mon., Thu., Sat.)	7.15, 9.685
8:45 p.m.	Berne, Switzerland	6.12, 9.72
	Cologne, Germany	6.145, 9.545
9:00 p.m.	Havana, Cuba	11.76
	Hilversum, Holland (via Bonaire)	9.715, 11.73
10:00 p.m.	Moscow, USSR (via Khabarovsk)	9.735, 11.85, 15.18
	Tokyo, Japan	9.505
10:30 p.m.	Havana, Cuba	11.93

OMNI-EIGHT

(*Continued from page 73*)

economize by cutting a 1'-wide strip from one end of a square yard of cloth. Use this strip in a vertical position and wrap the 2' × 3' remaining strip around the enclosure. However you plan it, measure the distance around the enclosure before you buy the cloth or order an extra few inches to allow for mistakes

Fasten the cloth at one corner with tacks or staples. Stretch the cloth across each side, and add a few tacks or staples at each corner to hold it taut. The vertical wood strips will cover the corner staples.

The exact lengths of the top and bottom trim pieces will depend on the thickness of the grille cloth so they must be cut to fit. These pieces of trim can be made either from solid wood or plywood with veneer-covered edges. Use small finishing nails to attach them to the top and bottom of the enclosure.

Finally, cut outside corner molding to fit tightly between the top and bottom trim. Stain and finish this molding to match the other wood before attaching the pieces. (Other surfaces can be stained and finished in place.) When they are dry, attach the corner molding with small brads (see Fig. 7).

This completes the construction of your Omni-Eight. Connect the leads from your amplifier and give it a listening test. You may find that a change in position of the Omni-Eight in your listening room requires a different tweeter control setting. -30-

SOLID STATE

(*Continued from page 111*)

Pretty tricky is General Electric's (Electronics Park, Syracuse, N. Y. 13201) new ST3 Trigger for Triacs (almost rhymes). Actually a "kit" of two plastic encapsulated devices, the ST3 includes a zener diode in series with a silicon bilateral switch. This dual-unit arrangement provides a higher switching voltage in one polarity to offset the effect of capacitor discharge during previous half cycles.

Hail Britannia. British technical manufacturers are making a determined effort to penetrate the lucrative American industrial market. A number of British firms exhibited their products at WESCON in San Francisco last August, others were at the *ISA* Conference and Exhibition in Houston during October, and still others presented their products at the National Electronics Conference and Exhibition in Chicago in December. The items offered spanned the entire range from components to test equipment and from consumer products to production machinery. Naturally, semiconductor devices and a variety of solid-state equipment were included in the exhibits.

A light switch developed by Teknis Ltd. combines a silicon planar photo-diode, an IC amplifier and a trigger unit on a single substrate, encapsulated in a standard TO-18 case with a glass window. Identified as Type IPL 11, the device can supply load currents of up to 4 mA—enough to operate a small relay or drive a medium-power transistor. The firm's U.S. agent is Teknis, Inc., Plainville, Mass. 02672.

An audio oscillator, Model Si453, developed by J. E. Sugden & Co., Ltd. (Bradford Road, Cleckheaton, Yorkshire, England) can supply both sine and square

wave signals from 13 Hz to 30 kHz. Its operating range is covered in six overlapping bands to minimize dial "cramping." One unique feature is an output which simulates that of a typical high-quality phono cartridge with a sensitivity of 2 mV/cm/sec and conforms to the RIAA fine-groove recording standard. This feature permits the equalization response of a phono input to be checked quickly and easily without using special auxiliary equipment or making tedious calculations. Battery operated, the instrument measures 10′ × 5′ × 8′.

Transitips. Perhaps the most difficult task an experimenter or hobbyist can undertake is the disassembly of an etched circuit board in an attempt to salvage components. Repeated applications of a hot soldering iron can ruin most semiconductor devices, yet, in many cases, there may seem to be no alternative to this technique.

There are, of course, a number of excellent commercial de-soldering tools available through both mail order houses and local distributors. Most of these work reasonably well, but a good selection can be somewhat expensive. However, if your budget can stand the gaff, fine!

On the other hand, your columnist has developed several personal techniques which require a minimum of equipment and which work in most cases. You might want to try these—

First, if the solder on the board is in large gobs, try holding the board *above* the soldering iron, so that the melted solder naturally flows down to the iron's tip. A clean, well-tinned iron is essential here.

Second, obtain an inexpensive wire brush of the type furnished with some brands of rough finished shoes. These are available at most hardware and some shoe stores. Try *brushing* the melted solder off the board. But work as quickly as you can.

Third, if a particular connection is hard-to-reach, try *blowing* the solder away. You can use a small blow-pipe of the type found in school laboratories, or even an eye-dropper tip attached to a short length of rubber hose. A rubber-bulb ear syringe works in some cases.

Fourth, don't try to remove *every last bit* of solder. Once a component lead is exposed, you may be able to work it loose with a short-pointed scribe, ice pick or soldering-aid. Remember that solder is not very strong mechanically.

Finally, don't work too long at one spot. Shift around and allow time for the component leads to cool a little. You may be able to remove a component a little faster, but a ruined transistor or diode is hardly worth the trouble. —*Lou.*

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SHORT-WAVE LISTENING

(*Continued from page* 103)

Israel—*Kol Israel,* Tel Aviv, was found on 9625 and 9009 kHz from 2015-2100 in English and to 2130 in French; this was beamed to Europe and England.

Kuwait—*R. Kuwait* is fair to good on 15.345 kHz

SHORT-WAVE CONTRIBUTORS

Rick Mills *(WPE1HSA)*, Berwick, Maine
Robert McCarthy *(WPE1HUJ)*, Westwood, Mass.
Peter Macinta *(WPE2ORB)*, Kearny, N. J.
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Ronald Roberts, Windsor, N. Y.
Bob Roeder, El Cerrito, Cal.
Henry Seidner, Pearl River, N. Y.
Sweden Calling DX'ers Bulletin, Stockholm, Sweden

at 1800-1810 with pop music, and on 21,685 kHz at 1530-1550; Arabic is spoken on both channels.

Malaysia—*R. Malaysia,* Penang, is heard from 1300 on 4985 kHz with poor signals. Before that time a teletype station is usually operating.

Mexico—XECMT, Ciudad Mante, 6103 kHz, is noted around 0120-0130 with native music and ID's in Spanish. Medium-wave DX'ers report good reception of XEW, Mexico City, 900 kHz, after 0100 in Spanish, and XEG, Monterey, 1050 kHz (100 kW) at 0400-0500 with considerable English. Reports for XEW go to *R. Cadena Nacional,* Apt. Postal 7892, Mexico City 4, while reports to XEG can be sent simply to XEG, Fort Worth, Texas 76111.

Pakistan—*R. Pakistan,* Karachi, is often good on the West Coast at 1500-1515 with English news and weather on 11,695 kHz.

Peru—OAX4R, *R. San Jose,* Iquitos, 4825 kHz, is somewhat irregular in its programming but often has a *VOA* Spanish relay after 2300. OCY4S, *R. 15-50,* Huancayo, 4801 kHz, is heard after 0000 in Spanish; some reports indicate the callsign to be *R. 150* but this is incorrect. OAX6H, *R. Oficial del Congreso,* Lima, 6095 kHz, is heard at times after 0300 with a relay of political speeches in Spanish.

Seychelles—*Far East Broadcasting Company* is testing its new xmtr at 0030-0330 on 15,165 kHz and 1300-1630 on 17,755 kHz, both beamed to India, and 1700-2000 on 21,460 kHz to the Middle East. Also being heard is 21,635 kHz at 1700-2000 in English with music, frequent ID's and requests for reports, and giving the address of P. O. Box 234, Victoria, Seychelles.

Singapore—*R. Singapore* is good on 5055 kHz during mornings (local time) with pop records. Another station, believed to be in Singapore, was found on 4883 kHz at 1245 with pop records but in an unidentified language.

Spanish Guinea—EAJ206, *R. Ecuatorial,* Bata, has been noted on 4926 kHz from 0430 s/on in Spanish, then into modern pop tunes.

Sudan—*R. Omdurman* was heard well on 9508 kHz at 2145-2200 s/off with a xmsn in Arabic.

Switzerland—Berne's current English schedule, with each xmsn one hour in length, is as follows: to Australia and New Zealand at 0700 on 9590 and 11,775 kHz; to Europe (weekdays) at 0700 on 6165 and 9535 kHz; to Japan and China at 0845 on 9665 and 11,760 kHz; to Africa at 1000 on 15,305, 17,795 and 21,520 kHz and at 1815 on 15,305 and 17,795 kHz; to United Kingdom and Ireland at 1130 on 9665 and 11,865 kHz and at 1930 on 6055 and 9665 kHz; to Far East, India, and Pakistan at 1315 on 15,305, 17,845 and 21,520 kHz; to Near and Middle East at 1500 on 15,305 and 17,830 kHz; to N.A. (East) at 0130 on 6120, 9535 and 11,715 kHz; and to N.A. (West) at 0445 on 6120 and 9720 kHz.

Vatican City—*Vatican Radio* was found with an IS at 2258, then Bells of St. Peters and s/on at 2300 on 11,850 kHz.

Windward Islands—*Windward Islands B/C Corp.,* St. Georges, Grenada, is now on 11,995 kHz as heard at 0140-0200 with pop music and time checks.

Yemen—*Yemeni Royalist Radio,* 9976 kHz, is fair at 0415 with local music and Arabic vocals. Does anyone know if this is actually in Yemen?

Zambia—Peking is to supply *R. Zambia* with two 50-kW short-wave and one 200-kW medium-wave xmtrs as gifts as a result of a recent Zambian goodwill visit to Peking. Sites are being prepared but installation has not yet gotten under way. This information from an overseas bulletin.

Clandestine—*R. Espana Independiente* was heard on 15,509 kHz in Spanish just prior to 1731 s/off.

TWO-WAY REACTIONS

(*Continued from page 98*)

Nanuet, N.Y. . . . Citizens Radio Association of Rockland, Inc. has purchased a 40-acre campsite in the Catskill Mountains north of Ellenville, N.Y. Its use will be shared by members for recreational purposes.

Enon Valley, Pa. . . . Sociable 5 Watts Inc. had a very successful picnic and campout. They awarded over 250 prizes, presented 33 trophies and awards and credit the following CB groups for helping: Circle 8 Emergency Club, Independent REACT, Lorain County CB'ers, Beaver County REACT, and Derby Town CB'ers.

Spokane, Wash. . . . Members of the 7-11 CB Radio Club transported voters to the polls on Election Day. This was a civic project conducted in cooperation with the local Moose Lodge.

San Bernardino, Calif. . . . Officers of San Bernardino Valley REACT journeyed to Barstow, Calif., to assist the Barstow CB Radio Club in becoming a REACT team.

San Bruno, Calif. . . . REACT of the Golden Gate Area hosted a meeting of REACT teams in northern California and the result was the formation of a REACT Council in the area.

Beachville, Ont., Can. . . . Members of the Beachville Valley Wing Dingers are very proud of their communications trailer. Made from an old milk wagon, the trailer has seen some action on Halloween and various CB events. Fortunately, it has not been needed for an emergency, but they are ready!

River Falls, Wisc. . . . CB groups including West-Central Wisconsin REACT have banded together with others under Ron Miller, Civil Defense Director of Pierce County, to form a search and rescue unit. It will be trained and ready for search, rescue and communications in emergencies—including tornadoes.

AMATEUR RADIO

(*Continued from page* 100)

your ARRL Code Proficiency certificate multiplied by the number of ARRL sections you work. (Only one contact per station counts, by the way.)

WNØVKP made 771 contacts in last year's Novice Roundup. You might not do quite that well this year, but you should be able to add a couple more states to your quest for a Worked All States Certificate. Scores go to: Communications Department, American Radio Relay League, Inc., 225 Main St., Newington, Conn. 06111. Send a stamped return envelope to the same address for "NR" log sheets and a list of ARRL "sections."

Another envelope to the above address will get rules and log sheets for the 36th Annual ARRL DX Competition. The phone contest will be between 0001 GMT, February 7, and 2359, February 8, and the same hours on March 7-8; and the CW contest on February 21-22 and March 21-22. United States and Canadian amateurs work the world, including Alaska and Hawaii. They send a signal report and the name of their state or province to each station worked; the DX operator replies with a signal report and his transmitter power. Each exchange earns three points, and a station may be worked once per band. W/VE scores equal the QSO points multiplied by the sum of the different countries worked on each band. DX operators multiply by the number of states and provinces worked on each band.

NEWS AND VIEWS

Joel Miller, WA7JWC, 6870 S.W. Baylor St., Tigard, Ore. 97223, went from Novice to Advanced in about eight months. His Knight T-60 transmitter, Heathkit SB-301 receiver, and Hy-Gain 18-V vertical antenna have worked 49 states, 25 countries, and five continents. He also has a 25-w.p.m. code certificate. Joel's on-the-air time is now somewhat curtailed, however, as he is studying electrical engineering in college . . . **Don Babcock, WB4KUZ,** 2210 Talmadge Av., Titusville, Fla. 32780, is another of the amateurs who moved directly from Novice to Advanced class license. As a Novice, Don worked 23 states and two countries before getting interested in traffic handling and public service work and becoming assistant manager for the Florida Novice Hurricane Net. Don's equipment includes a Hallicrafters SR-42 transceiver for two meters, and a Hallicrafters SX-140 receiver and Heathkit MT-1 transmitter feeding a 40-meter dipole for the other bands. Besides Civil Defense work and handling traffic, Don likes to "ragchew," and has an RCC (Rag Chewers' Club) certificate to prove it . . . **Jack R. Main, W4YCZ,** 1951 Kingston Ave., Norfolk, Va. 23503, has found the secret of how to compete with the "big boys" with his mobile whip antenna and National NC-200 transceiver.

73, Herb, W9EGQ

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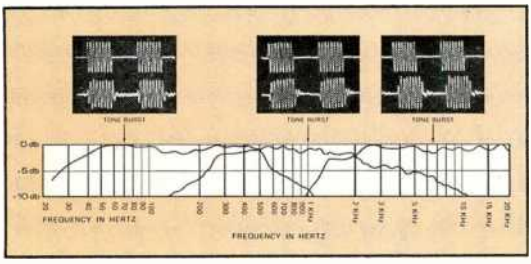

If you are as serious about musical reproduction as we are, the following discussion may help you in choosing your next speaker system. And the actual response curves and tone burst tests may prove most revealing when compared with other speaker systems currently available.

Aries is an uncommon speaker system. Larger than the ubiquitous bookshelf speakers for a very sound reason: greater internal volume permits a worthwhile extension of bass with lower distortion and higher efficiency. Effective use of this volume comes from a 12″ woofer with 9½ pound magnet structure, new sealed-foam half-roll surround, and rigid deep-cone geometry. It's a combination that insures ¾″ linear cone movement, precise transient response, and high power handling capacity without frequency doubling.

The mid-range was designed with equal care. A specially treated 6″ cone speaker is mounted in its own sealed inner enclosure. Speaker resonance is well below the crossover point to insure peak-free response and clean transients in this sensitive part of the spectrum. Oscilloscope testing of every unit is routine so that laboratory standards are maintained in production.

The Aries 2½″ cone/dome tweeter is particularly unique. For instance, to obtain ultimate response, damping compound is metered onto the cone within a tolerance of ±0.001 oz. And control of cone/dome materials insures a radiation area that varies predictably with frequency to insure uniform dispersion at all frequencies.

Even the crossover network is unusual. Four inductors (iron-core type for the woofer to avoid losses), three capacitors (with a Mylar type for the tweeter to maintain response beyond the high frequency limitations of electrolytic types), and a 5-position rotary ceramic switch offers precise control with up to 10 db attenuation at 10 kHz.

But Aries is more than a distinguished music reproducer. It is also handsome furniture in its own right. Tasteful design and robust construction set Aries apart from the anonymous styles of the past. In every detail from the hidden 2″ x 4″ bracing to the authentic hardware and richly finished hardwood veneers, Aries can be an attractive addition to your home... a delight to ear and eye.

See and hear the new Aries at your E-V dealer's soon. Look, touch... above all, listen. It can be an eye-opening experience. $275.00.

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