

12 PAGES—SCIENCE FAIR PROJECTS

# POPULAR ELECTRONICS

DECEMBER  
1966

50  
CENTS

**Automate Your Slide Projector • Build "J" Antenna  
Build Emitter Dipper • New Short-Wave Schedules**

**SPECIAL:**

- **New Uses for Small Recorders**
- **Parlor Games With Tape**
- **Report on Heathkit Tape Deck**
- **How To Tape Interviews**



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FAIR:

**Build**

**"Logic Demon"**

**Binary Counter • Tesla's T**

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Cincinnati, Ohio**

# POPULAR ELECTRONICS

WORLD'S LARGEST-SELLING ELECTRONICS MAGAZINE

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NUMBER 6

## SCIENCE FAIR PROJECTS

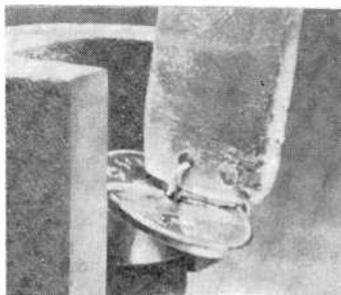
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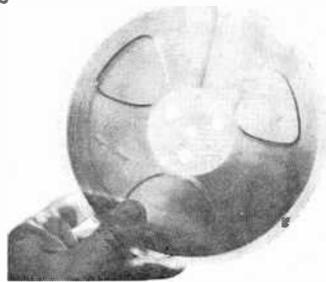
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(JULY-DEC., 1966)



Checking out the Curie temperature effect



Presenting a potpourri on tape recording

POPULAR ELECTRONICS is indexed  
in the Readers' Guide  
to Periodical Literature

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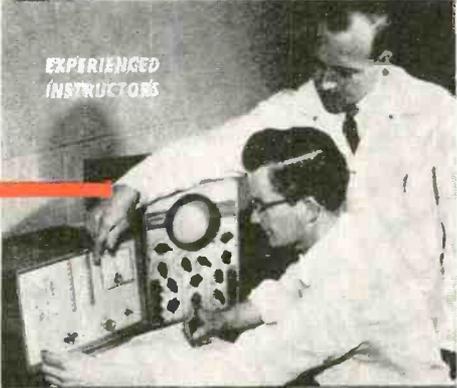
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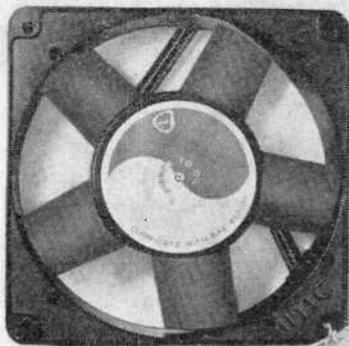
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CIRCLE NO. 19 ON READER SERVICE PAGE

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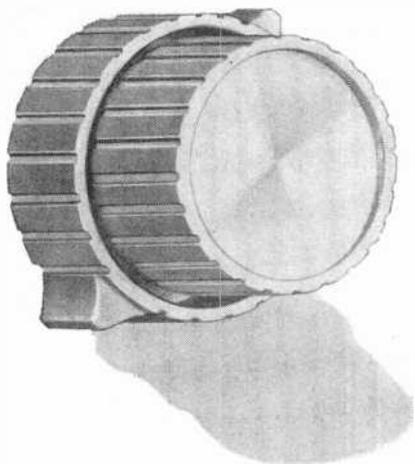
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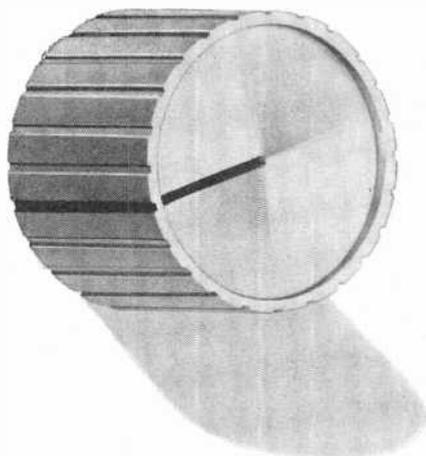


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# Simple

The new 725 is two knobs simple. Push the left one, it's on; turn the right one to any of 8 channels. Now you're ready to broadcast on the first 5 watt mobile transceiver designed to be operated by any member of the family. Forget about noise. A built-in jack lets you use it with your headset to eliminate loud outside noises.

The 725 is packed with performance, too. Inside, this compact (8½" x 6" x 2") is loaded with solid state circuitry and 14 silicone transistors. Outside, it's designed with the high-style of standard dashboard equipment. At \$119.95, it looks like the 725 belongs under the dashboard of your Ferrari, T-Bird . . . or your Chevrolet!

To learn more about the new 725—and the entire Amphenol solid state line—just drop into your nearest Amphenol two-way radio headquarters.

Or write Amphenol, Box 134, Broadview, Illinois 60153.



**AMPHENOL**

**CIRCLE NO. 2 ON READER SERVICE PAGE**

# GARRARD'S CUEING

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1. To lower the tone arm gently to the record without manual handling.
2. To pause (and then continue when ready) during single or automatic play.
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Built-in cueing controls are featured on three of Garrard's new automatic turntables:



50 Mk II  
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control lever built  
into the tone  
arm system.



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with manual  
cueing and pause  
control lever built  
into the tone  
arm system.



LAB 80 Mk II  
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hydraulically operated  
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conveniently built into  
the tone arm rest.

These are three of five Garrard Automatic Turntables just introduced. For complimentary copy of colorful new Comparator Guide describing all models, write Garrard, Dept. GX-356, Westbury, N.Y. 11590.

**CIRCLE NO. 47 ON READER SERVICE PAGE**

# LETTERS

## FROM OUR READERS

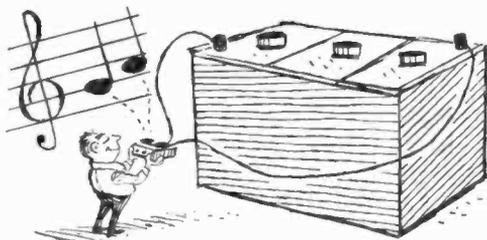
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Letters Editor, POPULAR ELECTRONICS  
One Park Avenue, New York, N. Y. 10016

### AUTO BATTERY-OPERATED TAPE RECORDER

A friend of mine says I can run my 6-volt tape recorder motor on a 6-volt automobile battery, and that the motor would just use the current it needs. But one of my teachers says that it would burn out the motor. Who is correct?

DALE R. TROTMAN  
Mayo, Fla.

*We don't like to disagree with one of your teachers, Dale, but we can't see how you could possibly damage a 6-volt d.c. motor on a 6-volt battery regardless of the physical size of the battery. Your teacher might be taking into*



*account the voltage rise from the generator when the engine is running. Aside from possible tape speed variations, the tape recorder motor—if it is actually a 6-volt unit—should be able to handle a nominal increase in voltage. However, you can run into a problem with the transistors and other electronic components if a higher voltage source is used.*

### DROOPED DECIBEL GRAPH

In your article "What Are These Things Called Decibels?" (October, 1966), is the graph on page 76 in error? It looks as though the reference lines are displaced downward from where they should be.

O. R. HEINZ, K7KHA  
Reno, Nevada

There seems to be a discrepancy in the "AC VOLTS TO DB GRAPH," or did I misinterpret the article?

ARTHUR S. DUBUAR  
Toms River, N.J.

See "Out of Tune" on page 89.

### "SCROUNGING" FOR AN ANTENNA

I am a registered Short-Wave Monitor (WPE6GOC), and I am now studying for my

# Why does one of these men earn so much more than the other?

More brains? More ambition?

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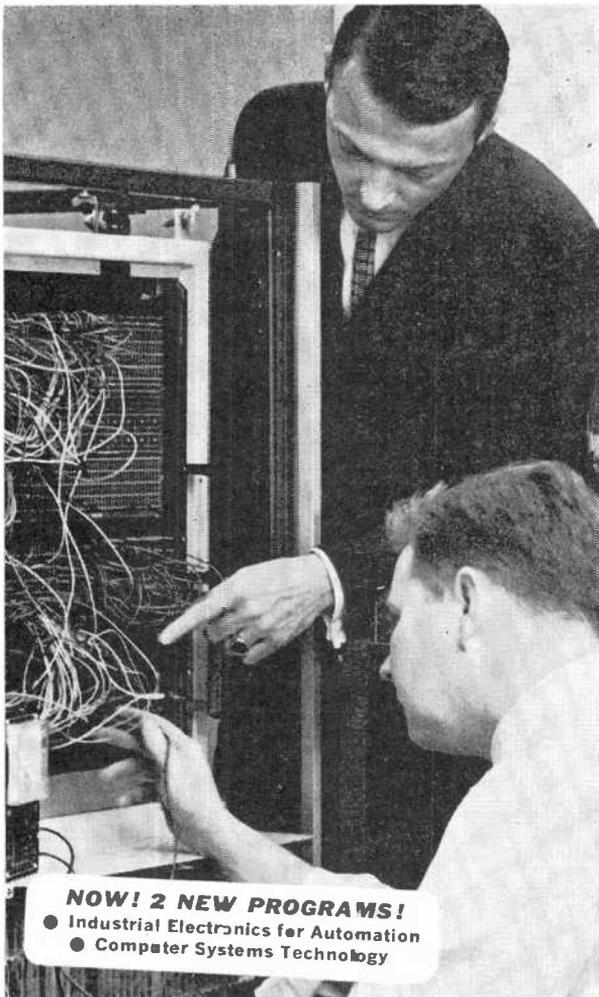
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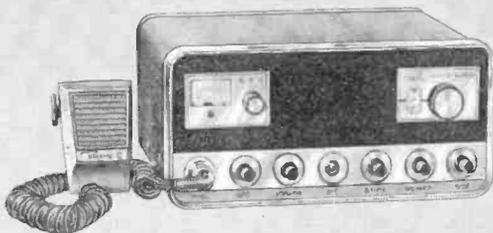
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This is the compact transistorized set with a long list of exclusives. The up front speaker, Collins mechanical filter, a dial system with channel numbers and big TO-3 power transistor are just a part of the construction features that make the Ranger the best of all CB mobiles. Join the rangers... you'll get your man on any of its 11 powerful channels!



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7900 PENDLETON PIKE  
INDIANAPOLIS, INDIANA

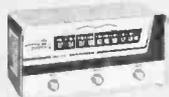
# Regency monitoradio

for listening to  
Police Calls • Fire Calls  
Aircraft Radio



## Model DR-200 with Matching Speaker

Tunable for both high (152-174 MHz) and low (30-50 MHz) bands. Provisions for 1 crystal controlled frequency in both high and low bands.



## Models MR-10B (152-174 MHz) and MR-33B (30-50 MHz) FM Receivers

Tunable with illuminated slide rule dial, 5" speaker and power transformer. Provision for external speaker or head phones.



## Model AR-136 Flight Monitoradio

Tunable from 108-136 MHz for listening to conversations between airplanes and control towers. Crystal controlled model also available.



## Model 2MH-2 (152-174 MHz) and TML-2 (30-50 MHz) Transistorized Monitoradio

The ultimate in emergency receivers. Up to 6 crystal controlled frequencies in high or low band. 3-way power supply keeps the receiver on call at all times . . . in home or car and all points in between.

*All Regency Monitoradios are built to professional standards to deliver strong readable signals. Each gives you a 1 year warranty. Get your favorite today for hours of listening pleasure.*

**Choice of 11 Regency Models  
Priced from \$69.95**

## LETTERS (Continued from page 6)

Novice license. I plan to get the Heathkit "Two-er" and operate phone on 2 meters, but I live on the first floor of a two-story apartment and have an antenna space problem.

DAVID KELLY  
Los Angeles, Calif.

*Fortunately, David, 2-meter antennas are quite small, and there are a number of good antennas available commercially; but you might be interested in what you can do with a piece of flat 300-ohm transmission line—the kind used for TV work. Try rigging up "The Scrounge—An Instant J Antenna," described on page 46 in this issue. For 2 meters, the total length of the antenna is only 54.9 inches. The half-wave section is 38.2 inches and the quarter-wave section is 16.7 inches.*

## POPULAR ELECTRONICS INDEX

I have a complete set of P.E. issues from Vol. 1, No. 1 (October, 1954) to the present. I am constantly called upon in my work to come up with different electronic devices to solve all kinds of problems, and I have found many solutions and shortcuts in your fine publication. Would it be possible for you to perforate the Table of Contents page in each issue so that I can tear them out and fit them into a suitable file?

AL DIAMOND  
New York, N.Y.

*Al, your suggestion is appreciated. However, since most readers don't like to cut up their issues, we would rather spend the money*



*for editorial material than for perforations. Are you using our Volume Index which is published in the June and December issues? For the latest semiannual index, see page 112.*

## BARIUM TITANATE NOT OUT OF DATE

We do not believe that barium titanate is out of date as indicated by the letter in your July, 1966, issue from C.P. Germano of the Clevite Corp. Barium titanate (or the modified titanate) is the most commonly used ceramic piezoelectric transducer material in existence. Barium titanate has been replaced in the ceramic phono cartridge application by the newer lead zirconate-titanate material. This replacement was accomplished because the lead zirconate-titanate seemed to work better in the old standard designs. More

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**LETTERS**

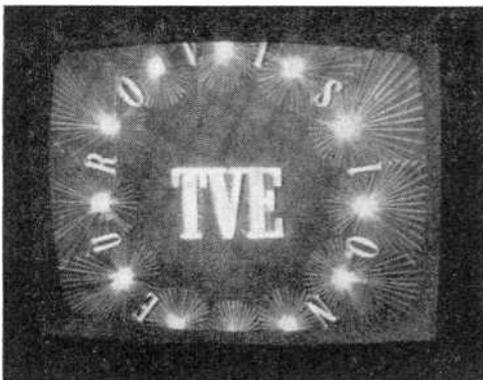
(Continued from page 9)

sophisticated designs with barium titanate elements have greatly outperformed the lead zirconate-titanates, but never gained wide popularity. In general, the lead zirconate-titanates exhibit both advantages and disadvantages when compared with barium titanate.

JAMES W. ANDERSON  
Linden Laboratories, Inc.  
State College, Pa.

**TV DX IN GREECE**

The article on "Riding the TV DX Trail" (July, 1966) was interesting. During the summer, especially in the afternoons (Greek time), I have received transmissions on Channels 2 and 3 from Germany (920 miles), from



Spain (1470 miles), and from Italy and Czechoslovakia (980 miles). I enclose a picture from Spanish television TV-ESPANA which I took last year.

DIM. GAGOSSIS  
Athens 811, Greece

**D.C. FLUORESCENT LIGHT**

I thought you might be interested in my adaptation of the "D.C.-Operated Fluorescent Light" (July, 1965). Not having any use for a self-contained portable unit, I separated the power supply from the fluorescent tube holder in order to obtain a slim light source for mounting in a car. The lamp holder is made from two pieces of 12" x 1" aluminum angle, and has a piece of translucent fiberglass over the front. The lamp is mounted on a swivel Kleenex holder and can swing out to face the driver. It works like a charm.

JOHN W. KINDLEY  
Birmingham, Mich.

**FLUX TO END ALL FLUX**

In "Solid State," (March, 1966), page 90, second column, third paragraph, I read about "an ordinary alligator clip to which a piece of felt is soldered." Now, I thought I knew all about soldering, but apparently Lou Garner is way ahead of me. Can you tell me what

# Out where the test begins—a man needs HALLICRAFTERS reliability!



Beyond the last outpost . . . where communication is a necessity, not a parlor game . . . don't settle for less than the quality of workmanship and un-failing performance that have made Hallicrafters products known throughout the world as "*the radioman's radio*".

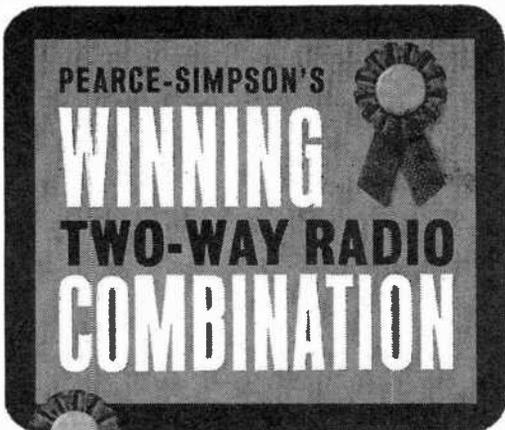
CB-11A 10-transistor citizens band pocket portable. 100 mw. of power . . . range up to three miles . . . battery life indicator . . . Price: \$74.95/pair.



## hallicrafters

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CIRCLE NO. 17 ON READER SERVICE PAGE



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**OR** The 11 channel **ESCORT II**  
**AND FOR BASE STATION**  
 The 23 channel **GUARDIAN**

Performance matched for peak efficiency, the All Solid State Director or Escort II in your car, truck or tractor teams with the Guardian 23 base-station command unit to give you the finest two-way radio communications network in the nation! SEE IT! TRY IT! BUY IT!

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 CB'S**



**DIRECTOR —**  
 23 Channel CB • \$269.90  
 (complete with crystals for 23 channels)

**ESCORT II —** 11 Channel CB • \$219.90  
 (complete with crystals for 6 channels)



**GUARDIAN 23 —** 23 Channel CB • \$269.90  
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 P.O. BOX 800—Biscayne Annex, Miami, Florida 33152  
 Please send full information and model specifications  
 on the Director, Escort II and Guardian 23.  
 Name \_\_\_\_\_  
 Address \_\_\_\_\_  
 City \_\_\_\_\_ State \_\_\_\_\_

**PEARCE-SIMPSON, INC.**  
 MIAMI, FLORIDA

CIRCLE NO. 31 ON READER SERVICE PAGE

## LETTERS (Continued from page 10)

type of flux your Semiconductor Editor uses when he solders felt?

BILL ROBERTS  
 Reno, Nev.

*Felt flux, of course, but we don't know where to get it. Bill, while we generally think of a metallic union when we think of solder, we can also get burned by the stuff, in more ways than one. Don't blame Mr. Garner for this slip of the typewriter; actually, if you look up the word solder in the dictionary, you'll find a definition reading: something that unites or cements. A problem of semantics?*

### HYDRONICS, HUM AND SKEPTICISM

It was with the greatest of skepticism that I constructed the Hydronics receiver described in the article "Is Plasmonics For the Birds?" (July, 1966). I was greatly surprised when I turned it on, and heard in my headphones chirps and short warbles. I used the dipole antenna which I held over the side of a rowboat in a lake at a day camp at Armonk,



N.Y., where I am a C.I.T., and act as an assistant to the science counselor. My congratulations to Mr. Minto on his interesting discovery.

ELLIOTT SHARP  
 White Plains, N.Y.

I built the Hydronics receiver, and it works fine with a microphone; but when I plug in the antenna, there is a loud hum. I have gone to all the TV and radio shops around town and nobody can help me. Can you?

D. A. STAN  
 Griffith, Ind.

I successfully detected several types of underwater signals using equipment similar to that described in your article: a 4' dipole antenna with 2" x 3" copper plates, an Olson AM-260 300-mW, 5-transistor amplifier, and a 4" speaker. Whenever the antenna was in the water (but not when it was out of the water), a 60-Hz hum could be heard. Also a crackling and popping sound was always present. There was never more than about a half a second interval between successive bursts of crackling. And I was unable to observe any directional effects in the intensity of the noise

(Continued on page 88)

**NEW!**

# 5-Band Portable CB Receiver/Direction Finder

Here is Nova-Tech's solid state 5 Band Portable. It picks up all CB channels, entire Marine Band, Low Frequency navigation beacons, weather stations, and standard broadcasts. It's also an accurate navigation instrument, used in thousands of planes and boats for position finding and homing.

## 5 Bands

- 1. CB Low** Tunes all 23 channels spread out on 2 bands for easy tuning and positive identification. You can monitor all CB channels wherever you go... including H.E.L.P. and R.E.A.C.T.
- 2. CB High**
- 3. L.F.** 200-400 KC. Beacon/Weather. Hear accurate, up-to-the-minute weather broadcasts around the clock. FAA stations give all weather data for 200 miles around. Also tunes navigation beacons.
- 4. S.W.** 1.4-4.5 MC. Marine/Shortwave/Police. Listen to all marine communications: ship-to-ship, ship-to-shore. Coast Guard, fishing and pleasure boats. MAYDAY. Radio hams on 75 meter band.
- 5. A.M.** Standard broadcast band, music, news, sports. Sensitive receiver brings in stations ordinary radios just can't get.

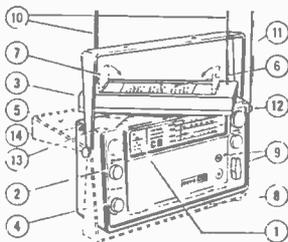
## Hours Of Fascinating Listening

Technically, this unit is superb. The CB section uses a 2 crystal, double conversion circuit to shift the entire 27 Mc CB band down to the 200 Kc region and by means of a tunable IF strip and a narrow band mechanical filter, a stability is produced that rivals laboratory instruments. 1 microvolt sensitivity is produced by 2 RF transistors ahead of the mixer. The adjustable squelch control can be set so that as little as 3 microvolts will unlock the audio. The S meter also serves as a null meter when direction finding on the lower bands.

Nova CB combines a superb CB receiver with an outstanding portable direction finder, of which over 50,000 are now in use, more than all other makes combined. Useful and handsome, this unit will be valued for many years.

Can operate 4 ways: from internal batteries, external dry cell, house current, or sun power from optional solar cells. (\$40 extra.)

The new Nova-Tech NOVA CB is a long range 5-band receiver and radio direction finder with exclusive features.



- 1. "NULL" METER.** Locates direction instantly.
- 2. SQUELCH CONTROL** eliminates noise and static between CB transmissions.
- 3. ROTATING ANTENNA** gives sharp, clean nulls to give accurate bearings. No need to rotate entire set.
- 4. DF LEVEL CONTROL** adjusts needle sensitivity. Also prevents overload from strong signals which could prevent sharp, accurate nulls.
- 5. 180° LEFT-RIGHT BEARING SCALE** gives accuracy of 10" diameter compass rose even though set is only 2 1/2" thick.

- 6. MORSE CODE,** a handy guide to help identify beacon signals.
- 7. CALIBRATED OPTICAL SIGHTS** on rotating antenna flip up for taking visual bearings.
- 8. REMOVABLE BRACKET** is adjustable for horizontal or vertical mounting and can be used as carrying handle.
- 9. TWO EXTERNAL HEADPHONE JACKS,** one for standard headphone, one for miniature earpiece (included free).
- 10. TWIN PLUG IN EXTENDABLE ANTENNAS** for the best mobile reception.
- 11. LONG RANGE EXTENDABLE REMOVABLE WHIP** provides maximum signal input on ground.
- 12. BUILT-IN EXTERNAL CB ANTENNA JACK** for roof top or car top antenna. Provides greater range.
- 13. PUSH BUTTON DIAL LIGHT** illuminates entire slide rule calibration scale for easy and accurate tuning at night.
- 14. BATTERY SAVER PLUG.** External batteries can be connected. Also comes with house current adapter.

A SPECTACULAR CHRISTMAS GIFT!



5 Band Portable CB Receiver / Direction Finder \$149.95

Over 50,000 Nova-Tech radio direction finders now in use all over the world... more than all other makes combined.

Complete with 3 telescoping whip antennas, miniature ear-phone, leather carrying case, batteries, removable and adjustable mounting bracket. Only 8" x 5" x 2", smaller than an ordinary cigar box, it weighs just 2 1/2 lbs. *And it also plugs into regular house current.*

**\$149<sup>95</sup>**

## 5 Band Nova CB

Budget terms available, \$40 down \$20 month or charge your Diners Card.



### UNCONDITIONAL MONEY BACK GUARANTEE

If you are not completely pleased with your Nova CB return it within 10 days for full refund. No questions. No explanations.

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630 Meyer Lane, Redondo Beach, California 90278

Please send me *with unconditional 10-day money back guarantee:*

5 Band Nova CB with house current adapter \$149.95

I enclose payment in full.  Diner's No. \_\_\_\_\_

Budget terms: I enclose \$40 down.  Ship C.O.D.

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PE126

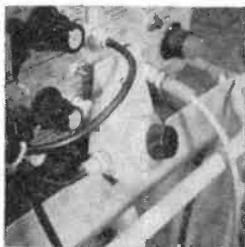
CIRCLE NO. 29 ON READER SERVICE PAGE

**PARTS**  
**METHODS**  
**IDEAS**  
**GADGETS**  
**DEVICES**

# TIPS & TECHNIQUES

## SLOPE-FRONT BOX STOPS STOOP AND SQUINT

A small slope-front box for mounting potentiometers, pilot lamps, small meters, etc., at a convenient angle for reading or accessibility can be made from a small metal box. Hold and position one section of the box next to the other and move it around until you get the slant you want. Mark cut lines on both pieces, and use a hacksaw to cut away the metal that is in your way. After you file the burrs, you can mount the component on the sloping front



as shown. Jacks and other connectors can also be mounted on the box. Use self-tapping sheet metal screws to hold the two sections together.  
—Roger White

## TROUBLESHOOT THERMAL DRIFT WITH PLASTIC "ICE CUBES"

If you have some of those drink coolers that are made of plastic with water trapped inside, you can use them to cool off hot components when you're troubleshooting for thermal drift. The novelty plastic "ice cubes" are available in a variety of sizes and shapes, and they can snuggle right up to a suspected component and draw away the heat. If circuit operation is restored after the component has been cooled, you've found the defective part.  
—Henry R. Rosenblatt



## ROTATE YOUR RADIO FOR BETTER RECEPTION

Some of the more expensive AM portable radios on the market have antennas built  
(Continued on page 20)

# STOP LOOK, LISTEN!

Everybody's Talkin' . . . about the New Mosley '67 CB Antenna Catalog. Send for your FREE copy. Write Dept. 119.

**Mosley Electronics, Inc.**  
4610 N. Lindbergh Blvd, Bridgeton Mo. 63042

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# POPULAR ELECTRONICS

## READER SERVICE PAGE

**You can get  
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Circle the number on the coupon below which corresponds to the key number at the bottom of the advertisement or is incorporated in the editorial mention that interests you.

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Mail the coupon to the address indicated below.

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**VOID AFTER JANUARY 31, 1967**

12



## **This important job (and its big salary) is reserved for a qualified electronics technician. It can be you!**

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opportunity . . . lasting security . . . and a steadily-increasing salary.

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A comprehensive program covering Automation, Communications, Computers, Industrial Controls, Television, Transistors, and preparation for a 1st Class FCC License.



#### 2. First Class FCC License

If you want a 1st Class FCC ticket *quickly*, this streamlined program will do the trick and enable you to maintain and service all types of transmitting equipment.



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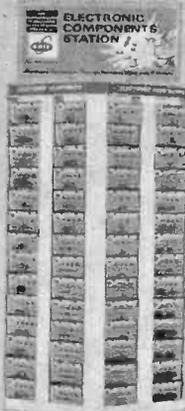
**NEWS FOR VETERANS:** New G. I. Bill may entitle you to Government-paid tuition for CIE courses if you had active duty in the Armed Forces after Jan. 31, 1955. Check box on reply card for complete information.

# CIE

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Voltages — 12 V. thru 1000 V.  
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Voltages — 200 V. thru 600 V.  
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Ceramic · Plastic · Glass  
Ranges to suit your needs

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Industry's Most Popular Types

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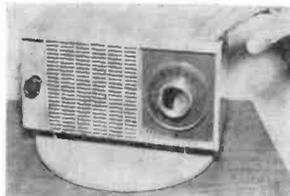
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CIRCLE NO. 46 ON READER SERVICE PAGE

## TIPS

(Continued from page 14)

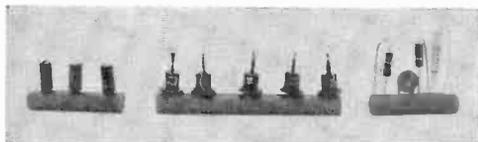
into their rotatable handles so that the antenna can be positioned for best reception. You can obtain the same results with your table radio if you set it on a plastic turntable (Lazy Susan) and rotate the whole thing. These "space-saver" turntables are sold at most dime stores



and department stores in a variety of sizes. Although metal turntables are more durable, you should avoid using them because they can cause interference; but select a stiff turntable to prevent the radio from shifting position with every vibration. —Art Trauffer

## HANDY HOLDERS FROM FLASHBULB PLASTIC PACKING

Split plastic tubing for AG-1 flashbulbs can be used on the workbench to hold small electronic components when you're constructing



a project. They also keep resistors, capacitors and other small components in one place so that you don't have to dig through piles of assorted parts for the one you need. If you wish, you can glue a narrow strip of heavy cardboard to each tube to serve as a stand.

—George E. Gates

## MAKE YOUR TRANSISTOR RADIO A WRIST-STRAP SWINGER

If your pocket-size portable radio doesn't have a wrist strap, you're just not with it.

All you need to join the swingers are a camera wrist strap and a suitable size solder lug. Remove the back of the radio, unsolder the earphone jack connections, and slip the jack out of its



mounting bracket. Place the solder lug over the threads, secure the jack, and resolder the wires. Then bend the lug to accommodate the strap, but leave enough room for the earphone plug. You can cut a notch in the plastic case if necessary, to prevent the solder lug from interfering with the back cover.

—S. E. Gohi

# If You Service Citizens Radio Transceivers...

you should have

**AN INTERNATIONAL**

**C-12B**

**FREQUENCY METER**

## Four Instruments In One

The C-12B is more than a frequency standard—it measures power output, measures AM modulation, and is a signal generator . . . all self contained in one convenient unit.

### check these features!

■ **Frequency Measurement** — Range 26.965 mc to 27.255 mc. Frequency stability  $\pm .0025\%$  32°F to 125°F;  $\pm .0015\%$  50°F to 100°F.

■ **Power Measurement** — 0 to 5 watts, accuracy  $\pm \frac{1}{4}$  watt.

■ **Counter Circuit** — Frequency range 0 to 3 kc. Residual error 100 CPS @ zero beat.

■ **AM Modulation Measurement** — Range 0 to 100%. Accuracy 3% @ 400 CPS @ 80% modulation.

■ **Signal Generator** — Frequency range 26.965 mc to 27.255 mc. Low output 1 microvolt through special pick-off box furnished with meter. High output 100 microvolts through output jack.

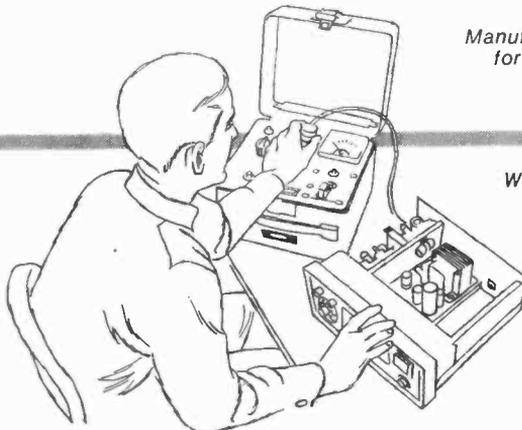
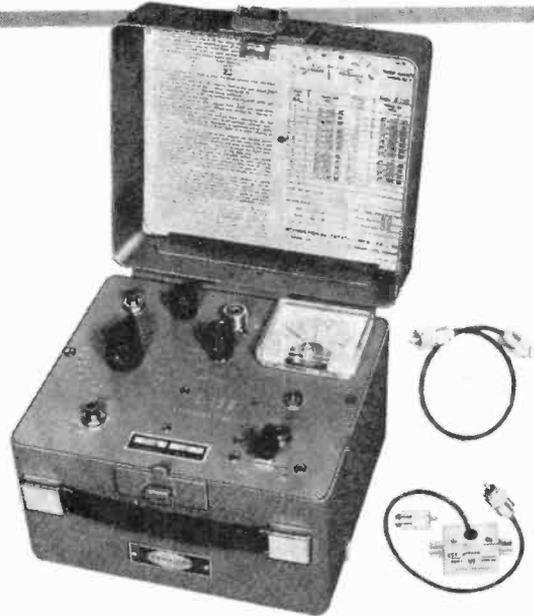
■ **Panel Controls** — Channel selector, 24 positions • "Hi-Lo" frequency adjust • RF level control • Modulation set • Power • Meter calibration adjust • Function selector, 7 positions • Modulation • RF • Deviation • Calibration • Battery Test "A" • Battery Test "B" • Battery Test "C".

■ **Battery Power Required** —  $1\frac{1}{2}$  vdc @ 60 ma,  $67\frac{1}{2}$  vdc @ 5 ma, 9 vdc.

The C-12B is capable of holding 24 crystals and comes with 23 crystals installed. Everything you need including connecting cable, PK box, dummy load, and batteries.

Cat. No. 620-101 ..... \$300.00

*Manufacturers of precision electronic products for home, industry and aerospace needs.*



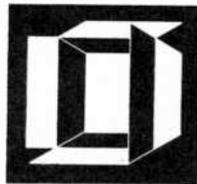
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**CRYSTAL MFG. CO., INC.**

18 NO. LEE OKLA. CITY, OKLA. 73102

CIRCLE NO. 20 ON READER SERVICE PAGE



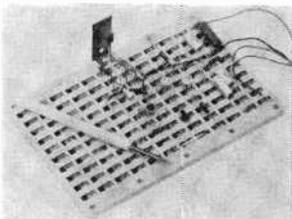
# NEW PRODUCTS

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.

## EXPERIMENTAL CIRCUIT BOARD

Want to eliminate worries about cold-solder joints, overheated devices, and burned insulation? "SPRINGBOARD," a new solderless experimental circuit board that permits the

instant addition or removal of components without damage to leads is now in production at Barry Instrument Corporation. The Model B I S - 1 0 0 S P R I N G -

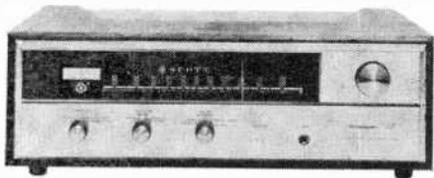


BOARD incorporates 120 ten-turn stainless steel springs that hold components securely and also act as connectors. All springs are electrically isolated from each other, but several can be joined with jumper wires as required by the circuit being constructed.

Circle No. 75 on Reader Service Page 15

## FET FM STEREO TUNER KIT

Field-effect transistor circuitry is incorporated in H. H. Scott's LT-112B FM broadcast monitor tuner kit for maximum sensitivity (1.8  $\mu$ V) and selectivity (45 dB) with minimum cross-modulation (rejection, 90 dB) and drift. An exclusive combination front-panel meter is used initially to align the tuner, and

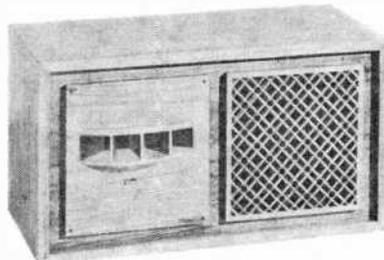


can be used to indicate signal strength, zero-center tuning, or multipath distortion. All difficult-to-wire or critical circuitry in the LT-112B is prewired, pretested, and prealigned at the factory. The kit comes with a full-color, "life-size" construction book, and with all wires precut and prestripped to the proper lengths.

Circle No. 76 on Reader Service Page 15

## THREE-WAY SPEAKER SYSTEM

Featured in the Olson Electronics Model S-777 "Ultima" system is a multi-cellular mid-range horn speaker for wide-angle dispersion of mid-frequency tones. A 12" woofer is coupled to the multicell horn and a 2 1/2" tweeter by an LC-type crossover; there are level controls on the midrange speaker and

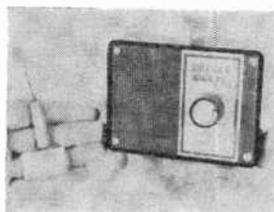


the tweeter. The midrange horn can be turned 90° in the cabinet, permitting the cabinet to be mounted either vertically or horizontally. Power-handling capacity: up to 50 watts. Impedance: 8 ohms. Frequency response: 30 to 23,000 Hz.

Circle No. 77 on Reader Service Page 15

## AUTO SAFETY ALARM

DRIVER AWAKE! That's the name of an auto safety alarm by Executive Devices which helps to keep you awake at the wheel on long drives. Its operation is based on the fact that a driver constantly moves the steering wheel back and forth slightly no matter how



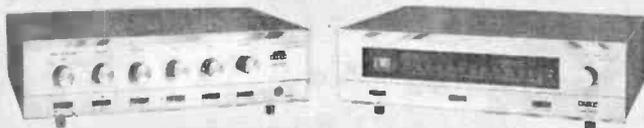
straight the highway. As the driver gets sleepy, however, the number of wheel movements declines. The DRIVER AWAKE stores your average rate of steering wheel move-

ments, and if it senses a deviation from the normal, it sounds a warning alarm. Moving the wheel slightly either way turns it off. The unit can be installed under the dash in less than two minutes, and it does not interfere in any way with steering.

Circle No. 78 on Reader Service Page 15

## PORTABLE POWER SOURCE

Most conventional portable power sources can be used for only one specific device. The lightweight, 12-volt, rechargeable CRL-1200 "Power Pack" introduced by Centralab covers a wide range of applications and can be transferred easily from one appliance to another. It is said to power most battery-operated devices for longer periods—at lower cost—than any other power source, including the original equipment battery pack. The CRL-1200 can operate continuously up to 40 hours or more—it will power a small TV set for 10 hours on



### Introducing EICO's New "Cortina Series"!

Today's electro-technology makes possible near-perfect stereo at moderate manufacturing cost: that's the design concept behind the new EICO "Cortina" all solid-state stereo components. All are 100% professional, conveniently compact (3 1/4"H, 12"W, 8"D), in an esthetically striking "low silhouette." Yes, you can pay more for high quality stereo. But now there's no need to. The refinements will be marginal and probably inaudible. Each is \$89.95 kit, \$119.95 wired.

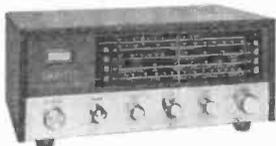
Model 3070 All-Silicon Solid-State 70-Watt Stereo

Amplifier: Distortionless, natural sound with unrestricted bass and perfect transient response (no inter-stage or output transformers); complete input, filter and control facilities; failure-proof rugged all-silicon transistor circuitry.

Model 3200 Solid-State FM/MPX Automatic Stereo Tuner: Driftless, noiseless performance; 2.4µV for 30db quieting; RF, IF, MX are pre-wired and pre-tuned on printed circuit boards — you wire only non-critical power supply.

# 7 New Ways to make Electronics more Fun!

Save up to 50% with EICO Kits and Wired Equipment.



You hear all the action-packed capitals of the world with the NEW EICO 711 "Space Ranger" 4-Band Short Wave Communications Receiver — plus ham operators, ship-to-shore, aircraft, Coast Guard, and the full AM band, 550KC to 30MC in four bands. Selective, sensitive superhet, modern printed circuit board construction. Easy, fast pinpoint tuning; illuminated slide-rule dials, logging scale; "S" meter, electrical bandspread tuning, variable BFO for CW and SSB reception, automatic noise limiter. 4" speaker. Headphone jack. Kit \$49.95. Wired \$69.95.



More "ham" for your dollar than ever — with the one and only SSB/AM/CW 3-Band Transceiver Kit, new Model 753 — "the best ham transceiver buy for 1966" — Radio TV Experimenter Magazine. 200 watts PEP on 80, 40 and 20 meters. Receiver offset tuning, built-in VOX, high level dynamic ALC, silicon solid-state VFO. Unequaled performance, features and appearance. Sensationally priced at \$189.95 kit, \$299.95 wired.



### NEW EICO 888 Solid-State Engine Analyzer

Now you can tune-up, troubleshoot and test your own car or boat.

Keep your car or boat engine in tip-top shape with this completely portable, self-contained, self-powered universal engine analyzer. Completely tests your total ignition/electrical system. The first time you use it — just to tune for peak performance — it'll have paid for itself. (No tune-up charges, better gas consumption, longer wear) 7 instruments in one, the EICO 888 does all these for 6V and 12V systems; 4, 6 & 8 cylinder engines.

The EICO 888 comes complete with a comprehensive Tune-up and Trouble-shooting Manual including RPM and Dwell angle for over 40 models of American and Foreign cars. The Model 888 is an outstanding value at \$44.95 kit, \$59.95 wired.



New EICOCRAFT® easy-to-build solid-state electronic TruKits:® great for beginners and sophisticates alike. As professional as the standard EICO line — only the complexity is reduced to make kit-building faster, easier, lower cost. Features: pre-drilled copper-plated etched printed

circuit boards; finest parts; step-by-step instructions; no technical experience needed — just soldering iron and pliers. Choose from: Fire Alarm; Intercom; Burglar Alarm; Light Flasher; "Mystifier"; Siren; Code Oscillator; Metronome; Tremolo; Audio Power Amplifier; AC Power Supply. From \$2.50 per kit.



There's more PUNCH in the new EICO "Sentinel-Pro" 23-channel Dual Conversion 5-watt CB Transceiver. New advanced Big-Reach "Range Plus" circuitry lengthens "talk-power" reach. Automatic noise limiter super-sensitizes for weak signals. "Finger Tip" antenna loading and transmitter tuning controls. 23 crystal-controlled transmit and receive channels — all crystals supplied. Rear-illuminated S/R/F meter. Transistorized 12VDC and 117VAC dual power supply. Wired only, \$169.95. Positive-Negative Ground/Mobile Marine Modification kit (optional \$5.95).



Model 460 Wideband Direct-Coupled 5" Oscilloscope. DC-4.5mc for color and B&W TV service and lab use. Push-pull DC vertical amp., bal. or unbal. input. Automatic sync limiter and amp. \$109.95 kit, \$149.95 wired.

### FREE 1967 CATALOG PE-12

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Model 232 Peak-to-Peak VTVM. A must for color or B&W TV and industrial use. 7 non-skip ranges on all 4 functions. With exclusive Uni-Probe.® \$29.95 kit, \$49.95 wired.

CIRCLE NO. 11 ON READER SERVICE PAGE

## PRODUCTS (Continued from page 22)

a single charge—and as much as 40 amperes or 480 watts can be used intermittently. Charge loss during storage is only 3% per month. The CRL-1200 comes with built-in charger in a leather carrying case.

Circle No. 79 on Reader Service Page 15

### STEREO TAPE DECK

The deluxe Model RK-880 stereo record/playback tape deck introduced by *Lafayette Radio Electronics* incorporates features usually associated with higher priced tape decks. Three heads provide four-track stereo and mono



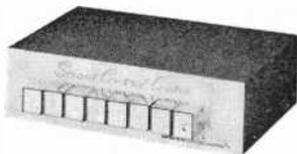
record/playback plus sound-on-sound and sound-with-sound features. In addition, the RK-880 utilizes adjustable control of playback and record equalization and bias current from

the front panel. Frequency response is 30 to 22,000 Hz at  $7\frac{1}{2}$  in/s,  $\pm 3$  dB; 40-12,000 Hz at  $3\frac{3}{4}$  in/s,  $\pm 3$  dB. Wow and flutter is less than 0.15% at  $7\frac{1}{2}$  in/s, less than 0.25% at  $3\frac{3}{4}$  in/s. Signal-to-noise ratio: over 53 dB. The unit can be operated either horizontally or vertically.

Circle No. 80 on Reader Service Page 15

### SPEAKER SWITCHING SYSTEMS

Instant multiple-output selection of up to eight stereo speaker systems is possible with the Models 641 and 642 "Sound Control Centers" announced by *Switchcraft, Inc.* Model 642 is designed for situations where simultaneous distribution of sound to more than one stereo speaker system is desired; Model 641 restricts sound distribution to one stereo speaker system at a time. Frequency response through the internal switching network of both units is from d.c. to 30 kHz with negligible switching loss. No external power (other than the audio power being distributed) is required for operation. Power-handling capability is 100 watts maximum into a 4-ohm load.



Circle No. 81 on Reader Service Page 15

### AUTO "HASH HUSHERS"

"Hash Husher" kits have been developed by the *Hallett Manufacturing Company* to reduce the electrical interference to mobile re-

ceivers (hash) caused by ignition noise pulses. The kits consist of electronic RL filters that snap into place between spark plugs and leads, plus a special, filtered coil-to-distributor high-tension lead. Hash Hushers fit all standard gasoline engines, won't affect mechanical or electrical operation, and can be installed in minutes.

Circle No. 82 on Reader Service Page 15

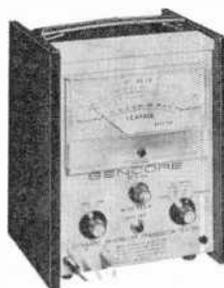
### PLASTIC LIGHT GUIDE KIT

"CROFON" light guides are now available in a do-it-yourself kit from *Edmund Scientific Company*. These plastic fiber optics, recently developed by DuPont, transmit light around corners, to many outlets from a single source, and into remote and inaccessible places. Used with photocells, they will count, select, detect, and sort by size, shape, and color. The Edmund kit includes two 2-foot lengths of the light guides, one with 16 fibers, the other with 64—which transmits four times the amount of light; concentrating lens; penlight-type light source (less batteries); and adapter for connections. It also contains all material needed to polish and cap the ends of the guides—plus detailed instructions.

Circle No. 83 on Reader Service Page 15

### IN-CIRCUIT TRANSISTOR TESTER

Rather than pulling each transistor for out-of-circuit or substitute testing, *Score's* TR-139 lets you check any transistor or diode



without disconnecting a single lead. The TR-139 provides two important readings: true a.c.  $\beta$ , the gain factor of a transistor, and leakage current ( $I_{cbo}$ ) in microamperes. In-circuit and out-of-circuit test procedures are identical. A specially designed circuit in the unit protects the most delicate low-current-type transistor

or diode from damage even if the leads are accidentally hooked up backwards. And parameters of unknown transistors can be determined without a setup book or manual.

Circle No. 84 on Reader Service Page 15

### SCREWDRIVER KITS

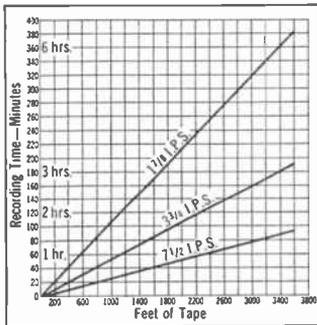
Two new Series 99 "Plastic View" kits, each with a  $1\frac{1}{16}$ " x  $4\frac{1}{8}$ " handle and a selection of interchangeable, single-ended screwdriver blades have been introduced by *Xcelite*. A handy "hang-up" eyelet is provided in each compact, see-through, zipper case. Handles are of shockproof, breakproof amber plastic, and will accept any of the interchangeable screwdriver, nutdriver, and other blades in Xcelite's extensive Series 99 line. Blades are of high carbon steel with highly polished nickel-chrome finish.

Circle No. 85 on Reader Service Page 15

Some plain talk from Kodak about tape:

## Uninterrupted listening pleasure... and the answer to a searching question

Recording a pop tune or even the whole top ten isn't much of a problem with standard sound tapes. But people always want more—like getting a whole Wagnerian opus on a single reel. Actually, the problem of long playing time involves two variables: how fast you run the tape, and how much tape length you get on a reel. The following chart will give you an idea of running times with different lengths of tape:



**Some like it slow.** Taking it slow is the obvious way to get longer playing time. This works very well up to a point. As a matter of fact, it is the historical trend—from 15 ips to 7½ ips to 3¾ ips and so on. But as you cut speed, you make the microscopic perfection in the tape more and more important. Furthermore, at slow speeds the increased dependence upon short wavelength information and the concurrently reduced flux-carrying capacity of the tape makes head design more difficult. But even though improved quality slow-play tape recordings are strongly dependent upon improved equipment, you are still ahead with the built-in quality of KODAK Tapes—high output tape Type 34A, with its output and noise advantages, or low-print tape Type 31A.

**Some like it thin.** The other avenue is to go to a thinner tape . . . one that packs more length on the reel. This too is an appealing idea—one that explains the proliferation of double and triple play tapes. So what's the catch? Well, for one thing, very thin tapes require careful habits on the part of the home recordist. Your recording/playback heads should be in good shape, as thin tape is more liable to physical distortion and breakage. Strive for smooth starts and stops. You can help by turning the reels away from one another (gently, please) so as to take up any slack in the tape which may have occurred during threading. Also, forget the fast-rewind knob—store tapes "as played." Fast rewind can set up a lot of tension and often cause erratic winding. All this can result in "stretched" or "fluted" tapes. In a nutshell, treat thin tapes with loving care.

When you record, be careful not to overload on input (if you have a VU meter, keep the needle slightly below the record level you would normally use for regular tape).

Last but not least, make sure you get your tape from a reliable maker—like Kodak. It takes a lot of extra care in winding, slitting and over-all handling to come up with a superior triple-play tape like Kodak's famed Type 12P. Because of its highly efficient oxide, Type 12P gives you a signal-to-noise ratio better by close to 6 db compared to the other leading triple-play tape. Add to this the advantage of back printing (so you always know what type of tape you're using—even when it's in the wrong box), and a dynamically balanced reel that reduces the stress and strain on a thin tape, and you can see why KODAK 12P Tape is becoming so popular.



KODAK Tapes — professional types and the long-playing variety — are available at most electronic, camera, and department stores. If you've had trouble finding them at your favorite store, Kodak would like to help. Simply tell us where you'd like to buy KODAK Tape, and we'll see what we can do about having these stores stock it. In the meantime, we'll rush you the names of nearby Kodak dealers where you'll be sure to find KODAK Tape; also, a very informative booklet "Some Plain Talk from Kodak about Sound Recording Tape." Just fill out the coupon.

— Mail coupon today —

Eastman Kodak Co., Dept. 940  
Rochester, N. Y. 14650

Gentlemen: I would like to be able to get KODAK Sound Recording Tape at the following stores:

1) \_\_\_\_\_  
Camera store

2) \_\_\_\_\_  
Department store

3) \_\_\_\_\_  
Electronic supply store

Please send names of nearby outlets and my free copy of "Some Plain Talk from Kodak about Sound Recording Tape."

Name \_\_\_\_\_

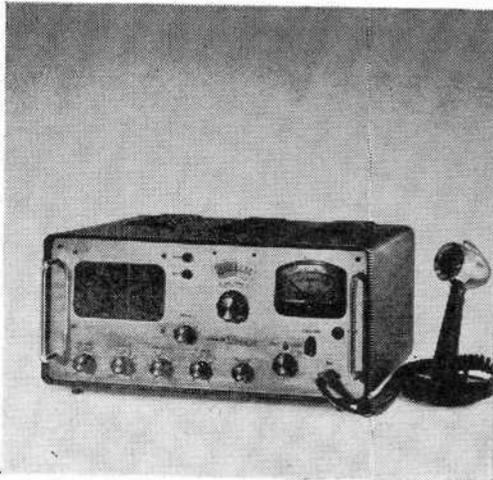
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City & State \_\_\_\_\_ Zip \_\_\_\_\_

EASTMAN KODAK COMPANY, Rochester, N. Y.

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*Incomparable  
Excellence*



## The Super-Sharp TRAM TITAN CITIZENS BAND BASE STATION

\*Multi-function meter reads: "S" units, SWR, and absolute power in watts into built-in dummy load. Measures power through the antenna.

\*Super-sharp selectivity with Collins mechanical filter—adjacent channel rejection is 90 db or better. \*First class sensitivity. \*All 23 transmit channels.

\*Transmitter delivers 3.5 watts minimum output; separate indicators for carrier on and modulation. \*RF gain control.

\*Tone control. \*Built-in low pass filter for minimum T.V.I. \$434.

For full details write:

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# ELECTRONICS LIBRARY

## DIRECT CURRENT CIRCUITS AND MEASUREMENTS

by Charles J. Anderson, Anthony  
Santaneli, and Fred R. Kulis

Beginner and advanced student alike will find this book a noteworthy presentation of self-instructional material designed to equip the reader with a working knowledge of d.c. circuits, using only algebra and general science. The book is organized to permit a quick reference review of important fundamentals. Readers wishing to take a refresher course are easily programmed through the text by simple notations. One of the better books in programmed self-instruction.

Published by Prentice-Hall, Inc., Englewood Cliffs, N.J. 07632. 346 pages. Hard cover. \$12.00.



## ALLIED ELECTRONICS DATA HANDBOOK, Fifth Edition

The latest edition of the *Allied (Radio) Electronics Data Handbook* is about the most complete compact reference book on the market today—it's surprising how much information can be sandwiched into 112 pages. There is something in this handbook for everyone from the graduate engineer to the beginning student in electronics. The new edition is much larger than the last one and is chock full of specialized information as well, such as the tape recording and TV sections, to name only two. The handbook also has trigonometric tables and a cross-reference of American and foreign tubes. This book is a real time-saver and is highly recommended.

Published by Allied Radio Corp., 100 North Western Ave., Chicago, Ill. 60680. 112 pages. Soft cover. 75 cents.



## ABC'S OF CAPACITORS

by William F. Mullin

What is a capacitor? How is it made? Where is it used? These and many more questions you might have about capacitors are answered in refreshingly readable language in William F. Mullin's new text. Technicians, servicemen and students will find this book a valuable aid in practical applications and classroom studies. *ABC's of Capacitors* is designed to tear away the shroud of mystery around capacitors.

Published by Howard W. Sams & Co., Inc., 4300 West 62 St., Indianapolis, Ind. 46206. 96 pages. Soft cover. \$2.25.

—30—

You don't even have to gift wrap  
the most useful gifts for Christmas



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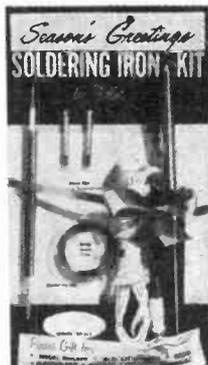
## SOLDERING KITS

for electrical soldering, household repairs, hi-fi building, hobbies and crafts

**Dual heat soldering gun kit.** Includes 100/140 watt dual heat gun with 2 trigger positions, 3 soldering tips, soldering aid, tip wrench, flux brush, solder, rugged \$8.95 list plastic case. Model 8200PK

**Heavy duty dual heat soldering gun kit.** Features a 240/325 watt heavy duty gun; 3 tips for soldering, cutting and smoothing; tip-changing wrench; solder; break proof \$12.95 list plastic case. Model D550PK

**Marksman soldering iron kit by Weller.** Featherweight 25 watt iron outperforms all other irons of its size and price. Kit includes 3 different tips, soldering aid and solder. Model SP23K \$4.44 list



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**READ WHAT  
THE EXPERTS SAY  
ABOUT THE**

***knight-kit***<sup>®</sup>

**EXPOSURE METER**



**POPULAR PHOTOGRAPHY—May, 1965—**  
“Any way we look at it, this kit is an excellent buy. And the lure is strong: a fine meter at far less than ‘readymade’ cost . . .”

**RADIO-ELECTRONICS—October, 1965—**  
“Wiring up some kits these days can be a major project, taking dozens of hours. This little Knight-Kit is refreshingly different—my 14-year-old daughter wired it and put it into action late one Sunday afternoon.

Most striking thing about this one is the ease of taking a reading.”

Yes, the easy-to-build KNIGHT-KIT KG-275A has a taut-band two-range meter that outperforms units costing far more. Uses battery powered cadmium-sulphide photocell so sensitive you can take a reading by moonlight. Gives you correct exposure for perfect pictures—black and white or color . . . movies or stills.

Complete with instructions, neck cord and batteries. . . . . **\$19.95**

Rush coupon for details and Introductory Offer

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Please rush—free and without obligation—Special Introductory offer on the Knight-Kit KG-275A Exposure Meter.

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**CIRCLE NO. 23 ON READER SERVICE PAGE**

**NEW  
LITERATURE**

To obtain a copy of any of the catalogs or leaflets described below, simply fill in and mail the coupon on page 15.

“Scott Stereo” is the title of a new 16-page multi-color brochure published by *H. H. Scott, Inc.* It answers the question “What Is Stereo?” and tells you what to look for in buying stereo components. All Scott receivers, speakers, amplifiers, and tuners are pictured and described, both factory-wired and kit units, and complete specifications are included.

Circle No. 86 on Reader Service Page 15

*Mark Products’* “Heliwhip” mobile amateur band antennas with “Static Sheath” are featured in a 4-page antenna catalog (plus inserts). “Static Sheath” is a durable dielectric plastic covering that acts as an electrical insulator and eliminates static interference caused by the precipitation effect. A complete line of antenna mounts and accessories is also covered.

Circle No. 87 on Reader Service Page 15

In addition to the regular line of electronic kits, *Conar Instruments’* 1966 Christmas Catalog carries a considerably expanded line of general products, including some items just being introduced on the market. Products have been “departmentalized” and the index made more convenient. Featured are the Conar Model 800 CCTV camera, the “Audio-color,” and the “300” stereo system.

Circle No. 88 on Reader Service Page 15

Bulletin No. 94025, put out by the *Clevite Corporation*, outlines major reasons why ceramic filters are finding new opportunities to replace LC, quartz, and mechanical filters in military and commercial equipment. Five different kinds of ceramic filters, representative of models in production, are illustrated and described in detail.

Circle No. 89 on Reader Service Page 15

A data sheet on *Triplet Electrical Instrument Company’s* recently introduced Model 630-APLK volt-ohm-milliammeter emphasizes its solid-state switching circuit which guards against accidental burnouts and bent pointers and provides overload protection. Other technical features and specifications are listed, and optional carrying cases and attachments are also described.

Circle No. 90 on Reader Service Page 15



# 2 watts or 100 milliwatts



... at Ray-tel  
the C-B portable  
situation is  
well in hand



## AM-100, 100MW transceiver.

... AM-100 personalized 6 transistor C-B unit and excellent AM broadcast radio for news, music, sports. Wonderful for football, baseball games. Hear broadcast, switch to talk with friends in stands, etc. Supplied with leather carrying case, earphone in case, crystals for Channel 11, telescoping antenna.

Complete  
37.50 ea.



Write for QIK-FACTS  
brochures on  
TWR-8, AM-100

TWR-8, full 2 watts input power, 14 transistor hand-held portable. Extra small and conveniently carried. Delivers solid signals under conditions where other units drop out. 2 channels—earphone for privacy in crowds, etc. 2 antennas: 10 section whip and 9½" "stubby" plug-in type where clearance is low as under trees, in warehouses. Sensitive superheterodyne receiver—noise limiter—squelch. A complete big value package with 2 ni-cad batteries, battery charger, crystals for Channel 11, earphone in case, leather carrying case, 2 antennas ..... 119.95

RAYTHEON COMPANY

RAYTHEON

213 East Grand Avenue, South San Francisco, California 94080

CIRCLE NO. 48 ON READER SERVICE PAGE

## New JERROLD

# PARALOG Plus™

### improves color reception three ways

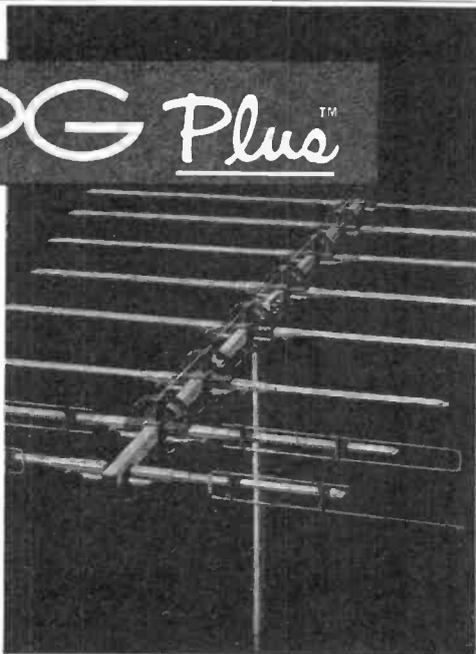
1. **Plus GAIN** — provides sharper directivity to eliminate multipath reception.
2. **Plus FLATNESS**—eliminates tilts which cause incorrect colors on the TV screen. Industry experts say that color antennas must be flat within  $\pm 2$  db. Paralog-Plus antennas are flat within  $\pm 1$  db per channel.
3. **Plus MATCH**—to prevent color-distorting phase shifts.

To give you these *exclusive* color features Paralog-Plus has a unique Bi Modal Director system that actually works on high and low band channels simultaneously, making each element serve double duty.

What's more, you get a choice of 300 and 75 ohm coaxial outputs, *plus* excellent gain over the entire FM band. For the greatest realism in lifelike color, try the Paralog-Plus.

December, 1966

CIRCLE NO. 21 ON READER SERVICE PAGE



## JERROLD

JERROLD ELECTRONICS CORPORATION  
DISTRIBUTOR SALES DIVISION  
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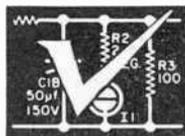
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**OPERATION  
 ASSIST**

Through this column we try to make it possible for readers needing information on outdated, obscure, and unusual radio-electronics gear to get help from other P.E. readers. Here's how it works: Check the list below. If you can help anyone with a schematic or other information, write him directly—he'll appreciate it. If you need help, send a postcard to Operation Assist, POPULAR ELECTRONICS, One Park Avenue, New York, N.Y. 10016. Give maker's name, model number, year of manufacture, bands covered, tubes used, etc. State specifically what you want, i.e., schematic, source for parts, etc. Be sure to print or type everything legibly, including your name and address. Because we get so many inquiries, none of them can be acknowledged. POPULAR ELECTRONICS reserves the right to publish only those items not available from normal sources.

**Crosley Model 616 receiver**, ser. 1136823; tunes s.w. from 540 kHz to 20 MHz on 3 bands; has 6 tubes. Schematic and source for parts needed. (Cliff Briere, Rt. 4, Box 283, Mechanicsville, Va. 23111)

**Eicor Model 400 tape recorder**, ser. T 1347; has 5 tubes. Schematic and plug-in erase/record/playback head needed. (Harold E. Reinbold, 123 S. 6 St., N. Wales, Pa. 19454)

**Letline Model 240 transmitter**; covers bands from 160 through 10 meters; has 6 tubes. Schematic, operating manual, and parts list needed. (F. J. Burgess, 15318 Deerfield, E. Detroit, Mich. 48021)

**Rogers Majestic Type 20 receiver**, circa 1935; tunes 145 kHz to 19 MHz on 4 bands; has 11 tubes. Schematic, alignment data, and service manual needed. (Mike Thompson, 3388 E. 27 Ave., Vancouver 12, B.C., Canada)

**Patterson Radio Co. Model 223 PR-10 receiver**, circa 1930; tunes BC band to 15 meters; has 10 tubes. Schematic needed. (Arnold R. Achille, 896 Kingston St., Aurora, Colo. 80010)

**Dumont CR oscillograph**, type 303, ser. #1086, circa 1950. Schematic and instruction manual needed. (Larry A. Yonkey, Rt. 2, 1759 7 Mile Rd., Pinconning, Mich.)

**Packard Bell Model 602 receiver**; tunes BC; has 6 tubes. Schematic needed. (Wayne Hellstrom, 2716 E. Melrose, Walla Walla, Wash. 99362)

**BC-721-B/SCR-585-B receiver**, made by Galvin. Schematic, operating manual, and source for parts needed. (A. Tasker, 72 Belmont St., Reading, Mass. 01867)

**Crosley Model 50 receiver**. Schematic and WX12 tube needed. (John Schwerbel, Rt. 1, Box 215, Catskill, N.Y.)

**Just-Tone Model 30417 receiver**; tunes AM and FM. Schematic needed. (Bruce Conrad, Rt. 1, Windsor, Vt.)

**Johnson Service Co. Model ML-310G/AMT-1 radiosonde modulator. Molded Insulation Co. Model T-69C/AMT-1 radiosonde transmitter**. Schematics and instruction manuals needed. (Richard Teh, McCallsburg, Iowa 50154)

**National Model SW-3 receiver and power supply**, circa 1934. Schematic and operating manual needed. (L. Mueller, 12700 Elliott Ave., SP287, El Monte, Calif. 91731)

**Sparton Model 7-36 receiver**; tunes 1.6 kHz to 18 MHz on 3 bands; has 7 tubes. **Emerson Model CS-268 receiver**; tunes on 2 bands; has 6 tubes. Schematics and parts lists needed. (Carl Mason, Box 311, Rt. 1, Holmdel, N.J. 07733)

(Continued on page 32)

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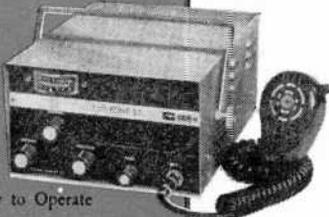
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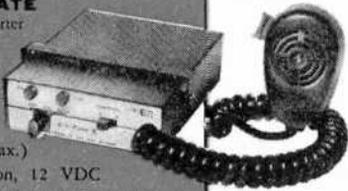
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## ASSIST (Continued from page 30)

**Garod** neurodyne receiver, ser. 6000, circa 1923; has 4 tubes. Operating manual, power supply, antenna data, and source for C-301A and CX200-A tubes needed. (Harry J. Donovan, 199 Nesbitt Terrace, Irvington, N.J. 07111)

**Golden-Leutz** "Super Pilotdyne" receiver, type 9, ser 140, circa, 1923; has 9 tubes. (R. Borduas, 8060 Vidal St., St. Hyacinthe, Quebec, Canada)

**Grebe** CR-11, CR-15, and CR-17 receivers. Schematics and/or operating manuals wanted for personal collection of historical radio receivers. (J. C. Gillespie, Box 239, Park Ridge, N.J. 07656)

**Stewart-Warner** Model 11-7A receiver. Schematic needed. (Jack A. Merrell, SFC NCOIC, Radio TV Repair Shop, U.S. Army, Disciplinary Barracks, Ft. Leavenworth, Kan.)

**Midwest** Model 916 receiver, series 16; tunes AM and FM; has 16 tubes. Operating manual needed. (Mike Peterson, N. 5207 Post, Spokane, Wash.)

**Supreme** Model 665 composite video generator, ser. 28S. Schematic and instruction manual needed. (J. P. Maley, 95 Fairbank Ave., Toronto 10, Ont., Canada)

**Hickok** Model 228X crystal-controlled FM-AM signal generator. Schematic and service manual needed. (Daniel Gibbons, Box 84, Talara, Peru, S.A.)

**REP 10D-142B** receiver, surplus, made by RCA for Royal Canadian Air Force. Schematic and service manual needed. (H. W. Baurne, Box 693, Campbellford, Ont., Canada)

**Stewart-Warner** Model 91-1117 receiver; has 10 tubes and magic eye. Schematic, alignment procedure, knobs, and dial holder needed. (Clyde Propst, Rt. 2, Sellersville, Pa. 18960)

**Triplet** Model 1632 signal generator, circa 1940. Operating manual needed. (W. Taylor, 11 Terrace Ave., Willowdale, Ont., Canada)

**Sparton-Withington** Model 10Y21 receiver-phonograph combination, circa 1942; tunes AM and s.w.; has 2 tubes and magic eye. Schematic needed. (Fred Budig, 315 E. 93 St., New York, N.Y. 10028)

**Collaro** Model RC54 record changer. Source for replacement needle needed. (Mark Handley, 31 Mohawk Dr., Clarendon Hills, Ill. 60514)

**DeForest** oscilloscope; has 4 tubes plus cathode-ray tube and 8 controls and 4 input jacks. Schematic and operating manual needed. (Henry Warchall, 4055 W. Melrose, Chicago, Ill.)

**RK34** tube needed. (David Hamilton, River Rd., Rt. 1, Paw Paw, Mich. 49079)

**Philco** receiver, chassis P29758 (?), circa 1935; tunes 530 kHz to 7.4 MHz on 2 bands; has 5 tubes. Schematic and power supply filter capacitors needed. (Stanley Blair, Rt. #3, Ballston Spa, N.Y. 12020)

**Atwater-Kent** Model 60C receiver, circa 1929; tunes BC; has 8 tubes. Schematic, parts list, and service information needed. (Frank V. Carr, 2210 Eufaula Ave., Birmingham, Ala. 35208)

**Radio Craftsman** Model C-800 tuner-preamp, ser. H33855, circa 1953; tunes AM and FM; has 15 tubes plus tuning eye. Schematic and operating information needed. (M. Denno, 1661 Taylor St., San Mateo, Calif.)

**Sterling** "B" battery eliminator, type R-81; has Raytheon BH tube. Schematic or operating manual needed. **Magnavox** Model 151 B radio-phonograph combination; tunes AM and s.w. Schematic or service notes needed. (Brian Kennedy, 2875 Kenmore Pl., Santa Barbara, Calif. 93105)

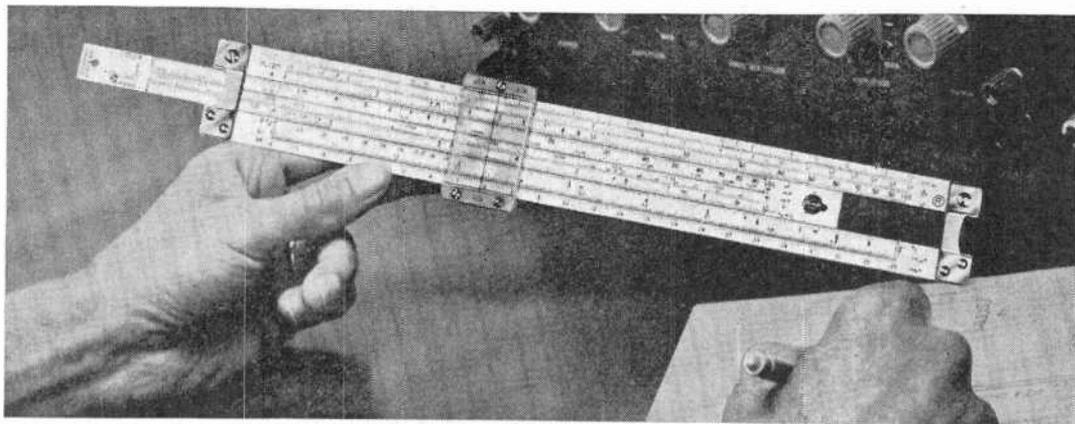
**Harvey-Wells** Model "Bandmaster Deluxe" 50D transmitter, circa 1950; tunes 3.5 to 144 MHz on 8 bands. Schematic, operating manual, and VFO needed. (G. F. Huffines, 2073 Aheita Dr., Pleasant Hill, Calif.)

**Emerson** Model OP-8QS-509A receiver; tunes 550 kHz to 18 MHz on 2 bands; has 6 tubes. Dial cord information needed. **Atwater Kent** amplifier, type TA; has 2 audio stages. Schematic, battery and receiver connection information needed. (Chuck Ridenour, Rt. 1, Box 408, London, Ohio 43140)

**Rocket** Model 8HL TV receiver, made by Egawa Electric Lab Co. Inc. of Tokyo, Japan. High-voltage transformer ZC105726 needed. (E. J. Bunker, 1804 Thornbury Rd., Baltimore, Md. 21209)

(Continued on page 38)

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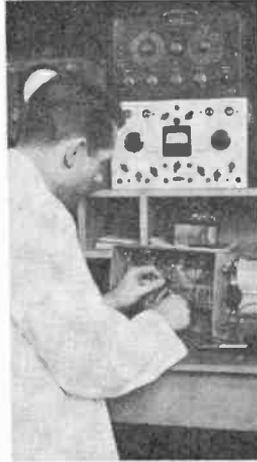
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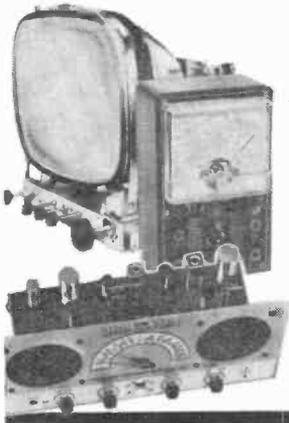
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## ASSIST

(Continued from page 32)

Millen secondary frequency standard, type 90501, ser. 1151. Schematic and service manual needed. (Harry M. Hammond, 1095 Arlington Ave., Teaneck, N.J. 07666)

CFT-46154 receiver, made by Federal Radio Telegraph Co. Parts list and operating manual needed. CRV-20130 power supply, used with CFT-46154, made by RCA. Schematic and manual needed. (Robert H. French, 450 38 St., Bellaire, Ohio 43906)

Hallicrafters Model S-22-R receiver. Output transformer needed. (Richard Harris, Box 284, Camilla, Ga.)

Atwater-Kent Model 55C receiver; has 7 tubes. Operating manual, parts source, and celluloid tuning dial and cabinet needed. (James Chew, 900 N. 4 St., Jeannette, Pa. 15644)

Atwater-Kent Model 33 receiver. Sockets and coils needed. Atwater-Kent Model 20. Two audio transformers with 3 hole mounts needed. (J. N. Clapp, 1516 Elm St., Davenport, Iowa 52803)

Firestone Model R-316-A receiver, ser. 116047; tunes s.w. Schematic and tube complement information needed. (Wayne Aho, 13 Memorial St., Baldwinville, Mass. 01436)

F.M. Link Model 1905 receiver; has 13 tubes. Schematic and alignment information needed. (R. Leon Bridwell, Box 176, Antlers, Okla. 74523)

Millen synroscope, type CJA-60ACM, surplus. Conversion diagram needed. (Fred Jahn, 1675 Oriole St., San Leandro, Calif. 94578)

B & K Models 500 & 550 tube testers. Tube checker adapters needed. (Bill T. Brinson, 608 N. Shartel, Oklahoma City, Okla. 73102)

Atwater-Kent Model 44 receiver; has 8 tubes. Source for tubes needed. (Dave Beal, 501 Pleasant Hill Ct., Rt. 1, Duluth, Ga.)

Hickok Model 530-B tube tester, circa 1939. Instruction manual needed. (R. L. Trott, 1690 Sharkey St., Tallahassee, Fla. 32304)

Cossor Model 1035 oscilloscope, circa 1954. Schematic and operating manual needed. (J. F. Rich, 94 Neilson Dr., Etobicoke, Ont., Canada)

Creative Electronics Model "Transcon 10" transmitter and converter, circa 1957. Schematic and operating manual needed. (Dick Hutchinson, 1705 Kaywin Ave., Bethlehem, Pa. 18018)

Motorola Model PA-8343-A receiver; tunes FM from 152 to 174 MHz. Source for parts needed. (G. D. Griffin, 322 W. State St., Ithaca, N.Y. 14850)

CW-50124 demodulator, surplus, circa 1948. Operating manual and tube source needed. (Gery Sasko, Box 552, Rt. 1, Monongahela, Pa. 15063)

Weidenhoff Model 1004 ohm-capacity meter, ser. 5994. Schematic, operating and alignment information needed. (Michael Sidey, 427 Grace Ave., Garfield, N.J. 07026)

Superior Model 670-P VOM. McMurdo-Silver Model 900 "Vomax" VTVM. Schematics needed. (R. S. Davey, Box 58, Frankfort, Ind. 46041)

Superior Model TW11 tube tester. Tube chart roll needed. Feiler Model TS9 VTVM. Schematic needed. (Leo Pencok, 10678 St. Charles Rd., Sumner, Mich.)

Grunow Model 1291 receiver, chassis 12B; tunes 550 kHz to 18 MHz on 2 bands; has 12 tubes. Schematic needed. (Robert McDaniel, 711 4 St., Fairbury, Nebr.)

Zenith Model 58-29 receiver, ser. N225899; tunes 550 kHz to 18 MHz. Motorola TV receiver, chassis 27E90129, circa 1948; has 14 tubes. Schematics needed. (Joe Rock, Jr., Box 162, Knoxville, Md. 21758)

Gonset "Communicator II" transceiver, ser. CM 7357. Hallicrafters Model S-38D receiver, ser. F 129310. Operating manuals needed. (James Lincoln, 12 Crestview Terrace, Wallingford, Conn. 06492)

Airline Model 14BR904A receiver; tunes on 5 bands; has 10 tubes. Schematic and operating manual needed. (Mike Timmons, 14200 S.W. 184 St., Miami, Fla.)

Electronic Research Associates Model 50TM power supply. Schematic and operating manual needed. (Thomas McCarthy, 367 Bergen Blvd., Oradell, N.J.)

(Continued on page 87)

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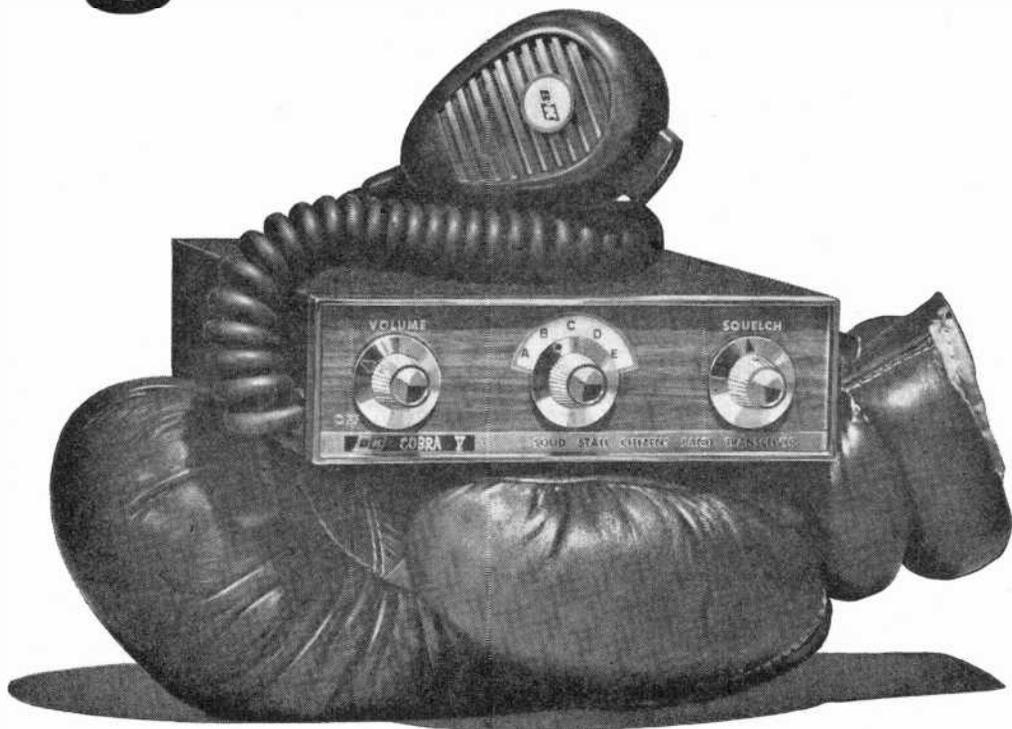
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## SCIENCE FAIR PROJECT

# THE LOGIC DEMON

USING INTEGRATED CIRCUITS (IC'S),  
THE DEMONSTRATOR DUPLICATES THE LOGIC FUNCTIONS  
OF GIANT ELECTRONIC COMPUTERS

By DON LANCASTER

**E**VER wondered how is it that electronic computers are able to exhibit such a distinctively human characteristic as making logical decisions? Ask the "Logic Demon" and it will tell you that, very simply, the answer lies in the truth of logic—computer logic.

And what IS logic? It is the process of determining, by deductive reasoning, the means of obtaining a desired result from a given set of conditions. Consider the following paradoxical dialogue involving *formal* logic which dates back to Aristotle:

*Socrates*: "What Plato is about to say is false."

*Plato*: "Socrates has just spoken the truth."

Now, if Socrates spoke the *truth*, then Plato's statement must be *false*. But if Plato's statement is *false*, then Socrates

*did not* speak the truth and, hence, what Plato said must have been *true*. If Plato spoke the *truth*, then Socrates also spoke the *truth*, and hence what Plato said is *false*. Needless to say, this circular process could go on and on. But can this formal logic be reasoned out mathematically?

The Logic Demon, utilizing the latest in resistor-transistor logic (RTL) circuitry, can serve as a demonstrator/trainer in computer logic—the same logic used by the giant sophisticated digital computers. And you can build the Logic Demon for under \$10 to show off at your next Science Fair.

**Computer Logic.** Computer logic, also known as Boolean Algebra, translates Aristotle's *formal* logic to a *mathematical* logic which can be used for reasoning

out problems. Developed by Augustos De Moran and George Boole over 100 years ago, Boolean Algebra (computer logic) was crystalized in 1938 by Claude E. Shannon who, while studying for his Master of Science degree at M. I. T., applied it to the solution of switching problems.

As an example of Shannon's application of computer logic to solve practical problems, consider the simple series circuit shown in Fig. 1. Two switches (A and B) are in series with lamp I and a battery. If you ask which switch must be closed in order for current to flow and light the lamp, the answer would be that *both* switches—A AND B—must be closed. Thus, the circuit is called an AND gate. A gating circuit is one that operates as a switch to apply or eliminate a signal.

Following a logical procedure, a table can be made listing all possible switch combinations to prove that switches A and B must be closed at the same time or current will not flow. Thus,

Switch "A"	Switch "B"	Lamp "I"
Closed	Closed	Lights
No	No	No
No	Yes	No
Yes	No	No
Yes	Yes	Yes

As shown in the table, a "yes" appears in the lamp column only when a "yes" appears in both switch columns. The table can be simplified by substituting a "0" (zero) for a "no" and a "1" for a "yes." This allows us to establish a convention to symbolize that a statement or condition is *false* when a 0 is represented, while a 1 can be used to denote that a statement or condition is *true*. The simplified table is as follows:

Switch "A"	Switch "B"	Lamp "I"
Closed	Closed	Lights
0	0	0
0	1	0
1	0	0
1	1	1

In computer logic (also called symbolic logic), the preceding table is known as a *truth table* for the logical AND for it represents the simple true statement that the lamp lights only when both A AND B are closed at the same time.

If the same switches are rearranged and connected in parallel as shown in Fig. 2, the following table can be pre-

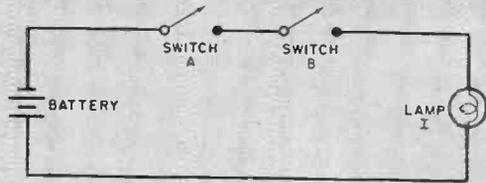


Fig. 1. Switches A and B in series with a battery and lamp can represent the logical AND circuit.

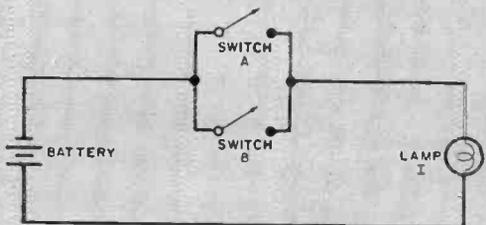
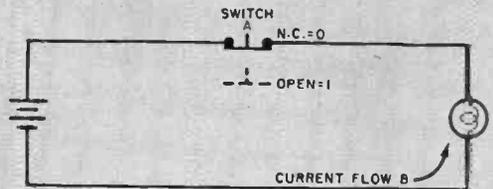


Fig. 2. In the logical OR circuit, current flows if either switch A or switch B, or both, are closed.



SWITCH A	CURRENT B
0	1
1	0

Fig. 3. In this circuit, the lamp lights when A is NOT pushed; the circuit is called a NOT gate.

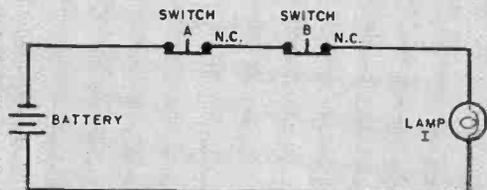


Fig. 4. A NOR gate is represented by adding one or more switches to the NOT gate described above.

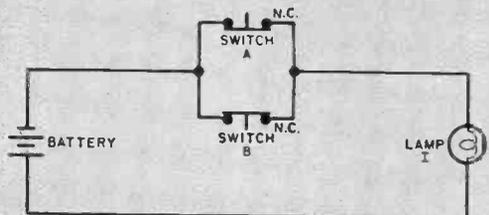


Fig. 5. The NAND function can be depicted by normally closed parallel-connected switches A and B.

pared to show for what switch combination the lamp will light:

Switch "A" Closed	Switch "B" Closed	Lamp "I" Lights
0	0	0
0	1	1
1	0	1
1	1	1

The lamp lights when either one or both of the switches are closed. Thus, logically, *I* is 1 (true) whenever *A* OR *B* (OR *A* and *B*) is true (closed), and the circuit is called a logical OR gate.

Consider the circuit of Fig. 3. Unactuated, normally closed (NC) switch *A* represents a 0, but when pressed, the switch represents a 1. The corresponding truth table asserts that *B* (current flow) is 1 whenever *A* is 0, and that *B* is 0 whenever *A* is 1. In other words, the lamp lights (is 0) when the switch is NOT pushed, and is extinguished when the switch is pushed (1). The circuit is characterized by a single switch, and is called a NOT gate (inverter).

By adding one or more switches to the NOT circuit, we come up with what is called a NOR gate (Fig. 4). A truth table for this circuit would state simply that *C* (current through the lamp) is true only if both *A* and *B* are false, and that *C* is false if either *A* or *B* is true. Since these conditions represent the opposite (negative) of the OR—NOT OR—it is called simply a NOR gate.

The opposite (NOT) of the AND gate can be represented by the circuit of Fig. 5. The NOT AND, or briefly, NAND, function can be depicted by the normally closed parallel-connected switches (*A* and *B*). The lamp lights if *either* or *both* switches are left in their "0" position. But it will be extinguished if both switches are "1" (pressed) at once.

**Applying Computer Logic.** A computer is capable of carrying out a long string of YES-NO decisions without having to repeatedly ask for more information as the operation progresses.

Depending on the complexity of the problem to be solved, thousands upon thousands of such decisions, may be needed for mathematical problems requiring addition, subtraction, multiplication, and division. Programmed instructions, stored in the computer's memory, coordinate all operations, time

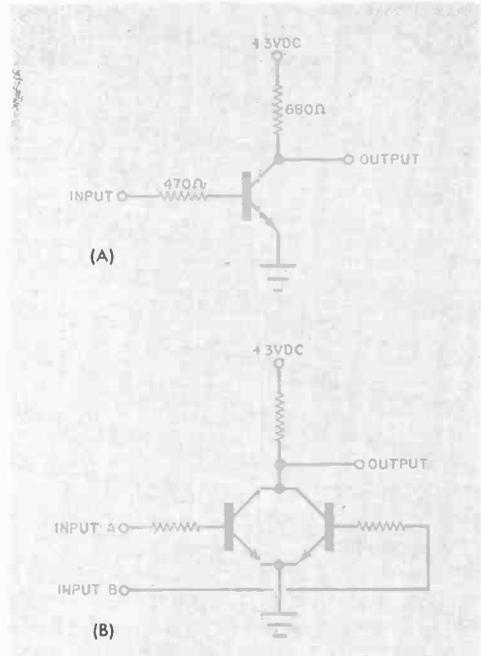


Fig. 6. NOT operation can be performed by a one-input RTL gate shown in (A). A two-input gate (B) can serve either as NOR or NAND circuit.

them for proper sequence, and route the information in the proper sequence to the various registers and output devices.

Logic gates can be constructed with such devices as relays, switches, tubes, and transistors. But in this era of microminiaturization, integrated circuits (IC's) offer the greatest advantage because they occupy very little space, consume little power, are extremely reliable, are quick-acting, and inexpensive.

Of the many varieties of logic IC's on the open market, the *resistor-transistor logic* (RTL) variety is probably the most popular. It can easily drive other

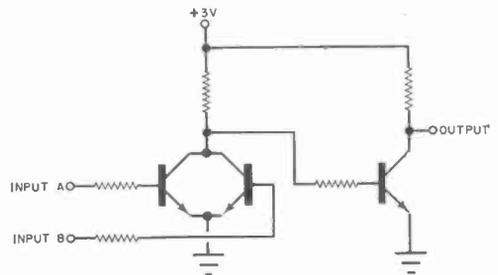


Fig. 7. The AND function is obtained by the addition of a NOT gate to output of a NAND gate.

IC's, and operates with voltage levels that are compatible with the requirements of external circuits. Typical one- and two-input RTL gates are shown in Fig. 6. If additional inputs are required, more transistors are added.

Operation of the gates is simple. If a transistor receives an input, it turns on

to produce 0 output at the collector. The one-input gate, shown in Fig. 6(a), is the NOT circuit. If +3 volts are applied to the input, the output becomes 0. The absence of a voltage at the input produces +3 volts at the output. Observe that the output is always opposite in state to the input.

Now consider the two-input gate shown in Fig. 6(b). By first establishing that the presence of +3 volts at the input represents a 1, and the absence of this voltage represents a zero, the gate will function as a NOR gate since a 1 at either input produces a 0 at the output. If an OR gate is desired, a NOT circuit (one-input gate) can be added to the output to reverse the state.

If, on the other hand, it is established that the presence of +3 volts at the input represents a 0, while the absence of this voltage represents a 1, then the circuit will function as a NAND gate so long as the +3 volts appears on both inputs. Once again, the adding of a NOT circuit reverses the function to produce an AND response. See Fig. 7.

We can now proceed to build the "Logic Demon" around the circuits discussed so far by including a suitable selector switch and a transistor lamp-

### PARTS LIST

- B1—1.5-volt size "D" flashlight cell (2)
- I1—3.2-volt, 160-mA pilot light (GE #1490 or similar)
- IC1—Fairchild  $\mu$ L914 epoxy Micrologic dual two-input gate (Data sheet and list of distributors available from: Fairchild Semiconductor, 313 Fairchild Dr., Mountain View, Calif.)
- Q1—Motorola MPS 834 transistor, or 2N834, or similar type (Data sheet and list of distributors available from Motorola Semiconductor, Box 955, Phoenix, Ariz. 85001)
- S1, S2—S.p.d.t. switch or two-circuit NO/NC push-button switch
- S3—4-pole, 5-position non-shorting selector switch (similar to Mallory 1325L)
- 1—5" x 4" x 3" cabinet (similar to Bud CU-2105A or Premier PMC-1005)
- 1—Metalphoto dialplate (optional)\*
- 1—Scalectro TS-800 IC 8-pin socket (available from Federated Purchasers, Inc., or Arrow Electronics, Inc., both in New York City)
- Misc.—Battery holder, bracket for Q1 (optional—see text), bar-type knob, 5/16"-i.d. rubber grommet, transistor socket for Q1, nylon or rubber feet with hardware (4), rivets or screws for battery holder

\*Available from Reill's Photo Finishing, 4627 N. 11 St., Phoenix, Ariz. 85014; in silver color—\$2.75; blue, red, or copper—\$3.25; postpaid in the U.S.A.

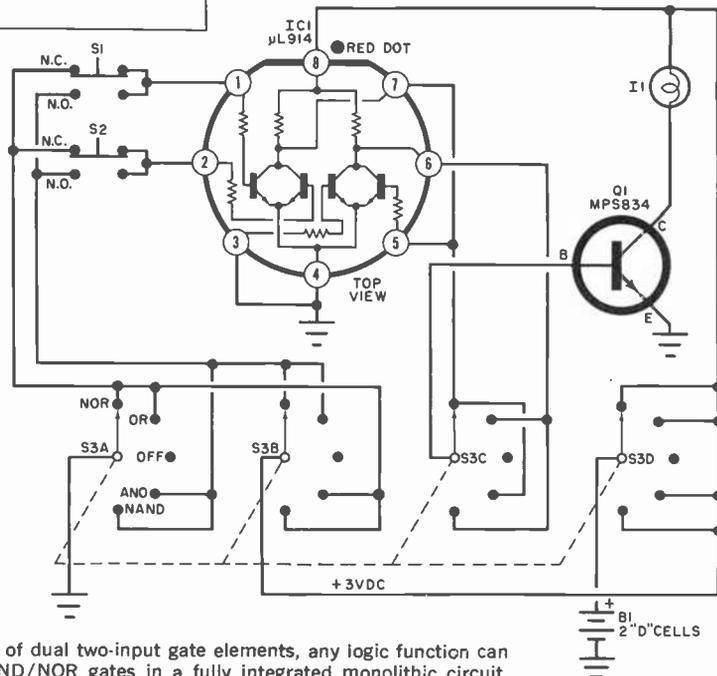


Fig. 8. Through exclusive use of dual two-input gate elements, any logic function can be generated from basic NAND/NOR gates in a fully integrated monolithic circuit.

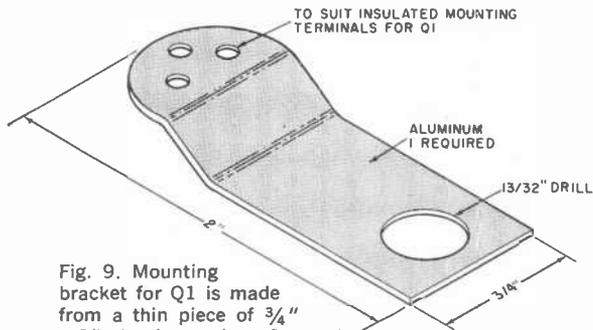
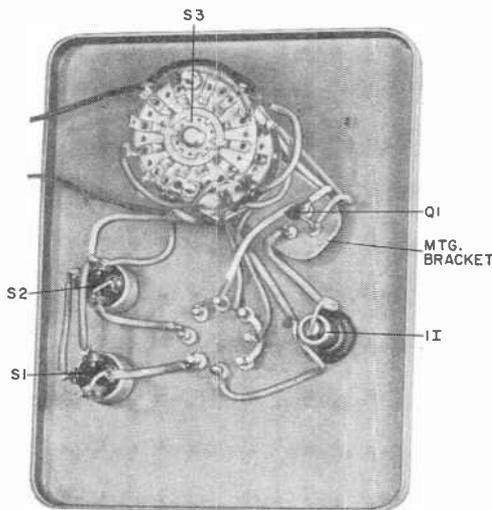


Fig. 9. Mounting bracket for Q1 is made from a thin piece of  $\frac{3}{4}$ " x 2" aluminum plate. See text.

driver stage. After designing and building the Logic Demon, it can be used to perform real computer logic operations.

**About the Circuit.** The "brain" of the Logic Demon is integrated circuit IC1 which contains dual RTL two-input gates (Fig. 8). One input is eliminated from one of the gates by grounding pin 3. Thus, a two-input gate and a one-input gate remain.

When the output (which drives Q1) is taken directly from the two-input gate, the circuit performs the NOR/AND functions. However, by feeding the output of the first gate to the one-input gate (which acts as an inverter or NOT gate) and then taking the output from the latter gate, the OR and NAND functions are obtained.



The Logic Demon can be wired using the schematic diagram and component layout shown in this photo.

A selector switch defines the input logic states and routes the lamp-driving transistor (Q1) to the appropriate gate output. If desired, separate slide or toggle switches can be used to produce the same logic functions.

**Construction.** The unit can be assembled on a metal chassis or in a wooden or plastic container. However, the use of a 5" x 4" x 3" metal box will give the project a neat appearance.

Except for the two dry cells which are mounted in battery holders that can be pop-riveted or screwed to the base, the switches, IC, and indicator lamp are mounted on the enclosure cover. If you use the prefabricated dialplate (see Parts List), the appearance of the project will be enhanced, and the dialplate can also serve as a drilling template for the holes that must be made in the cover to accommodate the switches, lamp, and the IC. The mounting hardware for the switches can be used to hold down the dialplate on the cover.

The IC shown here is mounted on individual Teflon insulated feedthrough connectors, but an alternate—and better—method is to use a single 8-pin Press-Fit IC socket as specified in the Parts List. Pin 8 of the IC case is usually coded with a red dot, or it may simply be beside the flat side of the case. Viewed from the top of the case, the pins are counted counterclockwise.

Transistor Q1 is mounted on stand-off insulators inserted in a fabricated aluminum bracket (Fig. 9) which is secured on the inside of the enclosure cover by the rotary switch. However, this mounting procedure need not be followed since Q1 can be mounted on a transistor socket in any convenient location in the enclosure.

The pilot lamp fits in a 5/16"-i.d. rubber grommet that mounts in a hole through the dialplate, and leads are soldered directly to the bulb. After making all the wiring connections (Fig. 8), you can proceed to test the unit.

**Operation.** If the unit is wired correctly, it will obey all the logic rules indicated on the dialplate. With the switch in the NOR position, the bulb lights and is extinguished by pressing either push

(Continued on page 93)

# The "Scrounge" —an Instant "J" Antenna

YOU CAN WHIP A VHF ANTENNA  
TOGETHER IN 30 MINUTES

By ALBERT S. VON TROTT, W3UIX/6

THE "J" style antenna has been around for years and years. Hams, police, forestry and fire radio stations started using the "J" back in the 1930's, and even today it is not uncommon to see a Business Radio system using "J" antennas. The advantages of the "J" are the omnidirectional characteristic of the radiated pattern and the vertical polarization—two important requirements in working mobile and vertically polarized stations. The short wavelengths of the very high frequencies also favor the use of these vertical antennas.

If you are going on 6 or 2 meters, you will probably find the vertically polarized antenna a welcome addition to your antenna farm. Also, if you are an SWL tuning for the radio services between 150 and 170 MHz, the "J" antenna will be a practical and valuable asset.

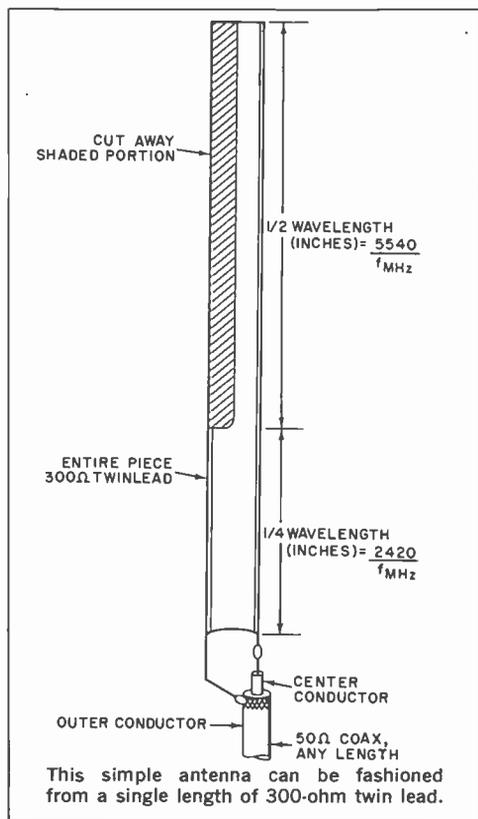
You can build a "J" antenna from a short length of 300-ohm twin lead à la "Sneaky Pete" in just about 30 minutes. A very desirable feature of the "J" antenna is the built-in quarter-wave matching section which lets you use a regular 52-ohm coax transmission line; VSWR's of less than 1.3:1 are not unusual.

The drawing shows the simple layout of the "Scrounge" with notations for determining its length. If you are working a band of frequencies, cut the antenna to resonate in the center of the band. If you are interested in listening on 156 MHz, for example, simply divide the figure 5540 by 156 to determine the length of the half-wave section ( $35\frac{1}{2}$ "). This is the radiating portion of the "J." Add to this dimension the length of the quarter-wave matching section ( $2420 \div 156 = 15.5$ ) to find the total length (approx. 51"). The higher the frequency, the shorter the antenna.

The rest is simple. Cut one conductor  $35\frac{1}{2}$ " from the end of a 51" piece of 300-ohm twin lead and remove it. You can use a knife to cut the insulation, or you can strip out the undesired lead by getting a good grip on the cut end and pulling. Don't try it with your fingers or your teeth; use a pair of diagonals or pliers.

Tape your "Scrounge" to a wooden pole, solder the wires at the bottom of the "J" to your coax feed line, and you're in business.

(Continued on page 94)



# BUILD THE Emitter Dipper



## SINGLE BATTERY-OPERATED 2-TRANSISTOR DIPPER SPANS 3 TO 30 MHZ ON 5 BANDS

By **ROBERT N. TELLEFSEN**

W7SMC/Ø

**O**NE OF THE MOST useful instruments a ham, CB'er, or experimenter can own is a Grid Dip Oscillator (GDO). The GDO is a versatile instrument which makes the job of finding the resonant frequency of an unknown tuned circuit a snap, as well as detecting oscillations, tuning and neutralizing transmitters, finding unknown values of coils and capacitors, and performing a host of other tests.

The *Emitter Dipper* (EDO) does all the things a GDO does, but unlike the GDO's with their a.c. line cords, the

EDO operates on a small 9-volt battery. Its frequency range is continuously variable from 3 MHz to 30 MHz, and—for suitable bandspread—is divided into five different bands. A sensitivity control and more than adequate current flow lets you start with a full-scale reading on all bands. Inexpensive home-brew plug-in coils are used, and the entire project costs about \$15 to build.

**How It Works.** The *Emitter Dipper* has two simple transistor circuits: a Colpitts oscillator (*Q1*), and an emitter-follower (*Q2*). Variable capacitor *C1* provides the EDO with a VFO capability, and any frequency within range can be quickly obtained. Frequency of oscillation is determined by the value of the plug-in coil (*L1*) and the setting of *C1* (see Fig. 1). Capacitors *C2* and *C3* form the feedback network to sustain oscillation. Capacitor *Cx*, mounted in four of the five plug-in coils, helps estab-

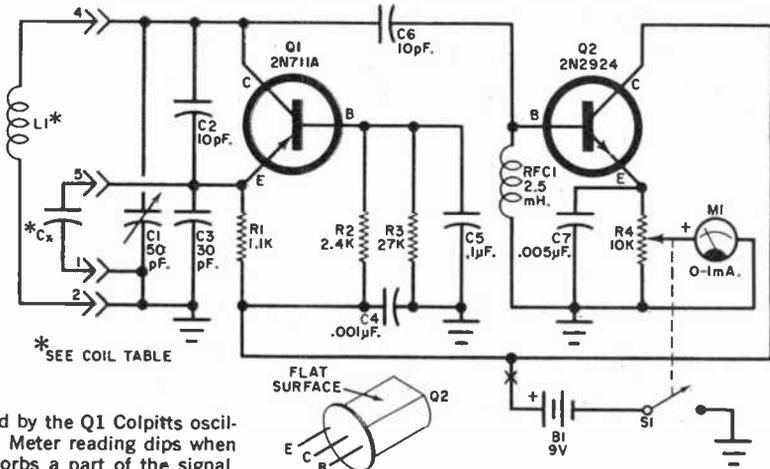


Fig. 1. Signal generated by the Q1 Colpitts oscillator circuit drives Q2. Meter reading dips when an external circuit absorbs a part of the signal.

lish the proper level of feedback for each frequency range.

The r.f. signal from the oscillator is coupled to Q2. The meter across R4 serves as an emitter current indicator. Variable potentiometer R4 is used as a sensitivity control and is adjusted to obtain a full-scale meter reading when the plug-in coil is operating in the "clear."

When the coil is held close to a tuned circuit and the EDO is operating at the resonant frequency of the tuned circuit, some of the r.f. energy is absorbed by the tuned circuit. Amount of absorp-

tion depends on the degree of coupling. The resultant drop in signal strength from the Q1 oscillator circuit shows up as a decrease in emitter current, and causes the meter pointer to dip. The meter reading will be maximum above and below the resonant frequency.

**Construction.** Except for the plug-in coils, all components are mounted inside a 4" x 2 1/4" x 2 1/4" metal box. Parts layout is not critical. Drill appropriate-size holes in the cabinet to accommodate the meter, jack, and other components. You can follow the layout shown in Fig.

Fig. 2. Parts layout is not critical, but avoid excess component lead length. Strap the battery firmly in place to prevent short circuits.

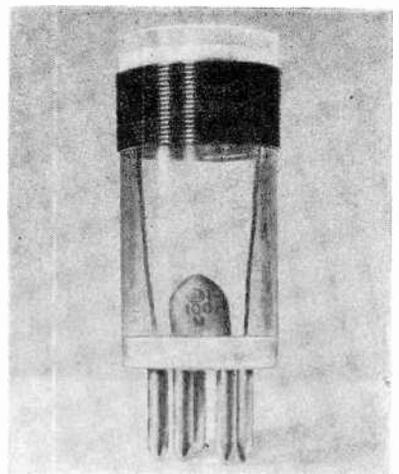
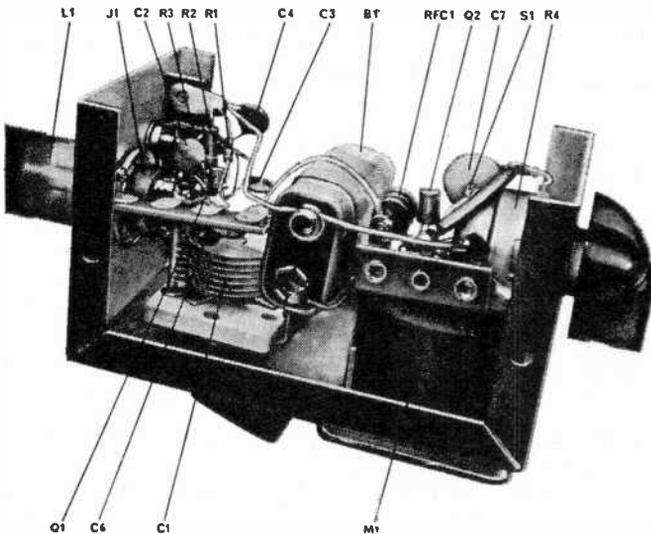


Fig. 3. Wind all coils as shown, and in accordance with the Coil Table. Four of the five coils require a small capacitor (Cx).

## PARTS LIST

*B1*—9-volt transistor battery  
*C1*—50-pF variable capacitor (Hammarlund HF-50)  
*C2, C6*—10-pF disc capacitor  
*C3*—30-pF disc capacitor  
*C4*—0.001- $\mu$ F disc capacitor  
*C5*—0.1- $\mu$ F, 10-volt disc capacitor  
*C7*—0.005- $\mu$ F disc capacitor  
*Cx*—See Coil Table  
*J1*—5-pin miniature socket (Amphenol 78-55S)  
*L1*—See Coil Table  
*M1*—0 to 1.0-mA meter  
*Q1*—2N711A transistor, or similar  
*Q2*—2N2924 transistor, or similar  
*R1*—1100-ohm,  $\frac{1}{2}$ -watt resistor  
*R2*—2400-ohm,  $\frac{1}{2}$ -watt resistor  
*R3*—27,000-ohm,  $\frac{1}{2}$ -watt resistor  
*R4*—10,000-ohm potentiometer, linear taper (Mallory U-20 Midgetrol)  
*RFC1*—2.5-mH choke, 25 to 50 mA coil (Millen or Mallory)  
*S1*—Add-on s.p.s.t. switch for *R4* (Mallory US-26)  
 1—2 $\frac{1}{4}$ " x 2 $\frac{1}{4}$ " x 4" metal box  
 Misc.—3-lug terminal strip, center lug mounting;  
 3-lug terminal strips, end-lug mounting (2);  
 pointer knobs (2); sheet metal or plastic strip,  
 nuts and screws

## L1 COIL TABLE

NUMBER OF TURNS	WIRE SIZE*	VALUE OF Cx	FREQUENCY RANGE (MHz)
47 $\frac{1}{2}$	#28	470 pF	3 to 4.4
32 $\frac{1}{2}$	#24	470 pF	4.4 to 7.6
17 $\frac{1}{2}$	#24	100 pF	7.4 to 11.6
12 $\frac{1}{2}$	#16	100 pF	11.5 to 18
6 $\frac{1}{2}$	#16	none	18 to 30

\*Enamel-coated solid conductor

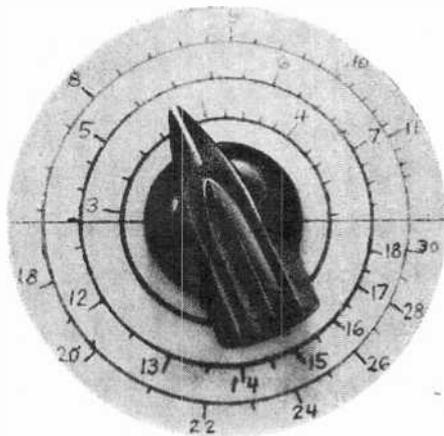


Fig. 4. Dial markings should be made when you calibrate your EDO. Align the knob pointer horizontally when *C6* is fully meshed, and tighten knob in shaft. Photo shows actual size of dial scale on prototype.

2. You may have to modify a terminal strip to fit, but that is easily accomplished with a pair of cutters.

A 1" x 4" piece of sheet metal or plastic strap holds the battery in place. If you wire *S1* into the circuit at the point marked "X" instead of between the battery and ground, as shown in the schematic, you can connect the negative side of the battery directly to ground.

Wind the coils on  $\frac{3}{4}$ "-diameter polystyrene plug-in forms according to the information given in the Coil Table. See Fig. 3. Don't use a different wire size or make any other changes in the coil winding data if you want to obtain the indicated tuning range. Before soldering any of the pins, heat-sink them to prevent melting the coil form.

You can make a 2 $\frac{1}{4}$ "-diameter circular dial out of a piece of heavy paper or cardboard. Draw three concentric circles on the dial,  $\frac{3}{16}$ " apart, starting  $\frac{1}{4}$ " from the outer edge. The frequency range and intermediate points of the five plug-in coils can then be marked on these circles, without crowding. To mount the dial on the cabinet, cut a  $\frac{1}{2}$ "-diameter hole in the center of the dial, remove the hex-nut from the shaft of *C1*, center and paste the dial over the opening, and replace the nut. Mount the knob securely on the shaft, and calibrate the dial. See Fig. 4.

**Calibration.** Accuracy of the EDO can be no better than the accuracy of your calibration procedure, or the calibration equipment you are working with. An accurately calibrated receiver or a crystal-controlled generator can be used.

If you are working with a receiver, turn on the receiver's BFO, plug in the 3-MHz to 4.4-MHz coil switch on the EDO and place the coil end close to the receiver's antenna. Tune the receiver to 3 MHz, rotate *C1* until you hear a tone in the receiver, and mark the EDO dial. (Tune for zero beat.) Advance the receiver's tuning in 100-kHz steps, advance *C1*, and mark the dial as you go. Do the same for the other coils.

Mark a different semicircle on the dial for each plug-in coil. It makes no difference which half of the dial you use. Mark the dial just like a ruler (short and long marks) with numerical callouts at 1-MHz positions.

# St. Petersburg Tapers Go Back to School



By J. W. NELLIGAN

## COMPREHENSIVE ADULT EDUCATION COURSE COVERS PRACTICALLY EVERY PHASE OF TAPE RECORDING

**T**HE IMPACT on one community of an idea that struck Lon Cooper, an electronics jobber in St. Petersburg, Florida, has set into motion currents of energy that may have significance for tape recording enthusiasts everywhere. Lon was reading a brochure sent out by the Pinellas County (Fla.) Board of Public Instruction. As he glanced over the listing of all the courses offered by the adult education department, he thought, "Why not a class in tape recording techniques?"

Cooper's long career in electronics and his reputation as an authority on magnetic recording would qualify him for certification as a part-time instructor. So, a few days later, Lon met with school

officials and presented his idea to them.

The educators were impressed with his reasoning that: "Probably no single piece of electronic equipment available today has greater usefulness or can provide more entertainment than the tape recorder. It has infinite applications in school, in business, and in recreational activities."

"Okay," they said, "If we can enroll a minimum of ten students, we'll schedule a class."

The new course was officially called "The Tape Recorder—Its Use and Care." Within a few days after it was announced in a local newspaper, 20 students had enrolled. Their registration reached 25—the maximum permitted. Eventually, Cooper was compelled to start a waiting list and schedule another class.

Who enrolled? A teen-ager and an 80-year-old retired engineer were among the first to pay the established \$2 fee. Then there were several audiophiles, and a former star of the Chicago Opera Company who intended to record professionally. But most of the enrollees were just people with a yen for tape recording who wanted to learn more about it.

Cooper's new class had neither precedent to follow nor a published text avail-



Unique course in recording techniques was conceived by Lon Cooper, shown at far left demonstrating fundamentals of sound. In the "lab," (above), students record from various sources and practice programming.

able. In preparing the curriculum, he had to rely largely upon his own knowledge supplemented by material from such books as *Tape Recorders—How They Work*, by Wescott and Dubbe, and *Magnetic Recording for the Hobbyist* by Arthur Zuckerman. But others came forward with assistance. For example, Audio Devices, Inc., a pioneer in the development of quality recording tape, furnished much of the material used in sessions on recording tape.

Audio-visual equipment was also made available—an overhead projector proved to be indispensable during lecture periods. Other equipment included a combination signal generator-amplifier-speaker-oscilloscope arrangement used to demonstrate audio principles.

Starting with the history of magnetic recording, the course touches on the fundamentals of sound, treats the students to a small dose of theory, and continues logically through transport mechanisms, motors, recording indicators, bias oscillators, heads, amplifiers and speakers, recording tape and microphones. In the "lab," students learn head alignment, investigate testing procedures, record from various sources, and practice programming—including mixing, editing, and splicing.

The class makes three field trips: (1) to a local church which uses magnetic recording; (2) to Radio Station WLCY to watch program taping; and (3) to the sound room of the Cooper Radio Company, where the students are instructed in the proper use of connectors and cable hookups, and are given an opportunity to use tape recorders in conjunction with other types of audio equipment.

Finally, the class receives instruction in the methods of evaluating tape recorders, tape, and accessories. The students learn to read "specs," are told what to look for in choosing a tape recorder and are cautioned against "bargain basement" tape.

At this writing, three classes have been graduated in St. Petersburg, and a fourth is in progress. In addition, plans have been completed for an advanced class.

But of special significance to tape recording enthusiasts outside the St. Petersburg area is the interest shown in these classes by Superscope, Inc., marketing agency for Sony tape recorders. Superscope is exploring the possibilities of making Lon Cooper's course available to all amateur tapers—wherever they may live.



# SMALL TAPE RECORDERS

**S**MALL TAPE recorders can be used for entertainment, private-eye work, correspondence, conference recording, dictation, voice training, and can be made to perform many other practical—and many not so practical—functions. They do have certain limitations, but their portability, low price, and ability to work—after a fashion—under the most adverse conditions, make them highly desirable.

What can be done with a small tape recorder depends upon its features and usually its cost. Some small machines record and play back only at “one” speed, accommodate only small 2½-inch reels, work only on batteries and cost as little as \$10. Some \$35 recorders operate on 117-volt, a.c. power, at two speeds (1½ in/s and 3¾ in/s), and accommodate larger reels. Some have a switch on the microphone for remote control, and some have outlets for extension speakers and earphones.

**Capstan or Direct Drive.** When shopping for an inexpensive tape recorder, be aware of the fact that not all recorders drive the tape in the same manner, and that tapes recorded on one machine cannot always be played back properly on another machine. Two methods in general use are capstan drive and direct drive.

Capstan drive offers a greater degree of uniformity of tape speed. It rotates at a predetermined fixed speed, such as 1½ in/s or 3¾ in/s, and draws all the tape through the recorder at the same rate of speed regardless of the size of the reels or the amount of tape on the reels. Tapes recorded on a capstan drive recorder can be played back on another capstan drive recorder providing that the tape speed is the same and the geometry of the recorded sound track is compatible with the playback heads.

MAN WAS MADE FOR BETTER THINGS TO DO—  
LET THE TAPE RECORDER HELP YOU GET GREATER PRODUCTIVITY AND MORE LEISURE

By **HERB HOWORKA, Jr.**

In a direct-drive recorder, the take-up reel is the driving element and it revolves at a set speed, but actual tape speed varies constantly. Beginning tape speed could be at the rate of about 1½ inches per revolution, depending upon the diameter of the reel's hub, and ending tape speed greater than 9 inches per revolution on a 3-inch reel.

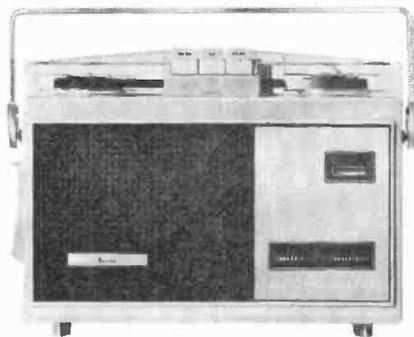
When a direct-drive recorded tape is played back on a capstan-drive recorder, the first part sounds like a flock of monkeys; somewhere toward the middle of the tape, the sounds become intelligible; and near the end, the sounds become a series of grunts and growls.

In a great many instances, tapes recorded on a direct-drive tape recorder must be played back on the same recorder, or on another machine of the same make and model. Forget about splicing a section of tape recorded at the beginning of one reel into the middle or end of a tape on another reel.

**Mike Fright.** With a small recorder, you can tape all sorts of interesting “people talk”—when the people are relaxed and speak freely. However, if you put a microphone in front of some people, they “clam up.” Try hiding the recorder and

*(Continued on page 91)*

SMALL BATTERY-OPERATED TAPE RECORDERS HAVE BEEN GREATLY IMPROVED WITHIN THE PAST TWO OR THREE YEARS, AND QUALITY UNITS ARE AVAILABLE AT REASONABLE PRICES. PRICES FOR THE UNITS SHOWN HERE RANGE FROM \$39.95 TO \$79.50.



Norelco "Continental 101" 4-inch reel; 2 tracks;  $1\frac{7}{8}$  in/s speed; operates on 6 "D" cells for 40 hours; has combination audio level and battery condition indicator, and can be remotely controlled; 8" x 11" x  $3\frac{3}{4}$ "; 7 lb.



Sony "Sony-Matic 907"  $3\frac{1}{4}$ -inch reel; 1 track; 2 speeds ( $3\frac{3}{4}$  and  $1\frac{7}{8}$  in/s); operates on 4 "D" cells for 20 hours; has automatic record level circuit (a.v.c.), and can be remotely controlled;  $8\frac{3}{4}$ " x  $8\frac{3}{4}$ " x  $5\frac{1}{2}$ ";  $5\frac{1}{2}$  lb.



Craig "212"  $3\frac{1}{4}$ -inch reel; 2 tracks; 2 speeds ( $3\frac{3}{4}$  and  $1\frac{7}{8}$  in/s); operates on 6 "C" cells; has automatic level control and fast wind and rewind; can be remotely controlled;  $7\frac{7}{8}$ " x  $9\frac{3}{4}$ " x  $3\frac{1}{8}$ ";  $4\frac{1}{2}$  lb.

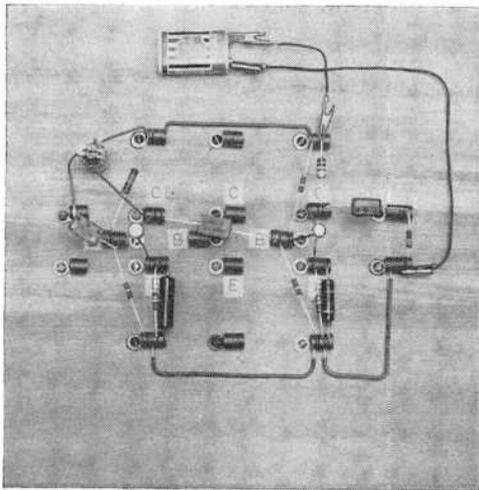
RCA "YHS12" 3-inch reel, 2 tracks; 2 speeds ( $3\frac{3}{4}$  and  $1\frac{7}{8}$  in/s); operates on 4 "C" cells for 20 to 40 hours intermittently and 10 hours continuously; can be remotely controlled;  $9\frac{3}{4}$ " x  $9\frac{1}{4}$ " x  $2\frac{3}{4}$ "; 4.9 lb.



# SOLDERLESS BREADBOARD

CUT UP A  
SCREEN DOOR RETURN SPRING  
AND MAKE YOUR OWN  
QUICK-CONNECT TERMINALS

By A. A. MANGIERI



**T**RANSISTORS are wonderful devices for the experimentally-minded electronics hobbyist. They are small and easy to work with, the power supply requirements are absolutely minimal, and the associated components are usually standard items. All sorts of transistorized circuits can be whipped together in a few hours, checked out, and put in operating order if you use a "breadboard" similar to the one shown here.

**Construction.** The base for your breadboard can be a 12" x 12" x 1" piece of white pine. Varnish or shellac the board for the sake of improved appearance. Lay out screw holes according to the diagram and make spring terminals from short lengths of  $\frac{3}{8}$ "-diameter door

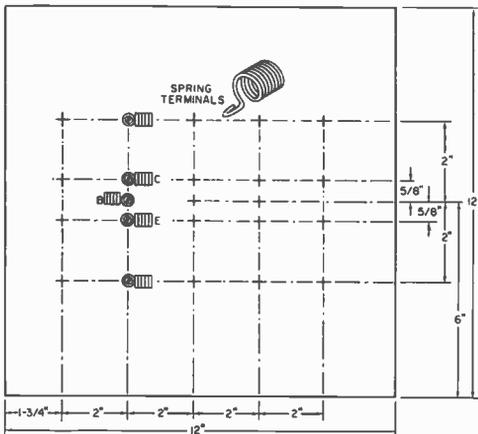
spring—the kind used to close a summertime screen door. Make each spring length about 12 turns and bend the last turn at a right angle to form an eye for a wood screw.

Screw the terminals to the board using small wood screws and flat metal washers. Face the "base" connections for your transistors to the left and all other springs to the right. Twenty-three springs is about right for nominal small-scale experimenting with transistors. You can add assorted brackets of  $\frac{1}{16}$ " aluminum to support volume controls, inductors, tuning capacitors, etc., as required.

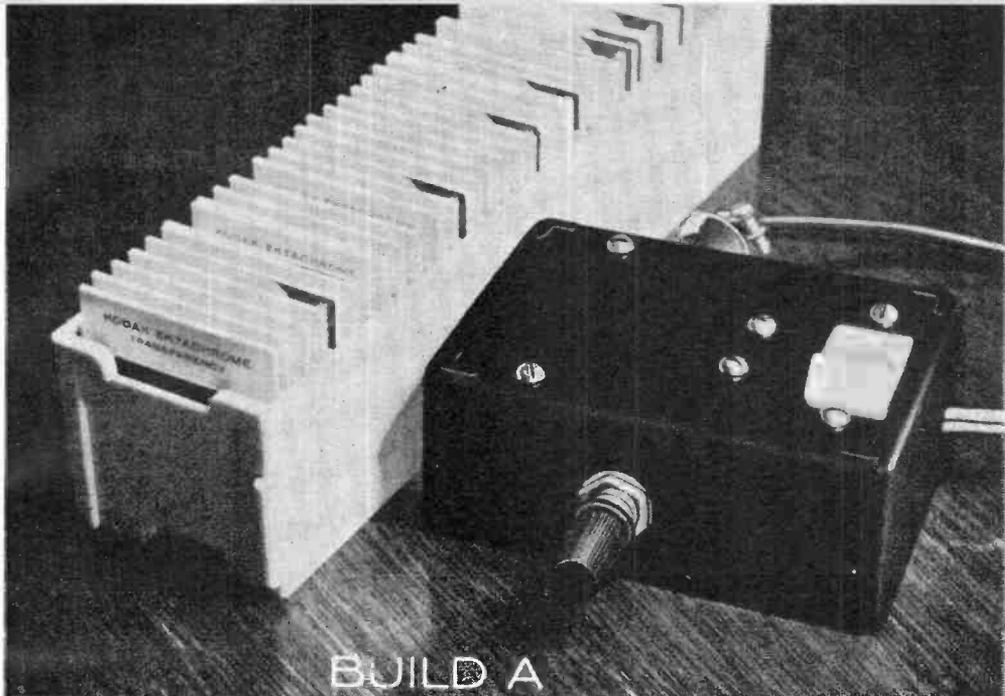
**Using the Breadboard.** The preferred method of using a breadboard is to lay out the circuit according to the arrangement in the schematic. Practically every transistorized circuit schematic reads from left to right, and the transistors are positioned so that the collector is toward the top of the board and the emitter toward the bottom. Use the top row of springs for the collectors and the bottom row for the emitters. Of course, the springs can be loosened and rotated to face any direction.

Miniature transformers fit between transistor terminal groups; larger transformers are mounted at the top of the board. Transistors with short clipped leads will require sockets; to solve this problem, solder some leads to a "universal" transistor socket and attach the socket to the board and the leads to the appropriate springs.

To install or remove a component from the spring terminals, simply push the blade of a small screwdriver into the coil and slip wire lead in or out. —50—



This arrangement will enable experimentation with 1, 2, or 3 transistors in control or audio circuits.



# “Relaxatrol” to Automate Your Slide Projector

VARIABLE TIMER CONVERTS PUSH-BUTTON  
MACHINES TO FULLY AUTOMATIC OPERATION

By GARY W. TOWNER

**L**OOK, NO HANDS—here’s a low-cost way to fully automate a push-button semi-automatic slide projector. Build a “Relaxatrol,” set the speed of operation, and join the audience. It is an ideal accessory for continuous repeat-performance applications.

Actually, the Relaxatrol can be used to automatically control at preselected intervals almost any device which is operated manually with switches—without modifying the equipment. The only requirement is that the control be hooked across the switch on the equipment. The control can be overtaken or “dropped out” of the equipment at any time without any additional connections or disconnections.

**How It Works.** A simple relaxation oscillator consisting of  $R1$ ,  $R2$ ,  $C2$ , and  $I1$  (Fig. 1) periodically energizes  $K1$  to trigger the projector. Capacitor  $C2$  takes on a charge through  $R1$  and  $R2$ , until the voltage across it is sufficient to fire  $I1$  (usually on the order of 60 to 70 volts).

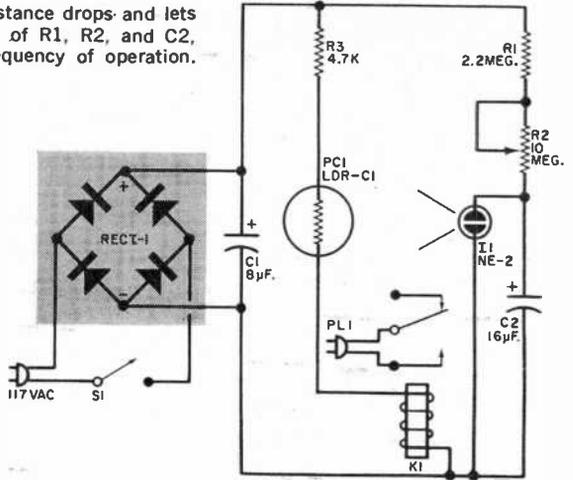
When the lamp fires, it discharges  $C2$  until the voltage drops sufficiently to black out the lamp. The frequency of lamp ignition depends upon the values of  $C2$ ,  $R1$  and  $R2$ , as well as the voltage across the entire circuit. Variable resistor  $R2$  makes it possible for you to adjust the frequency according to your needs.

Neon lamp  $I1$  is close-coupled to a

Fig. 1. When PC1 "sees" the light from I1, its resistance drops and lets enough current flow to energize K1. Time constant of R1, R2, and C2, as well as the applied voltage, determines the frequency of operation.

light-dependent resistor (PC1). When the lamp lights, PC1's resistance drops and allows enough current to flow through K1 to energize it. In the absence of light, the combined resistance of R3 and PC1 is enough to keep the relay in its off position. The relay simply does what the slide-change push button on the projector would normally do, if the relay contacts are wired in parallel with the push button.

A bridge rectifier can be made up of four individual diodes, but you may find



### PARTS LIST

- C1—8-µF, 150-volt electrolytic capacitor
- C2—16-µF, 150-volt electrolytic capacitor
- I1—NE-2 neon lamp
- K1—10,000-ohm, 4.5-mA relay (Allied Radio 75 U 774, type LB-5 or similar)
- PC1—LDR-C1 light-dependent resistor (Allied Radio 7 U 565, or similar)
- PL1—2-terminal plug (small size; use with matching socket)
- R1—2.2-megohm, ½-watt resistor, ± 10%
- R2—10-megohm linear potentiometer
- R3—4700-ohm, ½-watt resistor, ± 10%
- RECT-1—Rectifier bridge (International Rectifier 10DB3A, or similar)
- S1—S.p.s.t., 6-ampere switch
- Misc.—Black alligator clip insulator, 2 7/8" x 4" x 1 9/16" plastic case, 2-terminal strips (4), line cord, hookup wire, knob, etc.

it more convenient to use the commercially available module described in the Parts List. Capacitor C1 serves as a power supply filter.

**Construction.** Layout is not critical and it may be possible to assemble all the parts inside your projector. If you do, be sure to keep the parts away from

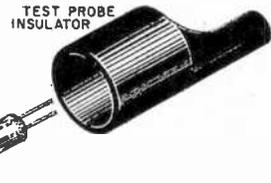


Fig. 3. Black insulator fitted over PC1 and I1 permits assembly to function without interference from external lighting.

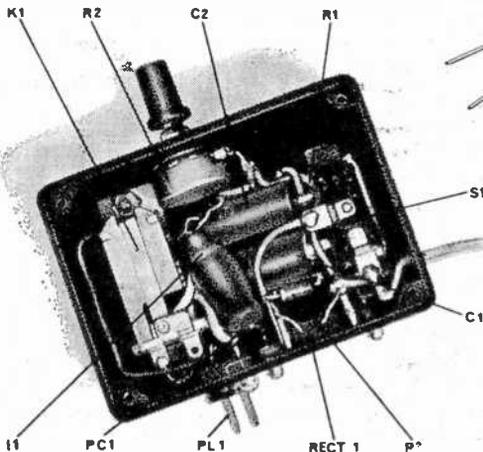


Fig. 2. Parts layout is not critical. Small plastic box helps insulate relay and other components from a.c. line. A line cord can be substituted for PL1.

the hot lamp. However, in most instances, it is better to build a separate unit.

The small plastic meter box shown in Fig. 2 is inexpensive, easy to work with, and looks good. A test probe insulator, the kind usually placed over an alligator clip, couples the light from the neon lamp to PC1 and shields the assembly from "outside" light. (See Fig. 3.) You may cut away some of the insulator at each end if it is too long. Assemble the unit as shown in the drawing, and do your best to obtain a light-tight assembly.

(Continued on page 93)

WANT  
TO BUILD AN



# INTEGRATED CIRCUIT BINARY COUNTER?

By DON LANCASTER

10 = 1 0 1 0

COUNTING IN THE BINARY SYSTEM IS SIMPLE:  
YOU START WITH "ZERO, ONE" . . . AND YOU'VE  
USED UP ALL OF THE BINARY DIGITS

**N**OW you can build a demonstration binary counter using inexpensive integrated circuit (IC) industrial flip-flops with ordinary pilot lamps serving as readout devices. The binary counter described on the following pages can be used to demonstrate basic digital computer principles including the addition of binary digits. It also provides an opportunity to utilize integrated circuits for storing binary information.

In order to use the binary counter, however, you must understand the concepts of binary arithmetic. Most of us are familiar with the decimal number system which needs just 10 symbols—digits 1 through 9, and 0—to express any

quantity. And while some earlier computers did use this system for computing, the complexity of the circuits dictated the need for a simpler system, one requiring fewer digits. So a number system using two digits only—1 and 0—was devised: the binary (base-2) number system.

**Binary Number System.** To learn how the binary (base-2) system works, consider Fig. 1 in which four groups of blocks are shown. The first one-block on the right is preceded by a group containing two blocks, which is preceded by a group containing four blocks, preceded by an eight-block group.

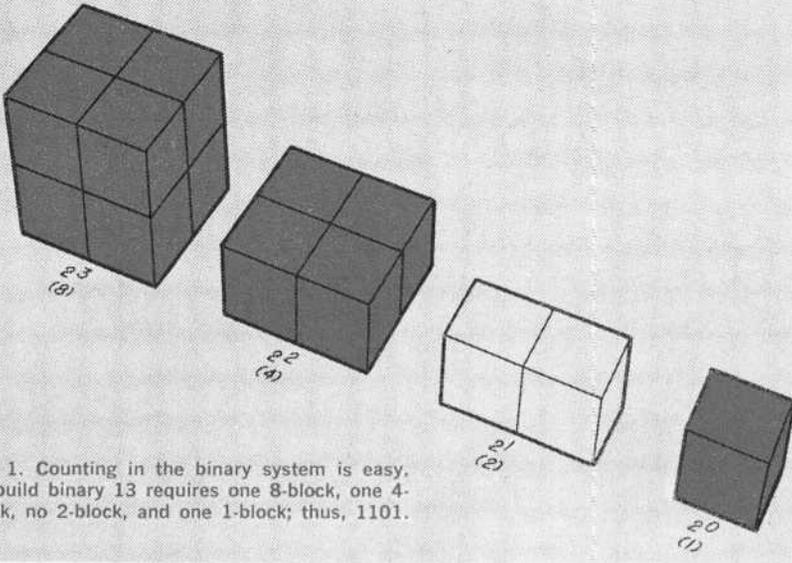


Fig. 1. Counting in the binary system is easy. To build binary 13 requires one 8-block, one 4-block, no 2-block, and one 1-block; thus, 1101.

Now, since we are working with a base-2 number system, we could change things a bit by writing the same group of blocks in this order:  $2^3$ ,  $2^2$ ,  $2^1$ ,  $2^0$ . The superscript numerals (3, 2, 1, and 0) are referred to as the powers of the base number which, in this case, is 2. The power of a base tells the number of times the base must be multiplied by itself or, putting it another way, the power to which it is raised. For example,  $2^3 = 2 \times 2 \times 2 = 8$ . The mathematicians tell us that a number raised to its 0 power is 1; thus,  $2^0$  becomes 1. But we can also write: 8, 4, 2, 1 to represent the blocks.

To express 3 in the binary system, we need *no* 8 block, *no* 4 block, *one* 2 block, and *one* 1 block. In binary notation this is written as 0011. Similarly, the number 10 is written as 1010. And that is all there is to the binary number system.

The convenience of this system is immediately apparent, considering that any number in the decimal system can be converted to a series of 1's and 0's. Thus, to "write" a number on a punched card, you either have a hole or no hole—a 1 or a 0. Putting it another way,

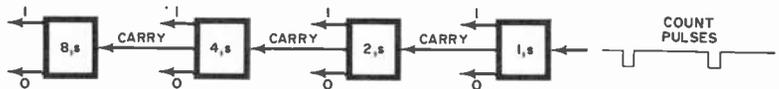
a YES or a NO. If lights are used as a readout device, it could be established that if the lamp lights it means a 1, and if it doesn't, it means a 0.

**Binary Addition.** Adding 5 and 3 gives us 8 in the binary system just as it does in the decimal system, except that the numerical process is different. The following decimal-to-binary conversion table will save you some time in working out a few examples of binary addition.

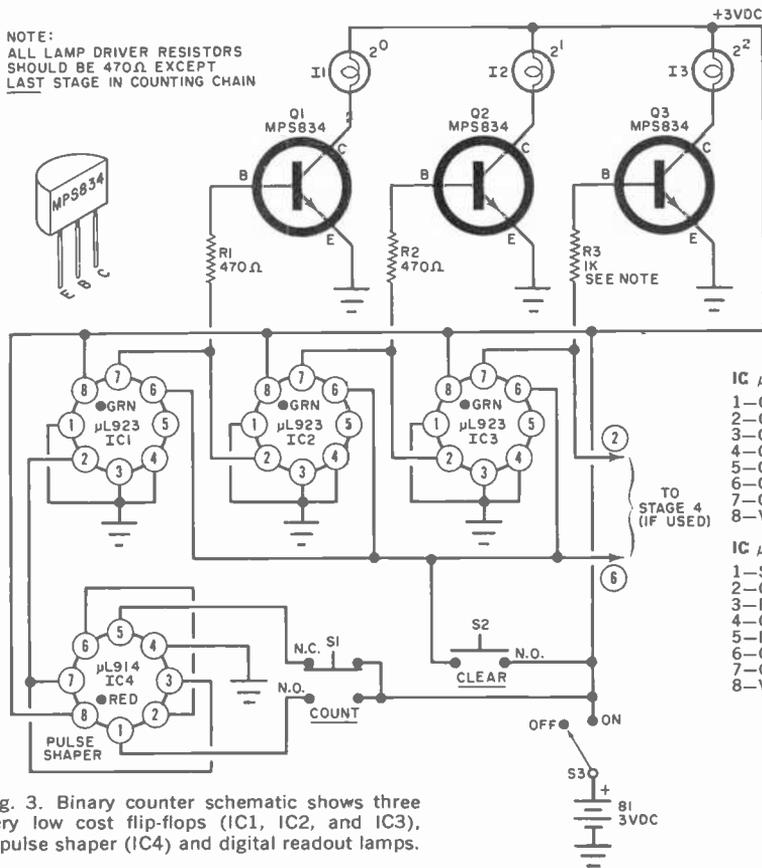
DECIMAL NUMBER	BINARY NUMBER
0	000
1	001
2	010
3	011
4	100
5	101
6	110
7	111
8	1000

Three basic rules govern binary addition: (1) 0 plus 0 equals 0; (2) 1 plus 0 equals 1; and (3) 1 plus 1 equals 0 with a 1 carry to the next left-hand column. Applying these rules to the sample problem  $5 + 3$  will give you

Fig. 2. This four-stage flip-flop has a counting limit of 15. Adding stages increases count capacity.



NOTE:  
ALL LAMP DRIVER RESISTORS  
SHOULD BE 470Ω EXCEPT  
LAST STAGE IN COUNTING CHAIN



- IC μL914 IDENTIFICATION**
- 1—Gate A, Input 1
  - 2—Gate A, Input 2
  - 3—Gate B, Input 1
  - 4—Common
  - 5—Gate B, Input 2
  - 6—Gate B, Output
  - 7—Gate A, Output
  - 8—Vcc + 3 Volts D.C.
- IC μ923 IDENTIFICATION**
- 1—Set Input (Gnd.)
  - 2—Count Input
  - 3—Reset Input (Gnd.)
  - 4—Common
  - 5—Not used
  - 6—Clear Input
  - 7—Output
  - 8—Vcc + 3 Volts D.C.

Fig. 3. Binary counter schematic shows three very low cost flip-flops (IC1, IC2, and IC3), a pulse shaper (IC4) and digital readout lamps.

**PARTS LIST**

- B1—1.5-volt, C-size cells (2)
- I1, I2, I3—#49 pilot light (2.0-volt, 60-mA)
- IC1, IC2, IC3—μL923 epoxy JK flip-flop (Fairchild\*)
- IC4—μL914 dual two-input gate (Fairchild\*)
- Q1, Q2, Q3—2N834 transistor (Motorola MPS834)
- R1, R2—470-ohm, ¼-watt resistor
- R3—1000-ohm, ¼-watt resistor—see text
- S1—S.p.s.t. push-button switch
- S2—S.p.s.t. push-button switch
- S3—S.p.s.t. slide switch
- 1—6" x 4½" x 1¼" aluminum box with cover (Zero Z64-104A-20 and Z64-104A-COT-5) or 5" x 7" x 2" box chassis (Bud AC-402)
- 1—METALPHOTO dialplate, hard anodized aluminum, with POPULAR ELECTRONICS trademark, available from Reil's Photo Finishing, 4627 N. 11 St., Phoenix, Ariz.

- 85014; in silver color for \$2.75; blue, red, or copper for \$3.25; postpaid in U.S.
  - 1—2" x 3" sheet of aluminum or perforated phenolic board
  - 1—1⅝"-diameter aluminum disc (optional—see text)
  - 4—Sealectro 8-lead IC sockets for TO-5 case (optional, available from Arrow Electronics or Joseph Kurzan, Inc., both in New York City)
  - Misc.—Teflon insulated terminals (52, optional), insulated feedthroughs (4, optional); battery holder for two C-size cells, ½"-o.d. rubber grommets (3), pop rivets or #6 hardware, 6-32 x ⅜" threaded spacers (4), rubber feet (4), wire, solder, #6 mounting screws (4)
- \*Data sheets and distributor list available from Fairchild Semiconductors, 313 Fairchild Dr., Mountain View, Calif.

$$\begin{array}{r} 101 \\ + 011 \\ \hline = 1000 \end{array}$$

To define the above addition, starting with the right-hand column you have

1 + 1 = 0 with a carry of 1. Place the carry above the second column so that it now contains 1, 0, and 1. Thus, the second column is also 0 with a 1 carry. The carry added to the third column also produces a 0 with a 1 carry. Since there

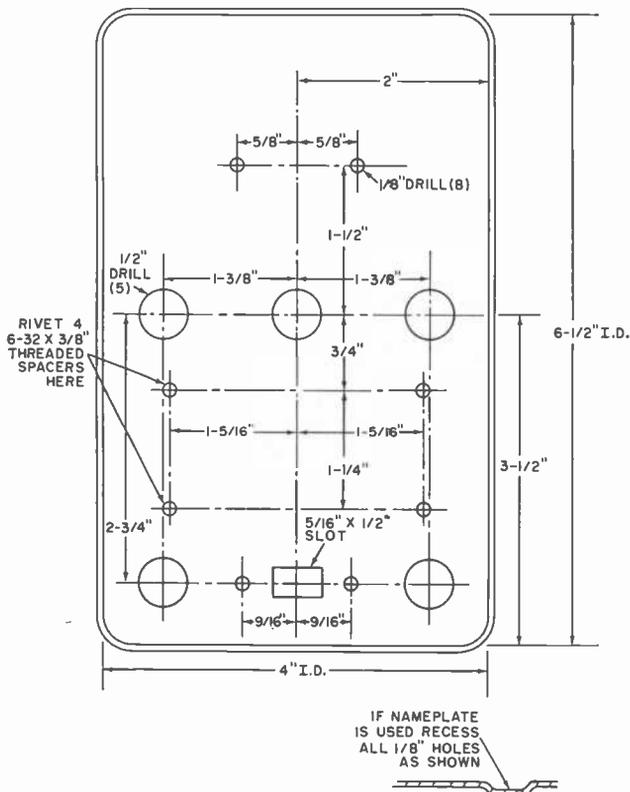


Fig. 4. You can use these dimensions to duplicate the front cover layout. Hole sizes should be made to accommodate your hardware and fittings.

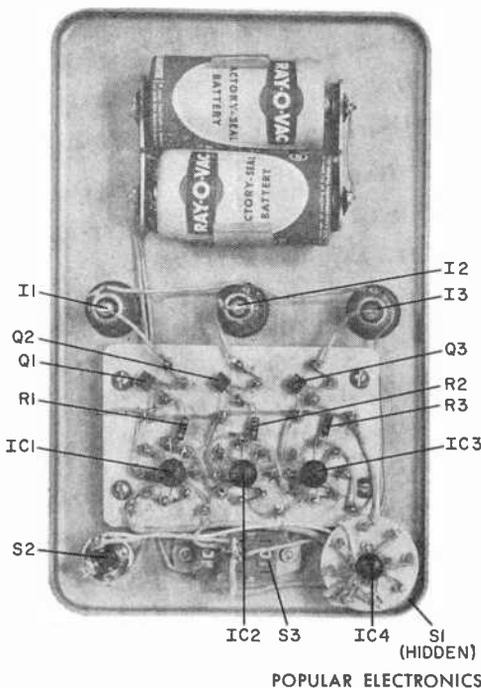
Fig. 5. The flip-flop IC's, and transistors and resistors, are first mounted on a subassembly supported on standoff spacers. IC4, shown on an aluminum disc, is supported by the push-button COUNT switch (S1).

is no fourth column in the problem, the carry is brought down as the fourth or most significant digit of the sum. The answer then becomes 1000 or 8.

When adding more than two binary numbers to produce a single sum, the numbers should be added in pairs. In other words, the sum of the first two numbers is added to the third number. The fourth number is then added and so forth until the last number is added to the sum of the previous two numbers to produce the total sum.

**Electronic Counters.** The essential difference between an electronic counter and earlier counters with mechanical wheels is that the electronic counters add pulses instead of gear teeth. But in addition to its ability to add, a counter must also have a way of storing the discrete digits representing the numbers.

A decimal counter, for example, must be able to store ten counts—0 through 9—before the next count resets the



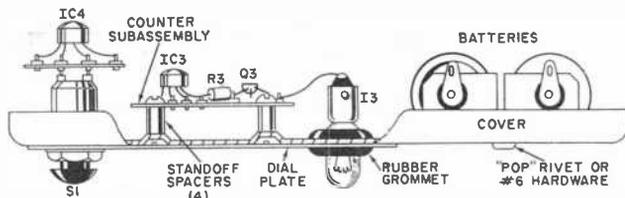


Fig. 6. This cutaway view of the front cover shows how the subassembly is mounted on the spacers. Observe that the mounting screw holes are recessed a bit so the dialplate can lay flat on the cover assembly.

counter to 0 with a 1 carry. Similarly, a binary counter is required to store only two counts—1 and 0—before it is reset. The electronic circuit used for counting is a simple flip-flop with its “set” state representing a 1, and its “reset” representing a 0.

The block diagram of a four-stage flip-flop binary counter that provides a count of up to 15 is shown in Fig. 2. Additional stages can be added to increase the count limits. For example, if one more stage is added, the count is increased to 31, while adding two more stages increases the count to 63.

During operation, pulses are applied to the count input of the 1's stage. A carry output from this stage is passed on to the count input of the 2's stage, and so on down the line to the last stage. With each incoming pulse, the 1's counter is alternately set to one, then reset to 0, set to 1 again, and so on.

The 2's counter also alternates between 1 and 0 each time it receives a count, but this happens only during every other input pulse when the 1's counter develops a carry signal. This process continues to activate each counter up to the last pulse in the string.

**The IC Counter.** Figure 3 shows the schematic of the IC counter. The innards of IC1-4 have been deliberately left out to simplify matters. IC1, IC2, and IC3 are the counting flip-flops, while IC4 is a medium-power dual two-input resistor-transistor logic gate serving as a pulse shaper to eliminate the effects of contact bounce when the COUNT push button (S1) is pressed to produce the count pulses.

The modified output from the pulse shaper is applied to the count input of first counter stage IC1. The output of IC1 is applied to the count input of IC2, whose output in turn is applied to IC3. Indicator lamps I1 through I3, driven by Q1 through Q3, visually de-

note the presence or absence of a 1 in each counting circuit. When a flip-flop circuit goes into its 1 state, a positive voltage is applied to the base of its respective output transistor through the proper base resistor ( $R1$ ,  $R2$  or  $R3$ ). The voltage causes the transistor to conduct, lighting the lamp.

Observe that  $R3$  is of a larger value than either  $R1$  or  $R2$ . If it were not so, lamp I3 would burn brighter than I1 and I2 since IC3's output is not loaded by the input of any other flip-flop, as is the case with IC1 and IC2. Thus, if additional counting stages are added, bear in mind that the larger base resistor must appear in the last stage, although the base resistor of the other stages are of equal value.

CLEAR switch S2 provides immediate reset capabilities by simultaneously applying a “1” pulse to the CLEAR input of each counter, resetting it to the 0 state.

**Construction.** The binary counter can be assembled in any small metal, wood, or plastic container. It is shown assembled in a 6" x 4½" x 1¼" aluminum box. A prefabricated METALPHOTO dialplate (see Parts List) can be put on the container cover to give the project a professional appearance. Layout and dimensions for drilling the cover are shown in Fig. 4. You can, however, lay out the counter differently, if you wish, since neither parts arrangement nor lead dress will affect operation of the unit.

Use a low-wattage soldering iron when assembling the unit to minimize the possibility of overheating and destroying the transistors and IC's. For ease of assembly, the IC's and transistor circuitry can be preassembled on a 2" x 3" aluminum plate, or phenolic circuit board. Then the plate or circuit board can be mounted on standoffs in the container cover. Interconnection is made from the  
(Continued on page 90).

# ALL ON QUARTER-INCH MYLAR

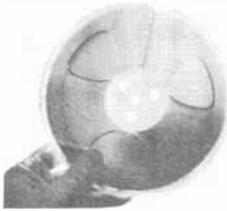
SOME COMMENTARIES ON THE  
TAPE RECORDING SCENE

By AL JOHNS





## How to Conduct an Interview With a Tape Recorder\*



NO MORE PENCILS,  
NO MORE PAD,  
NO MORE MISQUOTES  
TO MAKE YOU MAD

By LEWIS A. HARLOW

**A**RE YOU an attentive listener? Do you enjoy relaxed and easy conversation, and can you pose interesting and intelligent questions? If these qualities describe you, and you own a tape recorder, you have the makings for a fascinating hobby or another source of income.

Unlike the old BTR (Before Tape Recorder) days when an interviewer barely had time to get a few questions answered because of the limitations of pencil and pad, modern interviewers are able to capture 100% of all that is said. Freedom from note-taking lets the interviewer concentrate fully on the subject matter and maintain complete control of the proceedings.

*\*Much of the material in this story also applies to office conferences, such as the one attended by staff members of POPULAR ELECTRONICS in photo above. Note automatic Concord Model 350 battery-operated recorder in background.*

Almost any standard medium-sized tape recorder in reasonably good condition can be used to record an interview. The recorder should accept a 5-inch tape reel and be easy to carry.

**Omnidirectional microphones** are perhaps the best to use for a large group because they can pick up sounds coming from all directions. However, the microphone supplied with your recorder is usually quite suitable for interviews.

If you have a choice, avoid recording with a hand-held microphone. The main disadvantage of the hand-held mike is the constant fluctuation of mouth-to-mike distances which produce variations in volume and pitch.

The best microphone position for most indoor recording is near the center of the room with the mike pointed away from the window to minimize back-

ground noise. Prepare an extension cable for your microphone so that the tape recorder can be tucked away in a corner where it won't attract attention during the interview.

Round out your equipment with a good supply of empty tape reels, an editing kit, and an ample supply of tapes. Select your tapes carefully and don't let the "look-alike" appearances fool you. Tapes vary in quality and price and there could be an enormous difference in footage among tapes for any given size reel. If your primary interest is to get maximum playing time from a reel of tape, select a thin tape, such as 0.5 mil. A 7-inch reel of 0.5 mil tape, played at a speed of 3¾ inches per second, will give over two hours of unattended playing time per track—ample enough for most interviews.

**A relaxed atmosphere** is a must for interviews. Before you attempt to set up your first appointment, practice with your family and friends until you build up your confidence. Also, invest in one of the many paperback books which explain the mechanics of interviewing. Professionals usually jot down key questions on a small card (3" × 5") which can be held in the palm of the hand and glanced at without distracting the person being interviewed.

Basic to all interviews is the requirement that you know as much as possible about the story you are after. It also helps to know a little about the background of the person you plan to interview. If he is a public figure, newspaper files can usually provide you with all the information you need to have about his career. Most people are impressed when someone takes the time and effort to learn about them. To be sure, the best way to inspire confidence is to first start out by praising the achievements of your subject.

Half the battle is won with the proper placement and handling of your microphone. If possible, use a stand mike which permits easier control of mike-to-subject distance and eliminates finger-tapping noises that are invariably produced by hand-held mikes. The mike should be placed on a table approximately equidistant from each person involved in the interview. Experiment to

determine an appropriate distance and the required recording level for the room acoustics.

**After preparing the room** and setting up your recorder and mike, all you should have to do is flip the record switch to be "on the air." Once the interview is started, keep it going in a normal conversational tone.

Look directly at the person being interviewed, and by no means keep looking at the mike. The line of questioning should not lead to "yes" or "no" replies, but rather to a "here's my point of view" dialogue. If the person being interviewed wanders off on an unrelated track, act interested, and don't interrupt him. You can always edit the tape later.

If you are shown clippings or other prized possessions, read them into the microphone, and return them immediately. Also, any off-the-record comments should be kept confidential. By all means, when you edit the interview, destroy these passages. Your integrity must never be questioned.

Let the tape recorder run without your attention and do not stop the recorder with every pause. When the tape runs out and you can hear it flapping, show some concern, but make it appear that it would pain you if some important point in the interview were missed.

When the interview is over, you will know it because there will be nothing more to talk about. Thank the person you interviewed for taking so much of his or her valuable time, and pack up.

**Editing the interview tape** can be a time-consuming yet rewarding experience. All unrelated material and pauses which produce blank tape should be spliced out. This is where the empty reels come into play.

Identify the deleted tape you want to keep with written captions, and wind it on a separate reel. You can even rearrange the dialogue so that it follows a plausible, continuous line of thought.

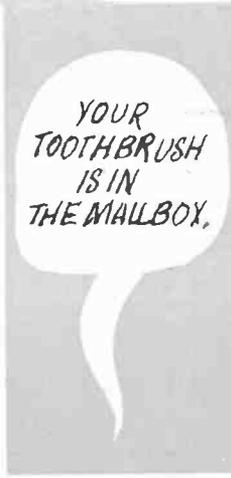
The edited tape should play smoothly from start to finish without any apparent jumps or "blips." If your first attempt is not wholly successful, don't be discouraged. As you become more experienced, your taped interviews will take on a more professional quality. —30—



EIGHT  
MINUTES  
LATER



EIGHT  
MINUTES  
LATER



EIGHT  
MINUTES  
LATER



# PARLOR GAME

By LEWIS A. HARLOW

**I**F THAT OLD hidden microphone gag has just about worn thin at your social get-togethers, why not pull a switcheroo? It's a lot more fun to do, and it can be a bigger party perker-upper than those replays.

Prerecord about 90 minutes worth of tape with pauses between attention-getting phrases spoken a little louder than normal conversation. About eight minutes of pause is the limit if you want to keep your guests' attention. Don't make it too short, though, or you'll lose the whole effect.

Shown above and below are examples of the type of dialogue you can use. Tailor your dialogue to fit the company you plan to have over.

When the guests have begun to gather into small groups for the inevitable small talk, mute your hi-fi and start the tape going. Allow an initial eight minutes of blank running time so that anyone who might have seen you turn the recorder on will have forgotten it.

When the dialogue starts, watch the party perk up and the small talk turn to a discussion of your switcheroo. —30—

EIGHT  
MINUTES  
LATER



EIGHT  
MINUTES  
LATER



EIGHT  
MINUTES  
LATER



# A TAPE RECORDER KIT —DELUXE



NEW HEATHKIT AD-16 PUTS TOP-QUALITY  
FOUR-TRACK TAPE RECORDER  
IN THE HI-FI/STEREO BIG LEAGUES

**T**HE FELLOW at the Heath Company who thought up the idea of putting someone else's accepted manufactured product into a kit deserves a pat on the back. Heath introduced this new philosophy a few years ago with a couple of electronic organs (Thomas). A 21" color TV kit followed which looked suspiciously like an RCA, and a few months ago Heath announced a deluxe tape recorder kit that is really the Magnecord 1020 in kit guise.

POPULAR ELECTRONICS built one of the first of the new Model AD-16 recorders and can report that the Heath/Magnecord marriage is a happy one. Within 17½ hours, the AD-16 was assembled and ready for tape head alignment. Another hour, and the recorder was mounted and playing as perfectly as any hi-fi enthusiast might desire.

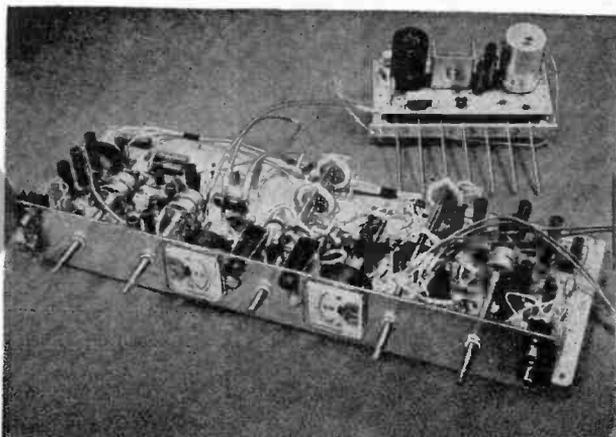
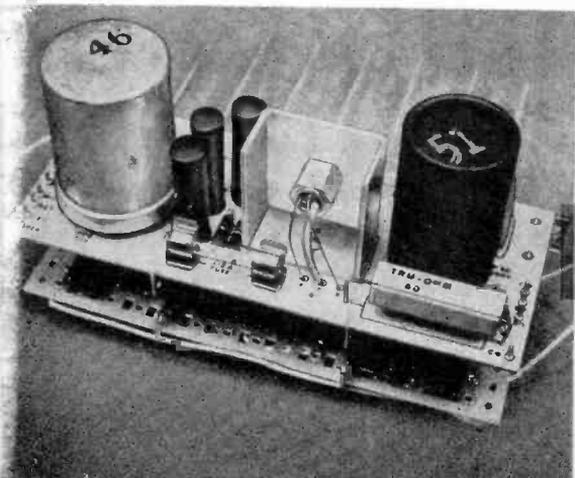
**Why Build a Tape Recorder?** There are three important reasons to start on your way to building an AD-16. First, there is a significant monetary saving. The AD-16 is selling as the Magnecord 1020 for 45% more than you pay for the

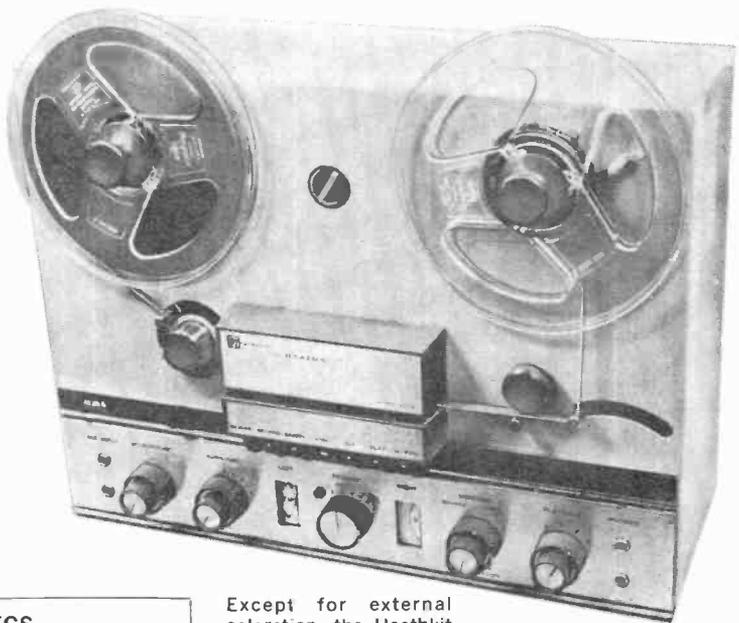
kit. Since 16-18 hours of construction time is about average, you're getting a bonus equal to \$10 per hour for your spare time.

Secondly, the AD-16 cum 1020 is the Rolls-Royce of the tape recording industry. This *IS* a deluxe tape recorder—all solid-state circuitry (21 transistors) and ready for instant operation (no warmup). Third—and this is important—when you build a piece of gear like a tape recorder, you *learn*. You *learn* how the whole recorder operates; you *learn* the mechanics of the transport; and when maintenance is required, you have the experience and a manual with all the facts right at your fingertips.

**No Need To Be a Mechanic.** If you have ever opened up a tape recorder and been startled by the maze of flywheels, linkages, drive belts and cams, you can be excused for thinking that building a  
(Continued on page 92)

First step in building the AD-16 tape recorder is wiring the power supply circuit board (left), which takes about 2 hours. Next in line is the major printed circuit board (below), with the remainder of the electronics. The average builder should reach this point in about 3 to 9 hours of working time.



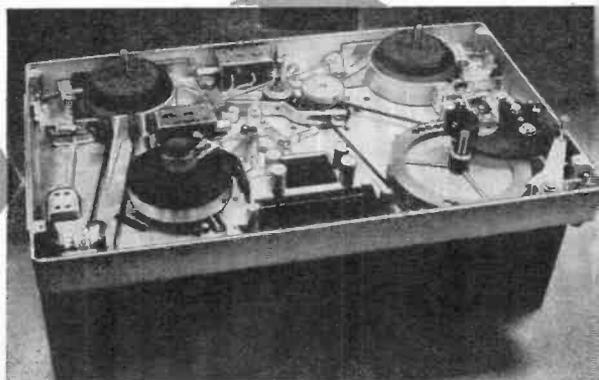
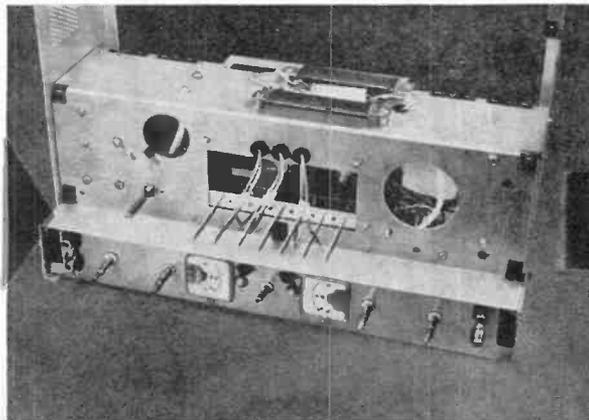
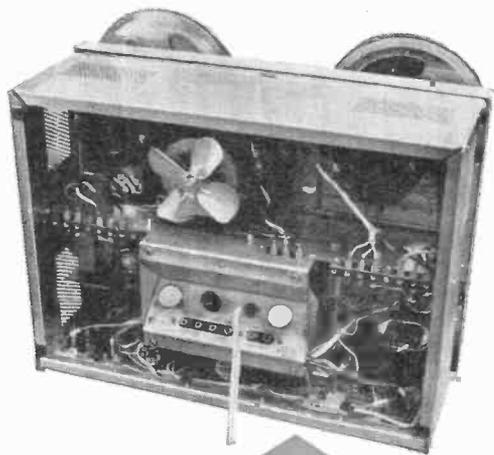


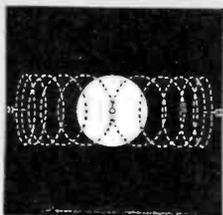
### SHORT SPECS

- Two-speed ( $7\frac{1}{2}$  and  $3\frac{3}{4}$  in/s), 4-track record and playback, with provision for sound-on-sound or sound-with-sound recording.
- The AD-16 accepts  $\frac{1}{4}$ "-wide tape; 1.5, 1.0, 0.75, or 0.5-mil thickness. Use 7" NAB reels or special  $8\frac{1}{4}$ " Magnecord reels.
- Measured frequency response at  $7\frac{1}{2}$  in/s exceeded 45-17,500 kHz at  $\pm 2$  dB.
- Unit draws 140 watts maximum, measures  $13\frac{3}{32}$ " x  $17\frac{5}{8}$ " x  $8\frac{1}{4}$ ".
- Price: \$399.50. Base, \$19.95, extra.

Except for external coloration, the Heathkit AD-16 has the physical appearance of a Magnecord 1020, at a price saving of about \$175.00.

Mounting the two electronics assemblies on the main frame also involves mounting the power transformer, filter capacitors and bleeder resistors. By the time your AD-16 looks like the photo, below, work time will be just under 12 hours. Another 3 hours is spent assembling the transport mechanism (below, right). After the heads are mounted, the recorder will look something like the rear view photo at right, in just about  $17\frac{1}{2}$  hours. The small inset panel is for connections to the tape auxiliary input, monitoring, and tape output. The silver knobs are for winding up the a.c. power cable. Microphone and headphone jacks are all on front panel.

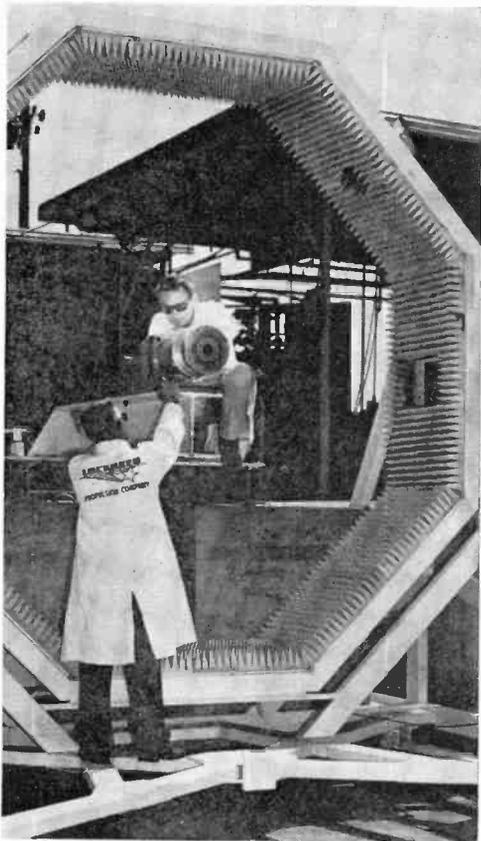




# ZERO-BEATING THE NEWS

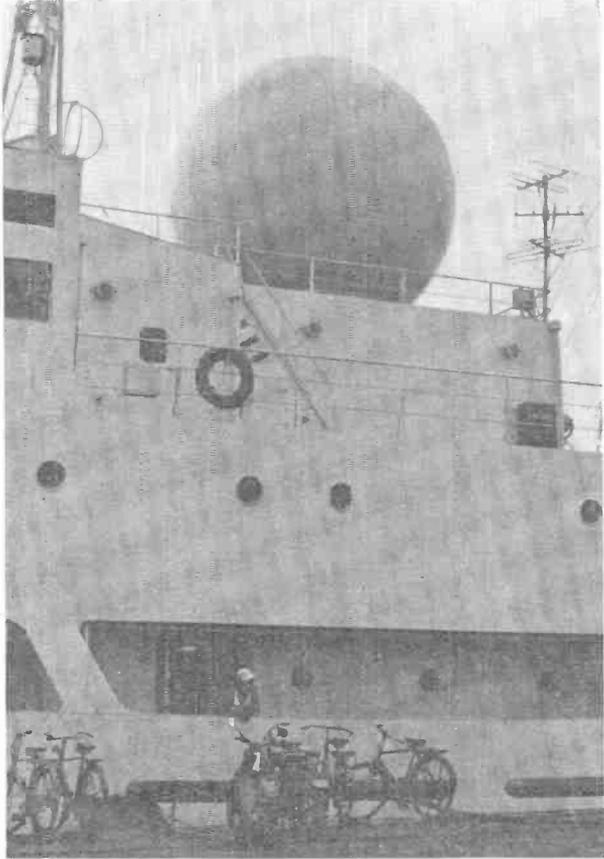
**TOM THUMB WEATHER STATION**—With its state-of-the-art accuracy in measuring basic weather variables, the AN/TMQ-22 Meteorological Measuring Set made for the U.S. Army by Cambridge Systems, Inc., is said to be the most advanced portable weather unit to go into the field to date. One man can set it up in less than 5 minutes.

**HOT STATIC COOLER**—Tremendous heat and tiny particles in rocket exhausts often produce communications-blanking static. This giant octagonal ring, developed by Lockheed Propulsion, is used to study these effects in an effort to design rockets that do not generate static.



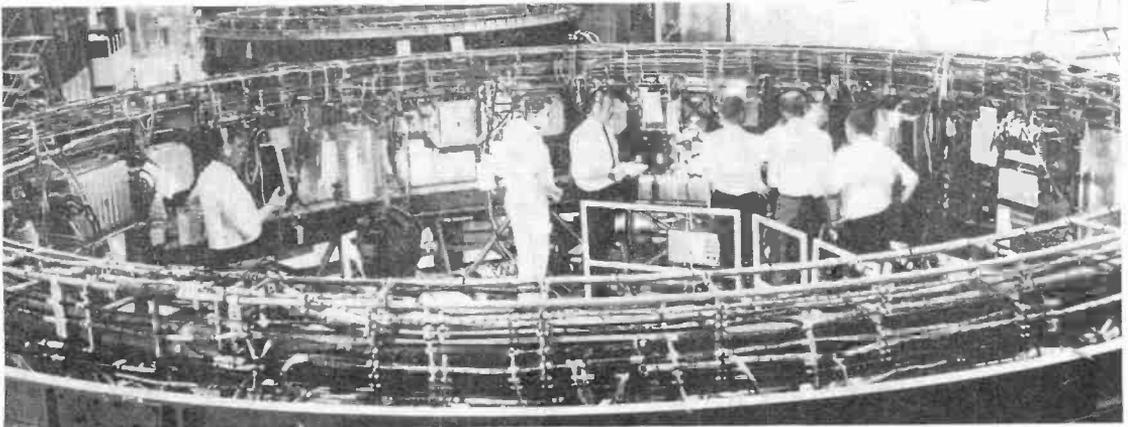
**"REHABAPHONE"**—Among the unusual equipment designed by General Telephone and Electronics Corp. are dials in Braille for the blind, telephones that answer themselves for the paralyzed, and telephones in oversized booths at convenient heights for wheelchair patients. Shown above is the "Rehabaphone" which requires only a slight pressure on a switch for dialing.

**WORLD'S LARGEST**—The largest weather radar system ever to be placed aboard a ship is installed on the "Ryofu-Maru." The system was designed and built for the Japanese Ministry of Transportation by Toshiba, and it incorporates many new features, one of which is a device that maintains desired antenna angle, compensating for pitching and rolling in heavy seas.

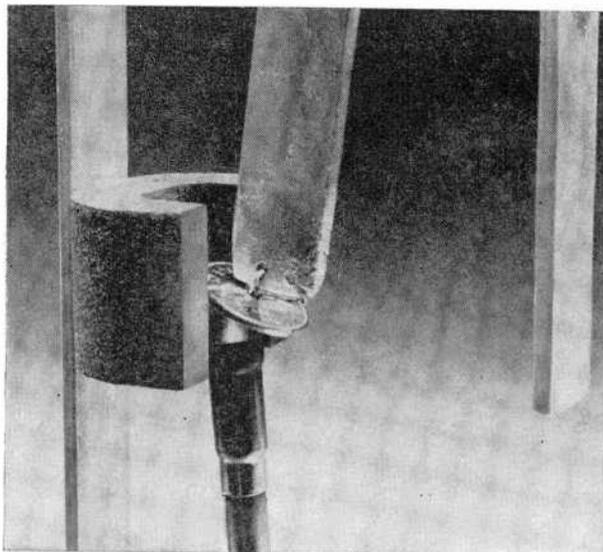


**MULTIPLIED TEACHER**—Educating Systems, Inc., has developed a new method by which educational programs are multiplexed on one regular FM or CATV channel. Four separate supersonic subchannels which correspond to the choices of answers make it possible for the student to press one of the four buttons on a special Sylvania-built receiver to indicate his answer. If a wrong answer is selected, the correct answer is given plus the reasoning behind it.

**SATURN SANDWICH TO GO**—The more than 60 component parts which make up an Instrument Unit are assembled and hung inside 3'-thick slices of a Saturn rocket. The slices are fitted between the propulsion stage and the payload. The Instrument Unit will guide a Saturn vehicle on a suborbital flight. IBM engineers and technicians check the slices out prior to delivery to Cape Kennedy.



SCIENCE  
FAIR  
PROJECT



# TESLA'S THERMOMAGNETIC MOTOR

A LITTLE-KNOWN  
INVENTION BY  
THAT CONTROVERSIAL  
GENIUS

By ARTHUR S. COOKFAIR

**M**ENTION Nikola Tesla to any electronics hobbyist and the chances are his first thought will be of the Tesla Coil. Upon reflection, he may recall that Tesla had something to do with developing alternating current power transmission, or the invention of the induction motor. The fact is that in the early days of electricity and magnetism, Tesla's active mind was probing in many directions to find ways of putting these forces to use. The thermomagnetic motor was one approach.

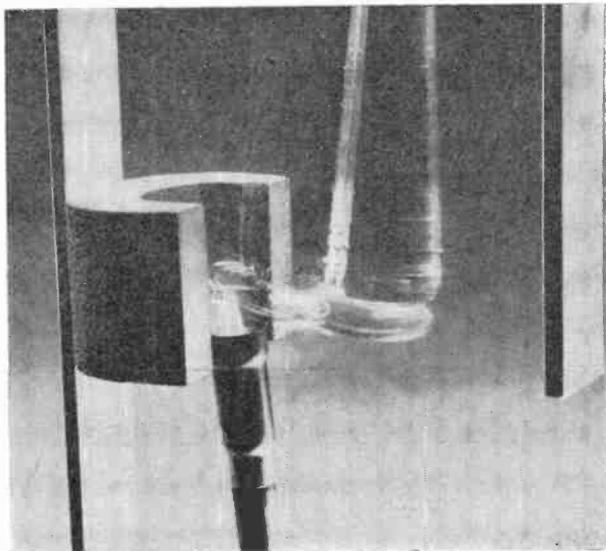
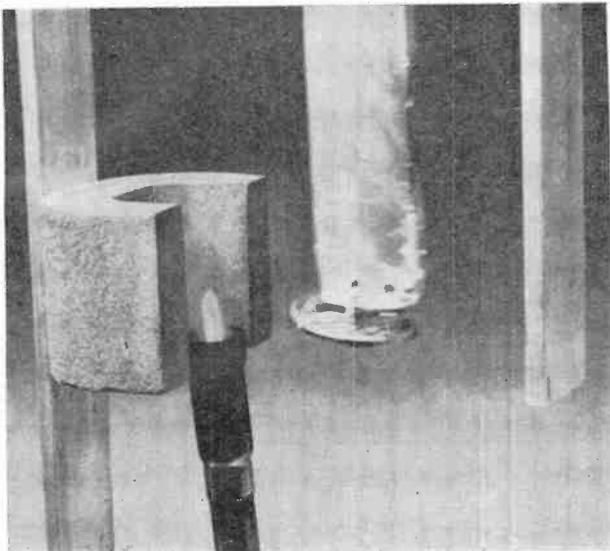
Unlike the induction motor (Tesla's most useful contribution), the thermomagnetic motor was destined to obscurity. It is a little known invention buried among the millions of inventions in the archives of the U.S. Patent Office. The motor itself is easy to construct and

provides a simple—yet interesting—science fair project or demonstration device to show the effects of temperature on magnetism.

**Theory.** Tesla's thermomagnetic invention is based on the phenomenon known as *Curie temperature* (after its discoverer, Pierre Curie—of radium fame). The Curie temperature is the point at which permanent magnetic properties of certain metals go down the drain.

A Curie temperature transformation occurs in both *hard* and *soft* magnetic materials. Hard magnetic materials—such as alnico or hard steel—are those which are used in the manufacture of permanent magnets. Soft magnetic materials, such as soft iron, are those metals which are easily magnetized when placed in a magnetic field, but tend to lose their magnetism rapidly when removed from the field. Since permanent magnets can be damaged by excessive heat, Tesla's thermomagnetic motor was designed so that heat would be applied only to a soft magnetic material.

The Curie temperature varies for different metals. Iron loses its magnetism at 770° C, nickel at 360° C, and cobalt



The above sequence shows how Tesla's motor operates. As the gas flame heats the nickel, a point is reached when the attraction to the alnico magnet is cancelled. A weak spring pulls the arm and nickel away from the flame. When the nickel cools, the magnetic attraction is restored and the nickel returns to its original position. This oscillation should be at a rate of about 20 strokes per minute. Be careful not to heat the magnet.

at 1120° C. Alloys such as nickel-iron may lose their magnetism at temperatures ranging from below room temperature as high as 770° C, depending on the ratio of nickel to iron. Place any one of the above metals or alloys near a magnet, at ordinary temperatures, and it will be attracted. Heat it above the Curie temperature and the attraction is lost. As it cools, the magnetic attraction returns. Alternate heating and cooling creates an alternating magnetic force.

**How It Works.** In operation, a facsimile of Tesla's motor consists of a movable rider made of a soft magnetic material that is pulled in one direction by a spring and in the opposite direction by a magnet—the magnet being the stronger of the two forces. The rider is pulled by the magnet to a position where it can be heated by a flame (or other heat source).

When the rider reaches the Curie temperature, it is no longer attracted by the magnet and is pulled away from the flame by the spring. The rider cools rapidly to below the Curie temperature, regains its magnetic properties, is again attracted by the magnet to a position over the flame; and the cycle repeats itself.

The frequency of the rider oscillation depends on the heating and cooling cycle. Once the operation has started, the magnetic rider will remain close to the Curie transformation point and will lose and regain its magnetic properties by variations of only a few degrees above or below that temperature.

A Bunsen burner or hand propane torch will do an excellent job of heating. If these are not available, a candle will serve the purpose. Or, if you want to keep up with the latest trends in science, you can demonstrate the conversion of solar energy by heating the rider with a small magnifying glass.

**Construction.** The frame of the motor shown (above and on page 114) was made of aluminum since it is easy to work and the non-magnetic qualities of aluminum will not be attracted by the magnetic field. You can build the motor to operate with almost any size of magnet. Small alnico magnets are available in hardware stores. Naturally, a more powerful magnet is easier to use—it will pull from a greater distance, and it also permits the use of a heavier spring. In a model similar to that shown, a 2-ounce

*(Continued on page 114)*

JUST  
WHEN I  
FORGOT



## MY (SOLDERING) GUN!

Sequel 3

**C**URBING THE TIDE of entries to our contest on nonsensical remarks about electronics has the appearance of an impossible task. And why not? Surely you've heard a wild, implausible, or inane remark about electronics. Send it in and you may win a soldering gun—so you'll be able to turn the heat on when the next remark is made in your presence.

Typical remarks have appeared in the July, September, and November issues.

**Best of the Lot.** Since our last "Sequel," the comment that got the biggest reception here was one made by a bright-eyed secretary who, when asked (over the telephone) if a missing carton of capacitors had arrived, replied, "No, but there's a box full of farads."

**Talk About TV.** About half of the entries received in the past month have been about TV—installation or repair. As might be expected with such a popular topic, there are innumerable duplications.

The most common TV tale is about the housewife who sees all of the dust inside the TV set. Since most wives are unnerved at the sight of such filth, they set forth and wash out the insides with Soilax—or a similar cleaner—whereupon the husband in question tightens all loose screws and bolts. As far-fetched as this might sound, it apparently has happened from coast to coast—many times over.

Confusion about color TV is a dominant topic and we couldn't help laughing at the recommendation not to use 300-ohm twin lead because it "flattens out

the picture." Or at the story of the housewife who, having moved back into the hills where electric service was not available, asked the technician to "change her TV over to gas."

**Now Come the Puns.** Possibly because some of the "real life" remarks are too silly to be believed, many readers are submitting puns and other jokes. It's impossible to resist publishing some of them although this was not the original intent of the "No Gun" contest.

The editorial staff particularly liked the letter from a bionic laboratory that asked for a soldering gun because they "wanted to attach a resistor to the stove—they always wanted an ohm on the range." And the one about the electronics technician who had been working late and arrived home to be greeted with, "Oh, Henry, wire you insulate?"

The "classic" pun is so terrible that only engineers will get it; but, as the story goes, a case of butter was missing from a ham club banquet. The problem was solved when one member remarked, "After all, what's Butterworth to Chebyshev?"

**Winners.** This month soldering guns went to Thomas Collins, J. Engel, M. J. Ehrenburg, Robert MacElvain, Kevin Garrity, Walter F. Smith, and Donald Strachan.

Send as many entries as you wish to "Gun Contest," POPULAR ELECTRONICS, One Park Avenue, New York, N.Y. 10016. The date of the postmark determines the winner in case of a tie.

—50—

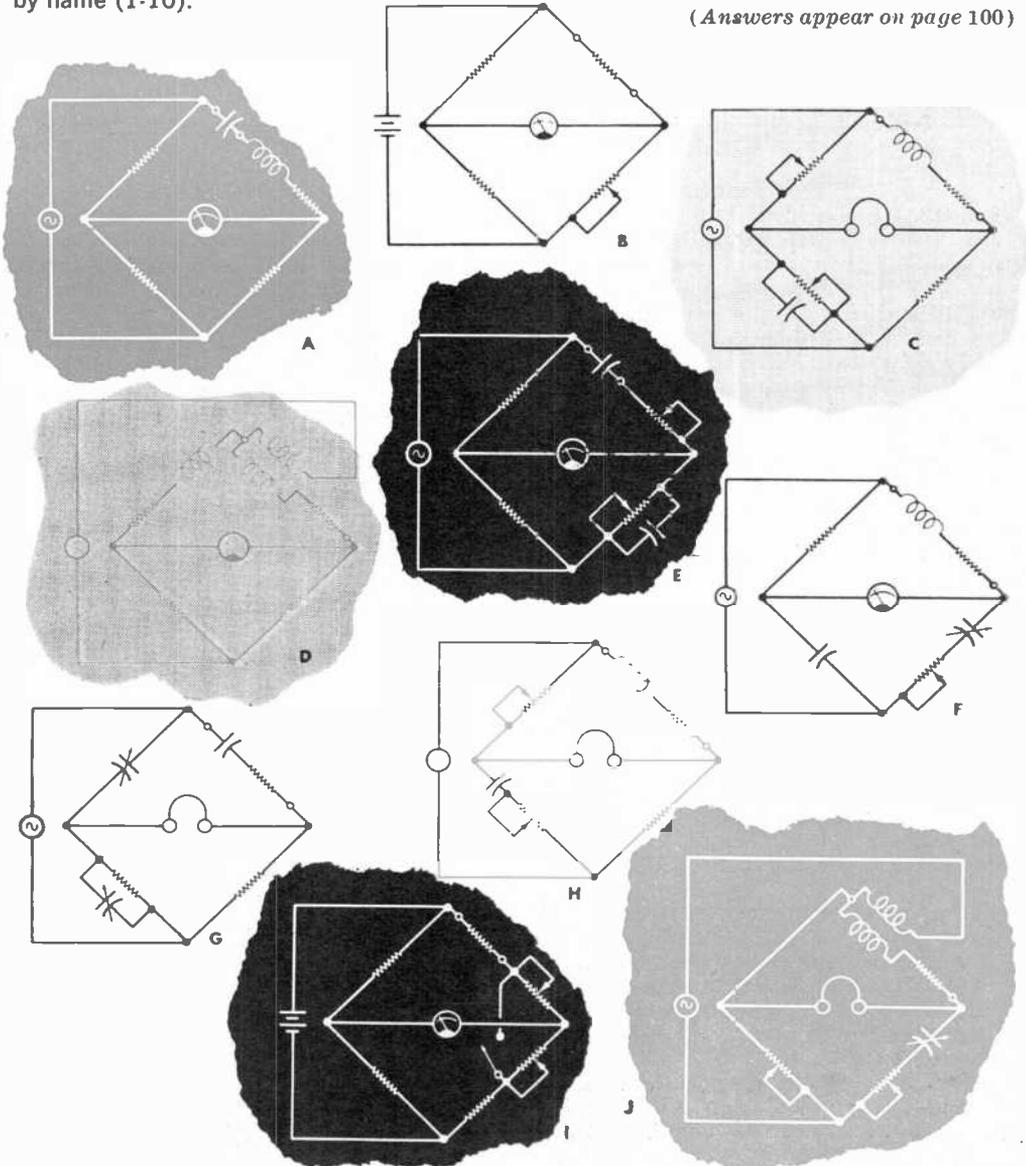
# BRIDGE CIRCUIT QUIZ

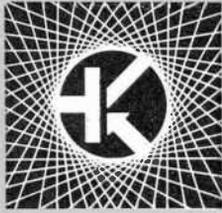
By ROBERT P. BALIN

Most electronic technicians are familiar with the widely used Wheatstone bridge. But many are not so familiar with other types of bridges commonly used in the laboratory for measurement of impedance—resistive, reactive, inductive, or capacitive—at frequencies well up into the UHF band. Bridges employ the so-called null method to measure an unknown quantity, either directly or by computation. In the latter case, values of some of the fixed and adjustable components in the bridge are substituted in an applicable equation, which is then solved for the unknown quantity. See how many circuits (A-J) you can identify by name (1-10).

- 1 CAREY FOSTER
- 2 HAY
- 3 HEAVISIDE
- 4 KELVIN
- 5 MAXWELL
- 6 OWEN
- 7 RESONANCE
- 8 SCHERING
- 9 WHEATSTONE
- 10 WIEN

(Answers appear on page 100)





# SOLID STATE

By LOU GARNER, Semiconductor Editor

**G**IFT-GIVING during the holiday season can be a brain-wracking, time-consuming chore, or a relatively pleasant, rewarding experience—depending on your financial status, and on the recipient's interests. For example, if your friends are all electronics hobbyists, the task is bound to be a simple one, since suitable gifts are available in every price range, and the electronics hobbyist who "has everything" is as rare as the dodo bird.

The catalogs put out by mail-order houses like Olson Electronics, Radio Shack, Lafayette Radio, Allied Radio, and Burstein-Applebee make excellent "wish books" and gift-selection guides. (If you want to "drop a hint" to a parent, relative, or friend, simply put a check mark against the items you'd like, insert necessary page markers, and leave the catalog in a conspicuous place.)

If you are operating with a tight budget, consider giving one of the many books on electronic theory that are offered by semiconductor manufacturers—or a subscription to *POPULAR ELECTRONICS*.

Also available are books on electronic construction projects by Motorola, Semiconductors, G. E., Texas Instruments, International Rectifier and others, that can be used as guides in choosing more unusual—though perhaps costlier—gifts. Simply select a project and make up a package containing the book and all the components specified in the parts list. Or, you could limit your gift to the "special" components called for—this might include a selection of the required semiconductor devices.

With a fatter pocketbook, your gift might be a Conar, Heath, EICO, Allied Radio (Knight-Kit) or Lafayette test equipment kit . . . or a CB transceiver, hi-fi component, antenna rotator, transistorized d.c. power supply, or an automatic "bug" . . . depending on the recipient's special interests.

If you have an unlimited budget, you can pull out all the stops and let your imagination be your guide.

**Reader's Circuit.** A reader with the surprising—but familiar—name of Patrick Henry (2408 Queenstone Dr., San Rafael, Calif. 94903) submitted the four-transistor audio

amplifier circuit illustrated in Fig. 1. Pat indicates that he made up the amplifier by combining the best features from a number of commercial circuits and suggests its use be limited to low-to-medium power applications.

At first glance, the circuit seems akin to the four-transistor design featured in the "Update to Solid State" project in the September, 1966, issue of *POPULAR ELECTRONICS*. However, a closer examination reveals a number of important differences. Pat used single-ended class B output amplifiers rather than the push-pull arrangement described in the article, and uses a phase-inverter driver and a different type of biasing network.

An audio signal at *J1* is applied to the base of *Q1*, serving as a common-emitter preamplifier, through d.c. blocking capacitor *C1*, and *GAIN* control *R1*. Resistor *R2* supplies the base bias, and *R5*, bypassed by *C2*, provides stabilization. Resistor *R3* is the collector load.

The amplified output at the collector of *Q1* is coupled through *C3* to *Q2*, a split-load phase inverter. Base bias for this stage is furnished through voltage divider *R4-R6*, with *R7* and *R8* acting, respectively, as collector and emitter loads.

The output signal from *Q2* is direct-coupled to power amplifiers *Q3* and *Q4*, biased by respective voltage developed across *R7* and *R8*. Emitter resistors *R9* and *R10* act to stabilize and balance the power amplifier stage. The output signal is applied to the speaker through d.c. blocking capacitor *C4*. Operating power is furnished by battery *B1*, through switch *S1*.

Standard parts are used throughout the circuit. Transistors *Q1* and *Q2* are 2N410's, while *Q3* and *Q4* are 2N456's. Potentiometer *R1* is a 500,000-ohm audio taper unit and *J1* is a standard phono jack. The capacitors are all 15-WVDC electrolytics, although a higher voltage rating (up to 25 volts) can be used. Except for *R9*, which is a 1-watt resistor, and *R10*, which is a 1.3-ohm filament choke, all resistors are half-watt types. Switch *S1* can be combined with *R1*, or can be a separate slide or toggle type.

The amplifier can be assembled on a met-

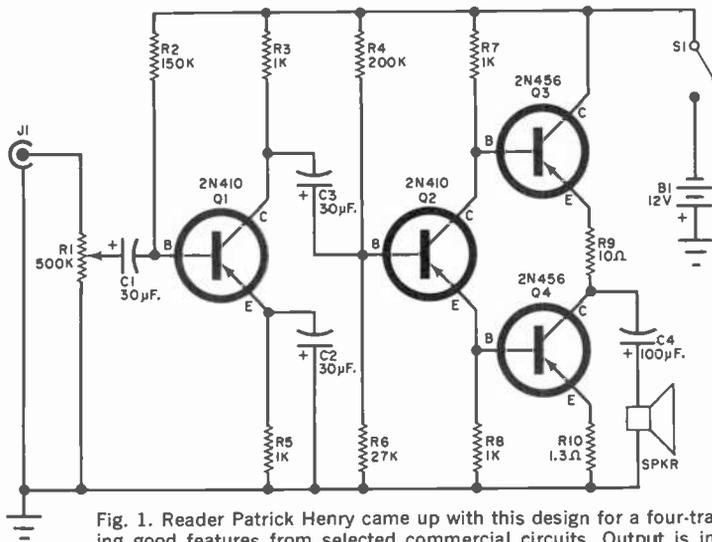


Fig. 1. Reader Patrick Henry came up with this design for a four-transistor amplifier by combining good features from selected commercial circuits. Output is in the medium power range.

al chassis or on a phenolic board, as preferred. One advantage of using a metal chassis is that it can also serve as a heat sink for  $Q3$  and  $Q4$ , which must be heat-sunked. The completed amplifier can be used with any standard PM speaker having a 3.2- to 16-ohm voice coil. In general, the higher the speaker impedance, the better the system's low frequency response; and remember that larger speakers (6- to 8-inch) are more efficient than the miniature types. Battery  $B1$  can be a 12-volt lantern type, or it can be made up of eight flashlight cells in series.

**Manufacturer's Circuit.** Many electronic equipment circuits, including stabilized oscillators, signal generators, transistorized test meters, characteristic curve tracers, and calibrated amplifiers, call for regulated d.c. power supplies. The simple voltage-regulator circuit shown in Fig. 2 is one of several power transistor circuits discussed in a recently published bulletin by Bendix's Semiconductor Division (Holmdel, N.J.).

This circuit is capable of maintaining a constant output voltage even with relatively wide variations of input voltage or load conditions. Due to its utter simplicity, it can be added to an existing power supply, or can serve as an integral part of a regulated power supply design.

Employing the principles of conventional series regulation, the circuit utilizes the internal collector-emitter resistance of  $Q1$ , which varies with changes in the applied voltage or in circuit loading, to provide automatic voltage regulation. The regulation is controlled essentially by a stabilized base bias that is furnished and maintained by resistor  $R1$  and zener diode  $D1$ .

Component values will, of course, vary with design requirements, but with a nominal 12-volt d.c. source, Bendix suggests a B-5000 *npn* power transistor for  $Q1$  and a 1N2044-3 zener diode for  $D1$ . Resistor  $R1$  is a 22-ohm, 5- or 10-watt unit. With these values, the circuit maintains a steady out-

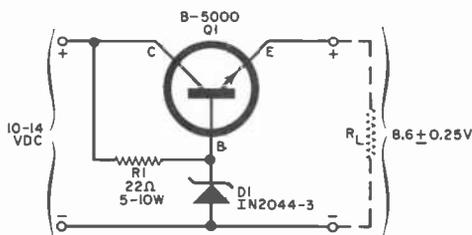


Fig. 2. Voltage regulator by Bendix maintains a relatively constant output, notwithstanding wide variations of input voltage or load conditions.

put of  $8.6 \pm 0.25$  volt across a 180-ohm load, with a d.c. input of from 10 to 14 volts. In fact, the output will drop less than 1 volt even if the load is reduced to only 4 ohms.

The regulator circuit can be assembled in a small metal box for test purposes or on a suitable phenolic board or etched circuit board for addition to an existing power supply. An adequate heat sink should be provided for  $Q1$ .

**New Developments.** A solid-state, positive-temperature-coefficient thermistor in a new hermetically sealed, hard-glass package is now being produced by Texas Instruments, Inc. (13500 N. Central Expressway, Dallas, Texas). The new unit (Fig. 3) is only one-

third the volume of the earlier molded type shown. Dubbed a *Sensitor*, and identified as type TG1/8, the  $\frac{1}{8}$ -watt silicon unit is ideal for temperature-sensing applications and for temperature compensation in transistor bias control and amplifier circuits. The TG1/8 features a linear resistance curve with temperatures between  $-55^{\circ}$  and  $+125^{\circ}$  C, and is available in 32 ohmic values, ranging from 10 to 2700 ohms.

If you like to work with UHF circuitry—whether as a ham or an advanced student—you'll be interested in a new *npn* silicon planar epitaxial transistor recently announced by the Ampere Electronic Corp. (Slatersville, R.I. 02876). Designated as Type A485, the transistor has a gain-bandwidth product ( $f_r$ ) of 1500 MHz and can

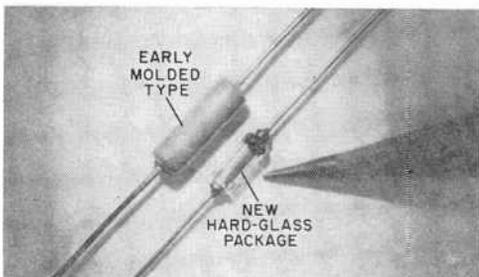


Fig. 3. The new positive-temperature-coefficient thermistor by Texas Instruments is only one-third the size of the earlier molded type, as shown here.

provide gain up to 200. Its noise figure is a low 3.5 dB at 200 MHz and only 4.5 dB at 450 MHz. A low-power device, the A485 is suitable for use in receivers, r.f. amplifiers, signal generators, test circuits, telemetry equipment, and other projects requiring high gain and low noise.

**Transitips.** How do you select your transistor audio transformers? By price? By size? By impedance ratios? By power rating? By brand name?

In practice, any one of these criteria, taken alone, can lead to disappointing results; for there is no such "animal" as a "perfect" transformer. At best, any standard commercial transformer design represents a compromise between such factors as cost, overall size, weight, frequency response, efficiency, and power-handling capability.

For example, take the output stage illustrated in Fig. 4. Although a push-pull amplifier, it can be considered as a single-ended stage if the lower half of the circuit ( $Q_2$ ) is blocked out. In this circuit, output transformer  $T_1$  must: (1) provide a d.c. path for  $Q_1$ 's collector current; (2) act as a collector load for the transistor; (3) match

the stage's output impedance to the loudspeaker's voice coil; and (4) transfer power efficiently from the primary to secondary windings.

Equally important, the transformer must *not*: (1) introduce excessive power losses; (2) discriminate against specific frequencies

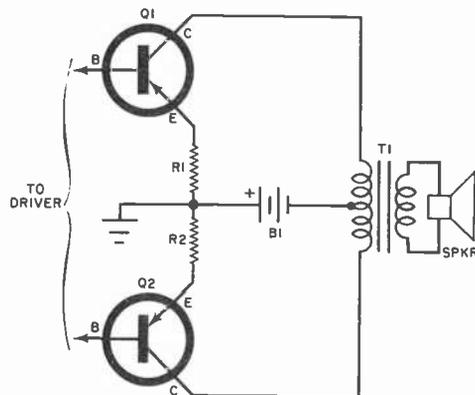


Fig. 4. A transistor audio transformer represents a compromise between ideal circuit requirements and factors of physical size, weight, and cost.

within its operating range; (3) introduce unwanted signals, such as spikes; (4) distort or otherwise change waveform of reproduced signals; (5) discriminate against signals of different amplitudes, such as transferring a high-level signal more efficiently than a low-level signal; and (6) produce a strong magnetic field that can couple to nearby components.

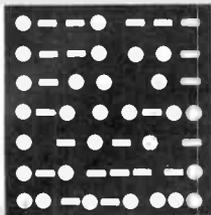
A good-quality audio output transformer is one which: (1) has the required impedance ratio, (2) has comparatively low d.c. resistance, and (3) can tolerate relatively large direct current levels. Unfortunately, these desirable characteristics can be obtained only at the expense of increased cost, size and weight.

To obtain a low d.c. resistance, the manufacturer must use a large size wire in the windings. This calls for more copper (which is expensive), and requires more space. Similarly, for maximum efficiency and good low-frequency response, the transformer must exhibit resistance to saturation by large signals. This means that the manufacturer has to use more iron in the transformer's core, and here again this calls for an increase in the size, weight, and cost of the transformer.

Inasmuch as wire and core size both affect a transformer's overall size, a good rule of thumb to follow—space permitting—is: the larger the transformer, the better.

Until next year—Happy Holidays!

—Lou



# AMATEUR RADIO

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

## GETTING THE MOST FROM YOUR DIPOLE OR BEAM ANTENNA

**I**T IS a well-known fact that a horizontal, center-fed, half-wave dipole, with or without traps, radiates best in a fairly wide pattern broadside to its length and poorest off its ends. But comparatively few people know the actual difference in signal strength or actual difference in how well they get out in various directions because of the orientation and directional characteristics of their antennas.

Here are some figures. Under normal conditions, the difference between broadside and end-fire signal reports when you're using a half-wave dipole averages less than half an "S" unit on the 3.5-MHz band and about one "S" unit on 7 MHz. On 14 MHz, the difference goes up to two to three "S" units; and on 21 MHz and higher, it averages about three "S" units.

From a practical standpoint, it is unimportant in what direction you string a horizontal,  $\frac{1}{2}$ -wave, 3.5- or 7-MHz dipole; but for working all states from most areas of the U.S. on the higher frequencies, stringing a  $\frac{1}{2}$ -wave dipole north and south is probably the best compromise. On the 14-, 21-, and 28-MHz bands, however, where directivity is more pronounced, a  $\frac{1}{2}$ -wave dipole is 33', 22', and 16 $\frac{1}{2}$ ' long, respectively; and many locations can accommodate two such antennas mounted at right angles to each other. By switching from one to the other, a rotating beam antenna effect can usually be obtained—especially on DX.

On the other hand, a small rotary beam requires less room than the two dipoles and provides power gain as well as directivity.

## AMATEUR STATION OF THE MONTH



Just count those TV screens! Bob Drete, K7VOR, Phoenix, Arizona, operates on 440-MHz amateur TV with a Blonder-Tongue vidicon camera chain, iconoscope slide camera, and a home-brew transmitter feeding a 10-element beam antenna atop a 65' tower. Bob also works 50 MHz (22 states confirmed), is an ARRL Assistant Director, and an Official Bulletin Station; the 50-MHz antenna is a 6-element beam. K7VOR will receive a one-year subscription to POPULAR ELECTRONICS for submitting this winner for December in our Amateur Station of the Month contest. If you would like to enter the contest, send us a clear picture of your station with you at the controls and some information about your radio career and the equipment you use. Even if you don't win, your photo may be used if space permits. Entries should go to: Amateur Radio Contest, c/o Herb S. Brier, P.O. Box 678, Gary, Indiana 46401.



Larry Trummel, WA9OMD, Lane, Ill., uses a dipole antenna, and George W. Moran, W2DGZ, Woodhaven, N. Y., (right) finds a simple vertical antenna satisfactory for 40-, 20-, 15-, and 10-meter operation. George's antenna gets nourishment from a Drake T-4X transmitter feeding a Heathkit HA-14 linear amplifier, which, in turn, feeds a Drake R-4A receiver. Larry transmits on a Johnson "Viking-II," with a VFO, and receives on a Hallicrafters SX-111. Their records: Larry worked 49 states in five months as a Novice, and as a General has added many foreign contacts; George counts WAC, WAS, and RCC among his various certificates.

But a beam is not much good unless it is aimed properly. While you don't have to aim it within half a degree, an error of more than ten degrees is too much.

The first step in aiming a beam accurately is locating true north from your location. Sighting the North Star will locate it within a degree. Also, a magnetic compass will locate magnetic north, and if you add the proper amount of variation for your area, you can readily determine true north.

Next, you need a world DX map drawn on a polar projection which identifies countries both by name and by call-letter prefix. When you hear a station called or mentioned, a glance at the map will identify the country and indicate where to aim your beam. But be sure to get a polar map; directions and distances indicated on a common Mercator map can be most confusing. For instance, Japan appears to be east of the United States on a Mercator world map. By the Great Circle route—the way radio signals usually travel—Japan is actually northwest of the United States. Similarly, Australia appears to be southeast of the U.S. on a Mercator map; actually, it is west.

There may be times when the shortest route between two stations is not the best way to beam your antenna. Propagation conditions could be such as to make it more desirable to rotate your beam 180° and shoot your contact the long way around. You won't notice any difference with a bi-directional dipole, but a beam with a good front-to-back ratio will give you some ammunition for rag-chewing when you go west instead of east.

The American Radio Relay League's "Amateur Radio Map of the World" and the *Call Book's* "Great Circle Chart of the World," available from amateur supply houses, are both excellent DX maps. In addition, hanging these maps on the wall really dresses up a ham shack.

**Code Practice.** Whether you have just memorized the code and your aim is 5 wpm for a Novice or Technician license, or you are aiming for 13 wpm to upgrade your license to General, or even 20 wpm for Extra Class, the only way you can improve your copying ability is by regular practice. Station W1AW, the headquarters station of the American Radio Relay League, Inc., makes the practice easy to get if you have a short-wave receiver.

For those who are not familiar with W1AW's schedule, code practice material is sent twice a day simultaneously on 1.805, 3.555, 7.08, 14.1, 21.075, 50.7, and 145.6 MHz at the following times and speeds. Early session: daily at 0300 GMT (7:30 p.m., EST; 6:30 p.m., CST; 5:30 p.m., MST; 4:30 p.m., PST) at speeds of 10, 13, and 15 wpm. Evening session: daily at 0230 GMT (9:30 p.m., EST; 8:30 p.m., CST; 7:30 p.m., MST; and 6:30 p.m., PST). Speeds on Sunday, Tuesday, Thursday, and Saturday evenings are 5, 7½, 10, and 13 wpm; on Monday, Wednesday, and Friday, they are 15, 20, 25, 30, and 35 wpm.

Approximately 10 minutes of code is sent at each speed. The start of each session is announced by "QST QST QST DE W1AW W1AW W1AW," repeated over and over.

(Continued on page 101)



# ON THE CITIZENS BAND

By MATT P. SPINELLO, KHC2060, CB Editor

**T**HE AUTOMOBILE Manufacturers Association and the General Motors Research Laboratories have announced operating test programs of the Highway Emergency Locating Plan (HELP). In the initial test, the City of Detroit Department of Streets

CB  
HELP  
PLAN  
TESTED

and Traffic and the GM Research Labs have inaugurated an experimental CB radio emergency service along the John C. Lodge expressway from Cobo Hall to Eight Mile Road. The system is designed to improve the flow of traffic along a main city traffic artery through use of CB radio by private motorists.

Under the experimental program, the Department of Streets and Traffic maintains a base station in the Herman Kiefer Hospital headquarters of the National Proving Ground for Freeway Surveillance. The GM Research Laboratories has supplied 100 CB transceivers for the system hookup. Some have been installed in City of Detroit vehicles, others in cars of selected GM employees who commute daily on the expressway. Operators of both City and GM CB-equipped vehicles have been instructed to call the base station only for expressway emergencies. The base station then directs

the police expressway patrol to the scene of the emergency.

Michigan's highway department has installed special markers along the freeway route from downtown Detroit to Lansing as well as signs advising that the highway is being monitored by CB radio. Special display banners also have been posted at each of the monitoring centers where HELP literature is being handed out to interested parties.

The purpose of the test programs is to gather data in support of the AMA petition to the FCC requesting that two new CB channels be reserved for highway emergency use. The FCC had indicated earlier that more information was necessary to determine whether such exclusive channels were needed.

A somewhat similar experimental CB system is now operating in the Kokomo, Ind., area where GM's Delco Radio Division has a CB base station in its plant. Calls for help received at the station are relayed to the city police or county sheriff's department. The calls received at Delco so far have concerned automobile accidents and motorists stalled for lack of gas. Researchers indicate, however, that the Kokomo system has proved that first aid for injured motorists can be expedited by HELP.

*(Continued on page 98)*

In HELP test program set up by the City of Detroit and GM Research Labs, operators of mobile CB transceivers call base station (at right) when an emergency occurs along the John Lodge expressway, and the base station directs the police expressway patrol to the scene.



# ENGLISH-LANGUAGE BROADCASTS TO NORTH AMERICA

## FOR THE MONTH OF DECEMBER

Prepared by **ROBERT LEGGE**

### TO EASTERN AND CENTRAL NORTH AMERICA

COUNTRY	CITY	TIME—EST	TIME—GMT	FREQUENCIES (MHz)
AUSTRALIA	Melbourne	7:15-8:15 a.m.	1215-1315	11.71
CANADA	Montreal	7:15-8:15 a.m.	1215-1315	5.97, 15.32
DENMARK	Copenhagen	7:30-8 a.m.	1230-1300	15.165
FINLAND	Helsinki	7:15-7:45 a.m.	1215-1245	15.185 (Tues., Sat.)
GREAT BRITAIN	London	10:30 a.m.-12:30 p.m.	1530-1730	15.26, 17.81
SWEDEN	Stockholm	9:9:30 a.m.	1400-1430	17.84

### EVENING BROADCASTS

ALBANIA	Tirana	7-7:30 p.m.	0000-0030	7.265
BULGARIA	Sofia	7-8 p.m.	0000-0100	6.07
CHINA	Peking	8-10 p.m.	0100-0300	11.945, 15.06
CUBA	Havana	8-11 p.m.	0100-0400	6.17, 11.76
CZECHOSLOVAKIA	Prague	8-9 p.m.	0100-0200	5.93, 7.115, 7.345
ECUADOR	Quito (HCJB)	9-11:30 p.m.	0200-0430	9.745, 11.915
EGYPT	Cairo	8:30-10 p.m.	0130-0300	9.475
GERMANY	Berlin	8-9 p.m.	0100-0200	6.16, 9.73
	Cologne	8:30-9:50 p.m.	0130-0250	6.075, 9.64
GREAT BRITAIN	London	4:15-10:30 p.m.	2115-0330	6.195, 7.13, 9.51
HUNGARY	Budapest	8:30-9:30 p.m.	0130-0230	6.235, 9.833
ITALY	Rome	8-8:20 p.m.	0100-0120	6.01, 9.63
JAPAN	Tokyo	6:45-7:45 p.m.	2345-0045	11.78, 15.135
LEBANON	Beirut	9:30-10 p.m.	0230-0300	9.71
NETHERLANDS	Hilversum	8:30-9:30 p.m.	0130-0230	9.59 (Bonaire relay)
PORTUGAL	Lisbon	9-9:45 p.m.	0200-0245	6.025, 6.185
ROMANIA	Bucharest	8:30-9:30 p.m.	0130-0230	6.15, 9.57
SOUTH AFRICA	Johannesburg	7:30-8:30 p.m.	0030-0130	9.525, 11.90
SPAIN	Madrid	8-9:30 p.m.	0100-0230	6.13, 9.76
SWEDEN	Stockholm	8:15-9:45 p.m.	0115-0245	5.99
SWITZERLAND	Berne	8:15-9:15 p.m.	0115-0215	5.965, 6.12, 9.535
U.S.S.R.	Kiev	7:30-8 p.m.	0030-0100	7.12, 7.31, 9.665
	Moscow	5-5:30 p.m. & hourly to 12-1 a.m.	(Mon., Thurs., Fri.) 2200-2230 & hourly to 0500-0600	(Tues., Fri., Sat.) 7.15, 7.31, 9.665
VATICAN	Vatican	7:50-8:10 p.m.	0050-0110	5.985, 7.25, 9.645

### TO WESTERN NORTH AMERICA

COUNTRY	CITY	TIME—PST	TIME—GMT	FREQUENCIES (MHz)
ARGENTINA	Buenos Aires	10-11 p.m. (Mon.-Fri.)	0600-0700 (Tues.-Sat.)	9.69
AUSTRALIA	Melbourne	5-7 p.m.	0100-0300	15.22, 17.84
BULGARIA	Sofia	8-8:30 p.m.	0400-0430	6.07
CHINA	Peking	7-9 p.m.	0300-0500	9.457, 11.82, 15.095
	Taipei	6:50-7:50 p.m.	0250-0350	11.86, 15.345
CUBA	Havana	10:30-12 p.m.	0630-0800	6.10
CZECHOSLOVAKIA	Prague	7:30-8:30 p.m.	0330-0430	5.93, 7.115, 7.345
GERMANY	Berlin	7:45-8:15 p.m.	0345-0415	5.96, 9.65
	Cologne	9-9:40 p.m.	0500-0540	6.145, 9.735
HUNGARY	Budapest	7-8 p.m.	0300-0400	6.235, 9.833
JAPAN	Tokyo	6-7 p.m.	0200-0300	15.135, 17.825
KOREA	Seoul	7-7:30 p.m.	0300-0330	11.925
PORTUGAL	Lisbon	8-8:45 p.m.	0400-0445	6.025, 6.185
SOUTH AFRICA	Johannesburg	6:30-7:30 p.m.	0230-0330	9.525, 11.90
SWEDEN	Stockholm	7:15-7:45 p.m.	0315-0345	5.99
SWITZERLAND	Berne	8:15-9:15 p.m.	0415-0515	5.965
U.S.S.R.	Moscow	7-10:30 p.m.	0300-0630	9.54, 9.735, 11.755



# SHORT-WAVE LISTENING

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

## BROADCASTING STATION NEWS AROUND THE WORLD

**T**HE Australian Administration Territorial Government recently opened its sixth new broadcasting station. This regional station is located at Mount Hagen, Papua, and the call-sign is VL8CH. The schedule calls for transmissions in English and native languages at 0700-1100. Station VL8CH should prove to be a difficult catch for North American DX'ers, since the frequency being used is 2450 kHz, and the power rating is only 250 watts.

According to *Radio New York Worldwide*, a new radio station (reportedly backed by American money) is already on the air in South Korea. Its announced purpose is to transmit the truth to millions of listeners in Communist sections of Asia. The station is called *Radio Free Asia* and is run by the Korean Cultural and Freedom Foundation. This is a private, non-profit organization with headquarters in Washington, D.C. At present, *Radio Free Asia* is using the facilities of a 500,000-watt station run by the South Korean government; however, the construction of a transmitter is planned.

*The Voice of the Himalayas*, Katmandu, Nepal, will begin testing soon, if it has not already done so, with two 100,000-watt transmitters, probably on or near 7105 kHz.

When the tiny British possession in the South Atlantic, Tristan da Cunha, celebrated its 150th anniversary, a new radio station was inaugurated to mark the occasion. Details are lacking, but in view of the fact that the population of Tristan da Cunha amounts to only several hundred people, the station is more likely to be a utility station than a regular broadcaster.

Word has been received that the Armed Forces Caribbean Network broadcasts on 1200 kHz from its main studio in El Morro at Fort Brooks, Puerto Rico. All programming is rebroadcast from satellite stations at Roosevelt Roads Navy Base and Fort Allen, Ponce, as well as from an affiliated station at Ramey Air Force Base. The latter operates on 870 kHz with 50 watts, according to Major C. F. De Smet, Information Officer.

DX'ers all over the world are receiving surprises nowadays in the form of verification cards from *Radio Aparecida*, Brazil. Some of these QSL's are in confirmation of

reports sent in more than 15 years ago! Responsible for the change is a 23-year-old student, Jose Dinys, who is now acting as International Correspondence Chief for the station. He says that all reports will be verified and that one or two IRC's will be appreciated from those who would like to have airmail replies. Mr. Dinys is also interested in exchanging stamps with other collectors. Reports should be sent to: Praca N. S., Aparecida 315, Aparecida, Sao Paulo, (Continued on page 106)



In San Angelo, Texas, Explorer Post 382 of the Boy Scouts of America took part in a field day exercise. Scout Robert Montgomery is shown at the controls of a Hammarlund HQ-120 receiver (above) with advisor Roy Baker in the background. Below, Scout Joe Milam takes his turn at a Hallicrafters SX-110. All participating Explorers helped with the various chores, from digging of post holes for antenna towers to laying of wire for electrical power.



# FOREIGN-LANGUAGE BROADCASTS TO NORTH AMERICA

Prepared by **BILL LEGGE**

LANGUAGE	STATION	TIME—EST	TIME—GMT	FREQUENCIES (MHz)
ARABIC	Cairo, Egypt	6:30-7:30 p.m.	2330-0030	9.475
	Damascus, Syria	8-9 p.m.	0100-0200	9.605
BULGARIAN	Sofia, Bulgaria	8-8:30 p.m.	0100-0130	6.07
CHINESE	Peking, China	8-10 p.m.	0100-0300	9.92, 12.01, 15.095
		10-12 p.m.	0300-0500	9.48, 12.01, 15.08
CZECH/SLOVAK	Prague, Czechoslovakia	8:30-9 a.m. (Sun.)	1330-1400	15.285, 17.825
		10-10:30 p.m.	0300-0330	7.345, 5.93, 7.115
DANISH	Copenhagen, Denmark	7-7:30 a.m.	1200-1230	15.165
		8-9 p.m.	0100-0200	9.52
DUTCH	Brussels, Belgium	6:15-8 p.m.	2315-0100	9.615
	Hilversum, Holland	9:30-10:50 p.m.	0230-0350	9.59
FINNISH	Helsinki, Finland	7:15-10:10 a.m.	1215-1510	15.185
FRENCH	Brussels, Belgium	6:15-8 p.m.	2315-0100	9.615
	Lisbon, Portugal	9:15-10 p.m.	0215-0300	5.985
	Paris, France	4-5 p.m.	2100-2200	11.885, 15.13
	Rome, Italy	8:20-8:35 p.m.	0120-0135	6.01, 9.63
	Vatican City	8:10-8:35 p.m.	0110-0135	5.985, 7.25, 9.645
GERMAN	Berlin, Germany	8:30-9:30 p.m.	0130-0230	5.96, 9.73
	Cologne, Germany	7-10 p.m.	0000-0300	6.10, 9.545
		10 p.m.-1 a.m.	0300-0600	6.10, 9.64
	Vienna, Austria	7-9 p.m.	0000-0200	9.77
HUNGARIAN	Budapest, Hungary	7-7:30 p.m.	0000-0030	6.235, 9.833
		9-10:30 p.m.	0200-0330	6.235, 9.833
ITALIAN	Rome, Italy	5:30-8 p.m.	2230-0100	6.01, 9.63
JAPANESE	Tokyo, Japan	7:15-7:30 a.m.	1215-1230	9.505, 9.605
		8:30-9 p.m.	0130-0200	15.135, 17.825
NORWEGIAN	Oslo, Norway	10-11:30 a.m.	1500-1630	15.175
		4-5:30 p.m.	2100-2230	9.61
PORTUGUESE	Lisbon, Portugal	7-9 p.m.	0000-0200	6.025, 6.185
		9:45-11 p.m.	0245-0400	6.025, 6.185
RUMANIAN	Bucharest, Rumania	6:15-7 p.m.	2315-2400	6.15, 9.57
		10:30-11 p.m.	0330-0400	6.15, 9.57
RUSSIAN	Moscow, U.S.S.R.	7 a.m.-12:30 p.m.	1200-1730	15.15
		6:30-7 p.m.	2330-0000	7.15, 7.31
		8:30-9 p.m.	0130-0200	7.15, 7.31
SPANISH	Buenos Aires, Argentina	8-9 p.m.	0100-0200	9.69
		11-12 p.m.	0400-0500	9.69
	Havana, Cuba	6 a.m.-4 p.m.	1100-2100	6.135, 15.30
		5-11 p.m.	2200-0400	6.135, 9.55
	Quito, Ecuador	6-9 a.m.	1100-1400	9.745, 11.915, 15.115
	7:30-9 p.m.	0030-0200	6.05, 9.745, 11.915	
SWEDISH	Stockholm, Sweden	8-8:45 p.m.	0100-0145	5.99
		9:30-10:15 p.m.	0230-0315	5.99
UKRAINIAN	Kiev, U.S.S.R.	7:30-8 p.m.	0030-0100	7.11, 7.31

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MODEL #65-1 \$29<sup>95</sup> list



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Finco's famous 2-tube, 4-set VHF-TV OR FM Distribution Amplifier is now available for 75 OHM CO-AX or 300 OHM operation.

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#### Outstanding Features:

- 350,000 microvolts maximum input with +8dB to each output • Maximum signal output of .85 volts in each of 4 outputs • Low noise 6HA5 premium tubes • One 300 ohm input - 4 300 ohm outputs • Silicone diode rectifier for dependability • Flat response -  $\pm 1/2$  db per 6 mc channel • Ventilated perforated steel cabinet  $6\frac{1}{2} \times 3\frac{1}{4} \times 3\frac{1}{4}$ " • Metal enclosed to eliminate shock hazard - easy access for servicing • Easy mounting and connecting • All fittings & brackets supplied • UL listed AC cord - 117 volts, 60 cycles • 100% test for all electrical characteristics

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#### Outstanding Features:

- 400,000 microvolts maximum input with +6dB to each output • 200,000 microvolt input - 1 volt output per band • Low noise 6HA5 premium tubes • One 75 ohm input - 4 75 ohm outputs • Most compatible "F" type input and output fixtures • Ultra-flat frequency response and complete RF isolation • Ventilated perforated steel cabinet  $6\frac{1}{2} \times 3\frac{1}{4} \times 3\frac{1}{4}$ " • Metal enclosed to eliminate shock hazard - easy access for servicing • Easy mounting and connecting • All fittings & brackets supplied • UL listed AC cord - 117 volts, 60 cycles • 100% test for all electrical characteristics



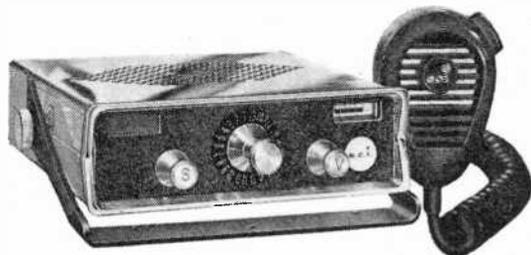
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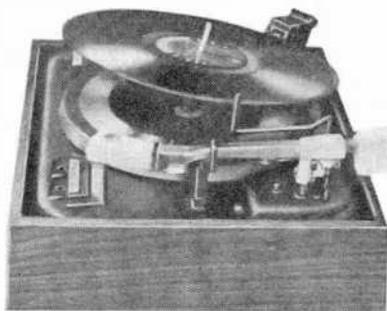
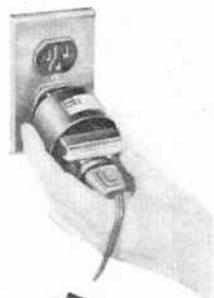
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PE-612

CIRCLE NO. 10 ON READER SERVICE PAGE

## ELAPSED TIME INDICATOR

KEEPS  
TRACK  
OF  
STYLUS  
WEAR



**H**OW do you know when it's time to change your hi-fi cartridge stylus, or demagnetize your tape recorder head, or overhaul the engine on your boat? By logging operating time in a book? Now there's a better way. A new 1 $\frac{3}{4}$ " x  $\frac{3}{8}$ " direct-reading elapsed time meter developed by Curtis Instruments, Inc., Mt. Kisco, New York, can log up to 5000 hours of operating time before recycling.

The timer consists of a glass tube with two columns of mercury separated by an electrolyte gap. When a small direct current is passed through the tube, mercury is transferred through the gap from anode to cathode, the displacement being a linear measure of the hours of operation.

For a.c. operation, the timer is combined with a small epoxy-encapsulated transformer and rectifier, and the device to be timed is plugged into the assembly. Prices start at \$8. Data sheets and distributor list are available free from the manufacturer.

CIRCLE NO. 25 ON READER SERVICE PAGE →

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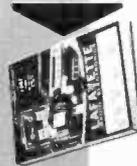
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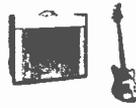
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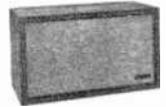
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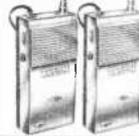


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PLACE  
STAMP  
HERE

**Detrola** auto radio, circa 1932; has 5 tubes. Schematic needed. (Leroy Gross, 150 W. Alachua, Cocoa Beach, Fla. 32931)

**Giffillan Bros.** Model 56A receiver, circa 1946; tunes BC; has 5 tubes. Schematic and specifications needed. (Bill Denton, Rt. 1, Box 612B, Arroyo Grande, Calif. 93420)

**Silvertone** Model 101.772-1 wire recorder; has 6 tubes. Spring for cam lever assembly and stainless steel recording wire needed. (Jim Holland, 2641 Elmdale Ct., Palo Alto, Calif.)

**RME/Electro-Voice** Model 4350 receiver. Instruction manual or schematic needed. (John E. Spiegel, 1586 Moravia Ave., Holly Hill, Fla. 32017)

**Stromberg-Carlson** Model 1121-PL receiver; tunes BC, FM and s.w.; has 11 tubes. Schematic and source of power transformer needed. (Steve Ordinetz, RFD #2, Chester Depot, Vt. 05144)

**ID-6/APN-4** oscilloscope, surplus. Schematic, operating manual, and power supply data needed. (William Weir, 406 Prospect St., Berea, Ky. 40403)

**Supreme** Model 599A tube checker. Schematic needed. (Lou E. Smith, 2405 5 St., Meridian, Miss.)

**Hammarlund** "Super-Pro" receiver, type RHV-2; tunes 1300 kHz to 40 MHz. Schematic and alignment data needed. (M.J. Vandermoien, Rt. 2, Box 33, Perkins, Okla. 74059)

**Zenith** Model 26-201 receiver, ser. S357088, circa 1940; tunes 550 kHz to 24 MHz on 3 bands; has 6 tubes and magic eye. Schematic needed. (D.H. Lord, 411 Red Chimney Dr., Warwick, R.I. 02886)

**McMurdo Silver** Model 904 capacitance resistance bridge, Model 900 volt ohm Vomax, Model 905 signal tracer gain test set. Schematics and operating manuals needed. (Melvin V. Berninger, 16 Grand St., Reading, Mass. 01867)

**Hickok** Model 202B volt-ohm-milliammeter, Series B. Schematic needed. (George M. Kistler, 2956 Loyola St., Sacramento, Calif. 95826)

**Philco** Model 39-116 receiver, code 121, circa 1939; has 13 tubes. Schematic, dial face plate, and source for parts needed. (George A. Bingaman, Box 685, Glenrock, Wyo. 82637)

**Philco** Model 42-350 receiver; circa 1930; tunes AM and FM on 3 bands; has 6 tubes. Schematic needed. (Gary Schneider, 4413 Carnation, Cincinnati, Ohio 45238)

**Meissner** Model 9-1065 phono-recorder p.a. system. Operating and instruction manual needed. (Barry Weisman, 112 Ridge Ave., Newton, Mass. 02159)

**Motorola** Model T41G-1A, T51G transistor, circa 1954; tunes FM from 30 to 54 MHz. Operating manual and TK206 adapter chassis needed. (Robert W. Merdler, 196 S. Jefferson, Saginaw, Mich. 48601)

**Stewart-Warner** Model 206BBS receiver. Schematic needed. (William M. Wilmoth, 230 N. Eufaula Ave., Eufaula, Ala. 36027)

**Hickok** Model RFO-5 oscillograph, circa 1950. Schematic and operating manual needed. (Barry Lowry, 1102 Hoigutni St., Lancaster, Calif. 93534)

**Surplus** mine detector Model SCR-625-C-2915-Phila-45-08. BC-1141-E amplifier, made by Horni Signal Mfg. Corp. Operating manuals needed. (William W. Rigden, 103 Madison St., Milton, Fla. 32570)

**Philco** Model 39-25 receiver, code 121; tunes BC and 3 to 18 MHz. Schematic needed. (John Boxhorn, 13650 Tremont St., Brookfield, Wis. 53005)

**Elgin** Model D receiver; tunes BC and 5.5 to 20 MHz; has 7 tubes. Schematic, service data, and K-38-B-2 tube needed. (Mike Wheeler, 3523 Altamont Dr., Klamath Falls, Ore. 97601)

**Atwater-Kent** Model 20 receiver, ser. 226289; tunes BC; has 5 tubes. Schematic and source for parts needed. (SSgt. Orville Gallimore, AF 55287149, 2140th Comm. Sqdn., AFCS, Box 2162, APO, New York 09223)

**Hickok** Model 450 VOM. Schematic and operating manual needed. (Brad Woelke, 11422 Marion, Detroit, Mich. 48239)

**T 193B/VRC-2** transmitter, made by Utility Electronics Corp. for Signal Corps, order #20591-PH-49. Schematic or booklet #TM-11-607 needed. (Eric Smitt, 609 Oakfield La., Philadelphia, Pa. 19115)

**TWO NEW**

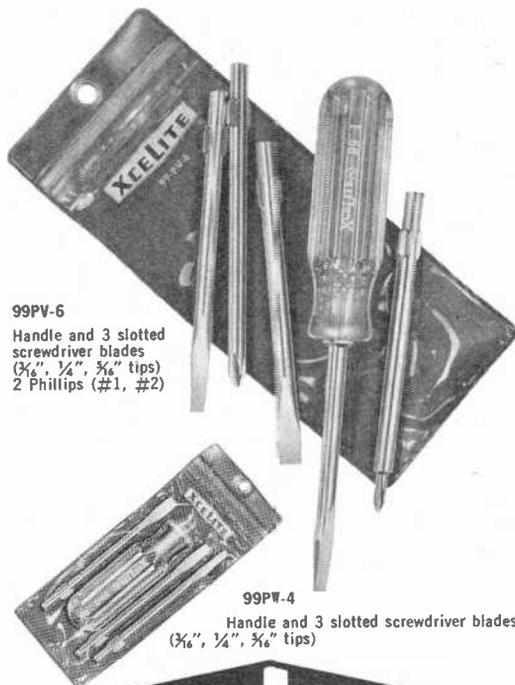
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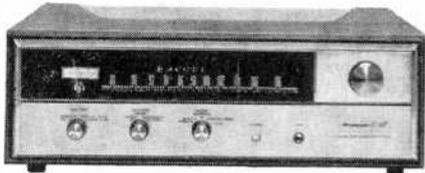


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CIRCLE NO. 45 ON READER SERVICE PAGE

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LT-112B specifications: Usable sensitivity, 1.8  $\mu$ V; Cross modulation, 90 dB; Stereo separation, 40 dB; Capture ratio, 2.5 dB; Price, \$189.95.

\*Patents pending

For complete information on the Scott LT-112B, send for your free copy of Scott's 16-page full-color illustrated Guide to Custom Stereo.

Scott . . . where innovation is a tradition



Prices slightly higher west of Rockies. Subject to change without notice.

CIRCLE NO. 35 ON READER SERVICE PAGE

## LETTERS (Continued from page 12)

when the dipole was rotated. The sound was equally intense when observed from shore or from a boat in the middle of the lake (Lake Eau Claire, S.E. Eau Claire County, Wis.)

On two occasions, both after sunset, distinct "ping" sounds could be heard in addition to the crackle. On one other occasion, a sunny afternoon, a few whistles were heard. On that same afternoon, I also heard something which I can best describe as a rather low-pitched cricket-type sound. All sounds ceased as soon as the antenna was removed from the water. Passing motor boats did not create any detectable signal.

GEORGE R. ROSSMAN  
Eau Claire, Wis.

I am an experimenter who is always looking for something unusual to build. I had all the equipment for the Hydronics receiver, so I built it. It works fine in large bodies of water but when I put it in my aquarium the only thing I get is the local radio station (KXXW).

DAVID YOUNGBLOOD  
Lafayette, La.

David, that's one way to listen to your local radio station. George, did you try putting these sounds on a tape recorder and then listening to the recording at a slower speed? D.A., your unit seems to be working fine; apparently, what you need is a large body of water. Elliot, glad you lost your skepticism, but we still don't know if Plasmonics is for the birds. For what it's worth, Minto is still working away at this project in an effort to find a method of long-range "radio" communication under water.

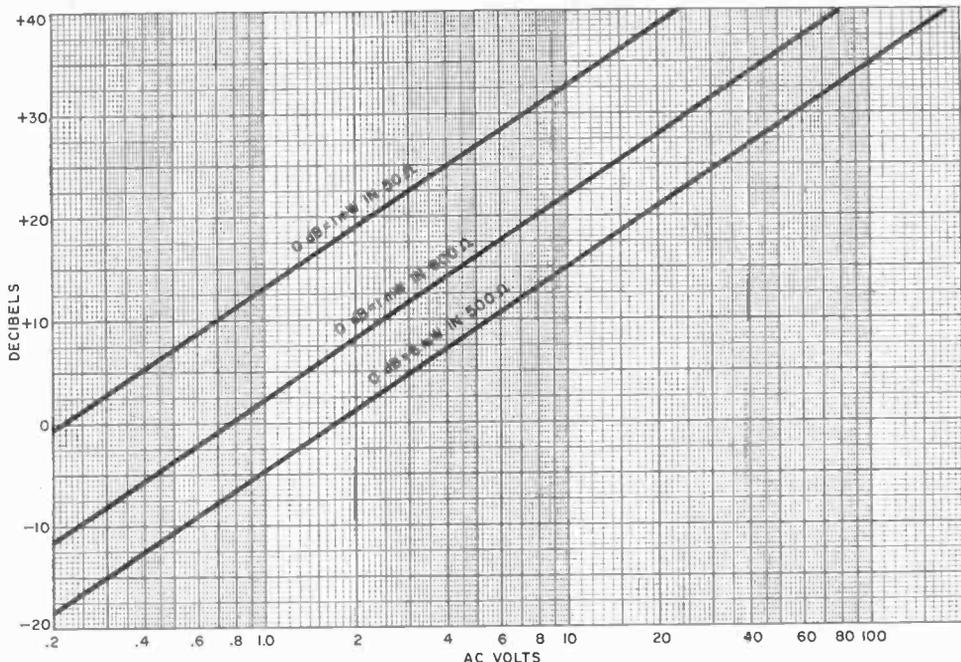
## OUT OF TUNE

**Powerhouse 2-Tube Short-Wave Receiver** (August, 1966, page 62). In Fig. 4,  $L_3$  and  $L_4$  should be transposed; also transpose  $L_3$  and  $L_4$  in the Parts List.

**Static-Free Thermistorized Aquarium Heater** (September, 1966, page 74). Resistor  $R_4$  should be 10,000 ohms and  $R_7$  should be 56,000 ohms.

**Four On The Floor** (November, 1966, page 75). Dimensions on the drawing are correct but in the Bill of Materials the wood for the exterior sides should be listed as  $13\frac{1}{8}'' \times 34'' \times \frac{3}{4}''$ ; for the exterior top as  $13\frac{1}{8}'' \times 19'' \times \frac{3}{4}''$ ; and for the exterior bottom as  $12\frac{7}{8}'' \times 17\frac{1}{2}'' \times \frac{3}{4}''$ .

**Update to Solid State** (September, 1966, page 44). Caption under bottom photo should read small "metal" clamps rather than small "plastic cable" clamps. Metal clamps serve as a heat sink.



What Are These Things Called Decibels? (October, 1966, page 76). The three heavy black rules on the "AC Volts To dB Graph" slipped out of registration in some copies of the October issue. See corrected graph above. The "0 dB=1 mW in 600-ohm" line should show 0 dB for 0.775 volts, and 28 dB for 20 volts. Space between the rules remains the same. -30-

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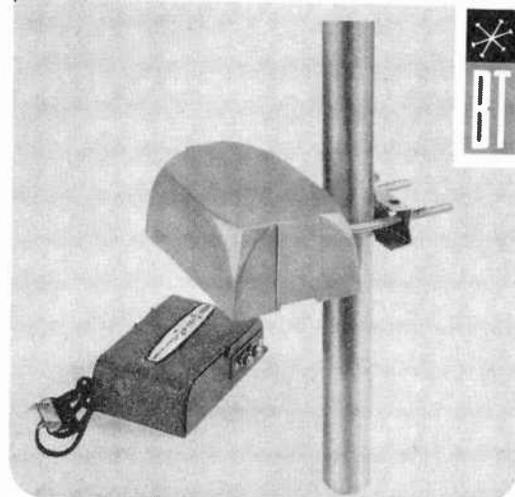
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**U/Vamp-2** — mast-mounted, deluxe 2-transistor UHF/VHF amplifier. Weatherproof housing. Remote power supply. AC operated. Separate UHF and VHF 300-ohm inputs and outputs. Ideal for separate UHF and VHF antennas.

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CIRCLE NO. 5 ON READER SERVICE PAGE

## BINARY COUNTER

(Continued from page 61)

preassembled circuit board to the readout lamps, push-button switches, and supply battery.

The IC's and the transistors can be mounted on insulated Teflon press-fit terminals as shown in the layout of Fig. 5, or on "flea" clips (push-in terminals) if a perforated phenolic board is used. The use of regular 8-pin IC sockets and 3-terminal transistor sockets will provide greater ease of assembly, and reduce the possibility of the solid-state devices being damaged due to overheating at the terminals.

The IC packages are coded by a flat side or a green or red dot indicating pin 8. When viewed from the top, the pins are counted counterclockwise.

Figure 5 shows IC<sub>4</sub> mounted directly on one of the push buttons by means of a circular plate with feedthrough terminals, but you'll find it more convenient to mount IC<sub>4</sub> on the same circuit board with the other units.

Switch S<sub>3</sub> and the battery holder can be fastened to the case with #6 hardware, or can be pop-riveted in place. Switches S<sub>1</sub> and S<sub>2</sub> are mounted with hardware provided. The lamps are held by 1/2"-o.d. rubber grommets mounted in the holes provided. If a dialplate is used, it can be secured to the cover with the mounting hardware for the push-button switches. A cross-section view of the assembled unit (Fig. 6) shows mounting details of major components. Rubber feet can be attached to the container base.

**Operation.** Insert the batteries and flip the power switch to *ON*. With each depression of the *COUNT* push button, the binary count is advanced by one. To demonstrate binary addition, clear the binary counter to 000 with the *CLEAR* push button, and press the *COUNT* button to enter your first number. If it's a 2, enter binary 010 by depressing the *COUNT* push button twice. Now enter your second number. If it's a 3, enter 011 by pressing the *COUNT* push button three times. The answer 101 should appear on the readout lamps.

-30-

## SMALL TAPE RECORDERS

(Continued from page 52)

the mike, or pretend that the recorder is not working. Use the phony cord trick.

For instance, suppose some one asks you what's in that little box you are carrying. Don't hesitate to tell him it's a tape recorder. If he stops talking, pull a line cord out of your pocket and offer to show him how it works if you can find an a.c. outlet. As soon as he is convinced that the recorder is not working, he'll start talking again. What he doesn't know is that the machine is operating on batteries.

**Voice Letters.** Very often the written word can be misconstrued, but a tape of your voice with all its inflections, your laughing, or sobbing—which is really you by nature—will get through with full meaning. And a taped letter can become a group project, with comments and sounds of an entire household—truly a family letter.

Taped conversations in a barber shop, a beauty parlor, between a couple of friends meeting on the street, or between two motorists fighting for the same parking space, are vastly different from even a most vivid description of these events in a written letter. Chances are that once you get into the habit of taping letters, you will stick to it.

**Other Applications.** If you are a student, let your tape recorder do your note-taking so that you can concentrate on what is being said. When you get home, you can transpose your notes into writing if you have to. You can cut down your library time considerably if you have to transcribe reference works. Find a corner in the library where you won't disturb anybody, and read the works in to your tape recorder.

You can also add another dimension to your home movie-making; just turn on your tape recorder (without telling anybody) and start shooting pictures.

From the busy executive on the go, dictating in a car, train, or plane, to the man on the street capturing the sounds of the town, the small tape recorder serves its purpose admirably.

-50-

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DP 6-11

CIRCLE NO. 9 ON READER SERVICE PAGE

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CIRCLE NO. 3 ON READER SERVICE PAGE

## TAPE RECORDER KIT—DELUXE

(Continued from page 66)

tape transport is too big a job for the electronics technician. But you may not know that a high percentage of tape recorders use a single motor. That motor must be linked up to perform the functions of rewind, drive, and fast forward. The Heathkit AD-16 uses three separate synchronous motors and each does just one job. Linkages and drive belts are few and far between in the AD-16.

To further eliminate the complexity that you see in some tape transport mechanisms, the AD-16 is all-solenoid-operated. You push a button on the front panel and the solenoid plungers do all the work—starting and stopping the tape, lifting tape off heads, etc.

**How Good Is Good?** If you have never heard a good tape played back on a good tape recorder, words are not adequate devices to insure a good description. About the best we can do without resorting to hyperbole and superlatives is to mention the dynamic range and obvious purity of sound.

A tape recording is much, much closer to an original performance than even the very best disc recording—and, by the way, tapes are not gimmicked like the recordings of most major record companies. There's no reason to add distortion to compensate for distortion when you play nothing but tapes.

The AD-16 lets you hear everything on the tape just as perfectly as when it was recorded.

-30-



"Instead of four 50-ohm resistors, I gotcha one 200-ohm—it was much cheaperer."

## LOGIC DEMON

(Continued from page 45)

button. In the OR function, the bulb lights when either push button is depressed, while in the AND function, both push buttons must be pressed at the same time for the light to come on. With the switch in an NAND position, both push buttons must be simultaneously pressed to put out the light.

The Logic Demon can be used in a classroom or at a Science Fair to demonstrate the practical application of computer (symbolic) logic. Granted that a number of individual switches could be used to perform the same function as the single IC package, it can be seen that the use of integrated circuits greatly simplifies the project. The Logic Demon also demonstrates some practical applications of the use of integrated circuits in computer technology. —70—

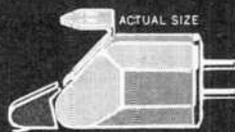
## "RELAXATROL"

(Continued from page 56)

bly. Slip a piece of spaghetti over each of the leads to insulate them and prevent short circuits.

Exercise care and work slowly when drilling holes in the plastic case. Use a file to shape the opening for the switch. A bottom cover for the case can be made from a thin piece of plastic or stiff cardboard, if you don't already have one. Two precautions should be taken: observe polarity of the diodes or proper connections of the rectifier module; and don't compromise the insulation—the rectifiers and *SI* are connected directly to the a.c. line.

**Operation.** When the unit is completed, check the wiring for any errors, then secure the bottom cover. Plug the a.c. line cord into a wall outlet and switch on the unit. After a slight delay, the relay should pull in and out at a regular interval. Rotate *R2* to change the interval. Range should be from very fast (approximately 15 seconds) to very slow (approximately 2 minutes). If desired,



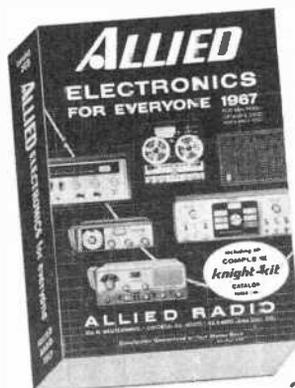
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the time intervals can be marked on a dialplate placed under the control knob.

Connect the push-button leads from the projector to *PL1* through a mating socket. Use a small caliber plug and socket for this purpose to prevent confusion with the a.c. line cord. Set up your projector as usual, and allow the Relaxatrol to go to work. If you want to view a particular slide for a longer period of time, simply turn the unit off until you are ready to start again. If you want to quickly dispose of a slide without upsetting the timing sequence, hit the push button just once.

You can shift the range of speeds by using a smaller or larger resistor in place of *R1* or by changing value of *C2*. -30-

**THE "SCROUNGE"**

*(Continued from page 46)*

You could hang this antenna from a tree, or—if you want to get fancy—substitute aluminum or copper tubing, but maintain the same dimensions. If you support the lower part of the antenna with insulated standoffs, you'll have a first-class permanent installation.

If you hang the antenna from a tree or other high structure, you can reverse the connections to the coaxial cable to provide for some degree of lightning protection. With the leads reversed, the highest point of the antenna will be connected to the coaxial cable's shield, which is usually grounded at or near the equipment. Antenna action is not materially affected by this reversal because the quarter-wave section acts like a transformer.

As with any antenna work, there is no substitute for actual on-the-job tuning, adjusting, and other optimizing activities. The figures shown are close enough for most applications, and include some consideration for end effect. If you want to experiment using a cut-and-try technique, you can first try shortening the quarter-wave section about 1/2" at a time before modifying the half-wave section. Telescoping sections such as are found on a pair of TV "rabbit ears" could help you pin down the exact dimensions. -30-

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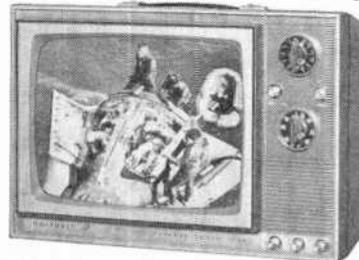
**\*Kit GR-180**, everything except cabinet, 102 lbs. . . . . **\$379.95**

**GRA-180-1**, walnut cabinet (shown above), 30 lbs. . . 18 1/4" D x 28 1/4" W x 29" H . . . . **\$49.95**

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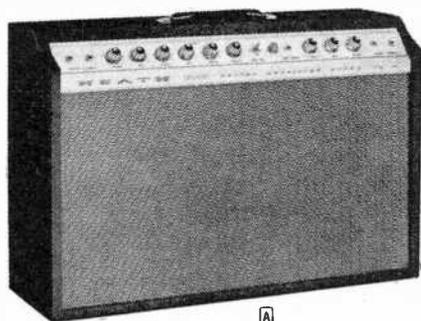
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All guitars include instruction book, tuning record, pick, connecting cord, deluxe red leather cushioned neck strap and chipboard carrying case. All wood parts assembled and factory finished — you just mount metal parts, pickups & controls in pre-drilled holes and install strings.

**B** Deluxe Guitar ... 3 Pickups ... Hollow Body

Double-cutaway for easy fingering of 16 frets; ultra-slim fingerboard — 24 1/2" scale; ultra-slim "uniform feel" neck with adjustable Torque-Lok

reinforcing rod; 3 pickups with individually adjustable pole-pieces under each string for emphasis and balance; 3 silent switches select 7 pickup combinations; 6 controls for pickup tone and volume; professional Bigsby vibrato tail-piece; curly maple arched body — 2" rim — shaded cherry red. 17 lbs.

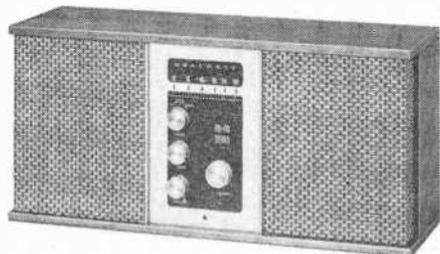
**C** Silhouette Solid-Body Guitar ... 2 Pickups

Modified double cutaway leaves 15 frets clear of body; ultra-slim fingerboard — 24 1/2" scale; ultra-slim neck for "uniform feel"; Torque-Lok adjustable reinforcing rod; 2 pickups with individually adjustable pole-pieces under each string; 4 controls for tone and volume; Harmony type 'W' vibrato tail-piece; hardwood solid body, 1 1/2" rim, shaded cherry red. 13 lbs.

**D** "Rocket" Guitar ... 2 Pickups ... Hollow Body

Single cutaway style; ultra-slim fingerboard; ultra-slim neck, steel rod reinforced; 2 pickups with individually adjustable pole-pieces for each string; silent switch selects 3 combinations of pickups; 4 controls for tone and volume; Harmony type 'W' vibrato tailpiece; laminated maple arched body, 2" rim; shaded cherry red. 17 lbs.

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## NEW Deluxe SB-401 Amateur Transmitter Kit



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CIRCLE NO. 16 ON READER SERVICE PAGE

## ON THE CITIZENS BAND

(Continued from page 79)

"Thatman and Who?" We were minding our own business, coming out of an electronics center after having made a purchase, and to our surprise found half-a-body hanging out of our sports car window, clad in a pair of tights and some very "different" looking shoes. The other half of the body projected into the interior of the car. On closer inspection through the windshield, we found the top half of the mysterious figure clad in a tight jersey, a pretty sharp looking cape, and (of all things) a black mask.

The gent emerged to inform us that he had become interested in our two-way CB gear under the dash. He then asked an assortment of questions on how CB's operate, the type of communications we become involved in, and the main purpose of the system. We were happy to oblige (see photo below).

In the middle of our discussion on the useful application of CB radio to emergency situations (he seemed very impressed, incidentally), a sleek, highly powerful looking black automobile(?) drove up alongside to pick up my friend. The driver of the vehicle was similarly clad in an assortment of close-fitting garments, but sported a hood and a large flowing cape, and the car itself was loaded with all sorts of devices, controls, and gadgets. Indicating that my

Photo by James Karr



friend should get in quickly, he mumbled something about a caper.

As the pair went off in a puff of exhaust, we thought we faintly heard them enthusiastically exchanging a series of words like: "Biff-Pow-Wup-Hmm . . ." Sometimes people make you wonder, boy!

**Club News.** The Western New York Pioneer Citizens Band Association, North Tonawanda, N.Y., reports that its Third Annual CB Jamboree was extremely successful. The event was held for the benefit of handicapped and retarded children, with monies raised to be distributed among area children's homes.

Honored guests of the day were 70 children from St. Rita's Home For Retarded Children. The children were brought to the jamboree by buses supplied by the Pioneer CB Club, and were escorted by 36 adults from St. Rita's who watched over them during their three-hour visit. They were treated to dinner, cotton candy and liquid refreshments, plus rides on the midway.

At the jamboree, the publicity director of the Pioneers, Vernon W. Batt, K1C5311, supervised the presentation of a bound copy of the June, 1966, issue of POPULAR



Photo by Al Shoen

ELECTRONICS to Lockport, N.Y., Mayor Roland T. Grant by James Trombino. (The Pioneer CB'ers had been praised in the OTCB column that month for their fund-raising activities.) Vern reported that the one-day affair realized a profit of approximately \$4000 to aid needy children.

In the week following the jamboree, the Pioneer membership approved the purchase of a tape recorder, slide projector and screen, and a 35-mm. camera, to be presented to St. Rita's Home. The officers and members of the club extended their sincere thanks to all persons involved with the jamboree, in addition to the following CB clubs that gave both personal and financial aid: Grape Belt CB Club, Dunkirk, N.Y.; The W.N.Y. Frontiersmen CB Club, Lockport, N.Y.; The Niagara Nuggets CB Club, Buffalo,

December, 1966

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CIRCLE NO. 34 ON READER SERVICE PAGE

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N.Y.; and the Police Benevolent Association, Lockport.

**1967 OTCB Club Roster.** If your group was not placed on the 1966 OTCB roster of active associations across the U.S. and Canada, gather up the statistics and ship them off to us soon—in time for the first 1967 listing. Specify membership totals and club officers; detail recent public service assists and activities; and be sure to forward your club paper as soon as it's published. Include some photos of your group and a club decal and/or membership card, and we'll try to show them to the rest of our CB readers.

I'll CB'ing you!

—Matt, KHC2060

## BRIDGE CIRCUIT QUIZ ANSWERS

(Quiz appears on page 73)

- 1 — J The CAREY FOSTER bridge measures capacitance in terms of mutual conductance, and mutual conductance in terms of capacitance.
- 2 — H The HAY bridge measures the self-inductance of high-Q coils (Q greater than 10), and also determines unknown frequencies.
- 3 — D The HEAVISIDE bridge measures the mutual inductance of the coils of a transformer in terms of a known self-inductance and known resistances.
- 4 — I The KELVIN bridge is used when extremely low resistances—down to 0.001 ohm—are to be measured.
- 5 — C The MAXWELL bridge measures the self-inductance of low-Q coils (Q of 10 or less).
- 6 — F The OWEN bridge, like the HAY and MAXWELL bridges, measures the self-inductance of coils. The main difference between the OWEN and the other two bridges is that the OWEN bridge has the two adjustable components in the same arm.
- 7 — A The RESONANCE bridge measures capacitance, inductance, and frequency.
- 8 — G The SCHERING bridge measures capacitance in terms of a standard capacitor and known resistances.
- 9 — B The WHEATSTONE bridge, oldest of the bridge family, is used where accurate resistance measurements—in the range of 1 ohm to approximately 1 megohm—are to be made.
- 10 — E A WIEN bridge is used to measure capacitance by comparison with a standard capacitor, and inductance by comparison with a standard inductor.

# AMATEUR RADIO

(Continued from page 78)

## NEWS AND VIEWS

Louis Laukich, WA/WN8SNF, 107 7th St., N.W., Barberton, Ohio, works 40-meter CW and 2-meter phone with a rebuilt Knight-Kit T-150A transmitter. He receives on a Knight-Kit R-100A (aided by a Vanguard converter for "6"), and the outdoor work is handled by a 40-meter inverted-V antenna, a 24' home-brew vertical antenna, and a 6-meter beam. There are 35 states logged on Lou's "brag sheet." . . . SP/4 John W. Good, Jr., K3SIO/HS1, U.S. Army Satcom Station, APO, San Francisco, Calif., says there is no VHF or UHF amateur activity within 500 miles of Bangkok; so he spends most of his time building and testing gear. His latest creation is a 6-meter receiver with a 6-dB signal-plus-noise to noise ratio at a -124 dBm signal. His next project is to "scrounge" some 1296-MHz gear. John can be heard on the Southeast Asia net on 14.322 MHz at 1200 GMT using an SBE-34 exciter, a 1000-watt amplifier, and a Telrex tri-band beam . . . K3SIO reports that Don, WA80BB/XV5, Cam Ranh Bay, Vietnam, is also active on 14 MHz with a Drake TR-4 and a 1/2-wave dipole antenna.

Alexandre Ermine, TAQ3RXTX, Izmir, Turkey, studies electronics in the daytime and works in a radio shop at night. He would like to exchange letters with U.S. amateurs about getting on the air. Address letters c/o A3C Delbert Stout, AF-17701793, TUSLOG Det. 118, C.M.R. Box 342, APO, New York 09016 . . . Dan Taylor, ex-WB6PJK, c/o Ron Davis, 3907 Shadyhill Dr., Dallas, Texas, had rather an odd record while a Novice in Covina, Calif. Using a 5-watt, home-brew transmitter, he made 300 contacts—all in California—on 80 meters. Then with a 40-watter, he worked 10 states. When he became a General, a Johnson "Challenger" transmitter feeding a vertical antenna racked up 40 states and five countries. We don't know what Dan's new "5" call letters are . . . Jim Rembiszewski, WN95IK, R.R. #3, Box 83A, Antigo, Wis., found out "the hard way" that the pi-net output tank circuit of a transmitter won't match just any old antenna. But his Knight-Kit T-60 transmitter and 32 1/2' home-brew vertical antenna get along well on 40 meters. The antenna is constructed of 1/2" conduit and is fed with 52-ohm coaxial cable. Jim receives on a Knight-Kit R-55A. He has worked 13 states so far, and two Canadians.

Landon L. Chapman, W4VTU, 204 Sunset St., Bristol, Tenn., and his local radio club are offering a QSO Award to amateurs who work five Tennessee amateurs (25 if you live in Tennessee). You can

get the details from Landon for a stamped reply envelope. He will also answer questions about amateur radio for truly interested people. W4VTU works the lower frequencies with a Johnson "Ranger" transmitter and a Hammarlund HQ-110A receiver. For 2 meters, a war-surplus ARC-4 transmitter feeding a beam antenna and a converter ahead of the receiver do the work. He has a wall full of QSL cards to prove that he doesn't talk to himself . . . Mike Czuhajewski, WA8MCQ, Route 3, Paw Paw, Mich., believes that he worked a "KZ5" on the 80-meter Novice band in broad daylight recently. We hate to disappoint Mike, but we suspect that he worked a "bootlegger" in the neighborhood. Happier news: Mike found that adding radials to his Hy-Gain 18V antenna allowed him to work three W6's in a row on 40 meters. Before making the change, he had worked one "6" out of 1143 contacts . . . Red Rowcliffe, WA6QMU, 6271 Merced Lake Ave., San Diego, Calif., makes certain that recipients really look at his QSL card. It is a very attractive color photo of him and his station, with the call letters occupying a 1/4" x 1/4" space in the picture. Red (who is former KØKOA) uses a Collins 32S3 driving a 30L1 amplifier into a Hy-Gain TH-3 rotary beam 70' high and a Collins 75S-3B receiver. Besides being good-looking, the equipment must work well, because Red keeps regular traffic schedules with KR6USA on Okinawa.

Joe Patrick, WN3FDT, R.D. #4, Box 104, Finleyville, Pa., uses a 35-watt transmitter built by WA3CWD. It shares time with a Hallicrafters SX-101A receiver on a 24' high, 40-meter inverted-V antenna. In six months of 40-meter operation, Joe has eight pages of contacts scattered from coast to coast . . . If you should run across Howard Pyle, W7OE, and Lew, W7APS, sending "crazy" CW on 3540 kHz, think nothing of it. They are using "land-line" Morse code. Join them if you can send and receive the stuff. Thanks to the 7th Call Letter District QRP Amateur Radio Club Bulletin for this information . . . Dave "Top" Harmacek, WN8TOP, 8364 Lincoln Drive, Chesterland, Ohio, knocked off 23 states and Canada his first five weeks on the air. An EICO 720 transmitter feeding dipole antennas and a "homemade" (yep, that's what the man said) Mosley CM-1 receiver on the 40- and 80-meter bands did the work.

Before we hit the bottom of the page, let us say "Merry Christmas and Peace on Earth" to all. If your chimney is too small for that new gear you asked for, leave the door unlocked. As always, we remind you that the first step towards representation in your column is mailing us your "News and Views" and photographs. Keep those club bulletins coming; and please let us know if you or your club conducts on-the-air code practice. The address is: Herb S. Brier, W9EGQ, Amateur Radio Editor, POPULAR ELECTRONICS, P. O. Box 678, Gary, Ind. 46401.

73, Herb, W9EGQ

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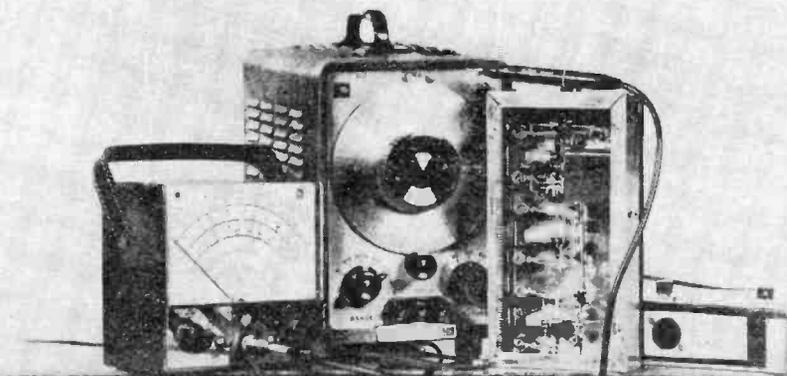
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CIRCLE NO. 36 ON READER SERVICE PAGE

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**Digital Techniques.** For a career as a Digital Techniques Electronics Technician; Industrial Electronics Technician; Industrial Laboratory Technician.

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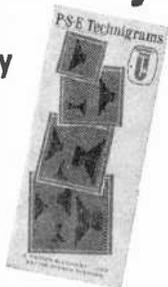
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CIRCLE NO. 43 ON READER SERVICE PAGE

## SHORT-WAVE LISTENING

(Continued from page 81)

Brazil. The station is currently operating on ZYR44, 9635 kHz, and ZYR89, 3285 kHz.

*Trans World Radio*, Bonaire, Netherlands Antilles, now has a DX program for North American listeners on Fridays at 1205 on 11,820 kHz; for Europe on Saturdays at 0200 on 15,245 kHz; and another broadcast on Sundays at 0335 on 11,815 kHz. Al Stewart is in charge of the program.

Over the past three years, a number of DX'ers have asked us to help them identify the singer of the "Kiss Me Honey" record that, until recently, was the one and only recording of the *Kiss Me Honey* station on 11,695 kHz. (It has been changed to "Can't Buy Me Love," recorded by the Beatles.) The singer is Miss Shirley Bassey, and the record is an LP issued by Phillips of Australia in the "Party Dance Series," number PD29. The orchestra is believed to be that of Tony Osborne.

Mr. C. E. Chicarelli of the Anglo-Thai Corp., Ltd., states that *Radio Thailand* is now using an RCA "Ampliphase" 100-kW transmitter with a horizontal rhombic antenna beamed at N. A. over the North Pole. Current operations are on 11,910 kHz "most of the day with programs in Thai, French, and English." They are anxious to receive detailed reception reports from N. A., which should be sent to Thailand Overseas Broadcasting Station, Rangsit, c/o Public Relations Department, Rajadamnern Ave., Bangkok, Thailand. Mr. Chicarelli is in the Communications and Engineering Department.

### CURRENT STATION REPORTS

The following is a resume of current reports. At time of compilation all reports are as accurate as possible, but stations may 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 your Short-Wave Editor by the fifth of each month; be sure to include your WPE identification, and the make and model number of your receiver. We regret that we are unable to use all the reports received each month, due to space limitations, but we are grateful to everyone who contributes to this column.

**Ascension Island**—Look for the new service from the BBC relay station here at 2300-0215 beamed to South and Central America. This xmsn, on 15,375 kHz, is a relay of the BBC Latin American service.

**Bermuda**—DX'ers needing a QSL from this country should tune to the medium-wave outlet on 1235 kHz for ZBM1, Hamilton. While on a split channel between two "graveyard" frequencies, the station is often noted well in Eastern areas around 0500. A report with an IRC brought a prompt QSL.

**Bolivia**—R. Ambaro, Santa Cruz de la Sierra, has been noted once again on 4898 kHz (varies) and announcing as 4915 kHz. Signal is very weak.

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Latin American pop tunes are featured; there are a few ID's; and closing is around 0200.

**Burma**—The 5040-kHz outlet has been heard as early as 1115-1155 with Burmese music and what appears to be a newscast at 1146.

**Cambodia**—Phnom-Penh has a new frequency, 4910 kHz, for the Home Service, noted at 1230-1245 in French, at 1245 with Eng. news, and dance music with anmts in French at 1300 and 1330.

**Canada**—Those who have CBC schedule #56 should change the frequency of 11,725 kHz in the Caribbean and Latin American Service at 2258-0046 to 11,760 kHz.

**Colombia**—A new or "misplaced" station being heard on 6020 kHz is definitely Colombian and is located in Bogota. Check for it around 0230.

Station HJFW, *Transmisora Caldas*, Manizales, has moved up from 5020 to 5025 kHz, where the signal is much weaker. This may be a standby xutr in use while the main one undergoes maintenance. Do not confuse with the Ecuadorian on 5023 kHz.

A new outlet is *R. Nacional de Colombia* on 15-325 kHz. Noted all day, it runs "dual" to 3290, 4955, and 6180 kHz with the same programming, including "English By Radio" from the BEC at 2345. S/off varies from 0400 to 0500.

#### SHORT-WAVE ABBREVIATIONS

anmt—Announcement	kHz—Kilohertz
BBC—British Broadcast- ing Corporation	kW—Kilowatts
CBC—Canadian Broadcast- ing Corporation	N.A.—North America
Eng.—English	QRM—Station interference
ID—Identification	QSL—Verification
IRC—International Reply Coupon	R.—Radio
IS—Interval signal	s/off—Sign-off
	s/on—Sign-on
	xmsn—Transmission
	xutr—Transmitter



Newcomer Kevin Drost, of Union Lake, Mich., has already logged 30 countries—with a Hallicrafters SX-71 receiver—and has QSL's from 11 of them.

**R. Santa Fe**, Bogota, is widely reported from 0000 s/on to 1000 s/off on 4965 kHz, all-Spanish, with frequent and clearly understood ID's.

**El Salvador**—Station YSS, *R. Nacional*, San Salvador, reads all reports over the air in a special program called "Reports From Around The World" in Spanish on Sundays at 2330 and Mondays at 0100. This station transmits on 6010 and 9555 kHz at 1700-0500 with 5 kW.

**Germany (East)**—*R. Berlin International* has been logged on a new frequency of 17,880 kHz at 1650 in native language.

**Haiti**—Station 4VEH, Box 1, Cap Haitien, has been heard at 1211 with public service anmts in Eng., religious programming, and ID's on 9770 kHz. English is scheduled daily at 1130-1430, on Saturdays at 1130-1500, and on Sundays at 1130-1500

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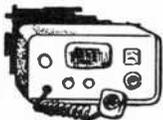
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CIRCLE NO. 39 ON READER SERVICE PAGE

# radio —

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and 1900-2030. Other frequencies in use are: 11,835, 6120, 2450, and 1035 kHz. Reports are requested from regular monitors; write to the address given above or to 466 Weaver Road, Webster, N.Y.

**Haute Volta**—Ouagadougou, 4815 kHz, opens at 0600 in French with Balafon IS and dance music to 0635, then news. This s/on time was confirmed in a QSL.

**Honduras**—Station HRVC, *La Voz Evangelica de Honduras*, Tegucigalpa, 4820 kHz, has a program in Eng. called "Songs In The Night" from 0300 to 0330 s/off on Mondays. Normal s/off other days is 0300. This station is heard best on Mondays because XEJG, Mexico, is off the air then.

**Hungary**—*R. Budapest* opens in Eng. at 0030 on the seldom-heard frequency of 9540 kHz, dual to the N. A. program on 11,910 kHz. The latter has also been noted with a repeat of the same program at 0130.

**Indonesia**—Sorong, 3335 kHz, was caught in Indonesian at 1255-1300 with female speaker and piano recitals. Another female gave the news at 1300 after four time pips.

**Japan**—A new frequency for *Nippon Hoso Kyokai*, Tokyo, is 9670 kHz. It was observed at 1645 in Eng. with broadcast beamed to Africa.

**Korea (North)**—Pyongyang was noted on 7580 kHz in Eng. at 1141-1210 but QRM prevented good readability. A new or different Russian broadcast now opens at 1300 with an anthem; listed s/on times are 0300, 1000, and 1800. Another opening, with a 7-note IS on an instrument resembling an organ, is at 2335; this xmsn, in Spanish, is on 14,510 and 11,750 kHz—no Eng. noted.

**Lebanon**—*R. Lebanon*, Beirut, has the following schedule in effect: to Africa daily on 15,350 kHz in Eng. at 1830-1900, in Arabic at 1900-2000 and in French at 2000-2030; to South America daily on 15,325 kHz in Portuguese at 2300-2330, in Arabic at 2330-0030 and in Spanish at 0030-0100; to N. A. daily on 11,760 kHz in French at 0130-2000, in Arabic at 0200-0230, in Eng. at 0230-0300, in Arabic at 0300-0330 and in Spanish at 0330-0400. Omnidirectional xmsns are broadcast daily at 0430-0730 and 1415-1820 on 5980 kHz and at 0930-1400 on 9545 kHz.

**Malagasy**—Tananarive, 7105 kHz, was noted with Network II French at the odd time of 1410 to 1435 fade, with pop and dance music. Best day to log this one is Sunday, when schedule runs through from 0400 to 1930.

**Malawi**—Blantyre, 3380 kHz, was heard from 0359 to 0425 fade; drums IS to 0400, then a cock crowing and a native-language anmt, followed by news in native language at 0415.

**Malaysia**—*R. Malaysia* has a relay of BBC news



Two receivers are in use in the shack of H. Charles Fanjul, Jr., WPE4IVC, Miami, Fla.—a Lafayette HA-230 and a Heath GR-64. His record to date is 15 countries (10 verified), 4 states (verified).

## SHORT-WAVE CONTRIBUTORS

Roger Camire (WPE1GEEK), Manchester, N. H.  
William Read (WPE1GTC), South Hadley Falls, Mass.

William Graham (WPE2LMU), Binghamton, N. Y.  
Frank Mather (WPE2LWW), Buffalo, N. Y.  
Kenneth Cohen (WPE2LZI), Woodbridge, N. J.  
C. N. Coombe (WPE2MOB), Trenton, N. J.  
Alan Coles (WPE2NUY), Leonia, N. J.  
Bernard Kinahan, Jr. (WPE2OEE), Yonkers, N. Y.  
Bill Hafner (WPE2OJI), West Islip, N. Y.  
John Zapisek (WPE2OKD), Wading River, N. Y.  
Sherman Klem (WPE2OKU), North Merrick, N. Y.  
Steve Milovich (WPE2OSC), Buffalo, N. Y.  
Clifford Mass (WPE2OWT), East Meadow, N. Y.  
Ed Kowalski (WPE3AK), Philadelphia, Pa.  
Bob Huber (WPE3GUN), Wilmington, Del.  
Grady Ferguson (WPE4BC), Charlotte, N. C.  
Bruce Churchill (WPE4EVD), Chula Vista, Calif.  
Kenneth Alyta, Jr. (WPE4FXB), Charlotte, N. C.  
Russ Steinke (WPE4IOK), Birmingham, Ala.  
David Meisel (WPE4IRS), Charlottesville, Va.  
Paul Judkins (WPE4ISO), Herndon, Va.  
John Faulk (WPE4JCF), Tucker, Ga.  
Douglas Gwyn (WPE5ASZ), Pasadena, Texas  
Stewart Mac Kenzie (WPE6AA), Huntington Beach, Calif.

Shaler Hanisch (WPE6BPN), Pasadena, Calif.  
Trevor Clegg (WPE6FAF), Fresno, Calif.  
Mike Lombardi (WPE6GIW), Lynwood, Calif.  
Mike Craig (WPE6GPA), Tustin, Calif.  
Robert Eddy (WPE8EOW), Newport, Ohio  
Robert French (WPE8FGH), Bellaire, Ohio  
Greg Bovee (WPE8JAC), Rochester, Mich.  
Robert Wright, Jr. (WPE8JCF), Brighton, Mich.  
Carl Durnavich (WPE9IFO), Riverdale, Ill.  
A. R. Niblack (WPE9KM), Vincennes, Ind.  
John Beaver, Sr. (WPE9AE), Pueblo, Colo.  
Ervin Ramos-Moll (KP4PE2O), San Antonio, Puerto Rico

Jack Perolo (PY2PE1C), Milwaukee, Wis.  
Daniel Thomas (VE3PE2IR), Burlington, Ont., Canada

Leo Alster, Rahway, N.J.  
C. F. Chicarelli, Bangkok, Thailand  
K. F. Frost, Darwin, N. T., Australia  
Richard Fye, Jr., Salix, Pa.  
David Gross, Syosset, N. Y.  
Bob Hill, Washington, D. C.  
Mike Macken, Winthrop, Mass.  
Bill McDaniel, Markham, Ill.  
Canadian Broadcasting Corp., Montreal, Que., Canada  
Sweden Calling DX'ers Bulletin, Stockholm, Sweden

at 1100-1110 daily, then local news to 1115 s/off. on 9750 kHz. Station returned to air at 1140 for a 17-minute xmsn in Eng. on the same channel. Reports go to Department of Radio, P. O. Box 1047, Kuala Lumpur, Federation of Malaysia.

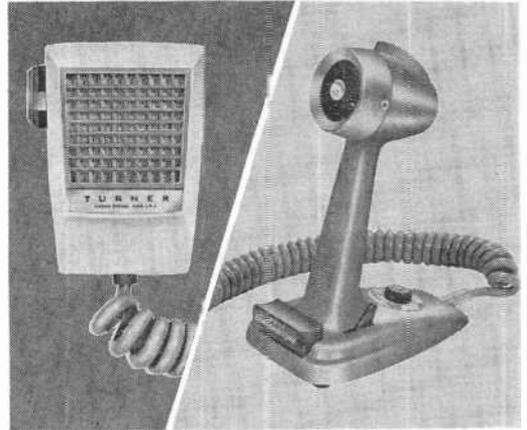
**Mauritius**—R. Mauritius, Forest Side, now operates, as per the latest schedule, at 0230-1300 on 9710 kHz and at 1300-1830 on 4850 kHz, both with 10 kW.

**Morocco**—Aqui Rabat, R. Diffusion TV Maroqui, Rabat, opens on 15,390 kHz at 2230 with a piano selection, then a newscast, followed by pop records; all-Spanish. S/off is at 0000. Do not confuse this station with Rome, which opens shortly afterward on 15,385 kHz and runs far beyond 0000.

**New Caledonia**—Noumea is readable on 3335 kHz with a dramatic program at 1028 in French, semi-classical piano instrumentals at 1040, news summary at 1055, and s/off with "La Marseillaise" at 1058.

**Norway**—The new schedule from Oslo reads: to Western N.A. and the Middle East at 0400-0430 on 9550, 9610, and 11,850 kHz; to Pacific areas and E. Africa at 0745-0815, to Pacific areas, Africa, Europe and S. America at 1100-1230, to Middle East, S. Asia, Eastern N.A. and S. America at 1300-1430, to Europe and N.A. at 1500-1630, to Scandinavia, Pacific areas and Africa at 1700-1830 and to Europe and Africa at 1900-2030, all on 15,175, 17,825, and 21,670 kHz (also on 11,850 kHz at 0745 and 1900, 7240 kHz at 1100, and 21,730 kHz at 1300, 1500, and 1700); to N. Africa, Newfoundland, and S. America at 2100-2230 on 11,850, 15,175, and 17,825 kHz; to W. and S. Africa, Newfoundland, and

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CIRCLE NO. 40 ON READER SERVICE PAGE

# DX STATES AWARDS PRESENTED

To be eligible for one of the DX States Awards designed for WPE Monitor Certificate holders, you must have verified stations (any frequency or service) in 20, 30, 40, or 50 different states in the U. S. The following DX'ers have qualified for and received awards in the categories indicated.

## FIFTY STATES VERIFIED

Richard Markell (WPE6DXC), Los Angeles, Calif.  
Reg Firth (WPE2GFO), Amsterdam, N. Y.  
Allen Holmes (WPE7CLB), Alderwood Manor, Wash.  
Dick Schier (WPE4HIO), Chattanooga, Tenn.  
Doyle Simons (WPE4AGI), Taylors, S. C.  
Frank Scolaro, Jr. (WPE2LUZ), Yonkers, N. Y.  
Carl Durnavich (WPE9IFO), Riverdale, Ill.

## FORTY STATES VERIFIED

Robert Crowell (WPE4HKO), Fort Walton Beach, Fla.  
Paul Ochenkowski (WPE1FYY), Hamden, Conn.  
Larry Zigrang (WPE9HLM), South Bend, Ind.  
Douglas Messimer (WPE3FMZ), Enola, Pa.  
Larry Himsel (WPE2NRR), North Bergen, N. J.  
Bruce Reynolds (WPE0EKU), Warrensburg, Mo.  
Joseph Aman (WPE4IFM), Clifton Forge, Va.  
Dave Oester (WPE7CEZ), Deer Island, Oregon

## THIRTY STATES VERIFIED

Brent Holcomb (WPE4HLH), Clinton, S. C.  
Dwain Davis (WPE1GJO), Cranston, R. I.  
Easy Barber (WPE5DTS), Fort Smith, Ark.  
Elliot Straus (WPE2NOO), West Orange, N. J.  
Jan Lichtig (WPE6EE0), Livermore, Calif.  
Norris Alford (WPE8FYF), Winfield, W. Va.  
Paul Pruitt (WPE6GJR), Dana Point, Calif.  
Barry Premeaux (WPE8HIP), Lansing, Mich.  
Leo Baca (WPE5CLR), East Bernard, Texas  
John Sgrulletta (WPE2MXF), Bedford Hills, N. Y.  
David Bartlett (WPE1GQQ), East Hartford, Conn.  
Russell Feran (WPE5CXT), New Orleans, La.  
Harry Dence, Jr. (WPE4IKY), Cynthia, Ky.  
Calvin Bright (WPE8ISA), Grass Lake, Mich.  
Donald Lee (WPE3EVB), Lebanon, Pa.  
Richard Cooper (WPE1GHI), Wayland, Mass.  
W. E. Raczo (WPE8JBT), Toledo, Ohio  
Kelly Andrews (WPE4IGA), Goldsboro, N. C.  
Philip Smith (WPE8HIA), Kettering, Ohio  
Jack Palladay, Jr. (WPE9E0E), Maxwell Air Force Base, Ala.  
Alan Rhodes (WPE2OQU), Mountainside, N. J.

## TWENTY STATES VERIFIED

David Crowe (WPE3FRC), Pittsburgh, Pa.  
Richard Sears (WPE1FNM), Cambridge, Mass.  
John Megas (WPE1GJL), Ellsworth, Maine  
Frank Hames (WPE3CDM), Silver Spring, Md.  
Robert Mayer (WPE9HQQ), Winnetka, Ill.  
Romona Hagerman (WPE20BV), Delaware, N. J.  
Mark Hosmer (WPE9HPM), Carmel, Ind.  
Jerry Headen (WPE4HQL), Winston-Salem, N. C.  
Jimmy Chocklett (WPE4IDH), Wilson, N. C.  
John Tuomi (WPE2NNO), Brooklyn, N. Y.  
Alan Petersen (WPE0EHF), Hampton, Iowa  
Charles Angell (WPE3TP), Collegeville, Pa.  
Robert Mayer (WPE9HQQ), Winnetka, Ill.  
Ronald Stoltz (WPE3GCC), Trafford, Pa.  
Robert Ruggley (WPE9HJH), Chicago, Ill.  
Forrest Hudspeth (WPE3FWN), Glen Burnie, Md.  
Gary Schwartz (WPE6GGG), Rossmoor, Calif.  
Gary Herron (WPE8IQN), Fraser, Mich.  
Robert Mansbach (WPE2NJB), Long Beach, N. Y.  
Roger Taylor (WPE0EMD), Independence, Mo.  
Ben Hughes (WPE0EMX), Seward, Nebr.

E. Kent (VE3PE2GF), Rexdale, Ontario, Canada  
Harold Allen (VE2PE1JM), Arvida, Quebec, Canada  
William Chrysler (VE6PE6K), Edmonton, Alberta, Canada

David Miller (WPE3GMH), Pittsburgh, Pa.  
Leroy Ireland (WPE2MSY), Ventnor City, N. J.  
Roger Greene (WPE2NFC), Bronx, N. Y.  
Paul Emch (WPE6GBG), Trabuco Canyon, Calif.  
David Lalor (WPE5EIQ), Corpus Christi, Texas  
Thomas Woods (WPE3GTZ), Newark, Del.  
Edward Greb-Lasky (WPE1GPQ), New Britain, Conn.

James Saribalis (WPE6GIB), Daly City, Calif.  
Richard Goldfinger (WPE20OW), Pound Ridge, N. Y.

Dave Ciotti (WPE4IZC), Fairfax, Va.  
Marion Lilienthal (VE3PE2DO), Waterloo, Iowa  
Alan Rhodes (WPE2OQU), Mountainside, N. J.  
Austin Arnold (WPE1GAK), Litchfield, Conn.  
James Reda (WPE3FXA), Beaver, Pa.  
Geoff Fleck (WPE2OQB), Mt. Kisco, N. Y.  
Thomas Break (WPE2OQH), Fairlawn, N. J.  
Charles Schroeder (WPE8IYP), Dayton, Ohio  
Fred King (WPE9IEA), Wabash, Ind.  
Jimmy Eppright (WPE5ELM), Dallas, Texas  
Kenneth Kuberacki (WPE0CM), Detroit, Mich.  
Robert Thacker (WPE8ISX), Dayton, Ohio  
William Vines (WPE9HVF), Hollywood, Ill.  
Mike Jeffrey (WPE7CLK), Wenatchee, Wash.  
W. F. Gilly (WPE3GNT), Allentown, Pa.  
Albert Earnhardt (WPE4IJN), Charlotte, N. C.  
Frank Colin (WPE2OPG), Suffern, N. Y.  
Frank Eitler (WPE1GSE), Hamden, Conn.  
Bruce Kesselman (WPE2OGO), Woodbridge, N. J.  
Ron Hopkins (VE7PE7P), Trail, British Columbia, Canada

Drew Kalman (WPE8ILL), Dearborn, Mich.  
Kenneth Hanna (WPE3GSY), Pittsburgh, Pa.  
Jerome Wolf (WPE2NOQ), Rochester, N. Y.  
J. R. Miller (WPE7CIA), Tigard, Oregon  
Greg Shepard (WPE1GHL), Longmeadow, Mass.  
Arthur Del Gaudio, Jr. (WPE2NRT), Smithtown, N. Y.

James Brady, Jr. (WPE9HXW), Wheaton, Ill.  
Ronald Hartwig (WPE5ELA), Midland, Texas  
Michael Cohen (WPE2NTW), Brooklyn, N. Y.  
Samuel Gold (WPE6DXA), San Francisco, Calif.  
Rodney Vlach (WPE0EPG), Benson, Minn.  
Charles Rittenhouse (WPE8IMT), Westerville, Ohio  
Donny Perro (WPE4HDU), Mobile, Ala.  
Jonathan Lisenco (WPE2MAC), Flushing, N. Y.  
Leo Blouin (VE2PE1KJ), Quebec, Quebec, Canada  
Steve Jones (WPE4IOW), Lawrenceburg, Ky.  
Lawrence McManus (WPE2NAR), Spring Grove, Pa.

Ron Sibbett (VE3PE2HB), Cooksville, Ontario, Canada

H. K. Ogan (WPE7CIS), Mountain Home Air Force Base, Idaho

Frank Johnson (WPE2NAX), Union, N. J.  
Robert Braunwart (WPE7CJQ), Moses Lake, Wash.  
Helmut Meier (VE2PE1JZ), Sept-Illes, Quebec, Canada

Gregory Hendrix (WPE5EKJ), Galveston, Texas  
Ernest Doane (WPE1DTE), Lynn, Mass.  
Bradley Weekley (WPE8GPY), Wilbur, W. Va.  
James Mason (VE3PE2FB), Hamilton, Ontario, Canada

Robert Blazeyewski (WPE2FZY), South Farmingdale, N. Y.

Norm Shacat (WPE1GTP), Malden, Mass.

S. America at 2300-0030 on 9550, 9610, and 11,850 kHz. A 30-minute program in Eng. is broadcast on Sundays at 1200, 1400, 1600, 1800, and 2000, and on Mondays at 0000 and 0400.

**Peru**—Station OBZ4M, *R. La Voz del Valle*, 3387 kHz, was heard at 0300 with Western music. Reports have been returned by the Peruvian post office with the notation that they cannot locate the station at Junin 834, Chaucha. Anyone have any better address for this station?

**Rwanda**—The *Deutsche Welle* relay station in Kigali was noted well on 15,435 kHz at 0020-0035 with music and anmts in German.

**Saudi Arabia**—The *Voice of Islam* has been heard on 15,150 kHz at 1430-1600 and on 9720 kHz at 0315-0445, both in Arabic. They reportedly s/on at sunset in their country. (Do not confuse the 15,150-kHz xmsn with the BBC Arabic Service on 15,140 kHz.) Their QSL arrived by registered airmail after 15 months. No schedule was received but the available channels listed were: Jeddah domestic short-wave on 7230, 9670, 11,855, and 15,150 kHz; Jeddah overseas service on 15,115 kHz; and Riyadh short-wave on 6000, 7220, 9720, and 11,950 kHz.

**Singapore**—*R. Singapura*, 7250 kHz, was noted from 1015 with teen music and anmts in Malay; at 1030 with Arabic vocal and instrumental music. News scheduled at 1045 was not presented as Arabic ran until 1100. The IS is the playing of the musical notes C, G, and E on chimes. The dual 6155-kHz channel was barely readable.

**South Africa**—*R. RSA*, Johannesburg, was heard beamed to Canada from 2330 s/on after bird chirp and musical selection on 11,925 kHz (fair) and on 9525 kHz (covered by Havana). Another outlet, on 11,785 kHz, was noted at 2210 with Eng. news. The United Kingdom and European Service beam on 9720 kHz can be heard at 2200-2255, dual to 7270 and 11,785 kHz.

**Sweden**—Recent changes: to Eastern N. A. in Eng. at 1400-1430 and 1445-1515, and in Swedish at

#### DX AWARDS PROGRAM RULES

Here's an easy way to get a copy of the rules and regulations for each of the three phases of the DX Awards Program to date (Countries, States, and Provinces). Just supply a postage stamp or return envelope, and your Short-Wave Editor will send you a leaflet containing the rules for all three phases—plus a copy of the official Countries List for DX Awards. The stamp or envelope, with your request, should go to: DX AWARD RULES, P. O. Box 333, Cherry Hill, N. J. 08034.

1515-1600 on 17,845 kHz (replacing 15,420 kHz), Swedish at 0100-0145 and Eng. at 0145-0215 on 11,805 kHz (replacing 11,880 kHz); to Canada in French at 1615-1645 on 17,845 kHz (replacing 15,420 kHz); and to Mexico and Central America in Spanish at 0400-0430 on 11,880 and 11,705 kHz (replacing 15,420 kHz).

**Uruguay**—Station CXA7, *R. Oriental*, 11,735 kHz, was noted at 0225-0300 with vocal music and many organ selections. Station CXA6, S.O.D.R.E., 9620 kHz, is again being heard from 0100 to 0300 s/off with organ music and a symphony. Both stations are in Montevideo.

**Vatican City**—*R. Vaticano*, 11,760 kHz, has been heard broadcasting in Spanish to South America at 2330-2345 and to Latin America at 0000-0015.

**Venezuela**—A new station is *Ondas Panamericanas*, El Vigia, 3215 kHz, noted at 0050-0130. Another station, on 9747 kHz, is being heard around 1100; overseas listeners list it as *R. Tovar*. The latter bears further checking.

**Vietnam (North)**—Hanoi has moved from 9775 to 9763 kHz with Eng. at 1000. —30—

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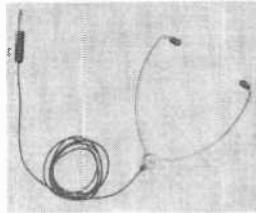
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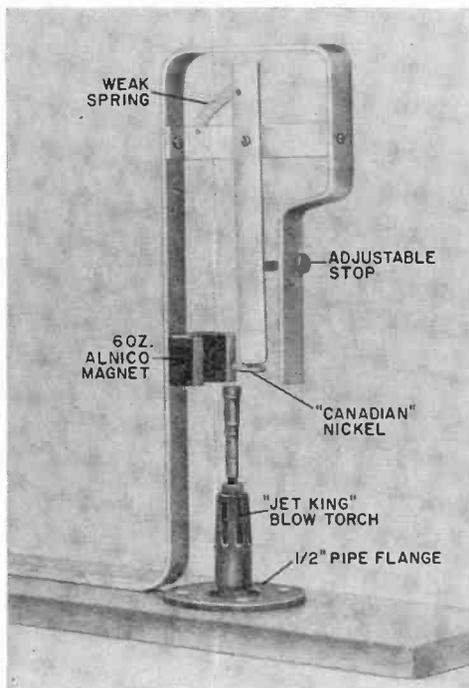
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(Continued from page 71)



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—30—

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1RS	1.10	6AW8	1.35	6Q7	2.05	10A8	1.86	30	1.45
1S5	1.10	6AX4	.96	6Q7	2.05	10A8	1.86	30	1.45
1S5	1.10	6AX5	1.10	6Q7	2.05	10A8	1.86	30	1.45
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4B8	1.45	6C6B	1.45	6Z/84	1.25	12SC7	1.50	50A1	3.50
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5AM8	1.40	6CQ8	1.39	7A6	2.69	12SH7	1.50	50X6	2.80
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5AQ5	.82	6CW4	1.90	7A8	2.95	12SK7	1.40	50Y6	1.55
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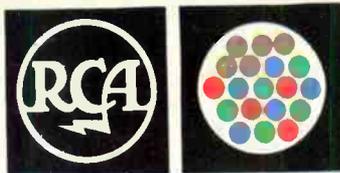
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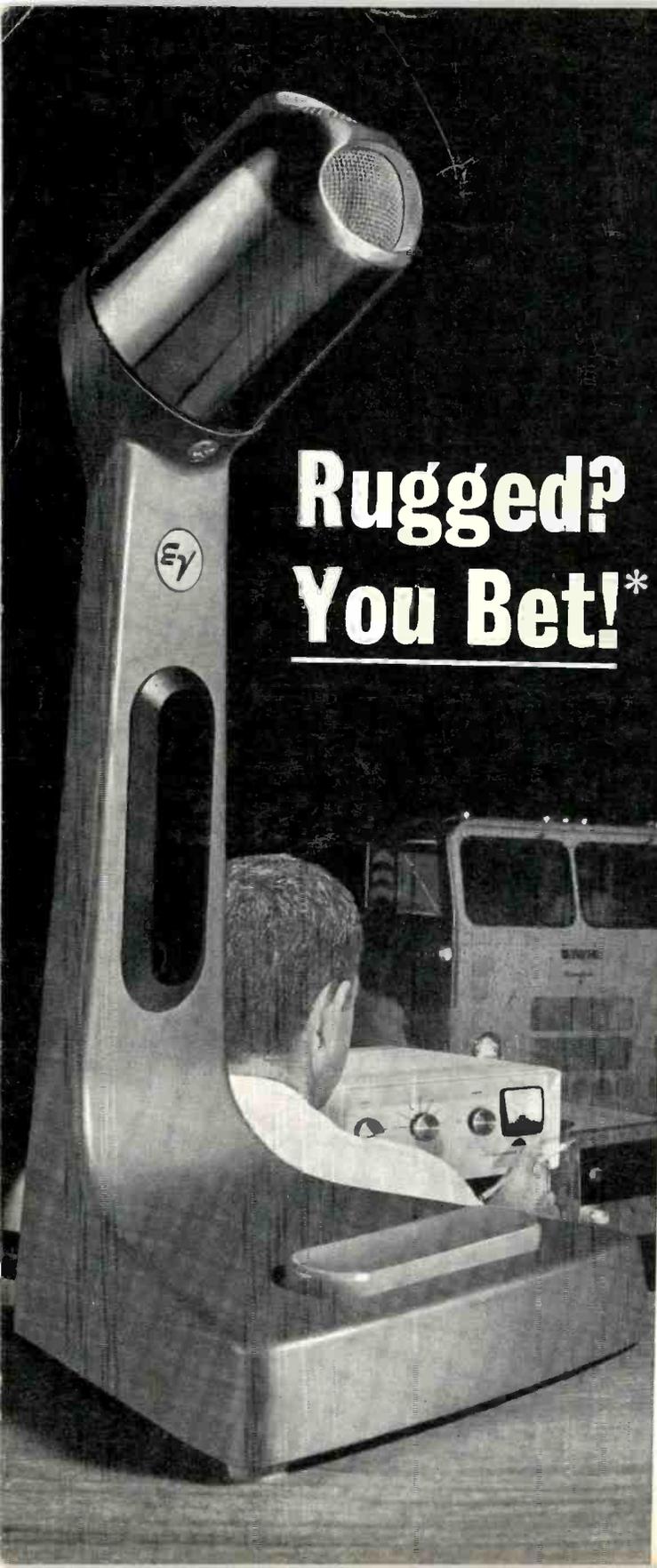
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