12 PAGES—SCIENCE FAIR PROJECTS

POPULAR ELECTRONICS

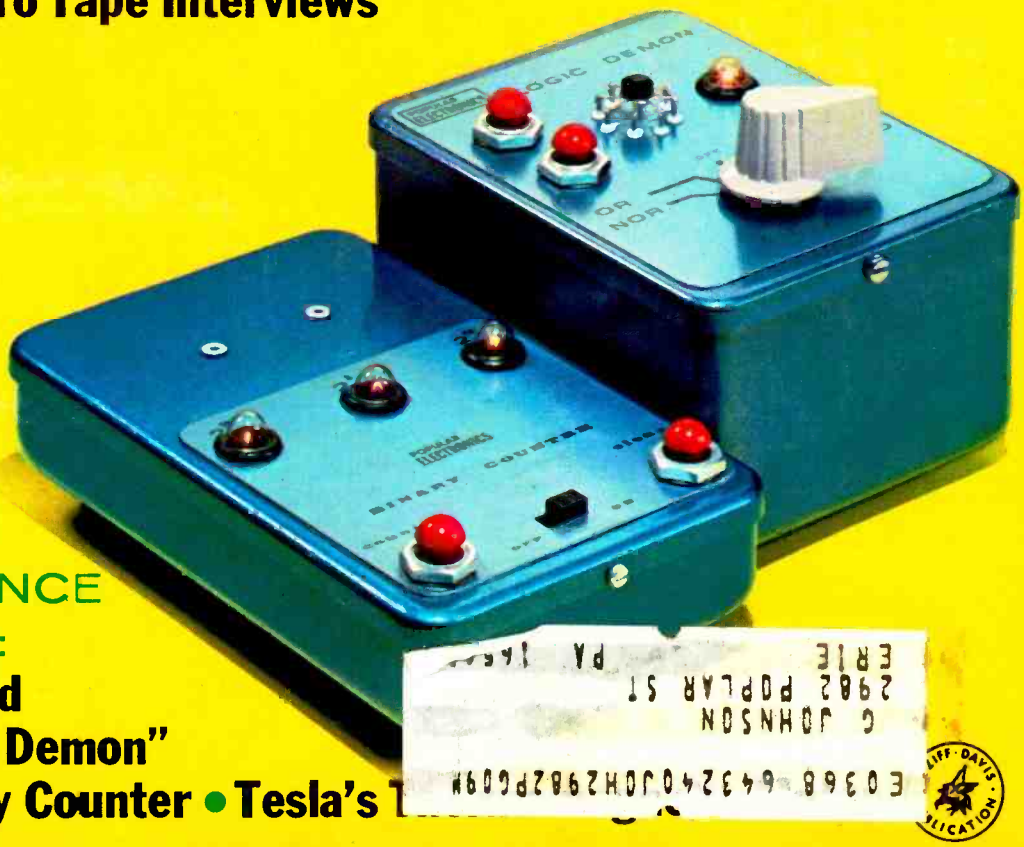
DECEMBER 1966

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**



SCIENCE FAIR:

Build 'Logic Demon" Binary Counter • Tesla's T

E 0368 6432402JOH2982PG09M
C JOHNSON
2982 POPLAR ST
ERIE
PA

www.americanradiohistory.com

ısands Who Gained ough NRI

TRAINING KITS XCITING, FAST

ls of NRI gradu-, Industrial Elec-vision and Radio hter futures and Training men to ctronics has been y. NRI pioneered home instruction, ıg equipment fur-time-proved way train. With NRI tter position with ve on to greater ıatter how much have, plans

Available Under NEW GI BILL

If you served since January 31, 1955, or are in service, check GI line in postage-free card.

Make $3 to $5 An Hour in Spare Time

You don't have to wait until you get an NRI diploma to start earning. As many others have done, you can be making $3 to $5 an hour in your spare-time as you train, fixing radios and TV sets for friends and neighbors. You learn how to install, maintain and service stereo hi-fi, radios, TV sets (including color), even how to charge for service and how to set up your own spare-time or full-time business. Many students pay for their NRI training out of spare-time earnings long before they graduate.

Skilled Technicians Are in Demand

There has never been a time when ambitious men with specialized Electronics knowledge were as much in demand as they are today. From television service shops to launching pads, there's a profitable place for *you* as a skilled technician to help service, operate, install and supervise Electronically-controlled equipment. The NRI diploma is respected and recognized in business and industry. It can be *your* key to success in America's "glamor" industry.

Achievement Kit Gets You Started Fast

As soon as you enroll with NRI we deliver to your door everything you need to make a fast start in the Electronics training of your choice. This new Achievement Kit is an unparalleled example of the value of NRI home-study training. No other school has anything like it. Find out about the NRI Achievement Kit, about NRI training equipment, about NRI courses, about opportunities for success in Electronics. Send for the NRI catalog. There's no obligation. No salesman will call. NATIONAL RADIO INSTITUTE, Electronics Division, Washington, D. C. 20016.

MAIL POSTAGE-FREE CARD NOW

PICK YOUR FIELD

FROM NRI'S SPECIALIZED INSTRUCTION PLANS

1 TELEVISION-RADIO SERVICING
Complete training from basic fundamentals of electricity to home entertainment equipment. You learn to fix radios, hi-fi and stereo sets, black-and-white and color TV, etc. A profitable field full or part time.

2 INDUSTRIAL-MILITARY ELECTRONICS
From basic principles to computers. Comprehensive training teaches fundamentals, then takes you into such modern-day miracles as servos, telemetry, multiplexing, phase circuitry, others.

3 COMPLETE COMMUNICATIONS*
Teaches you, with actual practice, operation, service and maintenance of AM, FM and TV broadcasting stations. Also covers marine, aviation, mobile radio, facsimile, microwave, radar.

4 FCC LICENSE*
Prepares you for your First Class FCC Radiotelephone License examinations. You begin with a thorough background in fundamental Electronic principles, advance to required subjects covering equipment and procedures.

5 MATH FOR ELECTRONICS
A brief course for engineers, technicians who need a quick review of essential math used in industry, communications, government. Basic arithmetic review, shortcut formulas, modern digital number system, much, much more.

6 BASIC ELECTRONICS
A concise course in Electronic terminology and components. A wealth of useful information to help you better understand the field. For anyone who wants basic understanding of Radio-TV Electronics.

7 ELECTRONICS FOR AUTOMATION
Not for beginners. Offered for men with some knowledge of Electronics who want better understanding of process control, ultrasonics, telemetering, and remote control, electromechanical measurements, other subjects.

8 AVIATION COMMUNICATIONS*
This course prepares you to install, maintain, service aircraft communications equipment. Covers direction finders, ranges, markers, Loran, Shoran, Radar, landing systems. Earn your First Class FCC License with Radar Endorsement.

9 MARINE COMMUNICATIONS*
Covers transmitters, direction finders, depth indicators, radar, sonar, other equipment used on commercial ships and thousands of pleasure boats. Prepares you for a First Class FCC License with Radar Endorsement.

10 MOBILE COMMUNICATIONS*
Learn to install and maintain mobile equipment and associated base stations. Covers transmitters and receivers used by police and fire departments, public utilities, construction projects, taxis, etc. Prepares you for FCC License.

11 ELECTRICAL APPLIANCE REPAIR
Prepares you quickly to repair all types of appliances, including air conditioning, refrigeration, small gasoline engines. An easy, practical course leading to profitable part-time or full-time business of your own.

12 ELECTRONICS FOR PRINTERS
Designed to teach operation and maintenance of Electronic equipment which controls the latest devices developed for the graphic arts industry. From basic principles to computer circuits. Approved by major manufacturers.

*NOTE: You must pass your FCC License exam (any Communications course) or NRI refunds in full the tuition you have paid.

www.americanradiohistory.com

The Oldest and Largest School of its Kind in America

WHERE YOU TRAIN IS AS IMPORTANT AS YOUR DECISION TO TRAIN

At NRI you are backed by 50 Years of leadership in home-study training for Electronics • Automation • TV • Radio

J. E. Smith, Founder—1914.

Fifty years ago, a school teacher named James E. Smith started giving extra instruction to four of his students in the "mysterious" new field of radio. From that small beginning, National Radio Institute has grown to be America's largest home-study school in the many fields of Electronics. Nearly three-quarters of a million students have enrolled over the years. This vast experience is behind NRI's meaningful, interesting, easy-to-understand methods of training; methods that make Electronics a practical subject for almost anyone to learn no matter how much or how little formal education he has.

But experience is only the *base* upon which NRI is built. Today there is a staff of more than 150 dedicated people working with you as a "class" of one, keeping training material up-to-the-minute, providing consultation services as you train, advising you about new developments in Electronics, even helping you with job placement when you're ready. Ask men whose judgment you respect about NRI training. And send for the catalog we offer. Read about opportunities in Electronics, about new developments, about NRI itself and the variety of training plans open to you at reasonable cost. Mail the postage-free card today.

JOIN MEN LIKE THESE— TRAIN FOR SUCCESS WITH NRI

"I went into my own business six months after finishing the NRI Radio-TV Servicing Course. It makes my family of six a good living. We repair any TV or Radio. I would not take anything for my training with NRI. It is the finest."

DON HOUSE, Lubbock, Texas

"Many thanks to NRI for the Electronics training I received. I hold a first class FCC License and am employed as a studio and master control engineer/technician with KXJB-TV."

RONALD L. WOOD, Fargo, N.D.

"I am a Senior Engineering Aide at Litton Systems, in charge of checkout of magnetic recording devices for our computers. Without the help of NRI I would probably still be working in a factory at a lower standard of living."

DAVID F. CONRAD, Reseda, Calif.

"NRI training enabled me to land a very good job as Electronic Technician with the Post Office Dept. I also have a very profitable spare-time business fixing Radios and TV."

NORMAN RALSTON, Cincinnati, Ohio

www.americanradiohistory.com

POPULAR ELECTRONICS

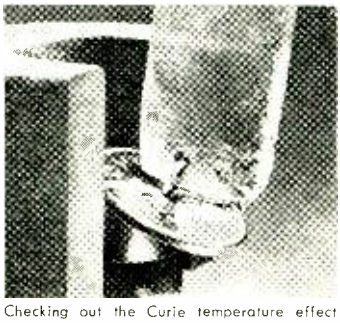
WORLD'S LARGEST-SELLING ELECTRONICS MAGAZINE

VOLUME 25 **DECEMBER, 1966** NUMBER 6

SCIENCE FAIR PROJECTS

FEATURE ARTICLES

DEPARTMENTS



Checking out the Curie temperature effect

Presenting a potpourri on tape recording

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

This month's cover photo by Conrad Studios, Inc.

Copyright © 1966 by ZIFF-DAVIS PUBLISHING COMPANY. All rights reserved.

POPULAR ELECTRONICS, *December 1966, Volume 25, Number 6. Published monthly at 307 North Michigan Avenue, Chicago, Illinois 60601. One year subscription rate for U.S., U.S. Possessions and Canada, $5.00; all other countries, $6.00. Second class postage paid at Chicago, Illinois and other mailing offices. Subscription Service: Portland Place, Boulder, Colorado 80302.*

www.americanradiohistory.com

DeVRY TECH NOT ONLY TRAINS YOU... BUT HELPS YOU GET STARTED AT NO EXTRA COST IN THE BIG-MONEY FIELD OF

ELECTRONICS!

PREPARE AT HOME

Whether you want to prepare for a good-paying new job or for advancement in Electronics with your present employer, DeVry Tech offers specialized educational programs designed to meet your needs. You set up your own HOME LABORATORY and work over 300 construction and test procedures to develop on-the-job type skills. You build a quality Transistorized Meter, a 5-inch Oscilloscope and a special Design Console. DeVry also includes modern "programmed" texts, instructive motion pictures, Consultation Service. Effective? Yes!

RESIDENT SCHOOL

If you prefer you may get all of your training in DeVry's U.S. or Canadian resident schools under the close guidance of friendly, experienced instructors. You work with a wide variety of commercial equipment similar to that actually used in industry as you prepare in our laboratories for a technician's job in Communications, Microwaves, Radio-Television, Automation, Radar, Computers, or other branch of Electronics. DeVry even provides part-time job placement service to those who wish to earn extra money while attending day or evening classes.

PLACEMENT SERVICE

Meet W. E. Bartz, who has helped thousands of DeVry men toward exciting, profitable careers in Electronics. When YOU complete your program, he will help you too. As Placement Manager in touch with business and industry across the nation, Bartz knows the employer demand for DeVry-trained men. He has cooperated in placing our graduates with thousands of firms!

Men 18-45, start preparing NOW for this vast opportunity field. Soon you should be ready for DeVry's valuable employment help!

MAIL COUPON TODAY!

No Advanced Education or Previous Technical Experience Needed to Get Started

Your ambition and desire to succeed are more important! DeVry guides you every step of the way toward success.

Free

Send coupon for these two factual booklets NOW!

DeVRY TECHNICAL INSTITUTE
4141 Belmont Avenue • Chicago, Illinois 60641
Accredited Member of National Home Study Council

DeVRY TECHNICAL INSTITUTE
4141 Belmont Avenue, Chicago, Ill., 60641 Dept. PE-12-W

Please give me your two free booklets, "Pocket Guide to Real Earnings." and "Electronics in Space Travel"; also include details on how to prepare for a career in Electronics. I am interested in the following opportunity fields (check one or more):

- ☐ Space & Missile Electronics
- ☐ Television and Radio
- ☐ Microwaves
- ☐ Radar
- ☐ Automation Electronics
- ☐ Communications
- ☐ Computers
- ☐ Broadcasting
- ☐ Industrial Electronics
- ☐ Electronic Control

Name_____ Age_____

Address_____ Apt._____

City_____ State_____ Zip Code_____

☐ Check here if you are under 16 years of age.

HOME STUDY AND RESIDENT SCHOOL TRAINING AVAILABLE IN CANADA

2103

www.americanradiohistory.com

put a price on your equipment!

Then add this one, and stop heat from robbing you of component life.

The Hi Fi Boxer fan can return its cost 10 times or more by increasing the life of the average color TV or Hi Fi set. Save money with fewer service calls, fewer replacements and better performance.

This unit, made by the company that produces airmovers for computers, broadcasting equipment, and the Minuteman missile is now available in the new long-life Grand Prix model at no extra cost.

Avoid plastic substitutes, get the real Grand Prix from your nearest Hi Fi dealer or write:

IMC Magnetics Corp imc
New Hampshire Division, Route 16B,
Rochester, New Hampshire 03867

CIRCLE NO. 19 ON READER SERVICE PAGE

POPULAR ELECTRONICS

PHILLIP T. HEFFERNAN
Publisher

OLIVER P. FERRELL
Editor

ROBERT CORNELL, WA2HDQ
Managing Editor

JOHN D. DRUMMOND
Technical Editor

WILLIAM GALBREATH
Art Director

MARGARET MAGNA
Associate Editor

ALEXANDER W. BURAWA
Assistant Editor

ANDRE DUZANT
Technical Illustrator

NINA KALAWSKY
Editorial Assistant

PATTI MORGAN
Editorial Assistant

H. BENNETT, W2PNA
H. S. BRIER, W9EGQ
L. E. GARNER, JR.
M. P. SPINELLO, KHC2060
Contributing Editors

LAWRENCE SPORN
Advertising Sales Manager

ARDYS C. MORAN
Advertising Service Manager

ZIFF-DAVIS PUBLISHING COMPANY

Editorial and Executive Offices
One Park Avenue, New York, New York 10016
212 679-7200
Eastern Advertising Manager, RICHARD J. HALPERN

Midwestern Office
307 North Michigan Avenue, Chicago, Illinois 60601
312 726-0892
Midwestern Advertising Manager, JAMES WEAKLEY

Western Office
9025 Wilshire Boulevard, Beverly Hills, California 90211
213 CRestview 4-0265; BRadshaw 2-1161
Western Advertising Manager, BUD DEAN

Japan: James Yagi
c/o Fukushima
19-14 Minami 3-chome
Koenji, Suginami-ku
Tokyo, Japan

Circulation Office
Portland Place
Boulder, Colorado 80302

William B. Ziff, Chairman of the Board (1946-1953)
William Ziff, President
W. Bradford Briggs, Executive Vice President
Hershel B. Sarbin, Vice President and General Manager
Philip Sine, Financial Vice President
Walter S. Mills, Jr., Vice President, Circulation
Stanley R. Greenfield, Vice President, Marketing
Phillip T. Heffernan, Vice President, Electronics Division
Frank Pamerantz, Vice President, Creative Services
Arthur W. Butzow, Vice President, Production
Edward D. Muhlfeld, Vice President, Aviation Division

Ziff-Davis also publishes Skiing, Flying, Business & Commercial Aviation, Boating, Car and Driver, Cycle, Popular Photography, HIFI/Stereo Review, Electronics World, Modern Bride, Skiing Trade News, and Skiing Area News.

All subscription correspondence should be addressed to POPULAR ELECTRONICS, Circulation Department, Portland Place, Boulder, Colorado 80302. Please allow at least six weeks for change of address. Include your old address, as well as new—enclosing if possible an address label from a recent issue.

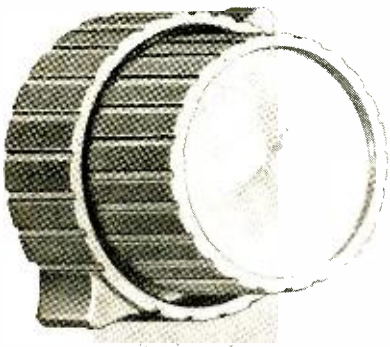
EDITORIAL CONTRIBUTIONS must be accompanied by return postage and will be handled with reasonable care; however, publisher assumes no responsibility for return or safety of art work, photographs or manuscripts.

ZIFF-DAVIS PUBLISHING COMPANY

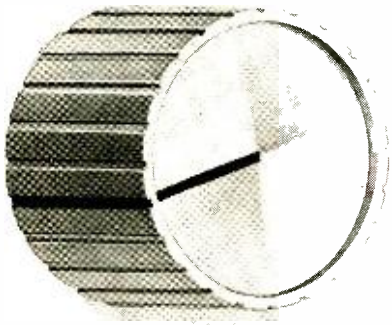
AUDITED PAID CIRCULATION ABC

MPA
Member Audit Bureau of Circulations

www.americanradiohistory.com



On-Off
Volume
Squelch



Channel

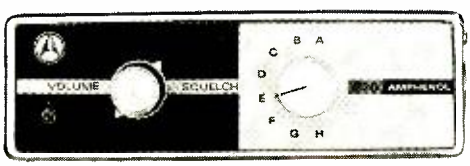
Simple

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

www.americanradiohistory.com

GARRARD'S CUEING

... the most wanted feature on record player units today is now available in models from $54.50 ... a revolutionary development! The Garrard cueing controls eliminate the danger of accidental damage to records or stylus through manual handling; work three ways:

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.

3. To locate any record groove accurately and safely.

Built-in cueing controls are featured on three of Garrard's new automatic turntables:

50 MK II —$54.50 with manual cueing and pause control lever built into the tone arm system.

60 Mk II —$74.50 with manual cueing and pause control lever built into the tone arm system.

LAB 80 Mk II —$99.50 with exclusive hydraulically operated cueing tab control 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

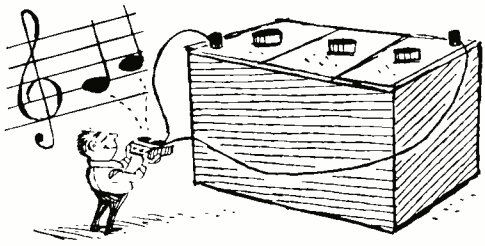
Address correspondence for this department to: Letters Editor, POPULAR ELECTRONICS One Park Avenue, New York, N. Y. 10016

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

www.americanradiohistory.com

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

More brains? More ambition?

No, just more education in electronics.

You know that two men who are the same age can work side-by-side on the same project, yet one will earn much more than the other.

Why? In most cases, simply because one man has a better knowledge of electronics than the other. In electronics, as in any technical field, you must learn more to earn more. And, because electronics keeps changing, you can never stop learning if you want to be successful.

But your job and family obligations may make it almost impossible for you to go back to school and get the additional education you need. That's why CREI Home Study Programs are developed. These programs make it possible for you to study advanced electronics at home, at your own pace, on your own schedule. You study with the assurance that what you learn can be applied on the job to make you worth more money to your employer.

CREI Programs cover all important areas of electronics including communications, servo-mechanisms, even spacecraft tracking and control. You're sure to find a program that fits your career objectives.

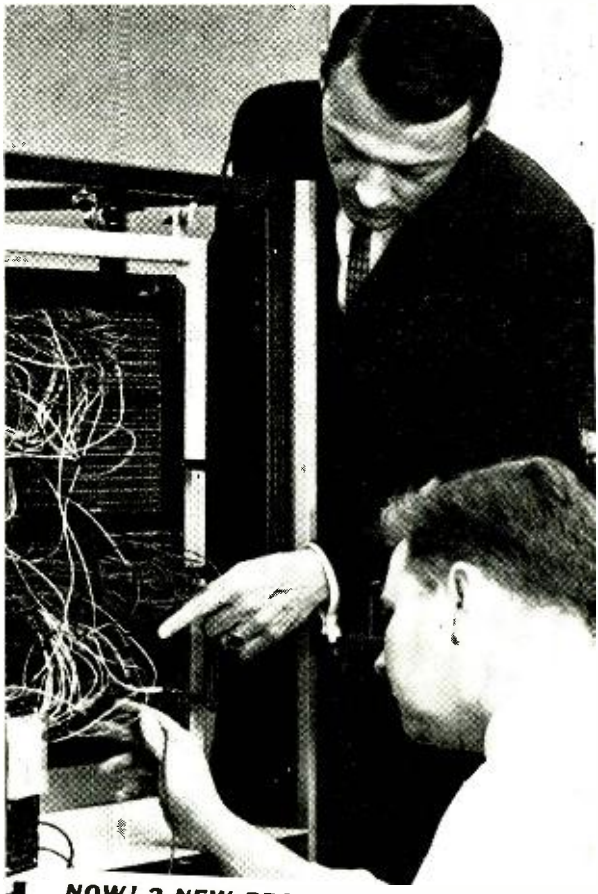
You're eligible for a CREI Program if you have a high school education and work in electronics. FREE book gives all the facts. Mail coupon or write: CREI, Dept. 1212-D, 3224 Sixteenth Street, N.W., Washington, D.C. 20010.

Send for Free Book

Accredited Member of the National Home Study Council

CREI

Founded 1927



NOW! 2 NEW PROGRAMS!

- **Industrial Electronics for Automation**
- **Computer Systems Technology**

The Capitol Radio Engineering Institute
Dept. 1212-D, 3224 Sixteenth Street, N.W.
Washington, D.C. 20010

Please send me FREE book describing CREI Programs. I am employed in electronics and have a high school education.

NAME _____ AGE _____

ADDRESS _____

CITY _____ STATE _____ ZIP CODE _____

EMPLOYED BY _____

TYPE OF PRESENT WORK _____

_____ ☐ GI BILL

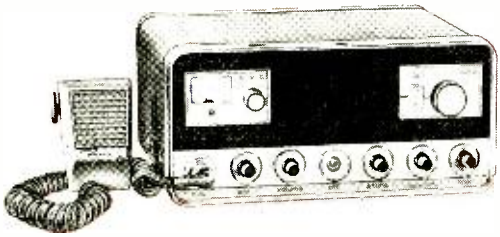
I am interested in ☐ Electronic Engineering Technology
☐ Space Electronics ☐ Nuclear Engineering Technology
☐ **NEW! Industrial Electronics for Automation**
☐ **NEW! Computer Systems Technology**

Approved for Veterans Administration Training

www.americanradiohistory.com

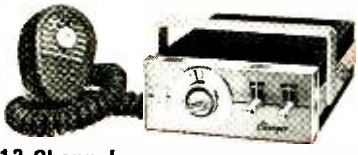
GIFTED COMMUNICATIONS

by Regency *for every purpose . . . every purse*



The Incomparable 23 Channel Range Gain II $235.00

No other CB set, at any price, can match the Double Side-Band, Reduced Carrier performance that Range Gain II gives on all **23** channels. You get up to 4 times more coverage and 30 watts P. E. P. modulation capacity in base or mobile applications. Try it once . . . and you'll like it forever!



The 12 Channel Solid State Charger $110.00

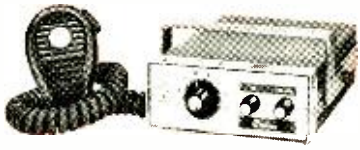
New! Our Metrotek Charger offers more channels at less cost. This smooth running DC powered mobile set has 13 silicon transistors and 5 diodes for peak performance on all 12 crystal controlled channels. And the low price includes mike, mobile mounting bracket, adjustable squelch and built-in A. N. L. plus remote speaker, P. A. capability and crystals for channel 11.

The Popular, Versatile Pacer II $110.00

The economical, CB transceiver that is at home in base or mobile installations. 11 crystal controlled channels on transmit and receive plus 23 channel tunable receiver. Works equally well on AC or transistorized DC power supply. The Pacer's illuminated "S" meter, spotter switch and adjustable squelch are extras that enable the Pacer II to give you so much for so little money.

The Ultra Special Regency Ranger $175.00

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!



The Transistorized, Needle Busting Bronco $89.95

New! Here is the transceiver that has broken the CB price barrier. It gives crystal controlled performance on 8 channels. 13 silicon transistors and 5 diodes deliver maximum efficiency for your 2-way radio dollar. The streamlined circuitry includes built-in A. N. L. and adjustable squelch control. The Bronco comes complete and ready to operate with mike, mounting bracket and channel 11 crystals plus remote speaker capability.

Every Regency and Metrotek transceiver gives you a 1 year warranty

Regency

ELECTRONICS, INC.
7900 PENDLETON PIKE
INDIANAPOLIS, INDIANA

CIRCLE NO. 33 ON READER SERVICE PAGE

www.americanradiohistory.com

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

www.americanradiohistory.com

TRAIN AT HOME FOR
ELECTRONICS
• Radio - Television • Data Processing • Computers
• Telecommunications • Telemetry • Industrial Electronics

Get yourself into ELECTRONICS, the greatest field of opportunity today.

TO FIND OUT HOW YOU CAN BECOME A PART OF THE ELECTRONICS WORLD TODAY.

SEND FOR FREE ELECTRONICS SELECTION CAREER KIT

Yes, I'm interested in the Electronics Field. Please send me your FREE ELECTRONICS CAREER SELECTION KIT. I understand there is no obligation.

Occupation _____ Age _____

Name _____

Address _____

City _____ State _____ Zip _____

TECHNICAL TRAINING INTERNATIONAL, Inc.
10447 South Torrence Avenue Chicago, Illinois 60617

"Over a Quarter of a Century of World Wide Professional Experience in Training Men"

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

www.americanradiohistory.com

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 unfailing 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

5th & Kostner Aves., Chicago, Ill. 60624
Export: International Div. **Canada:** Gould Sales Co.

CIRCLE NO. 17 ON READER SERVICE PAGE

www.americanradiohistory.com

PEARCE-SIMPSON'S
WINNING
TWO-WAY RADIO
COMBINATION

FOR MOBILE OPERATION
The 23 channel DIRECTOR
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!

ALL SOLID STATE 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
(complete with crystals for 23 channels)

PEARCE-SIMPSON, INC. PE-1266
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*)

www.americanradiohistory.com

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**
2. **CB High** — 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.

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.

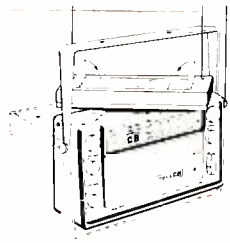
Hours Of Fascinating Listening

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 2½" 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!

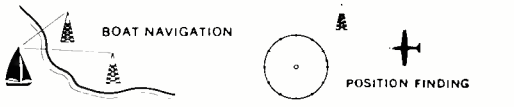
5 Band Portable CB Receiver/Direction Finder $149.95

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 earphone, leather carrying case, batteries, removable and adjustable mounting bracket. Only 8" x 5" x 2", smaller than an ordinary cigar box, it weighs just 2½ lbs. *And it also plugs into regular house current.*

5 Band Nova CB $149.95

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.

NO RISK ORDER BLANK

nova-tech INC.

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.

Name

Address

City, State

PE126

CIRCLE NO. 29 ON READER SERVICE PAGE

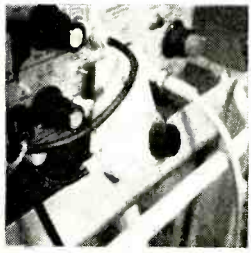
www.americanradiohistory.com

TIPS & TECHNIQUES

PARTS
METHODS
IDEAS
GADGETS
DEVICES

SLOPE-FRONT BOX STOPS STOOP AND SQUINT

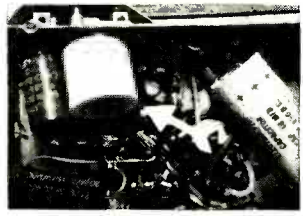
A small slope-front box for mounting potentiometers, pilot lamps, small meters, etc., at a convenient angle for reading or accessibility can be made from a small metal box. Hold and position one section of the box next to the other and move it around until you get the slant you want. Mark cut lines on 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.

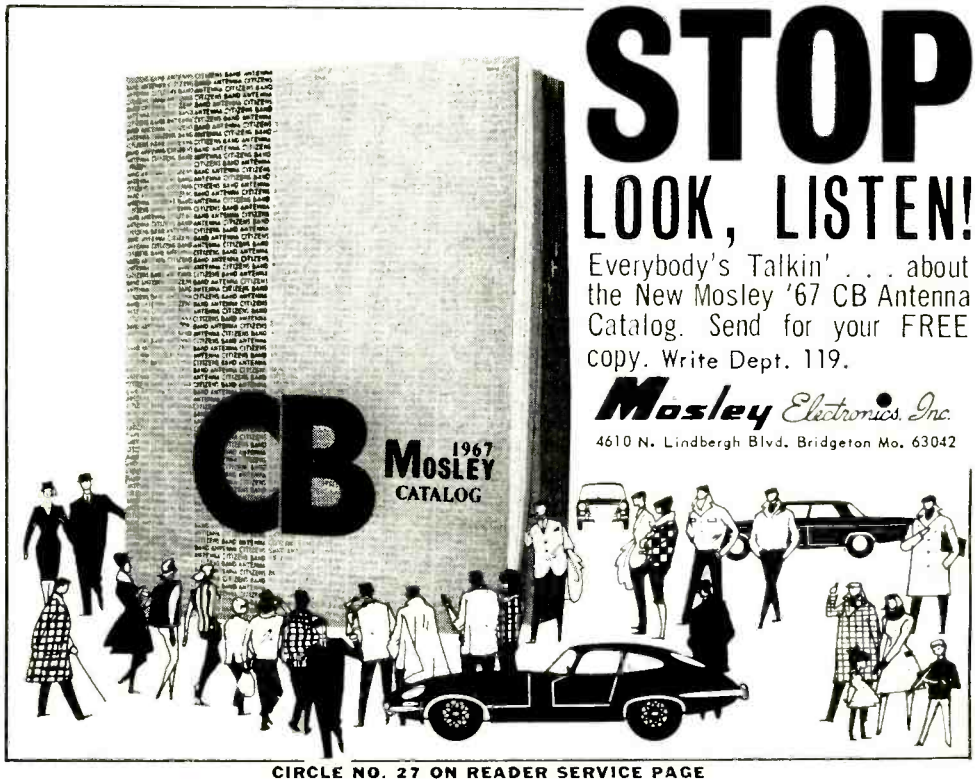


—Henry R. Rosenblatt

ROTATE YOUR RADIO FOR BETTER RECEPTION

Some of the more expensive AM portable radios on the market have antennas built

(*Continued on page* 20)



CIRCLE NO. 27 ON READER SERVICE PAGE

www.americanradiohistory.com

POPULAR ELECTRONICS
READER SERVICE PAGE

You can get
additional information promptly
concerning
products advertised or mentioned
editorially
in this issue

1

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.

2

Mail the coupon to the address indicated below.

3

Please use this address only for Product Service requests.

POPULAR ELECTRONICS
P. O. BOX 8391
PHILADELPHIA, PA. 19101

Please send me additional information about the products whose code numbers I have circled

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25
26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50
51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75
76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100

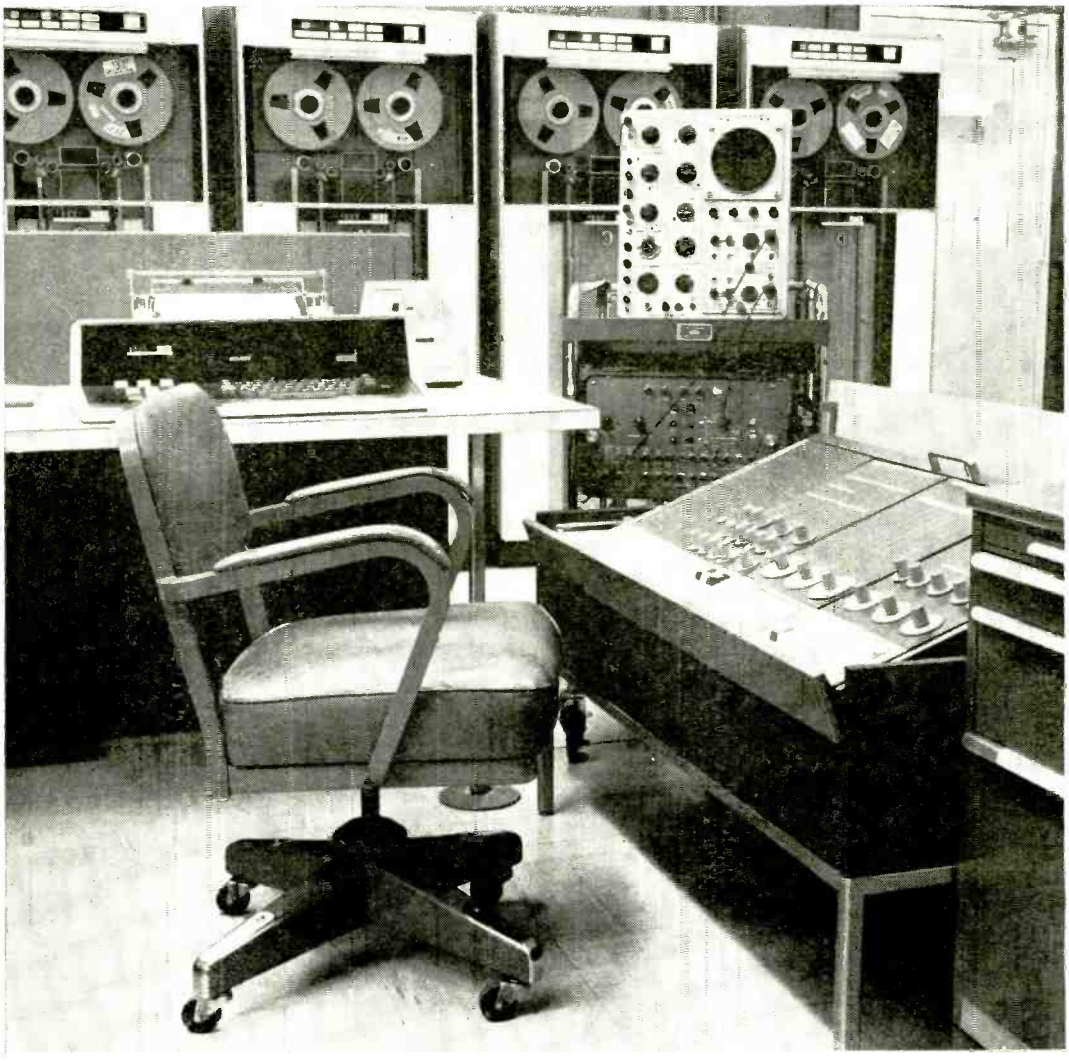
NAME *(Print clearly)*_____

ADDRESS_____

CITY_____ **STATE**_____ **ZIP CODE**_____

VOID AFTER JANUARY 31, 1967 12

www.americanradiohistory.com



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

It's a fact. There are *thousands* of jobs like this available *right now* for skilled electronics technicians. What's more, these men are going to be in even *greater* demand in the years ahead. But how about you? Where do you fit into the picture? Your opportunity will never be greater . . . so act *now* to take advantage of it. The first step? Learn electronic fundamentals . . . develop a practical understanding of transistors, troubleshooting techniques, pulse circuitry, micro-electronics, computers and many other exciting new developments. Prepare yourself now for a job with a bright future . . . unlimited opportunity . . . lasting security . . . and a steadily-increasing salary.

Over 15,500 ambitious men are using Cleveland Institute Electronics Training Programs as a stepping stone to the good jobs in electronics. Why not join them? You will learn at home, in your spare time, and tuition is remarkably low. Read the important information on the facing page. Then fill out the postage-free reply card and drop it in the mail today. Without obligation we'll send you all the details. But act now . . . and get *your* high-paying job just that much sooner.

www.americanradiohistory.com

How You Can Succeed In Electronics
. . . Select Your Future From Five Career Programs

The "right" course for your career

Cleveland Institute offers not one, but five different and up-to-date Electronics Home Study Programs. Look them over. Pick the one that is "right" for you. Then mark your selection on the reply card and send it to us. In a few days you will have complete details . . . without obligation.

1. Electronics Technology

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.

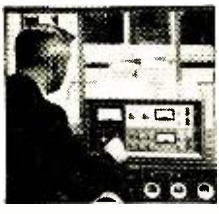
3. Broadcast Engineering

Here's an excellent studio engineering program which will get you a 1st Class FCC License and teach you all about Program Transmission and Broadcast Transmitters.

4. Electronic Communications

Mobile Radio, Microwave, and 2nd Class FCC preparation are just a few of the topics covered in this "compact" program . . . Carrier Telephony too, if you so desire.

5. Industrial Electronics & Automation



This exciting program includes many important subjects such as Computers, Electronic Heating and Welding, Industrial Controls, Servomechanisms, and Solid State Devices.

An FCC License . . . or your money back!

In addition to providing you with comprehensive training in the area indicated, programs 1, 2, 3, and 4 will prepare you for a Commercial FCC License. In fact, we're so certain of their effectiveness, we make this *exclusive* offer:

The training programs described will prepare you for the FCC License specified. Should you fail to pass the FCC examination after completing the course, we will refund *all* tuition payments. You get an FCC License . . . or your money back!

CIE's AUTO-PROGRAMMED™ lessons help you learn faster and easier

Cleveland Institute uses the new programmed learning approach. Our AUTO-PROGRAMMED* lessons present facts and concepts in small, easy-to-understand bits . . . reinforce them with clear explanations and examples. Students learn more thoroughly and faster through this modern, simplified method. You, too, will absorb . . . retain . . . advance *at your own pace.* *TRADEMARK

Lifetime job placement service for every CIE graduate . . . at no extra cost

Once enrolled with CIE, you will get a bi-monthly listing of the many high-paying interesting jobs available with top companies throughout the country. Many Cleveland Institute students and graduates hold such jobs with leading companies like these: American Airlines, American Telephone and Telegraph, General Electric, General Telephone and Electronics, IBM, Motorola, North American Aviation, New York Central Railroad, Raytheon, RCA and Westinghouse.

CIE lessons are always up-to-date

Only CIE offers new, up-to-the-minute lessons in all of these subjects: Logical Troubleshooting, Laser Theory and Application, Microminiaturization, Single Sideband Techniques, Pulse Theory and Application, Boolean Algebra.

Full accreditation . . . your assurance of competence and integrity

Cleveland Institute of Electronics is accredited by the Accrediting Commission of the National Home Study Council. You can be assured of competent electronics training by a staff of skilled electronics instructors.

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.

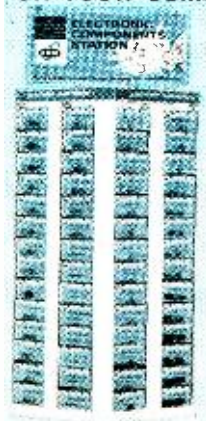
CIE

Cleveland Institute of Electronics

1776 East 17th Street, Dept PE-48, Cleveland, Ohio 44114

www.americanradiohistory.com

ONE-SOURCE
FOR YOUR COMPONENT NEEDS



ERIE'S EXCITING NEW ELECTRONIC COMPONENTS STATION

. . . COMPONENTS IN HANDY, EASY TO IDENTIFY PACKAGES AT DISTRIBUTORS Everywhere!

CERAMIC DISC CAPACITORS!
Voltages — 12 V. thru 1000 V.
Capacitance — 5 pF thru 220,000 pF (.22 uF)

CERAMIC TUBULAR CAPACITORS!
Voltages — 100 V. and 500 V.
Capacitance — 1 pF thru 1000 pF

MYLAR FILM CAPACITORS!
Voltages — 200 V. thru 600 V.
Capacitance — .01 uF thru .1 uF

TRIMMER CAPACITORS (*Variable*)!
Ceramic · Plastic · Glass
Ranges to suit your needs

RECTIFIERS & DIODES!
Industry's Most Popular Types

IF AN ERIE STATION IS NOT AT YOUR DISTRIBUTOR CLIP and MAIL COUPON TODAY!

ERIE TECHNOLOGICAL PRODUCTS, INC.

ERIE

Erie, Pennsylvania

ERIE TECHNOLOGICAL PRODUCTS, INC.
Attn: Distributor Sales
Erie, Pennsylvania

YOUR NAME _____

ADDRESS _____

CITY _____ STATE _____

NAME OF YOUR FAVORITE DISTRIBUTOR . . .

_____

ADDRESS _____

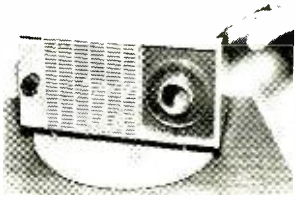
CITY _____ STATE _____

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*



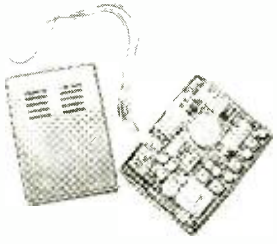
HANDY HOLDERS FROM FLASHBULB PLASTIC PACKING

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. Gohl*



www.americanradiohistory.com

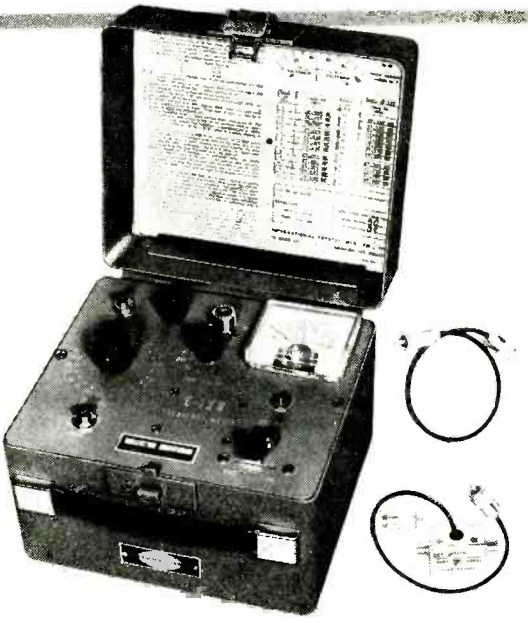
If You Service Citizens Radio Transceivers . . .

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.

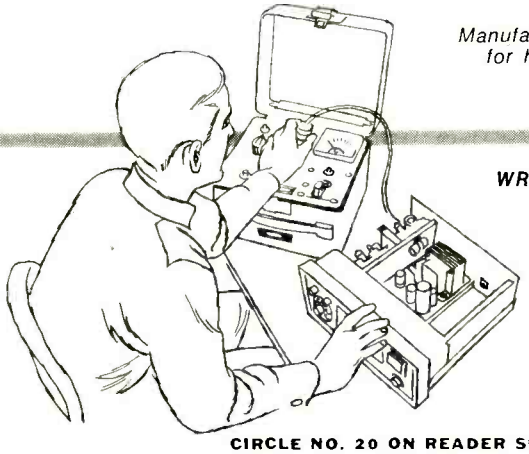
check these features!

- *Frequency Measurement* — Range 26.965 mc to 27.255 mc. Frequency stability ± .0025% 32°F to 125°F; ± .0015% 50°F to 100°F.
- *Power Measurement* — 0 to 5 watts, accuracy ± ¼ 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* — 1½ vdc @ 60 ma, 67½ 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.



WRITE FOR COMPLETE CATALOG

INTERNATIONAL

CRYSTAL MFG. CO., INC.

18 NO. LEE OKLA. CITY, OKLA. 73102

CIRCLE NO. 20 ON READER SERVICE PAGE

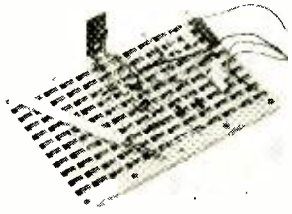
www.americanradiohistory.com

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

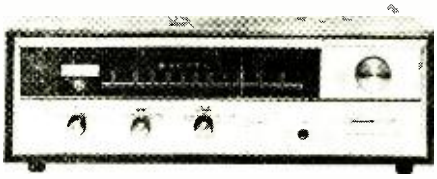
Want to eliminate worries about cold-solder joints, overheated devices, and burned insulation? "SPRINGBOARD," a new solderless experimental circuit board that permits the instant addition or removal of components without damage to leads is now in production at *Barry Instrument Corporation*. The Model BIS-100 SPRINGBOARD 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 μV) 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

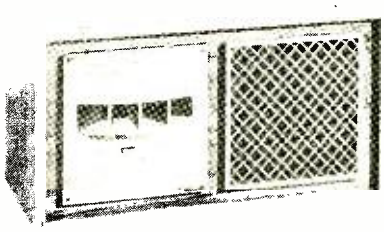


can be used to indicate signal strength, zero-center tuning, or multipath distortion. All difficult-to-wire or critical circuitry in the LT-112B is prewired, pretested, and prealigned at the factory. The kit comes with a full-color, "life-size" construction book, and with all wires precut and prestripped 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 midrange horn speaker for wide-angle dispersion of mid-frequency tones. A 12" woofer is coupled to the multicell horn and a 2½" tweeter by an LC-type crossover; there are level controls on the midrange speaker and

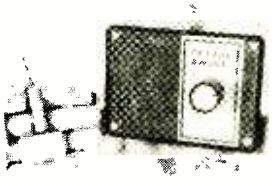


the tweeter. The midrange horn can be turned 90° in the cabinet, permitting the cabinet to be mounted either vertically or horizontally. Power-handling capacity: up to 50 watts. Impedance: 8 ohms. Frequency response: 30 to 23,000 Hz.

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 movements, 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

www.americanradiohistory.com

Introducing EICO's New "Cortina Series"!

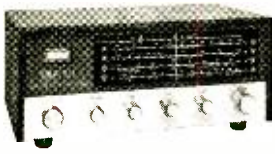
Today's electro-technology makes possible near-perfect **stereo at moderate manufacturing cost:** that's the design concept behind the new EICO "Cortina" all solid-state stereo components. All are 100% professional, conveniently compact (3⅛"H, 12"W, 8"D), in an esthetically striking "low silhouette." 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 interstage 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.

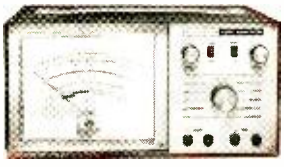
7 New Ways to make Electronics more Fun!

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.**



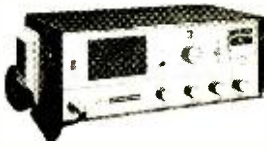
NEW EICO 888 Solid-State Engine Analyzer

Now you can tune-up, trouble-shoot 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/RF 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

EICO Electronic Instrument Co., Inc.
131-01 39th Ave., Flushing, N. Y. 11352

Send me **FREE** catalog describing the full EICO line of 200 best buys, and name of nearest dealer. I'm interested in:

- ☐ test equipment
- ☐ ham radio
- ☐ stereo/hi-fi
- ☐ Citizens Band radio
- ☐ automotive electronics

Name_____

Address_____

City_____

State_____ Zip_____

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

www.americanradiohistory.com

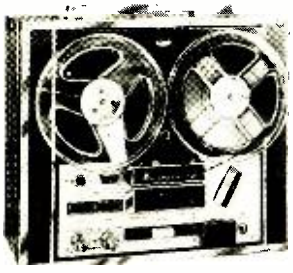
PRODUCTS *(Continued from page 22)*

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

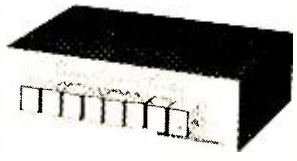
The deluxe Model RK-880 stereo record/playback tape deck introduced by *Lafayette Radio Electronics* incorporates features usually associated with higher priced tape decks. Three heads provide four-track stereo and mono record/playback plus sound-on-sound and sound-with-sound features. In addition, the 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 7½ in/s, ±3 dB; 40-12,000 Hz at 3¾ in/s, ±3 dB. Wow and flutter is less than 0.15% at 7½ in/s, less than 0.25% at 3¾ 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 receivers (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, *Sencore*'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 1/16" x 4⅛" 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.

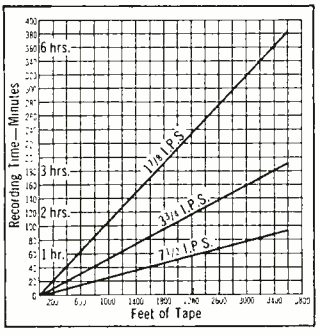
Circle No. 85 on Reader Service Page 15

www.americanradiohistory.com

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_____

Address_____

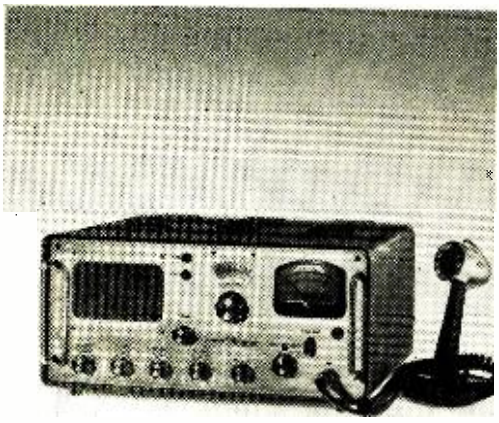
City & State_____ Zip_____

EASTMAN KODAK COMPANY, Rochester, N.Y.

CIRCLE NO. 12 ON READER SERVICE PAGE

www.americanradiohistory.com

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:

Tram Electronics, Inc.
Dept. No. E-12, Lower Bay Road P.O. Box 187
Winnisquam, N. H. Phone 603-524-0622

All use must conform with Part 95 F.C.C. regulations. Hobby type communications or aimless small talk prohibited.

For information write directly to advertiser

ELECTRONICS LIBRARY

DIRECT CURRENT CIRCUITS AND MEASUREMENTS

by Charles J. Anderson, Anthony Santanelli, 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—

www.americanradiohistory.com

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

Weller®

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 plastic case. Model 8200PK $8.95 list

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 plastic case. Model D550PK $12.95 list

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

WELLER ELECTRIC CORP., Easton, Pa. *WORLD LEADER IN SOLDERING TOOLS*

CIRCLE NO. 44 ON READER SERVICE PAGE

www.americanradiohistory.com

READ WHAT THE EXPERTS SAY ABOUT THE knight-kit® 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

ALLIED RADIO, Knight-Kit Div.
Dept. 3-MM, P. O. Box 8528
Chicago, Illinois 60680

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

NAME _____
Please Print

ADDRESS _____

CITY _____ STATE _____ ZIP _____

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 "Audiocolor," 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

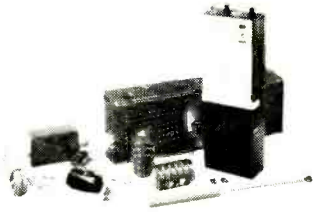
A data sheet on *Triplett Electrical Instrument Company*'s recently introduced Model 630-APLK volt-ohm-milliammeter emphasizes its solid-state switching circuit which guards against accidental burnouts and bent pointers and provides overload protection. Other technical features and specifications are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

Circle No. 90 on Reader Service Page 15

www.americanradiohistory.com

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.

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**

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

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 ±2 db. Paralog-Plus antennas are flat within ±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.

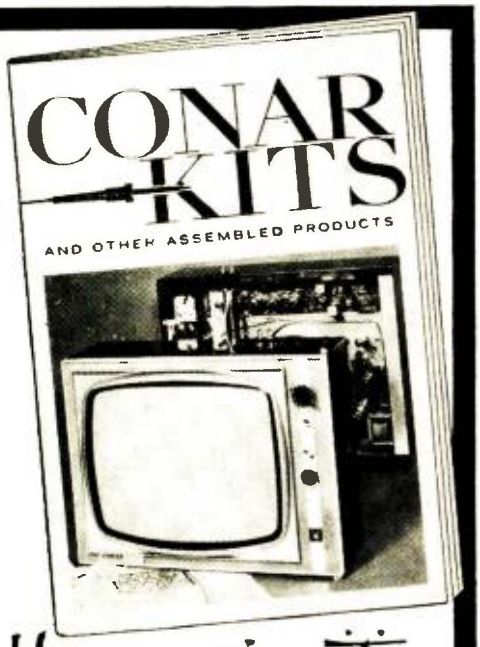
What's more, you get a choice of 300 and 75 ohm coaxial outputs, *plus* excellent gain over the entire FM band. For the greatest realism in lifelike color, try the Paralog-Plus.

JERROLD

JERROLD ELECTRONICS CORPORATION
DISTRIBUTOR SALES DIVISION
401 Walnut St., Phila., Pa. 19105

CIRCLE NO. 21 ON READER SERVICE PAGE

www.americanradiohistory.com



Your copy is waiting

The do-it-yourselfer's newest catalog

Here's your new catalog of quality electronic kits and assembled equipment . . . your shopping guide for TV set kits, transistor radios, voltmeters, scopes, tube testers, ham gear, PA systems, and a host of other carefully engineered products. Every item in the Conar catalog is backed by a no-loopholes, money-back guarantee. It's not the biggest catalog, but once you shop its pages you'll agree it's among the **best.** For years of pleasurable performance, for fun and pride in assembly, mail the coupon. Discover why Conar, a division of National Radio Institute, is just about the fastest growing name in the kit and equipment business.

CONAR

MAIL NOW!

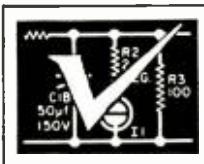
CONAR NA6C
3939 Wisconsin Avenue, Washington, D.C. 20016

Please send me your new catalog.

Name_____

Address_____

City_____ State_____ Zip Code_____



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)

Lettine 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 30117 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)

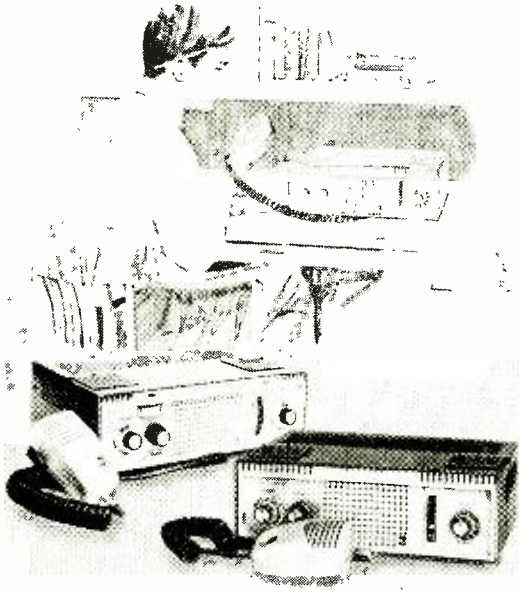
Sparton Model 7-36 receiver; tunes 1.6 kHz to 18 MHz on 3 bands; has 7 tubes. **Emerson** Model CS-268 receiver; tunes on 2 bands; has 6 tubes. Schematics and parts lists needed. (Carl Mason, Box 311, Rt. 1, Holmdel, N.J. 07733)

(*Continued on page* 32)

www.americanradiohistory.com

The ideal base/mobile combination for CB radi

FOR BASE STATIONS where 117 V 60 cycle AC current is available...



The Low-Cost RCA Mark VIII and Mark NINE

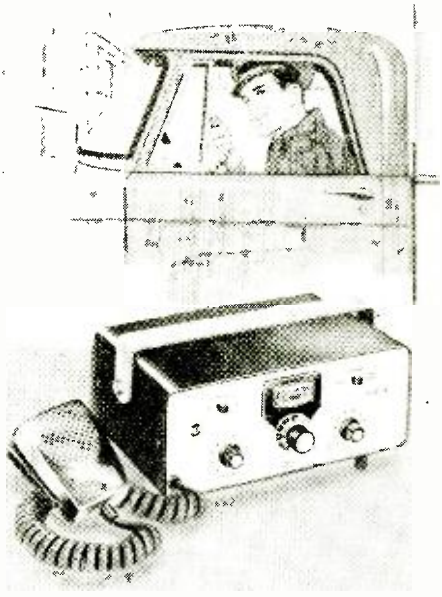
- 9 crystal-controlled transmit and receive channels.
- Tunable receiver for reception of 23 C-B channels; dial marked in both channel numbers and frequency.
- Exceptionally good voice reproduction.
- Highly selective superheterodyne receiver with one RF and two IF amplifier stages.
- Electronic switching—no relay noise or chatter.
- Illuminated "working channel" feature.
- Light and compact—only 3¾ inches high, weighs only 9 pounds with mike.
- Improved Automatic Noise Limiter.

Plus these EXTRA features in the Mark NINE

- Combination "S" Meter and relative RF Output Meter (indicates the relative strength of incoming signal) and Relative RF Output Meter (indicates relative strength of signal being transmitted).
- Spotting Switch. Permits precise manual tuning of receiver without use of receiver crystals.
- External Speaker Jack. Lets you connect an external speaker to set, so that incoming calls can be heard in remote locations.

Mark VIII: $99.95* **Mark NINE: $114.50***

FOR MOBILE UNITS where low power consumption is important...



The all-solid-state MARK 10

- All silicon transistors assure low power consumption, dependable communications at temperatures from —23° to +130° F.
- Compact, lightweight. Fits easily under dash of any car or truck. Only 3⅜" high, 5¾" deep, 8½" wide. Weighs less than 4½ pounds.
- 12 crystal-controlled transmit and receive channels with illuminated channel selector.
- Combination "S" Meter and relative RF Output Meter.
- Operates from 12-volts DC power source (positive or negative ground).
- Crystal-controlled double conversion, superheterodyne receiver provides frequency accuracies greater than 0.004%.
- Separate AGC amplifier eliminates blasting and overloading, minimizes fading.
- Six-stage IF bandpass filter for maximum selectivity without ringing.
- Low-distortion, series-type noise limiter with automatic threshold adjustment.
- Receiver power regulated for maximum stability.
- Acoustically designed cabinet with audio characteristics shaped for maximum intelligibility.
- External speaker jack (de-activates internal speaker).

Mark 10: $189.95*

*Optional distributor resale price.

See them at your Authorized RCA CB Radio Distributor. Look for stores displaying this symbol.

RCA ELECTRONIC COMPONENTS AND DEVICES, HARRISON, N. J.

The Most Trusted Name in Electronics

CIRCLE NO. 32 ON READER SERVICE PAGE

www.americanradiohistory.com

GET MORE ACTION WITH

MULTI-ELMAC PRECISION MADE, POPULAR PRICED CB UNITS!

CITI-FONE SS $169.50

FULL 23 CHANNEL

AC-DC Operation, Illuminated Meter & Channel Selector, Triple Tuned RF, Noise Immune Squelch, Double Tuned IF's, Ready to Operate

CITI-FONE 99 $99.50

FULL 8 CHANNEL

AC-DC Operation, Delayed AVC, Electronic Switching, 2 Stage Pre-Amp, Illuminated "S" Meter, Complete with Crystal for 1 Channel

CITI-FONE II $49.95

SOLID STATE

Transmitter/Converter

Compact 5¾ x 4⅜ x 1½, 9 Transistor, 2 Diodes, 5 Watt Input (FCC Max.) 100% Modulation, 12 VDC Operation, Complete with Crystal for 1 Channel

Please send further information on Citi-Fone SS ☐, 99 ☐, II ☐

MULTI-ELMAC CO.

21470 Coolidge • Oak Park, Michigan 48237

NAME_____

ADDRESS_____

CITY_____

STATE_____ ZONE_____

CIRCLE NO. 28 ON READER SERVICE PAGE

ASSIST (*Continued from page 30*)

Garod neutrodyne 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. 288. 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-1428 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)

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

Sparton-Withington Model 10Y21 receiver-phono 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-phono 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 Alhneita Dr., Pleasant Hill, Calif.)

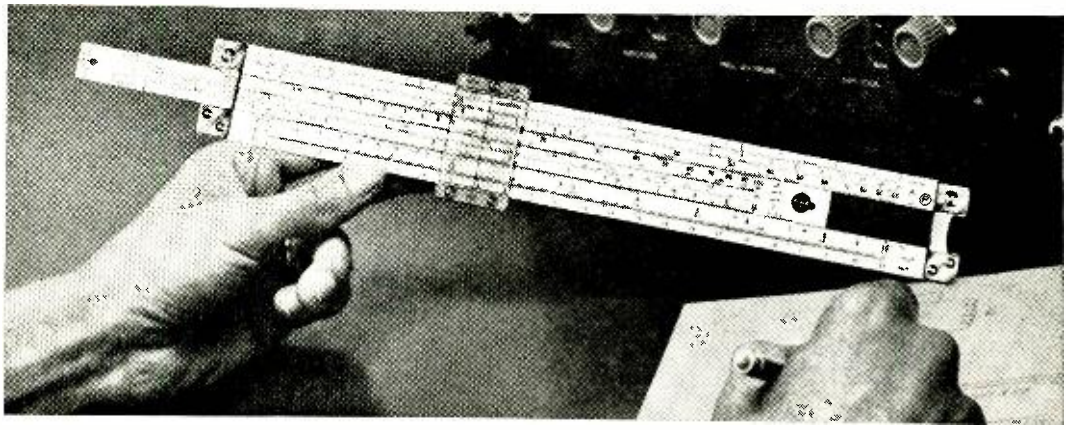
Emerson Model OP-8QS-509A receiver; tunes 550 kHz to 18 MHz on 2 bands; has 6 tubes. Dial cord information needed. **Atwater Kent** amplifier, type TA; has 2 audio stages. Schematic, battery and receiver connection information needed. (Chuck Ridenour, Rt. 1, Box 408, London, Ohio 43140)

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*)

www.americanradiohistory.com

Even if you've never had a slide rule in your hands before



...you can now start solving electronics problems fast with this new electronics slide rule and course

EVER ENVIED the way some fellows whip out a "slip stick" to solve a problem...instead of struggling through it with pad and pencil?

Now *you* can "outshine" them—even if you've never used a slide rule before.

With our exclusive new Electronics Slide Rule, you can do not only common mathematical calculations but also special *electronics* problems in resonance and reactance.

This is a professional slide rule in every detail, made for us by Pickett, Inc. It has two special scales for solving resonant frequency and inductive or capacitive reactance problems—or any problem involving the factor 2π. On the other side...a unique decimal point locator plus useful electronics formulas and conversion factors. Handsome leather carrying case has heavy-duty plastic liner, removable belt loop, flip-open cover.

With it you get four full-length AUTO-PROGRAMMED™ lessons which teach you with actual examples how to use it. These lessons are carefully designed to meet the same high educational standards as our famous electronics career courses. Each lesson will be personally graded, if you wish, by one of our expert instructors the same day it is received and returned with his comments.

To make friends with career-minded electronics men, we have deliberately underpriced the CIE Slide Rule and Course. The low cost will really surprise you.

Find out more. Send for free booklet. No obligation, of course. Mail coupon or write Dept. PE-127 at the address below.

CIE **Cleveland Institute of Electronics**
1776 East 17th Street, Cleveland, Ohio 44114

Acclaimed by Electronics Experts

"It opens a whole new era of quick calculations. Even if you never had a slide rule in your hands before, the four-lesson instruction course that is included takes you by the hand and leads you from simple calculations right through resonance and reactance problems with hardly a hitch."
—WAYNE LEMONS, *Radio-Electronics*

"Why didn't someone think of this before?...the slide rule saved me time the very first day. The 'refresher' course is a marvel of clarity. I couldn't help being amazed at how many standard formula functions I was performing the hard way."
—OLIVER P. FERRELL, Editor, *Popular Electronics*

"I was very intrigued by the 'quickie' electronics problem solutions. It is an ingenious technique. The special scales should be of decided value to any technician or engineer."
—JOSEPH J. DeFRANCE, Head of Electrical Technology Dept., New York City Community College

Mail this coupon for **FREE BOOKLET**

Cleveland Institute of Electronics
1776 East 17th Street, Cleveland, Ohio 44114

Please send me without charge or obligation your booklet describing the CIE Electronics Slide Rule and Instruction Course. ALSO FREE if I act at once: a handy pocket-size Electronics Data Guide.

Name _____
(please print)

Address _____

City _____ State _____ Zip _____

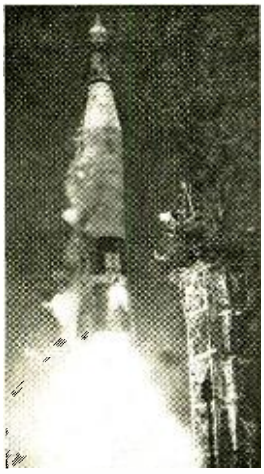
Accredited Member National Home Study Council
A Leader in Electronics Training...Since 1934.
PE-127

CIRCLE NO. 7 ON READER SERVICE PAGE

www.americanradiohistory.com

Choose Your Tailor-Made Course in
N.T.S. "PROJECT METHOD" ELECTRONICS

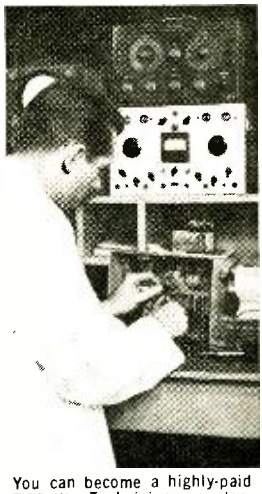
Now! N.T.S. — one of America's oldest leading home-study and resident technical schools—offers you GREATER CAREER OPPORTUNITIES IN ELECTRONICS.



You can install and maintain electronic circuitry in missiles and rockets . . . specialize in microwaves, radar, and sonar.

You can succeed in TV-Radio Communications . . . prepare for F.C.C. License, service advanced satellites for industry and defense.

You can service and repair the electronic "brains" of industry — computers, data processing and other automation equipment.



You can become a highly-paid TV-Radio Technician, an electronics field engineer, or succeed in your own sales and service business.

CHOOSE YOUR FIELD—INSURE YOUR FUTURE!

1 ELECTRONICS-TV-RADIO SERVICING AND COMMUNICATIONS

A basic course thoroughly covering fundamentals of electronics, radio, TV servicing and communications.

2 MASTER COURSE IN ELECTRONICS-TV-RADIO, ADVANCED TV AND INDUSTRIAL ELECTRONICS

Qualifies you as a Master Electronics Technician — the Man in Demand.

3 FCC LICENSE COURSE

Preparation for this government license essential for many interesting jobs in radar, radio, television, communications, guided missiles, many others. Upon completion of this course, if you do not pass the FCC exam, your tuition will be refunded in full.

4 RADIO SERVICING (AM-FM-TRANSISTORS)

Train for radio sales and service with dealer or distributor.

5 TELEVISION SERVICING (INCLUDING COLOR)

Covers installation, adjustment, repair and servicing of black and white and color television . . . prepares you for your own sales and service business.

6 STEREO, HI-FI AND SOUND SYSTEMS

A growing field. Prepares you to build, install and service modern sound equipment for home or industry.

7 BASIC ELECTRONICS

Gives you the fundamentals you must know to build on for a future Electronics career. Also offers an excellent background for Salesmen, Purchasing Agents, and others in Electronics.

8 ELECTRONICS MATH

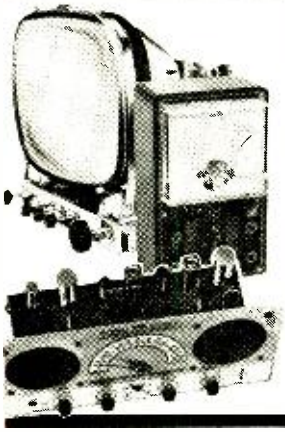
Simple, easy-to-follow instructions in the specialized math you need in many electronics jobs.

INDUSTRY WELCOMES N.T.S. STUDENTS AND GRADUATES

www.americanradiohistory.com

N.T.S. HOME TRAINING: QUICK, PRACTICAL WAY TO HIGHER PAY, LIFELONG BENEFITS

N.T.S. "Project Method" Courses can help you get a new and better job — or move up to higher pay in your present one.



N.T.S. "Project Method" home training lessons are shop-tested in the Resident School in Los Angeles. You work on practical job projects, learn to use shop manuals and schematics. Your N.T.S. training is individual. You proceed at your own pace. The Schools' practical methods plus more than 60 years of experience have helped thousands of students all over the world to successful careers.

Most courses include Equipment Kits. There are no Kit Deposits. Everything included in your low tuition.

HIGH SCHOOL AT HOME

Learn easily. New modern method. National also offers accredited high school programs for men and women. Take only subjects you need. Study at your own pace. Latest approved textbooks — yours to keep — everything included at one low tuition. Check High School box in coupon for information.

MAIL REPLY CARD OR COUPON FOR FREE BOOK AND SAMPLE LESSON In Field of Your Choice

Sample Lesson

You Enroll by Mail — and Save Money.
No Salesmen: This means lower tuition for you.
Accredited Member N.H.S.C.

CLASSROOM TRAINING AT LOS ANGELES

If you wish to take your Electronics-TV-Radio training in our famous Resident School in Los Angeles — the oldest and largest School of its kind in the world—write for special Resident School catalog and information, or check coupon.

NATIONAL TECHNICAL SCHOOLS
WORLD WIDE TRAINING SINCE 1905
4000 S. Figueroa St., Los Angeles, Calif 90037

BENEFIT NOW AND ALL YOUR LIFE WITH N.T.S. HOME TRAINING

The personal guidance you receive during your training can be very helpful to your progress. Many N.T.S. students are able to earn more money within a few months. You can pick and choose your career. Work in industry or go into business for yourself.

Your services will always be in demand wherever you go — and you can pick your spot!

N.T.S. Graduate Advisory Service can help you answer technical questions in establishing your own business and in countless other ways after you've completed your training.

NATIONAL TECHNICAL SCHOOLS
4000 S. Figueroa St., Los Angeles, California 90037

Please Rush FREE ELECTRONICS "OPPORTUNITY BOOK" and SAMPLE LESSON on Course Checked Below:

- ☐ ELECTRONICS-TV-RADIO Servicing & Communications
- ☐ Master Course in ELECTRONICS-TV-RADIO Color TV & Industrial Electronics
- ☐ FCC LICENSE
- ☐ RADIO SERVICING (AM-FM-Transistors)
- ☐ TELEVISION SERVICING (Including Color)
- ☐ STEREO, HI-FI and SOUND SYSTEMS
- ☐ BASIC ELECTRONICS ☐ ELECTRONICS MATH
- ☐ HIGH SCHOOL Department

Dept. 205-126

Name _____ Age _____

Address _____

City _____ State _____ Zip _____

☐ Check for Veteran Training under new G.I. BILL.

☐ Check here if interested ONLY in Classroom Training at Los Angeles.

www.americanradiohistory.com

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 syncroscope, 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 5S-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)

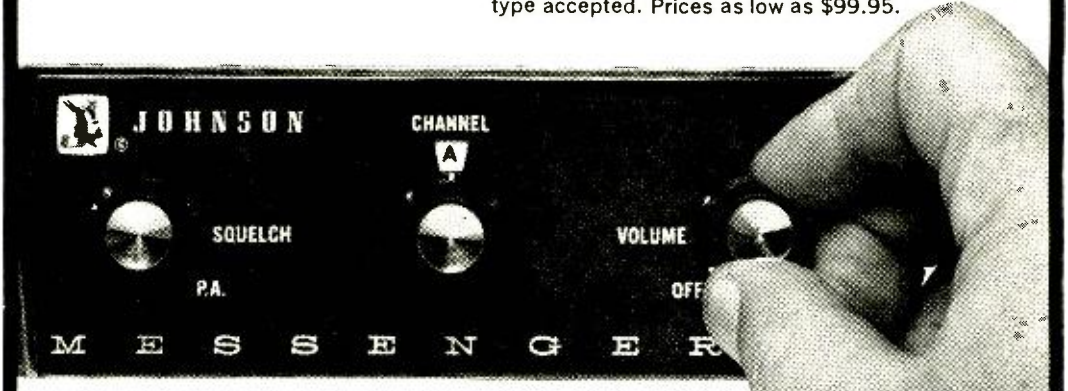
Airline Model 14BR904A receiver; tunes on 5 bands; has 10 tubes. Schematic and operating manual needed. (Mike Timmons, 14200 S.W. 184 St., Miami, Fla.)

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

(*Continued on page 87*)

There's only one way to take a Johnson Messenger off the air...

You have to turn it off. That's because Johnson's engineering superiority builds in the features that keep you on the air. Whether it's a compact hand-held Personal Messenger; a portable field pack unit; a popular priced tube-type or solid-state transceiver for base station or mobile use, Johnson reliability will insure that the message is delivered.
Look to Johnson for the most versatile, most reliable two-way radio equipment available today! FCC type accepted. Prices as low as $99.95.



E. F. JOHNSON COMPANY
2425 TENTH AVE. S.W. • WASECA, MINN. 56093

CIRCLE NO. 22 ON READER SERVICE PAGE

www.americanradiohistory.com

Looking for Hi-Fi equipment, but in the dark about which to buy? Well you can always . . .

1 Ask your Uncle Fred. He used to fix your toaster.....

2 Inquire from store to store to store to store.....

3 Choose the one that looks nicest. And cross your fingers...

OR you can get a copy of the 1967 **STEREO/HI-FI DIRECTORY**

and forget about the first 3!

If you think buying hi-fi equipment has to be a game of "musical chairs" . . . **chance** not **choice** . . . we've got news for you! Now there's a quick, easy, foolproof way to plan your next equipment purchase: with the all-new 1967 STEREO/HI-FI DIRECTORY.

It's a giant, 180 page buyer's guide to virtually every new audio component on the market—

• **amplifiers** • **changers and turntables** • **cartridges—arms—accessories** • **receivers** • **tuners** • **tape machines** • **speakers/cabinets** • **hi-fi systems** • **miscellaneous accessories**

PLUS—special directories for **home TV tap recorders** and **tape cartridge machines for cars and boats!**

Every technical specification, measurement, special feature, optional accessory, price and model number of all the latest products is at your fingertips. Including detailed photos. To help you compare similar items—feature for feature, dollar for dollar—and decide which is best for you. **Before** you buy!

Forget the guesswork, costly mistakes and "after-you-get-it-home" disappointments. With the 1967 STEREO/HI-FI DIRECTORY as your authoritative guide, you buy with confidence—and **know** your're getting the greatest value for your money on every piece of equipment you select.

The price for this valuable "encyclopedia" of hi-fi information? **Just $1.25.** A very small investment when you think of the time, trouble and money it's guaranteed to save you. So don't delay. Use the coupon below and order your copy of the 1967 STEREO/HI-FI DIRECTORY today!

Also available in a leatherflex-bound DELUXE EDITION — a superb addition to your permanent reference library. **$3**

ZIFF-DAVIS SERVICE DIVISION • DEPT. SD
589 Broadway • New York, N. Y. 10012

YES! Send me the new 1967 STEREO/HI-FI DIRECTORY.

☐ **$1.25 enclosed,** plus 15c for shipping and handling. Send me this regular edition. ($1.75 for orders outside the U.S.A.)

☐ **$3.00 enclosed.** Send me the Deluxe Leatherflex-bound edition, **postpaid.** ($3.75 for orders outside the U.S.A.) Allow three additional weeks for delivery.

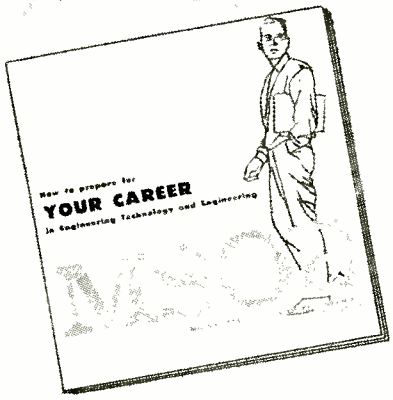
name please print PE-126

address

city state zip code

PAYMENT MUST BE ENCLOSED WITH ORDER

Thinking of college and a space age career?



Send for this booklet on ENGINEERING TECHNOLOGY AND ENGINEERING

Learn how you can prepare for a dynamic career as an electrical or mechanical engineering technician or engineer in such exciting, growing fields as **avionics, missiles, reliability control, fluid mechanics, data processing, metallurgy, microelectronics, and advanced aerospace research.**

MSOE offers residence study programs leading to these degrees in engineering technology and engineering:

2 years — Associate in Applied Science
4 years — Bachelor of Science

Also get facts about scholarships and financial aids, job placement and other student services, plus photographs of MSOE technical laboratories and student activities. Courses approved for veteran training. For your copy, just mail the coupon — no obligation.

MSOE
Milwaukee, Wisconsin 53201

Milwaukee School of Engineering
Dept. PE-1266, 1025 N. Milwaukee Street
Milwaukee, Wisconsin 53201

Please send the "Your Career" booklet. I'm interested in

☐ Electrical fields ☐ Mechanical fields

Name.....Age.....

Address.....

City.....State.....ZIP.....

MS-284

CIRCLE NO. 26 ON READER SERVICE PAGE

www.americanradiohistory.com

punchy galore

Was it possible to put *extra* punch, *extra* power and *extra* performance into a 5 watt CB mobile radio . . . and sell it for only $99.95? B&K, creators of the famous Cobra CAM 88, thought so—and built the new Cobra V. The 5 channel Cobra V is solid state, all-the-way. Those who have heard it and tested it say it is a most remarkable achievement in miniaturization—in CB technology—In selectivity, sensitivity and 100% modulation. It's true; this one's got punch galore. We've proven it . . . now you can. At B&K Distributors.

B&K

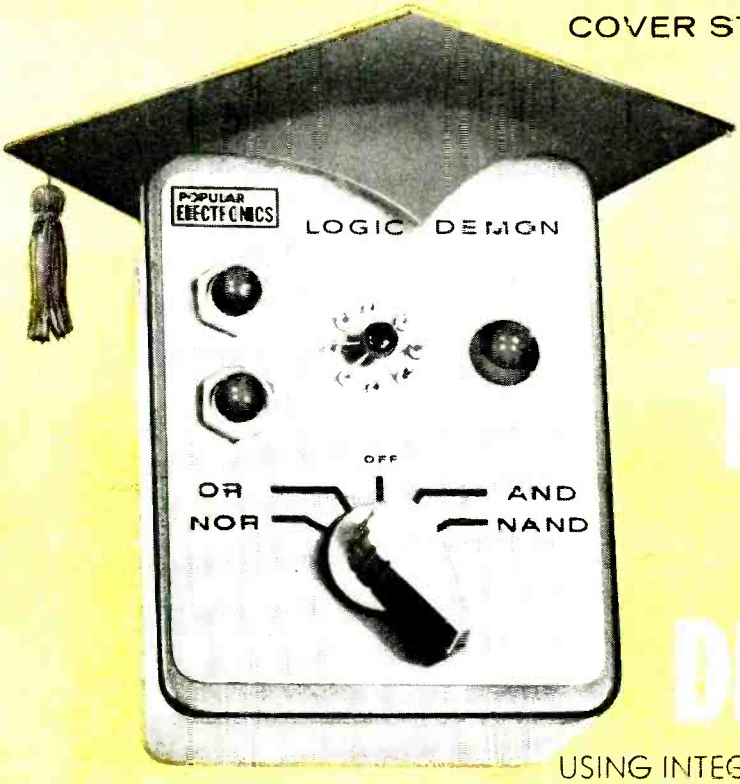
A DIVISION OF DYNASCAN

1801 W. Belle Plaine, Chicago, Illinois 60613

WHERE ELECTRONIC INNOVATION IS A WAY OF LIFE

CIRCLE NO. 4 ON READER SERVICE PAGE

www.americanradiohistory.com



SCIENCE FAIR PROJECT

THE LOGIC DEMON

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

By DON LANCASTER

EVER 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

www.americanradiohistory.com

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" Closed	Switch "B" Closed	Lamp "I" 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" Closed	Switch "B" Closed	Lamp "I" 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-

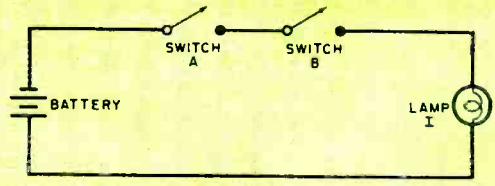


Fig. 1. Switches A and B in series with a battery and lamp can represent the logical AND circuit.

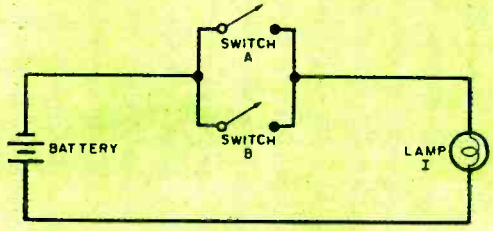
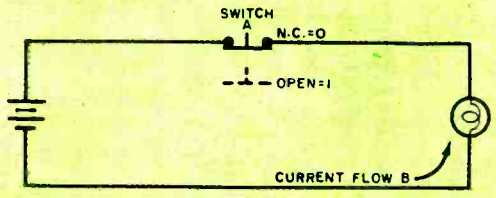


Fig. 2. In the logical OR circuit, current flows if either switch A or switch B, or both, are closed.



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.

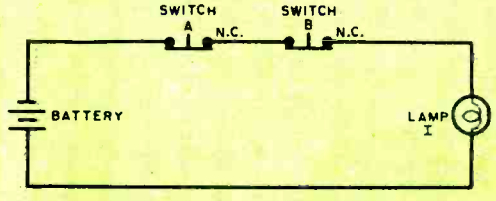


Fig. 4. A NOR gate is represented by adding one or more switches to the NOT gate described above.

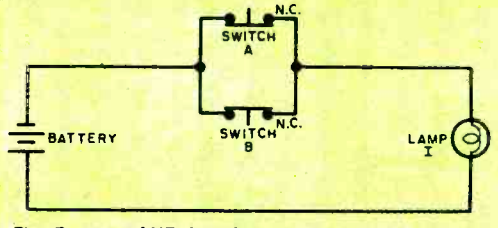


Fig. 5. The NAND function can be depicted by normally closed parallel-connected switches A and B.

www.americanradiohistory.com

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

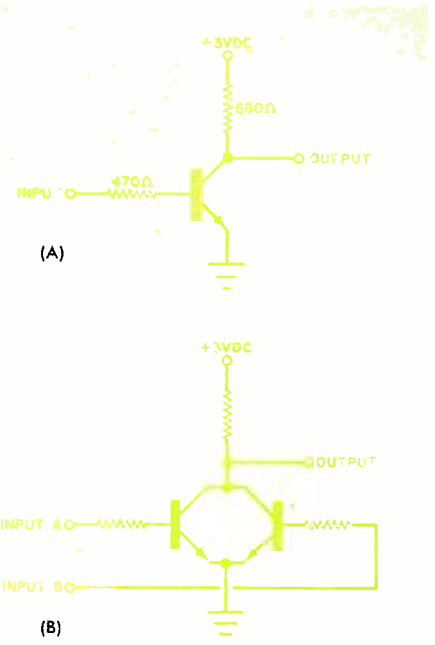


Fig. 6. NOT operation can be performed by a one-input RTL gate shown in (A). A two-input gate (B) can serve either as NOR or NAND circuit.

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

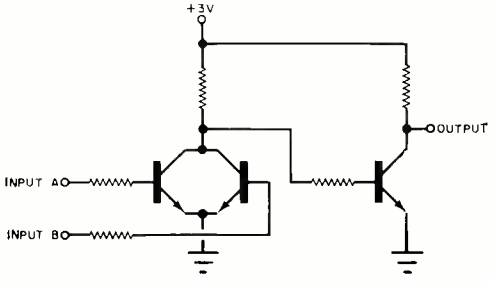


Fig. 7. The AND function is obtained by the addition of a NOT gate to output of a NAND gate.

www.americanradiohistory.com

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 μL914 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—Sealectro 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.

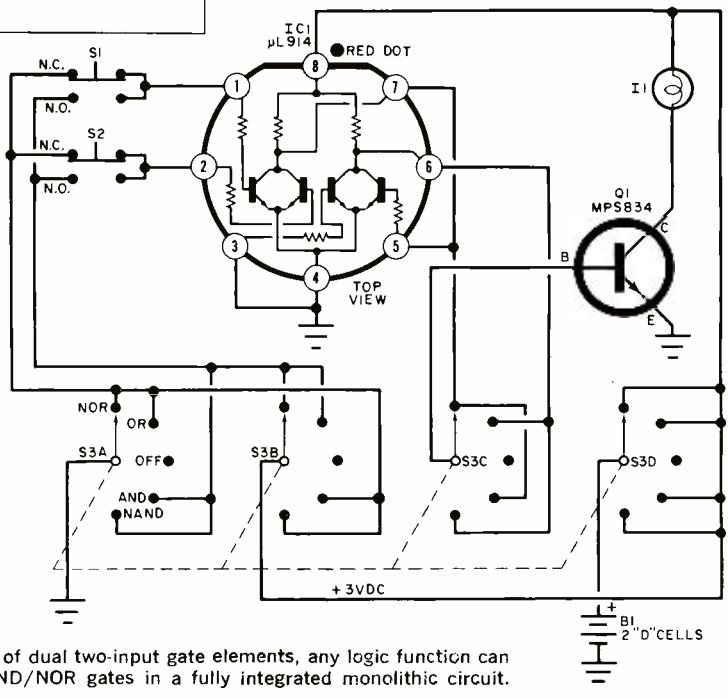


Fig. 8. Through exclusive use of dual two-input gate elements, any logic function can be generated from basic NAND/NOR gates in a fully integrated monolithic circuit.

www.americanradiohistory.com

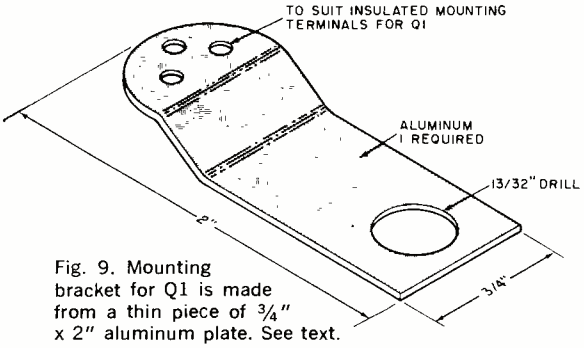
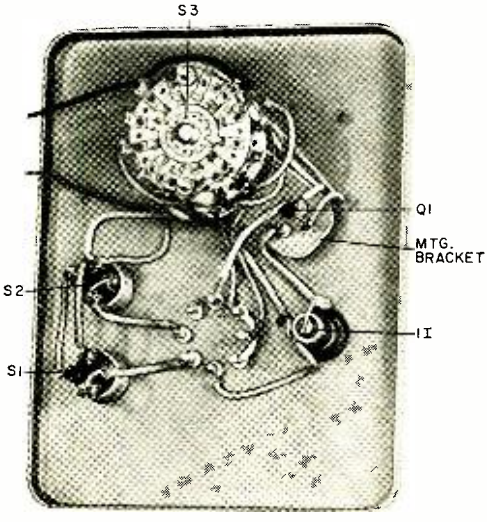


Fig. 9. Mounting bracket for Q1 is made from a thin piece of 3/4" x 2" aluminum plate. See text.

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)

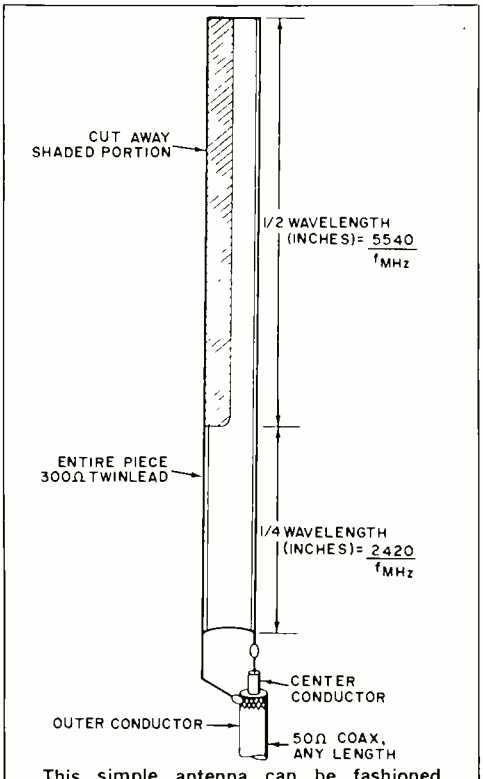
www.americanradiohistory.com

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.



This simple antenna can be fashioned from a single length of 300-ohm twin lead.

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 (35½"). This is the radiating portion of the "J." Add to this dimension the length of the quarter-wave matching section (2420 ÷ 156 = 15.5) to find the total length (approx. 51"). The higher the frequency, the shorter the antenna.

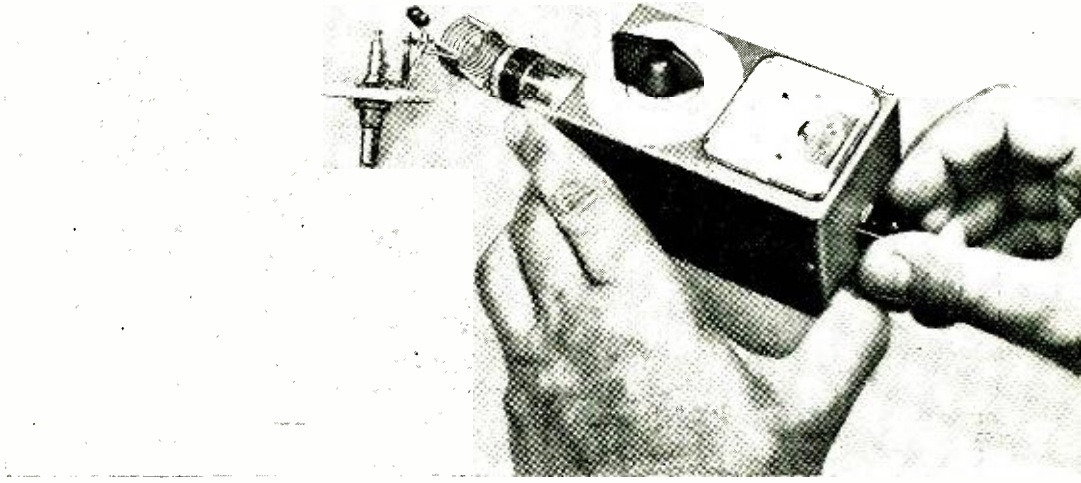
The rest is simple. Cut one conductor 35½" from the end of a 51" piece of 300-ohm twin lead and remove it. You can use a knife to cut the insulation, or you can strip out the undesired lead by getting a good grip on the cut end and pulling. Don't try it with your fingers or your teeth; use a pair of 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)

www.americanradiohistory.com

BUILD THE Emitter Dipper



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

By ROBERT N. TELLEFSEN
W7SMC/Ø

ONE 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-

www.americanradiohistory.com

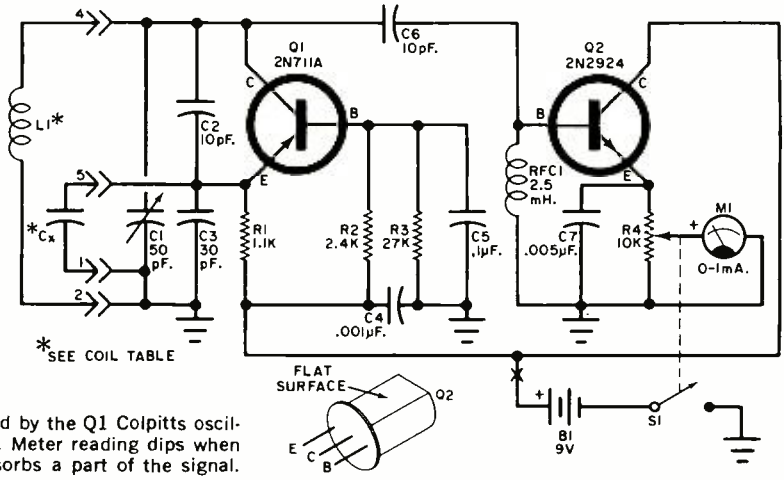


Fig. 1. Signal generated by the Q1 Colpitts oscillator circuit drives Q2. Meter reading dips when an external circuit absorbs a part of the signal.

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 absorption 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 2¼" x 2¼" 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.

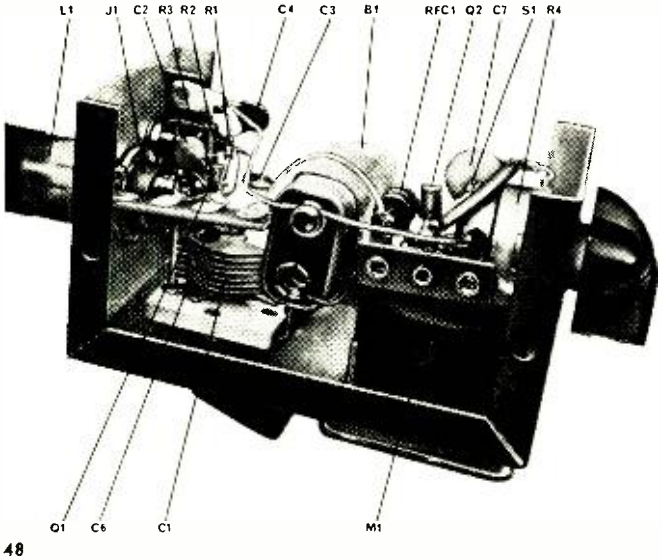


Fig. 3. Wind all coils as shown, and in accordance with the Coil Table. Four of the five coils require a small capacitor (Cx).

www.americanradiohistory.com

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-μF disc capacitor
C5—0.1-μF, 10-volt disc capacitor
C7—0.005-μF disc capacitor
Cx—See Coil Table
J1—5-pin miniature socket (Amphenol 78-S5S)
L1—See Coil Table
M1—0 to 1.0-mA meter
Q1—2N711A transistor, or similar
Q2—2N2924 transistor, or similar
R1—1100-ohm, ½-watt resistor
R2—2400-ohm, ½-watt resistor
R3—27,000-ohm, ½-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—2¼" x 2¼" 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)
47½	#28	470 pF	3 to 4.4
32½	#24	470 pF	4.4 to 7.6
17½	#24	100 pF	7.4 to 11.6
12½	#16	100 pF	11.5 to 18
6½	#16	none	18 to 30

**Enamel-coated solid conductor*

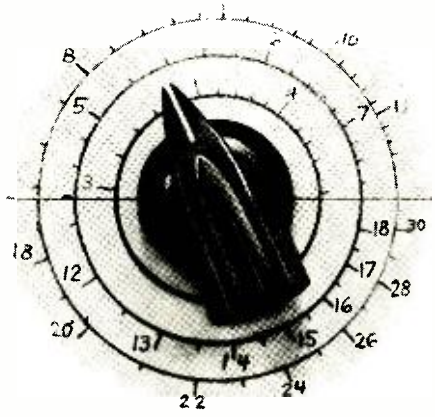


Fig. 4. Dial markings should be made when you calibrate your EDO. Align the knob pointer horizontally when C6 is fully meshed, and tighten knob in shaft. Photo shows actual size of dial scale on prototype.

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 ¾"-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 2¼"-diameter circular dial out of a piece of heavy paper or cardboard. Draw three concentric circles on the dial, 3/16" apart, starting ¼" 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 ½"-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 call-outs at 1-MHz positions. -30-

www.americanradiohistory.com

St. Petersburg Tapers Go Back to School

By J. W. NELLIGAN

COMPREHENSIVE ADULT EDUCATION COURSE COVERS PRACTICALLY EVERY PHASE OF TAPE RECORDING

THE 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. Then 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-

www.americanradiohistory.com

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 indispensible 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. —30—

www.americanradiohistory.com

SMALL TAPE RECORDERS

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

By HERB HOWORKA, Jr.

SMALL 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 (1⅞ 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 1⅞ 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.

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.

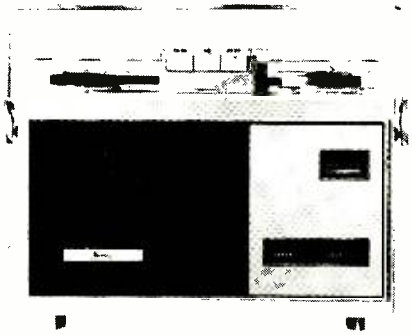
In a great many instances, tapes recorded on a direct-drive tape recorder must be played back on the same recorder, or on another machine of the same make and model. Forget about splicing a section of tape recorded at the beginning of one reel into the middle or end of a tape on another reel.

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)

www.americanradiohistory.com

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.

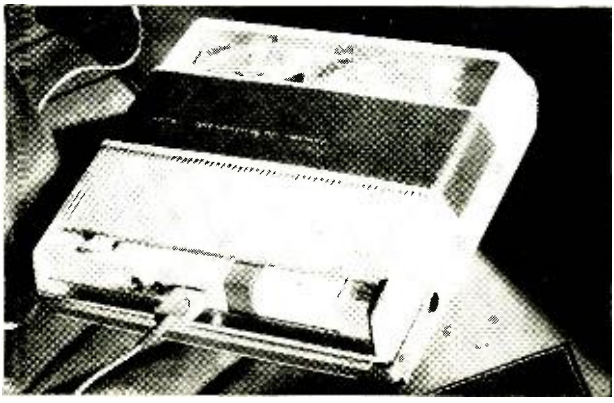


Norelco "Continental 101" 4-inch reel; 2 tracks; 1 7/8 in/s speed; operates on 6 "D" cells for 40 hours; has combination audio level and battery condition indicator, and can be remotely controlled; 8" x 11" x 3 3/4"; 7 lb.

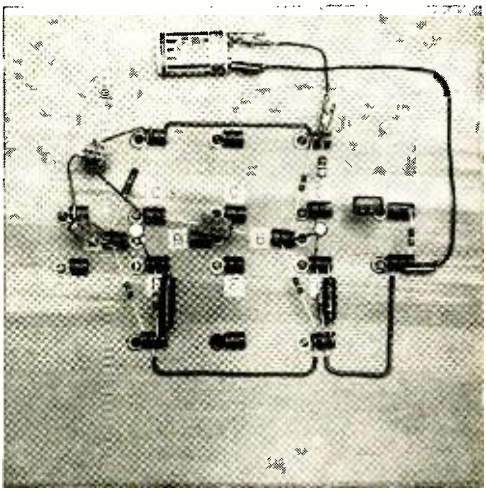
Sony "Sony-Matic 907" 3 1/4-inch reel; 1 track; 2 speeds (3 3/4 and 1 7/8 in/s); operates on 4 "D" cells for 20 hours; has automatic record level circuit (a.v.c.), and can be remotely controlled; 8 3/4" x 8 3/4" x 5 1/2"; 5 1/2 lb.

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

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



www.americanradiohistory.com



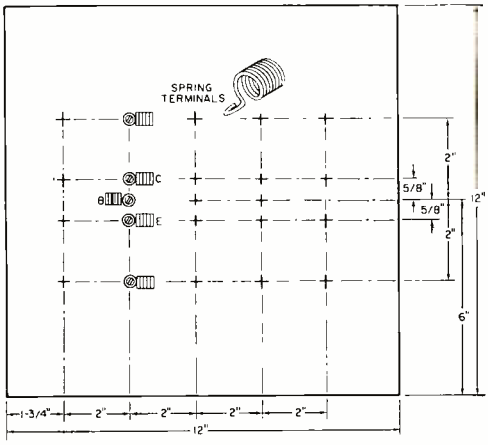
SOLDERLESS BREADBOARD

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

By A. A. MANGIERI

TRANSISTORS 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 ⅜″-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.



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

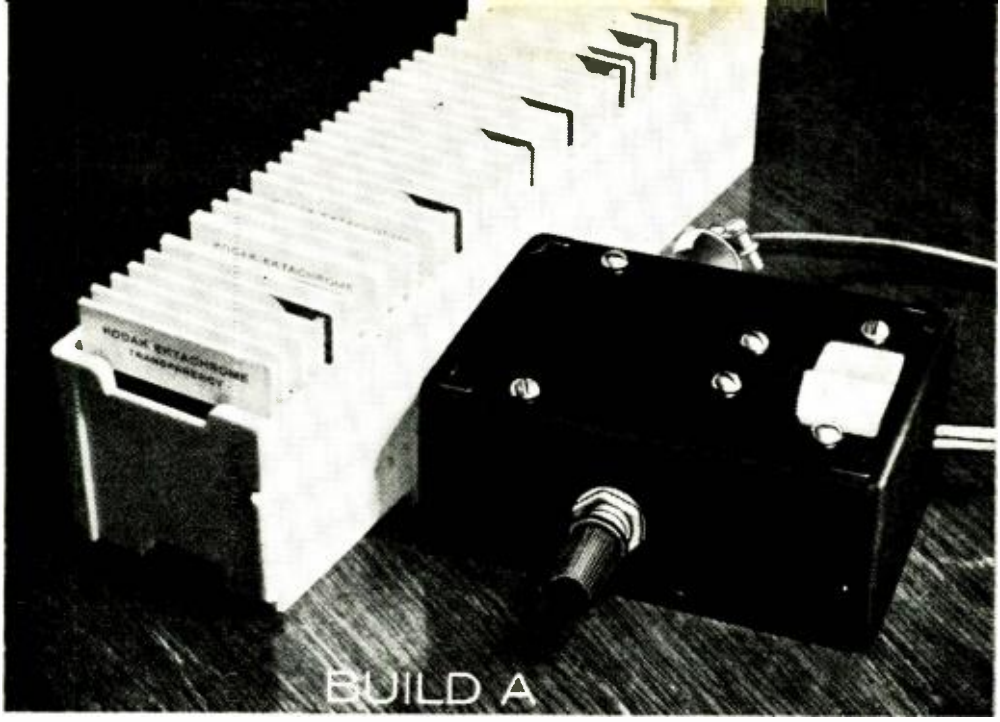
Screw the terminals to the board using small wood screws and flat metal washers. Face the "base" connections for your transistors to the left and all other springs to the right. Twenty-three springs is about right for nominal small-scale experimenting with transistors. You can add assorted brackets of 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. —30—

www.americanradiohistory.com



"Relaxatrol" to Automate Your Slide Projector

VARIABLE TIMER CONVERTS PUSH-BUTTON MACHINES TO FULLY AUTOMATIC OPERATION

By GARY W. TOWNER

LOOK, 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.

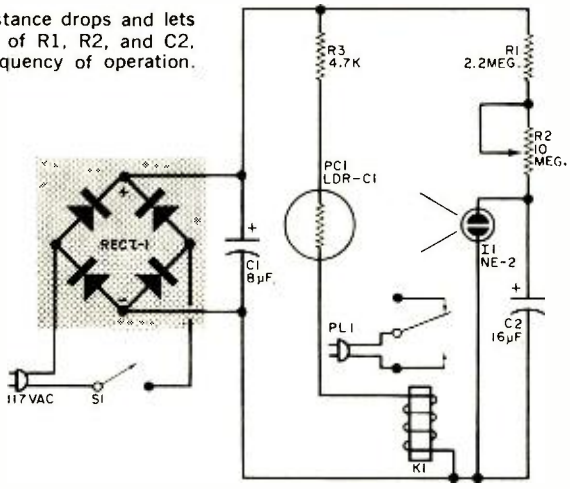
How It Works. A simple relaxation oscillator consisting of *R1*, *R2*, *C2*, and *I1* (Fig. 1) periodically energizes *K1* to trigger the projector. Capacitor *C2* takes on a charge through *R1* and *R2*, until the voltage across it is sufficient to fire *I1* (usually on the order of 60 to 70 volts).

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

www.americanradiohistory.com

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

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, 2⅞" x 4" x 1 9/16" plastic case, 2-terminal strips (4), line cord, hookup wire, knob, etc.

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

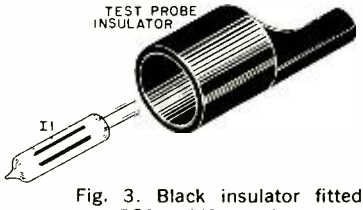


Fig. 3. Black insulator fitted over PC1 and I1 permits assembly to function without interference from external lighting.

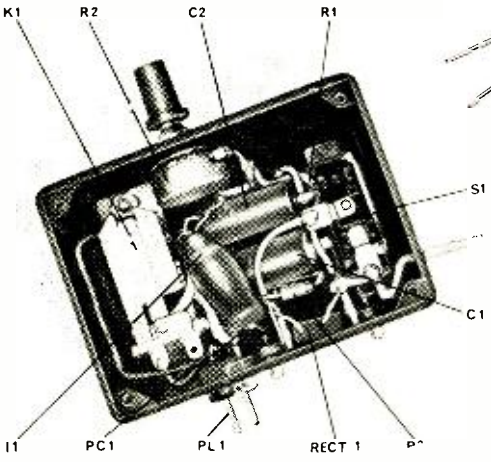


Fig. 2. Parts layout is not critical. Small plastic box helps insulate relay and other components from a.c. line. A line cord can be substituted for PL1.

The 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 assem-

(*Continued on page 93*)

www.americanradiohistory.com

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

NOW 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.

www.americanradiohistory.com

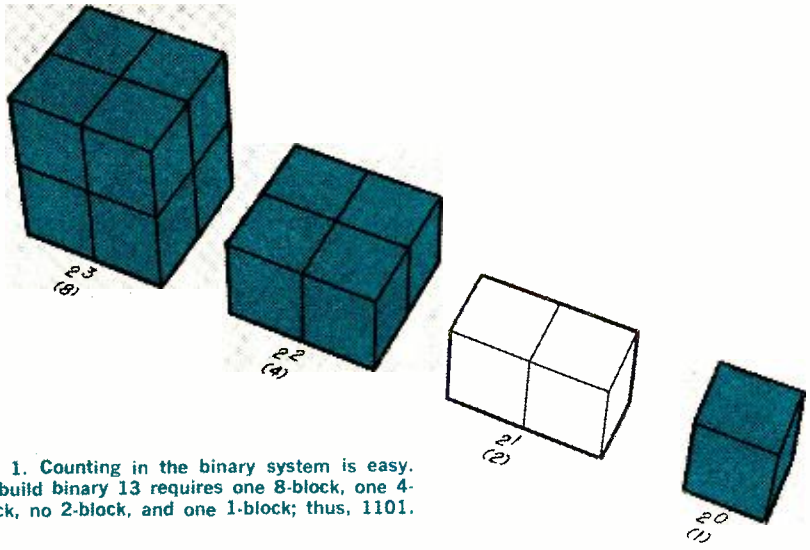


Fig. 1. Counting in the binary system is easy. To build binary 13 requires one 8-block, one 4-block, no 2-block, and one 1-block; thus, 1101.

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

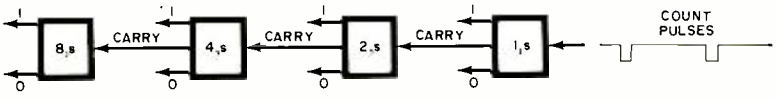
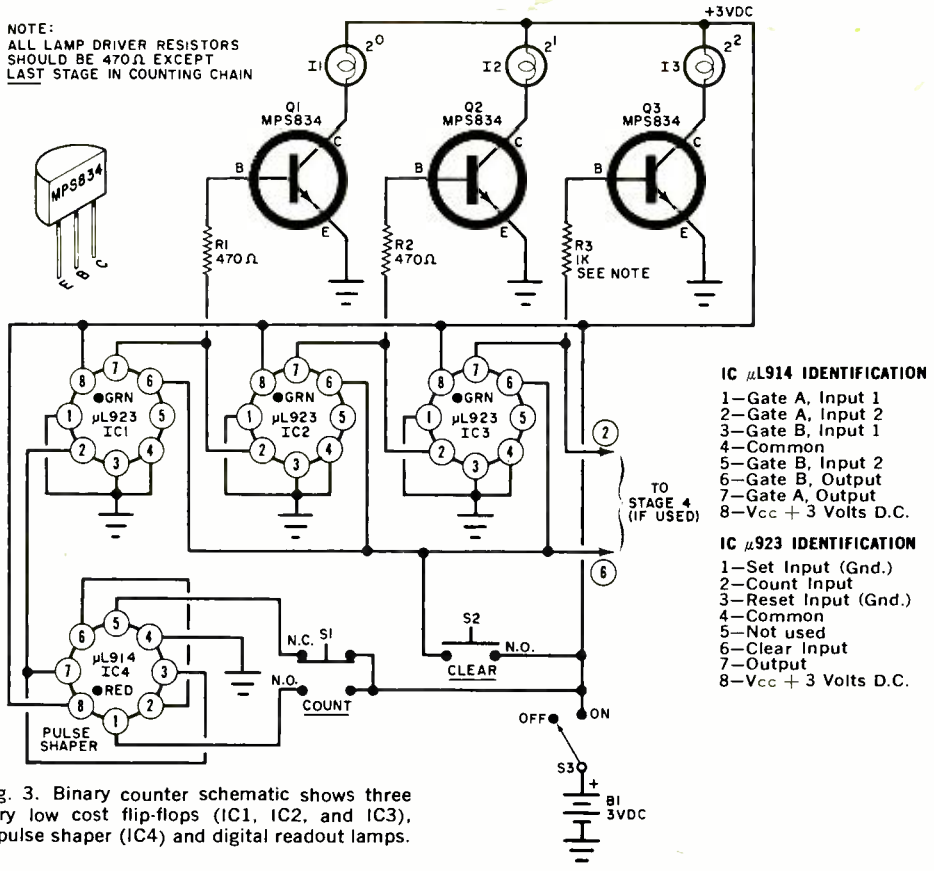


Fig. 2. This four-stage flip-flop has a counting limit of 15. Adding stages increases count capacity.

www.americanradiohistory.com



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.d.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 Reill'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—1⅛"-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

www.americanradiohistory.com

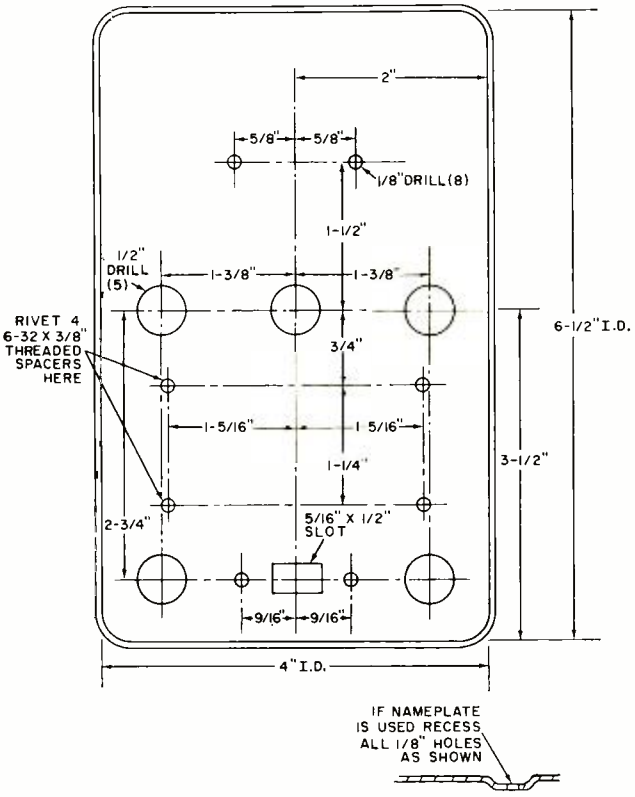


Fig. 4. You can use these dimensions to duplicate the front cover layout. Hole sizes should be made to accommodate your hardware and fittings.

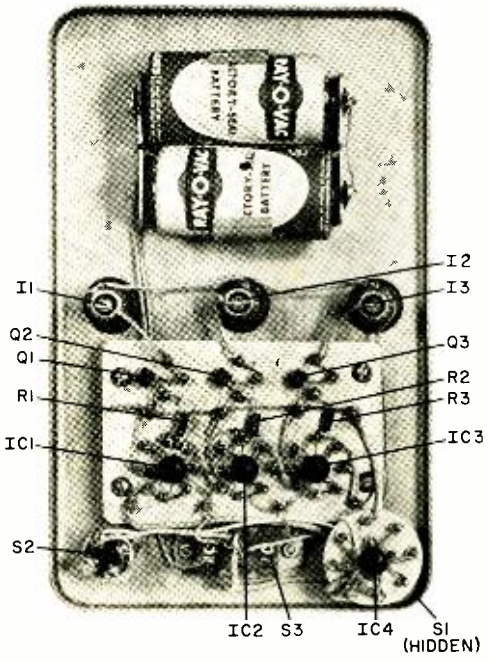
Fig. 5. The flip-flop IC's, and transistors and resistors, are first mounted on a subassembly supported on standoff spacers. IC4, shown on an aluminum disc, is supported by the push-button COUNT switch (S1).

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



www.americanradiohistory.com

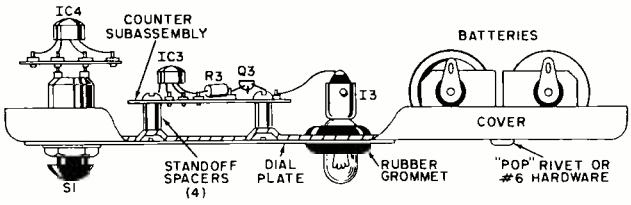


Fig. 6. This cutaway view of the front cover shows how the subassembly is mounted on the spacers. Observe that the mounting screw holes are recessed a bit so the dialplate can lay flat on the cover assembly.

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 denote 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)

www.americanradiohistory.com

ALL ON QUARTER-INCH MYLAR

SOME COMMENTARIES ON THE TAPE RECORDING SCENE

By AL JOHNS

"I bug offices . . . what do you do for a living?"

". . . and this device will eliminate your flutter and WOW!"

www.americanradiohistory.com

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

ARE 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-

www.americanradiohistory.com

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 $3\frac{3}{4}$ 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 ($3'' \times 5''$) 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.

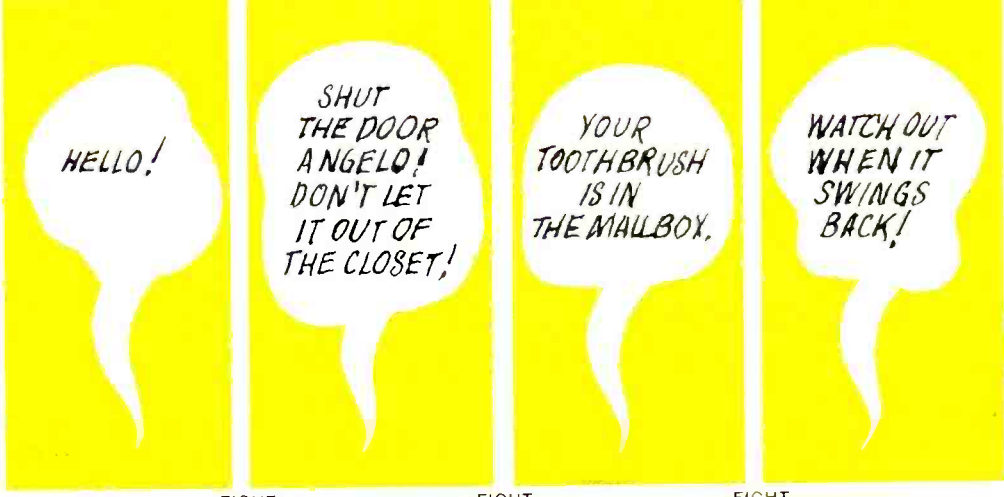
When the interview is over, you will know it because there will be nothing more to talk about. Thank the person you interviewed for taking so much of his or her valuable time, and pack up.

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—

www.americanradiohistory.com



PARLOR GAME

By LEWIS A. HARLOW

IF 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—

www.americanradiohistory.com

A TAPE RECORDER KIT —DELUXE

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

THE 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.

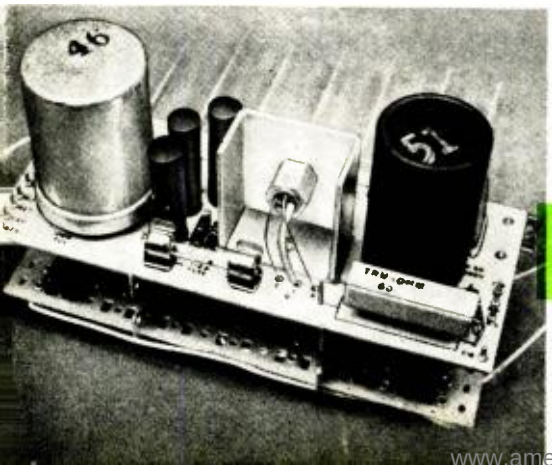
Why Build a Tape Recorder? There are three important reasons to start you on your way to building an AD-16. First, there is a significant monetary saving. The AD-16 is selling as the Magnecord 1020 for 45% more than you pay for the kit. Since 16-18 hours of construction time is about average, you're getting a bonus equal to $10 per hour for your spare time.

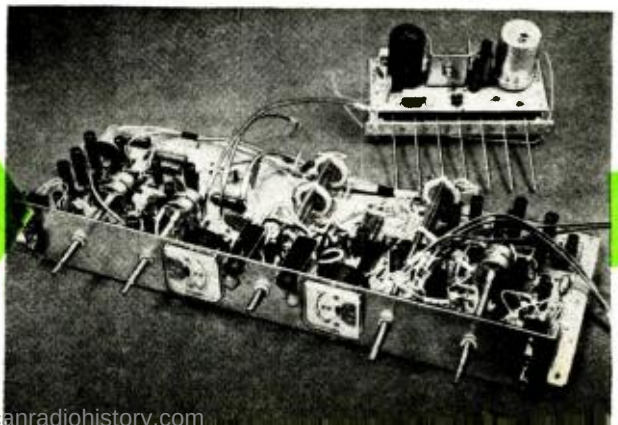
Secondly, the AD-16 cum 1020 is the Rolls-Royce of the tape recording industry. This *IS* a deluxe tape recorder—all solid-state circuitry (21 transistors) and ready for instant operation (no warmup). Third—and this is important—when you build a piece of gear like a tape recorder, you *learn*. You *learn* 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

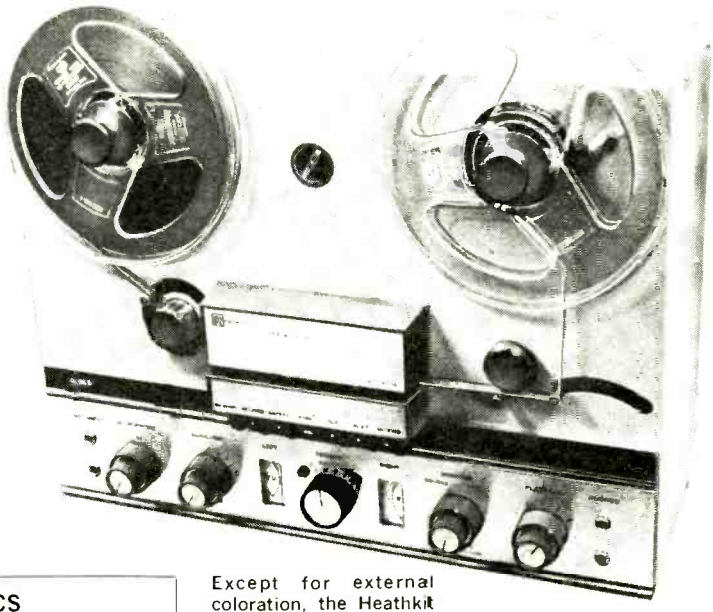
(*Continued on page* 92)

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 8 to 9 hours of working time.





www.americanradiohistory.com

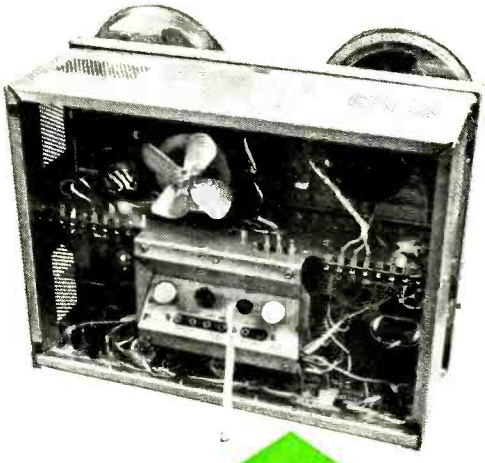


Except for external coloration, the Heathkit AD-16 has the physical appearance of a Magnecord 1020, at a price saving of about $175.00.

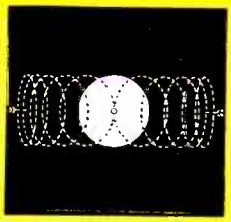
SHORT SPECS

- Two-speed (7½ and 3¾ in/s), 4-track record and playback, with provision for sound-on sound or sound-with-sound recording.
- The AD-16 accepts ¼"-wide tape; 1.5, 1.0, 0.75, or 0.5-mil thickness. Use 7" NAB reels or special 8¼" Magnecord reels.
- Measured frequency response at 7½ in/s exceeded 45-17,500 kHz at ± 2 dB.
- Unit draws 140 watts maximum, measures 13 3/32" x 17 5/8" x 8¼".
- Price: $399.50. Base, $19.95, extra.

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 17½ 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.



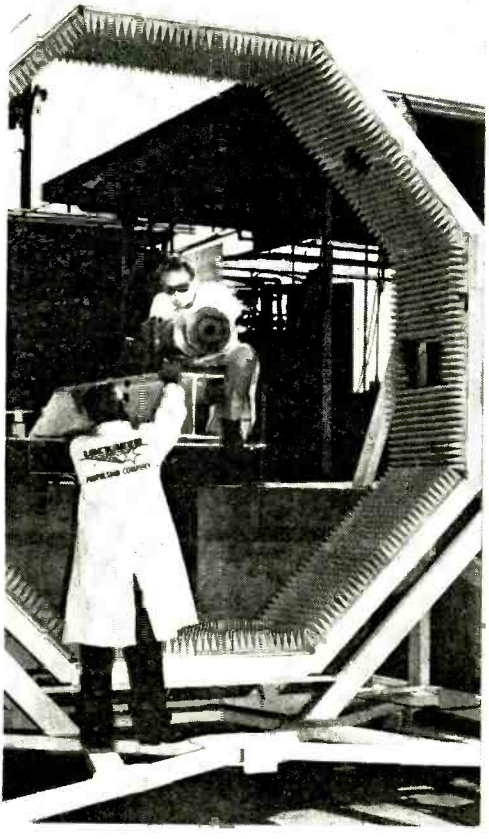
www.americanradiohistory.com

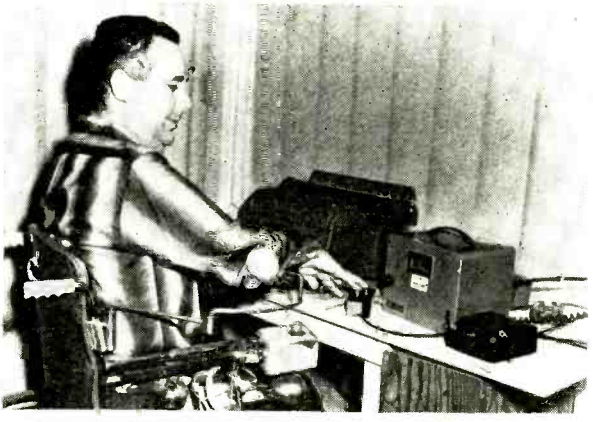


ZERO-BEATING THE NEWS

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-blanketing 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.

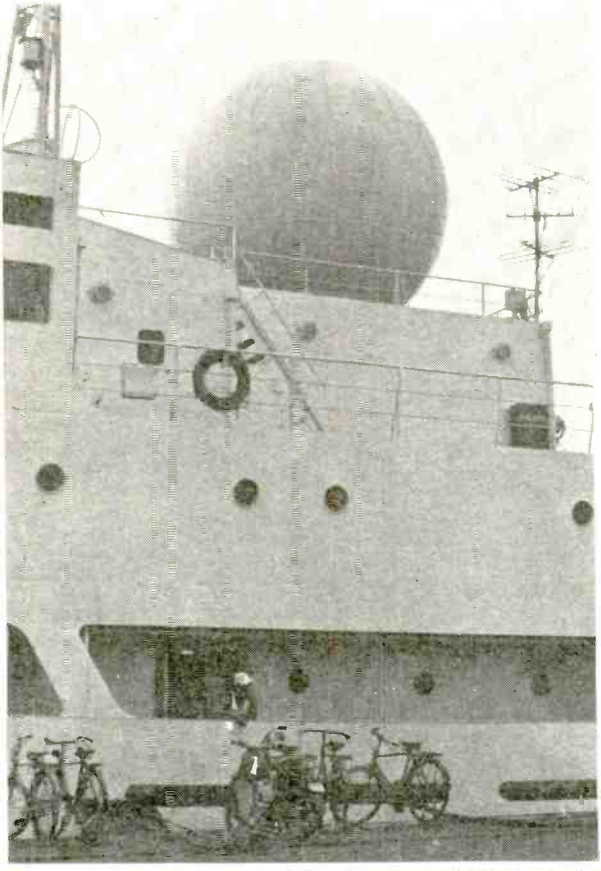


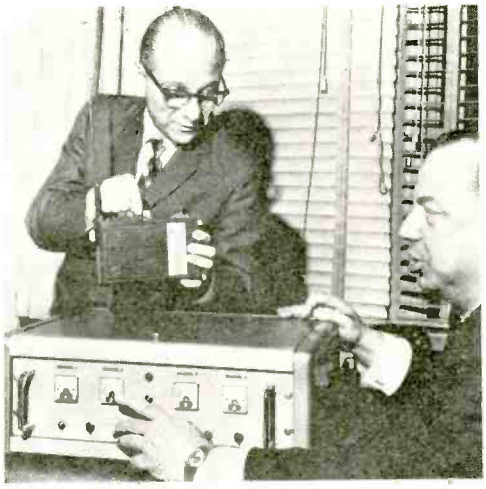


"REHABAPHONE"—Among the unusual equipment designed by General Telephone and Electronics Corp. are dials in Braille for the blind, telephones that answer themselves for the paralyzed, and telephones in oversized booths at convenient heights for wheelchair patients. Shown above is the "Rehabaphone" which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

www.americanradiohistory.com

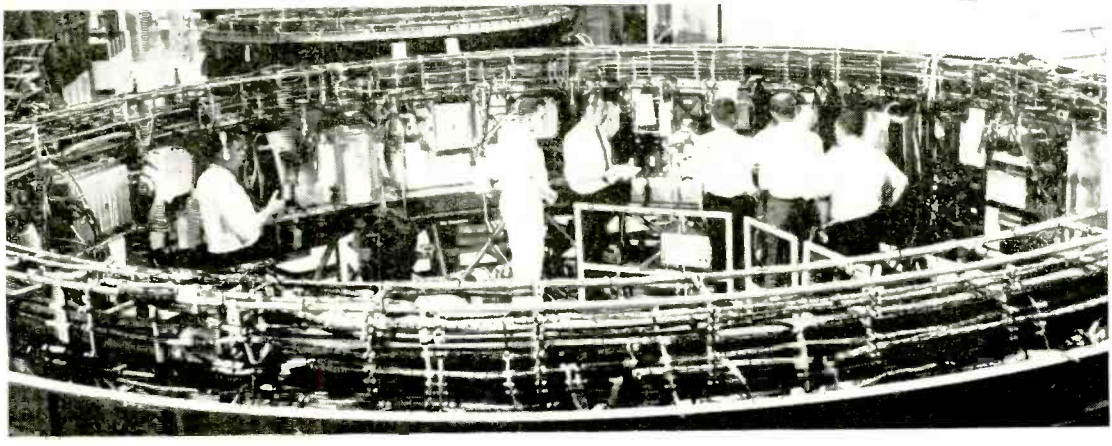
WORLD'S LARGEST—The largest weather radar system ever to be placed aboard a ship is installed on the "Ryofu-Maru." The system was designed and built for the Japanese Ministry of Transportation by Toshiba, and it incorporates many new features, one of which is a device that maintains desired antenna angle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





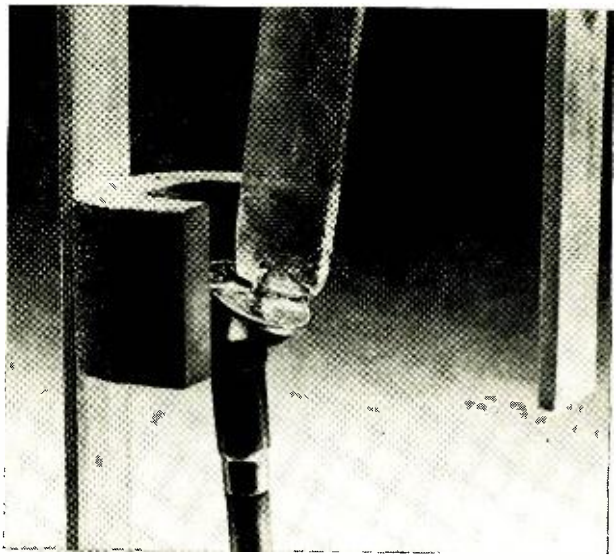
MULTIPLEXED TEACHER—Educasting Systems, Inc., has developed a new method by which educational programs are multiplexed on one regular FM or CATV channel. Four separate supersonic subchannels which correspond to the choices of answers make it possible for the student to press one of the four buttons on 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.



www.americanradiohistory.com

SCIENCE FAIR PROJECT



TESLA'S THERMOMAGNETIC MOTOR

A LITTLE-KNOWN INVENTION BY THAT CONTROVERSIAL GENIUS

By ARTHUR S. COOKFAIR

MENTION 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.

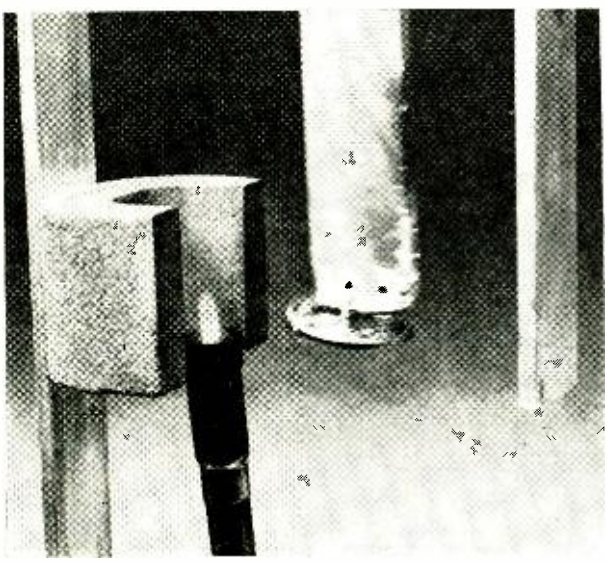
Unlike the induction motor (Tesla's most useful contribution), the thermomagnetic motor was destined to obscurity. It is a little known invention buried among the millions of inventions in the archives of the U.S. Patent Office. The motor itself is easy to construct and provides a simple—yet interesting—science fair project or demonstration device to show the effects of temperature on magnetism.

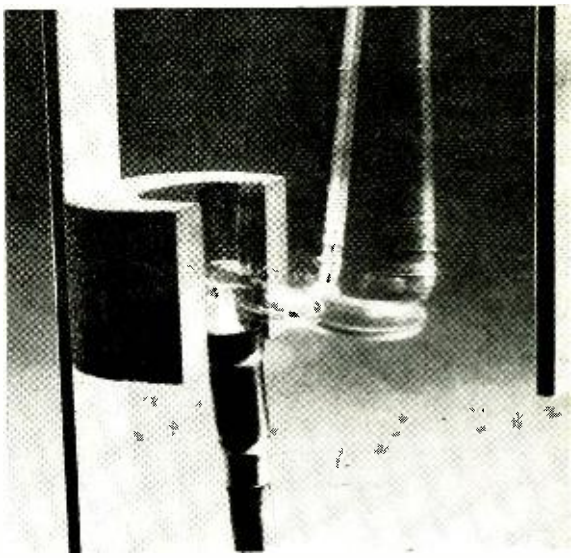
Theory. Tesla's thermomagnetic invention is based on the phenomenon known as *Curie temperature* (after its discoverer, Pierre Curie—of radium fame). The Curie temperature is the point at which permanent magnetic properties of certain metals go down the drain.

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

www.americanradiohistory.com





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)

www.americanradiohistory.com

JUST
WHEN I
FORGOT

MY (SOLDERING) GUN!

Sequel 3

CURBING 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. —30—

www.americanradiohistory.com

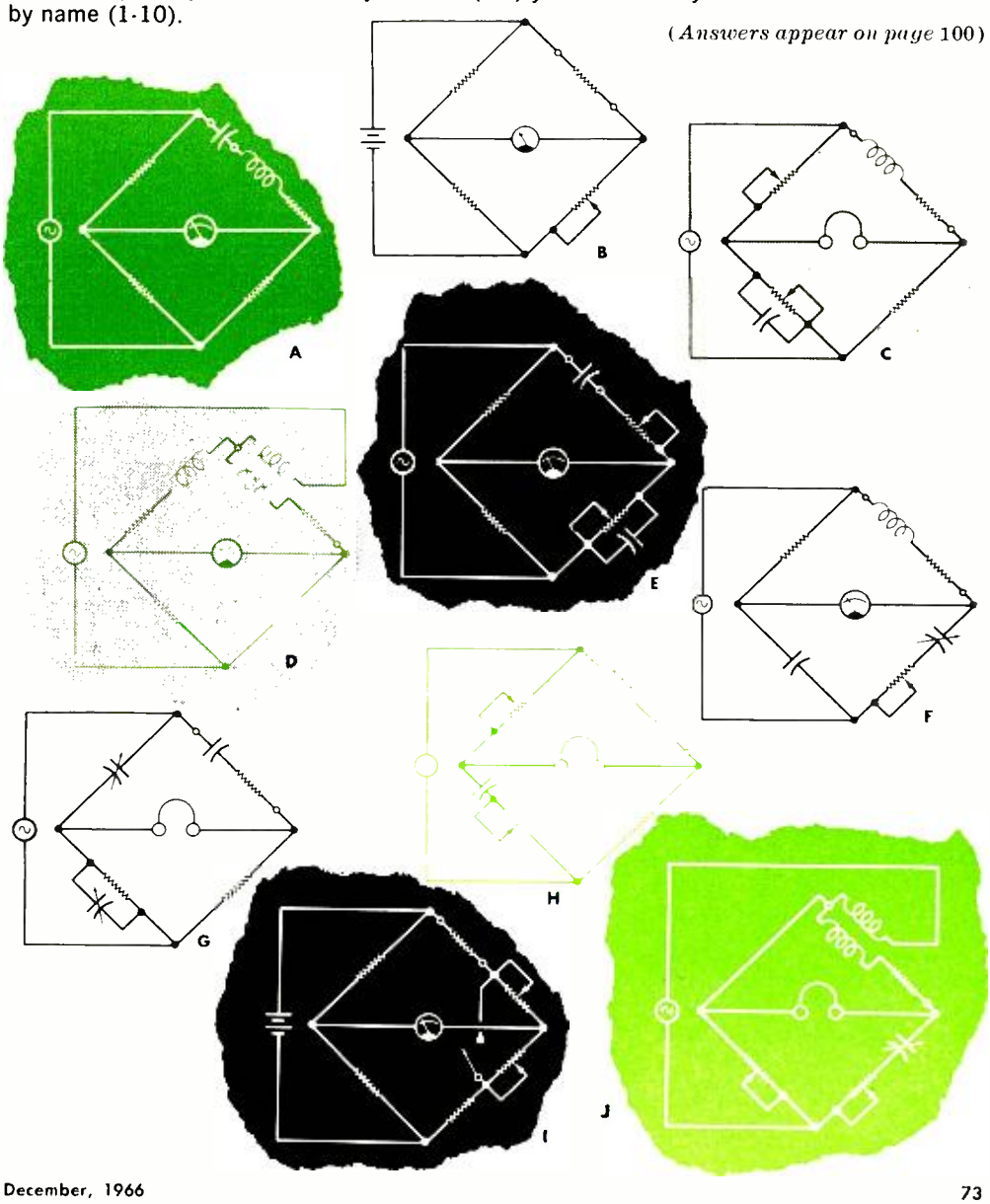
BRIDGE CIRCUIT QUIZ

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)



www.americanradiohistory.com

SOLID STATE

By LOU GARNER, Semiconductor Editor

GIFT-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, Semitronics, 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-

www.americanradiohistory.com

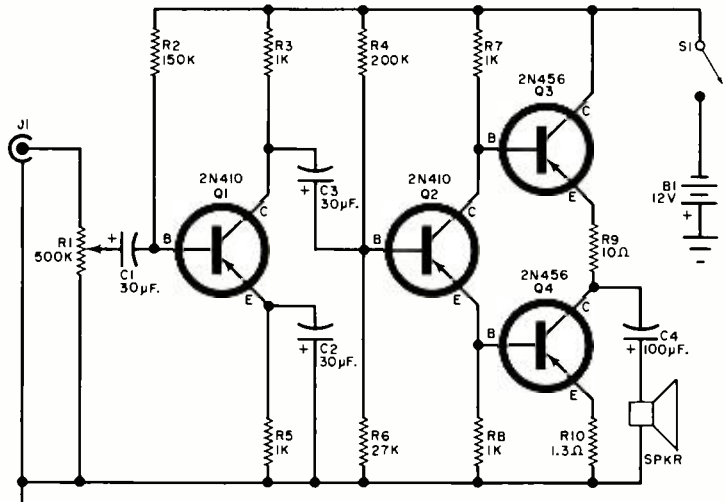


Fig. 1. Reader Patrick Henry came up with this design for a four-transistor amplifier by combining good features from selected commercial circuits. Output is in the medium power range.

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-sinked. 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-

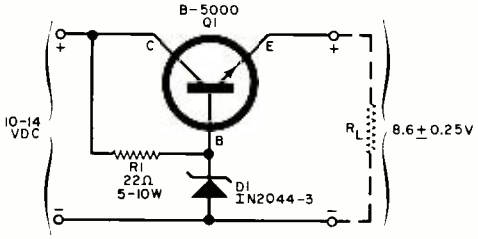


Fig. 2. Voltage regulator by Bendix maintains a relatively constant output, notwithstanding wide variations of input voltage or load conditions.

put of 8.6 ± 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-

www.americanradiohistory.com

third the volume of the earlier molded type shown. Dubbed a *Sensitor*, and identified as type TG1/8, the ⅛-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° and +125° 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 an advanced student—you'll be interested in a new *npn* silicon planar epitaxial transistor recently announced by the Amperex Electronic Corp. (Slatersville, R.I. 02876). Designated as Type A485, the transistor has a gain-bandwidth product (f_T) of 1500 MHz and can

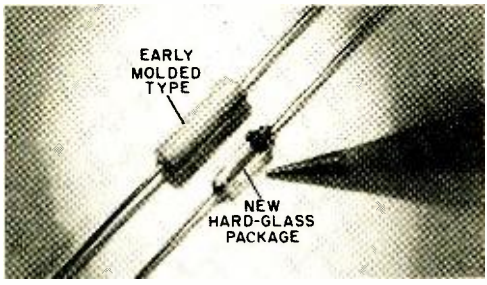


Fig. 3. The new positive-temperature-coefficient thermistor by Texas Instruments is only one-third the size of the earlier molded type, as shown here.

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 (*Q2*) is blocked out. In this circuit, output transformer *T1* must: (1) provide a d.c. path for *Q1*'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

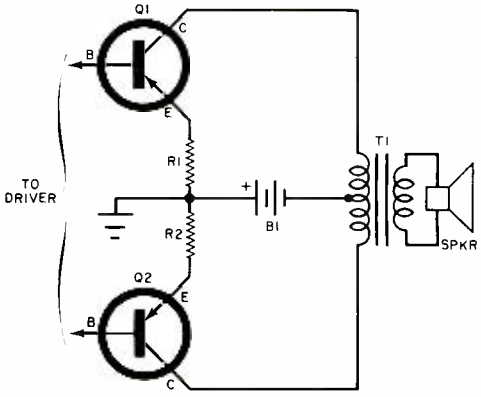


Fig. 4. A transistor audio transformer represents a compromise between ideal circuit requirements and factors of physical size, weight, and cost.

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

www.americanradiohistory.com

AMATEUR RADIO

By HERB S. BRIER, W9EGQ
Amateur Radio Editor

GETTING THE MOST FROM YOUR DIPOLE OR BEAM ANTENNA

IT 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, ½-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 ½-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 ½-wave dipole is 33′, 22′, and 16½′ 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 Dreste, 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.

www.americanradiohistory.com

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)

www.americanradiohistory.com

ON THE CITIZENS BAND

By **MATT P. SPINELLO,** KHC2060, CB Editor

THE 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 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.

CB HELP PLAN TESTED

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.

www.americanradiohistory.com

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. (Mon., Thurs., Fri.)	0030-0100 (Tues., Fri., Sat.)	7.12, 7.31, 9.665
	Moscow	5-5:30 p.m. & hourly to 12-1 a.m.	2200-2230 & hourly to 0500-0600	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

www.americanradiohistory.com

SHORT-WAVE LISTENING

By HANK BENNETT, W2PNA/WPE2FT
Short-Wave Editor

BROADCASTING STATION NEWS AROUND THE WORLD

THE 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.

www.americanradiohistory.com

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

www.americanradiohistory.com

FINCO

"has 'em both"

MODEL #65-1 $29.95 list

MODEL #65-2 $39.95 list

BOOSTER COUPLERS IN 300 OR 75 OHM

For Deluxe Home & Commercial Use

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.

Price? You can't beat it! Rugged quality? Finco's got it! Performance? Finco challenges 'em all!

Equip either model with Finco low-loss splitters (#3001 or #3003) and you can drive up to 16 sets in a master antenna system!

FINCO MODEL #65-1 $29.95 list

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 — ±½ db per 6 mc channel • Ventilated perforated steel cabinet 6⅝ x 3⅞ x 3⅜" • 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

FINCO MODEL #65-2 $39.95 list

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 6⅝ x 3⅞ x 3⅜" • 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

MAKER OF THE WORLD FAMOUS COLOR FINCO BLACK / WHITE TV AND FM ANTENNAS

ALL FINCO PRODUCTS ARE ENGINEERED FOR COLOR!

THE FINNEY COMPANY

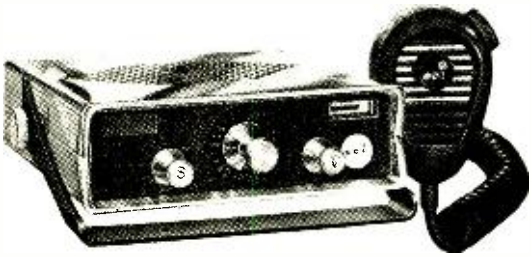
34 West Interstate Street, Bedford, Ohio 44014

CIRCLE NO. 15 ON READER SERVICE PAGE

www.americanradiohistory.com

$169.

Courier's 23-channel solid-state CB rig. Guaranteed for 10 years!



Look for everything you've ever wanted in a CB rig in Courier's TR-23S. Silicon-transistors throughout bring the size down to 5¾" W x 6¼" D x 1⅞" H. Crystals supplied for all 23 channels. Complete with microphone. Illuminated S meter. Illuminated channel selector. PA system. Auxiliary speaker jack. Single-knob tuning. Modulation indicator. DC cord. Exclusive Courier "Safety-Circuit" to protect against mismatched antenna, incorrect polarity, and overload. Plus the biggest guarantee in the business—*10 full years!*

eci **COURIER COMMUNICATIONS, INC.**
A Subsidiary of
electronics communications inc.
56 Hamilton Avenue, White Plains, N. Y.

Yes! I'd like to know all about the $169 Courier TR-23S with the 10-year guarantee.

Name_____

Address_____

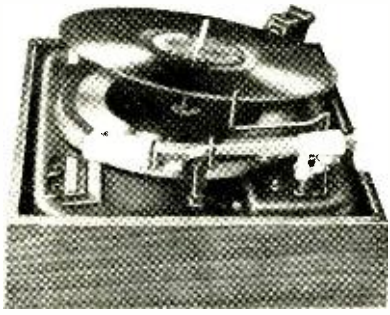
City_____ County_____ State_____

PE-612

CIRCLE NO. 10 ON READER SERVICE PAGE

ELAPSED TIME INDICATOR

KEEPS TRACK OF STYLUS WEAR



HOW 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 1¾" x ⅜" 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→

www.americanradiohistory.com

ASSIST (*Continued from page 38*)

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

Gilfillan 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 A/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. Vandermolen. 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 transceiver, 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 Holgutni 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) —30—

TWO NEW "plastic view" screwdriver kits

EASY TO USE, CARRY & STORE

These neat, extremely compact kits fit hip pocket, tool box, boat kit, glove compartment . . . can also be hung on a wall. Durable "Plastic View" zipper case permits instant identification of tools.

Amber plastic (UL) Service Master handles are shockproof, breakproof, have patented spring holding device that accepts all Xcelite Series 99 blades — lets you add tools as needed at minimum cost.

Space saving, single-ended interchangeable blades . . . can be used with Xcelite extensions for extra reach.

99PV-6
Handle and 3 slotted screwdriver blades (3/16", 1/4", 5/16" tips) 2 Phillips (#1, #2)

99PV-4
Handle and 3 slotted screwdriver blades (3/16", 1/4", 5/16" tips)

XCELITE®

XCELITE INC. • 20 BANK ST., ORCHARD PARK, N. Y. 14127
Send Catalog 166 with information on "Plastic View" Screwdriver Kits.

name _____

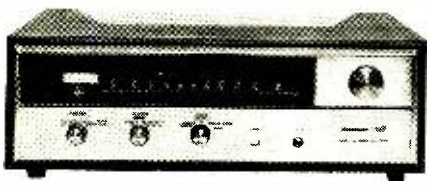
address _____

city _____ state & zone _____

CIRCLE NO. 45 ON READER SERVICE PAGE

www.americanradiohistory.com

SCOTT



SCOTT'S NEW ONE-AFTERNOON TUNER KIT DELIVERS AMAZING FET PERFORMANCE

Now you can get factory-wired performance from a kit that takes only one afternoon to build! Scott's new LT-112B is the only kit with Field Effect Transistor circuitry*, enabling you to enjoy more stations more clearly. Interstation Muting Control effects complete quiet between FM stations . . . oscilloscope output allows laboratory-precise correction for multipath distortion.

"Scott's LT-112 . . . is one of the finest FM stereo tuners we have tested and it is easily the best kit-built tuner we have checked . . . Because of its simple construction and trouble-free nature, it is a logical choice for anyone who wants the finest in FM reception at a most remarkable price." HiFi/Stereo Review.

LT-112B specifications: Usable sensitivity, 1.8 μV; 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

SCOTT

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 (KXKW).

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

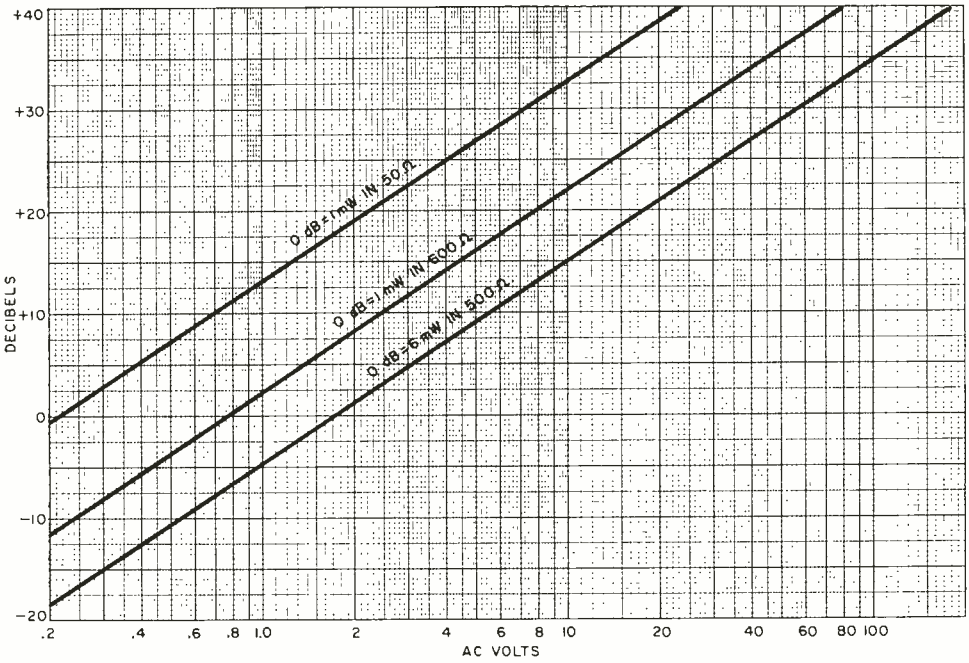
Powerhouse 2-Tube Short-Wave Receiver (*August*, 1966, *page* 62). In Fig. 4, *L3* and *L4* should be transposed; also transpose *L3* and *L4* in the Parts List.

Static-Free Thermistorized Aquarium Heater (*September*, 1966, *page* 74). Resistor *R4* should be 10,000 ohms and *R7* 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 13⅛" x 34" x ¾"; for the exterior top as 13⅛" x 19" x ¾"; and for the exterior bottom as 12⅞" x 17½" x ¾".

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.

www.americanradiohistory.com



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—

HEAR POLICE, FIRE, AIRCRAFT, TAXIS on Your Transistor Broadcast Radio

It's Easy with the PRM VHF COMPACT CONVERTER

SINGLE CHANNEL
Crystal-controlled Antenna extends to 36 inches.
$24.95
POSTPAID

DUAL CHANNEL
Has two crystal-controlled channels, with selector switch. Not to exceed 4 Mc. between frequencies.
$29.95
POSTPAID

Place it next to a good 7-10 transistor broadcast radio, and you can monitor the VHF frequency specified. Performance of up to 20 miles or more under good conditions. Compact, portable. No internal connection needed. Case 2-13/16 x 1-5/8 x 4 inches. Powered by 9-volt transistor battery. Current drain 3 Ma. at 9V.

In ordering, specify VHF frequency desired, within these ranges: 148-175 Mc., 25-50 Mc. AM or FM, and 108-136 Mc. Give position of low activity on your broadcast dial. Price includes battery.

USE THIS COUPON TO ORDER

PETERSEN RADIO CO., INC.
2800 West Broadway
Council Bluffs, Iowa 51501

PETERSEN RADIO CO., INC.
2800 West Broadway
Council Bluffs, Iowa 51501

Please send VHF COMPACT CONVERTERS as ordered below:
_____Single Channel @ $24.95 each, Postpaid.
To receive VHF Frequency _____ Mc.; Broadcast _____ Kc.
_____Dual Channel @ $29.95 each, Postpaid.
For VHF Frequencies _____ Mc. and _____ Mc.
Broadcast frequency preferred _____ Kc.
_____Check or money order enclosed. (Or _____ send C.O.D.)
Name _____
Address _____
City _____ State _____ ZIP _____

www.americanradiohistory.com

The most experienced all-channel amplifiers keep getting better and better

Blonder-Tongue pioneered and developed the industry's first all-channel, all-transistor TV signal amplifier. That was more than two years ago. During that period this top-rated original design has brought superior all-channel and color reception to homes located in all reception areas.

Now, we are employing the better performing silicon transistor in these amplifiers. The result: 40% more gain in the lowband, 100% more in the highband, greater ability to handle strong signals without overloading and better signal to noise ratio. Color or black-and-white TV reception on any and all channels from 2 to 83 is better than ever.

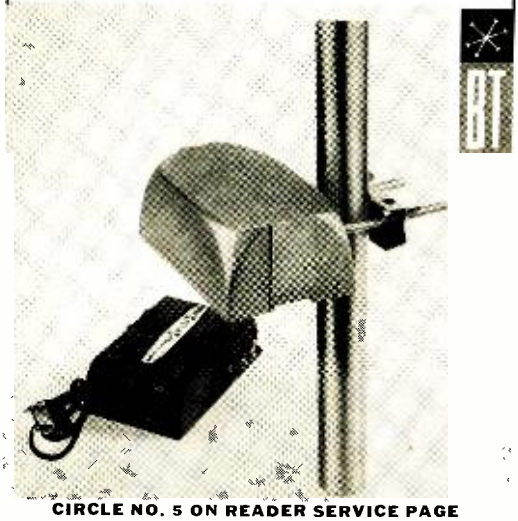
Only Blonder-Tongue gives you a choice of all-channel, color-approved amplifiers:

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.

Coloramp-U/V–same as the U/Vamp-2 except it has a single UHF/VHF input. Matches the new all-channel antennas.

V/U-All-2 – deluxe 2-transistor indoor UHF/VHF amplifier. Can drive up to 4 TV sets. Has built-in 2-way splitter with excellent impedance match and isolation for interference and ghost-free reception.

These UHF/VHF amplifiers are just one more reason to go all-channel from antenna to TV with color-approved Blonder-Tongue TV products. Of course, we also have a full line of top quality VHF, VHF/FM and UHF-only amplifiers. Write for free catalog #74. Blonder-Tongue Laboratories, Inc., 9 Alling St. Newark, N.J.



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 *IC4* 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 *IC4* on the same circuit board with the other units.

Switch *S3* and the battery holder can be fastened to the case with #6 hardware, or can be pop-riveted in place. Switches *S1* and *S2* are mounted with hardware provided. The lamps are held by ½"-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–

www.americanradiohistory.com

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 into 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. —30—

NOW FROM DELTA

A Complete Automotive and Ignition Tune-Up System

MARK TEN
Capacitive Discharge Ignition System
$44.95 Assembled
$29.95 Kit Form

Get mileage you never dreamed of! 3 to 10 times spark plug life. Instant starts in all weather. Installs in only 10 minutes. Up to 20% gas savings. Dramatic increase in engine performance and acceleration.

2 NEW AUTO TUNE UP INSTRUMENTS

DWELL METER $12.95 Ppd.

TACH METER $14.95 Ppd.

These two new cousins to the world famous proven MARK TEN now give you the capability to tune your own car inexpensively, easily, with remarkable precision. These **separate** instruments are low cost, portable and the easiest to read you've ever seen.

- Delta's famous printed circuit design
- Superior in precision, quality and performance to instruments selling for FIVE TIMES as much
- Large dial, high quality jewel D'arsonval meters
- Operates with standard, transistor or capacitive discharge systems as well as magnetos
- Instant readings — no confusing scales

Send Your Order Today

DELTA PRODUCTS, INC.

P.O. Box 1147 PE • Grand Junction, Colo.

Enclosed is $_____. Ship prepaid.
☐ Ship C.O.D.
Please send:
☐ **Dwell Meters @ $12.95**
☐ **Tach Meters @ $14.95**
☐ **Mark Tens (Assembled) @ $44.95**
☐ **Mark Tens (Delta Kit) @ $29.95**
(12 volt positive or negative ground only)
SPECIFY — ☐ Positive ☐ Negative
☐ 6 or ☐ 12 Volt

Car Year_____ Make_____
Name_____
Address_____
City/State_____ Zip_____

DP 6-12

CIRCLE NO. 9 ON READER SERVICE PAGE

www.americanradiohistory.com

STEP UP YOUR INCOME

Learn at Home to Fix

ELECTRICAL APPLIANCES

If you have a business or job in Radio-TV Servicing or other home service, you'll find Electrical Appliance Repair a natural, profitable addition. NRI trains you quickly in spare time, shows you how to add to your income long before you finish training. NRI gives you parts to build your own Appliance Tester. Learn how to repair small and large appliances plus air conditioning, refrigeration, small gasoline engines, equipment used on farms and commercially. Cash in on this money-making sideline. Mail coupon for catalog. No obligation. NATIONAL RADIO INSTITUTE, Appliance Div., Washington, D.C. 20016

Training Available Under New GI Bill

FREE CATALOG MAIL COUPON

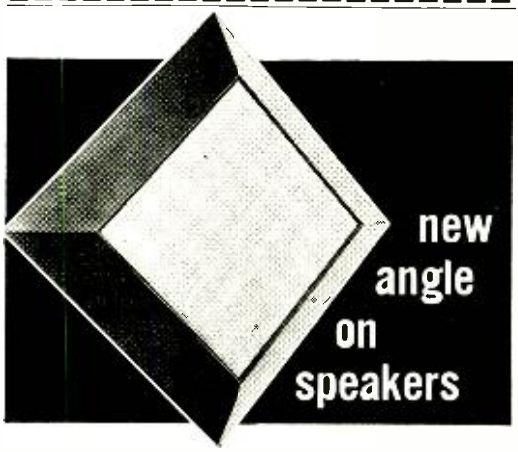
NATIONAL RADIO INSTITUTE
Washington, D.C. 20016 501-126
Please send me your Electrical Appliance Repair catalog.
No salesman will call.

Name _____ Age _____

Address _____

City _____ State _____ Zip _____

☐ Check for facts on new GI Bill
ACCREDITED MEMBER NATIONAL HOME STUDY COUNCIL



Striking contemporary art frame design in Dusk Walnut or Antique Birch. Mount traditionally or in diamond position. Special 8" dual cone speaker designed exclusively for Argos. Excellent for stereo or as extension speakers. **Audiophile net $12.95.**

Great gift idea!

Troubador model TSW-8S by

Argos PRODUCTS COMPANY

Dept. C, 600 Sycamore St., Genoa, Illinois 60135

CIRCLE NO. 3 ON READER SERVICE PAGE

TAPE RECORDER KIT—DELUXE

(*Continued from page* 66)

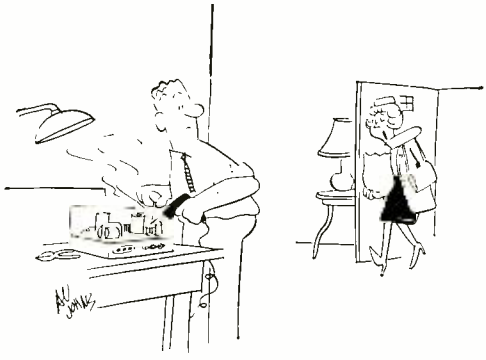
tape transport is too big a job for the electronics technician. But you may not know that a high percentage of tape recorders use a single motor. That motor must be linked up to perform the functions of rewind, drive, and fast forward. The Heathkit AD-16 uses three separate synchronous motors and each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

www.americanradiohistory.com

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. -30-

"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 *S1* 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,

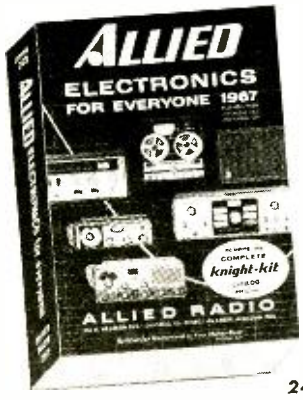
Great!/Full stereo separation even at 15,000 cps./4 poles, 4 coils & 3 magnets for better balance & phenomenal frequency response/Fully shielded/Lowest 1M distortion (electro-sheer suspension)/Highest output (8 Mv. per channel)/Lowest tracking for longer record wear. Write for 1967 color brochure.

EMPIRE LIVING CARTRIDGE SERIES FROM $14.95.

Empire Scientific Corp., 845 Stewart Ave., Garden City, L.I., New York 11530

CIRCLE NO. 13 ON READER SERVICE PAGE

FREE NEW 514-PAGE *ALLIED* 1967 CATALOG



Top Savings on the best in electronics for everyone . . .

Famous Knight-Kits • Stereo Hi-Fi • Tape Recorders • CB 2-Way Gear • Walkie-Talkies • FM-AM Radios • Short Wave • Portable TV • Amateur Gear • Intercoms and PA • Automotive Electronics • Test Instruments • TV Antennas Hardware, Parts • Plus scores of Allied values!

NO MONEY DOWN! 24 months to pay with Allied Credit Fund Plan.

FREE! ALLIED RADIO, Dept. 3M
P.O. Box 4398, Chicago, Ill. 60680

☐ Send FREE 1967 Allied Catalog

Name_____
PLEASE PRINT

Address_____

City_____ State_____ Zip_____

CIRCLE NO. 1 ON READER SERVICE PAGE

www.americanradiohistory.com

AM/FM VHF RECEIVERS
POLICE • FIRE • AIRCRAFT
AMATEUR • GENERAL COVERAGE

The new 364B is a completely self contained highly sensitive receiver offering the user continuous AM/FM coverage from 26 to 54 and 88 to 174 MC in eight bands. Features: superhet circuitry, full vision calibrated dial with vernier drive, speaker, power transformer, ready to use for 110/120 V AC.

364B
$49.95

348A Transistorized tuneable converter for use with car, home or portable radio. Ranges: 30-50, 115-130, 150-162 MC. Bat. incl. Same but crystal controlled for 12 V car use. (345A) $29.95. Economy tuneable model (315T) same ranges $18.95

348A
$34.95

361C AUDIO EQUALIZER
$44.95

Variable equalizer necessary for professional quality recording or playback. Ideal for use between mixer and tape recorder or tape to tape, etc. Write for details or send $2.00 for LP demonstration record. Covers tape and disc recording techniques. Refunded with purchase.

Order direct or write for information

KUHN ELECTRONICS
20 GLENWOOD CINCINNATI 17, OHIO

CIRCLE NO. 24 ON READER SERVICE PAGE

SAY YOU SAW IT IN POPULAR ELECTRONICS

SMALL, but POWERFUL

INTRODUCING...

the NEWEST and most ECONOMICAL MODEL of the Famous SYDMUR Transistorized Capacitor Discharge Ignition Systems, as described in the Nov. 1966 issue of POPULAR ELECTRONICS. THE COMPAC! Now SAVE MONEY on GAS! SPARK PLUGS & TUNE-UPS! This small but powerful unit measures 3 1-4 x 3 1-4 x 2 1-4, and weighs 1 lb. Designed for Automobiles, Motorcycles, Go-Karts, Golf-Karts and Boats.

Write for FREE LITERATURE on this Unit, and all other SYDMUR SYSTEMS. Better still, send Check or Money Order for your System TODAY!

COMPAC Assembled $34.75 plus 75c handling
COMPAC KIT 24.95 plus 75c handling
12 volt negative ground only.

SYDMUR ELECTRONIC SPECIALTIES, BOX 25C, Midwood Station, B'klyn, N.Y. 11230

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 ½" 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—

www.americanradiohistory.com

Regardless Of What You Pay For A 19″ Color TV...

It Can't Perform As Well As This New Heathkit® "180" For Only $379.95*

Here's Why!

Exclusive Features That Can't Be Bought In Ready-Made Sets At Any Price! *All* color TV sets require periodic convergence and color purity adjustments. This new Heathkit GR-180 has *exclusive* built-in servicing aids so *you* can perform these adjustments anytime . . . *without* any special skills or knowledge. Simple-to-follow instructions and detailed color photos in the GR-180 manual show you exactly what to look for, what to do and how to do it. Results? Beautifully clean and sharp color pictures day in and day out . . . and up to $200 savings in service calls during the life of your set!

Exclusive Heath Magna-Shield . . . surrounds the entire tube to keep out stray magnetic fields and improve color purity. In addition, *Automatic Degaussing* demagnetizes and "cleans" the picture everytime you turn the set on from a "cold" start.

Choice Of Installation . . . Another Exclusive! The GR-180 is designed for mounting in a wall or your own custom cabinet. Or you can install it in either optional Heath factory-built Contemporary or Early American styled cabinets.

From Parts To Programs In Just 25 Hours. All critical circuits are preassembled, aligned and tested at the factory. The GR-180 manual guides you the rest of the way with simple, non-technical instructions and giant pictorials. You can't miss!

Plus A Host Of Advanced Features . . . like the hi-fi 180 sq. inch rectangular tube with "rare earth phosphors", smaller dot size and 24,000 volt picture power for brighter, livelier colors and sharper definition . . . *Automatic Color Control* and gated *Automatic Gain Control* to reduce color fading and insure jitter-free pictures at all times . . . deluxe *VHF Turret Tuner* with "memory" fine tuning . . . *2-Speed Transistor UHF Tuner* . . . *Two Hi-Fi Sound Outputs* for play through your hi-fi system or connection to the GR-180's 4″ x 6″ speaker . . . *Two VHF Antenna Inputs* — a 300 ohm balanced and a 75 ohm coax . . . *1-Year Warranty* on the picture tube, 90 days on other parts. For full details mail coupon on the following page. Better yet, use it to order the best 19″ Color TV buy . . . it's available now in limited quantities.

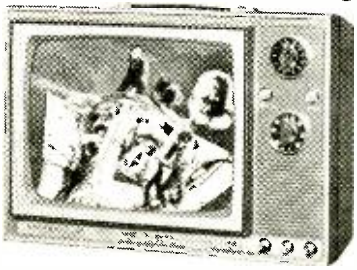
***Kit GR-180,** everything except cabinet, 102 lbs. **$379.95**

GRA-180-1, walnut cabinet (shown above), 30 lbs...18¼″ D x 28¼″ W x 29″ H. **$49.95**

GRA-180-2, Early American cabinet, 37 lbs...18¼″ D x 28¼″ W x 31¾″ H... Available February **$75.00**

NEW 12″ Transistor Portable TV — First Kit With Integrated Circuit

Unusually sensitive performance. Plays anywhere . . . runs on household 117 v. AC, any 12 v. battery, or optional rechargeable battery pack ($39.95); receives all channels; new integrated sound circuit replaces 39 components; preassembled, prealigned tuners; high gain IF strip; Gated AGC for steady, jitter-free pictures; front-panel mounted speaker; assembles in only 10 hours. Rugged high impact plastic cabinet measures a compact 11½″ H x 15¾″ W x 9⅜″ D. 27 lbs.



Kit GR-104

$119.95

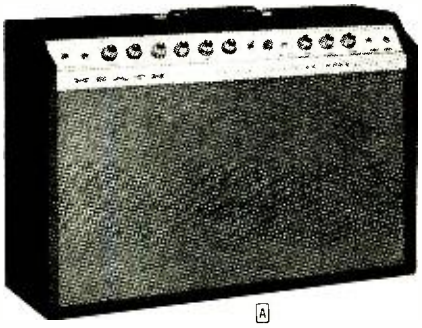
Turn Page For More New Kits From HEATH

CIRCLE NO. 18 ON READER SERVICE PAGE

www.americanradiohistory.com

9 Kit-Giving Ideas From Heath...

Harmony-by-Heathkit® Electric Guitars & Heathkit Guitar Amplifier



Kit TA-16
$129.95

[B] Kit TG-46 **$219.95** (save $109.55)

[C] Kit TG-26 **$99.95** (save $46)

[D] Kit TG-36 **$119.95** (save $38.55)

[A] NEW Heathkit Transistor Guitar Amplifier
60 watts peak power; two channels — one for accompaniment, accordian, organ, or mike, — the other for special effects . . . with both variable reverb and tremolo; 2 inputs each channel; two foot switches for reverb & tremolo; two 12″ heavy-duty speakers; line bypass reversing switch for hum reduction; one easy-to-build circuit board with 13 transistors, 6 diodes; 28″ W. x 9″ D. x 19″ H. leather-textured black vinyl cabinet of ¾″ stock; 120 v. or 240 v. AC operation; extruded aluminum front panel. 44 lbs.

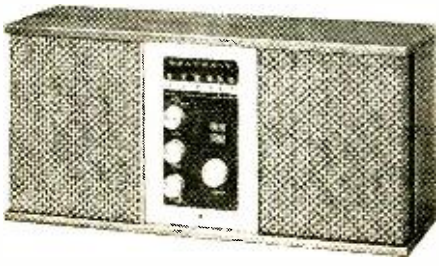
American Made Harmony-By-Heathkit Guitars
All guitars include instruction book, tuning record, pick, connecting cord, deluxe red leather cushioned neck strap and chipboard carrying case. All wood parts assembled and factory finished — you just mount metal parts, pickups & controls in pre-drilled holes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

[B] Deluxe Guitar . . . 3 Pickups . . . Hollow Body
Double-cutaway for easy fingering of 16 frets; ultra-slim fingerboard — 24½″ 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 — 24½″ 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, 1½″ 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.

NEW! Deluxe Solid-State FM/FM Stereo Table Radio



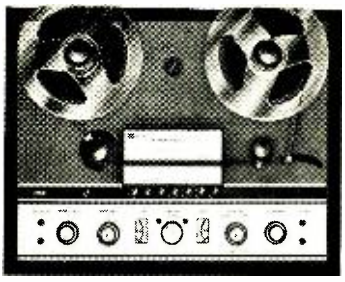
Kit GR-36
$69.95

Tuner and IF section same as used in deluxe Heathkit transistor stereo components. Other features include automatic switching to stereo; fixed AFC; adjustable phase for best stereo; two 5¼″ PM speakers; clutched volume control for individual channel adjustment; compact 19″ W x 6½″ D x 9¼″ H size; preassembled, prealigned "front-end"; walnut cabinet; simple 10-hour assembly. 17 lbs.

www.americanradiohistory.com

Something For Everyone

NEW Heathkit® /Magnecord® 1020 4-Track Stereo Recorder Kit



Kit AD-16
$399.50
(less cabinet)

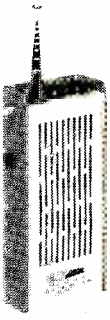
Save $170 by doing the easy assembly yourself. Features solid-state circuitry; 4-track stereo or mono playback and record at 7½ & 3¾ ips; sound-on-sound, sound-with-sound and echo capabilities; 3 separate motors; solenoid operation; die-cast top-plate, flywheel and capstan shaft housing; all push-button controls; automatic shut-off; plus a host of other professional features. 45 lbs. Optional walnut base $19.95, adapter ring $4.75

NEW Deluxe SB-301 Amateur Receiver Kit
NEW Deluxe SB-401 Amateur Transmitter Kit

Kit SB-301
$260.00
(less speaker)

New SB-301 receiver for 80 thru 10 meters with all crystals furnished, plus 15 to 15.5 MHz coverage for WWV; full RTTY capability; switch-selected ANL; front-paneling switching for control of 6 and 2 meter plug-in converters; crystal-controlled front-end for same rate tuning on all bands; 1 kHz dial calibrations, 100 kHz per revolution. 23 lbs. Matching SB-401 Transmitter, now with front-panel selection of independent or transceive operation... $285.00

2-Watt Walkie-Talkie



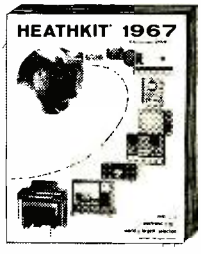
Assembled
GRS-65A
$99.95

New . . . Factory Assembled. Up to 6 mile range; rechargeable battery; 9 silicon transistors, 2 diodes; superhet receiver; squelch; ANL; aluminum case. 3 lbs. 117 v. AC battery charger & cigarette lighter charging cord $9.95. Crystals $1.99 ea.

NEW Portable Phonograph Kit

Kit GD-16
$39.95

All Transistor. Assembles in 1 to 2 hours. Preassembled 4-speed automatic mono changer; 4" x 6" speaker; dual Sapphire styli; 45 rpm adaptor; olive & beige preassembled cabinet; 117 v. AC. 23 lbs.



FREE

World's Largest Electronic Kit Catalog!

108 pages ... many in full color ... describe these and over 250 easy-to-build Heathkits for color TV, stereo/hi-fi, CB, ham, marine, shortwave, test, educational, home and hobby items. Mail coupon for your free copy.

HEATHKIT

HEATH COMPANY, Dept. 10-12
Benton Harbor, Michigan 49022

☐ Enclosed is $_____, plus shipping.

Please send model (s)_____

☐ Please send FREE 1967 Heathkit Catalog

Name_____

Address_____

City_____ State_____ Zip_____

Prices & specifications subject to change without notice. CL-265

CIRCLE NO. 18 ON READER SERVICE PAGE

www.americanradiohistory.com

Silence is Golden

(In Mobile Installations)

Only the Squires-Sanders Noise Silencer eliminates noise caused by ignition, power lines, etc. Only two transceivers have this exclusive feature–the Squires-Sanders "23'er" with full 23-channel capability (all crystals supplied) at $235 and the "S5S" 5-channel model at $185. Other features include an ultra-sensitive receiver and a powerful, long-range transmitter (special high efficiency RF output amplifier clipped and filtered audio, 100% modulation). 12 VDC power supply. Squires-Sanders Inc., Millington, N. J. 07946.

Squires Sanders

CIRCLE NO. 37 ON READER SERVICE PAGE

F.C.C. LICENSE TRAINING

by correspondence

• • • •

The best there is!

• • •

Ask about our

MONEY-BACK WARRANTY

• •

Approved for veterans and servicemen

•

For free information, write:

Dept. 63-S

GRANTHAM SCHOOL OF ELECTRONICS

1505 N. Western Ave.
Hollywood, Calif. 90027

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'ers 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

www.americanradiohistory.com

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, KIC5311, 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,

POPULAR SAMS BOOKS

USE THIS HANDY ORDER FORM

RECENTLY PUBLISHED! TIMELY!

☐ **Building Your Amateur Radio Novice Station.** Exceptionally clear and complete construction details for building an inexpensive transmitter and receiver, plus accessory items. Will efficiently serve the General-Class ham as well. Order **ASP-1**, *only* . **$3.50**

☐ **Computers Self-Taught Through Experiments.** Explains and demonstrates principles of computer operation through 28 simple, low-cost construction projects. Transistor use and individual computer operations are covered in detail. Full instructions given for each project. Order **CEB-1**, *only* **$4.25**

☐ **ABC's of Citizens Band Radio.** NEWLY REVISED & UPDATED. All you need to know about planning and setting up a CB 2-way radio system. Explains functions, principles, setup and operation, latest rules and regulations. Order **ACR-2** **$2.25**

☐ **ABC's of Transistors.** NEWLY REVISED AND FULLY UPDATED. Helps anyone understand the structure and function of the transistor. Explains not only what transistors are but how they operate. Describes basic transistor circuits and testing procedures. Order **TRA-2**, *only* **$1.95**

☐ **How To Read Schematic Diagrams.** Not only shows you how to read and interpret diagrams, but analyzes each component, its construction, and its circuit purpose and use. Order **RSD-1**, *only* **$2.25**

☐ **TV Servicing Guide.** Tells you how to apply proper trouble shooting procedures based on analysis of symptoms, illustrated by picture tube photos. Packed with troubleshooting and servicing hints. Order **SGS-1**, *only* **$2.00**

☐ **Color-TV Servicing Made Easy.** Full explanation of color principles, circuitry, setup adjustments, and servicing of all color-TV sets. Takes the mystery out of servicing color-TV. Order **CSL-1**, *only* **$3.25**

☐ **101 Ways to Use Your VOM & VTVM.** Shows you how to get the most from these popular instruments, how to make required connections, how to test properly, how to evaluate results. Order **TEM-3**, *only* **$2.00**

☐ **Transistor Ignition Systems Handbook. IGS-2** **$2.95**
☐ **TV Tube Symptoms & Troubles. TVT-2** **1.95**
☐ **Citizens Band Radio Handbook. CBH-2** **3.50**
☐ **2nd-Class Radiotelephone License Handbook. QAN-2** . . . **4.75**
☐ **Modern Dictionary of Electronics. DIC-2** **7.95**
☐ **Handbook of Electronic Tables & Formulas. HTF-2** **3.95**
☐ **Troubleshooting With the Oscilloscope. TOS-1** **2.50**
☐ **Color TV Trouble Clues. COL-1** **1.95**
☐ **Tube Substitution Handbook. TUB-9** **1.50**
☐ **Solving TV Tough-Dogs. TDM-2** **3.25**

FAMOUS ABC'S BOOKS

☐ Short Wave Listening. SWL-1 . . . $1.95
☐ Lasers & Masers. LAL-2 . . . . . 2.25
☐ Electronic Test Probes. APG-1 . . . 2.25
☐ Computer Programming. CPL-1 . . 1.95
☐ Modern Radio. ARS-2 . . . $1.95
☐ Electronic Organs. ECO-1 . . 1.95
☐ Hi-Fi & Stereo. HSF-1 . . . . . 1.95
☐ Tape Recording. TAP-2 . . . . 1.50

HOWARD W. SAMS & CO., INC.

Order from any Electronic Parts Distributor, or mail to Howard W. Sams & Co., Inc., Dept. PE-12 4300 W. 62nd St., Indianapolis, Ind. 46206

Send books checked above. $ _____ enclosed.

☐ Send FREE Sams Book Catalog.

Name _____
PLEASE PRINT

Address _____

City _____ State _____ Zip _____

CIRCLE NO. 34 ON READER SERVICE PAGE

www.americanradiohistory.com

POPULAR ELECTRONICS SUBSCRIBER SERVICE

Please include an address label when writing about your subscription to help us serve you promptly. **Write to:** Portland Place, Boulder, Colo. 80302

Change of Address:
Please let us know you are moving at least 4 weeks in advance. Affix magazine address label in space to the right and print new address below. If you have a question about your subscription, attach address label to your letter.

AFFIX LABEL

state
city
address
name
please print
zip-code
If you have no label handy, print OLD address here.

To Subscribe:
Check boxes below.

☐ New ☐ Renewal
☐ 5 years $20
☐ 3 years $13
☐ 1 year $5
Specify
☐ Payment enclosed — You get 1 extra issue per year FREE!
☐ Bill me later.

name please print 0138

address

city

state zip-code

GET INTO **ELECTRONICS**

V.T.I. training leads to success as technicians, field engineers, specialists in communications, guided missiles, computers, radar, automation. Basic & advanced courses. Electronic Engineering Technology and Electronic Technology curricula both available. Associate degree in 29 months. B.S. obtainable. G.I. approved. Start February, September. Dorms, campus. High School graduate or equivalent. Catalog.

VALPARAISO TECHNICAL INSTITUTE
DEPARTMENT PE, VALPARAISO, INDIANA

LEARN Electronics Engineering **AT HOME**

Fix TV, design automation systems, learn transistors, complete electronics. College level Home Study courses taught so you can understand them. Earn more in the highly paid electronics industry. Computers, Missiles, theory and practical. Kits furnished. Over 30,000 graduates now employed. Resident classes at our Chicago campus if desired. Founded 1934. Catalog. "Vets—write for information about G.I. Bill Training."

AMERICAN INSTITUTE OF ENGINEERING & TECHNOLOGY
1137 West Fullerton Parkway, Chicago, Illinois 60614

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.

www.americanradiohistory.com

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, WA8OBB/XV5,** Cam Ranh Bay, Vietnam, is also active on 14 MHz with a Drake TR-4 and a ½-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, WN9SIK,** 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 32½' home-brew vertical antenna get along well on 40 meters. The antenna is constructed of ½" 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 ¼" x ⅛" 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*

BE ON THE ALERT! with SONAR FM MONITOR RECEIVER

Perfect for
• Police • Fire
• Tow Trucks
• Civil Defense
• Weather
• Ship to Shore

wired for "Tone Alert."

TUNABLE RECEIVER AC Only $89.95

Model FR-101—(25-50 mc) Model FR-102—(150-175 mc)
Slightly higher prices for DC and XTAL control

Monitor the calls and know the facts as it happens.

NOW!—8 Super Deluxe FM communication receivers to meet your particular needs for home, office or car. Powerful and dependable. Engineered for rugged service under all operating conditions. Featuring High frequency oscillator, temperature compensated for stability, RF amplifier for maximum sensitivity, illuminated dial, safety rated components and ALL Aluminum construction plus many other outstanding features. Operates on 110 VAC. Includes power cord, mounting bracket.

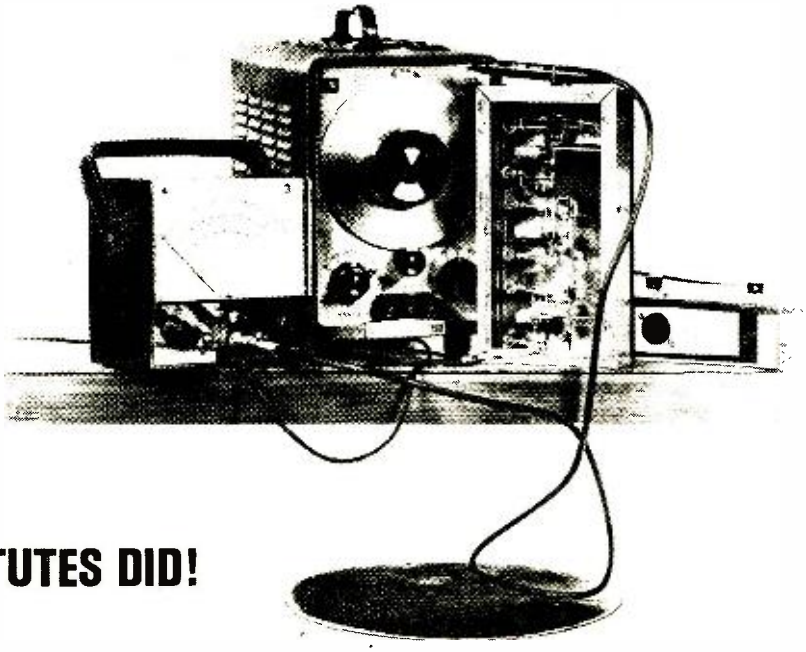
SONAR RADIO CORPORATION, 73 Wortman Ave., Bklyn. 7, N.Y.
Please send complete information FR101/102 Monitor Receiver.
Dept. 511

Name _____
Address _____
City _____ State _____

CIRCLE NO. 36 ON READER SERVICE PAGE

www.americanradiohistory.com

SOMEONE SHOULD DEVELOP AN EASY WAY TO LEARN ELECTRONICS AT HOME



RCA INSTITUTES DID!

Here is a whole new approach to learning electronics at home! RCA Institutes, one of the nations' largest schools devoted to electronics, has developed a faster, easier way for you to gain the skills and the knowledge you need for the career of your choice. Here for the first time, is a student-proved, scientifically designed way to learn. If you have had any doubts in the past about home training in electronics —if you have hesitated because you thought you might not be able to keep up—or that electronics was too complicated to learn—here is your answer! Read how RCA Institutes has revolutionized its entire home training ideas!

www.americanradiohistory.com

NEW CAREER PROGRAMS
BEGIN WITH "AUTOTEXT" INSTRUCTION METHOD!

Start to learn the field of your choice immediately!

No previous training or experience in electronics needed!

With this new revolutionized method of home training you pick the career of your choice—*and RCA Institutes trains you for it.* RCA's Career Programs assure you that everything you learn will help you go directly to the field that you have chosen! No wasted time learning things you'll never use on the job! The Career Program you choose is especially designed to get you into that career in the fastest, easiest possible way!

And each Career Program starts with the amazing "AUTOTEXT" Programmed Instruction Method—the new, faster way to learn that's almost automatic! "AUTOTEXT" helps even those who have had trouble with conventional home training methods in the past. This is the "Space Age" way to learn everything you need to know with the least amount of time and effort.

CHOOSE A CAREER PROGRAM NOW

Your next stop may be the job of your choice. Each one of these RCA Institutes Career Programs is a complete unit. It contains the know-how you need to step into a profitable career. Here are the names of the programs and the kinds of jobs they train you for. Which one is for you?

Television Servicing. Prepares you for a career as a TV Technician/Serviceman; Master Antenna Systems Technician; TV Laboratory Technician; Educational TV Technician.

FCC License Preparation. For those who want to become TV Station Engineers, Communications Laboratory Technicians, or Field Engineers.

Automation Electronics. Gets you ready to be an Automation Electronics Technician; Manufacturer's Representative; Industrial Electronics Technician.

Automatic Controls. Prepares you to be an Automatic Controls Electronics Technician; Industrial Laboratory Technician; Maintenance Technician; Field Engineer.

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

Telecommunications. For a job as TV Station Engineer, Mobile Communications Technician, Marine Radio Technician.

Industrial Electronics. For jobs as Industrial Electronics Technicians; Field Engineers; Maintenance Technicians; Industrial Laboratory Technicians.

Nuclear Instrumentation. For those who want careers as Nuclear Instrumentation Electronics Technicians; Industrial Laboratory Technicians; Industrial Electronics Technicians.

Solid State Electronics. Become a specialist in the Semiconductor Field.

Electronics Drafting. Junior Draftsman, Junior Technical Illustrator; Parts Inspector; Design Draftsman Trainee Chartist.

SEPARATE COURSES

In addition, in order to meet specific needs, RCA Institutes offers a wide variety of separate courses which may be taken independently of the Career Programs, on all subjects from Electronics Fundamentals to Computer Programming. Complete information will be sent with your other materials.

LIBERAL TUITION PLAN

RCA offers you a unique Liberal Tuition Plan—your most economical way to learn. You pay for lessons only as you order them. No long term contracts. If you wish to stop your training for any reason, you may do so and not owe one cent until you resume the course.

VALUABLE EQUIPMENT

You receive valuable equipment to keep and use on the job—and you never have to take apart one piece to build another. **New—Programmed Electronics Breadboard.** You now will receive a scientifically programmed electronic breadboard with your study material. This breadboard provides limitless experimentation with basic electrical and electronic circuits involving vacuum tubes and transistors and includes the construction of a working signal generator and superheterodyne AM Receiver.

Bonus From RCA—Multimeter and Oscilloscope Kits. At no additional cost, you will receive with every RCA Institutes Career Program the instruments and kit material you need to build a multimeter and oscilloscope. The inclusion of both these kits is an RCA extra.

CLASSROOM TRAINING ALSO AVAILABLE

RCA Institutes maintains one of the largest schools of its kind in New York City where classroom and laboratory training is available in day or evening sessions. You may be admitted without any previous technical training; preparatory courses are available if you haven't completed high school. Coeducational classes start four times a year.

FREE PLACEMENT SERVICE

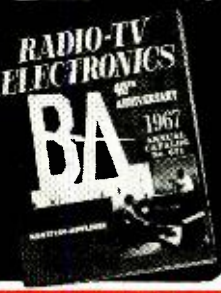
In recent years, 9 out of 10 Resident School students who used the Free Placement Service had their jobs waiting for them when they graduated. And many of these jobs were with top companies in the field—such as IBM, Bell Telephone Labs, General Electric, RCA, and radio and TV stations and other communications systems throughout the world.

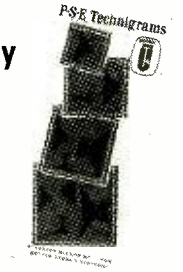
SEND ATTACHED POSTAGE PAID CARD FOR COMPLETE INFORMATION, NO OBLIGATION. NO SALESMAN WILL CALL. FREE BOOK INCLUDED. CHECK HOME STUDY OR CLASSROOM TRAINING.

RCA INSTITUTES, Inc., Dept. PE-D6
A Service of Radio Corporation of America
350 West 4th St., New York, N.Y. 10014

The Most Trusted Name in Electronics

www.americanradiohistory.com

FREE!
BIGGER . . . BETTER THAN EVER!
40th ANNIVERSARY 1967 CATALOG

YOUR BUYING GUIDE FOR: ● Stereo & Hi-Fi Systems & Components. ● Tape Recorders. ● Electronics Parts, Tubes, Tools. ● Phonos & Records. ● Ham Gear. ● Test Instruments & Kits. ● Cameras & Film. ● PA. ● Citizens Band. ● Radio & TV Sets. ● Musical Instruments.
SEND FOR YOURS TODAY!
BURSTEIN-APPLEBEE CO.
Dept. PE 1012 McGee, Kansas City, Mo. 64106
☐ Rush me the FREE 1967 B-A Catalog.
Name.....
Address.....
City.....State.....Zip Code.....
CIRCLE NO. 6 ON READER SERVICE PAGE

Plan and build your speaker system of tomorrow today!
The P.S.E. Way
University's PSE — Planned Speaker Expansion is a master blueprint for better stereo speaker systems. See your University Dealer today, or write for your FREE PSE Technigrams.


UNIVERSITY SOUND
A DIVISION OF LTV LING ALTEC, INC.
Dept. M64 P.O. Box 1056, Oklahoma City, Okla.
Name_____
Address_____
City_____
State_____ Zip_____
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. Amboro*, Santa Cruz de la Sierra, has been noted once again on 4898 kHz (varies) and announcing as 4915 kHz. Signal is very weak.

www.americanradiohistory.com

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 xmtr 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 BBC at 2345. S/off varies from 0400 to 0500.

SHORT-WAVE ABBREVIATIONS

anmt—Announcement	kHz—Kilohertz
BBC—British Broadcasting Corporation	kW—Kilowatts
CBC—Canadian Broadcasting 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
	xmtr—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

How much performance can you expect from a $69.50 turntable?

The most...when it's the new Dual 1010A

Only Dual could bring 'Dual quality' into the medium price field. Like the widely acclaimed $129.50 Dual 1019, the new 1010A offers unrestricted flexibility of automatic and manual operation in either single play or changer mode. Famous Elevator-Action changer spindle interchanges with single play spindle. Free-floating low mass tone-arm with magnesium head, tracks flawlessly as low as 2 grams. Stylus overhang adjust assures minimum tracking error with any cartridge. Precise click stop adjust sets tracking force without need for external gauge. Powerful new Dual Hi-Torque motor maintains speed within 0.1% even when line voltage varies ± 10%.

No need to settle for an ordinary changer because of price. The 1010A will upgrade your entire system for very little additional cost. See your franchised United Audio dealer, or write for literature.

united audio Dual

535 MADISON AVE., NEW YORK, N.Y. 10022

CIRCLE NO. 41 ON READER SERVICE PAGE

www.americanradiohistory.com

The Heart of your Radio is Its

INSIST ON CQC*

*Controlled Quality Crystals available only from Texas Crystals dealers. Extensive precision testing throughout manufacture enables Texas Crystals to unconditionally guarantee their frequency control crystals. Use of Texas Crystals in space program and by other governmental agencies is evidence of the quality you can count on.

If your dealer can't supply your needs, send his name with your request for catalog to our plant nearest you.

TEXAS CRYSTALS
Division of Whitehall Electronics Corp.

1000 Crystal Drive
Fort Myers, Fla. 33901
Phone: 813-936-2109

4117 W. Jefferson Blvd.
Los Angeles, Calif. 90016
Phone: 213-731-2258

CIRCLE NO. 39 ON READER SERVICE PAGE

radio

USEFUL TOOL, ABSORBING HOBBY

RADIO is not only a useful tool for business and personal use, but can also be an enjoyable leisure time activity. Licensed radio amateurs partake in the full range of radio's fascinations with the encouragement of the Federal Communications Commission — Emergency and CD work, message relaying, building, designing, experimenting, modifying, DX chasing, contests and even ragchewing. **THE** mysteries of radio theory melt away, the erratic rhythms of Morse code begin to make sense when you base your study for an amateur license on the GATEWAY TO AMATEUR RADIO, a series of four booklets published by the hams' own society.

AMERICAN RADIO RELAY LEAGUE, Inc.
Newington, Connecticut 06111

The Radio Amateur's License Manual P12
Operating an Amateur Radio Station
$2.00 Learning the Radiotelegraph Code
How to Become a Radio Amateur

Name.....

Street.....

City.....State.....Zip.....

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 annt, 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).

www.americanradiohistory.com

SHORT-WAVE CONTRIBUTORS

Roger Camire *(WPE1GEK)*, Manchester, N. H.
William Read *(WPE1GTG)*, South Hadley Falls, Mass.
William Graham *(WPE2LMU)*, Binghamton, N. Y.
Frank Mather *(WPE2LWW)*, Buffalo, N. Y.
Kenneth Cohen *(WPE2LZJ)*, Woodbridge, N. J.
C. N. Coombe *(WPE2MOB)*, Trenton, N. J.
Alan Coles *(WPE2NUV)*, Leonia, N. J.
Bernard Kinahan, Jr., *(WPE2OEE)*, Yonkers, N. Y.
Bill Hafner *(WPE2OJJ)*, 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 *(WPE6GJW)*, Lynwood, Calif.
Mike Craig *(WPE6GPA)*, Tustin, Calif.
Robert Eddy *(WPE8EQW)*, 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. *(WPEØAE)*, 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.

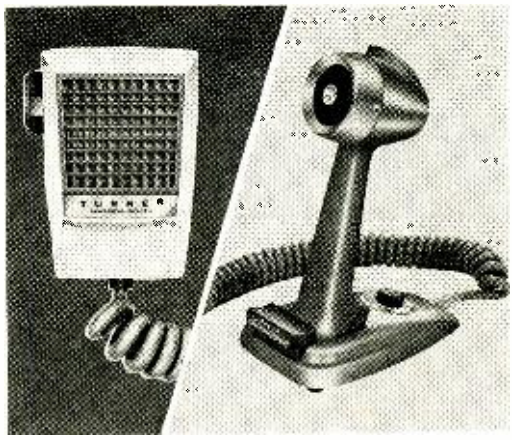
Mauritius—*R. Mauritius*, Forest Side, now operates, as per the latest schedule, at 0230-1300 on 9710 kHz and at 1300-1830 on 4850 kHz, both with 10 kW.

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

BUY 'EM BOTH...



AND GET THE LAST WORD.

Even more important, you get **every** word — with the "+2" microphone series. Through fingertip volume control, the "+2" gives you **up to 50 times** the modulation an ordinary mike can deliver, with just the turn of a dial. And with the companion "M+2" in your mobile rigs, you can be **sure** you'll get the last word . . . even at distances you hadn't thought possible.

Both "+2" series microphones use a two-transistor pre-amp to return life to your old transceivers; and both work efficiently with all transistor and tube sets. So why settle for a limited signal range, or a base station mike that'll do the job and a mobile mike that falls short? Talk to your CB dealer or distributor soon, to find out just what the Turner "+2" series can do for you.

And remember — it's no fun to hear if you can't talk back. Get the last word in microphone performance — the "+2" and the "M+2" . . . from Turner.

THE TURNER MICROPHONE COMPANY
919 — 17th Street N. E.
Cedar Rapids, Iowa

In Canada: Tri-Tel Associates, Ltd.
Export: Ad Auriema, Inc., 85 Broad Street, New York, N. Y. 10004

CIRCLE NO. 40 ON READER SERVICE PAGE

www.americanradiohistory.com

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 (WPEØEKU), 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 (WPE6EEO), 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 (WPE1GQK), East Hartford, Conn.
Russell Feran (WPE5CXT), New Orleans, La.
Harry Dence, Jr. (WPE4IKY), Cynthiana, Ky.
Calvin Bright (WPE8ISA), Grass Lake, Mich.
Donald Lee (WPE3EVB), Lebanon, Pa.
Richard Cooper (WPE1GHI), Wayland, Mass.
W. E. Raczko (WPE8JBT), Toledo, Ohio
Kelly Andrews (WPE4IGA), Goldsboro, N. C.
Philip Smith (WPE8IIA), Kettering, Ohio
Jack Palladay, Jr. (WPE9EOE), 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 (WPE9HQG), Winnetka, Ill.
Romona Hagerman (WPE2OBV), 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 (WPEØEHF), Hampton, Iowa
Charles Angell (WPE3TP), Collegeville, Pa.
Robert Mayer (WPE9HQG), Winnetka, Ill.
Ronald Stoltz (WPE3GCE), 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 (WPEØEMD), Independence, Mo.
Ben Hughes (WPEØEMX), 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 (WPE2OOW), 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 (WPE8CM), 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 (WPEØEPG), 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.

www.americanradiohistory.com

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 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. Torar*. The latter bears further checking.

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

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.

TELEX

FOR HAM QUALITY

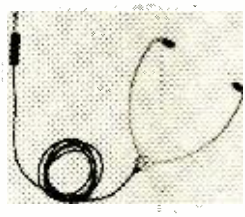
The quality of Telex headsets has become well known to hams over the last twenty-five years. Here are three Telex headsets that deliver the kind of top grade performance that hams expect from Telex—

MAGNA-TWIN

For absolute maximum intelligibility under difficult QRM conditions . . . Super-comfort foam cushions . . . Rugged, moisture-proof magnetic drivers give broad response, excellent sensitivity . . . Sturdy construction of high impact plastic.

TELESET

Lightweight, economy version of the famous Magna-Twin . . . High performance, shock-proof Magna-Twin drivers . . . Designed especially for ham requirements.



MONOSET

Feather-light at 1.2 oz. . . . Eliminates headset fatigue . . . Sound from replaceable driver is fed directly into your ears through adjustable tone arms . . . Telex quality construction assures reliability.

Write for descriptive literature today.

TELEX/*Acoustic Products*
COMMUNICATIONS ACCESSORIES
3054 Excelsior Blvd. • Minneapolis 16, Minn.

CIRCLE NO. 38 ON READER SERVICE PAGE

www.americanradiohistory.com

INDEX

TO VOLUME 25

JULY—DEC. 1966

AMATEUR RADIO

AUTOMOTIVE ELECTRONICS

CITIZENS BAND RADIO

CONSTRUCTION

FEATURE ARTICLES

www.americanradiohistory.com

HI-FI/STEREO AND AUDIO

PRODUCT REPORTS

SCIENCE FAIR PROJECTS

SHORT-WAVE LISTENING

SOLID-STATE CIRCUITS

TELEVISION

TEST EQUIPMENT

www.americanradiohistory.com

Olson®

FREE

Fill in coupon for a FREE One Year Subscription to OLSON ELECTRONICS' Fantastic Value Packed Catalog—Unheard of LOW, LOW PRICES on Brand Name Speakers, Changers, Tubes, Tools, Stereo Amps, Tuners, CB, and other Values. Credit plan available.

NAME _____

ADDRESS _____

CITY _____ STATE _____ ZIP ____

If you have a friend interested in electronics send his name and address for a FREE subscription also.

OLSON ELECTRONICS
INCORPORATED
539 S. Forge Street Akron, Ohio 44308

CIRCLE NO. 30 ON READER SERVICE PAGE

PERMANENT PROTECTION!
POPULAR
ELECTRONICS
Deluxe Magazine Files that hold a full year's copies!

Designed to keep your periodicals orderly and easy to refer to. These durable files guard against soiling, tearing, wear or misplacement of issues. They look, feel like leather and are washable! 23kt. gold lettering and exquisite 2-color binding make them highly-decorative additions to your bookshelves.

Shipped POSTPAID! FULLY GUARANTEED!
Only $3.50 each—3 for $10, 6 for $19!

Jesse Jones Box Corp., Box 5120, Dept. PE
Philadelphia 41, Pa.

Enclosed is $_____. Please send me_____ Popular Electronics Magazine Files in the colors checked below:

☐ Black backing/maroon sides
☐ Maroon backing/black sides

NAME _____

ADDRESS _____

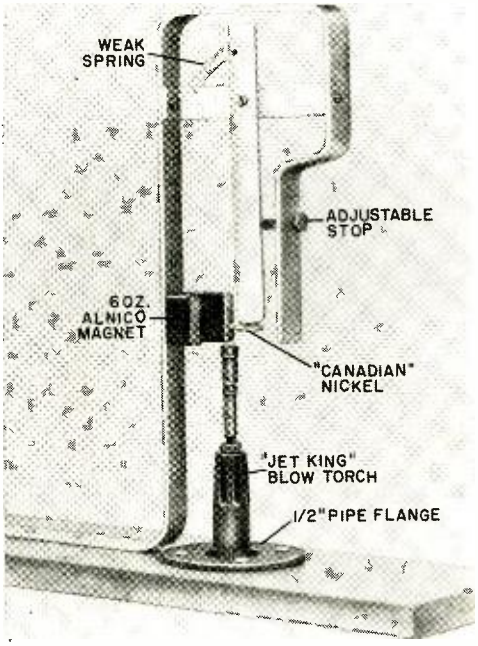
CITY _____ STATE _____ ZIP CODE _____

Orders outside U.S.A. please add $1 additional for each file ordered.

(Payment must accompany order)

THERMOMAGNETIC MOTOR

(*Continued from page 71*)



You can build motor frame with Reynolds stock aluminum, wood board, and pipe flange in half an hour.

alnico magnet, purchased at the local hardware store for $1.25, served the purpose admirably.

Almost any magnetic material can be used for the magnetic rider. Iron is an obvious choice because of its availability (nails, paper clips, and a host of other common items). However, nickel is better since it has a much lower Curie temperature. But don't bother trying to use United States nickels—they are made of a non-magnetic nickel-copper alloy. However, Canadian nickels are quite magnetic and will work very well.

A limitless number of variations of the basic thermomagnetic motor can be devised. A few of Nikola Tesla's variations can be seen in his patent drawings. Tesla was granted two patents (numbers 396,121 and 428,057) for his invention of the thermomagnetic motor, copies of which can be obtained for 50 cents each from the Commissioner of Patents, Washington, D.C. —30—

www.americanradiohistory.com

ELECTRONICS MARKET PLACE

COMMERCIAL RATE: For firms or individuals offering commercial products or services. $1.00 per word (including name and address). Minimum order $10.00. Payment must accompany copy except when ads are placed by accredited advertising agencies. Frequency discount: 5% for 6 months; 10% for 12 months paid in advance.

READER RATE: For individuals with a personal item to buy or sell. 60c per word (including name and address). No Minimum! Payment must accompany copy.

GENERAL INFORMATION: First word in all ads set in bold caps at no extra charge. Additional words may be set in bold caps at 10¢ extra per word. All copy subject to publisher's approval. Closing Date: 1st of the 2nd preceding month (for example, March issue closes January 1st). Send order and remittance to: Hal Cymes, POPULAR ELECTRONICS, One Park Avenue, New York, New York 10016.

FOR SALE

FREE! Giant bargain catalog on transistors, diodes, rectifiers, SCR's, zeners, parts. Poly Paks, P.O. Box 942, Lynnfield, Mass.

MESHNA'S TRANSISTORIZED CONVERTER KIT $5.00. Two models converts car radio to receive 30-50 mc or 100-200 mc (one mc tuning). Meshna, North Reading, Mass. 01864.

GOVERNMENT Surplus Receivers, Transmitters, Snooperscopes, Radios, Parts, Picture Catalog 25¢. **Meshna,** Nahant, Mass. 09108.

CANADIANS—GIANT Surplus Bargain Packed Catalogs. Electronics, Hi-Fi, Shortwave, Amateur, Citizens Radio. Rush $1.00 (Refunded). ETCO, Dept. Z., Box 741, Montreal, **CANADA.**

WEBBER LAB'S Police—Fire Transistorized Converter kit 30-50mc. & 100-200mc. (1 mc. spread) $5.00 each. 26-200mc. on broadcast band using any type radio, crystal controlled $23.00 wired pp. tunable—crystal controlled $11.00 kit. 72 Cottage Street, Lynn, Mass.

JAPAN & Hong Kong Electronics Directory. Products, components, supplies. 50 firms—just $1.00. Ippano Kaisha Ltd., Box 6266, Spokane, Washington 99207.

CANADIANS, TRANSISTORS AND PARTS. Free catalogue contains reference data on 300 transistors. J. & J. Electronics, Dept. PE, Box 1437, Winnipeg, Manitoba.

CANADIANS—Free catalogue radio TV parts, electronics. Gladstone Electronics, 1923 Avenue Rd., Toronto, Canada.

TRANSISTORS—Miniature Electronic Parts. Send for free Catalog. Electronic Control Design Company, **P. O.** Box 1432K, Plainfield, N.J.

INVESTIGATORS, FREE BROCHURE, LATEST SUBMINIATURE ELECTRONIC SURVEILLANCE EQUIPMENT, ACE ELECTRONICS, 11500-L NW 7TH AVE., MIAMI, FLA. 33168.

SEE YOURSELF ON TV! Closed-circuit **TV CAMERA KITS** for experimenters, industry, schools. Wide selection of tube and transistor models, $18.95 up. **EASY-TO-FOLLOW PLANS** included **FREE** with each kit or available separately ($3 to $5)—refundable with later order. **CHECK OUR UNBELIEVABLE PRICES.** Informative catalog 10¢. **ATV RESEARCH,** Box 396P, So. Sioux City, Neb. 68776.

CB-WPE-QSL CARDS. Same High Quality, Beautiful, Glossy multi-color cards. New **LOW PRICES. 26 SAMPLES,** 25¢. Dick, W8VXK, 19QA0625, Gladwin, Mich. 48624.

R.F. CONVERTERS. World's largest selection. Also CCTV cameras, transmitters, etc. Lowest factory prices. Catalog 10¢. Vanguard 196-23 Jamaica Ave., Hollis, N.Y. 11423.

GIANT TESLA COIL—FORTY-INCH SPARKS! Complete plans $5.00. Details, color photo 50¢ (deductible). Huntington Electronics, Inc., Box 9 Huntington Station, Shelton, Conn. 06484.

TELEPHONE VOICE SWITCH: (LS-500). ACTUATES AUTOMATICALLY AND UNATTENDED ANY TAPE OR WIRE RECORDER. PICTORIAL INSTALLATION INSTRUCTIONS INCLUDED. $23.75. POST PAID USA, WJS ELECTRONICS. 737 NORTH SEWARD, HOLLYWOOD, CALIF. 90038.

ELECTRONIC "CRACKAJACKS," relays, transistors, photocells, etc. Guaranteed prizes. $1.00 ppd. **DART ELECTRONICS,** Box 214, Jericho, N.Y.

ORIENTAL Electronics Directory. 200 Japanese—Hong Kong Manufacturing Exporters. All products. $2. Dee, Box 211, Beverly Hills, Calif. 90213.

INVESTIGATORS: KEEP IN STEP WITH ADVANCEMENTS IN THE ART OF ELECTRONICS FOR THE PROFESSIONAL. SEND $1.00 FOR EQUIPMENT BROCHURE. WJS ELECTRONICS, 737 NORTH SEWARD, HOLLYWOOD, CALIF. 90038.

BUG DETECTOR: WILL DETECT AND LOCATE SURREPTITIOUS TRANSMITTING DEVICES IN CONFERENCE ROOMS, HOME AND OFFICES, ETC. WRITE FOR DETAILS. WJS ELECTRONICS, 737 NORTH SEWARD, HOLLYWOOD, CALIF. 90038.

RECTIFIERS, transistors, other components. Catalog free. Electronic Components Co., Box 2902C, Baton Rouge, La.

TRANSISTORIZED Products Importers catalog. $1.00. Intercontinental, CPO 1717, Tokyo, Japan.

RADIO – T.V. Tubes—33¢ each. Send for free catalog. Cornell. 4213 University, San Diego, Calif. 92105.

CIRCUIT Boards, Parts for "Poptronics" projects. Free catalog. **DEMCO,** Box 16297, San Antonio, Texas 78216.

ROCKETS: Ideal for miniature transmitter tests. New illustrated catalog, 25¢. Single and multistage kits, cones, engines, launchers, trackers, rocket aerial cameras, technical information. Fast service. Estes Industries, Penrose 18, Colorado.

COMPONENTS? Kits? Hardware? For catalogue write Trans-Vu-Pacs, Box 267, Chelsea, Mass. 02150.

LOWEST Prices Electronic Parts. Confidential Catalog Free. **KNAPP,** 3174 8th Ave. S.W., Largo, Fla.

SURVEILLANCE EQUIPMENT—NEW HIGH PERFORMANCE SUBMINIATURE MODELS. ELECTRONIC COUNTERMEASURE DEVICES TO PROTECT PRIVACY. FREE DATA: SECURITY ELECTRONICS-PE, 15 EAST 43RD STREET, NEW YORK, N.Y. 10017.

SURPRISE electronics equipment $5.00, $10.00 package. Tang, Box 162, Framingham Center, Mass. 01701.

CB-QSL CARDS, New Designs, Record Books, Blabbermouth Awards, Gag Signs, Warning Decals, Novelties. Free Brochure. **WOODY,** 8474 Watson, St. Louis, Mo. 63119.

CRYSTALS . . . largest selection in United States at lowest prices. 48 hr. delivery. Thousands of frequencies in stock. Types include HC6/U, HC18/U, FT-241, FT-243, FT-171, etc. Send 10¢ for catalog with oscillator circuits. Refunded on first order. Jan Crystals, 2400F Crystal Dr., Fort Myers, Fla. 33901.

McGEE RADIO COMPANY. Big 1966-1967 catalog sent free. America's best values. HiFi Amplifiers—speakers—electronic parts. Send name, address and zip code number to McGee Radio Company, 1901 McGee Street, Dept. EG, Kansas City, Missouri 64108.

SAFEGUARD YOUR PRIVACY. Learn the facts, procedures and techniques in the art of de-bugging your home, office, boardroom or auto. $7.95. Tron-X, Post Office Box 38155, Hollywood, Calif. 90038.

www.americanradiohistory.com

HIFI speaker system. Small, walnut. Magnificent. $29.95. TANG, Box 162A, Framingham Ctr., Mass. 01701.

HOBBYISTS, EXPERIMENTERS, AMATEUR SCIENTISTS, STUDENTS . . . CONSTRUCTION PLANS—All complete including drawings, schematics, parts lists, prices, parts sources . . . **LASER**—Build your own coherent-light optical laser. Operates in the pulsed mode, in the visible light range—$6.00 . . . **DIODE LASER**—Invisible light (infrared) can be continuously modulated—$3.00 . . . **REVERBERATOR (ECHO) UNIT**—Build your own. Use with your automobile radio, home radio or hifi, electric guitar, etc.—$3.00 . . . **RADAR**—Build your own ultrasonic doppler radar. Detect motion of people, automobiles, even falling rain drops. Transistorized, uses standard small 9-volt battery—$4.00 . . . **TV CAMERA**—Build your own. The real thing—no rotating disc. Uses 5 tubes plus videcon tube. Output: 72 ohms or receive on any TV set channel 2-6. Excellent circuit—good picture—$6.00 . . . **STROBOSCOPE**—Flash rate variable from about 10 to 1,000 flashes per second. Stop effect will allow you to view rotating or oscillating objects while in motion —$3.00 . . . **STEREO AMPLIFIER**—Uses two 6T9 compactrons—for stereo phono, tuner, etc.—$3.00 . . . **TWO-WAY TALK OVER FLASHLIGHT BEAMS**—Hand-held microphone, loudspeaker volume. Use in daylight or darkness —$3.00 . . . **VIBRATO UNIT**—Use with electric guitar and other musical instrument amplifiers. Uses two transistors and two 9V batteries—$3.00 . . . **VOLUME COMPRESSOR/EXPANDER**—Use with your HiFi—$4.00 . . . **LONG-RANGE "SOUND TELESCOPE"**—This amazing device can enable you to hear conversations, birds and animals, other sounds hundreds of feet away. Very directional. Transistorized. Uses 9V battery—$3.00 . . . **CIGAR BOX ELECTRIC ORGAN**—Portable, self-contained battery. Eight notes, one octave. Two transistors, 9V battery—$3.00 . . . **ANALOG COMPUTER**—Multiply, divide, add, subtract, square and find square roots. Uses two flashlight batteries—$3.00 . . . **BINARY READOUT**—Program in decimal numbers and readout binary—$3.00 . . . **SOLID STATE BINARY COUNTER (COMPUTER-ADDER)**—Uses transistor flip-flop stages. Lightbulb readout. Punch in pulses, read binary count. Five stage. Includes easy to understand discussion of decimal to binary arithmetic conversion. Excellent start in digital computer technology—$6.00 . . . **TECHNICAL WRITERS GROUP, Box 5501, STATE COLLEGE STATION, RALEIGH, N.C. 27607.**

DETECTIVES! Free Brochures! Electronic Surveillance Devices. **SILMAR ELECTRONICS,** 3476 N.W. 7th Street, Miami, Fla. 33125.

FREE ELECTRONICS (new and surplus) parts catalog. We repair multimeters. Bigelow Electronics, Bluffton, Ohio 45817.

NEW supersensitive transistor instrument detects buried gold, silver, coins. Kits, assembled models. $19.95 up. Free catalog. Relco-A33, Box 10563, Houston 18, Texas.

CONVERT any television to sensitive, big-screen oscilloscope. Only minor changes required. No electronic experience necessary. Illustrated plans, $2.00. Relco-A33, Box 10563, Houston 18, Texas.

WE SELL CONSTRUCTION PLANS. AMAZING NEW SUPER HOBBY CATALOG 25¢. **TELEPHONE:** Answering Machines, Speaker Phones, Mobile Phones, Automatic Dialers, Central Dial Systems, Phonevision, Legal Connectors, Laser Links. **TELEVISION:** Cameras, 3D Converters, Color TV Converters, Video Recorders. **HOBBYIST:** Teletypes, Electron Microscopes, Tranquilizers, Private Eye Tail Transmitter. Plans $4.95 Each. **COURSES:** Electronics, $22.75; Detective Electronics, $22.50; Telephone Engineering, $39.50. Don Britton Enterprises, 7906 Santa Monica Blvd., Hollywood, Calif. 90046.

POLICE—AIRCRAFT—EMERGENCY CALLS on your broadcast radio with **TUNAVERTER!** Economical—Practical! Tune the Band! Only $29.95! **FREE** catalog. Salch & Co., Dept. 1 Woodsboro, Texas 78393.

LINE TRANSFORMER 2.5KW, four isolated windings 115V-21 amps 50/60cy 12x11x12 any combinations of 115-230V possible, 95 lbs. $44.95, **GREAT BUYS** catalog 10¢. Fertik's, 5249 "D" St., Philadelphia, Pa. 19120.

DIAGRAMS for repairing Radios $1.00. Television $2.50. Give make model. Diagram Service, Box 1151 PE, Manchester, Connecticut 06042.

EXPERIMENTER'S GIANT Catalog 250 exclusive items—25¢, refundable. Laboratories, 12041-L Sheridan, Garden Grove, Calif. 92640.

WORLD'S Tiniest Radios. Recorders, Transceivers, Portables. Free Catalog. Minitronics, 1983-1065 Via Del Rio, Corona, California 91720.

PRINTED CIRCUIT BOARDS, made to specifications. Free catalogue. C&S, 366 Marie Ct., East Meadow, N.Y. 11554.

ELECTRONIC Ignition Kits, Components, Free Diagrams. Anderson Engineering, Epsom, New Hampshire 03239.

FREE catalog of transistors, diodes, parts, equipment. Surabachi Electronics, 214 E. Brett, Inglewood, California 90302.

CB-QSL CARDS—Fast service. One color 1000, $10.50. Humphries, P.O. Box 574, Bacliff, Texas 77518.

FREE CATALOG Transistors, Diodes, Parts. Solid State Pax, P.O. Box 206, Dorchester, Mass. 02124.

SACRIFICE: Personal inventory. Test equipment, tape recorders, components. Send 25¢ for catalog. Robert Willis, Box 35305, Georgia Tech, Atlanta, Georgia 30332.

NEED RESISTORS? Standard ½-watt, 10% carbon 5¢ each, Postpaid. Minimum order $1.00. **FREE SAMPLE** and order blank. **TEPCO,** Box 508, Tullahoma, Tenn. 37388.

ELECTRONIC SURVEILLANCE DEVICES, detectives, hobbyists. **SNOOPER FM** wireless microphone $44.50. **TAILABEEP,** bumper beeper $99.50. **TELEGAB** phone transmitter $49.50. Other guaranteed high quality items in our catalog. Fudalla Associates, 1134 Avenue Road, Toronto 12, Ontario, Canada.

ELECTRONIC ignition Kits, Components, Free Diagrams. Anderson Engineering, Epsom, New Hampshire 03239.

ACHTUNG! Das machine is nicht fur Gerfingerpoken und mittengraben. Is easy schnappen der Springenwerk, blowenfusen und poppencorken mit spitzensparken. Ist nicht fur gerwerken by das Dummkopfen. Das rubbernecken sightseeren keepen hands in das pockets. Relaxen und watch das Blinkenlights. This attractive, brass metal plaque only $2.00 each, ppd. Southwest Agents, Dept. P, P.O. Box 12283, Fort Worth, Texas 76116.

SHORTWAVE LISTENING

SWL GUIDE, English programs listed by the hour. **REVISED EDITION,** $2.00. SWL Guide, 218 Gifford, Syracuse 2, N. Y.

HAM EQUIPMENT

CBers, HAMS, SWL's! 3-30 MC Preselector kit, $18.98. CB booster Kits. Novice transceiver kit, $29.95. Free catalog. **HOLSTROM,** Box 8640-E, Sacramento, Calif.

HIGH FIDELITY

"LOW, Low quotes: all components and recorders. HiFi, Roslyn 9, Penna."

HI-FI Components, Tape Recorders, at guaranteed "We Will Not Be Undersold" prices. 15-day money-back guarantee. Two-year warranty. No Catalog. Quotations Free. Hi-Fidelity Center, 239 (P) East 149th Street, New York 10451.

FREE! Send for money saving stereo catalog #**P12E** and lowest quotations on your individual component, tape recorder, or system requirements. Electronic Values, Inc., 200 W. 20th St., New York, N.Y. 10011.

TONE-CONTROL preamplifier. Low-noise FET design. 25 db bass and treble boost. 20 db treble cut. $35. Vernon Ritter, Nittany Avenue, Boalsburg, Pennsylvania 16827.

www.americanradiohistory.com

TAPE AND RECORDERS

BEFORE Renting Stereo Tapes try us. Postpaid both ways —no deposit—immediate delivery. Quality—Dependability —Service—Satisfaction—prevail here. If you've been dissatisfied in the past, your initial order will prove this is no idle boast. Free Catalog. Gold Coast Tape Library, Box 2262, Palm Village Station, Hialeah, Fla. 33012.

RENT 4-TRACK STEREO TAPES—Dependable service our keynote—**ALL MAJOR LABELS—FREE CATALOG** (48 States)—**TRIMOR** Company, P.O. Box 748, Flushing, N.Y. 11352.

STEREO TAPES. Save up to 60% (no membership fees, postpaid anywhere U.S.A.). Free 60 page catalog. We discount batteries, recorders, tape accessories. Beware of slogans "not undersold," as the discount information you supply our competitor is usually reported to the factory. **SAXITONE,** 1776 Columbia Road, Washington, D.C.

AUTOMATIC telephone connection for Concord and other transistorized recorders. **SURVEILLANCE** and Privacy Protection Devices. Free Data: Security Electronics-PER, 15 East 43rd Street, New York, N.Y. 10017.

TAPE transport. NAB recording studio quality. Build yourself for amazingly low cost. Detailed plans $5.00. Free particulars. Pepke Laboratories, 309-B West 19 Street, New York, N.Y. 10011.

TAPE-MATES now offers **ALL TAPES—ALL LABELS** at **TREMENDOUS SAVINGS** plus **FREE** Tape-Mates membership. For **FREE** brochure write **TAPE-MATES,** 5727-PE W. Jefferson Blvd., Los Angeles 90016.

TAPES. TAPE RECORDERS—sold, exchanged. Free catalog. Tower, Lafayette Hill, Pa. 19444.

TAPE RECORDER SALE. Brand new, latest models, $10.00 above cost. Arkay Sales, 1028-C Commonwealth Ave., Boston, Mass. 02215.

RENT Stereo Tapes—over 2,500 different—all major labels—free brochure. Stereo—Parti, 1616-PE Terrace Way, Santa Rosa, California.

TAPE RECORDERS, Hi-Fi, components, Sleep Learning Equipment, tapes. Unusual Values Free Catalog. Dressner, 1523R, Jericho Turnpike, New Hyde Park, N. Y. 11040.

EXCHANGE STEREO TAPES. Catalog. Art's, 4431A Avocado Street, Hollywood, Calif. 90027.

TUBES

BEFORE You Buy Receiving Tubes, Transistors, Diodes, Electronic Components and Accessories . . . send for Giant Free Zalytron Current Catalog, featuring Standard Brand Tubes: RCA, GE, etc.—all Brand new Premium Quality Individually Boxed, One Year Guarantee—all at Biggest Discounts in America! We serve professional servicemen, hobbyists, experimenters, engineers, technicians. Why Pay More? Zalytron Tube Corp., 469-E Jericho Turnpike, Mineola, N. Y. 11502.

TUBE Headquarters of World! Send 10¢ for Catalog (tubes, electronic equipment) Barry, 512 Broadway, N.Y.C. 10012.

TUBES "Oldies", latest. Lists free. Steinmetz, 7519 Maplewood, Hammond, Indiana 46324.

FREE Catalog. Electronic parts, tubes. Wholesale. Thousands of items. Unbeatable prices. Arcturus Electronics ZD, 502-22 St., Union City, N.J. 07087.

RADIO & T.V. Tubes—33¢ each. Send for free list. Cornell, 4213 University, San Diego, Calif. 92105.

TOOOOBES: HIFI, Transmitting, Special Purpose. Brand **NEW**—Lowest Prices. **CATALOG!!!** Vanbar Distributors, Box 444F, Stirling, New Jersey 07980.

WANTED

CASH Paid! Unused tubes, electronic equipment. Barry, 512 Broadway, N.Y.C. 10012.

HARD-TO-GET TUBES IN STOCK

BRAND NEW—1 YR. GUARANTEE

Type	Price	Type	Price	Type	Price	Type	Price	Type	Price
200-00A	2.00	6AC5	2.25	6J6A	.70	7Q7	1.85	14N7	1.95
01A	2.75	6AC7	1.75	6J7	1.88	7R7	2.25	14Q7	2.25
0C3-D3	.85	6AE3	1.05	6J7G/GT	1.75	7S7	1.79	14R7	2.50
OD3	.75	6AG5	1.03	6J8	2.50	7W7	1.74	14S7	1.95
1A7	1.75	6AG7	2.25	6K6GT	.93	7X6	2.49	14W7	1.85
1B3	.88	6AH4	1.10	6K7	1.90	7X7	1.35	14X7	1.75
1H5	1.50	6AK5	.80	6L6G	1.15	7Y4	2.85	14Y4	1.75
1L6	6.25	6AL3	1.00	6L6GC	1.50	7Y7	2.35	19	1.00
1LA4	1.30	6AL7	2.40	6L7M	2.58	7Z4	1.79	22	1.15
1LA6	1.98	6AM8	1.15	6M7M	.90	8AU8	1.63	24A	1.50
1LC5	1.05	6AN8	1.43	6P5	2.50	8BQ5	1.18	25C5	.75
1LC6	1.80	6AQ7	1.33	6Q7	2.05	8CG7	.99	25CD6	1.94
1LD5	1.95	6AR5	.88	6S7	1.95	8FQ7	.99	25JN6	2.40
1LE3	1.25	6AS5	.95	6S8GT	1.60	8JN8	1.59	25L6	.80
1LH4	2.80	6AS7	3.15	6S7M	1.60	8JV8	1.59	25Z5	1.15
1LN5	2.25	6AT6	.72	6S7M	1.60	9A8	1.59	25Z6	1.10
1N2A	1.60	6AT8	1.25	6S7T	2.45	9U8	1.30	26	1.60
1N5	1.85	6AU4	1.28	6S7T	1.49	9U8	1.30	27	1.75
1P5	2.00	6AU5	1.60	6S7S	.98	10DE7	1.14	30	1.40
1R4	.80	6AU6	.68	6S7T	2.40	10DR7	1.76	32	1.25
1R5	1.10	6AU8	1.50	6S7T	1.69	10KR8	1.86	32ET5	.88
1S5	1.10	6AW8	1.35	6S7H	1.50	12A8	2.95	33	1.15
1T5	.80	6AX4	.96	6S7GT	1.49	12AH7	1.99	33GT7	3.00
1U4	1.05	6AX5	.95	6S7M	1.65	12AT6	.59	34	1.25
1U5	.98	6AX7	1.25	6S7M	1.60	12AT7	.74	35A5	2.10
1V	2.00	6B4	5.95	6S7M	1.58	12AU6	.65	35L6	1.05
1V2	.83	6B7	2.75	6S7GT	.80	12AU7	.74	35W4	.47
2A3	3.75	6B8	2.66	6S7GT	.90	12AV6	.56	35Y4	1.62
2A5	2.50	6BR6	.68	6SQ7GT	1.33	12AX4	.84	35Z3	1.54
2A6	4.50	6BA8	1.35	6SQ7T	1.50	12AX7	.87	35Z5	.82
2B7	1.95	6BE6	.81	6SR7	1.50	12BA6	.59	36	1.50
2HA5	1.49	6BH6	.95	6S57M	1.15	12BE6	.59	37	1.25
2X2A	1.95	6BH8	1.35	6T8	1.20	12BH7	.96	38	1.25
3A3	.75	6BK5	1.35	6T9	1.46	12BQ6	1.35	39/44	1.25
3A5	1.10	6BK7	1.20	6U5	2.75	12BR7	1.08	41	1.50
3AU6	.82	6BQ6	1.42	6U8	1.00	12BY7	1.09	42	1.94
3B7	2.39	6BQ7	1.18	6V6GT	.79	12CU5	.95	43	2.75
3BN4	1.08	6BX7	1.95	6V6M	2.25	12K7	2.49	45/2A3	3.25
3BZ6	.83	6C4	.64	6W4	.86	12KBM	2.95	46	.95
3CB6	.82	6C5M	1.95	6W6GT	1.02	12L6	1.13	47	3.50
3DG4	1.48	6C6	2.50	6X4	.59	12L8	.50	48	4.00
3DT6	.88	6C8G	2.95	6X5GT	.69	12Q7	1.50	49	3.50
3Q5	2.00	6CA7	2.59	6X8A	1.00	12SA7	1.48	50	1.75
3V4	.95	6CG7	.75	6Y6GA	1.45	12SC7	1.50	50A1	3.50
4BQ7	1.45	6CG8	.95	6Z4/84	1.25	12SF5	.90	50C5	.85
4BU8	1.39	6CL6	1.45	7A4	2.25	12SF7	1.98	50X6	2.10
4BZ7	1.45	6CL8	1.50	7A5	2.05	12SG7	1.72	50Y6	1.55
4CB6	.82	6CM7	1.45	7A6	2.69	12SH7	1.50	50Y7	1.48
5AM8	1.40	6CQ8	1.39	7A7	2.70	12SJ7	1.50	53	3.50
5AN8	1.55	6CS7	1.10	7A8	2.95	12SK7	1.40	55	2.75
5AQ5	.82	6CW4	1.90	7AF7	2.34	12SL7	1.33	56	1.45
5AS8	1.64	6CX8	1.82	7AU7	.93	12SQ7	1.35	57	1.75
5AT8	1.44	6CZ5	1.75	7B4	2.52	12SR7	1.09	58	1.75
5AZ4	2.00	6D4	1.10	7B5	3.00	12V6	1.33	59	3.50
5BQ7	1.35	6D6	2.50	7B6	1.90	12W6	1.33	70L7	2.00
5BR8	1.50	6DA4	1.25	7B7	2.85	13GF7	1.75	71A	1.25
5CG8	1.19	6DN6	3.05	7B8	2.14	13JJ0	2.21	75	2.60
5HA7	1.20	6DN7	1.45	7C4	1.15	14A4	1.45	76	1.75
5J6	1.05	6DQ4	1.05	7C5	1.25	14A5	1.35	77	2.00
5U4	.59	6DQ5	2.25	7C6	2.75	14A7	1.85	78	1.75
5U8	1.19	6DQ6	1.00	7C7	1.28	14AF7	1.85	80	1.75
5V4	1.35	6E5	2.25	7E5	2.00	14B6	1.90	83	1.48
5W4	1.75	6F4	3.20	7E6	1.25	14B8	1.95	5881	3.00
5X8	1.30	6F5GT	1.72	7E7	1.95	14C5	1.75	6146	2.75
5Y3	.61	6F6G	1.95	7F7	2.84	14C7	2.33	6336	4.75
5Y4	1.45	6F7	4.39	7F8	3.10	14E6	1.39	6550	4.00
5Z3	1.54	6F8	3.08	7G7	2.25	14E7	1.39	807	.95
5Z4	3.00	6GJ5	2.40	7H7	1.95	14F7	3.10	KT-88	4.75
6A7	3.05	6GK5	1.66	7HG8	1.25	14F8	2.23		
6A8	2.49	6GK6	1.18	7J7	2.50	14H7	1.95		
6AB4	.80	6HZ8	2.38	7K7	3.05	14J7	1.95		
6AB7	.96	6J5G	1.34	7N7	2.71				

MINIMUM ORDER $5.00
POSTAGE EXTRA

Send for complete **TUBE CATALOG** *This Is A Partial List*

UNITED RADIO CO.
P.O. Box—1000 A12 NEWARK, N.J.

CIRCLE NO. 42 ON READER SERVICE PAGE

QUICKSILVER, Platinum, Silver, Gold. Ores Analyzed. Free Circular. Mercury Terminal, Norwood, Mass.

MILITARY SURPLUS EQUIPMENT NEEDED: ARC-34, ARC-38, ARC-44, ARC-52, ARC-54, ARC-55, ARC-66, ARC-73, ARC-84, ALSO ARN-14C, ARN-54, ARN-59. COLLINS 51X-2, 51V-3, 51Y-3, 51R-3, 17L-4, 17L-7, 618S-1, 18S-4. BENDIX TA-21, RA-21. APR-14, PRC-25, RT-66 THRU RT-70/GRC. APN-22, APN-117, APN-133. TEST SETS WANT WITH ARM, UPM, URM, USM, SG PREFIXES. TOP CASH DOLLAR PAID IMMEDIATELY. **SLEP ELECTRONICS CO.,** DRAWER 178-PE; ELLENTON, FLORIDA 33532, PHONE (813) 722-1843.

EQUIPMENT

FREE electronics catalog. Tremendous bargains. Send postcard. Electrolabs, Department C-672D, Hewlett, New York 11557.

REPAIRS AND SERVICES

TV Tuners rebuilt and aligned per manufacturers specification. Only $9.50. Any make **UHF** or VHF. We ship COD. Ninety day written guarantee. Ship complete with tubes or write for free mailing kit and dealer brochure. JW Electronics, Box 51C, Bloomington, Indiana.

www.americanradiohistory.com

INSTRUCTION

LEARN ELECTRONIC ORGAN SERVICING at home all makes including transistors. Experimental kit—trouble-shooting. Accredited NHSC, Free Booklet. **NILES BRYANT SCHOOL,** 3631 Stockton. Dept. A, Sacramento 20, Calif.

LEARN While Asleep, hypnotize with your recorder, phonograph. Astonishing details, sensational catalog free! Sleep-Learning Association, Box 24-ZD, Olympia, Wash.

FCC License in 6 weeks. First Class Radio telephone. Results Guaranteed. Elkins Radio School, 2603B Inwood, Dallas, Texas.

RE! First Class Radio Telephone License in (5) weeks Guaranteed. Tuition $295.00. Job placement free. Radio Engineering Institute, 1336 Main Street, Sarasota, Fla.

F.C.C. LICENSE (first class) in seven weeks. Resident classes or correspondence. Grantham, 1505 N. Western, Hollywood, California 90027.

HIGHLY—effective home study review for FCC commercial phone exams. Free literature! Cook's School of Electronics, P.O. Box 10634, Jackson, Miss. 39209.

"HOW TO MAKE MONEY WITH SIMPLE CARTOONS"—Everyone who likes to draw should have this book; **FREE.** Send name, zip code. Cartoonists' Exchange, 21312 Pleasant Hill, Ohio 45359.

FCC LICENSE THROUGH TAPE RECORDED INSTRUCTION. Bob Johnson Audio-Visual Training, 1060D Duncan, Manhattan Beach, Calif. 90266.

BINARY ARITHMETIC booklet. Learn the arithmetic of computers. $1.00. ECR Traders P-2, Box 3064, Falls Church Va. 22043.

HIGH SCHOOL DIPLOMA at home. Qualified instructors. Send age, highest grade completed, for free details. No salesman. **SOUTHERN STATES ACADEMY,** Professional Bldg., Dept. 5, Decatur, Ga.

GOVERNMENT SURPLUS

"GOVERNMENT SELLS".—Surplus Electronics; Oscilloscopes; Transceivers; Test Equipment; Radar; Walkie-Talkies; Boats; Jeeps; Aircraft; Misc.—Send For—"U.S. Depot Directory-Procedure"—$1.00—Service, Box 425 (ZE), Nanuet, N.Y.

GOVERNMENT Surplus. Complete Sales Directory $1.00. Surplus Publications, Box 45781E, Los Angeles 45, Calif.

JEEPS Typically From $53.90 . . . Trucks From $78.40 . . . Boats, Typewriters, Airplanes, Electronics Equipment, Photographic Equipment, used. 100,000 Bargains Direct From Government. Complete Sales Directory and Surplus Catalog $1.00 (Deductible First $10.00 Order). Surplus Service, Box 820-J, Holland, Mich. 49424.

REAL ESTATE

FREE Fall-Holidays CATALOG! Big 180 pages! Selected Best thruout the U.S. Thousands of properties described, pictured—Land, Farms, Homes, Businesses—Waterfront, Recreation, Retirement. 66 Years' service, 490 Offices, 36 states Coast to Coast. Mailed **FREE** from the World's Largest! **STROUT REALTY,** 60-ZD, East 42nd St., N.Y., N.Y. 10017.

PEACEFUL SOUTHERN UTAH VALLEY, 2½ Acres $250. Dept. ZD, Box 17401 Holladay, Utah.

CANADIAN VACATION LANDS: Full price $385.00. 40 acres, $10 month. Suitable cottage sites, hunting, fishing, investment. Free information, Land Corporation, 3768-P, Bathurst, Downsview, Ontario, Canada.

BOOKS

CANADIANS—Fabulous Electronic Book Catalog—listing over 500 Titles—Free. Books, Box 796A, Montreal.

FREE CATALOG. Adult Books. **POSTAL PE,** 2217 Lackland, St. Louis, Missouri 63114.

FREE Book. Prophet Elijah Coming Before Christ. Wonderful Bible Evidence. **PE** Megiddo Mission, Rochester, New York 14619.

INVENTIONS WANTED

INVENTIONS wanted. Patented; unpatented. Global Marketing Service, 2420-P 77th, Oakland 5, Calif.

INVENTIONS—IDEAS developed: **CASH/ROYALTY SALES.** Member: United States Chamber of Commerce. Raymond Lee, 130-G West 42nd, New York City 10036.

INVENTORS! Sell your invention for cash or royalties! Our client manufacturers eagerly seek new items. Patented. Unpatented. Financial assistance if needed. 25 years proven performance. For free information, write Dept. 20, Gilbert Adams, Invention Broker, 80 Wall St., New York 5, N.Y.

INVENTORS! Don't sell your invention, patented or unpatented, until you receive our offer. Eagle Development Company, Dept. P, 79 Wall Street, N.Y. 5, N.Y.

PATENT Searches including Maximum speed. full airmail report and closest patent copies, $6.00. Quality searches expertly administered. Complete secrecy guaranteed. Free Invention Protection forms and "Patent Information." Write Dept. 9, Washington Patent Office Search Bureau, 711 14th Street, N.W., Washington 5, D.C.

INVENTORS. We will develop, help sell your idea or invention, patented or unpatented. Our national manufacturer clients are urgently seeking new items for outright cash sale or royalties. Financial assistance available. 10 years proven performance. For free information, write Dept. 41, Wall Street Invention Brokerage, 79 Wall Street, New York 5, N.Y.

INVENTORS! Outright cash sale or royalties for your inventions. Patented. Unpatented. Active demand from our client manufacturers. Financial assistance available. Write Dept. 35, United States Invention Brokerage, 78 Wall Street, New York 5, N.Y.

INVENTIONS Wanted! Patented, unpatented. Extensive manufacturers lists. Free details: write Pioneer Invention Service, Dept. 79, 150 Broadway, New York, N.Y. 10038.

AUTHORS' SERVICES

AUTHORS! Learn how to have your book published, promoted, distributed. FREE booklet "ZD," Vantage, 120 West 31 St., New York 1.

SONGWRITERS WANTED. Send songs for recording—royalty contract. Tin Pan Alley, 1650-H Broadway, New York 10019.

RECORDS

REPLACE worn LP Jackets—white 20¢, colors 25¢. Min. shipment 20, samples 50¢. Jacket Supplies, Hillburn P.O., New York.

DORIC COMBO ORGAN RECORD. Hear the swinging sounds for 25¢, Doric Organs, Box 1, Convent, N.J. 07961.

MUSICAL INSTRUMENTS

ACCORDIONS, GUITARS, BAND INSTRUMENTS! Save to 50%. Terms. Trades. Free trial. Free catalog. Mention instrument. **MUSIC MART,** 5535-PE Belmont, Chicago 60641.

www.americanradiohistory.com

MUSIC

BE MAD. Buy M.A.D.. Enjoy "music-only" programs now broadcast on FM with MA's sub carrier detector plugged or wired into your tuner. Kit $49.50. Wired $75.00. List of FM stations with SCA authorization $1. Music Associated, 65 Glenwood Road, Upper Montclair, New Jersey (201) 744-3387.

POEMS wanted for new songs. Nashville Music Institute, Box 532-E, Nashville, Tennessee.

BUSINESS OPPORTUNITIES

INVESTIGATE Accidents—Earn $750 to $1,400 monthly. Men urgently needed. Car furnished. Business expenses paid. No selling. No college education necessary. Pick own job location. Investigate full time. Or earn $6.44 hour spare time. Write for Free literature. No obligation. Universal, CZ-12, 6801 Hillcrest, Dallas, Texas 75205.

VENDING Machines—No Selling. Operate a route of coin machines and earn amazing profits. 32-page catalog free. Parkway Machine Corporation, 715PE Ensor Street, Baltimore 2, Md.

ELECTROPLATING Equipment and supplies. All types for home workshops and industrial. Send $1.00 (refundable) for equipment guide formulas, operating data, catalog. HBS Equipment Division 90, 3543 East 16th, Los Angeles, California. 90023.

PIANO Tuning learned quickly at home. Tremendous field! Musical knowledge unnecessary. Information free. Empire School of Piano Tuning. Dept. PE, Box 327, Shenandoah Station, Miami, Florida 33145. (Founded 1935.)

CITIZENS BAND Radio Dealerships Available. Sell Full or Part Time. Knox Electronics, Dept. 274, Galesburg, Ill. 61401.

RAISE RABBITS for us on $500 month plan. Free details. White's Rabbitry, Mt. Vernon 52, Ohio.

FREE CATALOGS. Repair air conditioning, refrigeration. Tools, supplies. full instructions. Doolco, 2016 Canton, Dallas, Texas 75201.

I MADE $40,000.00 Year by Mailorder! Helped others make money! Start with $10.00—Free Proof. Torrey, Box 318-N, Ypsilanti, Michigan 48197.

FREE Book "990 Successful, little-known Businesses." Work home. Plymouth-945P, Brooklyn, N.Y. 11218.

HOW TO GET FINANCIAL CAPITAL, Loans, Grants, Cash to Start a Business. Free details. Counselor-47, Harlingen, Texas 78551.

FREE book: "America's Best Home Opportunities". Kinder, 615-77th Avenue, Laval, Quebec, Canada.

HYPNOTISM

HYPNOTIZE UNNOTICED! PATENTED new hand device makes you a Hypnotist first day or refund! Hypnotist's Handbook included! $2.00 Hypnosis Foundation, Box 487, La Mesa 9, California.

FREE Hypnotism, Self-Hypnosis, Sleep Learning Catalog! Drawer H400, Ruidoso, New Mexico 88345.

"FEMALE HYPNOTISM" Exposed, explained! "Secret Method"—they never know! $2, rushed. Guaranteed! Isabella Hall, Silver Springs, Florida.

HYPNOTIZE INSTANTLY! Secret Methods! Nerves! Females! Magnetic Healing! Self-Hypnosis, Illustrated Course, $2.20. Brugenheimer Publishers, Box 158-E30, Lexington, Mass.

HYPNOTIZE FEMALES!—Unnoticed! Instantly! Nerves! Send $2.25. Research Enterprises, 29-SN21 Samoset, Woburn, Mass.

SELF-HYPNOTAPES. Send for FREE brochure, **"WHAT'S IT ALL ABOUT?" PERSONALIZED TAPES,** Box 190PE, Quincy, Massachusetts 02169.

FREE TRIAL!! Sensational self-hypnosis record kit. Forum, 333-AA12 Michigan, Chicago 60601.

DO-IT-YOURSELF

SAVE! Build Transistorized Treasure Finder. Details Free. Del Research, Box 436A, Centerville, Georgia 31093.

PLANS AND KITS

ALLWAVE RADIO KIT. Tube, transistor included $5.00. Headset $2.50. Ekeradio, Box 131, Temple City, Calif.

KITS, Crystal Radio $1.95, Solar Powered Radio $4.95, Wireless Transmitter $3.95, Audio Telescope $5.95. Lectronix, Box 42-PE, Madison Heights, Mich. 48071.

PERSONALS

INVESTIGATORS, FREE BROCHURE, LATEST SUBMINIATURE ELECTRONIC SURVEILLANCE EQUIPMENT. ACE ELECTRONICS, 11500-K NW 7th AVE., MIAMI, FLA. 33168.

PERSONAL PROBLEMS got you down? Worried about world conditions? Learn to control your life and affairs through proper use of cosmic law. Free literature. Write today! Lemurian Fellowship, Dept. 628, Romona, California 92065.

BILL PROBLEMS? Poor credit no trouble. Not a loan company. Send for free application. Automatic Acceptance, 318PE Broadway Blvd., Reno, Nevada or 307PE Pocasset Ave., Providence, R.I.

SECRET LAW Wipes Out All Debts. Immediate relief. Free details. Counselor-48, Harlingen, Texas 78551.

HELP WANTED

YOUNG HOBBYIST wanted some evenings to help build projects with experimenter lacking time. Write Thein, 520 Fifth Avenue, New York 10036.

ELECTRONICS TECHNICIAN—Excellent opportunity for experienced person to work in research lab. Should be capable of troubleshooting electrical equipment, testing circuitry using oscilloscope, operating basic power tools. Many company benefits. Convenient to public transportation. American Medical Association, 535 N. Dearborn Street, Chicago, Illinois. 527-1500, Ext. 326.

RUBBER STAMPS

RUBBER ADDRESS STAMP $1.00. Signature $2.88. Free catalog. Jackson Products, 1433 Winnemac, Chicago, Ill. 60640.

PHOTOGRAPHY—FILM, EQUIPMENT, SERVICES

MEDICAL Film—Adults Only—"Childbirth"—1 reel 8mm $7.50—16mm $14.95. International-E, Greenvale, L.I., New York.

SCIENCE Bargains—Request Free Giant Catalog "CJ" —148 pages—Astronomical Telescopes, Microscopes, Lenses, Binoculars, Kits, Parts. War surplus bargains. Edmund Scientific Co., Barrington, New Jersey.

www.americanradiohistory.com

MOVIE FILMS

CHRISTMAS GIFT PROBLEMS?—SOLVE THEM EASILY WITH 200' 8mm EASTMAN COLOR FILMS. All the excitement . . . action . . . entertainment of: **SKI MODERNE,** $22.95. . . **'66 ROSE BOWL FOOTBALL** (UCLA vs. Michigan State), $19.95 . . . **NBA BASKETBALL,** $17.95. . . **'66 INDY 500,** $13.95—each postpaid. Order for yourself, too! **SPORTLITE FILMS-PE,** 20 North Wacker Drive, Chicago, Ill. 60606.

MAGAZINES

ELECTRONICS FROM JAPAN? English-Language monthly magazine covers all Japanese Electronics. $10. per year subscription. Sample Copy $1. Dee, 10639 Riverside, North Hollywood, California 91602.

EDUCATIONAL OPPORTUNITIES

LEARN While Asleep. Remarkable, Scientific, 92% Effective. Details Free. ASR Foundation, Box 7021, Dept. e.g., Lexington, Kentucky.

HELP WANTED advertisement in newspapers nationwide prove urgent demand for Draftsmen. "Quick-Learn" home-study plan has helped thousands beginners succeed. Good Salary! Clean Work! **"DRAFTING CAREER KIT"** sent **FREE!** Write: North American School of Drafting-MB, Newport, California 92660.

PROFESSIONAL Engineering, Electronics. Free Prospectus. CIST, Suite 695, 263 Adelaide Street, West, Toronto, Canada.

EMPLOYMENT INFORMATION

EMPLOYMENT Resumes. Get a better job & earn more! Send only $2.00 for expert, complete Resume Writing Instructions. J. Ross, 80-34 Kent St., Jamaica 32, N.Y., Dept. PE.

FOREIGN and **USA** job opportunities available now. Construction, all trades. Earnings to $2,000.00 monthly. Paid overtime, travel, bonuses. Write; Universal Employment, Woodbridge, Connecticut 06525.

MISCELLANEOUS

WINEMAKERS: Free illustrated catalog of yeasts, equipment. Semplex, Box 7208, Minneapolis, Minn. 55412.

BEERS, PEACH BRANDY, WINES—Strongest Formulas, $2.25. (complete brew supplies hydrometers catalog 10¢) —Research Enterprises, 29-D Samoset, Woburn, Mass.

LEARN Radio Announcing! Magazines, Beginners Books: Deejay, Box 11-PE, Aberdeen, South Dakota 57401.

LEBANON Holy Land Koweit, **REMAILING** $1.00 airmail. Box 5569, Beirut.

STOP AUTO THIEVES THE EASY WAY!! Affix Auto Alarm Decal to your car window (whether you have alarm or not) and burglars stay away! Send only $1.00 for two authentic decals to: J. Ross, 80-34 Kent St., Jamaica, N. Y. 11432, Dept. PE.

STAMMER—Stutter—No More. (Dr. Young.) Write: Gaucho, Box 9309-E8, Chicago 90.

ELECTRONICS MARKET PLACE Continues to Show Steady Growth! Our more than 400,000 monthly buyers eagerly await the offerings in **POPULAR ELECTRONICS' ELECTRONICS MARKET PLACE** each issue . . . they read, and they buy because they know they can rely on the products and services advertised in the pages of their favorite magazine. You can increase your mail order response substantially by running a low cost ad ($1.00 per word—minimum $10.00) in these columns. Forward advertising copy with your payment today in order to be sure of inclusion in the next issue—February (closing December 1st, on sale January 18th). Send to: Hal Cymes, Classified Advertising Manager, **POPULAR ELECTRONICS,** One Park Avenue, New York, New York 10016.

POPULAR ELECTRONICS

DECEMBER 1966

ADVERTISERS INDEX

Printed in U.S.A.

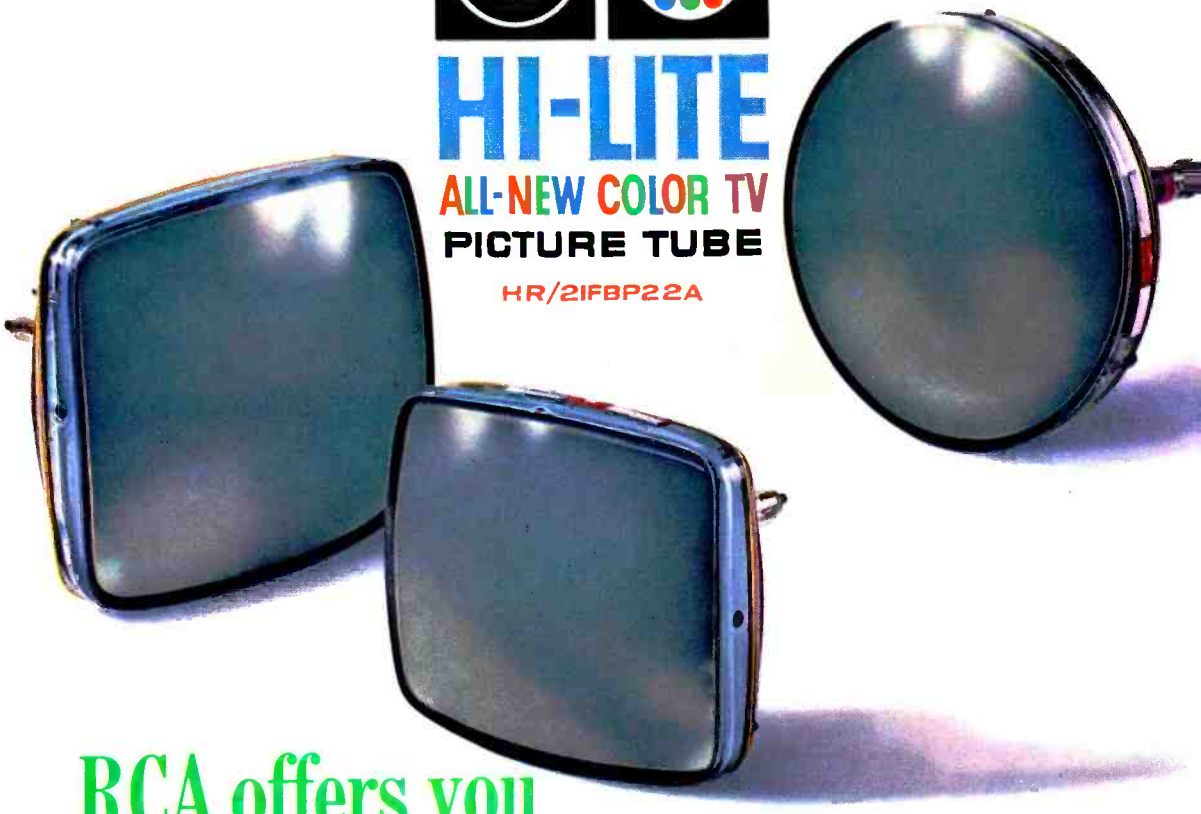
www.americanradiohistory.com

Are you ready for today's color?

HI-LITE

ALL-NEW COLOR TV PICTURE TUBE

HR/21FBP22A



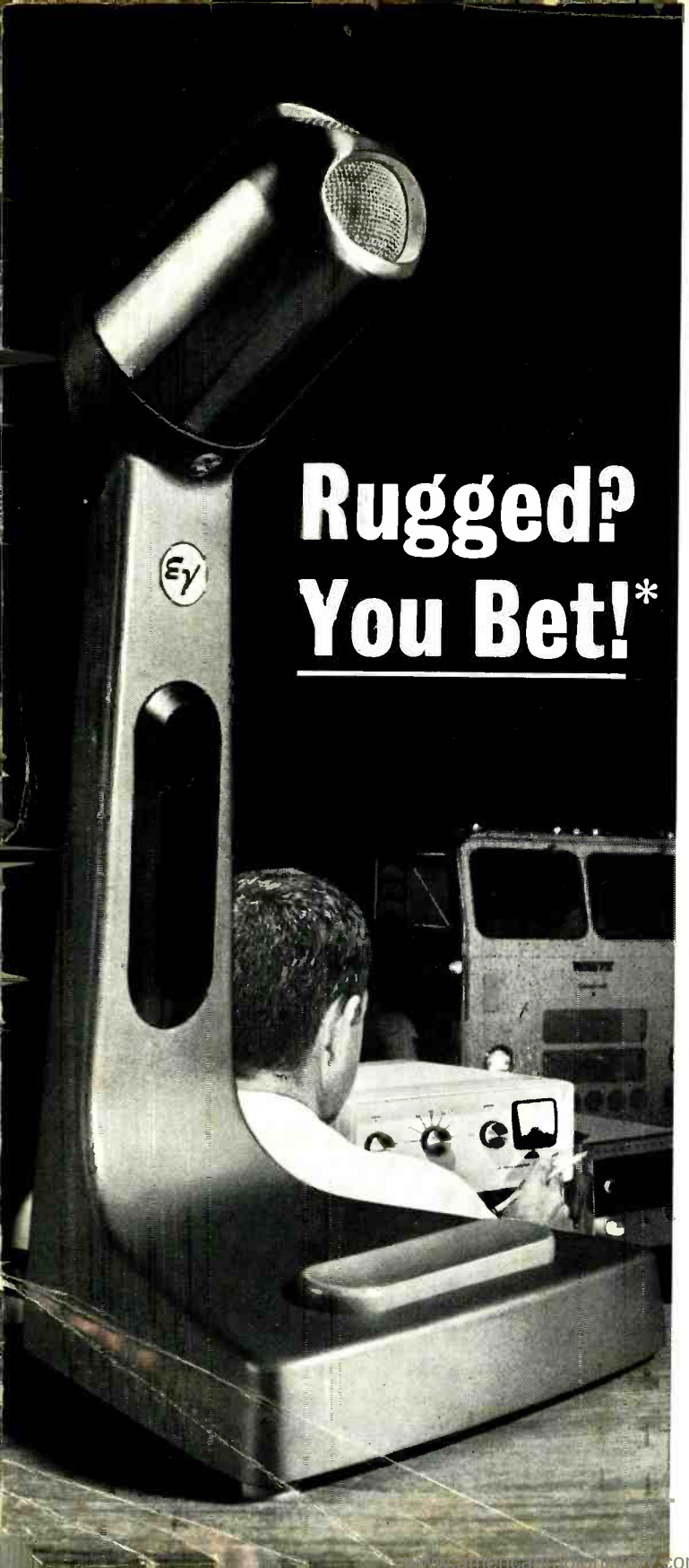
RCA offers you a replacement color picture tube that meets OEM specs

RCA Hi-Lite picture tubes are all-new... glass, gun, the works! They're RCA's best... the same quality... the same tubes... that go into original equipment sets. And because they incorporate the latest technological advances of the world's largest color picture tube manufacturer, you literally "up-date" your customer's color set each time you install one. Here is picture brightness and color fidelity at its finest, available for the service trade in 19-inch and 25-inch rectangular and 21-inch round tube types.

RCA Electronic Components and Devices, Harrison, N. J.

The Most Trusted Name in Electronics

www.americanradiohistory.com



TOUCH-TO-TALK
COMMUNICATIONS
MICROPHONES

Model 619 Dynamic $28.50 net
Model 719 Ceramic $16.50 net

These new beauties are tough. No fragile plastics or lightweight metal. A 400-ton high-pressure die casting machine turns two pounds of molten metal into a solid stand that laughs at heavy service. And tough baked enamel plus heavy chrome plating guarantees lasting good looks.

Just touch the big bar to talk. It latches on with a simple, sliding motion. Or move it to the grip-to-talk position on the stand riser in just minutes, with only a screwdriver. The DPDT telephone-type leaf switch will last a million calls or more. It operates both voice and relay circuits, with optional electronic switching available at the end of the 619 (Hi-Z) and 719 cable.

All models are omnidirectional, and come complete with heavy-duty cable. Most economical is the Model 719 ceramic. Response is from 80 to 7,000 cps at —56 db output.

For top quality, choose the Model 619 dynamic models with exclusive E-V Acoustalloy diaphragms. Smooth, peak-free response from 70 to 10,000 cps at —56 db output insures highest talk power and full modulation. Choose either Hi-Z or balanced Lo-Z model.

Try one of these rugged new beauties today. You'll find that your rig never sounded — or looked — so good!

ELECTRO-VOICE, INC.
Dept. 1262P, 630 Cecil Street
Buchanan, Michigan 49107

Electro-Voice®
SETTING NEW STANDARDS IN SOUND

*We cover our bet with a *lifetime* guarantee. If any 619 or 719 ever fails, just send it to us. We'll repair it at nominal cost. But if there's even a hint that our workmanship or materials weren't up to par, the repair is on the house — even 30 years from now! Fair enough?

CIRCLE NO. 14 ON READER SERVICE PAGE

www.americanradiohistory.com