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
Thousands Who Gained Through NRI

EXCITING, FAST

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fitter futures and education. Training men to operate, install and supervise
electronics has been a key NRI pioneered
home instruction, time-proved way of train. With NRI
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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.

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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.

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TELEVISION-RADIO SERVICING
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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.

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

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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-Electronics.

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MARINE COMMUNICATIONS
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MOBILE COMMUNICATIONS
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©NOTE: You must pass your FCC License exam (any Communications course) or NRI refunds in full the tuition you have paid.
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"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 KXJ-B-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
DECEMBER, 1966

SCIENCE FAIR PROJECTS

DON LANCASTER 41 THE LOGIC DEMON
Getting to know NOR, NAND, and some other gates

DON LANCASTER 57 WANT TO BUILD AN INTEGRATED CIRCUIT BINARY COUNTER?
Visual demonstrator of how binary addition works

ARTHUR S. COOKFAIR 70 TESLA'S THERMOMAGNETIC MOTOR
Curie temperature effects produce reciprocal motion

FEATURE ARTICLES

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ROBERT N. TELLEFSN, W7SMC/0 47 BUILD THE EMITTER DIPPER
Solid-state battery-operated wide-range test instrument for all experimenters

J. W. NELLIAGAN 50 ST. PETERSBURG TAPERS GO BACK TO SCHOOL
HERB HOWORKA, JR. 52 SMALL TAPE RECORDERS
You can do more than whistle into those inexpensive jobs

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GARY W. TOWNER 55 "RELAXATROL" TO AUTOMATE YOUR SLIDE PROJECTOR
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Stenos now push buttons instead of pencils

LEWIS A. HARLOW 65 PARLOR GAME
66 A TAPE RECORDER KIT—DELUXE
New recorder can be built in less than 18 hours

ROBERT P. BALIN 68 ZERO-BEATING THE NEWS
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Getting the most from your dipole or beam antenna

MATT P. SPINELLO, KHC2060 77 AMATEUR RADIO
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Broadcasting station news around the world

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88 OUT OF TUNE
112 INDEX TO VOLUME 25
(JULY-DEC., 1966)

Checking out the Curie temperature effect

Presenting a potpourri on tape recording
DEVRY TECH NOT ONLY TRAINS
YOU . . . BUT HELPS YOU GET
STARTED AT NO EXTRA COST IN
THE BIG-MONEY FIELD OF
ELECTRONICS!

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- Television and Radio
- Microwaves
- Radar
- Automation Electronics
- Communications
- Computers
- Broadcasting
- Industrial Electronics
- Electronic Control

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Address: ________________________ Apt: ____________
City: ___________________________ State: ___________ Zip: ___________
Check here if you are under 16 years of age.

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Accredited Member of National Home Study Council

December, 1966
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 air movers 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:

ICM Magnetics Corp
New Hampshire Division, Route 16B, Rochester, New Hampshire 03867

CIRCLE NO. 19 ON READER SERVICE PAGE
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.
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:

<table>
<thead>
<tr>
<th>Model</th>
<th>Price</th>
<th>Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>50 MK II</td>
<td>$54.50</td>
<td>with manual cueing and pause control lever built into the tone arm system.</td>
</tr>
<tr>
<td>60 MK II</td>
<td>$74.50</td>
<td>with manual cueing and pause control lever built into the tone arm system.</td>
</tr>
<tr>
<td>LAB 80 MK II</td>
<td>$99.50</td>
<td>with exclusive hydraulically operated cueing lab control conveniently built into the tone arm rest.</td>
</tr>
</tbody>
</table>

These are three of five Garrard Automatic Turntables just introduced. For complimentary copy of colorful new Comparator Guide describing all models, write Garrard, Dept. 61456, 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. Heinze, K7KHA
Reno, Nevada

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

Arthur S. Dubias
Toms River, N.J.

See “Out of Tune” on page 89.

"SCROUNGING" FOR AN ANTENNA

I am a registered Short-Wave Monitor (WPE6GOC), and I am now studying for my
Why does one of these men earn so much more than the other? More brains? More ambition?

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.

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Washington, D.C. 20010

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□ Space Electronics □ Nuclear Engineering Technology
□ NEW! Industrial Electronics for Automation
□ NEW! Computer Systems Technology

Approved for Veterans Administration Training

December, 1966

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The Incomparable 23 Channel Range Gain II
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 Ultra Special Regency Ranger
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 12 Channel Solid State Charger
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 Transistorized Needle Busting Bronco
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.

The Popular, Versatile Pacer II
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.

Every Regency and Metrotek transceiver gives you a 1 year warranty

Regency
ELECTRONICS, INC.
7900 PENDLETON PIKE
INDIANAPOLIS, INDIANA
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 Scrummage—An Instant J Antenna," described on page 46 in this issue. For 2 meters, the total length of the antenna is only 54.9 inches. The half-wave section is 38.2 inches and the quarter-wave section is 16.7 inches.

POPULAR ELECTRONICS INDEX

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

Al Diamond
New York, N.Y.

Al, your suggestion is appreciated. However, since most readers don't like to cut up their issues, we would rather spend the money for editorial material than for perforations. Are you using our Volume Index which is published in the June and December issues? For the latest semiannual index, see page 112.

BARIUM TITANATE NOT OUT OF DATE

We do not believe that barium titanate is out of date as indicated by the letter in your July, 1966, issue from C.P. Germano of the Clevite Corp. Barium titanate (or the modified titanate) is the most commonly used ceramic piezoelectric transducer material in existence. Barium titanate has been replaced in the ceramic phono cartridge application by the newer lead zirconate-titanate material. This replacement was accomplished because the lead zirconate-titanate seemed to work better in the old standard designs. More
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Yes, I'm interested in the Electronics Field. Please send me your FREE ELECTRONICS CAREER SELECTION KIT. I understand there is no obligation.

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10447 South Torrence Avenue Chicago, Illinois 60617

"Over a Century of a 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 Czecho- slovakia (980 miles). I enclose a picture from Spanish television TV-ESPAÑA which I took last year.

Dim. Gagossis
Athens 811, Greece

D.C. FLUORESCENT LIGHT

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

John W. Kindley
Birmingham, Mich.

FLUX TO END ALL FLUX

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

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

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

5-Band Portable CB Receiver/Direction Finder

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

5 Bands
1. CB Low
   Tunes all 23 channels spread out on 2 bands for easy tuning and positive identification. You can monitor all CB channels wherever you go... including H.E.L.P. and R.E.A.C.T.
2. CB High
   Also prevents overload from 4.2 to give 2.4.
3. L.F.
   200-400 Kc. Beacon/Weather. Hear accurate, up-to-the-minute weather broadcasts around the clock. FAA stations give over date for 200 miles around. Also tunes navigation beacons.
4. S.W.
   1.44-5 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 microwatts 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 with 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° and can be seen even though set is only 2 1/2" thick.
6. MORSE CODE, a handy guide to help identify beacon signals.
7. CALIBRATED OPTICAL SIGHTS an retarding antenna flip up for taking visual readings.
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 headphones, one for miniatures earphone (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 2 1/2 lbs. And it also plugs into regular house current.

5 Band Nova CB

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

UNCONDITIONAL MONEY BACK GUARANTEE

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

NO RISK ORDER BLANK

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630 Meyer Lane, Redondo Beach, California 90278

Please send me

with unconditional 10-day money back guarantee:
5 Band Nova CB with house current adapter $149.95

☐ I enclose payment in full. ☐ Diner's No. ______
☐ I enclose payment in full. ☐ Diner's No. ______
☐ Budget terms: I enclose $40 down. ☐ Ship C.O.D.

Name ________________________________
Address ________________________________
City, State ________________________________

CIRCLE NO. 29 ON READER SERVICE PAGE

December, 1966
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)
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

NAME (Print clearly)

ADDRESS

CITY STATE ZIP CODE

VOID AFTER JANUARY 31, 1967
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.
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:

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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.

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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.

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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.
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
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 — 1 ½ 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.
10 NO LEE, OKLA. CITY, OKLA. 73102

CIRCLE NO. 20 ON READER SERVICE PAGE
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...
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 (3¾"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/MMX Automatic Stereo Tuner: Driftless, noiseless performance. 2.4-A for 30 channel, logarithmic scale; logging; automatic sync 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, full SW to 30MC in four bands. Selective, sensitive superhet, modern printed circuit board construction. Easy, fast alignment. Illuminated slide rule dials, logging scale; 5" meter, electrical bandwidth 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, now Model 753 — "the best ham transceiver buy for 1966" — Radio TV Experimental Magazine. 200 watts PEP or 60, 40 and 20 meters. Receiver offset tuning, built-in VFO, high level dynamic ALC, silicon solid-state VFO, balanced performance, features and appearance. Sensationally priced at $189.95 kit. $229.95 wired.

NEW EICO 888 Solid-State Engine Analyzer

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

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

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/hifi [ ] Citizens Band radio
[ ] automotive electronics

Name: _______________________
Address: ____________________
City: ________________________
State: ________________________

CIRCLE NO. 11 ON READER SERVICE PAGE

December, 1966
a single charge—and as much as 40 amperes or 480 watts can be used intermittently. Charge loss during storage is only 3% per month. The CRL-1200 comes with built-in charger in a leather carrying case.

Circle No. 79 on Reader Service Page 15

STEREO TAPE DECK

The deluxe Model RK-880 stereo record/playback tape deck introduced by Lafayette Radio Electronics incorporates features usually associated with higher priced tape decks. Three heads provide four-track stereo and mono record/playback plus sound-on-sound and sound-with-sound features. In addition, the RK-880 utilizes adjustable control of playback and record equalization and bias current from the front panel. Frequency response is 30 to 22,000 Hz at 7 ½ in/s, ±3 dB; 40-12,000 Hz at 3 ½ in/s, ±3 dB. Wow and flutter is less than 0.15% at 7 ½ in/s, less than 0.25% at 3 ½ 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 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 (Icbo) 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 4 1/4" 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, break-proof amber plastic, and will accept any of the interchangeable screwdriver, nutdriver, and other blades in Xcelite's extensive Series 99 line. Blades are of high carbon steel with highly polished nickel-chrome finish.

Circle No. 85 on Reader Service Page 15
Some plain talk from Kodak about tape:

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

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

Some like it 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 ________________

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EASTMAN KODAK COMPANY, Rochester, N.Y.

CIRCLE NO. 12 ON READER SERVICE PAGE

December, 1966
The Super-Sharp
TRAM TITAN
CITIZENS BAND
BASE STATION

*Multi-function meter reads: "S" units, SWR, and absolute power in watts into built-in dummy load. Measures power through the antenna.
*Super-sharp selectivity with Collins mechanical filter—adjacent channel rejection is 90 db or better. *First class sensitivity. *All 23 transmit channels.
*Transmitter delivers 3.5 watts minimum output; separate indicators for carrier on and modulation. *RF gain control.
*Tone control. *Built-in low pass filter for minimum T.V.I. $434.

For full details write:
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Dept. No. E-12, Lower Bay Road P.O. Box 187
Winnisquam, N. H. Phone 603-524-0622

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ELECTRONICS
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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.


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.
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

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

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

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

CIRCLE NO. 44 ON READER SERVICE PAGE
READ WHAT
THE EXPERTS SAY
ABOUT THE

knightskit®

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 outper-
forms 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 In-
trductory offer on the Knight-Kit KG-275A Exposure
Meter.

NAME
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 buy-
ning stereo components. All Scott receivers,
speakers, amplifiers, and tuners are pictured
and described, both factory-wired and kit
units, and complete specifications are in-
cluded.

Circle No. 86 on Reader Service Page 15

Mark Products' "Heliwhip" mobile amateur
band antennas with "Static Sheath" are fea-
tured in a 4-page antenna catalog (plus in-
serts). "Static Sheath" is a durable dielectric
plastic covering that acts as an electrical in-
ulator 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 Cata-
log carries a considerably expanded line of
general products, including some items just
being introduced on the market. Products
have been "departmentalized" and the index
made more convenient. Featured are the
Conar Model 800 CCTV camera, the "Audio-
color," and the "300" stereo system.

Circle No. 88 on Reader Service Page 15

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

Circle No. 89 on Reader Service Page 15

A data sheet on Triplett Electrical Instru-
ment 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 tech-
nical features and specifications are listed,
and optional carrying cases and attachments
are also described.

Circle No. 90 on Reader Service Page 15
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.

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(Continued on page 32)

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, 153 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, 15316 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 10 meters; has 10 tubes. Schematic needed. (Arnold R. Achille, 896 Kingston St., Aurora, Colo. 80010)


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

BC-721-B/SCR-588-B receiver, made by Calvin. 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, Calskill, N. Y.)

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


National Model SW-3 receiver and power supply, circa 1934. Schematic and operating manual needed. (L. Mueller, 12700 Elliott Ave., SP-257, Es Monte, Calif. 91731)

Sparton Model T-36 receiver; tunes 1.6 kHz to 18 MHz on 3 bands; has 7 tubes. Emerson Model CS-265 receiver; tunes on 2 bands; has 6 tubes. Schematics and parts lists needed. (Carl Mason, Box 311, Rt. 1, Holmedel, N.J. 07733)
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CIRCLE NO. 28 ON READER SERVICE PAGE

ASSIST

(Continued from page 30)

Garod neutralyne receiver, ser. 6000, circa 1923; has 4 tubes. Operating manual, power supply, antenna data, and source for C-301A and C-302A tubes needed. (Harry J. Donovan, 199 Nesbitt Terrace, Irvington, N.J. 07111)

Golden-Leutz “Super Pilotyne” 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)


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


Hickok Model 225X crystal-controlled FM-AM signal generator. Schematic and service manual needed. (Daniel Gibbons, Box 84, Tailara, 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, Campbeltown, Ont., Canada)

Stewart-Warnor 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)

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

Sparton-Withington Model 10121 receiver-phono combination, circa 1942; tubes 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, alignment, and operating manual needed. (Henry Warchall, 4055 W. Meilrose, Chicago, Ill.)

DeForest oscilloscope; has 4 tubes plus cathode-ray tube and 8 controls and 4 input jacks. Schematic and operating manual needed. (John Handley, 31 Mohawk Dr., Clarendon Hills, Ill. 60514)

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

Philco receiver, chassis P3976 (7), circa 1935; tubes 590 MHz 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)

Alwater-Kent Model 600 receiver, circa 1929; tubes BC; has 8 tubes. Schematic, parts list, and service information needed. (Frank V. Carr, 2210 Eufaula Ave., Birming- ham, Ala. 35208)

Radio Craftsman Model C-800 tuner- preamp, ser. H53655, circa 1953; tubes 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. (Magnanov Model 151 B radio-phono combination; tubes AM and s.w. Schematic or service notes needed. (Brian Kennedy, 2875 Kenmore Pl., Santa Barbara, Calif. 93105)

Harvey-Wellis "Bandmaster Deluxe" 50D transmitter, circa 1950; has 3 tubes 2 MHz to 4.5 MHz on 2 bands; has 3 tubes. Operating manual needed. (Atwater Kent amplifier, type TA; has 2 audio stages. Schematic, battery and receiver connection information needed. (Chuck Ridnerout, Rt. 1, Box 408, London, Ohio 43140)

Rocket Model SHL TV receiver, made by Egawa Electric Lab Co. Inc. of Tokyo, Japan. High-voltage transformer 2C105726 needed. (E. J. Bunker, 1804 Thorn- bury Rd., Baltimore, Md. 21209)

(Continued on page 38)
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December, 1966
CFF-46154 receiver, made by Federal Radio Telegraph Co. Parts list and operating manual needed. CRV-20130 power supply, used with CFF-46154, made by RCA. Schematic and manual needed. (Robert H. French, 450 38 St., Bellevue, 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 Chem, 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 z.w. Schematic and tube complement information needed. (Wayne Aho, 13 Memorial St., Baldwinsville, Mass. 01436)

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

Millen syncroscope, type CJA-60ACM, surplus. Conversion diagram needed. (Fred Jahn, 1675 Oriole St., Saratoga, Calif. 94078)

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)

Cosso Model 1035 oscilloscope, circa 1954. Schematic and operating manual needed. (J. F. Rich, 94 Nelison Dr., Etoboeke, 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-8314-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)

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

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


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, Neb.)

Zenith Model 58-29 receiver, ser. N225899; tunes 550 kHz to 15 MHz. Motorola TV receiver, chassis 27E50129, circa 1948; has 14 tubes. Schematics needed. (Joe Rock, Jr., Box 162, Knoxville, Md. 21758)


Airline Model 14BR004A receiver; tunes on 5 bands; has 10 tubes. Schematic and operating manual needed. (Mike Timmons, 14200 S.W. 184 St., Miami, Fla.)


(Continued on page 87)
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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?

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Computer Logic. Computer logic, also known as Boolean Algebra, translates Aristotle's formal logic to a mathematical logic which can be used for reasoning...
out problems. Developed by Augustos De Moran and George Boole over 100 years ago, Boolean Algebra (computer logic) was crystalized in 1938 by Claude E. Shannon who, while studying for his Master of Science degree at M. I. T., applied it to the solution of switching problems.

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

<table>
<thead>
<tr>
<th>Switch \textquotedbl{}A\textquotedbl{}</th>
<th>Switch \textquotedbl{}B\textquotedbl{}</th>
<th>Lamp \textquotedbl{}I\textquotedbl{}</th>
</tr>
</thead>
<tbody>
<tr>
<td>Closed</td>
<td>Closed</td>
<td>Lights</td>
</tr>
<tr>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>No</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>

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 \textit{false} when a 0 is represented, while a 1 can be used to denote that a statement or condition is \textit{true}. The simplified table is as follows:

<table>
<thead>
<tr>
<th>Switch \textquotedbl{}A\textquotedbl{}</th>
<th>Switch \textquotedbl{}B\textquotedbl{}</th>
<th>Lamp \textquotedbl{}I\textquotedbl{}</th>
</tr>
</thead>
<tbody>
<tr>
<td>Closed</td>
<td>Closed</td>
<td>Lights</td>
</tr>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

In computer logic (also called symbolic logic), the preceding table is known as a \textit{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-
pared to show for what switch combination the lamp will light:

<table>
<thead>
<tr>
<th>Switch “A”</th>
<th>Switch “B”</th>
<th>Lamp “I”</th>
</tr>
</thead>
<tbody>
<tr>
<td>Closed</td>
<td>Closed</td>
<td>Lights</td>
</tr>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>0</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>0</td>
</tr>
</tbody>
</table>

The lamp lights when either one or both of the switches are closed. Thus, logically, 1 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 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

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December, 1966
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.
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.

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

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

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

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

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

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

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

(Continued on page 93)
The "Scrounge"—an Instant "J" Antenna

YOU CAN WHIP A VHF ANTENNA TOGETHER IN 30 MINUTES

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

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

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

The drawing shows the simple layout of the "Scrounge" with notations for determining its length. If you are working a band of frequencies, cut the antenna to resonate in the center of the band. If you are interested in listening on 156 MHz, for example, simply divide the figure 5540 by 156 to determine the length of the half-wave section (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)
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 bands—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-
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 2½" x 2½" 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. 1. Signal generated by the Q1 Colpitts oscillator circuit drives Q2. Meter reading dips when an external circuit absorbs a part of the signal.

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 (Ct).
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, ⅝” apart, starting ⅛” 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.

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**PARTS LIST**

<table>
<thead>
<tr>
<th>PART</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>B1</td>
<td>9-volt transistor battery</td>
</tr>
<tr>
<td>C1</td>
<td>50-pF variable capacitor (Hammarlund HF-50)</td>
</tr>
<tr>
<td>C2, C6</td>
<td>10-pF disc capacitor</td>
</tr>
<tr>
<td>C3</td>
<td>30-pF disc capacitor</td>
</tr>
<tr>
<td>C4</td>
<td>0.001-μF disc capacitor</td>
</tr>
<tr>
<td>C5</td>
<td>0.1-μF, 10-volt disc capacitor</td>
</tr>
<tr>
<td>C7</td>
<td>0.003-μF disc capacitor</td>
</tr>
<tr>
<td>C8</td>
<td>See Coil Table</td>
</tr>
<tr>
<td>L1</td>
<td>See Coil Table</td>
</tr>
<tr>
<td>M1</td>
<td>0 to 1.0-mA meter</td>
</tr>
<tr>
<td>Q1</td>
<td>2N711A transistor, or similar</td>
</tr>
<tr>
<td>Q2</td>
<td>2N3924 transistor, or similar</td>
</tr>
<tr>
<td>R1</td>
<td>1100-ohm, ½-watt resistor</td>
</tr>
<tr>
<td>R2</td>
<td>2400-ohm, ½-watt resistor</td>
</tr>
<tr>
<td>R3</td>
<td>27,000-ohm, ½-watt resistor</td>
</tr>
<tr>
<td>R4</td>
<td>10,000-pF potentiometer, linear taper</td>
</tr>
<tr>
<td>RFC1</td>
<td>2.5-mH choke, 25 to 50 mA coil (Millen or Mallory)</td>
</tr>
<tr>
<td>S1</td>
<td>Add-on s.p.s.a. switch for R4 (Mallory U-26)</td>
</tr>
<tr>
<td>Misc</td>
<td>2½” x 2½” x 4” metal box</td>
</tr>
<tr>
<td>Misc</td>
<td>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</td>
</tr>
</tbody>
</table>

**L1 COIL TABLE**

<table>
<thead>
<tr>
<th>NUMBER OF Turns</th>
<th>WIRE SIZE</th>
<th>VALUE OF CX</th>
<th>FREQUENCY RANGE (MHz)</th>
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</thead>
<tbody>
<tr>
<td>47½</td>
<td>#28</td>
<td>470 pF</td>
<td>3 to 4.4</td>
</tr>
<tr>
<td>32½</td>
<td>#24</td>
<td>470 pF</td>
<td>4.4 to 7.6</td>
</tr>
<tr>
<td>17½</td>
<td>#24</td>
<td>100 pF</td>
<td>7.6 to 11.6</td>
</tr>
<tr>
<td>12½</td>
<td>#16</td>
<td>100 pF</td>
<td>11.6 to 18</td>
</tr>
<tr>
<td>6½</td>
<td>#16</td>
<td>none</td>
<td>18 to 30</td>
</tr>
</tbody>
</table>

*Enamel-coated solid conductor*
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. Their registration reached 25—the maximum permitted. Eventually, Cooper was compelled to start a waiting list and schedule another class.

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

Cooper's new class had neither precedent to follow nor a published text avail-
Unique course in recording techniques was conceived by Lon Cooper, shown at far left demonstrating fundamentals of sound. In the "lab," (above), students record from various sources and practice programming.

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

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

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

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

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

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

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

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 (1½ in/s and 3½ in/s), and accommodate larger reels. Some have a switch on the microphone for remote control, and some have outlets for extension speakers and earphones.

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

Capstan drive offers a greater degree of uniformity of tape speed. It rotates at a predetermined fixed speed, such as 1½ in/s or 3½ in/s, and draws all the tape through the recorder at the same rate of speed regardless of the size of the reels or the amount of tape on the reels. Tapes recorded on a capstan drive recorder can be played back on another capstan drive recorder providing that the tape speed is the same and the geometry of the recorded sound track is compatible with the playback heads.

**Man was made for better things to do—let the tape recorder help you get greater productivity and more leisure**

By Herb Howorka, Jr.

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

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

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

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

(Continued on page 91)
SMALL BATTERY-OPERATED TAPE RECORDERS HAVE BEEN GREATLY IMPROVED WITHIN THE PAST TWO OR THREE YEARS, AND QUALITY UNITS ARE AVAILABLE AT REASONABLE PRICES. PRICES FOR THE UNITS SHOWN HERE RANGE FROM $39.95 TO $79.50.

Norelco "Continental 101" 4-inch reel; 2 tracks; 1 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; 9 7/8" x 9 1/4" 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.
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 3/8"-diameter door spring—the kind used to close a summertime screen door. Make each spring length about 12 turns and bend the last turn at a right angle to form an eye for a wood screw.

Screw the terminals to the board using small wood screws and flat metal washers. Face the “base” connections for your transistors to the left and all other springs to the right. Twenty-three springs is about right for nominal small-scale experimenting with transistors. You can add assorted brackets of 1/8" 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.

SOLDERLESS BREADBOARD

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

By A. A. MANGIERI
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 $R_1$, $R_2$, $C_2$, and $I_1$ (Fig. 1) periodically energizes $K_1$ to trigger the projector. Capacitor $C_2$ takes on a charge through $R_1$ and $R_2$, until the voltage across it is sufficient to fire $I_1$ (usually on the order of 60 to 70 volts).

When the lamp fires, it discharges $C_2$ until the voltage drops sufficiently to black out the lamp. The frequency of lamp ignition depends upon the values of $C_2$, $R_1$ and $R_2$, as well as the voltage across the entire circuit. Variable resistor $R_2$ makes it possible for you to adjust the frequency according to your needs.

Neon lamp $I_1$ is close-coupled to a
When PCI "sees" the light from I1, its resistance drops and allows enough current to flow through K1 to energize it. Time constant of R1, R2, and C2, as well as the applied voltage, determines the frequency of operation.

Light-dependent resistor (PCI). When the lamp lights, PCI'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 PCI 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.

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.

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 PCI and shields the assembly from "outside" light. (See Fig. 3.) You may cut away some of the insulator at each end if it is too long. Assemble the unit as shown in the drawing, and do your best to obtain a light-tight assembly.

(Continued on page 93)
WANT TO BUILD AN INTEGRATED CIRCUIT BINARY COUNTER?

By DON LANCASTER

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.

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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: \(2^3, 2^1, 2^0\). 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.

<table>
<thead>
<tr>
<th>DECIMAL NUMBER</th>
<th>BINARY NUMBER</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>000</td>
</tr>
<tr>
<td>1</td>
<td>001</td>
</tr>
<tr>
<td>2</td>
<td>010</td>
</tr>
<tr>
<td>3</td>
<td>011</td>
</tr>
<tr>
<td>4</td>
<td>100</td>
</tr>
<tr>
<td>5</td>
<td>101</td>
</tr>
<tr>
<td>6</td>
<td>110</td>
</tr>
<tr>
<td>7</td>
<td>111</td>
</tr>
<tr>
<td>8</td>
<td>1000</td>
</tr>
</tbody>
</table>

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

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)
B2, B3—#49 pilot light (2.0-volt, 60-mA)
IC1, IC2, IC3—μL923 epoxy JF flip-flop (Fairchild*)
IC4—μL914 dual two-input gate (Fairchild*)
Q1, Q2, Q3—2N834 transistor (Motorola MPS834)
R1, R2—470-ohm, 1/2-watt resistor
R3—1000-ohm, 1/2-watt resistor—see text
S1—S.p.d.i. push-button switch
S2—S.p.s.t. push-button switch
S3—S.p.s.t. slide switch
1—6" x 4 1/4" x 1 1/4" aluminum box with cover (Zero Z64-1041-20 and Z64-1041-1075) or short x x x" box chassis (Rud IC-402)
1—METALPHOTO dial plate, hard anodized aluminum, with POPULAR ELECTRONICS trademark, available from Reill's Photo Finishing, 4827 N. 11 St., Phoenix, Ariz.
85014; in silver color for $2.75; blue, red, or copper for $3.25; postpaid in U.S.
1—3" x 3" piece of aluminum or perforated phenolic board
1—1/8"-diameter aluminum disc (optional—see text)
4—Sealec 8-lead IC sockets for TO-95 case (optional, available from Arrow Electronics or Joseph Kurcan, Inc., both in New York City)
Misc.—Teflon insulated terminals (52, optional), insulated feedthroughs (4, optional); battery holder for two C-size cells, 1/2"-o.d. rubber grommets (3), pop rivets or #6 hardware, 6-32 x 3/8" 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.

\[
\begin{array}{c}
1 + 1 = 0 \\
+ 011 \\
\hline 1000
\end{array}
\]

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

December, 1966
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
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 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 inners 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 ICS’s output is not loaded by the input of any other flip-flop, as is the case with IC1 and IC2. Thus, if additional counting stages are added, bear in mind that the larger base resistor must appear in the last stage, although the base resistor of the other stages are of equal value.

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

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

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

(Continued on page 90).
ALL ON QUARTER-INCH MYLAR

SOME COMMENTARIES ON THE TAPE RECORDING SCENE

By AL JOHNS

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

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

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

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

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

The best microphone position for most indoor recording is near the center of the room with the mike pointed away from the window to minimize back-
ground noise. Prepare an extension cable for your microphone so that the tape recorder can be tucked away in a corner where it won't attract attention during the interview.

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

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

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

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

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

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

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

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

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

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

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

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

---

HELLO!

SHUT THE DOOR ANGELO! DON'T LET IT OUT OF THE CLOSET!

YOUR TOOTHBRUSH IS IN THE MAILBOX.

WATCH OUT WHEN IT SWINGS BACK!

EIGHT MINUTES LATER  EIGHT MINUTES LATER  EIGHT MINUTES LATER

THIRTY SEVEN
THIRTY SEVEN
THIRTY SEVEN...

IT SMELLS TO ME LIKE PLASTIC.

THIS ROPE ISN'T LONG ENOUGH. GET ME A SHOVEL.

I'VE GOT TO GO HOME NOW. PLEASE SHUT ME OFF!
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 3 to 9 hours of working time.
SHORT SPECS

- Two-speed (7 1/2 and 3 3/4 in/s), 4-track record and playback, with provision for sound-on-sound or sound-with-sound recording.
- The AD-16 accepts 1/4"-wide tape; 1.5, 1.0, 0.75, or 0.5-mil thickness. Use 7" NAB reels or special 8 1/4" Magnecord reels.
- Measured frequency response at 7 1/2 in/s exceeded 45-17,500 kHz at ± 2 dB.
- Unit draws 140 watts maximum, measures 13 3/8" x 17 5/6" x 8 1/4".
- Price: $399.50. Base, $19.95, extra.

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

Mounting the two electronics assemblies on the main frame also involves mounting the power transformer, filter capacitors and bleeder resistors. By the time your AD-16 looks like the photo, below, work time will be just under 12 hours. Another 3 hours is spent assembling the transport mechanism (below, right). After the heads are mounted, the recorder will look something like the rear view photo at right, in just about 17 1/2 hours. The small inset panel is for connections to the tape auxiliary input, monitoring, and tape output. The silver knobs are for winding up the a.c. power cable. Microphone and headphone jacks are all on front panel.
TOM THUMB WEATHER STATION—With its state-of-the-art accuracy in measuring basic weather variables, the AN/TMQ-22 Meteorological Measuring Set made for the U.S. Army by Cambridge Systems, Inc., is said to be the most advanced portable weather unit to go into the field to date. One man can set it up in less than 5 minutes.

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

"REHABAPHONE"—Among the unusual equipment designed by General Telephone and Electronics Corp. are dials in Braille for the blind, telephones that answer themselves for the paralyzed, and telephones in oversized booths at convenient heights for wheelchair patients. Shown above is the "Rehabaphone" which requires only a slight pressure on a switch for dialing.
WORLD'S LARGEST—The largest weather radar system ever to be placed aboard a ship is installed on the “Ryofu-Maru.” The system was designed and built for the Japanese Ministry of Transportation by Toshiba, and it incorporates many new features, one of which is a device that maintains desired antenna angle, compensating for pitching and rolling in heavy seas.

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.
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...
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)
Curb 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, why 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.
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).

(Answers appear on page 100)
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, Semtronics, 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-
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-sunk. 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 output 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-
third the volume of the earlier molded type shown. Dubbed a Sensitor, and identified as type TG1/8, the 1/2-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 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 (fh) of 1500 MHz and can 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.


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

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

AMATEUR STATION OF THE MONTH

Just count those TV screens! Bob 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.

December, 1966
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 south-east 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 bidirectional 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 shortwave 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)
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.

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)
## ENGLISH-LANGUAGE BROADCASTS TO NORTH AMERICA
FOR THE MONTH OF DECEMBER

Prepared by ROBERT LEGGE

### TO EASTERN AND CENTRAL NORTH AMERICA

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

### EVENING BROADCASTS

<table>
<thead>
<tr>
<th>COUNTRY</th>
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<th>TIME—EST</th>
<th>TIME—GMT</th>
<th>FREQUENCIES (MHz)</th>
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<tbody>
<tr>
<td>ALBANIA</td>
<td>Tirana</td>
<td>7:30-8 p.m.</td>
<td>0000-0030</td>
<td>7.265</td>
</tr>
<tr>
<td>BULGARIA</td>
<td>Sofia</td>
<td>7-8 p.m.</td>
<td>0000-0100</td>
<td>6.07</td>
</tr>
<tr>
<td>CHINA</td>
<td>Peking</td>
<td>8-10 p.m.</td>
<td>0100-0300</td>
<td>11.945, 15.06</td>
</tr>
<tr>
<td>CUBA</td>
<td>Havana</td>
<td>8-11 p.m.</td>
<td>0100-0400</td>
<td>6.17, 11.76</td>
</tr>
<tr>
<td>CZECHOSLOVAKIA</td>
<td>Prague</td>
<td>8-9 p.m.</td>
<td>0100-0200</td>
<td>5.93, 7.115, 7.345</td>
</tr>
<tr>
<td>ECUADOR</td>
<td>Quito (HCJB)</td>
<td>9:11-30 p.m.</td>
<td>0200-0430</td>
<td>9.745, 11.915</td>
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<tr>
<td>EGYPT</td>
<td>Cairo</td>
<td>8:30-10 p.m.</td>
<td>0130-0300</td>
<td>9.475</td>
</tr>
<tr>
<td>GERMANY</td>
<td>Berlin</td>
<td>8-9 p.m.</td>
<td>0100-0200</td>
<td>6.16, 9.73</td>
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<tr>
<td></td>
<td>Cologne</td>
<td>8:30-9:50 p.m.</td>
<td>0130-0250</td>
<td>6.075, 9.64</td>
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<tr>
<td>GREAT BRITAIN</td>
<td>London</td>
<td>4:15-10:30 p.m.</td>
<td>2115-0330</td>
<td>6.195, 7.13, 9.51</td>
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<td>HUNGARY</td>
<td>Budapest</td>
<td>8:30-9:30 p.m.</td>
<td>0100-0230</td>
<td>6.235, 9.833</td>
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<tr>
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<td>Rome</td>
<td>8-8:20 p.m.</td>
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<td>6.01, 9.63</td>
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<td>JAPAN</td>
<td>Tokyo</td>
<td>6:45-7:45 p.m.</td>
<td>0130-0300</td>
<td>11.78, 15.135</td>
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<td>LEBANON</td>
<td>Beirut</td>
<td>9:30-10 p.m.</td>
<td>0230-0300</td>
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<tr>
<td>NETHERLANDS</td>
<td>Hilversum</td>
<td>8:30-9:30 p.m.</td>
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<td>6.025, 6.185</td>
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<td>PORTUGAL</td>
<td>Lisbon</td>
<td>9-9:45 p.m.</td>
<td>0200-0245</td>
<td>6.15, 9.57</td>
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<td>ROMANIA</td>
<td>Bucharest</td>
<td>8:30-9:30 p.m.</td>
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<td>6.13, 9.76</td>
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<tr>
<td>SOUTH AFRICA</td>
<td>Johannesburg</td>
<td>7:30-8:30 p.m.</td>
<td>0030-0130</td>
<td>9.525, 11.90</td>
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<td>SPAIN</td>
<td>Madrid</td>
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<td>6.13, 9.76</td>
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<tr>
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<td>0115-0245</td>
<td>5.99</td>
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<td>SWITZERLAND</td>
<td>Berne</td>
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<td>U.S.S.R.</td>
<td>Kiev</td>
<td>7:30-8 p.m.</td>
<td>0030-0100</td>
<td>7.12, 7.31, 9.665</td>
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<td></td>
<td>Moscow</td>
<td>7-8 p.m.</td>
<td>0000-0030</td>
<td>7.265</td>
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### TO WESTERN NORTH AMERICA

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<thead>
<tr>
<th>COUNTRY</th>
<th>CITY</th>
<th>TIME—EST</th>
<th>TIME—GMT</th>
<th>FREQUENCIES (MHz)</th>
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</thead>
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<td>ARGENTINA</td>
<td>Buenos Aires</td>
<td>10-11 p.m.</td>
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<td>Melbourne</td>
<td>5-7 p.m.</td>
<td>0100-0300</td>
<td>15.22, 17.84</td>
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<tr>
<td>BULGARIA</td>
<td>Sofia</td>
<td>8-8:30 p.m.</td>
<td>0400-0430</td>
<td>6.07</td>
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<td>7-9 p.m.</td>
<td>0300-0500</td>
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<td>11.86, 15.345</td>
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<td>Prague</td>
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<td>6.10</td>
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<td>GERMANY</td>
<td>Berlin</td>
<td>7:45-8:15 p.m.</td>
<td>0345-0415</td>
<td>5.93, 7.115, 7.345</td>
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<td>9-9:40 p.m.</td>
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<tr>
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<td>Budapest</td>
<td>7-8 p.m.</td>
<td>0300-0400</td>
<td>6.235, 9.833</td>
</tr>
<tr>
<td>JAPAN</td>
<td>Tokyo</td>
<td>6-7 p.m.</td>
<td>0200-0300</td>
<td>15.135, 17.825</td>
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<td>KOREA</td>
<td>Seoul</td>
<td>7-7:30 p.m.</td>
<td>0300-0330</td>
<td>11.925</td>
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<td>Lisbon</td>
<td>8-8:45 p.m.</td>
<td>0400-0445</td>
<td>6.025, 6.185</td>
</tr>
<tr>
<td>SOUTH AFRICA</td>
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<tr>
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<td>0415-0515</td>
<td>5.965</td>
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<tr>
<td>U.S.S.R.</td>
<td>Moscow</td>
<td>7-10:30 p.m.</td>
<td>0300-0630</td>
<td>9.54, 9.735, 11.755</td>
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</table>
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)
# FOREIGN-LANGUAGE BROADCASTS TO NORTH AMERICA

Prepared by BILL LEGGE

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

**BOOSTER COUPLERS**
**IN 300 OR 75 OHM**
For Deluxe Home & Commercial Use

Fisco'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? Fisco's got it! Performance? Fisco challenges 'em all!

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Outstanding Features:
- 350,000 microvolts maximum input with +4 dB to each output
- Maximum signal output of .85 volts in each of 4 outputs
- Low noise 6H45 premium tubes
- One 300 ohm input - 4 300 ohm outputs
- Silicon diode rectifier for dependability
- Flat response
- Metal enclosed to eliminate shock hazard
- Easy access for servicing
- Easy mounting and connecting
- 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 +6 dB to each output
- 200,000 microvolts input - 1 volt output per band
- Low noise 6H45 premium tubes
- One 75 ohm input - 4 75 ohm outputs
- Most compatible "F" type input and output fixtures
- Ultra-flat frequency response and complete RF isolation
- Ventilated perforated steel cabinet 6 1/4 x 3 1/2 x 3 3/4" in metal enclosed to eliminate shock hazard
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- Easy mounting and connecting
- All fittings & brackets supplied
- UL listed AC cord - 117 volts, 60 cycles
- 100% test for all electrical characteristics

ALL FINCO PRODUCTS ARE ENGINEERED FOR COLOR!

THE FINNEY COMPANY
34 West Interstate Street, Bedford, Ohio 44014

December, 1966

CIRCLE NO. 15 ON READER SERVICE PAGE
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 6¾” D x 1¾” 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!

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

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 ¾” 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.

ELAPSED TIME INDICATOR
KEEPS TRACK OF STYLUS WEAR

COURIER COMMUNICATIONS, INC.
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6-Transistor Walkie-Talkie Model HA-62
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Lafayette

P.O. BOX 10
SYOSSET, L.I., N.Y. 11791

PLACE STAMP HERE

FREE! MAIL THE CARD TODAY!
ASSIST

(Continued from page 38)

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

Gillfillan Bros., Model 56A receiver, circa 1946; tunes BC; has 5 tubes. Schematic and specifications needed. (Bill Denton, Rt. 1, Box 612B, Arroyo Grande, Calif. 93405)

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, 1556 Moravia Ave., Holly Hill, Fla. 32107)

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, Va. 05144)

ID-6 A/APN-4 oscilloscope, surplus. Schematic, operating manual, and power supply data needed. (William Weir, Prospect St., Berea, Ky. 44011)

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

Hammarlund "Super-Pro" receiver, type RH-2; tunes 1300 kHz to 40 MHz. Schematic and alignment data needed. (M.J. Vandermol, Rt. 2, Box 39, Perkins, Okla. 74059)

Zenith Model C2-201 receiver, ser. 537088, 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. Kissier, 2856 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. Bingsman, 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 45239)

Meissner Model 9-1056 phono-recorder p.a. system. Operating and instruction manual needed. (Barry Weismann, 112 Ride Ave., Newton, Mass. 02158)

Motorola Model TF1G-1A, TS1G 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. 48638)


Hickok Model RF0-5 oscillograph, circa 1950. Schematic and operating manual needed. (Barry Lowry, 1102 Holguin St., Lancaster, Calif. 93535)


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 X-38-B-2 tube needed. (Mike Wheeler, 3523 Altamont Dr., Klamath Falls, Ore. 97601)

Atwater-Kent Model 20 receiver, ser. 228289; tunes BC; has 5 tubes. Schematic and source for parts needed. (Sgt. Orville Gallimore, AF 55287419, 2140th Comm. Sqdn., AFCS, Box 2162, APO, New York 09223)

Hickok Model 450 VDM. Schematic and operating manual needed. (Brad Woeike, 11422 Marion, Detroit, Mich. 48239)


December, 1966

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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.

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

99PV-6

Handle and 3 slotted screwdriver blades (1/4", 3/16", 4/16" tips) 2 Phillips (#1, #2)

99PV-4

Handle and 3 slotted screwdriver blades (3/8", 1/4", 5/32" tips)

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Send Catalog 166 with information on “Plastic View” Screwdriver Kits.

name

address

city state & zone

CIRCLE NO. 45 ON READER SERVICE PAGE

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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 radar 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 (KXXKW).

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, L5 and L4 should be transposed; also transpose L3 and L4 in the Parts List.

Static-Free Thermistorized Aquarium Heater (September, 1966, page 74). Resistor R5 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 13¼“ x 34“ x ¾”; for the exterior top as 13¼“ x 19“ x ¾”; and for the exterior bottom as 12¾“ 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.
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VOLTS
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 Octo-
ber 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.

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

SINGLE
CHANNEL
Crystal-controlled.
Antenna extends
to 36 inches.
$24.95
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DUAL CHANNEL
Has two crystal-controlled chan-
nels, with selector switch. Not to
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It's Easy with the PRM
VHF COMPACT CONVERTER

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. Pow-
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SINGLE CHANNEL @ $24.95 each, Postpaid.

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For VHF Frequencies ___ Mc. and ___ Mc.

Broadcast frequency preferred ___ Kc.

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Address ________________________________

City __________________ State _______ ZIP _________

December, 1966
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:
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.

---

**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.

---

CIRCLE NO. 5 ON READER SERVICE PAGE
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 transcribe 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.
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 dis-
tortion 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.

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

"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,
AM/FM VHF RECEIVERS
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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.

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348A Transistorized tuneable converter for use with car, home or portable radio. Ranges: 30-50, 115-130, 150-162 MC. Salt. incl. Same but crystal controlled for 12 V car use. (345A) $29.95. Economy tuneable model (315T) same ranges $18.96

$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

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CIRCLE NO. 24 ON READER SERVICE PAGE

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12 volt negative ground only.

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

THE "SCRONGE"
(Continued from page 46)

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

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

As with any antenna work, there is no substitute for actual on-the-job tuning, adjusting, and other optimizing activities. The figures shown are close enough for most applications, and include some consideration for end effect. If you want to experiment using a cut-and-try technique, you can first try shortening the quarter-wave section about 1/2" at a time before modifying the half-wave section. Telescoping sections such as are found on a pair of TV "rabbit ears" could help you pin down the exact dimensions.
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For A 19'' Color TV...

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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 quanti-
ties.

*Kit GR-180, everything except cabinet.
102 lbs. ................................................ $379.95
GRA-180-1, walnut cabinet (shown above),
30 lbs...18 ¾” D x 28 ¾” W x 29” H...$49.95
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NEW 12'' Transistor Portable TV — First Kit With Integrated Circuit

Unusually sensitive performance. Plays any-
where...runs on household 117 v. AC, any
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grated sound circuit replaces 39 components;
preassembled, prealigned tuners; high gain IF
strip; Gated AGC for steady, jitter-free pic-
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in only 10 hours. Rugged high impact plastic
cabinet measures a compact 11 ½” H x 15 ¾” W
x 9 ¾” D. 27 lbs.

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$119.95

Turn Page For More New Kits From HEATH

CIRCLE NO. 18 ON READER SERVICE PAGE

December, 1966 95
9 Kit-Giving Ideas From Heath...
Harmony-by-Heathkit® Electric Guitars & Heathkit Guitar Amplifier

NEW Heathkit Transistor Guitar Amplifier
60 watts peak power; two channels — one for accompaniment, accordion, 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.

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.

Silhouette Solid-Body Guitar... 2 Pickups
Modified double cutaway leaves 15 frets clear of body; ultra-slim fingerboard — 24½" scale; ultraslim 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.

“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

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 5¾" 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.
NEW Heathkit® /Magnecord® 1020 4-Track Stereo Recorder Kit

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

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-66A

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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.

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CIRCLE NO. 18 ON READER SERVICE PAGE 97
“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
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 ELECTRONICS to Lockport, N.Y., Mayor Roland T. Grant by James Trombino. (The Pioneer CB'ers had been praised in the OTCB column that month for their fund-raising activities.) Vern reported that the one-day affair realized a profit of approximately $4000 to aid needy children.

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

December, 1966

Photo by Al Shoem...
100 POPULAR ELECTRONICS

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

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

I'll CB'ing you!

—Matt, KHC2060

BRIDGE CIRCUIT QUIZ ANSWERS
(Quiz appears on page 73)

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- The CAREY FOSTER bridge measures capacitance in terms of mutual conductance, and mutual conductance in terms of capacitance.
- The HAY bridge measures the self-inductance of high-Q coils (Q greater than 10), and also determines unknown frequencies.
- The HEAVISIDE bridge measures the mutual inductance of the coils of a transformer in terms of a known self-inductance and known resistances.
- The KELVIN bridge is used when extremely low resistances—down to 0.001 ohm—are to be measured.
- The MAXWELL bridge measures the self-inductance of low-Q coils (Q of 10 or less).
- 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.
- The RESONANCE bridge measures capacitance, inductance, and frequency.
- The SCHERING bridge measures capacitance in terms of a standard capacitor and known resistances.
- 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.
- A WIEN bridge is used to measure capacitance by comparison with a standard capacitor, and inductance by comparison with a standard inductor.
AMATEUR RADIO
(Continued from page 78)

NEWS AND VIEWS

Louis Leukich, WA/NW8SNF, 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-made vertical antenna, and a 6-meter beam. There are 35 states logged on Lou's "amateur sheet." John, Jr., KB9LV, U.S. Navy, 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 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 1900 GMT using an SBE-34 exciter, a 100-watt amplifier, and a Telrex tri-band beam... KS5IO reports that Don, WAOBB/XV5, Cam Ranh Bay, Vietnam, is also active on 14 MHz with a Drake TR-4 and a 1/2-wave dipole antenna.

Alexandre Erminne, 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 AEC Delbert Stout, AP-17071703, 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 on Novice in Covina, Calif., using a 5-watt, home-brew transmitter, he made 300 contacts—all in California—in 80 meters. Then with a 40-watt, he worked 10 states. When he became a General, a Johnson "Challenger" transmitter feeding a vertical antenna racked up 40 counties and five countries. We don't know what Dan's new "S" call letters are... Jim Rembiszewski, WN951K, R.R. #2, Box 83A, Antigo, Wis., found out the "hard way" that the qt-net output tank circuit of a transmitter won't match just any old antenna. But his Knight-Kit T-60 transmitter and 32½ home-made vertical antenna get along well on 80 meters. The antenna is constructed of 1/2" conduit and is fed with 52-ohm coaxial cable. Jim receives on a Knight-Kit R-56A. He has worked 13 states so far, and two Canadians.

Les W. Chapman, W4VU, 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. W4VU T works the lower frequencies with a Johnson "Ranger" transmitter and a Hammarlund HQ-110A receiver. For 2 meters, a new-surplus ARC-40 transmitter feeding a beam antenna and a converter ahead of the receiver do the work. He has a full set of QSL cards to prove that he doesn't talk to himself... Mike Czuhajewski, WA1MCQ, Route 3, Box 48, Pawtows, Mich., had 25 states on "KZ6" 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 113 contacts... Red Rowcliffe, WA8GMU, 6711 Merced Lake Ave., San Diego, Calif., makes certain that recipients really look at his QSL card. It is a very attractive color photo of him and his station, with the call letters occupying a 1/2" by 1/4" space in the picture. Red (who is former KK0KA) uses a Collins 323B driving a 30W1 amplifier into a Hy-Gain TH-3 rotary beam 70' high and a Collins 755-3B receiver. Besides being good-looking, the equipment must work well, because it keeps regular traffic schedules with KR6USA on Okinawa.

Joe Patrick, WN3DPT, R.D. #4, Box 104, Finneyville, Pa., uses a 35-watt transmitter built by WA3CWD. It shares time with a Hallcraft 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 meet 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" Harmacack, 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" (yes, 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 engineer takes a rugged set 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 contact practice. The Editor.

Herb S. Brier, W9EQQ, Amateur Radio Editor. Popular Electronics, P. O. Box 678, Gary, Ind. 46401.

73, Herb, W9EQQ

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CIRCLE NO. 36 ON READER SERVICE PAGE

December, 1966

101
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!
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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.

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December, 1966
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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 xman, 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 1535 kHz for ZBM1, Hamilton. While on a split channel between two “graveyard” frequencies, the station is often noted well in Eastern areas around 0500.

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.

POPULAR ELECTRONICS
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 2258-0946 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 Cadena, Manizales, has moved up from 5020 to 5025 kHz, where the signal is much weaker. This may be a standby xmt 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 3200, 4955, and 6180 kHz with the same programming, including "English By Radio" from the BBC at 2345. S/off varies from 0400 to 0800.

### SHORT-WAVE ABBREVIATIONS

amnt—Announcement kHz—Kilohertz
BBC—British Broadcasting kW—Kilowatts Corporation
CBC—Canadian Broadcasting QRM—Station km—Kilometers Corporation
Eng—English QSL—Verification
ID—Identification Radio
IR—International Reply R.—Radio
IRC—International Reply S/off—Sign-off
Coupon s/on—Sign-on
xmt—Transmission
IS—Interval signal xmt—Transmitter

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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.

Newcomer Kevin Drost, of Union Lake, Mich., has already logged 30 countries—with a Hallicrafter 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 17,850 kHz at 1600 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 1000-1200, and on Sundays at 1400-1500.
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 beat on Mondays because XEJG, Mexico, is off the air then.

Hungary—R. Budapest opens in Eng. at 0000 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 1845 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. A new opening, with a 7-note IS on an instrument resembling an organ, is at 2335; this xmn, 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 0200-0320, in Eng. at 0230-0300, in Arabic at 0300-0530 and in Spanish at 0530-0600. Omni-directional xmas are broadcast daily at 0400-0700 and 1415-1820 on 5890 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 0339 to 0425 fade; drum IS at 0400, then a cock crowing and a native-language anmt, followed by news in native language at 0415.

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

Mauritius—For Mauritius, Fort Forest Side, now operates, as per the latest schedule, at 0300-0300 on 9710 kHz and at 1300-1800 on 4850 kHz, both with 10 kW.

Morocco—Aquí Rabat, R. Diffusion TV Marocói, opens at 15.390 kHz to 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 plus instrumental 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 9850, 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 1200-1630, to Europe and N.A. at 1500-1820, to Scandinavian, Pacific areas and Africa at 1700-1830 and to Europe and Africa at 1900-2030, all on 15,175, 17,325, and 21,760 kHz (also on 11,850 kHz at 0745 and 1900, 2240 kHz at 1100, and 21,750 kHz at 1300, 1500, and 1700); to N. Africa, Newfoundland, and S. America at 2100-2230 on 11,850, 15,175, and 17,325 kHz; to W. and S. Africa, Newfoundland, and

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December, 1966

CIRCLE NO. 40 ON READER SERVICE PAGE
DX STATES AWARDS PRESENTED

To be eligible for one of the DX States Awards designed for WPE Monitor Certificate holders, you must have verified stations (any frequency or service) in 20, 30, 40, or 50 different states in the U.S. The following DXers 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. (WPE2NOO), West Orange, N. J.
Gary Charles Angell (WPE6EIO), Riverdale, Ill.

FORTY STATES VERIFIED
Robert Crowell (WPE4HKO), Fort Walton Beach, Fla.
Paul Ochenkowski (WPE1FY), Hamden, Conn.
Larry Zigragn (WPE9SHLM), South Bend, Ind.
Douglas Messimer (WPE3F3Z), Enola, Pa.
Larry Himsel (WPE2NRR), North Bergen, N. J.
Bruce Reynolds (WPE8EUK), 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.
Elliott Strauss (WPE2NOO), West Orange, N. J.
Jan Lichtig (WPE6EEO), Livermore, Calif.
Norris Alford (WPE8FFY), Winfield, W. Va.
Paul Pruitt (WPE6GJR), Dana Point, Calif.
Barr Premues (WPE8HIP), Lansing, Mich.
Leo Baca (WPE5CLR), East Bernard, Texas
John Sgrulletta (WPE2MFX), Bedford Hills, N. Y.
David Bartlett (WPE1QGK), East Hartford, Conn.
Russell Faren (WPE5CXT), New Orleans, La.
Harry Dence, Jr. (WPE4IKY), Cynthia, Ky.
Calvin Bright (WPE8BIA), Grass Lake, Mich.
Donald Lee (WPE3EBV), Lebanon, Pa.
Richard Cooper (WPE1GHI), Wayland, Mass.
W. E. Raczko (WPE8JBT), Toledo, Ohio
Kelly Fordreves (WPE4IGA), Charlotte, N. C.
Phillip Smith (WPEBIA), 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 (WPE1FM), Cambridge, Mass.
John Megas (WPE1GJL), Ellsworth, Maine
Frank Hames (WPE3CDM), Silver Spring, Md.
Robert Mayer (WPE9HQG), Winnetka, Ill.
Romona Hagerman (WPE2OBV), Detroit, N. J.
Mark Hosmer (WPE9PHM), Carmel, Ind.
Jerry Headen (WPE4HQL), Winston-Salem, N. C.
Jimmy Checkett (WPE4IDH), Wilson, N. C.
John Tuomi (WPE2NNO), Brooklyn, N. Y.
Alan Petersen (WPE9EHEF), Hampton, Iowa
Charles Angell (WPE3TTP), Collegeville, Pa.
Robert Mayer (WPE9HQG), Winnetka, Ill.
Ronald Stoltz (WPE3GCE), Trafford, Pa.
Robert Ruggles (WPE9HUH), Chicago, III.
Forrest Hudspeth (WPE3FWI), Barrie, Md.
Gary Schwartz (WPE6GGG), Rossmoor, Calif.
Gary Herron (WPE8I0N), Fraser, Mich.
Robert Mansbach (WPE2NJB), Long Beach, N. Y.
Roger Taylor (WPE8EMD), Independence, Mo.
Ben Hughes (WPE0EMX), Seward, Nebr.

E. Kent (VE3PE2GF), Rexton, Ontario, Canada
Harold Allen (VE2PE1JM), Arvida, Quebec, Canada
William Chrysler (VE6PE6K), Edmonton, Alberta, Canada
David Miller (WPE3GMH), Pittsburgh, Pa.
Leroy Irland (WPE2MSY), Ventnor City, N. J.
Roger Greene (WPE2NFC), Bronx, N. Y.
Paul Emch (WPE5GBG), Trabuco Canyon, Calif.
David Lator (WPE5EQQ), Corpus Christi, Texas
Thomas Woods (WPE3T2Z), Newark, Del.
Edward Greb-Lasky (WPE1GPO), New Britain, Conn.
James Sarabalis (WPE6GIG), Daly City, Calif.
Richard Goldfinger (WPE2ZOW), Pound Ridge, N. Y.
Dave Ciotti (WPE4IZC), Fairfax, Va.
Marion Lilienthal (VE3Z0D), Waterloo, Iowa
Alan Rhodes (WPE2OQU), Mountainside, N. J.
Austin Arnold (WPE1GAK), Litchfield, Conn.
James Reda (WPE3F3X), Beaver, Pa.
Geoff Fieck (WPE2OQB), Mt. Kisco, N. Y.
Thomas Break (WPE2OQH), Falls Church, N. J.
Charles Schroeder (WPE8I1YP), Dayton, Ohio
Fred King (WPE91EA), Wabash, Ind.
Jimmy Eppright (WPE5ELM), Dallas, Texas
Kenneth Kubera (WPE8CM), Detroit, Mich.
Robert Thacker (WPE8IX), Dayton, Ohio
William Vines (WPE9HVF), Hollywood, Ill.
Mike Jeffrey (WPE7CLK), Wenatchee, Wash.
W. F. Gilly (WPE3GNT), Allentown, Pa.
Albert Earnhardt (WPE4JUN), Charleston, S. C.
Frank Colvin (WPE2OQP), Suffern, N. Y.
Frank Etller (WPE1GSE), Hamden, Conn.
Bruce Kesselman (WPE2OQO), Woodbridge, N. J.
Ron Hopkins (VE7PE7P), Trail, British Columbia, Canada
Drew Kalman (WPE8ILL), Dearborn, Mich.
Kenneth Hanna (WPE3G5Y), 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. (WPE5HXW), Wheaton, Ill.
Ronald Hartwig (WPE5ELA), Midland, Texas
Michael Cohen (WPE2NTW), Brooklyn, N. Y.
Samuel Gold (WPE6DXA), San Francisco, Calif.
Rodney Viach (WPE6EPS), Benson, Minn.
Charles Rittenhouse (WPE8BIMT), Westerville, Ohio
Donny Perro (WPE4HDU), Mobile, Ala.
Jonathan Liseno (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 Brahmwart (WPE7C7Q), Moses Lake, Wash.
Helmut Meier (VE2PE12Z), Sept-Iles, Quebec, Canada
Gregory Hendrix (WPE5EJK), Galveston, Texas
Ernest Doane (WPE1DTE), Lynn, Mass.
Bradley Westley (WPE8G0Q), Wilbur, W. Va.
James Mason (VE3PE2FB), Hamilton, Ontario, Canada
Robert Blazeyewski (WPE2FZY), South Farmingdale, N. Y.
Norm Shacat (WPE1GTP), Malden, Mass.
S. America at 2300-0030 on 9550, 9610, and 11,850 kHz. A 30-minute program in Eng. is broadcast on Sundays at 1200, 1400, 1600, 1800, and 2000, and on Mondays at 0000 and 0400.

Peru—Station OBZ4M, R. La Vos 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, Chuacna. 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 anmnts 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 7220, 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 anmnts in Malay; at 1030 with Arabic vocal and instrumentul 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 chrip 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 0650-0130. Another station, on 9747 kHz, is being heard around 1100; overseas listeners list it as R. Tovar. The latter bears further checking.

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

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