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Letters
from
our
Readers

Real-Life Components Wanted

How about a series of electronic theory articles in which each component would function as intended,
but would take on human characteristics? The action
could take place in "Schematicsville," and the char-
acters might be "Coil," a shapely chick; "Ann Tenna,"
a skinny little gal with waving arms; "Mic Ro Farad,"
who runs the "Capacitor Motels"; etc. The police de-
partment would be made up of the Ohmsquad, its
members often decorated with colored stripes on their
uniforms.

Charlie Fields
Indianapolis, Ind.

And then there could be "Solder Lug," an out-and-out
crook; "R. F. Choke," a roughneck friend of his who
is foiled by "Ilmy," and "Chassit," a beautiful gun
moll. We like the idea, Charlie, and will consider
it for future use.

Novice Harmonics

Ever since I received my Novice ticket and put my
rig on the air, I've had trouble with strong harmonic
radiation on 80 and 40 meters. I wonder if you could
publish some information on reducing harmonics—I
bet there are a lot of hams in the same situation. Would an antenna tuner help solve the problem? How
about filters, traps, etc.?

John Stensby, Jr., WN4RES
Huntsville, Ala.

Will, first off, John, you should definitely try an an-
tenna tuner. Aside from the advantages; it will offer
in impedance matching, it will add considerable select-
ivity to your antenna system, and greatly reduce har-
monic radiation. One of our favorites is the simple

![Diagram]

"L" tuner shown here: it will match a wide variety of
antennas. If your harmonics can still be heard more
than a mile away, you can say goodbye to them forever
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**Letters**

(Continued from page 6)

need one for each band you work. See the ARRL Handbook and Antenna Book for more information.

**Labels Lambasted**

- **POPULAR ELECTRONICS** has always had a very attractive cover except for one thing—the mailing label. At the moment, I'm looking at the cover of the April (1964) issue which reads: "...d circuit," "... talkin,'" and "...t kit (p. 65)." Is there any way to remove the label without ruining the cover? Better yet, how about putting it on the back cover?

**Rick Vogt, W39JRY**

Chicago, Ill.

There's no handy way to remove mailing labels that we know of, Rick, unless it's steam ing them off, and, unfortunately, we'd get in trouble with the post office if we put them on the back cover. Most months we do try to put the printing where the label won't be, however.

"Secret Tube" Claims Disputed

- Concerning "The Secret Tube That Changed the War" (March, 1964) which is credited to Major Harold Zahl by author Orr, your readers may be interested to know that the basic patent on such a tube, which included the tuned circuits as well as the electrodes in a glass envelope, was filed by the writer in England during 1925 and issued under International Convention in the United States during 1930. The Zahl tube in fact was so similar to the writer's 1925 model 150-mc. tube described in his patent that a settlement in favor of the writer was obtained by action in the United States Court of Claims, Washington, D. C.

**W. J. Brown**

Registered Professional Engineer

Stamford, Conn.

Intrigued by Mr. Brown's letter, we asked both Dr. Harold A. Zahl and author Orr to comment on it. Both were kind enough to do so, and their letters (in part) appear below.

- U. S. Patent No. 2,522,557 covering the VT-158 as mentioned in Mr. Orr's story was filed by the applicant on Jan. 25, 1943, and issued Sept. 19, 1950. Twenty-six claims covering the features of my tube were granted. Eighteen earlier patents, including Mr. Brown's, were cited during the prosecution of my patent application. The issuance of my patent by the U. S.
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FONDED 1927

July, 1964
Letters (Continued from page 8)

Patent Office indicates that my tube was patently different from all of these earlier patents, including the patent to Mr. Brown. I, of course, do not wish to take any credit for what Mr. Brown did. My patent covers my contribution to an art in which many others made successive contributions.

The VT-155 was made in production lots of tens of thousands and the radar sets using these tubes saw service in both major theaters of WW II and later in Korea. I enjoyed Mr. Orr's article very much and his accolades made particularly pleasant reading for me.

HAROLD A. ZAHL
Fort Monmouth, N.J.

Many interlocking and overlapping patents exist in the field of electronics and several patents exist in the area of electron tubes which contain internal circuitry. The Coaxitron is one such example, and other patents in this field are traceable to de Forest and Edison. In any event, Dr. Zahl created a device that was sorely needed and was not otherwise available, and that served his country in a time of dire need.

WILLIAM I. ORR
San Carlos, Calif.

He Builds "The Lightning Bug"

The statement you made recently that "The Lightning Bug" (Carl and Jerry, Nov., 1963) exists only in the story is false. Needing a new stunt for a Halloween party, I built a prototype. The schematic shows the design used—the exterior is a matter of taste. Currently I’m working on "The Girl Detector" (Carl and Jerry, Jan., 1964).

RALPH M. REESE, JR., WN4QA
Niceville, Fla.

We hope you make out well with your second project, Ralph!

The "Forgotten" Citizens Band

A holder of Class B, C, and D Citizens Radio permits (in addition to an amateur ticket), I have never once read about operations in the 400-470 mc.

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(Continued from page 8)
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VOID AFTER JULY 31, 1964

July, 1964
Letters

(Continued from page 10)

Class B Citizens Band. A number of years ago, one company put out a relatively inexpensive transceiver for this region, but to date all the equipment I have seen for 460 consists of high-priced business rigs. Who manufactures this equipment? Are there many individuals with a "B" ticket or am I the only one?

Dave P. Weik, KAI0619/KAG3247
Livingston, N. J.

You are not alone, Dave. Theoretically at least, the 460-470 mc. Class B service is intended for exactly the same purposes as the 26,96-27,255 mc. Class D service, and anyone can get a Class B ticket if he has a need for one; many have. Equipment is another story, however. Gear—which must conform to FCC Regs—is expensive to produce for 460, is relatively difficult to install and service, and has a limited range in some locales. Practically speaking, therefore, the band is used mostly by small businesses and others with communications needs more pressing than those of most CB'ers. Some manufacturers of Class B equipment are Link, RCA, Motorola, and GE.

Pico Equals Micromicro

Popular Electronics recently published the schematic of a wireless microphone ("Transistor Topics," March, 1964), giving the values of two capacitors as 100 pf. and 250 pf. What does "pf." mean?

Charles F. Lester, M. D.
Miami, Fla.

The abbreviation "pf." is for "picofarad," which replaces the older term, "micromicrofarad" (µµf.). "Pico" was one of the recommended unit prefixes recently adopted by the International Committee on Weights and Measures, and means (as does "micromicro") 10^-12.

Found: Genuine Bargain

With reference to "Bargains by the Bagful" (February, 1964), you may be interested in a good buy I made recently—the amplifier section of a stereo tape recorder manufactured by a firm which went out of business. The unit—selling for 95 cents— Included 37 half-watt resistors, 8 one- and two-watt units, 33 capacitors, 7 tube sockets, 7 dual controls with switches—over 80 parts, ALL of which checked good!

Dennis C. Smith
Detroit, Mich.

Any more where those came from, Dennis?

Out of Tune

C Bridge (November, 1963, page 66). The value of C1, specified in the Parts List as 100 µµf., should be .001 µf. as shown in the schematic diagram.

The WXCVR (January, 1964, page 65). The value of C8, specified in the Parts List as 470 µf., should be 470 µµf. (or µf.) as shown in the schematic diagram.
NOW IT'S A BREEZE
Paint everything you see here—including the room—with the
WORLD'S FIRST ROTARY ACTION PAINT GUN!

Delivers as much paint per minute as a $200 industrial compressor
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INSECTICIDES... FLOOR WAXES, POLISHES AND OTHER LIQUIDS.
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• 2-SPEED OPERATION for perfect control of light and heavy
liquids.
• FINGER-TIP CONTROL OF PAINT FLOW—trigger lets you
start and stop spraying instantly
• ADJUSTABLE GATE FOR EXACT WIDTH OF SPRAY YOU
WANT—from 1/8" to 18"—can't ever clog in operation.

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CLAMP-ON CAN holds full
quart
PAINT VOLUME CONTROL
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For 115v AC operation
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rugged durability
CAN'T EVER CLOG
IN OPERATION
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action spin the paint at a
steady 17,000 RPM...
actually makes the Sloan-
Ashland Paint Gun impossible
to clog in operation!
Reduces misting and overspray
to a minimum. Eliminates 90%
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to cover everything in sight.

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Fill container with water or proper solvent, run gun for a minute or
two. That's all there is to it! No mess, no bother!

$59.95

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in each stroke than a 6" brush or roller...
Now you can do 100 Sq. ft. of surface in minutes—because you
cover three times as much area on each stroke, with the Sloan-
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minimum of feathering gives
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most precise painting.

American Products Division, 589 Broadway, New York 12, N.Y.
Send me your new Sloan-Ashland Rotary Paint Gun. I may use
it for seven days free, and return it at your expense if I am
not fully satisfied.

Also—send me two free quarts of Spred Satin Paint (worth $4.30)
which I may keep and use whether or not I agree to buy the
Sloan-Ashland Rotary Paint Gun.

If I do agree to keep it, I will pay only $8.50 a month until I've
paid the low price of just $59.95 (plus shipping and handling).

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DEGAUSS YOUR TAPE RECORDER HEADS

When your tape recorder begins to sound "muddy," it's a good indication that the heads are in need of degaussing (or demagnetizing). There are commercial degaussers available, but it's easy to make one. Saw a \( \frac{1}{8}'' \) slot in a \( \frac{1}{2}'' \) flat iron washer and wind six or eight turns of \#14 or \#16 insulated wire on the washer. Connect the wire ends to your soldering gun (after you remove the soldering element), and you'll be able to degauss both the heads and guides. The tool can also be used to erase small sections of recorded tapes, such as unwanted switch pops, or words.

—R. K. Dye

A "BELT" FOR YOUR SIGNAL

Planning to take your transistor radio on a camping or hiking trip? For better reception, make a belt out of TV twin-lead and a buckle from an old belt. Cut the twin-lead to a length slightly longer than one of your regular belts, and punch the appropriate holes in it. Fold over the buckle end and fasten it securely. Now connect the leads together at the other end, and solder one of the leads at the buckle end to the buckle. A clip-lead from the...
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Tips

(Continued from page 14)

transistor radio antenna jack to the buckle will improve reception, especially in remote areas far from a radio station.

—John A. Comstock

REMOVE EXCESS SOLDER WITH A “SOLDER SUCKER”

Softening solder with heat is just part of the de-soldering problem. Using a wire brush to remove the soft solder causes it to splatter around where it isn’t wanted. You can solve this problem with an empty squeeze bottle and an empty ball-point pen cartridge. Just remove the feed tube from inside the nozzle, and enlarge the opening in the nozzle to accept the cartridge from which the ball-point tip has been removed. To use the “solder sucker,” squeeze the bottle and plunge the end of the tube into the pool of melted solder, then release the pressure on the bottle. The solder will be sucked up into the bottle. Should the tip become clogged, it can be cleaned with heat and a piece of wire.

—Jerome Cunningham

DOUBLE-DUTY SOLDERING TIP

Need a small low-heat soldering tip? Carefully drill a hole through the end of an Ungar 20- or 50-watt soldering tip element, drilling as close to the end as possible to avoid damage to the heating element. Mash one end of a short length of #10 solid copper wire and insert the other end through the hole. Force the mashed end tightly into the hole to keep the wire in place. Dress the other end of the wire with a file to a chisel or pyramid tip, and tin it. The original larger tip can still be used whenever you wish.

—James F. Glennon
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THROUGH THIS COLUMN we try to make it possible for readers needing information on outdated, obscure, and unusual radio-electronics gear to get help from other readers. Here's how it works: Check over the list below. If you can help anyone with a schematic or other information, write him directly—he'll appreciate it. If you need help, send a postcard direct to OPERATION ASSIST, POPULAR ELECTRONICS, One Park Avenue, New York, N.Y. 10016. Give the maker's name, the model number, year of manufacture, bands covered, tubes used, etc. Be sure to print or type everything legibly, including your name and address, and be sure to state specifically what you want, i.e., schematic, source for parts, etc. Remember, use a postcard; we can handle them much faster than letters. And don't send a return envelope; your response will come from fellow readers. Because we get so many inquiries, none can be acknowledged, and POPULAR ELECTRONICS reserves the right to publish only those requests that normal sources of technical information have failed to satisfy.

Schematic Diagrams
Motorola FM receiver, chassis P 8116A1 H-C. Highway Patrol surplus. (James Wynta, 4220 N. 31 Ave., Phoenix, Ariz. 85017)

General Electric Model 776 receiver, ser. 862, mid-30's. (Gerald Widdick, Didibury, Alberta, Canada)

MD-23/ARA-3 surplus modulator made by Ballantine Labs. (Howard Butler, Jr., 3315 W. Louisiana St., Midland, Texas 79702)

Superior Instrument Model TV-11 tube tester. (Thomas M. Sutton, 829 Chestnut St., Burbank, Texas 76354)

Sparton Model 4970 AM-FM receiver, chassis 8810. (Steve Citrin, 6220 W. Tenth Ave., Hialeah, Fla.)

Western Auto Supply "Air Patrol" Model 276 receiver, about 1935. Covers 540 kc. to 18.5 mc. in three bands. (John D. Mutch, Route 2, Box 97, Paul, Idaho)

Zenith Model 118474 three-band receiver, ser. 8617231, chassis 1103. (Allen L. Andersen, 7915 S.W. 83 Ave., Portland, Ore. 97222)

RCA Model ACR175 ham receiver, about 1936. Tunes 550 kc to 60 mc. (T. Cecire, 73 Miami Dr., Cedar Grove, N.J.)

Capehart (div. of Farnsworth Corp.) Model 13LH2 three-band receiver plus phono, pre-war. 13 tubes. (Ken Grant, Box 36, Hubbard, Ore. 97032)


Hallicrafters Model 5K42 "Continental," a.c.-d.c., S.W. and BC. (James E. Bradbury, 4225 Beauty Lane, St. Louis, Mo. 63134)

Hartman Model 3059 30-watt marine radiotelephone. (Sanford C. Oshansky, 20100 Tracey Ave., Detroit 35, Mich.)

RCA Victor disc recorder, Model MI-12701, circa 1940. (Steven Zeigler, 1415 Beaver Rd., Sewickley, Pa. 15143)

(Continued on page 20)
Coming up in August

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☐ Transistor Ignition Systems Handbook. Clearly explains the principles, installation and tuning up of these new transistor ignition systems which are revolutionizing the auto industry. Order IGS-1, only... $2.95

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POPULAR ELECTRONICS

Operation Assist

(Continued from page 18)

Hallicrafters S-39A UHF receiver. Tunes 28-143 mc. (Fred L. Schultz, Box 182, Hashbrouck Heights, N.J.)

CRR-52253 surplus transmitter made by Bendix Corp. about 1940. (Davis Straub, 809 Podva Rd., Danville, Calif.)

Solar "Exam-eter," Model CF, ser. 91747. (C. B. Sutherland, 7272 Walling Lane, Dallas 31, Texas)

Apollo 16-mm. sound projector made by Excel Movie Products. Has two-tube amplifier that broadcasts audio to radio receiver. Uses infrared scanning system. (R. H. Reiter, Route 2, Box 97, Chesterton, Ind.)

U. S. Marine crystal-controlled receiver made by Fisher Research Labs., Type R825-3. (John R. Sandefur, 536 Elizabeth St., Natchitoches, La. 71457)

Atwater Kent Model 649 BC-s.w. receiver, about 1930. (R. W. Massie, 166 Boston St., Salem, Mass. 01970)

Dictascriber wire recorder made by Magnetic Corp. of America. (James Heath, Triangle Trailer Court, Lafayette, Ind.)

BC-455-B surplus receiver, 6-9.1 mc. (Curt Cochran, 13 Kingston Heights, Kingston, Tenn. 37763)

Fada TV Model TV-125, before 1949. (Ernesto Alvarado, Box 969, San Jose, Costa Rica, C.A.)

Firestone (model unknown) three-band receiver/phonograph. 11 tubes. Circa 1929. Has push-button tuning on BC. (Bob Cooley, 418 East 5 St., Port Clinton, Ohio)

Mercury "Mark T" CB set imported by International Communications Corp. of Santa Monica. (R. Hammond, 933 Linden Ave., Winnie, Texas)

Triumph Model 830 oscilloscope. (Barron Abrams, 7 Stuyvesant Oval, New York, N.Y. 10009)

Majestic Model G-25-A BC receiver, ser. 25,723. Uses $5. 58, 57AS tubes. (L. R. Young, Woodmont, Conn.)

Western Auto Supply Model 1139 10-tuber, 5 bands. Tunes 530 kc. to 1 mc. (Paul Cloud, 6567 Eldridge St., Dallas 20, Tex.)

United American Bosch Corp, Model 550 (or 810) receiver, ser. 129750. Three bands. (Hans G. Albrecht, RFD 3, Route 6, Newtown, Conn. 06470)

Bendix BC receiver, Model 657A, a.c.-d.c. or battery-operated. Circa W.W. II. (Bernard Kubinski, 1306 Ash St., Olean, N.Y. 14760)

AGA Model 1777 7-band, 7-tube s.w. receiver. Made in Sweden. Circa 1926. (Augustin Ortiz M., M. Calzadas 2550 Lomas, Mexico 10, D.P., Mexico)

Aurex 4-tube high-gain p.a. amplifier with built-in dynamic mike. (Ed Weidner, 678 Columbus, Benton Harbor, Mich.)

Lafayette Model HE-37 walkie-talkie. (S. E. Hollich, 12712 S. Memorial Parkway, Huntsville, Ala.)

Special Data or Parts

Bendix Model ATD (type CRR52253) Navy transmitter, about 1940, with 814 in final. Schematic, parts list and operating manual needed. (John E. Shea, 15-B Carr St., Watsonville, Calif. 95076)

Wireless Set No. 19, Supply Unit No. 1 MK1. Army surplus, circa early 1940's. Z.A. 123992, M.S.W. 48735. Schematic and source for parts needed. (Erie C. Kavana, Box 18040, Nairobi, Kenya, E. Africa)

Case Model 610 receiver, made in Marion, Ind., about 1925; has "Tell Time Tuning." Alignment info and a schematic needed. (John Whybrey, Upian, Ind. 46899)

National Union Radio Corp. radarcope. 5PFT8 CRT bent diagram needed. (Bill Gilmour, 19 Edgewood Ave., Hamilton, Ontario, Canada)

Westinghouse Model H-212 AM-FM receiver, chassis V-2137, about 1950. Selector switch, part V6140, and dial face needed. (Lewis E. Beleh, Box 183, Colerain, N.C.)

Zenith Model R615Y table-model radio, chassis 6J05; tunes AM 550-1600 kc. Loop antenna needed. (Ray Smith, 337 W. 6th Ave., Escondido, Calif. 92025)

BC-1335 Signal Corps receiver. Maintenance and operating manuals wanted, also info for conversion to CB or 10 meters. (Thomas Toms, Route 2, Bostic, N.C.)

(Continued on page 22)
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July 1964 CIRCLE NO. 11 ON READER SERVICE PAGE
Operation Assist
(Continued from page 20)

RT-111/TRC-20 surplus unit, Power requirements and schematic wanted. (Joe Cross, 5876 N. E. 22 St., Des Moines, Iowa 50313)

Brand and Millen Model 1003 amplifier, Schematic and tubes needed. (E. L. Rowe, 427 Ave. F South, Saskatoon, Sask., Canada)

Westinghouse Navy surplus dynamos, style 1171412-A, number on case are CAT-211483, P-718697-1, Operating data needed. (Andrew L. McCaskley, Route 1, Weyers Cave, Va. 24486)

Sparton Model 10 three-band superhet. Calibrated glass dial or contact negative of dial needed. (Wesley W. Harris, Route 5, Box 2325, Bremerton, Wash. 98312)

Zenith Model 6-B-107 six-tube receiver, Source for No. 15 tubes needed. (J.O. Sanborn, 2312 N.E. 92 St., Seattle, Wash. 98115)


Service Instruments Inc., Model 20-A electronic d.c. voltmeter, ser. 473. Schematic, parts list, and info to convert to a.c.-d.c. needed. (Robert D. Greene, 373 Newton St., Waltham, Mass. 02154)

Zenith receiver, ser. S498075, circa 1937-1940; has eight tubes including 1235 local. Schematic and alignment info needed. (John J. Bucholtz, Jordan, Minn.)

Mobilite (of Beverly, Mass.) Model TR-148 eight-tube receiver for two meters, series 150, ser. 354. Manual, schematic, technical data needed. (Pete Barth, 13645 Louvre St., Pacoima, Calif.)

General Electric Model F70 BC-s.w. receiver, about 1910. Schematic, parts list, and alignment info needed. (R. Barclay, 419 State St., Madison, W. Va.)

Earl Webber Co., Model 200 tube tester, ser. 8500. Replacement chart wanted. (Cari Geselichen, 617 Front Ave., Bismarck, N.D.)

BC-1271-A 12-tube receiver, ref. 10EU/17901, crystal-controlled on 128.15 mc., reconditioned by Canadian Aviation Electronics. Schematic and operating manual needed. (Reed Park, 260 Weldaick Rd., Richmond Hill, Ont., Canada)

Barker & Williamson surplus receiver, Model OA-05A/MRC-2. Technical manual needed and conversion info for ham use. (Neil Dresbach, 1022½ Haskell St., Reno, Nevada)

Raytheon color TV, Model C-21C1-M. Horizontal output transformer needed, part 12-E-26639. (Wayne B. Clymer, Route 3, Box 186D, Medford, Ore.)

Philharmonic transmitter/receiver, military surplus RT-255A/URC-11. Info wanted to convert to CB use. (Gary Burke, NAS Noris Faetupac ABW, San Diego 35, Calif.)

Electronic Specialty Co., "Ranger" aircraft receiver, Model 108, 9 tubes, 195-410 kc. Schematic and technical data needed. (B. J. Funk, 3399 W. 41 St., Cleveland 9, Ohio)

Silvertone wire recorder. Wire wanted. (S. K. Pawloski, 418 Pine St., Ambridge, Pa.)

Crosley receiver, circa 1923-1925. Book-type capacitor needed. (Howard Donaghay, 222 Glies Rd., Bridgeton, N. J.)

Kolster Type "K" BC receiver. Special parts and schematic needed. (Ken Rubin, 1216 E. 22 St., Brooklyn, N.Y. 11210)

Murdock "Neutrodyne" receiver, about 1923. Schematic, instructions, parts for tube needed. (William Thompson, Box 445, Bingham, Maine)


Readrite tube tester. Model 430, ser. 6512. Tube charts, schematic, and operating info needed. (Gary W. Roth, Box 122, Harrington, Wash.)

---

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New Products

Additional information on products covered in this section is available from the manufacturers. Each new product is identified by a code number. To obtain further details on any of them, simply fill in and mail the coupon which appears on page 11.

CAR RADIO CONVERTER

When the "Miniverter" is inserted in the antenna lead of an auto CB receiver, it converts it to a short-wave receiver which covers any 1-mc. band from 1 mc. to 160 mc., depending on the "Miniverter" model selected. Manufactured by Scientific Associates Corporation primarily for use in mobile applications, the unit is available in 19 standard models, each of which includes a tuned r.f. stage and crystal-controlled oscillator. A simple on-off switch selects either regular broadcast reception or short-wave reception. The "Miniverter" is intended for amateur, marine, CB, aviation, and some fire and police department uses. Models for frequencies not covered by the standard models are available on special order. Prices start at $14.95.

Circle No. 75 on Reader Service Page 11

VHF WHIP ANTENNA

Designed by Regency Electronics, Inc., primarily to work with its "Flight Monitoradio" aircraft band receiver, the new Type AA-1 coaxial whip antenna is for use in the 108-136 mc. VHF band. It has a nominal impedance of 72 ohms and weighs 4 ounces. The AA-1 comes in two easily assembled sections, each 23½" long (47" when fully extended). Price, $5.95.

Circle No. 76 on Reader Service Page 11

SPECTRUM MONITOR KIT

The first low-cost spectrum monitor available in easy-to-build kit form, the Heath Company's "Ham-Scan" can be operated with virtually any receiver in use today. It permits visual observation of band activity up to 50 kc. above and below the frequency to which the receiver is tuned. Among other things, the Heath kit "Ham-Scan" will identify SSB, AM, and c.w. signals, spot band openings, identify splattering signals, and facilitate checking of carrier and sideband suppression of SSB transmitters. As the receiver is tuned, the display moves horizontally across the base line, the signal being monitored appearing in the center.

CITIZENS BAND TRANSCEIVER

Available in both wired and kit form from Eico Electronic Instrument Co., Inc., the Model 777 CB transceiver features continuous receiver tuning, plus six crystal positions on both transmit and receive. The receiver is a double-conversion unit offering 6 db selectivity at 5 kc., and 20 db at 8 kc. It incorporates an automatic noise limiter, adjustable squelch, spotting switch, and S-meter. Sensitivity is rated at better than 1 µv. for a 10 db signal-to-noise ratio. A dummy load and ceramic mike are provided for use with the 5-watt-input transmitter. The power supply is a three-way type (6 or 12 volts d.c., 117 volts a.c.), permitting mobile or base station operation. Prices: $189.95 wired; $119.95 as a kit.

FM STEREO TUNER/AMPLIFIER

Incorporated in H. H. Scott's 345 64-watt FM stereo tuner/amplifier are three new circuits which are said to make for better

Circle No. 77 on Reader Service Page 11

Circle No. 78 on Reader Service Page 11

POPULAR ELECTRONICS
performance. The low-impedance symmetrical drive circuit in the amplifier section provides more power down to the low frequencies, lower distortion, cooler operation, and stability with any speaker load. Ultimate stereo separation and presence is claimed for the FM tuner series-gate time-switching multiplex circuit. Finally, the pulse-suppression-limiting circuit effectively suppresses interference from automobile ignitions, refrigerators, and the like. In addition, the 345 features new panel styling, slide-rule tuning with ball-bearing flywheel drive, and a convenient front-panel earphone receptacle. Price, under $350.

CERAMIC STEREO CARTRIDGE
Positive scratch protection is claimed for the new “Featheride” ceramic stereo cartridge announced by Electro-Voice, Inc. A spring - suspension mechanism permits the cartridge to pivot when sudden force is applied, bringing the stylus up off the record surface, and bringing a soft “sole” to bear on the delicate record surface. The “Featheride” is offered in two types, usable in phono units tracking at any force between 2 and 6 grams. It can be mounted in any modern tone arm having standard 1/2” or 1/16” mounting centers.

SQUARE CUSHION HEADPHONES
Piezoelectric Division/Clevite Corporation has announced a new square cushion design for its ED-300 Clevite/Brush hi-fi stereo headphones. Said to provide the wearer with more comfort over long periods of time while maintaining a tighter seal, the new headset carries an 18-month warranty against material or workmanship defects.

ONE-WATT WALKIE-TALKIE
The HA-150 is a transistorized two-way CB unit with a 1-watt r.f. input. Announced by Lafayette Radio Electronics Corporation, it features a quick-release battery compartment which contains eight standard C cells for heavy-duty service. Push buttons select one of two channels for operation and switch in the squelch circuit and noise limiter. The receiver has 1-μv. sensitivity, a push-pull audio circuit, and a 3” speaker. In addition to a 59” collapsible whip antenna, the HA-150 comes complete with a pair of crystals, batteries, push-to-talk dynamic microphone, and leather carrying case. Prices: $79.95 each; two for $154.95.

MATCHED DYNAMIC MICROPHONES
To insure uniformly good results for audiophiles who record live stereo programs, the Turner Microphone Company has made available two perfectly matched Model 500 cardioid dynamic microphones packaged together. Called the “Stereo Twins,” the microphones come complete with plugs to match most stereo recorder inputs. Price, $99.50.

PORTABLE TAPE RECORDER
The Norelco Continental “101” (Model EL 3586) transistorized tape recorder announced by North American Philips Company, Inc., weighs only seven pounds and uses inexpensive “D” type flashlight batteries. Frequency response is 80-8000 cycles. Features include a treble-base tone control, erase head, narrow-gap two-track record/playback head, sensitive dynamic microphone, input jack for recording from a radio, phonograph, or TV set, plus a second input jack for head-
New Products
(Continued from page 25)
phones, remote microphone switch, or a.c. adapter. Operating at 1% ips, the Continental "101" will provide up to two hours playing time on a single 4" reel. Signal-to-noise ratio is better than -45 db.

TAPE RECORDER MAINTENANCE KIT
Do you have all the items needed to keep your tape recorder in good condition? Freeman Electronics Corporation is now marketing a tape recorder maintenance kit, the MK-100. Conveniently packaged in a compartmentalized grey leatherette box is a tape splicer, head demagnetizer, head cleaner, head lubricant, mechanism lubricant, splicing tape, and special Q-tips for reaching hard-to-get-at parts. Price of the MK-100, $14.95.
Circle No. 85 on Reader Service Page 11

STEREO HEADSET REMOTE CONTROL
An individual volume control for each stereo channel has been incorporated into each ear piece of a new stereo headset—the ST-20—now being marketed by Telex/Acoustic Products. Stereo balance and volume are remotely controlled from the listener's easy chair by adjustment of control knobs on each ear cup. The ST-20 plugs into the headphone jack of the stereo system. Response: 16 to 15,000 cycles, 4-16 ohms. Price, $29.15, with 8' strain-resisting cord and plug.
Circle No. 86 on Reader Service Page 11

HIGH-OUTPUT MICROPHONE
Astatic Corporation has developed a -50 db output microphone for amateur or CB use. The 531 was designed for maximum clarity and intelligibility. Its hi-Z ceramic element has a wide temperature tolerance and is immune to humidity changes. A d.p.d.t. switch controls both signal and relay. The 531 comes equipped with a rectangular hang-up bracket.

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- **FM-AM Stereo Tuner ST96**
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- **70-Watt Integrated Stereo Amplifier ST70**
  - Kit $99.95; Wired $149.95

- **New Classic Series 36-Watt Stereo Amplifier 2036**
  - Kit $79.95; Wired $109.95
  - 50W-2050 K, $92.5C, $129.95
  - 80W-2080 K, $112.5C, $159.95

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  - 50-Watt Integrates:
    - 2-way system (4/5' woofer, HPS-10. W. $29.95 + 2-way system & woofer HPS-8, W. $44.95 + 3-way system 10' woofer. HPS-6, W. $55.95, W. $19.95

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  - Kit $89.95; Wired $129.50

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  - 1000 ohms
  - Kit $49.95; Wired $79.95

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  - Kit $28.95; Wired $39.95

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  - Kit $29.95; Wired $44.95

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POPULAR ELECTRONICS
A quarter of a million volts? All it takes is a transformer, a capacitor, a spark gap, and Tesla's famous coil

By CHARLES CARINGELLA, W6NJV

TESLA COILS have fascinated experimenters ever since the early 1900's when Nikola Tesla first experimented with giant coils that produced lightning-like discharges which would span his laboratory—the work of millions of volts of electricity. The Tesla coil described here is smaller than some of Tesla's designs, but it's capable of putting out almost a quarter of a million volts! Brilliant corona discharges as long as a foot or more provide a spectacular display of its intense electrical field, and neon and fluorescent lamps can be excited as far as five feet away.

Intended both as a dynamic demonstrator of electrical principles and as a crowd-attracting science fair project, "Big TC" can be put together for about $30. However, if a used transformer from a neon sign shop can be secured reasonably, the cost will be even less.

WARNING: The voltages used in this project are highly dangerous. Inexperienced persons should seek aid from an instructor or other expert before building it.
BIG TC

As shown in the schematic diagram above, $T1$ steps the household line voltage up to 12,000 volts. The transformer is the type commonly used to operate neon signs. A high-voltage glass-plate capacitor, $C1$, is connected directly across the high-voltage secondary winding of $T1$. The capacitor serves as an energy storage device, charging up to $T1$'s secondary voltage and then discharging in response to the 60-cycle a.c. voltage.

Discharging of $C1$ is through the spark gap into coil $L1$. Each time the spark gap "fires," a high current flows through $L1$. The larger capacitor $C1$ is made, the larger will be the current through $L1$. Discharges across the spark gap produce extremely jagged pulses of power which are very rich in r.f. harmonics. The energy—due to the values of the components used—is greatest in roughly the 100-kc. region.

Windings $L1$ and $L2$ form a air-core step-up transformer, with $L1$ the primary and $L2$ the high-voltage secondary. The voltage at $L2$ will be 75,000 to 250,000 volts depending on the size of $C1$.

Design and Layout. The prototype of "Big TC" was built on a plywood base measuring $\frac{3}{4}" \times 22" \times 22"$, although a larger base would be desirable for high-voltage units to prevent arcing between $L2$ and $T1$ and $C1$. Mount $L2$ in the center of the base and $T1$ and $C1$ as close to the edges as possible; if you plan to operate the unit at voltages exceeding 100,000 volts, make the base $3" \times 3"$ for even greater separation between components.

Power transformer $T1$ is the only
Construct for classroom demonstration, the author's unit was mounted on mahogany veneer plywood which was sanded and covered with five coats of plastic varnish. Other finishing touches were wood tape veneer around the edges, and nylon casters to make the unit easy to move.

Form for L1 with center cut out to take base or L2 is shown above. Polystyrene was used, but wood or cardboard can be substituted. The critical dimension is the outside diameter; less than 9" will result in arcing between coils L1 and L2.

The various dimensions of the prototype coil are indicated in the drawing; none is particularly critical. Note that space has been left at each end of coil, and that stand-off insulators are used to bring out the ends. Nylon screws or glue must be used to fasten top end cover to avoid arcing. After winding coil, cover with many coats of acrylic plastic spray. Spray form first if cardboard is used. Details of spark gap are shown at right.
BIG TC

Leads are soldered directly to capacitor plates. Note use of stand-off insulators.

Glue metal plates to glass, leaving a generous margin of glass on all sides (see text). Epoxy glue, contact cement, or any other glue which will form a tight bond can be used. The wood frame protects the glass and makes mounting it possible.

high-cost component. A neon-sign unit rated at 12,000 volts a.c. at 30 ma., it sells for about $40 new, but used transformers are constantly being salvaged by sign shops, and can be picked up for $10 to $20. It is also possible to find neon signs in junk yards, in which case you can probably buy the transformer for practically nothing. The author used a GE unit, No. 51G473, known technically as a "luminous tube transformer." Measuring 9½" x 6" x 4", it has 2" feedthrough insulators at either end connecting to the high-voltage winding.

Primary coil L1 and all connecting leads must be made with high-voltage wire, preferably supported away from the base on 1" ceramic standoff insulators. Test prod wire such as Belden Type 8898 is ideal—it has flexible rubber insulation with a puncture voltage rating of 29,000 volts.

Winding the Coil. For the big coil (L2) a phenolic coil form* measuring 4½" in outside diameter and 38" in length was used. Alternately, cardboard, wood or other insulating materials can be substituted. You can improve these latter types of coil forms by spraying on at least six coats of acrylic plastic spray before winding the wire on them.

The winding itself is done with No. 26 Formvar-insulated wire—two 1-lb. spools (splice them together and keep the solder joint as small as possible) will give you a 2000-turn, tightly spaced coil covering 34½" of the coil form. There should be extra space between the ends of the winding and the ends of the form—see the drawing on page 31.

The lower end of the coil is terminated at a 1" feedthrough insulator installed in the side of the form, the top end of the coil at a 4½" feedthrough mounted to the top end of the form. Make the end covers of wood or phenolic discs cut to the inside diameter of the coil form, and mount them in place with

(Continued on page 76)

*Tubing can be found in metropolitan areas at surplus houses and establishments which sell plastics (sheets, rods, etc.). Clear acrylic tubing (48" long, 4½" O.D.) can be ordered from Industrial Plastics Supply Co., 324 Canal St., New York, N.Y. 10013, for $13.95 including shipping charges and postage; address your order to the attention of Mr. Charles Roth.
A potent "little brother" to "Big TC," this Tesla coil version is inexpensive, easy to build, and it can put out 30,000 volts!

If you have read the preceding article on "Big TC," you will have learned that a Tesla coil is simply a radic-frequency step-up transformer carried to extreme limits. While a coil that can generate 150,000-200,000 volts is exciting and very dramatic, many of the same visual effects can be demonstrated on a smaller scale with "Li'l TC." In fact, "Li'l TC" is much safer, easier to build, and less expensive—your junk box probably contains many of the necessary parts.

The only item many experimenters will have to buy in order to build "Li'l TC" is the r.f. coil. This coil is manufactured by the J. W. Miller Co. for use in generating the high voltages required in large-screen TV receivers. It is an item that is not stocked by many parts stores, although most of them can obtain it for you within 48 hours. If you have trouble finding the coil, it can be ordered from Allied Radio Corp., 100 N. Western Ave., Chicago 80, Ill., as their stock number 61G102 at a price of $8.82 plus postage. An experienced project builder may not find it necessary to buy one of these coils, but may be able to
Li'l TC

Tuning capacitor C3 is attached to the h.v. coil with two bus-bar leads so that it will be suspended in mid-air away from the coil and metal chassis. Use an insulated alignment tool to rotate the setscrew adjustment.

construct "Li'l TC" using a high-voltage transformer from a large-screen old-style TV receiver.

Construction. The mechanical layout is not critical, and the design shown in the photographs need not be followed exactly. It is convenient to place the r.f. coil off in one corner of the chassis and to drop the connecting leads to V2 through grommeted holes in the chassis deck. The high-voltage output lead of the coil is shortened and a sewing needle soldered to the end to show "point discharge" effects.

The power supply is of conventional design and the B-plus applied to the plate of V2 can range from 250 to 500 volts. However, 250 - 350 volts is more than ample for an output of between 12,000 and 15,000 volts. The output will also vary according to the type of tube used at V2. When you open the coil box, you will see that a 6Y6 is recommended by the manufacturer. However, noticeably improved effects were obtained by the author by substituting a 6L6. A 6V6 or another equivalent power pentode would do in a pinch.

Capacitor C3 is used to tune the primary of the h.v. coil. For convenience, two bus-bar leads about 1" in length were soldered to the capacitor and used to support it in mid-air. The remaining components are scattered around below the chassis deck.

Firing Up Li'l TC. When used in a TV receiver, the high voltage generated by this coil/oscillator arrangement is rectified and filtered. It is then considerably more dangerous than the unfiltered r.f. generated by Li'l TC. Nevertheless, Li'l TC should be treated with respect, for the voltage can puncture the skin of a finger, although high-frequency voltages usually tend to flow relatively harmlessly along the skin's surface.
The numbered terminals shown in this wiring diagram pertain to the Miller 4526 coil. A separate instruction sheet accompanying the coil identifies the positions.

PARTS LIST

<table>
<thead>
<tr>
<th>Part</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1</td>
<td>8.0-μf, 450-volt electrolytic capacitor</td>
</tr>
<tr>
<td>C2</td>
<td>0.1-μf, 600-volt molded capacitor</td>
</tr>
<tr>
<td>C3</td>
<td>360-1000 pf, trimmer capacitor</td>
</tr>
<tr>
<td>C4</td>
<td>82-μf, 1.6-kv, ceramic capacitor—see text</td>
</tr>
<tr>
<td>C5</td>
<td>0.004-μf, 600-volt mica capacitor</td>
</tr>
<tr>
<td>R1</td>
<td>47,000-ohm, 1/2-watt resistor</td>
</tr>
<tr>
<td>RFC1</td>
<td>30-mh, 100-ma r.f. choke (J. W. Miller 692 or equivalent)</td>
</tr>
<tr>
<td>S1</td>
<td>S.p.s.t. toggle switch</td>
</tr>
<tr>
<td>T1</td>
<td>Power transformer: primary, 117 volts a.c.; secondaries, 500 volts, CT, 5 volts at 2 amperes, and 6.3 volts at 2.5 amperes (Thordarson 24R08U or equivalent)</td>
</tr>
<tr>
<td>V1</td>
<td>5Y3 tube</td>
</tr>
<tr>
<td>V2</td>
<td>6L6 tube—see text</td>
</tr>
<tr>
<td>I</td>
<td>High-voltage coil (J. W. Miller 4526—see text)</td>
</tr>
<tr>
<td>C3</td>
<td>360-1000 pf, trimmer</td>
</tr>
<tr>
<td>C4</td>
<td>82 pf</td>
</tr>
<tr>
<td>C5</td>
<td>0.004 pf</td>
</tr>
</tbody>
</table>

After double-checking your wiring, turn on the a.c. power and permit the two tubes to warm up. Take an insulated screwdriver—something like a long alignment tool—and adjust C3 for a brush discharge from the needle point. If you do not have enough range in C3 to tune through the maximum discharge, change the value of C4—add more capacitance at C4 if the plates of C3 are tightly meshed; use less if C3's are too loose. You can set C3 for maximum discharge by listening to the sound of the brush effect—tune for a clean high-pitched hiss and not a sputtering sound.

The brush discharge from Li'l TC will be about 1" in height and can be seen best in a dimly lighted room. Actually, a brush corona will appear at any sharp edge on the output lead, so be careful to round out the soldered connections between the eye of the needle and the shortened h.v. lead.

Ionic Propulsion Vane. Probably the most impressive demonstration of a Tesla coil is the ionic propulsion vane. You can make one for Li'l TC by cutting out the general pattern shown in the diagram above.

Make the over-all length of the vane about 1" to 1½". Cut the vane from aluminum foil and puncture the center so that the vane is balanced. Use one of your wife's extra beads as a bearing by slipping it on the upright needle. Then drop the vane over the needle so that it rests on the bead and can rotate freely. Put a piece of cork or rubber on the tip of the needle to stop the vane from picking up so much speed that it spins right off the needle.

The photograph on the first page of this article is a two-second time exposure (slightly enlarged) showing what the brush corona discharge and rotating vane should look like.
The crewmen are clad in bright orange flight suits. The plane is a $7-million Lockheed Constellation flown by Airborne Early Warning Squadron Four, the "Hurricane Hunters." Normally, the squadron is based at Roosevelt Roads Naval Air Station, near San Juan, P.R., but each summer a detachment is assigned to the Jacksonville, Fla., station to scout hurricanes moving up the coast for Miami Weather Central.

Equipment. Each weather plane is a nightmare (or dream) of electronic equipment. Power for the flying weather lab is drawn from six 28-volt d.c. generators and two 117-volt a.c. generators.

By AL ERXLEBEN

Crew members consist of aerographers, navigators, radio men and radar men. All are trained in the
“Connie” (at left) is airborne weather lab. Note big radome.

Pilot and co-pilot scan the instruments and leaden skies.

providing three-phase, 400- and 1000-cycle a.c.

Weather data is secured with a pair of radar systems. One, a long-range APS-20E, operates at two megawatts. The other, an APS-45, is used for height-finding. There are more than a half-dozen repeating scopes. While the plane is primarily designed for scientific use, IFF (Identification, Friend or Foe) equipment is included. A separate video radar transmitter can be brought into play to provide ships with a 200-mile radar “range.”

Radio-Sonde equipment and communications gear complete the electronic complement of the plane. There are 17 AM and c.w. transmitters, and 20 receivers—low-, high-, very-high-, and ultra-high-frequency units. Eight UHF transceivers are used for voice communications, limited to line of sight. The antennas are arranged on the fuselage so that banking will switch a different antenna into play, avoiding blind spots caused by the body of the plane. And there are two HF-SSB transceivers that share time with the LORAN DF equipment.

**The Mission.** A trip can last for more than 12 hours, and the crew can consist of 22 to 24 men, depending on the length of the mission. On short trips, food is carried aboard, and on long flights, the meals are cooked during the trip. Despite hundreds of penetrations to our hurricanes’ eyes during 21 years of operation, the “Hurricane Hunters” have lost only one plane and crew. These boys are on their toes... they have to be! —50—

science of plotting the path a hurricane has followed, is following, and will follow in the future.
Not Cricket, Caroline!

Englishmen are hearing their first radio commercials, thanks to offshore radio ships

By MAX E. POOLEY

THERE'S a new blight in blighty, and it's curdling the Post Master General's morning porridge! There are three government-controlled BBC networks operating in Great Britain, none of which carries commercial messages; the operating cost is defrayed by a tax levied on the listeners. Recently, a ship, fully equipped for quality radio transmission, anchored out of the territorial waters of England, and began transmitting to the shore on 1508 kc. or thereabouts. The ship station called itself "Radio Caroline," and in addition to pop programming, it offered Britons their first taste of commercials... paid for by advertisers at the rate of from 70 to 110 pounds per minute.

The idea seems to have caught hold, and there are indications that Radio Caroline will be joined by several sister ships. Although different firms are involved in the ventures, they all seem to be the brainchildren of Ronan O'Rahilly, a 23-year-old Irishman.

Her Royal Majesty's Post Master General hasn't taken this "pirate radio" situation very lightly, and has instituted proceedings against the "pirates," filing complaints with the International Telecommunications Union. The "Caroline" sails under a Panamanian flag as of this writing, but even if its operators lose this right, they are still safe—as long as they stay in international waters. So far, the P.M.G. has cut off radiotelephone service to the ship but food supplies haven't been tampered with, and two major oil companies are bidding for the contracts to supply fuel. Communication with shore is being handled by two charter tugboats.

So the battle rages. How will it come out? As one wit put it, the question seems to be whether or not "Britannia really rules the (radio) waves."
EXPERIENCED darkroom workers know that consistently good photographic negatives and prints can be achieved only if developing solution temperatures are carefully controlled. This can prove rather difficult, however, especially if you’re working in the dark or under a dim safelight, and it’s easy to forget to make periodic temperature checks when you’re involved in a complicated process.

The “Temperature Taker” illustrated here solves these problems. It not only provides a close, continuous check on the temperature of any liquid (its use is not limited to photography, of course), but it also emits an audible alarm whenever the temperature goes above or below a preset figure. It’s compact, battery-powered for convenience and to eliminate the shock hazard of a.c. power used near water pipes, and very accurate.

Heart of the Temperature Taker is a probe-shaped thermistor (R10 in the schematic diagram on page 41) having a nominal resistance of 4000 ohms at 77° Fahrenheit. The actual resistance of the thermistor depends upon the temperature to which it is subjected. For example, at 100° F its resistance drops to around 2500 ohms, while at 50° it goes up to approximately 7500 ohms. It is this temperature-sensitive resistance variation which actuates the audible temperature indicator incorporated in the unit.

Referring again to the schematic diagram, voltage from B1 is applied to the top and bottom of a resistance bridge formed by R1, R2, R3, R4, and R10. The junction between R4 and R10 is grounded, while the movable arm of R2, a potentiometer, is connected, via R5, to the base of Q1. When the bridge is balanced, that is, when the resistance ratio between R4 and R10 equals the ratio between R1 plus the top end of R2 and the bottom end of R2 plus R3, the voltage applied to the base of Q1 will be zero.

With its base at zero potential, the transistor lacks forward bias. For all practical purposes, the collector will draw no current from the voltage divider formed by R6 and R7. Thus, forward biasing voltage will be able to reach the base of Q2 via R6. Current flows in Q2’s collector circuit and, consequently,
through the coil of relay K1, pulling the movable relay contact against fixed contact B.

If we now slowly move the arm of R2 toward R3, an increasingly negative voltage will appear at the base of Q1. As this forward bias rises, Q1's collector begins to draw current through R6, creating a voltage drop in the resistor that lowers the bias on Q2. If we continue turning the shaft of R2, Q1 will finally draw so much current through R6 that the bias of Q2 will drop low enough to cut off its collector current. Relay K1 will open. The specific setting of R2 which results in the opening of K1 is dependent upon the resistance ratio between R4 and R10. Since R10 is a thermistor, this ratio varies with temperature. Consequently, the dial of R2 may be calibrated in degrees Fahrenheit as shown in the photos on pages 42 and 43.

Suppose we immerse R10 in a liquid with a temperature of 68° F. When R2 is set at the 68° mark, K1 will open. If the temperature now rises, the resistance of R10 will drop, thereby balancing the normally unbalanced bridge and reducing the negative bias on Q1. At a sufficiently high temperature, Q1 will draw so little current through R6 that the bias of Q2 will increase and K1 will close, applying voltage from B2 to the coils of K2 and K3 via R11 and R12.

As soon as C2 charges to the closing voltage of K3, the relay's armature will flip, interrupting the current flowing through the coil from B2. After the energy stored in C2 has been dissipated by the coil, the armature will flip back to once more provide a return path for the battery current. Capacitor C2 recharges and the cycle repeats itself approximately once each second. The clicking sound produced by the flipping armature serves as an effective warning to the darkroom worker of a temperature rise in the liquid surrounding R10.

Relay K3 will continue to click until the temperature goes down sufficiently to open K1. Since less current is needed to hold in K1 than is required to close it, a drop of at least 1° must normally occur to reduce Q2's collector current far enough to open K1. In order to reduce this on-off temperature differential, K2 ungrounds the arm of R9 whenever K1 closes. This operation adds resistance in Q2's emitter circuit, effectively lowering the transistor's bias so that its collector current falls to a level barely sufficient to hold in K1. As a result, only a small fraction of a degree drop in temperature is now required to deactivate K1.

Other Circuit Arrangements. If temperature control within a degree or so is satisfactory for your purposes, you can construct a simpler version of the Temperature Taker with some savings in cost. Simply ground the bottom end of R8 and omit R9, R11, and K2. Without these components, a temperature change of approximately 1° will be needed to activate K1.

While the unit shown here was wired to indicate a temperature increase—since photographic developers have a tendency to warm up above the desired temperature while in use—it can be easily converted to indicate a temperature drop. This feature may be especially useful if you employ elevated processing temperatures for color film. To make it work this way, just move the wire on terminal B of K1 to terminal A, and the wire on terminal A of K3 to terminal B.

The values of resistors R1 and R3 given in the schematic diagram provide a temperature range of 59° to 85° F. To monitor a lower temperature range, you simply alter the values of R1-R3, making R1 smaller and R3 greater. Increase R1 and decrease R3 for higher temperatures. A wider range of temperatures can be covered by using more resistance at R2, and less at R1 and R3. In all cases, however, the sum of the three resistances should equal approximately 14,000 ohms.

In applications where a ticking relay isn't loud enough, ground the bottom end of K3's coil and remove C2. The relay contacts can then be used to control an external bell, buzzer, or other noisemaker.

Construction. Although not especially critical, the layout shown in the photos makes for a neat, easily wired instrument. Mount R2, K3, J1, and S1 on the front cover of a 3" x 4" x 5" Mini-box as shown in the photo on page 41. Most of the other components are mounted on a 311/4" x 411/4" piece of perforated circuit board which is supported by four 1" spacers slipped over 11/4" 6-32

40 POPULAR ELECTRONICS
**PARTS LIST**

- **B1**—0-volt transistor battery
- **B2**—25-volt battery (Burgess XX22 or equivalent)
- **C1**—5-µf., 25-volt electrolytic capacitor
- **C2**—100-µf., 25-volt electrolytic capacitor
- **J1**—Phono pin jack
- **K1, K2, K3**—Miniature s.p.d.t. relay (Sigma 11F-9000-G/SJL)
- **P1**—Phono pin plug
- **Q1, Q2**—2N241A transistor
- **R1, R4**—200-ohm resistor
- **R2, R9**—2000-ohm potentiometer (Mallory 312MPX or equivalent)
- **R3**—390-ohm resistor
- **R5**—680-ohm resistor
- **R6**—1000-ohm resistor
- **R7**—2000-ohm resistor
- **R8**—4000-ohm probe-style thermistor (Fenwall G834!—Allied Radio Stock No. 8E624, $2)
- **R10, R11, R12**—2700-ohm resistor
- **S1**—D.p.s.t. slide switch
- **S2**—3" x 4" x 5" Minibox
- **R13**—Transistor battery connector (Cinch 5D or equivalent)
- **S3**—3-prong battery plug (Cinch 5B1A or equivalent)
- **R14**—1/4" 6-32 machine screws and nuts
- **R15**—1" metal spacers for 6-32 screws
- **R16**—3/16" x 4½" piece of perforated circuit board
- **R17**—6" length of 1/4" polystyrene tubing
- **R18**—Control knob
- **R19**—Roll of No. 28 stranded plastic covered hookup wire
- **R20**—Roll of No. 20 solid plastic covered hookup wire
- **R21**—Transistor sockets (Cinch 2H3 or equivalent)

**Misc.**—Polystyrene cement, solder, spaghetti, electrical tape

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Principle behind device is fact that R10 varies in resistance as temperature changes. As it does so, it balances resistance bridge, cutting off Q1 which, in turn, activates Q2, K1, K2, and K3.

Removal of perforated board from cabinet shows parts placement. The board is wired with No. 20 solid wire; use stranded wire for probe leads and for connections between board and front panel.
screws passing through holes in the front cover.

The only precautions to be taken in wiring the unit are to insulate $K1$ from the chassis—its armature and frame are attached to each other—and to observe the correct polarities of $C1$ and $C2$.

As stated on its shipping container, $R10$ is a "delicate electronic instrument." Therefore, it should be handled with care and given adequate physical protection. The thermistor specified in the Parts List is a tiny black dot at one end of a thin glass rod about $\frac{1}{2}$" long. Two bare wire leads emerging from the rod serve as terminals.

Construct a probe from a 6" length of $\frac{1}{4}$" polystyrene tubing to serve as a housing for the thermistor. Any convenient length of wire may be run between the probe and the Temperature Taker. In the original, two 2$\frac{1}{2}$-foot lengths of plastic-covered No. 28 stranded hookup wire were twisted together for the purpose. Connect one end of the twisted pair to $P1$ and thread the other end through the hole in the center of the probe. Before soldering the wires at this end to the thermistor, insulate one of the bare leads on $R10$ with spaghetti. There won't be room inside the probe for spaghetti on both leads.

Apply a liberal amount of polystyrene cement to the thermistor and spaghetti, and pull them into the probe by gently tugging on the wires until only the very tip of the thermistor extends beyond the end of the probe. Wipe all cement from the tiny bit of $R10$ which remains exposed. A few drops of cement placed on the cable where it emerges from the probe will keep out unwanted moisture. Push the clip from a discarded ball-point pen over the probe to act as a means for clamping it to the side of a developing tray.

Adjustment and Calibration. After all wiring has been completed and checked for errors, reduce the resistance of $R9$ to zero. Plug in the batteries and $R10$. Then turn the knob of $R2$ fully counter-clockwise. Throw on $S1$ and slowly advance $R2$. At some setting of the potentiometer, if the room temperature...
Completed Temperature Taker with thermistor probe is at right. Although prototype was designed to indicate rising temperatures over a specific range, the range can be tailored to suit the user; falling temperatures can also be made to sound an audible alarm.

is between 70° and 75°, K1 and K2 should close and K3 should begin clicking. After giving the knob of R2 a barely perceptible counterclockwise twist, advance R9 until the clicking stops. Too much resistance at R9 will cause erratic operation of K1 and irregular clicking of K3. Too little resistance at R9 will result in a significant difference between the on and off settings of R2.

An accurate photographic thermometer, a glass graduate or other suitable container, a stirring rod, some ice cubes and a supply of warm water are required to calibrate the instrument. Temporarily tape the heavy paper on which you plan to draw a dial scale underneath the knob of R2. Clip both the probe and the thermometer to the side of the graduate, as illustrated on page 42, and partially fill it with 70° water. Set R2 fully counterclockwise.

While stirring the contents of the graduate, slowly add warm water until K3 starts to click. Now, dunk an ice cube in the water just long enough to cool it to the point where K3 stops. Stir vigorously and then pause for a minute to allow the water to cease moving. Turn (Continued on page 82)
POCKETABLE METRONOME

A variable-speed pacer will be a boon for any tyro instrumentalists

PEOPLE are rhythm-conscious, and if you are learning to type, play an instrument, dance, exercise, or any of countless other rhythmical functions, this metronome will mark the beat for you at a rate of from 80 to 300 clicks per minute. It is small enough to fit in a pocket, and the earphone stores nicely in the roomy case.

The metronome circuit is a simple relaxation oscillator with a 20-µf. emitter bypass capacitor (C2) to stabilize the circuit. Two holes in the circuit board are enlarged to accept jack J1 and potentiometer R1. As these components also hold the circuit board to the plastic case, the jack hole should be enlarged sufficiently to pass the collar of the jack.

Before permanently wiring the circuit, check the range of clicks. If they are too slow, decrease the resistance of R2; if they are too fast, increase R2’s value. Potentiometer R1 has a tapered resistance, and both outer terminals should be tried to see which gives the greater spread of click range.

Metronomes are usually bulky affairs, never thought of as portable. This one is a departure from the norm, with more applications than a normal metronome could shake its pendulum at!

—Sal Stella

PARTS LIST

1—9-volt battery
C1—8-µf., 15-volt miniature electrolytic capacitor
C2—20-µf., 15-volt miniature electrolytic capacitor
J1—Miniature phone jack
C2—20-µf., 15-volt miniature electrolytic capacitor
J1—2N107 transistor
R1—500,000-ohm miniature potentiometer with switch S1 (Lafayette VC-39 or equivalent)
R2—68,000-ohm resistor
S1—S.p.s.t. switch (part of R1)
T1—Transistor miniature output transformer (Lafayette TR-99 or equivalent)
1—6-ohm earphone
1—Battery connector
1—3/4” x 1 1/2” circuit board
1—Plastic hinged box or other housing approx. 1” x 2” x 2 3/8”
THE field-effect transistor is a relatively unexploited member of the semiconductor family. Until last February it was also one of the more expensive transistors, but a "price break" now places this unusual component in an attractive position as a possible experimenter's tool. The voltmeter described in this article is similar in many respects to a VTVM, but uses, instead of a vacuum tube, a single unipolar field-effect transistor—the 2N2498.

The 2N2498 transistor—unlike its bipolar brothers—exhibits extremely high input impedance and some of the other characteristics that might be attributed to a vacuum tube, specifically a pentode. Because of these characteristics, a voltmeter can be designed with a single

As this is written, the 2N2498 field-effect transistor is being offered at $12.75. Both the 2N2497 and 2N2499 are somewhat more expensive, $14.25 and $16.35 respectively.

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transistor and a bare minimum of parts. As the specifications on the next page show, the field-effect transistor voltmeter is small, lightweight, and has a battery life equal to the shelf life of the mercury cells used to power it.

Technically, the voltmeter uses a field-effect transistor in a source-follower configuration (similar in many respects to the familiar cathode-follower arrangement used with vacuum tubes). The voltage gain of the final circuit is less than unity, and varies with changes of the small-signal common-source forward transfer admittance and other circuit impedances.

**Circuit Theory.** The basic voltmeter circuit is shown in the small diagram in the upper right-hand corner of the next page. To analyze it, assume that a zero potential is established between points A and B and that current will flow through the transistor and resistor $R_s$. This places point C negative with respect to point B. Combination resistors $R_a$ and $R_b$ can be adjusted to provide a potential at point D equal to the potential at point C. The meter will now indicate zero. If a negative potential is applied to the input (A-B), the current through the transistor and resistor $R_s$ will increase and point C will become more negative—causing a meter reading proportional to the potential difference between points A and B.

The input resistance of this circuit can be extraordinarily high since it is determined by the gate-to-channel leakage of the field-effect transistor. ("Channel" refers to the conducting path between the "source" and the "drain.") Obviously, this circuit will not work in actual practice since the open gate would permit static potentials at point A to cause the meter needle to wander. A practical version of this basic circuit is shown in the large schematic diagram and construction photograph.

**A Practical Circuit.** Through a rather modest arrangement of switches and resistors, a single field-effect transistor voltmeter can be built possessing the detailed specifications outlined at the bottom of page 47. The input impedance of this voltmeter is determined by the series combination of resistors $R_1$ through $R_9$. To provide protection from transient overload or stray a.c. voltage injection, the filter consisting of $C1$ and $R10$ has been introduced. Diode $D1$ has been wired across the meter so that the movement current can be limited to about 1½ times the full-scale deflection value. Although this circuit was designed using the 2N2498 field-effect transistor, most (but not all) of the 2N2497's and 2N2499's will work as well.

Since the over-all accuracy of the voltmeter is largely determined by the input resistor string, resistors $R2$ through
The theoretical circuit at right demonstrates the operation of the practical circuit below (see text for details).

**PARTS LIST**

- **B1**—4.2-volt mercury battery (Mallory TK233 or equivalent)
- **C1**—0.02-µf, 200-volt capacitor
- **D1**—1N436 silicon diode
- **M1**—0.30 microammeter (Simpson Model 29 or equivalent)
- **Q1**—2N3998 field-effect transistor (Texas Instruments)
- **R1**—2-megohm (or 1.8- or 2.2-megohm), 1/4-watt resistor, 10%
- **R2**—10 megohms 1/4-watt resistors, 1%
- **R3**—8.0 megohms (Acrovec CX-1 or equiv.)
- **R4**—1.0 megohm
- **R5**—50,000 ohms
- **R6**—10,000 ohms
- **R7**—5,000 ohms
- **R8, R9**—10,000 ohms

- **R10**—1.0-megohm, 1/4-watt resistor, 10%
- **R11**—5700-ohm, 1/2-watt resistor, 10%
- **R12**—5000-ohm potentiometer with lock
- **R13**—1000- to 5000-ohm resistor—see text
- **R14**—1000-ohm potentiometer
- **R15**—1000-ohm, 1/2-watt resistor, 1%
- **S1**—1-pole, 8-position rotary switch (Centralab P3-1001 or equivalent)
- **S2**—3-pole, 3-position rotary switch (Centralab P4-1001 or equivalent)

Accuracy Determined by meter movement used. Accuracy of instrument shown is within ±2% of full scale.

Battery Life  Essentially shelf life.

Input Impedance  22 megohms on any range (including 2-megohm probe)

Power Consumption Approximately 5 mw.

**SPECIFICATIONS**

- Power Supply  4.3-volt mercury battery.
- Voltage Range  0.5 volt to 1000 volts. Eight ranges selected with front panel switch.
- Full-scale readings of: 0.5, 1.0, 5.0, 10, 50, 100, 500, and 1000 volts.
- Warm-Up Time  Zero.
- Weight  Approximately 2 1/4 lb. with battery.

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should be stable and preferably have an accuracy of \( \pm 1.0\% \). Of course, if you have access to a bridge, standard \( \pm 5\% \) resistors can be measured and very close values selected on this basis.

Resistor \( R13 \) must be selected so that potentiometer \( R1\frac{1}{2} \) will adjust near its center position to set meter \( M1 \) to a zero deflection. The value of \( R13 \) may vary from 1000 to 5000 ohms, but once set it will need no further adjustment.

Construction and Calibration. The voltmeter can be built on a single piece of phenolic board and attached to the back of meter \( M1 \) through the meter input terminals. Except for the resistor in the probe, all of the resistors can be mounted to the board with Vector terminals and soldered in place. The layout should approximate that in the photo to eliminate the possibility of leakage paths in the input part of the circuit.

The final accuracy of the voltmeter depends on the values of resistors \( R2 \) through \( R9 \) as well as a calibrating voltage source. Ideally, a digital voltmeter of known accuracy and a variable d.c. voltage source should be used. However, initial calibration with several 1.34-volt mercury batteries may be used to set the 0-5 volt scale. Linearity of the scale is adjusted by varying potentiometer \( R12 \) and locking it into position once satisfactory linearity has been established.

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**BASS REFLEX ENCLOSURE DATA**

If you plan to build your own bass reflex speaker enclosure, you'll find the Electro-Voice Technical Bulletin #10 on the design and construction of bass reflex enclosures a real help. And before ordering the lumber, you might read the E-V "Guide to Compact Loudspeaker Systems," a colorful "idea book." Both are available free from Electro-Voice, Inc., Buchanan, Mich.

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**TEMPUS FUGIT**

"Wal sonny," said the OT to the youthful ham one day,
"It wasn't always easy to construct your rig, and say—
you had to build 'em big, in an ugly-looking rack;
the parts were really very scarce, they'd set your budget back!

"You'd breadboard all the circuits, testing each in turn, you see
with Fahnestock clips, resistive pencils, lots of wire and gee—
those tickler coils were fancy, you tuned for the least smoke.
The little sets you build today, they really are a joke!

"When we old hams would really go, why we'd talk far and wide
I once talked right to Pittsburgh and it filled my heart with pride."
The young ham flipped his little switch and gave the key a whack.
The OT sat there goggle-eyed! An AC4 came back!

—Byron G. Wels, K2AVB

POPULAR ELECTRONICS
The body of knowledge a technician should learn contains many terms that are derived from their resemblance to parts of the human anatomy. See if you can match the common electronic terms listed below (1-10) with the sketches (A-J) of the devices to which they most likely pertain.

(Answers on page 90)

1 Arm
2 Eye
3 Finger
4 Hair
5 Hand
6 Head
7 Legs
8 Knee
9 Neck
10 Nose
Equipment Report

MESSENGER III

Are you in the market for a CB transceiver that doesn’t drain your car battery? Or a transceiver that is so small you begin to wonder if the manufacturer hasn’t accidentally left out half of the circuitry? Completely transistorized, the E. F. Johnson “Messenger III” is absurdly small and on receive draws only 50 ma. from a 12-volt car battery. On transmit, the power drain is still only around 600 ma.—compared to the 4 to 6 amperes drawn by conventional tube-type transceivers.

And despite the size of the Messenger III, E. F. Johnson has not skimmed on circuitry. The tested power output (at 5 watts input) is right up there at a good solid 100% modulated 3.4 watts. The receiver is double-conversion with superior selectivity characteristics, plus more sensitivity than is needed.

The Messenger III can also be used as a field portable, or as a mobile public address system with only modest switching changes. Selling at $189.95 (net), plus $29.95 (net) for the base station 117-volt a.c. power supply, it is as modern in every sense of the word as any CB transceiver could be.

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The Messenger III, designed along “space-age” lines, is a rugged unit. In this photo, the crystal bank for 11 transmit and receive channels is visible just behind the front panel. The white box near the rear skirt is a special transmit/receive antenna switching relay such as might be found in a guided missile. Manufacturer also has transistorized selective calling systems available for use with the Messenger III.
Babylon Battery

The electric battery existed 2000 years ago! Did ancients possess other science facts?

Electric batteries over 2000 years ago? Not really impossible, if you stop to ponder the considerable amount of knowledge the ancients possessed. Unfortunately, most of this knowledge was lost during various conquests and library burnings.

These early electrochemical batteries were first brought to light by a German archaeologist, Wilhelm Konig, working for the Iraq Museum. They were discovered in the ruins of an ancient Parthian town on Khujut Rabu’a, a hill not far from Baghdad. The cells were apparently used for electroplating gold, and as there were no patent laws, the processing details were passed from father to son, and kept closely guarded.

Cell Construction. The ancient cells were reported to the American scientific press in 1939 by Willy Ley, a science historian. He described the central cell elements: a copper cylinder containing an iron rod that had been corroded as if by chemical action. The cylinder was soldered with a 60/40 lead-tin alloy, the same solder alloy we use today. The electrolyte was another matter. As this was thoroughly dried by time, it’s anybody’s guess. However, there were a number of usable chemicals around in those days that could have done the job.

Willard F. M. Gray, an engineer at GE’s Pittsfield, Mass., plant constructed...
replicas of these cells, and used copper sulphate as an electrolyte. Mr. Gray's models, shown in the photographs, are now in the Berkshire Museum in Pittsfield. The earthenware jars used to house the original cells kept the cells upright, and the tops were sealed with asphaltum, a caulking compound that cannot be duplicated today. Mr. Gray used black sealing wax instead.

Iron and copper rods found with the ancient cells may have been used to series-connect them for higher voltages.

Applications. Gold wasn't the only thing these pre-A.D. smiths used the cells for. They were also able to plate silver and antimony. Some of the plating solutions they had to compound included ferrocyanides, lye solutions and orate baths (gold dissolved in hydroxide). These chemicals were available to the ancients, and they could have used any of them. The asphaltum that sealed the batteries was the same material that Noah used to caulk the ark. The Bible calls this material "bitumen" and it must have been an all-around sealing compound, with numerous applications.

Other Finds. While the Parthians had only a limited knowledge of the electrochemical batteries, archaeologists have found the remains of four more in a magician's hut in the excavation of Seleucia, a town not far from Khujut Rabu'a. The Berlin Museum had pieces of ten more such batteries, possibly without realizing what they were.

Although Cleopatra didn't actually have electric lights in her palace, it is entirely possible that Mark Antony presented her with gifts that he had picked up in his travels, and that these gifts were electroplated. Surely, some of these electroplated jewelry items must have found their way out of the Mesopotamian region and into neighboring kingdoms.

While we are all doubtless impressed by our own technological achievements, it gives one pause to think that one of our commonplace "modern" discoveries is not a discovery at all, but a re-discovery of an ancient artifact! Who can surmise what other secrets the ancients hold in shrouded mystery?

It is unfortunate that the knowledge and technology of the ancients was destroyed before it could be recorded and saved, but each year more wonders of the old sciences come to light. Who knows? Perhaps some day our own technology will catch up to theirs.
Fifty years, during which the vacuum valve, the multipurpose tube, and the transistor have come into being, have neither outmoded the fascination of building a crystal set nor the thrill of listening to it for the first time. Basically, a crystal set is limited to the use of only the power supplied by the station heard. Transistors, which fall in the category of amplifiers, must also be ruled out if the experimenter wants to stay within the classic meaning of the term "crystal set."

Unfortunately, "cat whisker sets" have long been known for their lack of sensitivity and selectivity, usually receiving two or three local stations at once. The author's goal was to improve on the traditional crystal set by using good materials, high-Q resonant circuits, new techniques, and innovation. Proof of the success of the "Modern Crystal Set" is that its measured output is ten times as great as a "standard" coil-capacitor-diode kit used as a comparison with an acceptable degree of selectivity!

Antenna Circuit. In contrast to the usual crystal set which ignores a number of known facts about antenna length and tuned circuits, this set uses series tuning in the antenna circuit. Switch S1 selects either a capacitance (C1), or inductance (L1), or both. The result is that either a bedspring or 500 feet of
outdoor wire will work as an antenna, since \( L1 \) tends to "lengthen" a sky wire, while \( C1 \) "shortens" it.

By ganging \( C1 \) and \( L1 \) (although ganging is not absolutely necessary), one control does the work of two. As shown in the photos and drawing, a small dial cord drum is soldered to \( C1 \)'s last rotor plate, and revolves when \( C1 \)'s shaft is turned. One-half the circumference of the drum should be approximately equal to the total length of the ferrite slug used in \( L1 \); a bottle cap can be adapted if a dial cord drum is not available. Metal hooks are glued into the ends of the ferrite slug, which is then coupled to the drum with dial cord. A small pulley from an old BCB receiver (or a pulley made with a battery nut on a piece of wire) and a rubber band complete the job. The ferrite slug should enter the coil as \( C1 \)'s rotor plates begin to mesh.

Good selectivity is achieved by transformer \((L2-L3)\) coupling the antenna circuit to the main tuning circuit \((L3, C2)\). Start with 10 turns for \( L2 \), and reduce this if even greater selectivity is desired.

**Main Tuning Circuit.** The main tuning circuit has to perform two functions: provide both a parallel-resonant tuned circuit for station selection and enough audio power to drive the headphones. The first function is best served by using a high-\( Q \) circuit—this is achieved by winding the coil on a ferrite rod with litz wire. Since there is an optimum inductive-capacitive combination for highest \( Q \) at any frequency, \( L3 \) is tapped.

The taps also help in another way. The headphones place a load on the tuned circuit and lower \( Q \). By extending the taps to \( S3 \), the headphones can be matched to the coil at the point which

\( \text{(Continued on page 83)} \)
Shaft of C1 also tunes L1 with the components ganged as shown. Coil L1 is mounted in a cardboard holder which is glued to the back of C2. Components must be mounted so that end of L1 and drum are even.

Wind L3 on bare ferrite rod; 80 turns total. After L3 winding is completed, wind L2 over center section. The ferrite rod used here is approximately 2" x 1/2" x 3/16".

### PARTS LIST

<table>
<thead>
<tr>
<th>Part</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1</td>
<td>Miniature variable capacitor, approx. 230 pF maximum</td>
</tr>
<tr>
<td>C2</td>
<td>Dual TRF-type broadcast receiver variable capacitor, approx. 365 pF per section</td>
</tr>
<tr>
<td>D1, D2, D3, D4</td>
<td>General-purpose germanium diode (Lafayette No. Si-148 or equiv.)</td>
</tr>
<tr>
<td>J1</td>
<td>Three-conductor plug-circuit phone jack</td>
</tr>
<tr>
<td>L1</td>
<td>Slug-tuned broadcast tuning coil; may be salvaged from many old radios of 1939-40 vintage, or use Burstein-Applebee No. 14C89 and remove threads; inductance and critical</td>
</tr>
<tr>
<td>L2, L3</td>
<td>Wind directly on rod from new or used ferrite antenna, as per drawing, with 5 x 44 litz wire, enamel and fabric insulated</td>
</tr>
<tr>
<td>S1</td>
<td>S.p.d.t. switch with center &quot;off&quot; position</td>
</tr>
<tr>
<td>S2, S3</td>
<td>Two-pole, four-position major switch, non-sharing (Centralab PA-1000 Series, Type 10412, or equivalent)</td>
</tr>
<tr>
<td>L</td>
<td>Set of headphones, high-impedance crystal type recommended (Burstein-Applebee No. 22A47 or similar)</td>
</tr>
<tr>
<td>T</td>
<td>Three-circuit phone plug</td>
</tr>
<tr>
<td>M</td>
<td>4&quot; x 5&quot; x 6&quot; Minibox</td>
</tr>
<tr>
<td>W</td>
<td>Roll of 5 x 44 litz wire (Belden Type 8817; Allied Stock No. 487981 for 20 cents)</td>
</tr>
<tr>
<td>Misc.</td>
<td>Control knobs, binding posts, insulated push-through type for antenna), terminal strip, spacers, machine screws and nuts for mounting components, small dial card, drum (see text), epoxy cement, hookup wire, adhe, etc.</td>
</tr>
</tbody>
</table>

July, 1964
More Transistor Ignition Circuits

Following up our feature article in last month’s issue, here are five more circuit diagrams of systems currently on the market.

The Delta Products Transistor Mk-5 uses the circuit arrangement above to keep current through the points at a very low value. This system with coil sells for $39.95 with usual guarantee.

A Prestolite 250 system (below) is similar to this manufacturer’s 201 system (see p. 86, June issue). The transistor has a current capacity of 15 amperes with an applicable breakdown rating of 90 volts. This system presently retails at $63.00.

Micro-Kits sells the “Micro-Fury” system at right for $29.95 wired or $24.95 as a kit. The coil has a turns-ratio of 400:1.

The Palmer two-transistor circuit at left uses transistors with ratings of 60 volts and 15 amperes. The manufacturer supplies special coils for this circuit with a primary resistance of 0.26 ohm and a current rating of not over 10 amperes.

Alco’s “Trans-Power” is the only commercially available system with a split primary ignition coil to bias off the transistors. Through use of a prewired cable harness, unit is easily installed in all makes of cars.
The Lullaby Box

By HARTLAND B. SMITH
W8VVD

After fifteen minutes of soothing music, the box turns off. So does the baby . . .

GENTLY press the button atop the "Lullaby Box" and it softly emits soothing, tinkling tones for a 15-minute period. Then it turns itself off, making it unnecessary for the busy housewife to interrupt her duties to do so. An excellent baby tranquilizer, the gadget makes an ideal gift at baby showers or for parents of young children.

Depressing normally-open switch S1 lets current flow in the coil of K1, closing the relay; K1 is locked in the closed position. At the same time, power is applied to the musical movement and the timing motor.

After about one minute of operation, the timing motor cam moves away from the spring of S2 and this switch drops to the lower contact; current continues to flow to the motors and relay through this contact. Some 14 minutes later, the cam once again pushes the actuating arm of S2, forcing the arm back to the top contact. This time, current to K1 is interrupted, and the action stops.

Construction. All components are mounted on the rear cover of a 4" x 5" x 6" Minibox. Start by soldering a piece of \#12 copper wire about \( \frac{3}{4} \)" long to the timing motor gear (see photo at right) so that it protrudes about \( \frac{1}{8} \)" beyond the edge of the gear. Do not allow excess solder to drip into the gear teeth. Drill a 5/16" hole in the Minibox cover to provide clearance for the opposite end of the motor shaft.

Mount switch S2 on \( \frac{1}{2} \)" spacers which will place its contact spring in line with the motor cam. Be sure the distance to the cam is such that positive action takes place. Break or file off the locating stud under the relay, and mount the relay on a grommet, rather than directly to the box. This will eliminate a loud "boing" when the relay pulls in.

Since the entire box acts as a sound-
Musical movement, timing motor, and relay K1 are all 115-volt units. See text for operation.

--- PARTS LIST ---

<table>
<thead>
<tr>
<th>Part</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>K1</td>
<td>S.p.d.t. relay, 115-volt a.c. coil (Potter &amp; Brumfield KA5AV-115AC or equivalent)</td>
</tr>
<tr>
<td>S1</td>
<td>S.p.d.t. normally-open push-button switch</td>
</tr>
<tr>
<td>S2</td>
<td>S.p.d.t. snap-action switch (Acro BRD2-5L or equivalent)</td>
</tr>
<tr>
<td>1</td>
<td>115-volt a.c. musical movement—&quot;Brahms Lullaby&quot;</td>
</tr>
<tr>
<td></td>
<td>(Novelties of Distinction, 131 W. 42 St., New York, N.Y.)</td>
</tr>
<tr>
<td>1</td>
<td>4-rph timing motor (Allied Radio 78B407)</td>
</tr>
<tr>
<td>1</td>
<td>4&quot; x 5&quot; x 6&quot; aluminum Minibox</td>
</tr>
<tr>
<td>6</td>
<td>Rubber grommets for ¾&quot; holes</td>
</tr>
<tr>
<td>2</td>
<td>⅜&quot; metal spacers</td>
</tr>
<tr>
<td>2</td>
<td>6-32 x 1⅛&quot; machine screws</td>
</tr>
<tr>
<td>Misc.</td>
<td>Screws, nuts, washers, wire, solder, paint, decorative decals, etc.</td>
</tr>
</tbody>
</table>

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**Scientific Short-Wave Listening**

Unless you speak several languages, the chances are that you haven't been able to identify all the signals you hear as you tune across the short-wave bands. One good solution to this common SWL problem is the "Tentative High Frequency Broadcasting Schedule," which is published by the International Telecommunications Union in Geneva, Switzerland. This "tome" is available directly from the ITU, and it costs 17 Swiss francs. At present, the Swiss franc is worth about 20 cents, but this figure has been known to fluctuate from time to time. Its current value can be determined by consulting a financial news publication. When you order the book, send along an International Money Order for the full amount.

The THFBS contains over 100 large pages on which are listed the precise frequency, hours of operation, power and geographic coordinates of virtually every international short-wave station in the world. In addition, exact data is included for each station on the type of antenna system used, gain in db, and bearing of directional antennas. The zones, or target areas of the world to which each international broadcast is beamed, are also given. The introductory text is printed in French and Spanish as well as in English.

With the THFBS and a good receiver, you will probably be able to pinpoint any foreign short-wave station you hear. In fact, the book so quickly removes the mystery surrounding the location of some of the lesser-known foreign stations that you may find yourself passing these up and spending your time looking for and listening to the few clandestine stations that are not on the international list!

Other helpful items that will enhance your short-wave listening pleasure are a clock set to GMT time, a map showing the world zones, and a frequency standard for accurate frequency measurement.

—Lauren A. Colby, K4RFC
NOTES FROM YOUR SHORT-WAVE EDITOR'S DESK

THE FIRST commercial broadcasting station in the Arab world will go on the air shortly with a power of 500,000 watts. Located at Mansourah in the United Arab Republic, the station will broadcast a Pan-Arab non-political program of light music with short periods of advertising for 16 hours daily. It will be audible in Lebanon, Jordan, Syria, Iraq, Saudi Arabia, the Arabian Gulf, Libya, and Sudan, as well as in the United Arab Republic itself.

The new station may already be on the air as we go to press, but as this is being written we do not have any information as to the frequencies that will be used. In view of the territories to be covered, however, we assume that they will be in the medium-wave band. East Coast listeners should have a chance to log this super-powered station.

Radio Caroline. A commercial medium-wave station operating from a converted ferry boat nine miles off the English coast, Radio Caroline will soon be silenced if the International Telecommunications Union has any say in the matter. The ITU asked the Government of Panama to assist in closing the station because the ship has been flying the Panamanian flag. (See "Not Cricket, Caroline!" on p. 38 of this issue.)

The ITU, an agency of the United Nations, allocates radio frequencies under a world-wide agreement. In previous actions, its intervention led to the lowering of the Panamanian flag on commercial broadcast ships which were located off the coasts of the Netherlands and Denmark; however, both are reportedly still in operation.

How NOT to Obtain QSL's. "Please send me your QSL." No thanks, no return postage, no explanation. This request was received from a WPE6 short-wave listener by W1UGH, a licensed amateur operator in Hudson, Mass. It was sent to his previous home in Rhode Island by someone who evidently was trying the hard way to collect a verification card from that state.

As W1UGH pointed out, and we whole-
The listening post of Eddie Peschke, WPE5CJD, in Houston, Texas, features a Hammarlund HQ-145X receiver, with a Zenith "Transoceanic" portable serving as a standby. The antenna used is a 50' single-wire "L" type, 40' high. Eddie is a member of the National Association of Armchair Adventurers.

heartedly agree, this is definitely not the way to collect QSL cards. Such actions may make licensed operators take a dim view of all SWL requests. Needless to say, the WPE6 did not receive his Rhode Island card.

Thank You, KL7's. While this is out of the realm of short-wave broadcasting as such, we would, nevertheless, like to extend a collective vote of thanks to the amateur radio operators who maintained communications with the outside world during the recent Alaskan earthquake. They certainly performed under extremely adverse conditions. Most, if not all, of the normal forms of communications, including many of the medium-wave broadcast stations, were knocked off the air.

ENGLISH-LANGUAGE NEWSCASTS TO NORTH AMERICA

All of the stations below specifically beam English-language newscasts to the U.S.A. The times may vary a few minutes from day to day.

<table>
<thead>
<tr>
<th>COUNTRY</th>
<th>STATION</th>
<th>FREQUENCY (kc.)</th>
<th>TIMES (EST)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Argentina</td>
<td>Buenos Aires</td>
<td>11,780, 9690, 6090</td>
<td>2200, 0100 (Mon.-Fri.)</td>
</tr>
<tr>
<td></td>
<td>Melbourne</td>
<td>17,840, 15,220, 9580</td>
<td>2030, 2130, 2230</td>
</tr>
<tr>
<td></td>
<td>Sofia</td>
<td>6070 (and/or 9700)</td>
<td>1900, 2000, 2300</td>
</tr>
<tr>
<td></td>
<td></td>
<td>7290</td>
<td>1630</td>
</tr>
<tr>
<td>Canada</td>
<td>Montreal</td>
<td>15,190, 11,760, 9585</td>
<td>1800 (Caribbean)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>0215, 0300 (W. Coast)</td>
</tr>
<tr>
<td>East Congo</td>
<td>Leopoldville</td>
<td>11,755</td>
<td>1630, 2100, 2230</td>
</tr>
<tr>
<td>Czechoslovakia</td>
<td>Prague</td>
<td>11,905, 9795, 9550, 7345, 5930</td>
<td>2030, 2230</td>
</tr>
<tr>
<td>Denmark</td>
<td>Copenhagen</td>
<td>15,165</td>
<td>0700</td>
</tr>
<tr>
<td></td>
<td></td>
<td>9520</td>
<td>2100</td>
</tr>
<tr>
<td>Finland</td>
<td>Helsinki</td>
<td>15,185</td>
<td>1530 (Mon.-Fri.)</td>
</tr>
<tr>
<td>West Germany</td>
<td>Cologne</td>
<td>11,945, 11,795, 9735</td>
<td>1010</td>
</tr>
<tr>
<td></td>
<td></td>
<td>9545, 6075</td>
<td>2035</td>
</tr>
<tr>
<td></td>
<td></td>
<td>9735, 9575, 6145, 6075</td>
<td>0000</td>
</tr>
<tr>
<td>Hungary</td>
<td>Budapest</td>
<td>9833, 7215, 6234</td>
<td>1930, 2030, 2200, 2330</td>
</tr>
<tr>
<td>Italy</td>
<td>Rome</td>
<td>9575, 5960</td>
<td>1830, 2205</td>
</tr>
<tr>
<td>Japan</td>
<td>Tokyo</td>
<td>15,205, 15,175, 11,780</td>
<td>1830</td>
</tr>
<tr>
<td>Lebanon</td>
<td>Beirut</td>
<td>11,890</td>
<td>1630</td>
</tr>
<tr>
<td>Netherlands</td>
<td>Hilversum</td>
<td>17,810, 15,445</td>
<td>1030 (Tues., Fri.)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>11,950, 9590</td>
<td>1415 (Tues., Fri.)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>7125, 6085</td>
<td>1630 (exc. Sun.)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>6035, 5985</td>
<td>2030 (exc. Sun.)</td>
</tr>
<tr>
<td>Portugal</td>
<td>Lisbon</td>
<td>6185, 6025</td>
<td>2105, 2245</td>
</tr>
<tr>
<td>Rumania</td>
<td>Bucharest</td>
<td>11,810, 9510, 7225, 7195, 6190, 5990</td>
<td>1730</td>
</tr>
<tr>
<td>Spain</td>
<td>Madrid</td>
<td>9360, 6130</td>
<td>2215, 2315, 0015</td>
</tr>
<tr>
<td>Sweden</td>
<td>Stockholm</td>
<td>15,240</td>
<td>0900</td>
</tr>
<tr>
<td></td>
<td></td>
<td>9660</td>
<td>2215</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5990</td>
<td>2045</td>
</tr>
<tr>
<td>Switzerland</td>
<td>Berne</td>
<td>9665, 9535, 6165</td>
<td>2035</td>
</tr>
<tr>
<td>U.S.S.R.</td>
<td>Moscow</td>
<td>9740, 9730, 9700, 9680, 9660, 9650, 9620, 9610, 9570, 7320, 7310, 7240, 7200, 7150 (may not all be in use at any one time)</td>
<td>1730, 1900, 2000, 2100, 2300, 0040</td>
</tr>
<tr>
<td>Vatican City</td>
<td>Vatican City</td>
<td>9645, 7250, 6145</td>
<td>1950</td>
</tr>
</tbody>
</table>
First States Awards Presented!

To be eligible for one of the new series of DX awards designed for WPE Monitor Certificate holders, you must have verified stations (any frequency or service) in at least 20 different states. The following DX’ers, listed in the order in which their applications were received, are the first to qualify for these awards.

Fifty States Verified
Harold Schrock (WPE9AKF), Paxton, Ill.
Jack Lane (WPE9EUV), Lafayette, Ind.
Norman C. Elser (WPEBCSI), Evansport, Ohio
William R. Gardiner (WPE2CLX/A), Perry, Fla.
John W. Reasoner (WPE2CLU), Ames, Iowa
Nathan Rosen (WPE2CY), New York, N. Y.

Forty States Verified
Jerry McManahan (WPE0SS), Cedar Rapids, Iowa
Philip Berkeley (WPE1ENY), Swampscott, Mass.
David Johnson (WPE0DHI), Denver, Colo.
William E. Chapman (WPE1DRZ), Middletown, Conn.
James Eudaily, Jr. (WPE4GLQ), Millers Creek, N. C.
Steve Weinstein (WPE3NFL), Pittsburgh, Pa.
Bill Lund (WPE6CJ), Manhattan Beach, Calif.
Rod Paulson (WPE2CZR), Fargo, N. D.
John T. Arthur (WPE2CLD/G), San Jose, Calif.
Ray Minter (WPE3CRB), Baltimore, Md.
John S. Rose (WPE9FXU), LaGrange Park, Ill.

Thirty States Verified
Donald R. Stark (WPE3FCB), McMurray, Pa.
Don Stitt (WPE0BCT), Hastings, Nebr.
Martin Lash (WPE9GIE), Skokie, Ill.
Robert Binau (WPE3DTP), Williamsport, Md.
Denis E. Frank (WPE8BFO), Farmington, Mich.
James W. Phillips (WPE4EDV), Waverly, Va.
Chuck Edwards (WPE4BNK), Ft. Lauderdale, Fla.
Edward C. Bassett (WPE9EHR), Toledo, Ill.
Bruce McNair (WPE2LEP), Forks, N. J.
Michael J. Pilchik (WPE2JF), Woodside, N. Y.
Jan M. Dyroff (WPE3DSU), Norristown, Pa.
Christopher Luyster (WPE1FNB), Fairfield, Conn.
Ron Uzdavinis (WPE2KLO), Woodbury, N. J.
Thomas E. McNiff (WPE4FEW), Arlington, Va.
Roger C. Burket (WPE3EKS), Altoona, Pa.
Paul Turner (WPE2LHB), Albany, N. Y.
Mike Wolowich (VE3E1TW), Fort William, Ontario, Canada

While we do not have a record of those amateurs who participated in the Alaskan operation, we would like to emphasize the point that in times of great distress the amateur operator is more often that not the only source that civil authorities can go to for communications help. In the past, during fires, floods, and other disasters, amateurs have been on the spot and ready for action, usually within minutes. And we are pleased to able to say that, in many instances, non-licensed short-wave listeners have been right there with them to assist in any way possible.

Card Swapper’s Callbook. A compilation of active card swappers with names, addresses, calls, ZIP numbers, and other information has been proposed by Don Erickson, 24360 Myers St., Sunnyvale, Calif. 92388. If you are an active card swapper and would like your name to appear in such a callbook, write to him and find out more about it.

Club Notes. To date, the following clubs have indicated that they would like to join the Association of North American Radio Clubs currently being organized: Newark News Radio Club, Canadian DX Club, SWL-Certificate Hunters Club, North American Shortwave Association, American SWL Club, Worldwide Monitors Radio Club, National Radio Club, Inc. (Denver), Folcroft (Pa.) Radio Club, Canadian International DX Club, and the Kentucky DXers Association. There are still a few organizations from which no word has been received. A study of the proposed constitution is currently being made by the interested clubs.

(Continued on page 85)

July, 1964
CARL AND JERRY were sitting on Carl’s back stoop enjoying the dew-washed freshness of the summer morning. Carl had Bosco, his dog, clamped firmly between his knees and was wooling the dog’s ears affectionately while the animal growled in mock protest at this thoroughly enjoyed rough treatment.

“Hey, there’s Mr. Gruber heading this way,” Jerry said. “Sure looks as though he has something on his mind.”

Carl turned to see his elderly neighbor coming across the back yards at such a lively clip that his cane barely touched the grass. The little man was a favorite with both boys. They admired and respected the way Mr. Gruber refused to bow to his advancing years, maintaining a deep interest in everything, and especially scientific progress. Most of all they liked his enthusiasm, the way he became all worked up over a new idea or project.

“Good morning,” he greeted them as he sat down on the bottom step and began to fan himself with his ancient battered derby. “I was hoping you two might be up already. You’re invited to join me in performing a very interesting and rewarding experiment.”

“Good!” Carl exclaimed. “We were just wondering what we could do on a fine day like this. What have you got in mind?”

“Getting the honey out of a bee tree I’ve spotted!” Mr. Gruber announced triumphantly. “Yesterday when I was up Eel River fishing for goggle-eye, I noticed lots of bees flying around. I did some investigating, and found them going in and out of a hole in the side of a big old sycamore growing right on the bank of the river. Since the tree is growing between the road and the river, we don’t have to ask anyone’s permission to chop into it.”

“How about the bees’ permission?” Jerry asked. “While it has been some time since I was stung, I can remember how it feels with no trouble.”

“We’ll take care of that,” Mr. Gruber said confidently. His blue eyes sparkled
happily behind his steel-rimmed glasses as he went on. "Boys, you haven't really lived until you've helped cut a bee tree. It has everything: danger, mounting suspense, and finally a sweet reward. Best of all, it will give us a chance to try a new electronic method of keeping the bees quiet while we scoop out the honey. Just last week I read an article about it, and now we can try it. It seems like fate."

"What is this 'new electronic method'?" Carl asked cautiously.

"It was discovered by the entomology department of the University of Wisconsin's School of Agriculture along with the U. S. Department of Agriculture's Bee Culture Laboratory in Madison. The work was done by Mr. R. E. Showers, a teacher at the East High School in Green Bay, while holding a National Science Foundation fellowship and working under the supervision of Dr. F. E. Moeller. In fact, Mr. Showers and some of his high school students are still carrying on experiments.

"Anyway, it was discovered that certain audio frequencies have a very profound effect on bees. Frequencies between two hundred and twelve hundred cycles seemed to produce a strong tranquilizing effect, with nine hundred and sixty cycles being the optimum frequency. Going either way from this frequency reduced the effect. When a scout bee—you know, the one that comes back to the hive and does an interpretive dance to tell the others where the goodies are—was exposed to nine hundred and sixty cycle audio, he danced out completely erroneous information as long as the sound was on! Investigators were able to work colonies of bees without being stung and without the protection of veils or smoke, using only the soporic effect of a small code-practice buzzer tuned to nine hundred and sixty cycles and fastened to the side of the hive. Even when the bees had been quieted for as long as a half hour with the audio, they returned to normal almost instantly when the sound was cut off."

"Very interesting!" Jerry commented. "But how do we go about using this information?"

"There's nothing to it!" Mr. Gruber said, getting to his feet. "You fellows have a little transistorized audio amplifier and a transistorized code-practice oscillator already built up. You set the oscillator on nine hundred and sixty cycles and feed it into the amplifier. The amplifier can feed out into a small speaker with which we can direct sound toward the hole in the tree. While the sound puts the bees to sleep, we can chop into the tree and take out the honey. A half-watt of audio should be plenty—the buzzer the entomologists used couldn't have put out more than that."

"What do you think, Carl," Jerry asked, sounding more and more intrigued by the moment.

"I say let's do it," Carl answered, already way ahead of him.

"Time's a wastin'," Mr. Gruber broke in. "You two put the electronic gear we need into your car and drive around back in the alley. I'll get my axe and some dishpans and a dipper from Martha for collecting the honey. Boy oh boy! I can almost taste that fresh honey on hot biscuits right now!"

He departed in a shuffling trot, and Carl and Jerry, grinning affectionately at his retreating figure, started obediently for their basement laboratory. Truth to tell, they also felt tugs of growing excitement. There was something infectious about the enthusiasm of the little man.

MR. GRUBER was waiting for them when they stopped the car behind his garage, and they quickly loaded the pans and the axe into the trunk. Bosco, sensing that something was afoot, had followed them, and now he stood at the corner of the garage with drooping head and tail, looking the very picture of dejection as he saw they were preparing to leave without him.

"Hold on!" Mr. Gruber called as Carl

(Continued on page 80)
THE earliest low-cost transistors—the now-famous CK721 and CK722—were encapsulated in plastic. Although these transistors were widely used, the plastic cases were not entirely satisfactory. Often, internal defects would develop after the transistors had been in use for extended periods. In other cases, new transistors would become “leaky” or change their characteristics while still in storage. Many of these troubles could be traced to the properties of the plastic cases. As a result, manufacturers switched to the now almost universal metal cases.

Unfortunately, metal housings are relatively expensive as compared to plastic cases. The cost of the housing represents, in many cases, a fair percentage of the manufacturing cost of the transistor itself. The use of metal also involves a secondary operation, that of mounting the transistor in its case. Since special techniques are required, such as cold-welding or soldering, this adds to the cost of the finished component.

During the past few years, however, great forward strides have been made in the manufacture of plastic materials. Most of the problems encountered with the early plastics have been overcome by the development of new formulations. A little over a year ago, General Electric introduced a line of low-cost silicon transistors encased in an epoxy-plastic. They were developed to supply a potential consumer entertainment market for silicon types which, up to that time, had been prohibitively expensive and had been used almost exclusively in costly military equipment. Many of the new GE units (Types 2N2711 through 2N2716) were priced below comparative germanium types, their lower leakage and better high temperature characteristics notwithstanding.

More recently, Texas Instruments developed a line of silicone-plastic encapsulated transistors. Identified as “Sillect” transistors, the first units in the new series (Types TI 415 through TI 419) are low-level, low-noise amplifiers suitable for operation from d.c. to 30 mc., or as oscillators to 80 mc. They can be used in radios, intercoms, toys, cameras, TV sets, hi-fi equipment, electronic organs, portable receivers, car radios, and CB gear.

The new TI types are exceptionally resistant to heat, as shown in the composite photo on this page. The transistor package at right in (1) is made of silicone-plastic, while the unit on the left, made in the same molds, is conventional plastic. After being heated over a candle flame, (2) and (3), the conventional plastic deformed and split, while the silicone remained undamaged. The irregular outline of the silicone package in (4) is due to carbon deposited by the candle flame, which can easily be wiped off. A close-up view of one of the new transistors is shown in (5).

Technical specifications of the GE units

Silicone-plastic encapsulated transistors developed by Texas Instruments are much more resistant to heat than conventional plastic-cased units. Photo shows what happens to each type of case when held over a candle flame. See text for details.
can be obtained by writing to the General Electric Company, Electronics Park, Syracuse, N.Y., while data sheets on the “Silict” types are available from Texas Instruments, Inc., Semiconductor-Components Division, 13500 North Central Expressway, Dallas, Texas.

Readers’ Circuits. Jim Thorn (Box 87, Dayton, Wash. 99328) submitted the schematic diagram in Fig. 1. Jim adapted the circuit from one featured in our January, 1963, column. A light-sensitive audio oscillator, it can be used as the basis for a COP, a simple musical instrument, or an audible light meter.

Referring to the diagram, transistors Q1, Q2, and Q3 are wired as a three-stage, complementary, direct-coupled amplifier/oscillator. Capacitor CI provides feedback between the second and first stages to start and maintain oscillation, while Q3 serves as a power amplifier to drive the small speaker used as an output device. Photocell PCI provides a variable base bias to Q1. In operation, Q1 and Q2 function as a type of relaxation oscillator, with its frequency determined by CI and PCI’s resistance. Since the latter value changes with the amount of light falling on PCI’s sensitive surface, the unit’s output tone varies with light intensity. Operating power is supplied by B1.

Readily available components are used in the design. Transistor Q1 is a 2N107 pnp transistor, Q2 a 2N170 npn unit, and Q3 a 2N301A pnp power transistor. The photocell, PCI, is an International Rectifier CS-120-M6 cadmium sulphide photoconductor. Capacitor CI is nominally a 0.15-µf. paper or ceramic unit, but other values will serve the same purpose. A small (4" to 6") speaker with a 4- to 8-ohm voice coil is employed. The 6-volt power pack (B1) can be made up of four flashlight cells in series or may be a single battery, such as a Burgess Z4. If desired, an s.p.s.t. power switch (or hand key) may be connected in series with either of the battery leads.

Since the circuit is relatively simple, neither layout nor wiring is critical. The unit can be assembled in a metal, plastic or wooden case (such as a small cigar box), depending on individual preferences. Either point-to-point wiring or an etched circuit board can be used.

As with most direct-coupled circuits, individual transistor characteristics may be critical and it may be necessary to try different units to obtain optimum performance. Jim writes, also, that the circuit may not work if too much light falls on the photocell. In the latter case, he suggests connecting a small half-watt resistor in series with one of PCI’s leads, determining the proper value by experiment.

The simple wireless microphone circuit in Fig. 2 was submitted by John Franke (8208 Brinson Arch, Virginia Beach, Va.). Designed for short-range applications, the unit transmits in the AM broadcast band.

In operation, pnp transistor Q1 is used as a modified Hartley oscillator. The unit’s frequency of operation is determined by tuned circuit L1-C1. The transistor’s base bias is furnished through part of coil L1 and through current limiting resistor R1, bypassed by capacitor C2. The modulating audio signal, obtained from a crystal microphone cartridge, is introduced in Q1’s base circuit, while operating power is supplied by B1.

As in the previous circuit, readily available components are used. Transistor Q1 is a 2N393. C1 and C2 are small mica or ceramic capacitors, and R1 is a half-watt resistor. The 3-volt battery (B1) is made up by connecting two penlight cells in series. John used a hand-wound coil L1 in his model, winding 150 turns, center-tapped, of


Fig. 3. Transistorized ignition circuit suggested by the Bendix Corporation is designed for operation with a 12-volt, negative-ground electrical system.

#30 enameled wire on a small form. However, a standard tapped antenna coil could be used here, if preferred, and CI might be replaced with a small trimmer capacitor for adjusting frequency. An s.p.s.t. push button switch could be connected in series with either battery lead as a "push-to-talk" switch if desired.

Any of several construction techniques can be used. John writes that he assembled his model on an etched circuit board and mounted it in an empty cigarette package. Although no antenna is shown, a short one could be connected to Q1's collector.

Transistorized Ignition. The transistorized ignition circuits featured in past issues of POPULAR ELECTRONICS have been extremely popular, and a number of readers have requested that we feature additional circuits from time to time. Suggested by the Bendix Corporation (Semiconductor Division, Holmdel, N.J.), the circuit in Fig. 3 is quite simple and requires a minimum number of components. It is designed for operation with a 12-volt, negative-ground electrical system.

Referring to the diagram, Q1 is a Bendix B1867 pnp power transistor and DI is a 1N3004, 91-volt, 10-watt zener diode. Resistor RI is a temperature-compensating unit; rated at 50 watts, it should have a nominal value of 0.63 ohm and a temperature coefficient of 0.005 ohm/°C/ohm. Resistor R2 is rated at 10 ohms, 2 watts; R3 at 3.3 ohms, 5 watts. The inductance coil, T1, should have a 300:1 turns-ratio, with a primary inductance of 0.8 mh. and a secondary inductance of 65 h.

Leads should be kept short and direct and relatively heavy wiring should be used in the emitter and collector circuits. Wire the basic circuit in a closed case to prevent accumulations of dust and grease on the wiring, and mount Q1 on an insulated heat sink. The completed unit should be mounted in the automobile in a position where it is exposed to minimum heat from the engine.

Circuit Contest. Do you delight in developing new circuit applications? If so, you may be able to win a rich reward, for Motorola Semiconductor Products, Inc. has announced a four-months-long, nation-wide circuit design contest. Under the rules, contest entries must be based upon designs which use Motorola pnp and npn silicon annular transistors to improve efficiency and performance, reduce size and weight, and reduce component requirements in a given circuit.

First prize is a $2500 two-week paid vacation for two to attend the 1964 Olympic Games in Tokyo, Japan. Complete information about the contest, including a formal entry blank, is available from the sponsor. Write to Motorola Semiconductor Products, Inc., Technical Information Center, Box 955, Phoenix, Ariz. 85001.

Transitips. The average experimenter or hobbyist will—over a period of time—acquire a fair-sized collection of "defective" transistors. Some of these may be leaky, others partially open, and still others shorted. In many cases, fortunately, these units may still be useful for some projects.

A transistor with an open collector or emitter lead, for example, can be used either as a rectifier or as a diode detector. A typical rectifier application is illustrated in Fig. 4. Here, pnp power transistor Q1 is used as a half-wave rectifier in a low-voltage power supply. T1 is a step-down (Continued on page 78)


Across the Ham Bands

By HERB S. BRIER, W9EGQ
Amateur Radio Editor

VERTICAL ANTENNAS: STRAIGHT AND SIMPLE

THE long sunny days of summer are obviously the ideal time to refurbish your old antenna, put up a new one, or to experiment with a different type. If you’ve been using a horizontal antenna, for example, you might like to try a vertical. At the very least, your results will be different.

Basically, whether they’re vertical, horizontal, slanting, or bent, there are two kinds of simple antennas. One type requires a connection to an actual or artificial ground system for its operation; the other needs no ground connection. In the grounded type, the ground acts like an electrical mirror and doubles the antenna’s effective length.

Even when operated “against ground,” a full-size vertical antenna for 80 or 160 meters is quite a tall stick—60 or 125 feet high. But many amateur locations can easily accommodate the 33-foot length of a 40-meter vertical, or one of the commercially available 40-through-10-meter verticals which are approximately 27 feet long. These antennas will radiate most of their power at the low angles above the horizon most desirable for working DX.

For best results, it is very important to install any vertical antenna well away from utility wires, buildings and trees; otherwise, such obstructions will absorb much of the power radiated by the antenna and distort its theoretical circular radiation pattern. In addition, unless a grid of wires is buried just under the surface of the earth around the base to reduce ground losses, a large percentage of the r.f. power fed into the antenna will be wasted in ground having average conductivity.

This is where an artificial ground system becomes helpful. It is often possible to mount a vertical antenna on the roof of a building to get it above many power-absorbing objects. Then, four \( \frac{3}{4} \)-wave wires (“radials”) can be connected together under the base of the antenna and extended away from it like the spokes of a wheel to form an efficient “ground plane” for the antenna. The end of each “radial” is supported and insulated with a standard antenna insulator, and the antenna is fed with 50-ohm coaxial cable.

Compared to a horizontal antenna 30 to 40 feet high, the vertical antenna will usually perform better over the longer distances—say beyond about 700 miles—but the horizontal will usually do better over the shorter

Novice Station of the Month

You don’t need elaborate equipment to pile up contacts. Gordon Wolford, WNBXJF, New Carlisle, Pa., worked 29 states with an AMECO AC-1 one-tube, 15-watt transmitter; a three-tube home-built receiver; and a 16’-high 40-meter dipole. Gordon will receive a one-year subscription to POPULAR ELECTRONICS for submitting this winning photo in our Novice Station of the Month contest. If you would like to enter the contest, send us a clear picture of your station—preferably showing you at the controls—along with some information about yourself, your equipment, and operating achievements. All contest entries should go to Herb S. Brier, Amateur Radio Editor, POPULAR ELECTRONICS, Box 678, Gary, Indiana 46401.

July, 1964
Although Jo Kondas, WB2EKV, of Brooklyn, N.Y., has a General Class license, she still prefers to spend most of her air time on six meters. Her off-the-air time is divided between her OM, whose ham call-sign is WA2JKY, and her two-year-old son.

distances. The ideal arrangement, of course, is to have both types, and use the one that best matches the propagation conditions of the moment.

Detailed construction details for home-brew vertical antennas are available in the various amateur handbooks; and, of course, manufacturers include complete assembly instructions with their antennas.

CLASSIC HAM CIRCUITS

Unless you experienced them, it is difficult now to imagine the problems that the rapid growth of TV after World War II caused radio amateurs. As rapidly as television reached a new area, television interference (TVI) complaints flooded in on all hams in the area.

Overlooking the many TVI cases generated by sources of interference other than amateur, a major cause of the trouble was harmonic signals from nearby transmitters in and near the television channels. All short-wave transmitters—amateur and commercial—emitted these signals; but, until the advent of television, they rarely troubled anyone. When a harmonic happened to be in or near a local TV channel, however, it would ruin reception on that channel for all nearby viewers, even when it was very weak.

The problem quickly became a first-class crisis that had to be solved speedily or amateur radio would be fighting for its life. Some pessimists claimed that it could not be solved in transmitters operating above the 40-meter amateur band. They based this belief on the fact that all transmitters unavoidably generated harmonics, and it would be impossible to reduce their strength sufficiently to prevent interference to nearby TV receivers tuned to the lower channels.

For a time, this pessimistic outlook seemed to have some validity, because many amateurs managed to reduce the harmonics

Each summer 60 would-be radio amateurs with an interest in outdoor life enroll in the Camp Albert Butler Radio Session which is sponsored by the Gilvin Roth YMCA in Elkin, N.C. For more information on this unusual camp, write to C. L. Peters, General Secretary, Gilvin Roth YMCA, Elkin, N.C.
from their transmitters to the point where they could no longer be measured with a sensitive field strength meter, only to discover that the remaining harmonics were still strong enough to produce TVI!

Low-Pass Filter. Other amateurs tried another approach to the problem. Instead of trying to eliminate the harmonics, they reasoned that if they connected a low-pass filter with a cutoff frequency somewhat below 54 mc. (the low-frequency limit of TV channel 2) between the transmitter output terminal and the antenna, the filter would pass the desired signals to the antenna and reject the undesired harmonics.

One slight drawback to this idea was that no one had ever built a low-pass filter for such high frequencies. But design data for audio-frequency, low-pass filters were available in electronic engineering handbooks, and amateurs were quick to seize on what skimpy information there was as a basis for r.f. low-pass filters.

In spite of predictions of excessive losses and poor attenuation characteristics, the finished filters had negligible insertion losses, and their attenuation curves were even better than had been hoped for. Therefore it was a double shock when it was found that installing the low-pass filter between the transmitter and the antenna system reduced TVI much less than had been hoped for. In fact, sometimes, instead of reducing it, the low-pass filter actually increased local TVI!

Shielding the Transmitter. At this point, dedicated amateurs like Phil Rand, W1DBM, Mack Seybold, W2RYI, and others, who had been spending countless hours on the TVI problem, realized that another ingredient was necessary before they could hope for success. Since a low-pass filter in the antenna feedline kept harmonics from reaching the antenna, it was apparent that the TVI-producing radiation must be escaping from the transmitter via other routes. They reasoned that if the entire r.f. section were enclosed in an r.f.-leakproof, tight metal box, and if all leads into the enclosure were effectively grounded for r.f. (except for the antenna lead), the harmonics would be kept bottled up inside the enclosure where they could do no damage.

And they were right! A properly shielded and filtered high-powered amateur transmitter equipped with a good low-pass filter can be operated on any amateur frequency between 1.8 mc. and 29.7 mc. or 51 mc. (depending upon the cutoff frequency of the filter) without a trace of harmonic-type TVI on a TV receiver in the same room. Without the filter and adequate shielding, however, the same transmitter blots out the picture on one or more channels, at least when it is operated in the 14-mc. or higher frequency bands.

The diagram above shows the relative simplicity of a typical low-pass filter. Needless to say, this device has been a boon to amateur radio.

(Continued on page 77)
Golf Goes Walkie-Talkie

By ALBERT COYA

WHEN the golfers teed off in the $50,000 El Doral Open in Miami this year, over 300 loyal fans not only saw the action but heard a competent “play-by-play” description via the CB walkie-talkies (Lafayette HE-29’s) they rented from Golfcaster, Inc.

Sportscaster Jim Warga operated the base station transmitter. Aids, scattered over the course, employed other CB units to keep Jim informed of progress along the way, so that up-to-the-minute information could be passed on to the listeners. The channel used was not revealed for an obvious reason—people who owned walkie-talkies could take advantage of the system without paying the two-dollar fee!

The firm, founded by sportsman Thomas J. Burke, plans to use this system in the future to cover other sports events across the country. Before too long, you may pay admission to see an event, and a small additional fee to get the inside scoop.
R

REPORTS received from readers of this column make it possible for us to keep thousands of CB’ers abreast of new and unusual applications for Citizens Band equipment. Many of these uses are for emergency purposes. Some are out of the ordinary realm of personal and business communications, brought about by a particular need at a definite time.

UNUSUAL USES OF CB

For example, Irene Griffith, KKD-0768, secretary of the Somerset County Citizens Band Association of Middlesex, N. J., has told us about the part that CB equipment played in the county-wide “Victory Over Polio Campaign” held last March. Fourteen of the SCCBA club members participated in this operation under the supervision of the county civil defense director. Twelve mobile units were placed at distribution centers to coordinate necessary communications regarding quantities and condition of the Salk vaccine, and other details involved in its distribution. The CB “net control” was handled by Bill Noe, 2Q0649, and Rawley Nelson, 2W4584; they manned a 2-meter/11-meter station combination and successfully coordinated the efforts of the CB’ers with CD headquarters.

A very unusual application was brought to our attention by Grady J. Bell, Jr., KCF2548. The wife of a friend of his was killed while their son was serving with the U. S. Navy in the Pacific. Getting the son home in time for the funeral services entailed several telephone calls, both incoming and outgoing. So Grady established a temporary CB station at his friend’s home, utilizing a 5-watt unit with a 48” fiberglass whip. This enabled the friend to keep his phone line open for all incoming calls. Outgoing calls were made on Grady’s phone at his base after the friend had relayed the information needed via CB radio.

Then there’s the CB’er who made a trip to New York, glider capital of the world (that’s what he said) to watch the videotaping of a nationally known TV show. While there, he chatted with several glider pilots and learned that CB had become very popular with this group. Since gliders have been known to sit down in unusual places, CB seems to have become the answer when they need help. The pilots can count on getting a call through almost any-

Members of the Somerset County CB Association assisted civil defense authorities during recent “Victory Over Polio Campaign” in New Jersey. Bill Noe (seated above) and Rawley Nelson manned the CB/CD net control on 11 and 2 meters, while Ed Wahler (at left) was one of 12 mobile operators.
1964 OTCB JAMBOREE CALENDAR

Planning a jamboree, get-together, banquet or picnic? Send the details to: 1964 OTCB Jamboree Calendar, POPULAR ELECTRONICS, One Park Avenue, New York, N. Y. 10016. For more information on the jamborees below, contact the clubs or club representatives listed.


Martinsville, Ind. July 4-5 Location: Morgan County 4H Fairgrounds. Sponsor: Morgan County CB Radio Club, Box 335.


Alliance, Ohio July 12 Event: Picnic. Sponsor: Carnation City CB Club.


Reno, Nevada August 8-9 Sponsor: Silver State CB Association (Reno-Spark 1549 Prospect Ave., Sparks, Nevada).


Norwalk, Ohio August 22-23 Event: Second Annual Week-End for CB'ers. Location: Huron County Fairgrounds. Sponsor: Sheriff's Huron County Emergency Net, Box 201, Norwalk.


where in the U.S.A., and someone at the other end will always come to the rescue. The visiting CB'er informed the flying CB'ers that they had a definite advantage over earthly CB groups: "no ignition interference!"

While Weldon W. Shows, KCJ7810, the "Henderson Hummer" (in Henderson, N. C.), didn't report a new application, he reminded us that those who use the old faithful No. 47 pilot lamp for tuning up, either as a dummy load or within the line, should leave the final judgment to a photo exposure meter. It seems that our eyes don't quite pinpoint the glow as well as a meter does. This trick works—we've tried it.

Expressway Patrol. Atlanta (Georgia) Contac Radio Association members have seen to it that drivers in distress on Atlanta's expressways no longer need hit the panic button. A new CB-equipped "expressway patrol" cruises along the main traffic arteries leading into the city every night and brings aid to stranded motorists. The patrol is a public service project of the club, working under the direction of the Atlanta Traffic and Safety Council.

About 50 ACRA members volunteer their time to patrol the expressways each night. They are in constant contact with an ACRA monitor who can place emergency calls for wreckers, ambulances, and the police and fire departments. In case of minor motorizing difficulties patrol members will bring gasoline, help change tires, provide highway information, and aid in starting automobiles.

Club Chatter. Members of the Allegheny Valley Citizens Radio Club, Pittsburgh, Pa., are not an association to let grass grow under their objectives! They made three assists in just one week! An auto accident requiring police aid found Ethel Shagi, KID2541, relaying the plea to Evelyn Marsico, KIC7331, who in turn contacted police. Another auto accident prompted Al Marsico, 20Q2095, to contact the Johnstown Control on Channel 9 for police and an ambulance. And AVCR members John Scherzer, 20W5325, and John King, 20W4008, aided local police in recovering a stolen auto which had been on the missing list for several days.

Members of the Blair Cambria Citizens Radio Association, Duncansville, Pa., are again publishing the Five Watt Gazette. This monthly paper was off the scene for almost two years, and the new staff is making a stellar effort to revive it. The first issue to appear after the lengthy hiatus is filled with several editorials definitely worth reading.

(Continued on page 79)
New 1964 Heathkit® All-Channel Color TV

Everyone Agrees It Outperforms Any Other, Is Easy To Build, & Saves Up To $400!

Here's What The Experts Say! Popular Electronics, May issue: “The GR-53A is not a skimpy receiver in which corners have been cut to keep costs down and still provide color TV. Instead, the GR-53A (on a comparison shopping basis) has the same color and sound fidelity, flexibility, and ease of handling as those manufactured receivers which sell for over $600.”

Radio-TV Experimenter, June issue: “The repair cost savings during the Heath Color TV set’s life compared to commercial units may be more than $200.”

Popular Mechanics, February issue: “Mounted, pre-aligned critical circuits enable beginners to assemble. Picture quality is topnotch.”

Science & Mechanics, April issue: “Built-in servicing circuits such as a dot generator are valuable aids in getting the set operating for the first time & eliminating expensive service calls & bills when realignment or part replacement is needed later on.”

Anyone Can Build It: No special skills or knowledge required. . . all critical assemblies are factory-built & tested. . . simple check-by-step instructions take you from parts to picture in just 25 hours!

Exclusive Built-In Service Center Eliminates Maintenance Costs! You adjust and maintain the GR-53A yourself with the degaussing coil, service switch, and built-in dot generator! No more costly TV service calls! No other set has these self-servicing features!

No Expensive Service Contract! Since you maintain the set, there’s no need for a costly service contract. Heath warrants the picture tube for 1 year, all other parts for 90 days!

Compare These Additional Features:  26-tube, 8-diode circuit  Deluxe Standard-Kollsman VHF tuner with push-to-tune fine tuning for individual channels, 2 thru 15   New transistor UHF tuner for channels 14 thru 85   High definition 70° 21” color tube with anti-glare bonded safety glass   21,000 volt regulated picture power   Automatic color control & gated AGC for peak performance   3-stage high gain video I.F.   Line thermistor for longer tube life   Thermal circuit breaker for component protection.

Cabinet Or Custom Installation! After assembly, just slip the complete unit into the handsome GRA-53-6 walnut-finished hardboard cabinet! Or, if you prefer, mount it in a wall or custom cabinet. Enjoy Complete TV Reception Now! . . . by ordering the new 1964 Heathkit 21” High Fidelity Color TV!

Kit GR-53A, chassis, tubes, mask, VHF and UHF tuners, mounting kit, speaker, 121 lbs. — $399.00
GRA-53-6, walnut-finished cabinet, 53 lbs. — $49.00

FREE 1964 HEATHKIT CATALOG
See these and over 250 other exciting Heathkits available in easy-to-build kit form. Save 50% or more by doing the easy assembly yourself! Send for your free catalog today!

July, 1964
TRANSISTORIZED MINIATURE AMPLIFIER AND TUNER APPLICATIONS

by Rufus P. Turner

Several years ago Lafayette Radio began importing a small number of preassembled transistorized amplifiers and tuners. Attractive in price ($3.75 to $14.95), these units need only input, output, and battery power connections. Many projects have been published in POPULAR ELECTRONICS using both the amplifiers and tuners. However, a quick look at the 60-plus projects in this book is convincing proof that the surface has just been scratched. While exact construction details are not included, the volume is packed with ideas on scores of devices that can be activated by these low-cost component packages.


UNDERSTANDING DIGITAL COMPUTERS

by Ronald M. Benroy

This book offers an interesting compromise between arithmetic and electronics aimed at the audience that wants to know how a digital computer operates. It is definitely not a book that you can sit down and expect to finish in two or three evenings. It is instead a text that could have been part of a series of practical do-it-yourself experiments—such as those provided by correspondence schools. Your reviewer has no argument with the thoroughness with which the author attacks this difficult subject, only that he gives the reader far greater credit for memory and attentiveness than would seem justified. Nevertheless, the book is an excellent reference volume.

Published by John F. Rider Publisher, Inc., 850 Third Ave., New York 22, N.Y. 166 pages. With soft cover, $3.75; with cloth binding, $5.45.

TRANSISTOR TRANSmitters FOR THE AMATEUR

by Donald L. Stoner, W6TNS

Transistor experimentation and circuit development have always fascinated Don Stoner. POPULAR ELECTRONICS readers will recall that some of his circuits were published in these pages and in other electronics journals. This book is an extension of Don's articles on low-power transistorized transmitters. Written for the ham operator, it includes a variety of proven circuits for modulators, crystal checkers, tunnel diodes, and small transmitters.

Published by Howard W. Sams & Co., 4300 West 62 St., Indianapolis 6, Ind. Soft cover. 128 pages. Price, $2.95.

ELECTRONICS IN EVERYDAY THINGS

by William C. Vergaro

It's always interesting to find a book that is not a run-of-the-mill publication. This second edition of William Vergaro's book is an extraordinary "fact sheet" on electronics aimed at the curious, but not knowledgeable (electronically speaking), everyday citizen. The book asks 113 questions about electronics ranging from music power ratings in hi-fi to whether or not you can defeat a radar speed trap. The answers are concise but thorough, and obviously written with a great deal of care. About the only complaint a reader might have is that there is insufficient organization of the material into categories.


Free Literature

Allied Radio's 144-page "Carnival of Values" mid-season sales book includes many new products, selected items from the general catalog with substantial price reductions, and manufacturers' close-out values on leading national makers with discounts of up to 33 1/3%. The emphasis is on transistorized equipment, but all categories of products sold by Allied are represented. Write to Allied Radio Corp., 100 N. Western Ave., Chicago, Ill. 60680 for a copy of Sales Book No. 239 . . . The Datak Corporation, 63 Seventy-first St., Guttenburg, N. J., has published a new 48-page catalog on "Letraset Instant Lettering." Their electronic line has been expanded to include a new meter and dial set, as well as a "Datakoat Coating" which protects the rub-on lettering on metal, plastic, and painted surfaces.
The following satellites were in orbit and transmitting as this issue closed. The satellites are listed by frequency and by code name. Some satellites are mentioned several times since different frequencies are used for tracking and telemetry.

Vanguard 1* .................................. 108.012 mc.
Echo 2 ....................................... 136.020 mc.
Telstar ....................................... 136.050 mc.
Alouette** ................................... 136.077 mc.
Explorer 18 .................................. 136.110 mc.
Relay 1 ....................................... 136.140 mc.
Relay 2 ....................................... 136.141 mc.
Echo 2 ....................................... 136.170 mc.
Tiros 8 ....................................... 136.233 mc.
Tiros 7 ....................................... 136.234 mc.
Ariel 1 ....................................... 136.405 mc.
Syncom 2** ................................... 136.468 mc.
Ariel 2 ....................................... 136.558 mc.
Alouette** ................................... 136.590 mc.
Relay 1** ..................................... 136.620 mc.
Relay 2** ..................................... 136.621 mc.
1963 38C (USA) ................................ 136.651 mc.
EGRS .......................................... 136.804 mc.
Solar Radiation ................................ 136.887 mc.
Tiros 7 ....................................... 136.922 mc.
Tiros 8 ....................................... 136.924 mc.
Alouette ...................................... 136.978 mc.
Syncom 2** ................................... 136.980 mc.
Saturn 5 ...................................... 136.995 mc.

*Transmits while satellite is in sunlight
**Transmits only upon ground command

This listing does not include all of the satellites in orbit—many of which no longer transmit, or transmit weak or sporadic signals. Satellites of the Soviet Union use tracking and telemetry frequencies in the band between 19,990 and 20,010 mc. Whenever news reports indicate that a new Soviet satellite is in orbit, check the news broadcasts from Radio Moscow for the exact frequency. At press time a number of Soviet satellites are in orbit, but do not appear to be transmitting on their regular channels. These satellites include: Polyot 1 and 2, Cosmos 25, 26, and 29, Elektron 1 and 2.

July, 1964

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75
nylon screws (metal screws at the top end would produce corona discharges which could burn the coil form). Alternatively, the top coil cover can be cemented in place with epoxy cement if a sturdy coil form is used. The coil is attached to the base with a 3/8” bolt.

Winding the coil is not nearly as difficult as it appears—the author completed the task in about two hours. Spray the entire winding with acrylic plastic for added insulation, moisture protection, and to keep the windings in place. You can’t overdo this step—the author used the contents of an entire aerosol spray can on the prototype, applying one thin layer at a time and letting it dry before adding another.

Building the Primary. As shown on page 31, the form for L1 was made with polystyrene rods and sheeting. While the plastic has excellent insulating qualities and looks attractive, wood or even cardboard can be substituted. If plastic is used, it can be strongly “welded” together with acetone. Regardless of the material used, the form should have an outside diameter of at least 9” to avoid arc-over between L1 and L2. The coil itself (L1) consists of 20 turns of heavy test prod wire.

Spark Gap. The spark gap is simply two ordinary binding posts mounted on stand-off insulators. In turn, these are mounted on a phenolic base measuring 3/8” x 2 1/4” x 6”. The electrodes are brass and copper rods with a gap on the order of 1” between them. This distance will vary slightly, depending on the size of capacitor C1.

Fabricating the Capacitor. The capacitor consists of two 14” x 14” sheets of tin cemented to a 18 1/2”-square piece of window glass. Although aluminum foil can be used for the capacitor plates, tin was obtained from a sheet metal shop for this purpose so that connecting leads could be soldered directly to it. If you use aluminum foil, a fairly good connection can be had by making leads of 1/4”-wide aluminum foil strips and taping them down to the electrodes.

Glass is an excellent dielectric material for this application since it has an extremely high puncture voltage and a high dielectric constant. As you will note in the drawing on page 32, a border of glass is left around the capacitor plates—this should be at least 1 1/2” wide. The calculated capacity of C1 is approximately 0.0027 µ.

Testing and Operation. Caution! Adjustments to the Tesla coil, and specifically to the spark gap, should be made only when the unit is off. Although the output voltage of the Tesla coil may be on the order of 150,000 volts, the current capacity is only hundreds of microamps. This current can inflict a nasty shock and r.f. burns, however.

Use EXTREME CAUTION around the neon sign transformer. It delivers 12,000 volts at 30 ma., and this voltage could be lethal under certain conditions. Again, be sure the plug is out when you make adjustments.

To adjust the spark gap, first open it to about 1 1/2”; it will not fire at this point. Gradually move the electrodes together—unplugging the unit each time you adjust the gap—until the point is reached where the gap “fires.”

The author’s version of “Big TC” produced an output voltage of 100,000 volts with the 0.0027-µf. capacitor described. To increase the output voltage, simply construct one or two more capacitors and parallel them across C1. With two capacitors in parallel, the prototype Tesla coil produced 150,000 volts; with three capacitors, 200,000 volts. However, it began to break down between coil L2 and capacitor C1 above the 200,000-volt region. As mentioned earlier, greater output voltage can be obtained by making the base larger and increasing the spacing between components to eliminate arcing.

The output of your Tesla coil can be estimated by drawing an arc to a metallic object attached to a long wooden handle. Slowly increase the distance between the object and the discharge terminal until the arcing stops: a 6” arc represents 100,000 volts, a 14” arc about 200,000 volts, and a 21” arc some 300,000 volts. More amazing than figures, however, are the brilliant, spectacular phenomena exhibited by high-voltage, high-frequency electricity. –00–
Across the Ham Bands
(Continued from page 60)

Steve Bloisdell, K7SVB, Box 336, Grand Canyon, Ariz., is looking for skeds in Vermont, Rhode Island, and Maine to complete his WAS. If you can help him, look for him on any of the lower frequency ham bands.

Dennis Daupert, W9HDL, 6218 Zionsville Rd., Indianapolis, Ind., who won the Novice Station of the Month contest for January, now has his General ticket and 25 states worked on 80 meters. Equally important, his dad Richard is now WN9ITR . . . John Stensby, WN4RES, 5106 Holmes Ave., Huntsville, Ala., shares his equipment with his brother, James, WN4RER; and when their father's ticket comes through, he has his claim staked out for equal air time. John has 25 states confirmed on 80 meters. The Stensby station includes a home-constructed transmitter, an RME-4300 receiver, and a multiband doublet antenna.

John J. Kellog, WB2AWY, 31 Lincoln Court, Keansburg, N. J., spent part of a 15-day leave from the Navy on 80 meters. Fifteen states and two Canadian provinces were the result, giving John renewed faith in his Heathkit DX-20 transmitter and ARC-5 receiver . . . Still another John, this one John Wood, VE5DX, Box 493, Oxbow, Sask., Canada, operates on 40, 20, and 6 meters with his Knight-Kit T-60 transmitter and Lafayette HE-80 receiver. Although he has a "jumble of antennas," the favorite is a 40-meter vertical. He's looking for contacts in the southern U.S. in particular, but will be glad to schedule anyone needing a Saskatchewan contact . . . Paul Sussman, WB2AXW, 310 West 72 St., New York, N. Y., has been operating portable from Philadelphia on 54 mc. Using a Heathkit "Sixer" feeding a dipole only seven feet off the ground, he worked four states and Canada. Paul now has a Johnson Viking "Challenger" transmitter and a BC-312 receiver plus a 6-meter converter. WB2AXW/5 will be active on 8 meters into the fall at 6008 Chester Ave., Philadelphia, Pa.

David O. Box, W5SBCM, Mantachie, Miss., is not manager of the new Mississippi Novice Traffic and Training Net. The net meets daily at 1730 (5:30 p.m.) CST on 3745 kc.; the call-up signal is "CQ MISS NTT." You are invited to join; write to W5SBCM if you'd like more information . . . Since March 17, 1964, the FCC has been collecting its newly scheduled license fees and holding them pending final decision as to their legality. If the fees are finally ruled illegal, they will be returned . . . Chuck Long, WN6HHZ, 10009 Stonehurst Ave., Sun Valley, Calif., is a great believer in surplus gear. He has a BC-669 transmitter, a BC-779 "Super-Pro" receiver, and a BC-604 transmitter/receiver. A Heathkit "Twoer" completes Chuck's ham equipment . . . Phil Kampe, WASEAM, 4937 S. Tonti

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July, 1964
St., New Orleans, La., uses a Johnson Viking "Ranger" transmitter, a Hammarlund HQ-110 receiver, and a vertical antenna. As a Novice, Phil worked 49 states and 12 different countries; his record now is all states and 41 countries, which is darn good for a 13-year-old OM.

**Randy Riskin**, WN9JTP, 896 Webster Lane, Des Plaines, Ill., keeps the 80-, 40-, and 15-meter Novice bands working for him. A Heathkit DX-40 transmitter and a Hammarlund HQ-100C receiver take turns pushing and pulling on a dipole 45 feet high. Randy's record is 36 states and 10 countries worked . . . **Matt Harris**, W9SIBV, 422 Petama, Harlingen, Texas, sticks to 7176 kc. His favorite operating time is after 2:00 a.m., although his parents don't share his enthusiasm for that time. His Heathkit DX-60 transmitter feeds an inverted-V antenna, and he receives on a Hammarlund HQ-110. Matt worked 18 states in his first month on the air . . . **Ken Lindt**, W9EIQV, 8928 Chimineas, Northridge, Calif., works the 80-, 40-, and 15-meter Novice bands, but 40 meters is his favorite. Ken's EICO 720 transmitter, Hy-Gain 14-AVS vertical antenna, and Knight-Kit R-100A receiver have worked 22 states and Canada. He will be glad to add California to your states-worked list.

Don't you think your "News and Views" or a photo of you and your ham station would look good on these pages? We do; you send the material, and we'll do our best to use it. Write to: **Herb S. Brier, W9EGQ, Amateur Radio Editor, POPULAR ELECTRONICS, Box 678, Gary, Indiana 46401. 73,**

Herb, W9EGQ

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**Transistor Topics (Continued from page 66)**

(filament) transformer, L1 a filter choke, C1 and C2 electrolytic capacitors, and R1 a small current limiting resistor (typically, 33 ohms at 1 watt). With pnp types, the emitter or collector serves as an anode, the base as a cathode. With npn types, the emitter or collector becomes the cathode, the base the anode.

When a transistor is used as a rectifier, care must be taken not to exceed its nominal maximum voltage or current ratings. Two transistors may be employed for full-wave rectification and four in a bridge circuit.

Small signal transistors make excellent diode detectors. In the simple "crystal" receiver circuit illustrated in Fig 5, a transistor with an open emitter (Q1) is used in place of a conventional diode.

Frequently a "leaky" transistor can serve as a temperature-compensating element.

One arrangement is shown in Fig. 6. Here, a compensated base bias is supplied to amplifier Q1 by a voltage-divider made up of R1 and Q2. In operation, an increase in temperature lowers Q2's internal resistance, reducing the bias furnished to Q1.

Even shorted or "burned-out" transistors are useful. When polished or plated with gold (or silver), they can serve as the main element in a variety of interesting jewelry items. Your Semiconductor Editor has a lapel button made from a gold-plated transistor as well as a pair of cuff links assembled from defective units. They can also be used for tie-tacks and tie-bars, watch fobs, earrings, necklaces, pins, bolo ties, pendants, necklaces and bracelets.

**New Books.** If you're an advanced student or an experimenter who wants to learn more about engineering design methods, you'll be interested in two books recently published by Sine-Ser-Co., P.O. Box 3, Arlington, Mass. 02174. Both are college-level texts and are written by an eminent authority, Dr. Harry E. Stockman, Professor of Electrical Engineering at Lowell Technological Institute.

The first book, *Transistor and Diode Experiments*, is an 85-page, spiral-bound volume featuring 11 experiments covering such topics as transistor characteristics and parameters, amplifiers, phase splitters, output stages, multivibrators, triggering, a.f. and r.f. oscillators, synchronization and modulation. Reproduced by a "ditto" process, it sells for $2.

Selling for $2.75, the second book, *Tran-
On the Citizens Band
(Continued from page 72)

The group below are the officers of the Arfax CB Club of Falls Church, Va. Hard work, planning, and participation by all concerned have boosted a handful of members with a small, compact newspaper to an organization of 100 with a huge monthly paper (usually 20 pages or more) called the Arfax Facts. Shown in the back row (left to right) are: Ken Brewster, KCG1160, sergeant at arms; Warren Harrison, 4Q0791, trustee; and Ralphy Keys, KCF2462, trustee. Bottom row: Ann Gillenwater, KCG0258, secretary; Van Gillenwater, KCG0258, vice president; Don Bates, KCG0708, president; and Jim Lang, KCG2725, treasurer. There are seven members on the staff of Arfax Facts; “Cactus Bob” Howison, KCF0952, stands at the helm as editor. The club is a member of the Virginia State CB Association.

CB Club Roster. The following new clubs have been added to the 1964 OTCB Club Roster this month:

- Sioux Empire Citizens Communication Association, Sioux Falls, S.D. This group is the first South Dakota club to check in.
- Citizens Band Radio League, Lebanon, Pa. Their compact two-page newspaper manages to include a new members column, pet peeves in CB, items for sale, last-meeting information, next-meeting information, and a monthly message from the club’s president.
- Bedford County Five Watts, Bedford, Pa. Recently elected officers are Reid Hackney, KID6682, president; Loren Cooper, KID6559, vice president; Gene Kiessling, KID7759, secretary; James Kilcoin, Jr., KID5757, treasurer; and Earl Efflan, 20Q2956, communications officer.
- Capital District Citizens Band Radio Club, Inc., Albany, N.Y. This group’s excellent newspaper, The Carrier, is jammed with interesting reading, upcoming club activities, and paid advertising!
- Citizens Emergency Radio Club, Rome, N.Y. According to club president Tom Little, 20Q4550/WB2AZU, this is the largest CB organization in Rome. A special emergency committee trains members as to procedures during 10-33’s.
- Terre Haute CB Club, Terre Haute, Ind. If you’re interested in joining, contact Lester L. Morton in care of the club at the Terre Haute Police Department.

See you next month! In the meantime, don’t forget to write. Fill us in on the latest functions or planned activities in your area, and include pictures of club activities if you can. The address is: Matt P. Spinello, CB Editor, POPULAR ELECTRONICS, One Park Avenue, New York, N.Y. 10016.

—Matt, KHC2060
started the motor. “Look at that poor dog standing there sorrowing because he’s being left out of the fun. Can’t we take him?”

“O.K.,” Carl agreed. “An act such as that canine ham is putting on deserves an Oscar and should be rewarded. Come on, Bosco!”

The animal’s head and tail came up in a flash, and he leaped clear over the closed rear door of the car and landed in the seat with Mr. Gruber, shivering with delight at being permitted to go along.

They soon reached the spot where Mr. Gruber had been fishing. The little-traveled road paralleled the river at this point, with only a narrow strip of sloping river bank separating the two. While Bosco frolicked about, sniffing at all sorts of exciting scents, Carl and Jerry, carrying the equipment, followed Mr. Gruber along a path through the low bushes until he reached the base of a big sycamore tree. There was a three-inch hole in the scaly trunk about a dozen feet from the ground, and bees were flying busily in and out.

Jerry connected up the oscillator, speaker, and amplifier while Mr. Gruber stalked about the tree eyeing it with the intent concentration of a diamond cutter preparing to split the Great Kohinoor. Finally he extended his cane and touched a spot on the trunk about shoulder high and directly beneath the bees’ entrance.

“We’ll chop here,” he said to Carl, who was leaning on the axe handle. “Are you ready with the ‘beepacifier,’ Jerry?”

For an answer, Jerry threw a switch. A pure, surprisingly loud tone came from the little speaker he held in his hand.

“Point the speaker directly at the hole and stand out of the way of Carl’s axe,” Mr. Gruber directed. “Okay, Paul Bunyan, lay on the wood!”

Carl spat on his hands in imitation of a professional lumberjack, swung the double-bitted axe back over his shoulder,
and sank the blade deep into the green tree-trunk. He never had a chance to chop a second time. A tornado of angry insects boiled from the hole in the trunk and descended like a blanket, sparing no one.  

While Carl and Jerry were feeling the stabbing pain of multiple stings, they saw Mr. Gruber snatch off his derby and start flailing wildly with it, and yelps from Bosco revealed that he, too, was being stung. Suddenly Mr. Gruber turned and ran for the river with the speed and nimbleness of a sixteen-year-old, and the boys and the dog were right behind the galvanized little man as he gave a great leap out into the stream and disappeared beneath the surface.

Fortunately, the water was only about three feet deep, and it was fairly easy to keep submerged simply by squatting down and coming up briefly now and then for air. After a few minutes the bees gave up the attack, and the three men cautiously surfaced and waded on out to a sand bar in the middle of the stream. Bosco was already there, whimpering and pawing at his muzzle which had received the most stings.

THAT didn't work very well, did it?" 
Mr. Gruber said sheepishly, glancing out of the corner of his eye at the lumpy, swelling faces of his young friends.  
"That's the understatement of the year," Carl agreed, grinning crookedly as he started plucking stings from the back of his hand.  
"Don't do that!" Mr. Gruber said.  
"You're just squeezing venom from the little poison sacks down into the skin punctures. Scrape the stings off with a knife blade as I'm doing. That way they won't amount to much."

"Mr. Gruber," Jerry asked, "are you sure you didn't overlook something in that article about the bee-tranquilizing?"

"See for yourself," Mr. Gruber invited as he removed his derby, shook some water from it, and fished a soggy newspaper clipping from inside the sweatband.

Jerry read the story and then carefully examined the clipping. Suddenly he used his fingernails to separate two layers of paper and peeled them apart until the clipping was twice its former length. He read the continuation of the story, and a smile creased his swollen face.

"Mr. Gruber," he said gently, "I'm afraid you were in such a hurry to try out this bee-quieting business that you forgot one important point. The story goes on to say that the threshold limit for the reaction was 125 db of audio measured at the level of the bee. The figure is confusing since it gives the airborne energy which just serves to disturb the substrate. The actual sound energy we put into the substrate is much less, and it is substrate vibration that causes the reaction. In other words, there was enough energy from that little buzzer the researchers screwed to the side of the hive to quiet the bees perched on the hive or the comb, but to transmit the same amount of vibration to the hive by conduction through the air from a speaker, we would have to exceed the limit of human pain. The experimenters were never able to put out enough audio..."
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If that doesn’t beat everything!” Mr. Gruber exclaimed with a crestfallen air. “Now I remember I was interrupted by Martha’s wanting me to go to the store while I was reading that article. I folded it up and put it into my hat where it stuck together. I never finished reading it and even forgot that there was more to it. Does the story say anything else?”

“There’s one other thing. By amputating pairs of legs, the entomologists have found that the fore pair is about eighty-five per cent responsible for carrying the sound stimulus. The remaining fifteen per cent of conduction is about equally divided between the middle and hind pairs. Why are you grinning, Carl?”

“I was just thinking about that business of the sound energy having to be conducted to the bee’s body through his legs,” Carl said. “We failed because our sound energy didn’t pass through the bee’s knees. Get it? ‘The bee’s knees—’”

He was interrupted by handfuls of sand scooped in his direction by both Mr. Gruber and Jerry. Even Bosco barked and tried to nip his ankles as he ran away laughing.

---

Tap Tap Temperature Taker

(Continued from page 43)

R2 only far enough to start the unit ticking. Note the reading on the thermometer and place a light pencil mark on the paper scale opposite the knob’s pointer.

Put the ice cube back in the water until K3 stops and the temperature drops one degree. Then advance R2 to the point where the ticking starts again, and mark this new knob setting. Continue cooling the water and marking the scale until you can turn R2 no further. You will now have calibration points at one-degree intervals from approximately 85° to 59° F. The dial scale may be drawn and lettered with India ink. Before cementing it in place, moistureproof it with two coats of Krylon or clear lacquer.

During the calibration process, keep in mind that R10 reacts much more rapidly than the thermometer does. Thus, you
should wait at least one minute after each application of ice before comparing the setting of \( R2 \) with the thermometer's reading. And remember to do plenty of stirring to insure an even temperature throughout the water.

**Performance.** To demonstrate the Temperature Taker's ability to detect minute temperature differentials, the probe was held a foot above the floor in a heated room. Control \( R2 \) was set just below cutoff. Raising the probe only six inches was sufficient to cause \( K3 \) to begin clicking. Dropping the probe back to its original position almost immediately silenced the relay.

Since the transistors, relays, and other components in the device are, themselves, temperature-sensitive, you may wonder about the stability of the instrument, as a whole, under varying external temperature conditions. To check this problem, the unit was placed atop a hot air register. At the end of an hour, the case and contents were very warm to the touch, but the dial error was only 2°. When used at the relatively even temperatures encountered in the average home darkroom, errors resulting from ambient thermal changes should be insignificant.

Battery aging is of little consequence, since a 20 per cent voltage drop in either \( B1 \) or \( B2 \) has only a minor effect on accuracy. Battery cost runs in the neighborhood of two cents per hour.

---

**Modern Crystal Set**

*(Continued from page 55)*

permits the greatest transfer of energy with the least effect on tuning.

Wind \( L2 \) directly on a bare ferrite antenna rod without added insulation (see drawing, page 55). The leads should be long enough to reach \( S2 \)'s terminals; do not cut the tap loops when winding. Most litz wire can be soldered without scraping if it is held for a few moments in a puddle of solder and flux. Add a touch of glue at the base of each tap and at the ends of the windings.

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Set" is the use of fixed diodes—four of them in a bridge circuit—instead of a cat whisker and galena crystal. The author mounted them on a screw-type terminal strip to avoid heat damage; an ordinary tie strip can be substituted if you use a heat sink when wiring. Be sure to observe diode polarities.

By far the best headphones for this purpose are crystal types. Putting the two phones in series rather than in parallel may prove beneficial in some cases. If you must use magnetic phones, the addition of an output transformer may improve results.

Assembly and Testing. As shown in the photos, all components are mounted on the front of the aluminum case. While it is not necessary or especially desirable to follow the author's layout, some experimentation will be necessary to gang L1 (mounted to the back of C2 in the prototype with epoxy cement and a cardboard holder) and C1. The author used a lever switch for S1. Spacers were used to mount the terminal strip and C1 and C2. Small metal brackets can be made to support L2-L3 to the supporting screws holding S2 if desired. The ferrite rod is simply glued between the two small brackets.

The first step in testing the set is to provide a good ground such as a cold water pipe and an antenna, preferably a long wire. Tune with the main dial and the antenna control, trying S1's three positions for best results. When maximum volume has been achieved, try the three remaining switch positions on the "band switch" (S2), varying the other controls with each setting. Finally, try the four positions of the "impedance selector" (S3). As you will note, all controls unavoidably interact to some degree.

With all controls adjusted, you will find that changing stations involves a coordinated change of both antenna and main tuning knobs, with an occasional change in band and impedance switch settings. For those who have experimented with the "garden variety" crystal set, tuning will seem sharp and volume astounding. Not the least of the rewards you'll receive when you build a "Modern Crystal Set" are the police and aircraft calls you may hear at one of the tap settings!
Short-Wave Report
(Continued from page 59)

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 Eastern Standard and the 24-hour system is used. Reports should be sent to P.O. Box 254, Haddonfield, N.J., 08033, in time to reach your Short-Wave Editor by the eighth of each month; be sure to include your WPE Monitor Registration and the make and model number of your receiver. We regret that we are unable to use all of the reports received each month, due to space limitations, but we are grateful to everyone who contributes to this column.

Albania—According to a recent verification letter, R. Tirana is operating in Eng. at 2000-2030 and 2130-2200 on 9390 and 7090 kc. The 9390-kc. outlet is also noted in Eng. at 1630-1700 and from 1700 in Italian.

Argentina—Radiodifusión Argentina al Exterior, Buenos Aires, now operates Mondays to Fridays on the following schedule: to Europe on 11,710, 11,780, and 6090 kc. at 1400-1500 in Spanish, at 1600 in German, to 1700 in Italian, to 1800 in French, and to 1900 in English; to East Coast N.A. at 1900-2000 in Portuguese and 2000-2200 in Spanish on 9690 kc., at 2100-2200 on 11,780 kc. in Spanish, and at 2200-2300 on 11,780, 9690, and 6090 kc. in English; to West Coast N.A. at 2300-0100 in Spanish and to 0200 in Eng. on 11,780, 9690, and 6090 kc. Reports go to Sarmiento 151, Buenos Aires.

On weekends, Radio Nacional operates on 15,345 kc. to 1700 and on 9690 kc. from 1715. The 11,710-kc. channel is no longer used for this xmsn.

Azores—Emissora Regional dos Açores, CSA97, Ponta Delgada, is audible on 4865 kc. around 1730 with Portuguese music and anmts. The IS consists of chimes.

Barbados—Radio Barbados, Black Rock, is one of the most widely reported medium-wave stations. On 795 kc., it is being heard from 0500 to 0530 and evenings to 2115 s/off. It is rated at 10 kw. The station is government-owned and operated by a statutory board. Located four miles north of Bridgetown and 100 yards from the West Coast of Barbados island, it is beamed north-northwest.

Bolivia—Station CP81, R. Pio XII, Líliagagua, 5965 kc., is noted at 0515-0545 with news, music, and ID’s. Station CP70, R. Grigotia, Santa Cruz de la Sierra, 4828 kc., has been off the air for some time and is now heard irregularly around 2215 with Latin American music and talks and a very weak signal.

Brazil—According to R. Timbira’s QSL card, this station broadcasts a listeners’ correspondence program on Sundays at 1800 on 4975 kc. in Eng., Spanish, and Portuguese.

British Honduras—A recent verification letter states in part, “Our short-wave service is temporarily suspended; but we hope to resume transmission in June.” Meanwhile, the 834-kc. outlet continues to be heard well in many areas.

Brunei—R. Brunei, 4865 kc., has been noted at 0900-0930 with modern and old-time music and anmts in English.

Canada—Station CBNX, St. John’s, Newfoundland, relays CBM on 6180 kc. and is noted at 0740 with a religious program, at 0800 with news from R. Canada, and at 1730 but with heavy QRM from a station with Arabic music.

Ceylon—During the past years, many DX’ers have reported difficulties in obtaining QSL’s from the Commercial Service of R. Ceylon. However, reports addressed to Radio Advertising Service, Cecil Court, Lansdowne Rd., Bombay 1, India, have brought in verification letters. This probably is a company that produces some (or all) of the commercial programs broadcast from Colombo.

Dominican Republic—Station HICB, Santiago, is heard on 6120 kc. at good level but with heavy QRM to 0100 s/off.

El Salvador—Station HCJB, Quito, has a “DX Party Line” to N.A. on the first and third Monday of the month at 2130-2200 on 9745, 11,915, and 15,115 kc. and to the Pacific areas on the first and third Wednesday of the month at 0430-0500 on 6030 and 9745 kc. Station HICB4, R. Nacional Espejo, Esmeraldas, has been tuned at 2330-2345 on 3844 kc. R.
Quito, *La Voz de la Capital*, Quito, 4923 kc., was noted at 2300 with a news bulletin in Spanish and to 0000 s/off with pop music, ID's, and commercials; they verified with a QSL card and pennant. *Emisora Gran Colombia*, Quito, 4910 kc., was also noted at 2320-0030 with pop music and five ads for each record, all Spanish.

**France**—Paris has been noted on 9485 kc. with s/off at 2115 after a program in Spanish, although the latest schedule indicates that this program is aired only on 9755, 11,845, and 11,920 kc. to Latin America. An Arabic program to the Middle East has also been heard on 11,920 kc. at 1100-1500.

**Germany (West)**—Deutsche Welle, Cologne, has been carrying a special program to N.A. at 1710-1720 on 6120, 6185, and 9735 kc. The program generally consists of music only.

**Greenland**—If tests are satisfactory, there will be a short-wave xmr in Greenland in 1965 that will cover the entire island. The Armed Forces Radio & Television Service, Thule, has been noted on 1425 kc. in the medium-wave band from 2130, weak but clear.

**Iceland**—Reykjavik has moved from the 25-meter band to 9720 kc. and operates Sundays only at 0800-1000 in Icelandic.

**India**—*All India Radio*, New Delhi, has this schedule: 0500-0600 to N.E. Asia on 17,850, 15,105, and 9520 kc., and to Australia and New Zealand on 15,290, 11,710, and 9740 kc.; 0830-1000 to S. E. Asia on 15,225 and 11,810 kc.; 1340-1430 to E. Africa on 11,815, 11,790, 9680, and 7125 kc.; 1445-1545 to Europe on 9915, 7235, and 5995 kc. and to W. Africa on 11,825, 9690, and 7105 kc. The 15,225-kc. channel is one of the best heard at present, at 0830-1000.

**Indonesia**—*R. Republik Indonesia*, Djakarta, broadcasts in Eng. at 0600-0700 and 0900-1030 on 9710 and 9585 kc., and can also be heard on 11,795 and 11,710 kc.; they supply a decora-

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**SHORT-WAVE MONITOR CERTIFICATE APPLICATION**

All radio listeners interested in furthering the hobby of SWL'ing—regardless of whether you DX on the BCB, VHF, TV, SW, or FM bands—are eligible to apply for a POPULAR ELECTRONICS “Certificate of Registration.” You must have verified (have QSL cards from) a minimum of five radio stations, of which one was outside the borders of the United States. There is no age limit, or special equipment qualification; the only requirement is that the applicant have a sincere interest in radio communications.

All certificates are filled in and lettered before mailing; they are mailed flat and unfolded. If you want to register and receive your WPE identification sign, fill in the application blank below before August 15, 1964. Mail with 25 cents in coin to: Monitor, POPULAR ELECTRONICS, One Park Avenue, New York, N. Y., 10016. Canadians should use their own currency. All other applicants not in the U. S. A. should use five International Postal Reply Coupons. Allow 2-4 weeks for processing.

![Certificate Application Form](https://example.com/certificate_form.png)

(Please Print)  
(Do not fill out)

| Name |  
| Street, City and Zone |  
| State and Zip |  
| Receivers in use | Make | Model |  
| Make | Model |  
| Age | Occupation |  
| Ham/CB call—letter assignment(s) |  
| I listen mostly to SW Broadcast | Hams | CB | BCB | VHF | VLF |  
| I use the following antennas |  
| I have QSL cards and countries verified. | Check if subscriber to P.E. |  
| Signature | Date |  

(Good only until August 15, 1965)
DX COUNTRY AWARD RULES

Are you eligible to apply for a 25, 50, 75, 100, or 150 Countries Verified Award? Here is a brief resume of the rules and regulations.

1. You must be a registered WPE Short-Wave Monitor and show your call on your application.

2. You must submit a list of stations for which you have received verifications, one for each country heard. You must also supply the following information in tabular form: (a) country heard; (b) call-sign or name of station heard; (c) frequency; (d) date the station was heard; (e) date of verification. All of the above information should be copied from the station's verification. Do not list any verifications you cannot supply for authentication on demand. Do not send any verifications at this time. Should any verifications need to be sent in for checking, we will notify you and give you instructions on how to send them.

3. A fee of 50 cents (U.S. coin) must accompany the application to cover the costs of printing, handling, and mailing. This fee will be returned in the event an applicant is found ineligible. Applicants in countries other than the U.S. may send the equivalent of 60 cents (U.S.) in coins of their own country if they wish.

4. Apply for the highest DX award for which you are eligible. If, at a later date, you are eligible for a higher award, then apply for that award.

5. Send your application, verification list, and fee to: Hank Bennett, Short-Wave Editor, P.O. Box 254, Haddonfield, N.J. 08033. Do not include an application for a Short-Wave Monitor Certificate (you are not eligible for any of the awards until you have a Short-Wave Monitor Certificate in your possession). Reports, news items, or questions should be mailed in a separate envelope.

tive program schedule. Station YDDR2, a 300-watt outlet in Ambon, has been noted on 7140 kc. in native language at 0430-0503.

Iran—The latest schedule from Teheran shows these operations: Home Service at 0255-0715 and 0726-1430 on 3780 and 7125 kc., at 1430-2030 on 4840 and 7125 kc., and at 2030, 0133 on 7085 and 3780 kc.; the Foreign Service is broadcast on 7031 kc. at 1430 in Persian, at 1500 in Russian, at 1515 in Turkish, at 1530 in French, and at 1545 in English. Other Iranian stations are: R. Tabriz, on 6155 kc., at 2125-0000, 0254-0700, and 0824-1330; R. Razeleh, on 6910 kc., at 0645-1130. Despite the fact that this schedule was copied directly from the official schedule, we believe there are some errors in the Home Service portion. Further checks will be made. Test xmsns have been noted from 100-kw. xmr at 2130-0730 and 0730-1030 on 7135 and 9659 kc., and at 0030-0730 on 15,135 and 11,730 kc.

Iraq—R. Baghdad has French at 1530-1600, Eng. to 1640, and German to 1710, on 6030 and 6095 kc. Another outlet on 6155 kc. is heard in Arabic at 2313-0603.

Israel—Kol Zion, Jerusalem, has moved from 9625 kc. to 9615 kc. where it operates dual to 9009 kc., at 1100-1530. There is an Eng. newscast and talk at 1510.

Japan—Tokyo has been heard on 9530 kc. at 0400 with Eng. news, at 0415 in Japanese, and
at 0430 with music; and on 7195 kc. at 0615-0645 with native-language talks and music. There is an Eng. ID at 0645 s/off. The Far East bulletin was noted from 0700-0735, Wednesday, as follows: on 3910 kc. at 0245-1910 (10 kw.) and 1925-0235 (1 kw.); on 6155 kc. at 10, 15, and 15,360 kc. (1 kw.) 24 hours daily; on 11,750 kc. at 1925-0235 (10 kw.) and 0245-1910 (1kw.). Maintenance is performed at 1005-1458 on Tuesdays (3910 kc.), Thursdays (6155 kc.), Tuesdays (11,750 kc.), and Wednesdays (15,280 kc.).

Netherlands Antilles—Bonaire, 800 kc., has R. Nederland programs scheduled as follows: (weekdays) Spanish from 1830 to 1920, a Dutch news bulletin to 1940, and English to 2030; (Sundays) the “Happy Station Program” in Spanish at 1830-1920 and in English at 1920-2030. The Dutch newscast is also aired at 1920-1940 on Sundays.

Willemsstad’s assigned frequencies are 6085 kc. (2 kw.) and 9655 kc. (1 kw.). Does anyone have any information as to whether there are any broadcasts on these frequencies? Any information should be sent to World Radio TV Handbook, Lindorfsalle 1, Hellerup, Denmark.

New Zealand—Wellington’s latest schedule reads: to the Pacific Islands at 1200-1445 and 0100-0345 on 11,780 and 9540 kc., and at 1500-0045 on 15,280 kc.; to Australia at 1500-1730 on 11,780 kc., at 1745-0045 on 15,110 kc., and at 0400-0645 on 6080 and 9540 kc.; to Antarctica (Sundays only) at 0315-0455 on 6080 kc. The station states: “All reports are acknowledged by letter or QSL card. Listeners’ reports should include the wavelength or frequency of the transmission, date, time, and if possible, some program detail and comments on any interference.”

Nigeria—Lagos has been heard on 15,256 kc. at 1845 with “high-life” music announced in Eng. and at 1900 with a French newscast.

Norway—R. Norway was noted on 15,175 kc. at 1500 with news and at 1530 with s/off, and on Saturday at 0930-1000 with a listeners’ request program. The 9610-kc. outlet was heard closing in Eng. to N.A. at 0900.

Peru—A newly organized station, R. Andina, La Voz de Los Agricultores Andinos, 6255 kc., was heard at 0555-0630 with music and frequent ID’s. Station OAX3E, R. Huarez, Huarez, is another new one; operating on 5700 kc., it was noted from 2240 to 2307 s/off with music and a few anns in Spanish.

Philippines—Far East Broadcasting Corp., Manila, was noted on 15,230 kc. at 0719-0800 with hymns and a children’s program, and on 9730 kc. at 1030-1045 with Eng. news and at 1550-1559 with an Eng. religious program to India.

Portugal—Lisbon broadcasts daily to East Coast N.A. at 2100 and to the West Coast at 2245 on 6025 and 6185 kc. Another Voice of the

**SHORT-WAVE ABBREVIATIONS**

- ann—Announcement
- B/C—Broadcasting
- Enc.—English
- ID—Identification
- IS—Intermediate signal
- kw.—Kilowatts
- m—Minutes
- QRM—Station interference
- QSL—Verification
- R.—Radio
- s/off—Sign-off
- xmsn—Transmission
- xmt—Transmitter

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Gary Robertson, Hanford, Calif.
Charles Scott, Petrolia, Ontario, Canada
Steve Smay, Springield, Mo.
Deutsche Welle DX Bulletin, Cologne, Germany
Far East Network, Tokyo, Japan
Radiodiffusion Television Francaise, Paris, France
R. Malaysia, Sarawak
R. Nederland, Hilversum, Netherlands
Sweden Calling DX’ers Bulletin, Stockholm, Sweden
Trans World Radio, Chatham, N. J.
World Radio TV Handbook, Hellerup, Denmark

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**ABBREVIATIONS**

- kw.—Kilowatts
- m—Minutes
- QRM—Station interference
- QSL—Verification
- R.—Radio
- s/off—Sign-off
- xmsn—Transmission
- xmt—Transmitter

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**POPULAR ELECTRONICS** 88
West program is aired on 15,380 kc. with an Eng. news bulletin at 1305. Medium-wave DX'ers might try for the Eng. program on 755 and 1061 kc. starting at 1745 (at 1900 on Sundays).

Sarawak—The latest schedule from R. Malaysa, Sarawak, for Eng. xmsns reads: Sundays, Mondays, Wednesdays, Fridays, and Saturdays at 1800-1915 on 4950 and 7160 kc.; Sunday to Thursday (during school term only) at 2000-2245 on 7160, 7270, and 9585 kc.; daily newscast at 0000-0115 on 7270 kc.; daily except Wednesdays and Sundays at 0000-0030, Tuesdays at 2300-0030, Saturdays at 0030-0130 and 2200-0130, all on 7160 kc.; Saturdays at 0900-1000 on 4383 kc.; and daily at 0600-0700 and 0800-0930 (Saturdays at 1000) on 4950 kc.

Senegal—Dakar has started using a 200-kw. xmtr on 764 kc. that is reportedly scheduled from 0100 to 1900, Several East Coast medium-wave DX'ers claim that this is the strongest transatlantic station logged in many years. One report from the West Coast claims it is the loudest transatlantic station ever heard, with best reception at 1720-1900. Those DX'ers with smaller receivers might try for it on Mondays from 0200 when WABC, New York, 770 kc., is off the air.

Switzerland—Berne has been heard on 15-190 kc. with opening at 0944 to India and Pakistan.

United Nations—Reports for United Nations broadcasts should be sent to Radio and Visual Services Division, United Nations, New York, N. Y. Correct reports are confirmed by card and new listeners are sent general information about the U. N. upon request.

Uruguay—A new station on 11,710 kc. is R. Oriental, Montevideo, noted around 1900.

U.S.S.R.—Govorit Komschtski, Petropavlovsk, 4485 kc., was noted at 0445 with talks in Russian. Frunze, Kirgis, 4009 kc., has been heard at 2030-2100 with musical exercises, classical music, and some talks in Russian; a newscast is given at 2100. The Tyumen Asiatic S.S.R. closes at 1500 on 5045 kc. with the call Govorit Tyumen and 12 clock chimes.

Venezuela—According to a verification letter, R. Tovar, Tovar, 3365 kc., 1000 watts, op-

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**Bio-Electronic Quiz Answers**

(Quiz on page 49)

1 - E Pickup ARM  
2 - I Magic-EYE  
3 - C Contact  
4 - B HAIRspring  
5 - J HANDset  

6 - A Tape HEAD  
7 - G Tower LEGS  
8 - F Zener Diode  
9 - H Picture Tube  
10 - D Needle-NOSE  

Pliers
FOR SALE
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14 Weather instrument Plans $1.00. Saco, Box 2513B, South Bend, Indiana.


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