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POPULAR ELECTRONICS

DECEMBER 1965

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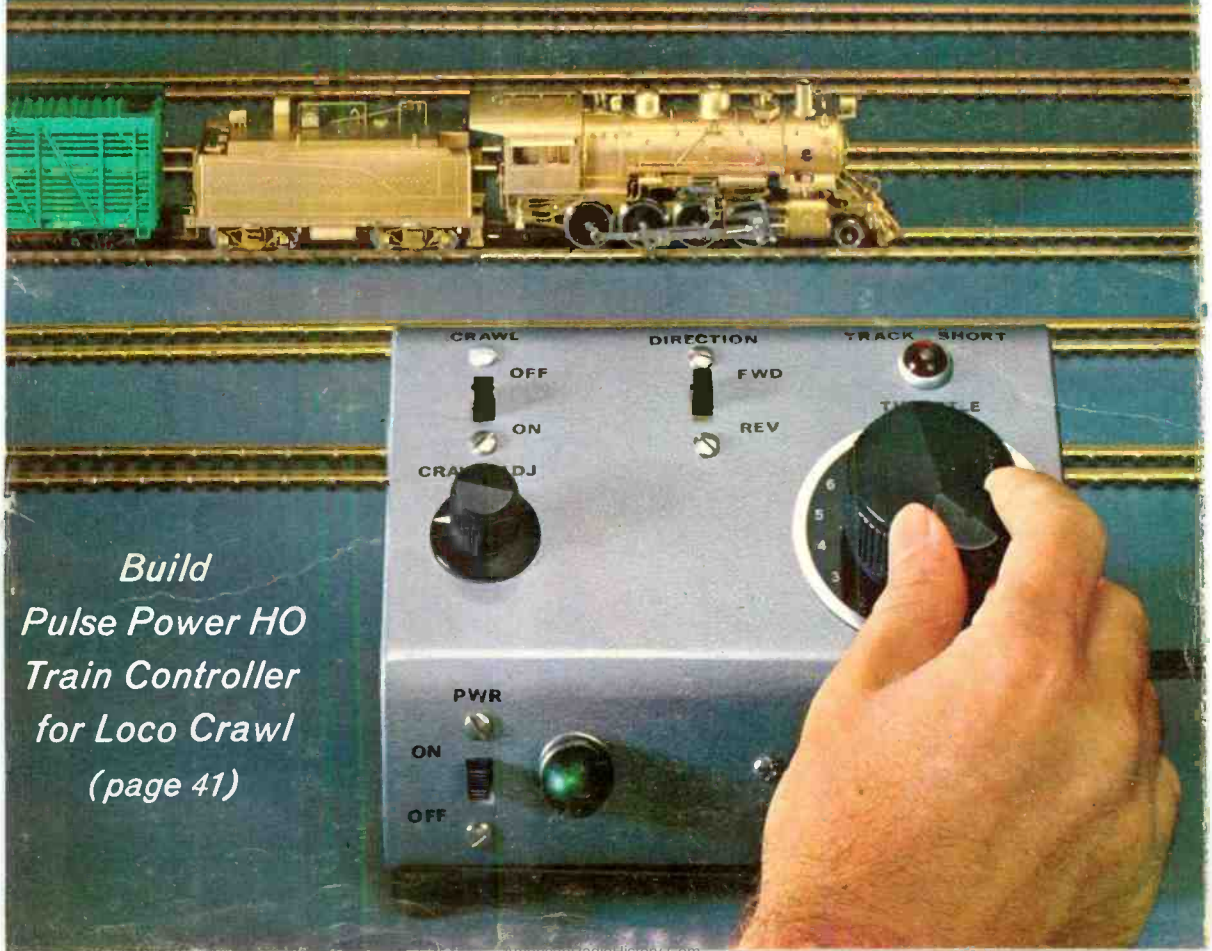

Build Pulse Power HO Train Controller for Loco Crawl *(page 41)*

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"Many thanks to NRI for the Electronics training I received. I hold a First Class FCC License and am employed as a studio and master control engineer/technician with KXJB-TV." RONALD L. WOOD, Fargo, N. D.

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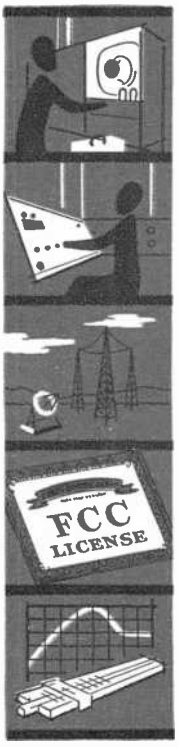

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POPULAR ELECTRONICS

POPULAR ELECTRONICS is indexed in the Readers' Guide to Periodical Literature
This month's cover photo by Bruce Pendleton

VOLUME 23 DECEMBER, 1965 NUMBER 6

Special Features on Tape Recording

Electronic Construction Projects

Communications

Other Features and New Developments

Departments

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CIRCLE NO. 4 ON READER SERVICE PAGE

LETTERS
FROM OUR READERS

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

CALL OUT THE MARINES

HELP! WE NEED HELP! The very fine article, "Project Choose," by Ken Gilmore (September, 1965) listed our "National Directory of Schools and Vocations," but failed to state that it is a 713-page book with a cost of $11.66. We have been besieged by stacks and stacks of letters from your readers asking us to send them free lists of schools. Although we would like to answer them, we do not have the facilities to do so. The directory is a standard guidance book which can be found in most High School Guidance Departments, High School Libraries, and in most large city libraries; it is available at

these places for examination by interested students. We are returning the quarters and five-cent stamps which some of your readers sent. You certainly have an eager public, and we shall never forget POPULAR ELECTRONICS. Even the Armed Forces are in on this.

ADELINE E. MILLER
State Schools Publishers
North Springfield, Pa.

Miss Miller, we know how you feel about the "quantity" of reader mail. The response to Ken Gilmore's article on resident schools has been terrific. Sorry that the price of your valuable Directory was omitted.

FIDO'S WHISTLE MODIFIED

If you want to save tape, you can modify the circuit in "Fido's Whistle-Controlled Flivvers" (October, 1964) to make a sound-actuated relay. I eliminated the frequency-selective network and the relays in the latching circuit and installed the system in the motor circuit of my tape recorder. Now the reels turn only when a sound is being recorded.

DOUGLAS HARRINGTON
Wellesley, Mass.

(*Continued on page* 8)

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

More brains? More ambition?

No, just more education in electronics.

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

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

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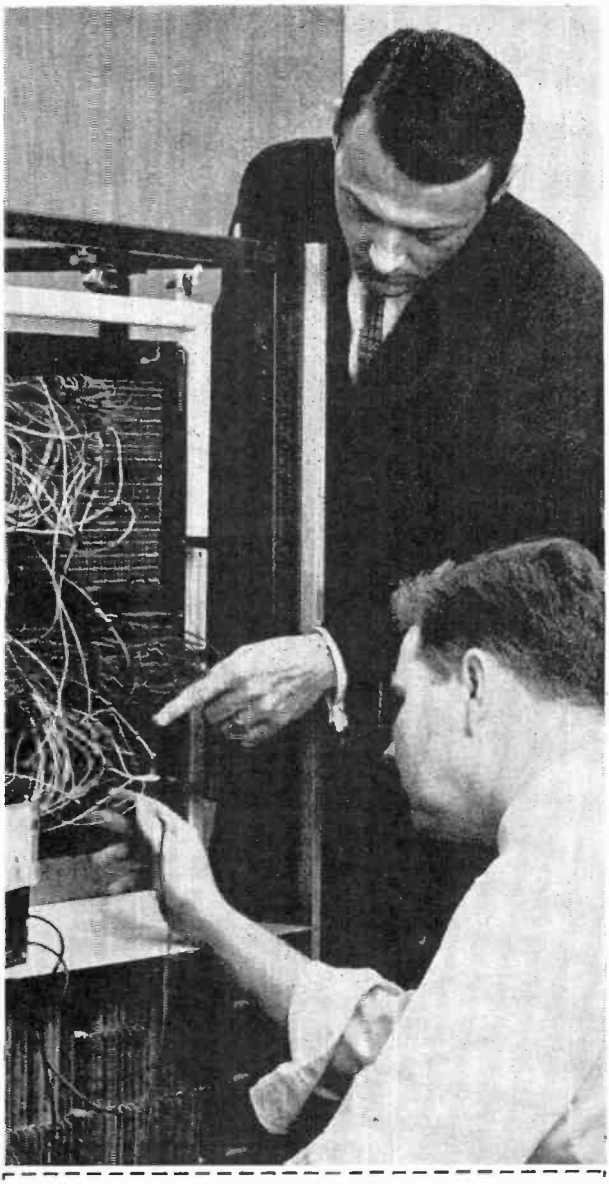

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LETTERS (*Continued from page 6*)

TV PICTURE TUBE TESTER

I am planning on building the "TV Picture Tube Tester and Rejuvenator" (October, 1965) and have a couple of questions concerning it. The 5-volt tap (position 6) on filament switch *S2a* in Fig. 7 does not seem to be connected. As I see it, this switch position will be dead. Is that correct? Also, can I use a 1-ma. meter in this tester?

MELVIN J. HYATT
Prairie Village, Kan.

Melvin, you are right about the 5-volt position of the switch; to correct for this condition, simply run a small piece of wire from pin 6 on S2a *to pin 8 on* S2b. *Also note that the value of* R3 *is 1 megohm as shown on the schematic, and not 1000 ohms as in the Parts List. Use of a 1-ma. meter is not recommended because it would throw too many usable readings too low down on the meter scale.*

MOSCOW IS EAST AND NEW YORK IS WEST

Mr. Pyle wrote an informative and certainly a most interesting article, "When It's 6 AM in Tokyo" (August, 1965), but I would prefer that he brush up on his navigation before flying with me. In my travels around the world in the USAF I have always found New York to be West of London, and Moscow to be East.

JESSE R. CALLAHAN
Villingen, Germany

Jesse, the editor who worked on this article was standing on his head; now he has his back to the wall. As for Mr. Pyle, he's facing

North and repeating 1000 times, "East is to the right, West is to the left, and some editors don't know their right from their left."

INTENSIFIER FOR "HI-LIGHTER"

The "Hi-Lighter" (September, 1964), was a complete success. I obtained the 6.3-volt filament transformer—the most expensive item on the list—for only $2 (Army surplus). I put a convex lens in front of the GE 1133 lamp to focus and intensify the light even more. It works beautifully.

MICHAEL SPIELZINGER
New York, N.Y.

(*Continued on page 10*)

NEW from FINCO

BOOSTER-COUPLER
Model No. 65-1 List $29.95

ALL FINCO PRODUCTS ARE ENGINEERED FOR **"COLOR"**

UHF CONVERTERS
Model U-Vert 300 List $39.95
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The CONVERTERS

"That challenge all competition"

FEATURES:

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CIRCLE NO. 12 ON READER SERVICE PAGE

LETTERS (*Continued from page 8*)

"PHONOVID" BAFFLING

How can Westinghouse's "Phonovid" system (August, 1965) reproduce video pictures on a standard TV set directly from a phonograph record? Since the minimum frequency response needed for a TV image is generally considered to be one million cycles per second, could you please explain how it is possible for the stylus and cartridge to respond to anything over the usual maximum of 20 kc.

ED DRAPER
Baldwinsville, N.Y.

Easy, Ed. It's slow-scan TV. The pictures are stills, and the frequency-response requirements are way down. You'll be interested in the article on page 67 of this issue.

SWAMPED BY OPERATION ASSIST

I was swamped with replies to my request in the Operation Assist column for a schematic. I tried to answer a few at first, but so many came in that I could not possibly answer all of them personally. Thank you (for publishing the request) and everyone who

was kind enough to write to me. My special thanks go to one fellow who sent me practically the whole booklet in Xerox form, and who did not give his name or address.

JOHN LUBE, WA5KGW, WPE5DTL
Houston, Tex.

PARTS PROFILES DT's

If any experimenters ran into the dv/dt effect when they set up the demonstrator/tester shown in Fig. 1 on page 73 of "Parts Profiles" (October, 1965), they should place push-button switch *S2* between the rectifier bridge and the 3-ohm, 1-watt resistor instead of in the position shown. This will eliminate the mysterious gremlin which turns on the SCR prematurely.

DONALD LANCASTER
Phoenix, Ariz.

Also, switch S2 *should be held open long enough for the SCR to turn off. The dv/dt effect is a characteristic that tends to turn on an SCR when the rate of rise of the applied voltage exceeds a certain critical value, even though the applied voltage is less than the*

CIRCLE NO. 33 ON READER SERVICE PAGE →

New from RCA!

ALL SOLID-STATE CB 2-WAY RADIO WITH ALL SILICON TRANSISTORS

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only $189.95*

Here's the latest, and the finest, in a long line of exceptional 2-way radios from RCA. The new all transistor RCA MARK 10 with the operating features you have been asking for...engineered to provide the most dependable communications possible. Check this partial list of RCA MARK 10 advantages:

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- 12 crystal-controlled transmit and receive channels with illuminated channel selector
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- Operates from 12-volts DC power source (positive or negative ground)
- 3-watt public address system with volume level fully controllable by receiver volume control
- Provision for tunable receive, AC operation, and external speaker (optional)
- Crystal-controlled double conversion, superheterodyne receiver provides frequency accuracies greater than 0.004%
- Separate AGC amplifier eliminates blasting and overloading, minimizes fading
- Six-stage IF bandpass filter for maximum selectivity without ringing
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See it at your Authorized RCA Citizens' Band Radio Distributor. To find him, look for stores displaying this symbol. It's your assurance of top-quality RCA CB equipment.

*Optional distributor resale price

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

The Most Trusted Name in Electronics

LETTERS (*Continued from page 10*)

static breakdown voltage. A pn *junction has capacitance, and the larger the junction, the larger the capacitance. An SCR is a* pnpn *device, and it has capacitance. Like a capacitor, the SCR can take on a fast charging current. The faster the SCR charges up, the faster the voltage rises. The trick, then, is to keep the current surge down to a minimum.*

RADIO MAGAZINES CIRCA 1925 AVAILABLE

We have been in radio since the earliest days of broadcasting (1922) and we have a dozen or more issues of *Popular Radio* magazine of 1924-25 vintage. They certainly bring out the primitive beginnings, like the Model T era of radio. Would you know of any organization that would appreciate having these issues?

CLARK BROTHERS
Albia, Iowa

CAMPER'S SPECIAL DOWN THE DRAIN

There goes another construction project down the drain due to the fact that the parts are not available where I live. I am referring to the "Camper's Special" (August, 1965). It would appear that the 2N3053 transistors used in the project are not stocked anywhere in Oakland or San Francisco. I have contacted some 20 electronic supply houses in the Bay Area and not one had them. Furthermore, they advised me to discontinue construction of the project because there was so

slim a chance that I could get hold of these transistors. Because the project uses transistor sockets, I was still able to complete the unit, but I find it extremely maddening not to know whether the project is a success or a failure. Could you possibly tell me where I can get these transistors?

D. MCDANIEL
Oakland, Calif.

The Bay Area is a big place and we can't understand why you couldn't get the 2N3053 transistors. They are made by RCA, list for $1.24, and are similar to the 2N2270, 2N3016, 2N3056, 2N3057, 2N3253, and 2N3444. Your distributors should have been more helpful instead of trying to discourage you from putting the project together. We suggest that you try one of the mail order houses if the distributors won't accommodate you. Incidentally D. M., your complaint was the only one we received on lack of parts availability, but we did get a lot of compliments on the project. -30-

CIRCLE NO. 47 ON READER SERVICE PAGE →

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6 Channels
*COURIER TR-6

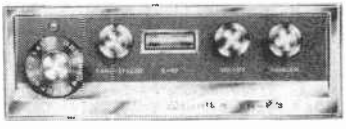
6" W x 6¾" D x 1⅞" H

■ SILICON TRANSISTORS. Illuminated channel selector. Auxiliary speaker jack. 4" oval speaker. Transmit indicator. External channel socket. Top or bottom speaker mount. Channel 9 crystals. **$129**

12 Channels
*COURIER TR-12

5¾" W x 5¾" D x 1⅝" H

■ SILICON TRANSISTORS. Collins filter. Illuminated S-RF meter. Illuminated channel selector. PA System. Auxiliary speaker jack. Modulation indicator. Channel 9 crystals. **$169**



23 Channels
*COURIER TR-23

6" W x 7½" D x 2½" H

■ SILICON TRANSISTORS. All crystals supplied for 23 channels. Illuminated S-RF meter. Illuminated channel selector. PA System. Auxiliary speaker jack. Single knob tuning. Modulation indicator. **$209**

(Delivery, Dec. 15, 1965).

*All units include: Microphone, Mounting Brackets, DC Cord, Chrome Cabinet. PLUS exclusive Courier circuit protection against mismatched antenna, incorrect polarity, and overload.

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■ 23 Channels ■ Dual Conversion ■ Transistor Power Supply ■ Includes all crystals, mounting brackets, power cords and noise-cancelling microphone. STILL **$189.50**

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eci. electronics communications inc.

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Yes! I'd like to know all about Courier's new 6-12-23 Channel SILICON-TRANSISTOR CB line!

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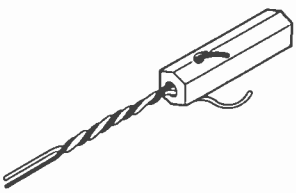
City_____ **County**_____ **State**_____

PARTS METHODS IDEAS GADGETS DEVICES

TIPS & TECHNIQUES

TWISTED PAIRS COME EASY USING A HOMEMADE DIE

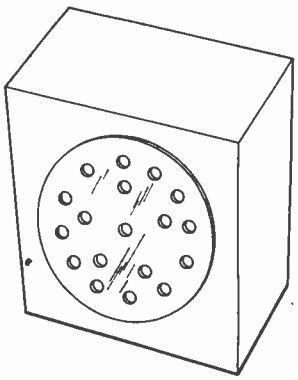
Here's a way to make professional-looking twisted pairs which are often used in wiring filament and a.c. circuits to minimize radiation or pickup of stray signals, hum, noise, etc. Obtain a short brass rod about



¼" in diameter and drill three holes in it as shown in the diagram. Hole size depends on the gauge of the wire you intend to twist; side holes should be drilled at angles of less than 45° for best results. To use, simply insert the two wires in the side holes and pull them from the center hole. Connect one end of the wires to be twisted in a vise and place the die in a hand drill. Then simply rotate the drill and work the die along wires until the lengths of wire are properly twisted.

—Roman A. Scheidel

SINK-DRAIN STRAINER PROTECTS SMALL SPEAKER



Small perforated sink drain strainers — the type found at corner hardware shops — make excellent protective grilles for small speakers. Chrome-plated and convex in shape, they come in many sizes and sell for about 25 cents each. To install one, simply glue it in place; a few drops of epoxy cement will do.

—Henry R. Rosenblatt

(*Continued on page* 20)

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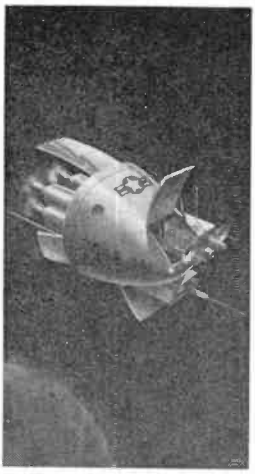

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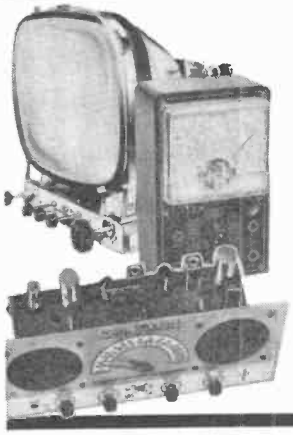

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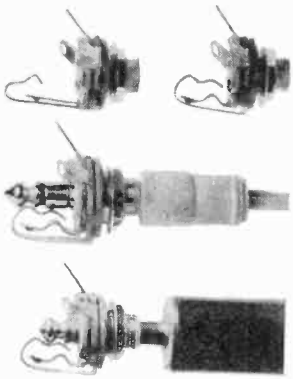
TIPS (*Continued from page* 14)

MODIFIED MONO PHONE JACK FEEDS MONO OR STEREO PHONES

Stereo as well as mono headphones can be plugged into a modified phone jack—a simple bend eliminates the need for an adapter or wiring changes. Just shorten the circuit closing prongs as shown in the photos. A pair of



long-nose pliers can be used as a bending tool, if they are strong enough. Adjust the bends so that the tip and center section of a stereo plug are contacted. A mono plug should be pushed in only partially. If you push the mono plug in all the way, it will serve as a shorting plug, and while this could be a desirable feature in some instances, it could also damage some types of transistor amplifiers. A small bushing or spacer cut to proper size and fitted over the mono plug would limit insertion distance. —*Art Trauffer*

BEEF UP THOSE FLOPPY RABBIT-EAR ANTENNAS

If the small swivel balls inside of the telescoping-type antenna mounted on the rear of your TV set should break through the plastic case, you can put them back in place with two small metal strips. Drill a ½" hole in each strip to allow the antenna sections to pass through, shape the strips with tin snips to fit inside the case, and insert them between the swivel balls and the top of the case as shown. Make the center screw just snug enough to provide sufficient friction to hold the antenna elements at any desired angle when they are fully extended. —*Homer L. Davidson*

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- ★ No Knowledge of Radio Necessary
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HUNDREDS OF DOLLARS FOR A RADIO COURSE

The "Edu-Kit" offers you an outstanding PRACTICAL HOME RADIO COURSE at a rock-bottom price. Our Kit is designed to train Radio & Electronics Technicians, making use of the most modern methods of home training. You will learn radio theory, construction practice and servicing. THIS IS A COMPLETE RADIO COURSE IN EVERY DETAIL.

You will learn how to build radios, using regular schematics; how to wire and solder in a professional manner; how to service radios. You will work with the standard type of punched metal chassis as well as the latest development of Printed Circuit chassis.

You will learn the basic principles of radio. You will construct, study and work with RF and AF amplifiers and oscillators, detectors, rectifiers, test equipment. You will learn and practice code, using the Progressive Code Oscillator. You will learn and practice trouble shooting, using the Progressive Signal Tracer, Progressive Signal Injector, Progressive Dynamic Radio & Electronics Tester, Square Wave Generator and the accompanying instructional material.

You will receive training for the Novice, Technician and General Classes of F.C.C. Radio Amateur Licenses. You will build Receiver, Transmitter, Square Wave Generator, Code Oscillator, Signal Tracer and Signal Injector circuits, and learn how to operate them. You will receive an excellent background for television, Hi-Fi and Electronics.

Absolutely no previous knowledge of radio or science is required. The "Edu-Kit" is the product of many years of teaching and engineering experience. The "Edu-Kit" will provide you with a basic education in Electronics and Radio, worth many times the low price you pay. The Signal Tracer alone is worth more than the price of the kit.

THE KIT FOR EVERYONE

You do not need the slightest background in radio or science. Whether you are interested in Radio & Electronics because you want an interesting hobby, a well paying business or a job with a future, you will find the "Edu-Kit" a worth-while investment.

Many thousands of individuals of all ages and backgrounds have successfully used the "Edu-Kit" in more than 79 countries of the world. The "Edu-Kit" has been carefully designed, step by step, so that you cannot make a mistake. The "Edu-Kit" allows you to teach yourself at your own rate. No instructor is necessary.

PROGRESSIVE TEACHING METHOD

The Progressive Radio "Edu-Kit" is the foremost educational radio kit in the world, and is universally accepted as the standard in the field of electronics training. The "Edu-Kit" uses the modern educational principle of "Learn by Doing." Therefore you construct, learn schematics, study theory, practice trouble shooting—all in a closely integrated program dsigned to provide an easily-learned, thorough and interesting background in radio.

You begin by examining the various radio parts of the "Edu-Kit." You then learn the function, theory and wiring of these parts. Then you build a simple radio. With this first set you will enjoy listening to regular broadcast stations, learn theory, practice testing and trouble shooting. Then you build a more advanced radio, learn more advanced theory and techniques. Gradually, in a progressive manner, and at your own rate, you will find yourself constructing more advanced multi-tube radio circuits, and doing work like a professional Radio Technician.

Included in the "Edu-Kit" course are Receiver, Transmitter, Code Oscillator, Signal Tracer, Square Wave Generator and Signal Injector circuits. These are not unprofessional "breadboard" experiments, but genuine radio circuits, constructed by means of professional wiring and soldering on metal chassis, plus the new method of radio construction known as "Printed Circuitry." These circuits operate on your regular AC or DC house current.

THE "EDU-KIT" IS COMPLETE

You will receive all parts and instructions necessary to build twenty different radio and electronics circuits, each guaranteed to operate. Our Kits contain tubes, tube sockets, variable, electrolytic, mica, ceramic and paper dielectric condensers, resistors, tie strips, hardware, tubing, punched metal chassis, instruction Manuals, hook-up wire, solder, selenium rectifiers, coils, volume controls and switches, etc.

In addition, you receive Printed Circuit materials, including Printed Circuit chassis, special tube sockets, hardware and instructions. You also receive a useful set of tools, a professional electric soldering iron, and a self-powered Dynamic Radio and Electronics Tester. The "Edu-Kit" also includes Code Instructions and the Progressive Code Oscillator, in addition to F.C.C. Radio Amateur License training. You will also receive lessons for servicing with the Progressive Signal Tracer and the Progressive Signal Injector, a High Fidelity Guide and a Quiz Book. You receive Membership in Radio-TV Club, Free Consultation Service, Certificate of Merit and Discount Privileges. You receive all parts, tools, instructions, etc. Everything is yours to keep.

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- SOLDERING IRON
- ELECTRONICS TESTER
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- HIGH FIDELITY GUIDE • QUIZZES
- TELEVISION BOOK • RADIO TROUBLE-SHOOTING BOOK
- MEMBERSHIP IN RADIO-TV CLUB: CONSULTATION SERVICE • FCC AMATEUR LICENSE TRAINING
- PRINTED CIRCUITRY

SERVICING LESSONS

You will learn trouble-shooting and servicing in a progressive manner. You will practice repairs on the sets that you construct. You will learn symptoms and causes of trouble in home, portable and car radios. You will learn how to use the professional Signal Tracer, the unique Signal Injector and the dynamic Radio & Electronics Tester. While you are learning in this practical way, you will be able to do many a repair job for your friends and neighbors, and charge fees which will far exceed the price of the "Edu-Kit." Our Consultation Service will help you with any technical problems you may have.

FROM OUR MAIL BAG

J. Stataitis, of 25 Poplar Pl., Waterbury, Conn., writes: "I have repaired several sets for my friends, and made money. The "Edu-Kit" paid for itself. I was ready to spend $240 for a Course, but I found your ad and sent for your Kit."

Ben Valerio, P. O. Box 21, Magna, Utah: "The Edu-Kits are wonderful. Here I am sending you the questions and also the answers for them. I have been in Radio for the last seven years, but like to work with Radio Kits, and like to build Radio Testing Equipment. I enjoyed every minute I worked with the different kits; the Signal Tracer works fine. Also like to let you know that I feel proud of becoming a member of your Radio-TV Club."

Robert L. Shuff, 1534 Monroe Ave., Huntington, W. Va.: "Thought I would drop you a few lines to say that I received my Edu-Kit, and was really amazed that such a bargain can be had at such a low price. I have already started repairing radios and phonographs. My friends were really surprised to see me get into the swing of it so quickly. The Trouble-shooting Tester that comes with the Kit is really swell, and finds the trouble, if there is any to be found."

PRINTED CIRCUITRY

At no increase in price, the "Edu-Kit" now includes Printed Circuitry. You build a Printed Circuit Signal Injector, a unique servicing instrument that can detect many Radio and TV troubles. This revolutionary new technique of radio construction is now becoming popular in commercial radio and TV sets.

A Printed Circuit is a special insulated chassis on which has been deposited a conducting material which takes the place of wiring. The various parts are merely plugged in and soldered to terminals.

Printed Circuitry is the basis of modern Automation Electronics. A knowledge of this subject is a necessity today for anyone interested in Electronics.

UNCONDITIONAL MONEY-BACK GUARANTEE

ORDER FROM AD—RECEIVE FREE BONUS RADIO & TV PARTS JACKPOT WORTH $15

- ☐ Send "Edu-Kit" postpaid. I enclose full payment of $26.95.
- ☐ Send "Edu-Kit" C.O.D. I will pay $26.95 plus postage.
- ☐ Rush me FREE descriptive literature concerning "Edu-Kit."

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(ATT: S. GOODMAN, M.S. In ED., PRES.)

1186 Broadway, Dept. 650D, Hewlett, N. Y. 11557

CIRCLE NO. 32 ON READER SERVICE PAGE

NEW PRODUCTS

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

ROTARY QSL CARD FILER

Is your shack wall covered to capacity with QSL cards? *Nordlund Radio Products* has a rotary QSL card filer that will hold up to 600 of them, for easy "flip-viewing." The Model S accommodates cards up to 3½" x 5½" in size, and its Mylar windows protect them from dust and handling. The basic unit comes with 20 binders (for 160 cards). Additional binders are available in lots of four. Each binder has an 8-card capacity, back-to-back.

Circle No. 75 on Reader Service Page 15

SHORT-WAVE RECEIVER

Covering 550 kc. through 30 mc. in four bands, the *Lafayette* HA-226 is an imported superheterodyne short-wave receiver with a built-in power supply and a 4" speaker. In addition to the on/off volume control, band selector, slide rule dial, main tuning and CW/phone switch—the HA-226 is also suitable for Novice hams—it features an illuminated S-meter which shows signal strength and correct tuning for best reception.

Circle No. 76 on Reader Service Page 15

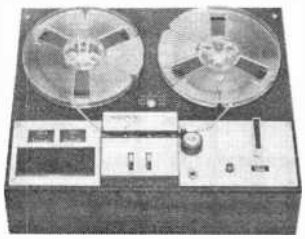
FLUORESCENT ANTENNAS

The newest color for mobile antennas is bright orange! *Antenna Specialists* is offering an extensive line of communications antennas made with brilliant fluorescent "International Emergency Orange" material. Called "Colorguard" antennas, they consist of both fiberglass and stainless steel whips. The coils on the latter are encased in molded fluorescent orange plastic jackets.

Circle No. 77 on Reader Service Page 15

STEREO TAPE DECK

Sound-on-sound, and tape and source monitoring are possible with the "three-headed" *Sony* 350 tape deck. Other features include 4-track stereophonic and monophonic recording and playback, solid-state circuitry, two vu meters, and vertical and horizontal operating positions. Tape speeds are 7½ and 3¾ ips; frequency response is 50-15,000 cycles ±2 db; and signal-to-noise ratio is better than 50 db. A carrying case is available if portability is desired.



Circle No. 78 on Reader Service Page 15

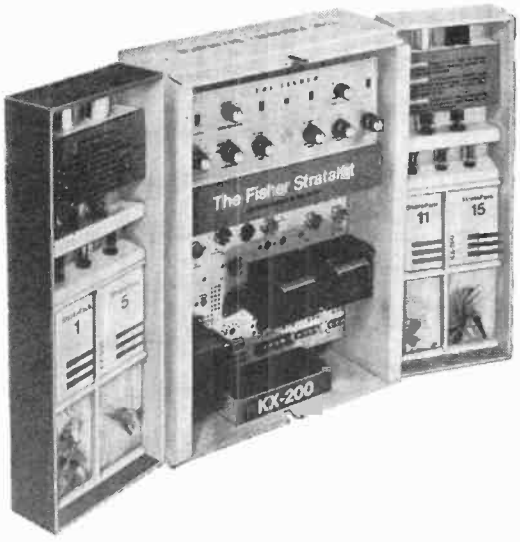
VERSATILE OSCILLOSCOPE

Said to fulfill practically every service and test requirement, *Allied Radio*'s Knight-Kit KG-635 5" oscilloscope covers d.c. to 5.2 mc. and is ideal for color TV servicing as well as wideband testing. It is also suitable for general-purpose testing of hi-fi, amateur, and CB equipment. Features include a dynamic sync limiter circuit that assures trace uniformity under any high sync level conditions, and automatic astigmatism correction for uniform focus regardless of trace position on screen. Vertical sensitivity is 17 millivolts r.m.s. per inch minimum; horizontal sensitivity, 0.6 volt r.m.s. per inch. The KG-635 also comes in factory-assembled form.

Circle No. 79 on Reader Service Page 15

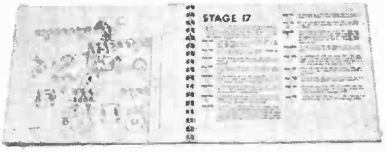
MOBILE CB ANTENNA

Mosley Electronics has created a new demon—the "Demon" DA-27 omnidirectional mobile CB antenna. Having an overall length of 17", the DA-27 is a flexible, durable stainless steel whip with a tensile strength of 290,000 p.s.i. The VSWR is 1.5:1 or better at resonance, and a simple whip adjustment permits antenna peaking at desired frequencies. Roof-



Build the Fisher KX-200 StrataKit and own a $250 stereo control-amplifier for $169.50.

It's almost absurdly easy. You need no experience whatsoever. The superbly detailed kit construction manual prepared by Fisher StrataKit engineers tells you absolutely everything you need to know to build this magnificent 80-watt stereo control-amplifier. The language is simple; the diagrams are huge and crystal-clear; the exclusive StrataKit method itself is uniquely 'beginner-proof.'



You build your StrataKit in ingeniously simplified stages (Strata). Each stage corresponds to a *separate* fold-out page in the instruction manual. Each stage is built from a *separate*, clearly identified packet of parts (StrataPack). The major parts come already mounted on the extra-heavy-gauge steel chassis. Wires are *pre*cut for every stage—which means every page. All work can be checked stage-by-stage and page-by-page, before proceeding to the next stage. There is no possibility of last-minute 'surprises.'

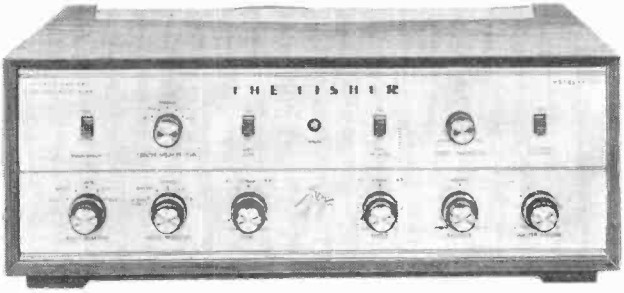
When you have built the Fisher KX-200, you are the owner of one of the world's finest amplifiers, easily worth $250.00. Its 80-watt (IHF) stereo power amplifier section will drive the least efficient speakers at extremely low distortion. Its preamplifier section provides a virtually unlimited range of input and control facilities. It even incorporates exclusive features like a laboratory-type d'Arsonval bias/balance meter and a power-derived third-speaker output with separate volume control.

All this is yours in a kit priced at $169.50. The Fisher KX-100, a 50-watt stereo control-amplifier kit of advanced design, costs only $129.50. (Walnut cabinet for either model, $24.95; metal cabinet, $15.95.)

"I personally guarantee that any Fisher StrataKit you assemble, as directed, will be fully equal in performance and reliability to its laboratory-wired prototype."

Avery Fisher

Founder and President
Fisher Radio Corporation



FREE! $1.50 VALUE!
Send for *The New Kit Builder's Manual*, an illustrated guide to high fidelity kit construction, complete with detailed specifications of all Fisher StrataKits.

Fisher Radio Corporation
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CIRCLE NO. 13 ON READER SERVICE PAGE

PRODUCTS *(Continued from page 22)*

mounting is recommended but a modified "Mobilmate" accessory is available for trunk or hood mounting. A screw-type provision within the base allows the antenna to be easily disconnected.

Circle No. 80 on Reader Service Page 15

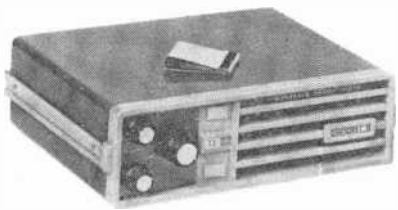
SOLID-STATE WIRELESS INTERCOM

Lafayette Radio Electronics has announced a solid-state wireless intercom that will connect any two locations which are serviced by the same electric company power line transformer. No wiring is required — you just plug each unit into the a.c. outlet, and it's ready to operate. Since the intercom is completely transistorized, no warm-up time is necessary. Each unit is a "master" with a volume/on-off control, push-to-talk bar with a "lock-bar" feature for continuous operation.

Circle No. 81 on Reader Service Page 15

CB TWO-WAY RADIO

Most CB radios require two crystals for each new channel. In the *Pearce-Simpson* 11-channel, solid-state "Escort II" a mono-crystal circuit provides additional channels with the installation of a single crystal for each channel, which means considerable savings for the user. There is a zener diode in the input circuit for stability, and special close-tolerance crystals provide a frequency tolerance of ±0.003. The "Escort II" generates minimum heat and effects minimum power drain. Operation is instantaneous. Size of unit: 8½" wide x 2¾" high x 8½" deep.



Circle No. 82 on Reader Service Page 15

MULTIPLE SPLINE SCREWDRIVER SET

Deep-seated or awkwardly placed screws are easier to reach with the tools in *Xcelite's* new 99PS-60 set than with conventional keys, according to the company. Designed to simplify service and assembly work on products with Bristol multiple spline socket screws, the set consists of a regular size 4⅛" screwdriver handle, nine interchangeable 4" Bristol multiple spline blades with major diameters from .048" to .183", and a 4" extension shaft. All items are contained in a pocket-size, see-through, plastic carrying case which doubles as a bench stand.

Circle No. 83 on Reader Service Page 15

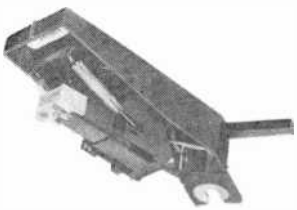
SOLID-STATE PREAMPLIFIER

The widest dynamic excursions on a record will not overload the sensitive low-level phono stages of the new *Marantz* Model 7T stereo preamplifier. Gain figures include: phono to main output, 64.5 db; phono to recording output, 42.5 db; high level to main output, 22.5 db. The frequency response of the Model 7T is 20 to 20,000 cycles ±0.1 db; noise, 80 db below 10 mv. input; IM distortion, 0.15% at 10 volts r.m.s. output. Among other features of the Model 7T are two panel jacks, a panel headphone jack, center channel output, and a tape play/tape copy switch.

Circle No. 84 on Reader Service Page 15

ELLIPTICAL-STYLUS CARTRIDGE ASSEMBLY

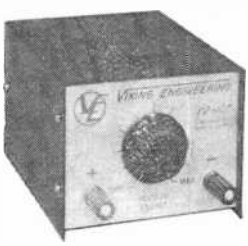
Bounce-proof and scratch-proof operation is claimed for the *Shure* Model M80E "Gard-A-Matic" phono cartridge assembly—even under conditions of careless handling and excessive floor vibration. Its retractile safety suspension system protects the elliptically shaped diamond stylus from damage if the tone arm is accidentally dropped. The Model M80E is specifically designed for use with Garrard Lab 80 and Type A70 automatic turntables, and comes mounted in a head that simply plugs into the tone arm of either turntable.



Circle No. 85 on Reader Service Page 15

REGULATED POWER SUPPLY KIT

An inexpensive, transistorized, regulated power supply kit has been introduced by *Viking Engineering* which is compact enough to fit into the most crowded work area (it's 3¼" x 4¼" x 5¼" deep). Also available factory-assembled, the supply will deliver a continuously variable output from 7 to 25 volts at 200 ma. d.c. (30 volts at 100 ma. d.c.). Load regulation is ±0.2%, and line regulation is ±0.4%. All functions are controlled by a single "on-off voltage adjust" knob. Output is isolated to provide either positive or negative grounding.



Circle No. 86 on Reader Service Page 15

Some plain talk from Kodak about tape:

The meat of the matter... and some boxing news

Undistorted output from a tape —as from any other link in the chain of audio components—is at the very heart of high fidelity enjoyment. Distortion (or the lack of it) is simple enough to evaluate in theory. You start out with something measurable, and you reproduce it. Everything added (or subtracted or modified) by the reproduction, that can be measured or heard, is distortion. Since most kinds of distortion increase as you push any component of your system closer to its maximum power capability, you have to label your distortion value to tell whether you did this while coasting or at a hard pant.

Cry "uncle"

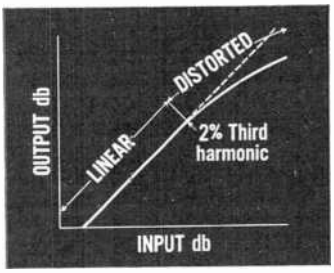
To make the distortions contributed by the tape itself big enough to measure and control, we simply drive the tape until it hollers "uncle" and use that power reference as our benchmark. Here's the procedure. Record a 400-cycle signal (37.5-mil wavelength at 15 ips) and increase its level until in a playback, which is itself pristine, you can measure enough 1200-cycle signal (third harmonic) to represent 2% of the 400-cycle signal level. This spells "uncle!" We use 400 cycles for convenience, but insist upon a reasonably long wavelength because we want to affect the entire oxide depth.

The more output level we can get (holding the reproduce gain constant, of course) before reaching "uncle," the higher the undistorted output potential of the tape. Simple, what?

"Wadayamean — undistorted output at two percent?"

That's what makes a Miss America Contest. Two percent third harmonic is a reference point that we like to contemplate for a picture of oxide performance. Since distortion changes the original sound, it becomes a matter of acumen and definition how little a change is recognizable. If you're listening, two percent is a compromise between a trained and an untrained ear. If you're measuring, it comes at a convenient point on the meter.

Because undistorted output helps to define the upper limit realism of the recording, the higher the undistorted output, the easier it is to reproduce the massed timpani and the solo triangle each at its own concert hall level. And this is just another area where Kodak tapes excel . . . our general-purpose/low-print tape (Type 31A) gives you up to 3 decibels more crisp, clean output range than conventional tapes.



2% third harmonic distortion represents the practical limit to linear recording.

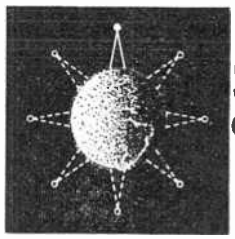
Kodak tapes—in the five- and seven-inch sizes—now *look* as good as they sound. We've put the package identification on a removable sleeve and designed a tape library box with a smart new look. This new box features durable one-piece construction, full index space, plus detailed tape use instructions on the inside. *Kodak* Sound Recording Tapes are available at most electronic, camera, and department stores.

New 24-page, comprehensive "Plain Talk" booklet covers all the important aspects of tape performance, and is free on request. Write: Department 8, Eastman Kodak Company, Rochester, N. Y. 14650.

The great unveiling — Kodak's new library box with removable sleeve!

EASTMAN KODAK COMPANY, Rochester, N. Y.

CIRCLE NO. 9 ON READER SERVICE PAGE



SATELLITES ON THE AIR

The following satellites were in orbit and transmitting as this issue closed.

Echo 2	136.020 mc.
Alouette**	136.077 mc.
Explorer 23**	136.080 mc.
Explorer 28	136.125 mc.
Relay 1**	136.140 mc.
Relay 2	136.142 mc.
Explorer 21	136.145 mc.
Echo 2	136.170 mc.
Explorer 22**	136.171 mc.
OGO 1**	136.200 mc.
Tiros 8	136.231 mc.
Tiros 9**	136.231 mc.
Tiros 10	136.232 mc.
Tiros 7	136.233 mc.
Explorer 26	136.275 mc.
Explorer 25	136.292 mc.
Explorer 20**	136.350 mc.
Pegasus 1**	136.410 mc.
Pegasus 2	136.410 mc.
Pegasus 3	136.410 mc.
Syncom 2**	136.468 mc.
Syncom 3**	136.470 mc.
Ariel 2	136.558 mc.
Alouette**	136.593 mc.
Relay 2**	136.620 mc.
Relay 1	136.621 mc.
1964 83C	136.650 mc.
1963 38C (USA)	136.651 mc.
Explorer 20**	136.680 mc.
Explorer 24	136.710 mc.
OSO 2	136.712 mc.
Explorer 27	136.740 mc.
1965 58C (USA)	136.768 mc.
Gravity Gradient (USA)	136.800 mc.
EGRS III	136.840 mc.
Solar Radiation	136.886 mc.
Pegasus 1	136.890 mc.
Tiros 7	136.924 mc.
Tiros 8	136.923 mc.
Syncom 2**	136.980 mc.

**Transmits only upon ground command

This listing does not include all of the satellites in orbit—many of which no longer are transmitting, or transmit erratic, very weak signals. Satellites of the Soviet Union generally use tracking and telemetry frequencies in the band between 19.990 and 20.010 mc. Exact frequencies of some Soviet satellites are broadcast by Radio Moscow immediately after launching. In orbit are Cosmos 41, 42, 43, 44, 49, 51, 53, 54, 55, 56, 58, 61, 62, 63, 70, 71, 72, 73, 74, 75, 80, 81, 82, 83, 84.

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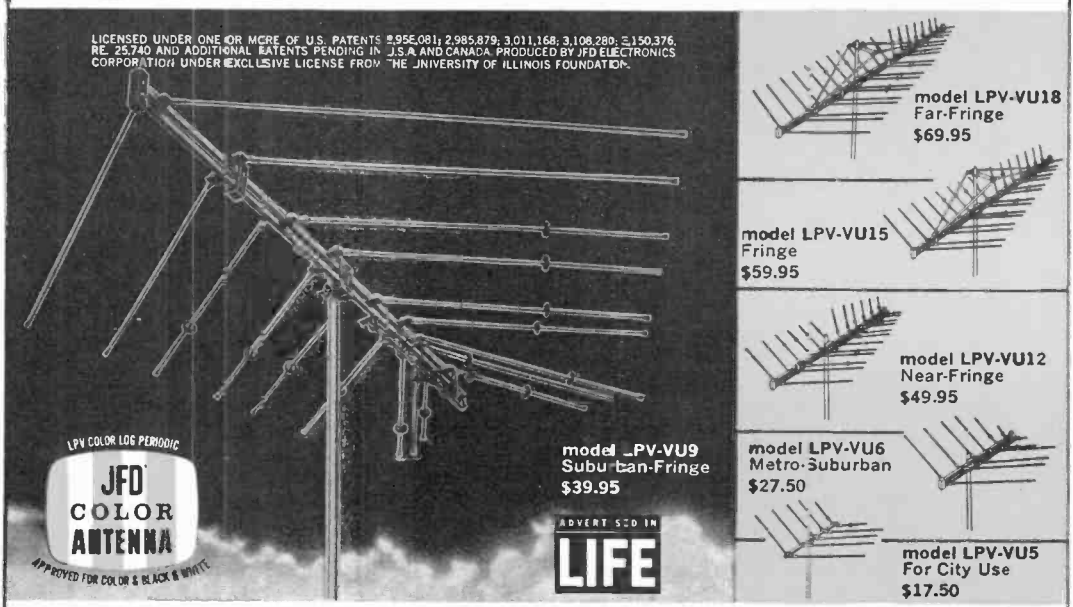

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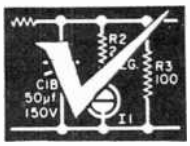

OPERATION ASSIST

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

SCHEMATIC DIAGRAMS

Seebury master amplifier, type MA 2-L6, ser. 13103. 140 watts. (Larry R. Splitter, 310 W. 7th, Hays, Kan.)

Pilot Model TP-32 receiver/record player, circa 1945. Has 6 tubes. (Martin Burdin, 2652 Saw Mill Rd., North Bellmore, N.Y. 11712)

R-2A/ARR-3 surplus receiver. Has 13 tubes and 1629 tuning eye tube. (K.A. Fulton, 754 N. Clementine, Anaheim, Calif. 92805)

Philco Model 48-482 receiver, code 121. Tunes s.w., BC and FM. Has 9 tubes. (Mike Draeger, 10 South Lane, North Tonawanda, N.Y. 14120)

Sonora Model "F" receiver, circa 1930. Tunes s.w. and BC. Has 7 tubes. (Frank Twardoch, 149 B'way, Valley Stream, N.Y. 11580)

Atwater Kent Model 55 receiver, ser. 4381940. Tunes BC. (Joe Rock, Jr., Box 162, Knoxville, Md. 21758)

BC-454 "Command" receiver. Tunes 3-6 mc. Has 6 tubes. (Larry Koolkin, 18 Bosworth Rd., Framingham, Mass. 01701)

Ward's "Airline" Model 62-288 receiver. Tunes BC. Has 5 tubes and magic eye. (Robert Stainer, Box 348, Oliver, B.C., Canada)

Sparton receiver. Tunes BC band, TRF. Has 10 tubes and Model 301 power converter. (G.E. Peacock, 3082 Lake Hollywood Dr., Los Angeles, Calif. 90028)

CV-57/URR surplus teletype monitor, made by RCA. Has 1" CRT. (JSH Lab, J. R. Hall, Mgr., Box 471, IAU, San German, P.R. 00753)

Hallicrafters S-53 receiver, circa 1942. Tunes s.w. and BC. Has 8 tubes. (Larry Schweiger, 8406 Belinder Rd., Leawood, Kan. 66206)

Oak Ridge Model 104 syncro sweep generator. (Louis W. Kogelmann, 2543 S. Logan Ave., Milwaukee, Wis. 53207)

H.H. Scott receiver, ser. K-432, circa 1933. Tunes 550 kc. to 22.5 mc. on 4 bands. Has 15 tubes. (Geoffrey Ashford, P.O. Box 213, San Carlos, Calif. 94071)

Ballantine Model 300 electronic voltmeter. (Thomas McCarthy, 367 Bergen Blvd., Oradell, N.J.)

Supreme Model 599 set tester. (M. Miloszar, 212 Louise Drive, Morrisville, Pa.)

Hallicrafters Model S-38C receiver. (David W. Holman, R.R. #3, Box 436A, Independence, Mo.)

(*Continued on page* 30)

ASSIST *(Continued from page 28)*

Bendix Model MN-26 receiver. Tunes 3 bands. Has 12 tubes. (Don Erickson, 24360 Myers St., Sunnymead, Calif. 92388)

RBC-1 Navy surplus receiver, circa 1941. (Stephen Gingold, 129 Woodlawn St., Springfield, Mass. 01108)

Philco Model 39-7 receiver. Tunes 180-545 meters. Has 5 tubes. (Joseph Mazary, 136 Liberty Ave., Arnold. Pa. 15068)

Space-Tone "Senator" Model 1962 receiver. Tunes AM and FM on two bands. Has 11 tubes. (John Bonhomme, 897 Crotona Park N., Bronx, N.Y. 10460)

Zenith Model 5-S-29 receiver, ser. R545691. Tunes 550 kc. to 18 mc. on 3 bands. Has 5 tubes. (Jack Hillegass, 80 Ave. B, New York, N.Y. 10009)

RT-11A/APN-12 surplus transceiver. Tunes 160-230 mc. on 8 channels. Has 18 tubes. (John Kimble, 345 Fourth St., Winnsboro, S.C.)

GE Model JFM-90 tuner, circa 1949. Has 5 tubes. (L.D. Cotter, 614 Griffith Rd., Neshaminy, Pa. 18976)

SPECIAL DATA OR PARTS

H. L. Schroeder receiver, circa 1920; has 8 tubes, 4 i.f. transformers and 2 a.f. transformers. Speaker. schematic, and service data needed. (Manuel Aleantora, 5955 S. Kolmar, Chicago, Ill. 60639)

RCA Model PR25 sound recording camera, circa 1936. Schematic of studio recording amplifier and service manual needed. (L.R. Gossard, 1201 Elizabeth Blvd., Fort Worth, Texas 76110)

National variable capacitor, type VHF 1-S, 3.0 pf. to 22.5 pf. capacity needed. (Henry L. Keehn, 25909 Narbonne Ave., Lomita, Calif. 90717)

RT53/TRC7 surplus transceiver, ser. 209, made by Radio Engineering Labs; operates on 2 meters. Crystal frequencies and schematic needed. (B.E. Weinhold, Box 180, Manheim, Pa. 17545)

"Hints & Kinks" volumes 1 through 5. (Francis F. Migone, 122 E. Pierson Ave., Somers Point, N.J.)

Hallicrafters Model S-20R "Sky Champion" receiver. Instruction booklet and tuning assembly including dial cards and indicators needed. (Jon Wright, RFD #2, Hammondsport, N.Y. 14840)

Link Model UFS-50 ED. 7 FM transmitter and receiver, circa 1940; uses loctal tubes and 816 mercury vapor rectifiers. Schematic and/or instruction manual needed; also 6-meter conversion wanted. (John W. Ranck, R.D. #3, Lewisburg, Pa. 17837)

Hammarlund "Comet Pro" receiver. Coils needed. (J. Padgett, 929 Humer Ave., Kansas City, Kan.)

Heath Model 05 oscilloscope kit, circa 1949; has 8 tubes. **Zenith** Model 9H0798 receiver, circa 1944; tunes 55-1600 on BC, 88-108 mc., 42-48 mc. on FM. Schematics and construction manuals needed. (Dana E. Mills, 145 Washington Ave., Endicott, N.Y. 13760)

Guild "Spice Chest" #484 receiver. Translucent dial scale and metal front panel needed. (Dave Gibson, 3100 Priscilla Ave., Parma, Ohio 44134)

Berlant "Concertone" Model 1401 tape recorder deck. Source for idler, drive wheels, and flywheel needed. (William O. Stottlemyer, 932 Worcester St., Natick, Mass. 01760)

Crosley Model 148 receiver, circa 1937; tunes BC; has 5 tubes. Plastic station selector dial needed. (Richard Pellard, 57 Rockwell Ave., Medford, Mass. 02155)

Silvertone #101.571 receiver; tunes BC and s.w.; has 6 tubes and phono plugs. Schematic, operating instructions, and all available data wanted. (Rodger Boots, Box 311, Mechanicsville, Iowa 52306)

Heath Model AT-1 transmitter kit; tunes 80, 40, 20, and 10 meters. Construction manual, coils, bandswitch, driver capacitor needed. (Steve Cushman, 5 Carbrey Ave., Sharon, Mass. 02067)

Westinghouse Model H-116 radio-phono combo., circa 1945; tunes AM-FM and s.w.; has 13 tubes. Parts list needed. (William Gavin, Jr., 10327 S. Drake, Chicago, Ill. 60655)

(Continued on page 32)

ASSIST (*Continued from page 30*)

Philco Model 20 receiver, circa 1928; has 7 tubes. Schematic and parts source needed. (Robert M. Balick, 37 Westwood Drive, Westfield, Mass. 01085)

Atwater Kent Model 30 receiver, ser. 536013. Schematic and speaker needed. (Louis W. Kogelmann, 2543 S. Logan Ave., Milwaukee, Wis. 53207)

Crosley Model 5-50 receiver, ser 61235C; has 3-301 and 2201 tubes. Schematic, operating info., and other available data wanted. (Thomas A. Bailey, P.O. Box 222, Knoxville, Ill. 61448)

Atwater Kent Model L receiver; has 6 tubes. Schematic and battery hookup needed. (Homer L. Linton, 1305 Nover Ave., N.W., Roanoke, Va.)

Pickwick receiver, circa 1934; tunes BC and s.w.; has 8 tubes. All available info. needed. (Myron E. Wood, 8615 N.E. Boehmer St., Portland, Ore. 97220)

Reed & Reese "Autonetics" NA5-15451 regulated power supply. Schematic and all other available data needed. (Larry Edwards, 2563 25th Ave., San Francisco, Calif. 94116)

Aemco Model RC-2 Geiger counter. Schematic and battery info. needed, or mailing address of Aemco. (Don Thompson, Box 849, Rifle, Colo.)

Belmont BC-1267-A war surplus transceiver, circa 1943. Schematic, operation instructions, and service manual needed to connect to RA-105-A power supply. (Harold Wright, 5406 W. 138 St., Hawthorne, Calif. 90251)

E.H. Scott Model SLRM marine receiver, circa 1952. **Pentron** Model P-4 tape preamp, circa 1957. Schematics, instruction manuals and specifications needed. (William A. Wells, Jr., 175 Lindenwood Rd., Staten Island, N.Y. 10308)

McMurdo Silver Model 700 transmitter, ser. 316, circa 1950; tunes 144-240 mc. Schematic and all other available info. needed. (Jerry Goodrich, 251 North Hwy. 91, North Salt Lake, Utah 84054)

Philco Model 61 "Transitone" receiver; tunes BC; has 5 tubes. Schematic and parts list needed. (Tim Vinden, 453 Spruce St. N., Timmins, Ontario, Canada)

CV116/URR surplus frequency shift converter. Schematic and operating manual TM-11-2241 needed. (C.R. Baumann, Box 307, Shiprock, N.M. 87420)

United Sound Eng'g. Model U amplifier, type 29, ser. 8107; has 5 tubes. Schematic and tube source needed. (Kevin Clark, 908 Goodrich Ave., St. Paul, Minn. 55105)

Permoflux Model B "Tape-Riter," series C-2. Schematic and diagram of belt drive needed. (Kirk Oatman, 1613 4th Ave., E., Spencer, Iowa 51301)

Emerson receiver, circa 1935; tunes 550 to 18,000 kc. on 3 bands; has 8 tubes and round clock-like dial. Operating manual and schematic needed. (Bill Plate, Box 12, Boykin, S.C. 29019)

McMurdo-Silver "Masterpiece VI," circa 1938; has 20 tubes, 6L6's output, 6F8 expander. Service notes and schematic needed. (S. Handelman, 50 E. 10 St., New York, N.Y. 10003)

Service Instruments Model 11 "Rider Chanalyst," type A. Schematic and operating info needed. (Arnold Remtema, Jr., 2440 32 St. S.E., Grand Rapids, Mich. 49508)

Echophone receiver; tunes 3 bands; has 6 tubes. Service manual needed. (Jonathan Hagger, Oak Knoll, Blue Earth, Minn. 56013)

RCA Model 155A CR oscillograph; has 5 tubes. Schematic, operating data, and parts manual needed. (Ronald Bromwich, Box 1156, Rt. #1, Augusta, Ga.)

Hickok Model 110-B VTVM, circa 1950, order #1070. Schematic and operating instructions needed. (Scott Wilkelson, 2519 Mason St., Silver Spring, Md. 20902)

Hickok Model 560 dynamic mutual conductance tube tester, Navy Model OZ-1, circa 1949. Operating instructions needed. **Radio City Products** Model 445 multitester. Operating instructions and schematic needed. (J.F. Champa, 20951 N. Vine Ave., Euclid, Ohio 44119)

No. 19 MK.II surplus wireless set, built by U.S. for Russian tanks, circa 1944. Schematic and power source needed. (David Krall, 2800 Monterey Rd., San Marino 9, Calif.)

Echophone Model EC-3 receiver. Schematic and operating manual needed. (Steve Whitney, 460 Rushmore Ln., Madison, Wis. 53711) —30—

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New Model 712 — Sentinel 12 Dual Conversion 5-watt CB Transceiver. Permits 12-channel crystal-controlled transmit and receive, plus 23-channel tunable receive. Incorporates adjustable squelch & noise limiter, & switches for 3.5 watt P.A. use, spotting, & Part 15 operation. Transistorized 12VDC & 117VAC dual power supply. $99.95 wired only.

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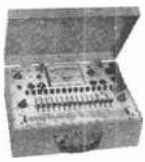
Model 324 RF Signal Generator. 150kc to 435mc range. For IF-RF alignment and signal tracing of TV, FM, AM, CB and mobile. Built-in and ext. modulation. $28.95 kit, $39.95 wired.



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PLACE AND DATE OF ISSUANCE BUFFALO, NEW YORK SEPTEMBER 11, 1963

DATE AND TIME OF EXPIRATION SEPTEMBER 11, 1968 AT THREE O'CLOCK A. M., EASTERN STANDARD TIME.

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ISSUING OFFICER

Federal Communications Commission.

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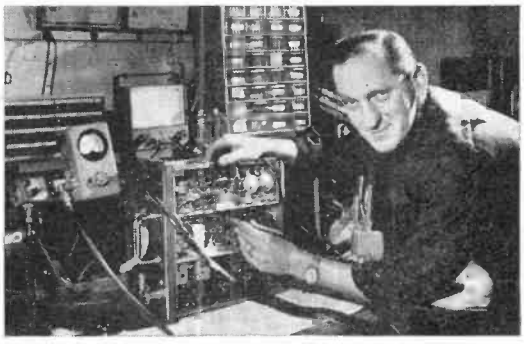

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COVER STORY

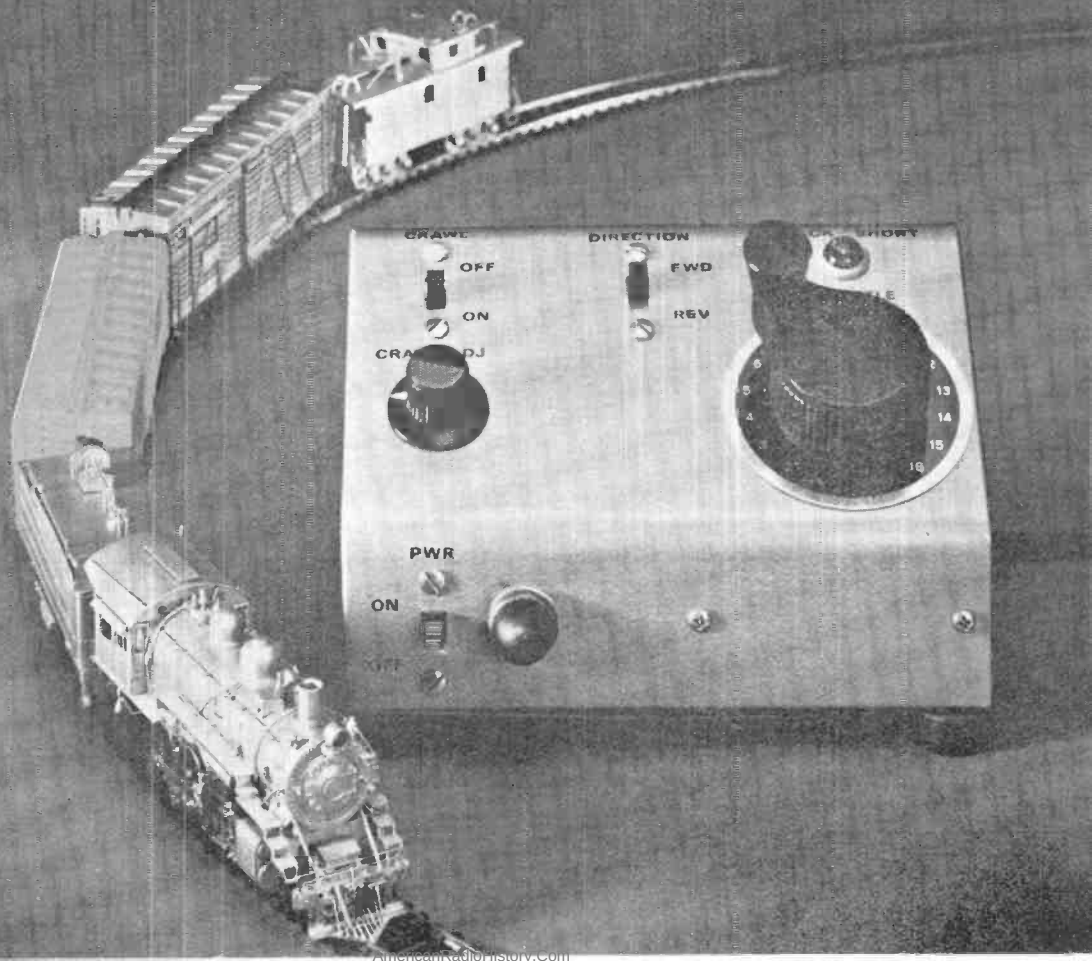
THE SUPER-X PULSE POWER PACK FOR HO RAILROADING

...and get the feel of the real thing

By **WOODROW POPE**
Design Engineer,
Collins Radio Company

SAY, Mr. Model Railroad Engineer, can you start your loco without jumping to 10 scale miles per hour? You can, you know, without equipping your locomotive with flywheels or high gear ratios. How? Easy . . . just build and use a new transistor throttle power pack on your pike for the ultimate in model railroading.

With it you get pulse power for smoother stall-free starts, and your loco



can crawl, or hi-ball, or couple—without crashing. You also get lots of power to operate signal lights, switch machines, or other accessories . . . all with circuit overload protection.

Just What is Pulse Power? To understand pulse power, you must first understand the nature and operation of the conventional d.c. power pack. Your loco is equipped with a tiny d.c. motor that operates off power supplied to the tracks by the power pack. When you man the throttle, which is nothing more than a rheostat, you are regulating the voltage across the track, and hence the motor speed.

Assume your throttle is turned all the way down and your loco is sitting still. You now begin to turn up the throttle, gradually increasing the voltage applied across the tracks. But notice, your loco does not start immediately; it waits until the proper operating voltage is reached, and until all magnetic and mechanical locking has been overcome. By this time the voltage is too high for a slow, smooth start, so the loco lunges ahead.

Figure 1 shows, graphically, how late a typical loco might start after you begin cranking up the throttle. You will note that a certain minimum voltage must be reached to overcome the inertial load on the motor before it will even begin to turn.

Now let's assume you are using one of the latest power packs to hit the scene—you know, like the one we're telling you about right now—your loco will start to crawl, like real trains do, the moment you hit the throttle. How come? Well, with pulse power you get maximum voltage in the form of narrow pulses the instant you flip the primary power switch. This is shown, graphically, in Fig. 2. Here the average power consumed by the motor is a direct func-

PARTS LIST

C1—1000-μf., 15-volt electrolytic capacitor (Sprague TVL 1165 or equivalent)
C2, C3—0.47-μf., 35-volt capacitor (Kemet KR47C35K or equivalent)
C4—1-μf., 35-volt capacitor (Kemet K1C35K, or equivalent)
D1, D2, D3, D4, D6, D7—1N2069 silicon diode, or equivalent)
D5—1N276 diode, or equivalent
F1—1-ampere fuse
I1—#47 lamp, 6-8 volts, 0.15-amp.
I2, I3—12-volt, 1.2-amp. automobile dome lamp, or equivalent (two required)
Q1, Q2, Q3, Q7—2N404 transistors
Q4, Q8—2N1382 transistors
Q5, Q6—2N456A transistors
R1, R6—2200-ohm, ½-watt resistor
R2, R3—22,000-ohm, ½-watt resistor
R4—Not used
R5—6800-ohm, ½-watt resistor
R7—10,000-ohm, 2-watt carbon potentiometer, linear taper
R8—390,000-ohm, ½-watt resistor
R9, R15, R16—1000-ohm, ½-watt resistor
R10, R14—10,000-ohm, ½-watt resistor
R11—10-ohm, ½-watt resistor
R12—1000-ohm, 2-watt carbon potentiometer, linear taper (with switch S3)
R13—330,000-ohm, ½-watt resistor
S1—D.p.s.t. slide switch
S2—S.p.s.t. slide switch
S3—S.p.s.t. switch (mounted on R12)
S4—D.p.d.t. slide switch
T1—Power transformer; primary, 115 volts; secondary, 12.6 volts with center tap, (Stancor P-8130, or equivalent)
1—Cabinet (Bud AC-1613-A or other suitable sized cabinet)
Misc.—Fuse clip; pilot light holder; red lens (Dialco series 1006); binding posts (4—2 red, 2 black); throttle knob (Raytheon 175-6-2G); crawl adjust knob (Raytheon 90-3-2G); power transistor mounting kit (Motorola MK-15)

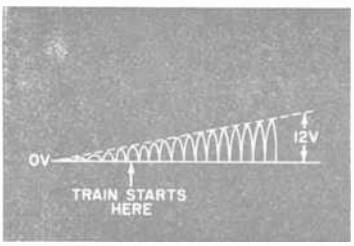


Fig. 1. The ordinary power pack is nothing more than a full-wave rectifier whose output is a pulsating d.c. voltage with peaks that look like the waveform above. For most locos, the average power required for starting is much too high for a smooth start, and the trains pull out with a sudden jerk, and at a speed not akin to real railroading.

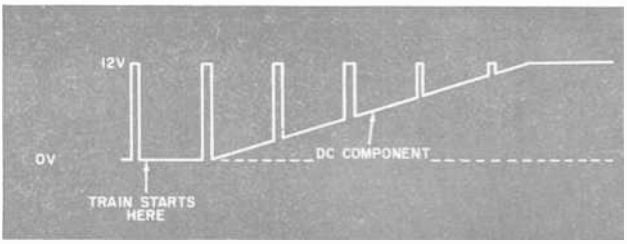


Fig. 2. The pulse power pack produces a train of narrow pulses in addition to variable d.c. power. The pulses are fully visible when the throttle is turned down, but disappear gradually as the throttle voltage builds up to full power. Instant rise of pulse from zero to maximum provides immediate power to operate train when crawl knob is turned up.

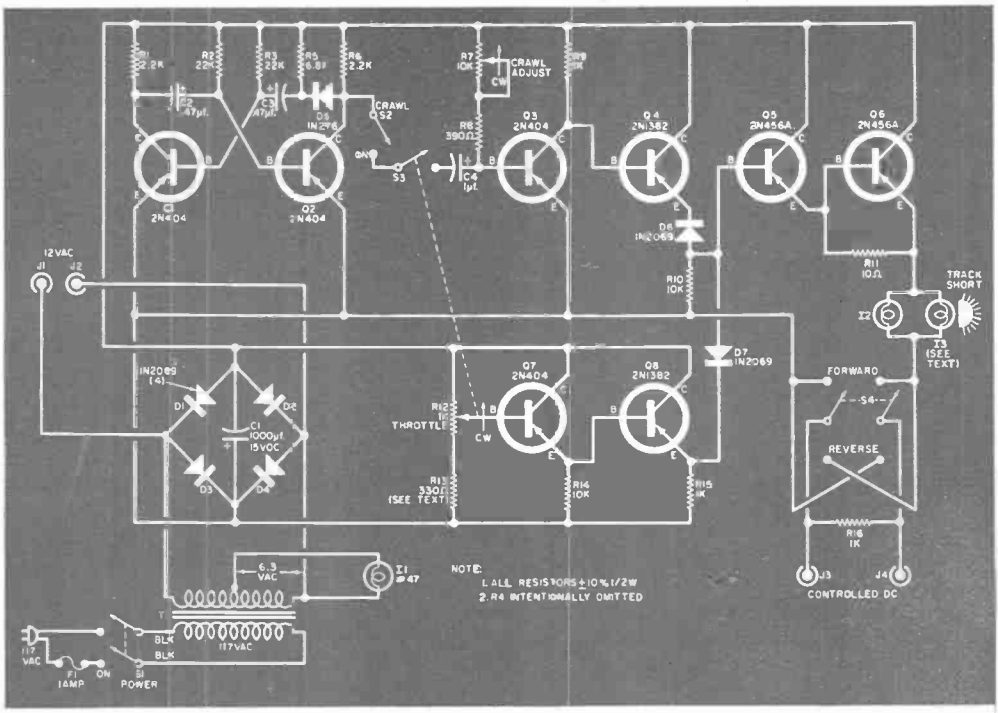


Fig. 3. Crawl control R7 adjusts pulse width to give desired crawl speeds when S2 and S3 are turned on. Throttle R12 is part of a voltage divider that drives emitter followers Q7 and Q8 with varying d.c.

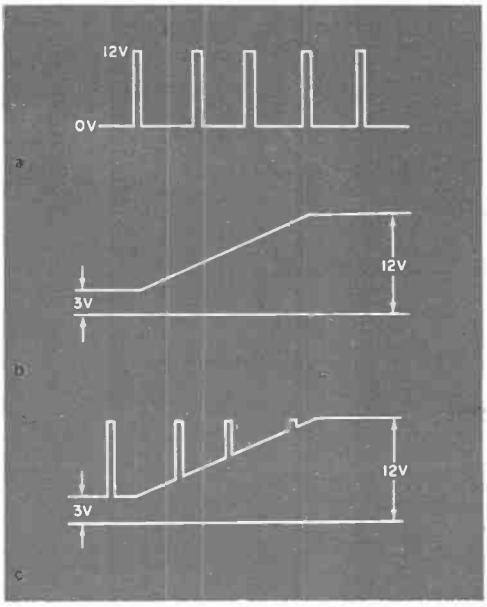


Fig. 4. Pulses rise to maximum as soon as power is turned on (a), providing immediate train start. Crawl knob adjusts pulse width for varying train loads and desired crawl speeds. Throttle adjusts d.c. at emitter of Q8 (b) to run train at desired speeds. With throttle turned down (c), pulses appear prominently, then fade away as d.c. is turned up.

tion of the pulse width which you adjust with a crawl control. This varies the circuit RC time constant.

How It Works. From Fig. 3 it is apparent that pulse power, which makes your trains run like a dream, calls for a rather sophisticated circuitry. Let's give the circuit a once-over and see what we mean. First, we have transformer *T1* stepping down the 117-volt a.c. primary power to approximately 12.6 volts. This 12.6-volt supply branches off to jacks *J1* and *J2*, where it is available to operate switch machines, signal lights, and other accessories. Some of this power is also tapped off and applied to the bridge rectifier circuit (*D1* through *D4*), from where it will eventually operate your trains.

The 6-volt #47 pilot lamp (*I1*), wired from the center tap to one side of the transformer secondary winding, is merely an indicator to tell you when the power is on. You can break down the rest of the power pack into its pulse forming and control circuits, the variable d.c. circuit, and the short-circuit protection circuit. If you care to, you

can throw in polarity switch *S4* (forward and reverse) for good measure.

The Pulse Circuits. These circuits begin with *Q1* and *Q2* which comprise a free-running multivibrator. The collector of *Q2* puts out a 60-cycle square wave which is fed through *S2* and *S3* to pulse generator *Q3* for conversion to narrow pulses. These pulses are then amplified by *Q4* and appear as shown in Fig. 4(a). *CRAWL ADJ* potentiometer *R7* adjusts the pulse width to suit varying train loads and desired crawl speed. The *CRAWL ON-OFF* switch (*S2*) is used to disable the crawl feature, if desired. Switch *S3* is ganged to the main throttle so that it cuts off the pulses when the throttle is turned all the way down to where you hear a "click."

Variable D.C. Circuit. In the variable d.c. function generator circuit, *R12* and *R13* form a variable voltage divider, the output of which is fed to emitter followers *Q7* and *Q8*. The emitter followers provide a low impedance source for the voltage. The output voltage at the emitter of *Q8* is variable from about 3 volts to 12 volts, as shown in Fig. 4(b), depending on the setting of *R12*, the speed control potentiometer.

Diodes *D6* and *D7* are used to mix the two functions (pulse and variable d.c.) together. The pulses and variable d.c. are fed to emitter followers *Q5* and *Q6*

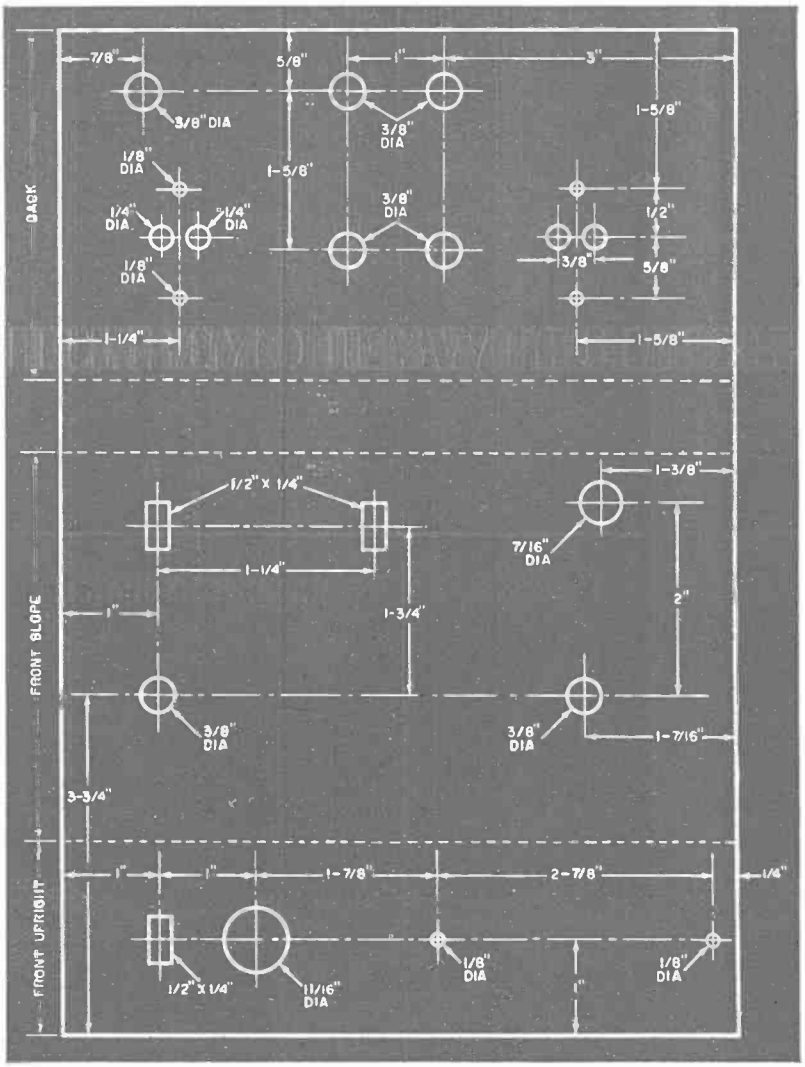


Fig. 5. This layout and accompanying dimensions are valid only if the recommended Bud cabinet is used. Lay out, drill, and punch all holes as shown. If you use another cabinet, this layout can still serve as a guide. The transistor mounting holes remain the same, regardless of cabinet dimensions.

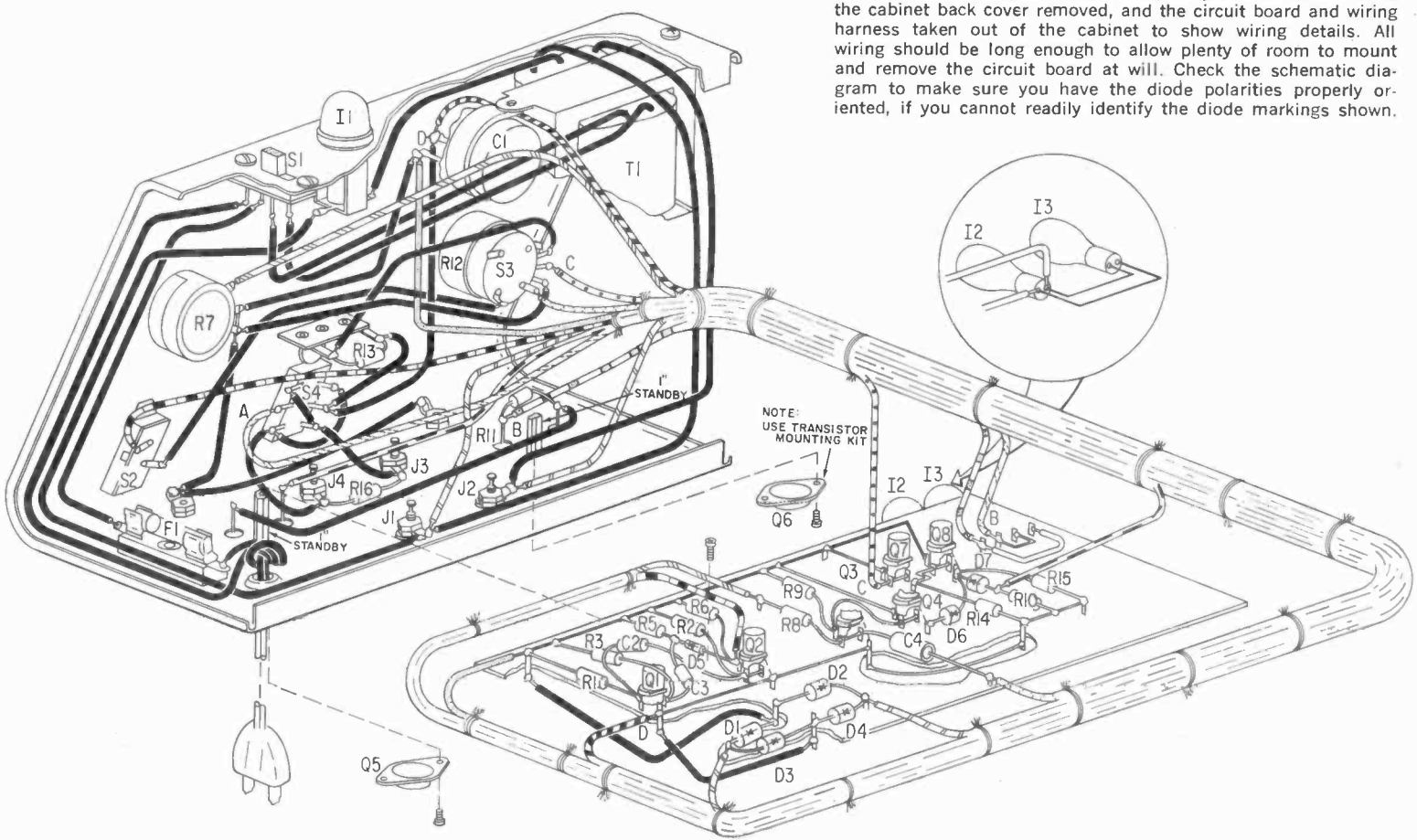
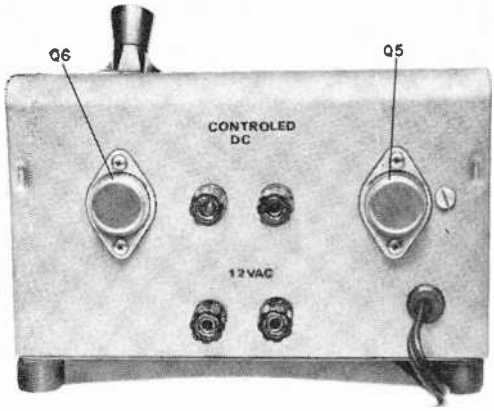


Fig. 6. Pictorial diagram of the completely assembled unit with the cabinet back cover removed, and the circuit board and wiring harness taken out of the cabinet to show wiring details. All wiring should be long enough to allow plenty of room to mount and remove the circuit board at will. Check the schematic diagram to make sure you have the diode polarities properly oriented, if you cannot readily identify the diode markings shown.



Rear view of transistor power pack showing location of power transistors Q5 and Q6. Be sure to use a rubber grommet to protect line cord from damage.

which provide a high current output. Their output waveform is as shown in Fig. 4(c).

Short Circuit Protection. Lamps *I2* and *I3* in the emitter circuit of *Q6* protect the entire unit against accidental short circuits or overloading. Together with a red jewel mounted on the front panel, they also double as a track short indicator. These lamps are of the ordinary 12-volt auto dome light type, each rated at 1.2 amperes. Putting them in parallel, however, increases the circuit capacity to 2.4 amperes.

When the filaments are cold, the lamps exhibit a very low resistance, and therefore act like a piece of wire. When your loco or other load begins to draw about 1 ampere of current from the power pack, the lamps begin to glow and their filament resistance goes up rather sharply to form a protective load for the power pack. Thus, even if the output leads at *J3* and *J4* were to be shorted together, no damage would result to the power pack. But because one of the lamps is mounted under the red jewel, you would know there was an overload when it lit up.

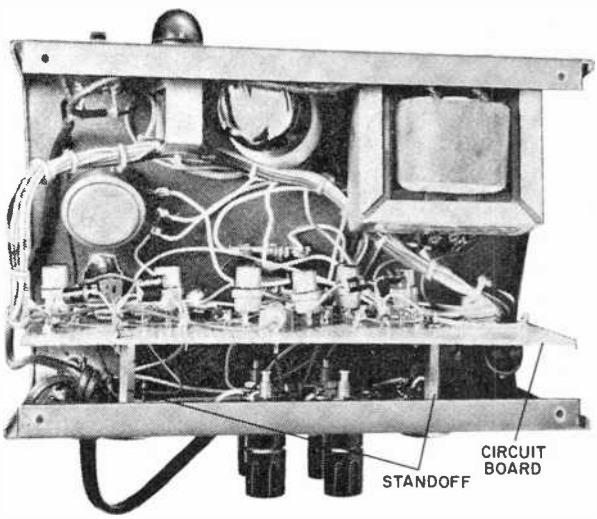
The *FWD-REV* switch (*S4*) is an ordinary d.p.d.t. switch wired to reverse the polarity of the d.c. voltage as it is flipped from one direction to the other.

Construction. Assuming you have obtained the Bud cabinet called for in the Parts List, you now proceed to lay out and drill the holes as shown in Fig. 5. After drilling all holes and deburring them, mount the power transistors on the back panel, making certain you use the mica strip and washers supplied with the mounting kit to insulate the transistors from the case.

Figure 6 shows the general layout of the wiring and other circuit components. Electrolytic capacitor *C1* should be wrapped with electrical tape to insulate it from the case. Notice that it is mounted with a plastic clamp.

The circuit board is made from a piece of 2¾" x 6¾" Vectorbord. Observe the location and mounting position of *I1* and *I2*. Bring out long leads to the panel mounted components, and use a

(*Continued on page* 96)



With bottom plate removed, laced wiring harness can be tucked away to one side during repair or maintenance of the unit. The component circuit board is supported with metallic or insulated standoffs. To install the line cord, thread free end through grommet at rear of cabinet. Separate ends of cord back 12 inches and tie into a knot to take up any strain on cord.

BIG YEAR FOR SMALL RECORDERS

Voice and music quality of miniature tape recorders has undergone dramatic improvement

By **PHIL GERACI**

IF any single word could sum up tape recording today, that word would be "miniaturization." Everything is getting smaller. Recorders for hobbyists once weighed nearly 50 pounds (the old Berlant Concertones of the fifties). Then came the 28-lb. Ampex 600 which was grabbed by the pros not only because it recorded well, which it did, but also because its Samsonite "one-suiter" size made it convenient to tote around.

Now just consider this: the new Craig TR-490 "Electronic Notebook" recorder weighs just *two pounds*. It can be worn holster-style around the waist, under a coat, for "secret" recording with a tie-bar mike. Yet the TR-490 can record for half an hour, the *same amount* as the Ampex 600 with full-rack heads on a 1200-ft. reel, or the old Concertone at 15 ips on a 10-inch reel *larger than the entire Craig recorder!* The sound? A pro can tell the difference, but many people can't.

Contributing Factors. Many things have contributed to this revolution in recorder size. To wit:

(1) Better metals, which permit narrower and straighter head gaps, thus better high-frequency response at low speeds.

(2) Better tapes, with more uniform coatings. Less clumping of the ferrous oxide particles means fewer fluctuations in output at slow speeds. The byword in

Beware the innocent tie-clasp. It's a snooper microphone, connected by concealed wires to a tiny recorder, worn holster-style over the shoulder. The 2-pound Craig TR-490 "Electronic Notebook" typifies trend to smaller, lighter recorders.

tape manufacture today is *uniformity*; and lower noise, smoother response, and lower distortion are all dependent upon it.

(3) Better transistors, meaning less bulk and heat. More important, they consume less power, making smaller electronic packages possible. Direct current devices, transistors work as well from batteries as from filtered d.c. supplies.

(4) Better batteries, notably rechargeable alkalines and nickel-cadmiums (thanks to space research) with flat-as-a-ruler discharge curves and the ability to bounce back fresh-as-new after recharging.

(5) Better microphones, especially ceramics and dynamics, which can be made in many shapes (such as the tie-bar of Craig's "Notebook" recorder).

Other Trends. Most major manufacturers will offer battery-powered models in 1965-66, some for the first time. Radio Corporation of America, which blazed a solitary trail in cartridge recorders for several years, this year is introducing a full line of reel-to-reel *and* cartridge models, including two "cordless" designs.

Roberts Electronics is introducing its first battery recorders, one for stereo. This company also is offering a subminiature recorder similar to the Craig TR-490. Roberts' unit is the 1510, a capstan-drive instrument with built-in mike, speaker, vu meter and battery-condition indicator.

"Subminiatures" are not new. Drug-stores and discounters have had $12.95 models for some time. But most of these are bare-minimum devices, some without erase heads, most without capstans (the tape moves under the power of the takeup-reel motor, so speed fluctuates as hub diameters change with tape transfer), and some even without a microphone, the "speaker" doing double duty.

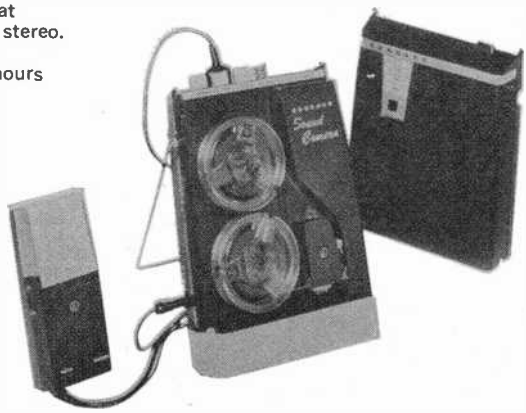
The Craig and Roberts instruments have capstans (so do some others—the Uher 4000, Sony, Telmar, Concord, etc. --already on the market) and shuttle tape at a constant 1⅞ or 3¾ ips. These tapes can be played on other machines, which is not true of most "cheapies."

But capstan drive is not all that makes the difference. Better-quality miniatures offer better mikes, quieter input circuits, more powerful motors, stronger erase currents, and generally more precision throughout. Some will record music satisfactorily, something capstanless machines won't do.

Another trend in evidence this year is the move toward automation. In tape recording, this means a way to make tape play in *both* directions and to stop, start or reverse direction without manual control. RCA's tape cartridge was a step in this direction, and now some of its hands-off features are being applied to reel-to-reel machines.

There's other automation, too. For example, Concord's F-88 "Sound Camera" has a mike with a sound-operated switch to start recording when the sound starts, and stop when it stops. This has intriguing possibilities. A mike near a front door could record messages from

Stereo in miniature. Roberts Electronics' 6000S is a battery-powered tape recorder that will play AND RECORD in stereo. Rechargeable batteries keep it going for several hours on an overnight charge.



visitors who arrive during your absence. Or, as a burglar alarm, the mike could turn on the recorder, which in turn could turn on lights, ring bells, maybe even summon the police.

What about stereo? Well, competition from discs continues keen. Four-track commercial stereo continues, but tape's ace-in-the-hole is its ability to *record* stereo as well as play it. Nearly all recorder manufacturers now offer machines which will record in stereo.

Accessory and Tape Changes. Progress in tape recording isn't limited to recorders, for they are just the *nucleus* of a recording system. Much is being done with accessories, too—mikes, mixers, monitoring devices—and with the raw material of recording, the tape.

Tape continues to improve, degree by degree. Quality control during manufacture is more rigid, and tape coatings are more uniform. Kodak, for example, holds tape to the same strict tolerances as film. More uniform coatings mean less output variation, a vital factor when you are recording as slowly as 1⅞ or 15/16 ips.

Clumping, once a way to tell a good tape from a bad one, has virtually disappeared. Backings, too, are better. Some tapes are now designed to break cleanly rather than stretch, on the theory that a break can be spliced together again, but a stretch does permanent damage by lengthening the tape.

You can still buy economy tapes. But even these are better than some of the "quality" tapes of a few years ago.

Progress in another vital accessory area—microphones—has continued and today's mikes are smaller and smoother. Here, the recordist often buys response over smoothness, a big mistake. The pros know that a "wide-range" mike with a big peak at 10-12 kc. will sound "tinny" whereas a mike with less range but smoother output will give the impression of wider range.

As mikes have improved, prices have tumbled. Shure's 575S, for example, costs less than $15; yet it is available either in high or low impedance, as a dynamic or as a ceramic.

With an additional mike goes a need for blending inputs. The answer is a mixer. Before transistors, only the pros could afford a good mixer. Today, you can buy a four-channel transistor model for $25 (Citroen Electronics' Model 1400). It takes up to four mikes, and gives you a volume control on each one.

The Future. What's on the horizon in recording? Many bright lights. Brightest is TV recording, still expensive but coming closer to earth each year.

Will TV recorders replace home movies? Doubtful, but who knows? That "instant" availability, with no wait for lab processing, is a powerful attraction. The day we get portable *color* TV recorders is the day to watch for.

Meanwhile, back at the plant, engineers are experimenting with microcircuits in the hope of making electronic gadgets even smaller. The trend toward miniaturization in tape recording is bound to continue. -30-

Voice-operated microphone with Concord F-88 "Sound Camera" turns recorder on when sound starts, off when sound stops. It operates on rechargeable batteries.

Transistors mean smaller mixers. Powered by batteries, Citroen Electronics' Model 1400 preamp/mixer works well with battery-powered recorders since neither require a.c.

Norelco's "Car-Mount" has a dual purpose. It can be a playback unit for music on the road, or used for recording travel notes.

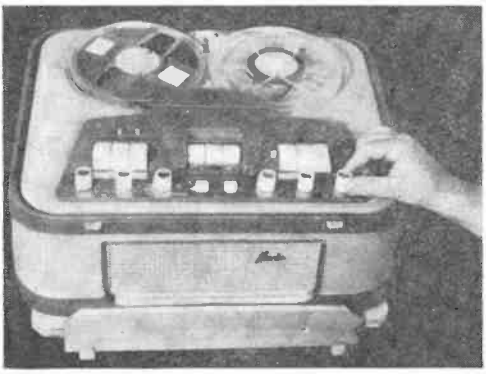
NEW SLANT ON RECORDING

There's no reason to crane your neck when an hour's worth of woodworking will solve the problem

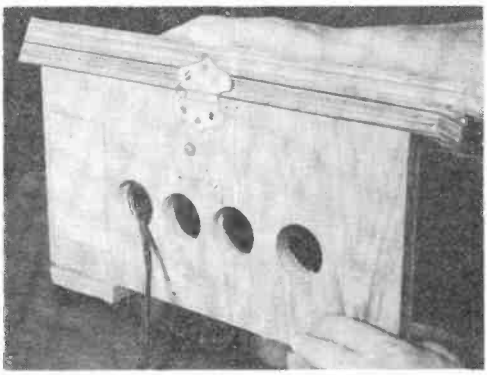
TAPE RECORDER orientation seems to have been split cleanly into two design philosophies over the years. There are recorders which work standing up, and recorders which function while lying on their backs.

The ideal seems to be somewhere in between, 45-60 degrees from horizontal being preferred. But this slant on recording is found only in professional studios. If you want to angle your own recorder, you'll have to build an inclined base for it, such as the one shown here.

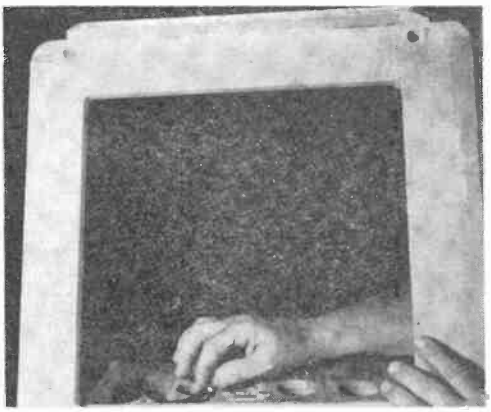
—*Glen F. Stillwell*



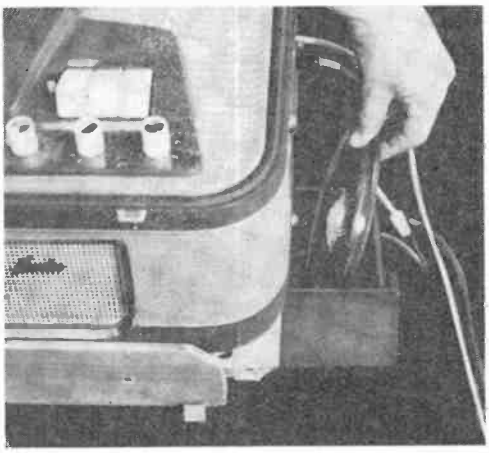
The recording level indicator light on this tape recorder was visible only when viewed from above. Placing the recorder on an angled base made the light as well as other controls more accessible.



Base should be constructed picture-frame style, with a cutout for under-the-recorder ventilation. Size and basic shape must be tailored to your own recorder. The material could be plywood or metal.



This rear view of the angled base shows holes for wires. Rubber feet guard against damage to furniture, help keep the base in position. Additional bracing could be used. Hinge permits compact storage.



"Bonus" benefit of inclined base is storage space provided for tapes, wires, mikes, and splicing tools.

INSIDE TIPS FROM THE PROS

There are no secrets in making good recordings—just the use of common sense

By **BYRON G. WELS,** K2AVB

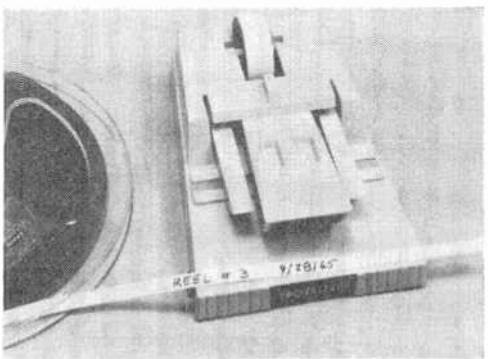
RECORDING AT HOME differs from recording in a professional recording studio not so much in acoustical matters as in the attitudes of the recording "engineers." Acoustically, the average living room comes close to the recording studio, due to overstuffed furniture, rugs, draperies, etc.

The big difference is "finesse"—the pro knows all the tricks, the electronic and mechanical shortcuts which make his job a paying proposition. Lacking the pro's experience, the home recordist must learn piecemeal, mistake-by-mistake.

If you would emulate your professional associate downtown, heed the following words of advice, guaranteed to turn a rank amateur into a knob-twirling, earphone-tapping, mike-waving pro.

1 Use leader tape. This is tape that looks and feels just like the oxide-coated variety, but oxide is what it doesn't have. Leader tape can be spliced in between selections on a reel of music to help locate beginnings and endings. It comes in opaque white (which the pros use most) and also in colors. Sonically it is "dead"; non-magnetic, it can't even hiss.

Spliced at the beginning of a reel, leader tape offers a convenient space for identifying the recording. You can write on it with a pen or felt marker.



Inked identification on leader tape helps keep your tape library in order. Boxes should be labeled too.

2 Make a click eraser. Nobody we know sells such a device, yet many pros wouldn't be without one. Make one yourself with a piece of Alnico cylindrical magnet (Edmund Scientific sells them) measuring ⅛″ in diameter, about ½″ to ¾″ in length. Remove the innards from an old ball-point pen and insert the magnet, holding it in place with epoxy cement.

This device will erase small spots—clicks, whistles and sibilants—by simply wiping the magnet across that portion of the track on which the unwanted sound occurs.

3 Record sound-on-sound. Some recorders are equipped to do this, some are not. All that is necessary for machines which are *not* so equipped is to defeat the erase function. (You can't put a switch in a lead to the erase head because the coil in the head is generally a part of the bias oscillator circuit.)

Simply bend a piece of thin metal (aluminum) into a U shape and hang it over the erase head before threading tape onto the machine. Unable to contact the erase head, your tape cannot be erased. Thus, the new sound you record will go right over the old. *Voila!* Sound-on-sound.

A microphone boom puts the mike where you want it and keeps it there. The boom swings in all directions. Priced at about $5, this particular boom is sold by Atlas Sound. Mike is top-quality Electro-Voice 676.

4 Don't "ride" gain. This will really separate the boys from the veterans. Pros set their levels ahead of time and *leave them alone.* Volume excesses are handled in other ways, such as by moving the mike (if it's on a boom) or by moving the announcer away from the mike. To fade back in, he simply walks up to the mike while talking.

5 *Label your tapes. Never* put a tape back in the box without identifying it. If you don't want to leave a permanent record, use grease pencil—to change the label, just wipe it off with a tissue.

6 Use a mike stand. Hand-holding a microphone is inviting trouble. Changing your grip on the case can make noise, which will become a permanent part of the recording.

Do as the pros do—use a stand. Table-top models are just a couple of dollars. Floor models can be purchased for $5.98. A "baby boom" which will put the mike most anywhere you want it, and *keep it there,* costs just a little more.

Head degaussing is a regular part of tape recorder maintenance. Remove head cover, plug in the degausser, and move it slowly past record/playback heads.

7 Perform preventive maintenance regularly. Don't wait until your tapes begin sounding muddy to get out the head demagnetizer. If you record often, do the maintenance once a month.

Follow this plan: degauss the heads, clean heads and tape guides with head cleaner, check pressure pads and friction idlers for hard spots (rough with a wire brush if necessary), dress down the pressure roller with sandpaper if it has become slick, use a vacuum cleaner to remove lint and pieces of broken tape from around the heads, and check to make sure all controls are in working order.

8 Make a duplicate of valuable tapes. If you have a tape which is irreplaceable, which needs editing, timing, rearranging, etc., make a "dupe" first and do your initial experimenting on that. Then, when you know *exactly* what must be done, go back to the original tape and do it.

9 If you edit, record in one direction only. This may seem uneconomical, but to a pro (who must worry about rent, travel, salaries, taxes and all sorts of

overhead), tape is the cheapest commodity of all.

The same should be true at home. It's false economy to record in both directions, thereby rendering the tape uneditable, only to have to suffer later through false starts, dead air, and other delays which could have been neatly spliced away had the tape been recorded one-direction-only.

If you *must* pinch pennies, you can save the bits of deleted tape, splice them end-to-end and make up a reel of tape which, for many purposes, is as usable as new tape. But don't use it for anything serious—differing bias requirements between tape bits can play havoc with frequency response and output.

10 Use alligator clips. Many home recordists record everything with a microphone: radio programs, records, the works. But with a mike they also pick up unwanted sounds: the baby crying, car horns, airplanes, birds and everything else within range. The pros use mikes only for live recording. To dub from records or radio, they use a direct cable connection between recorder and source. You should follow the example of the pros.

If your sound source has no "tape out" for a connecting cable, make up a cable yourself. Take a length of shielded cable, attach a plug to fit your recorder's high-level input on one end, and a pair of alligator clips on the other. Clip the gator jaws to the loudspeaker terminals of a radio or TV, and you can record without having to whisper. Keep the radio volume *low,* the recorder volume control *up* to minimize distortion.

11 Use a mixer. As you become more sophisticated, you'll invariably buy more mikes. If your recorder has only one mike input, hooking up your new mikes could be a problem. The pros know the answer: a mixer. Then you can plug in three or four mikes at the same time, and control their relative volume with a "pot" (the pros' term for "volume control") on each mike. Mixers today cost about $25. -30-

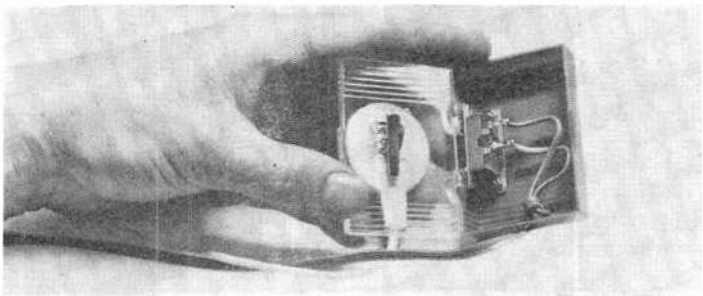
TAPE RECORDER REMOTE SWITCH

EVER find yourself at your cable's end (mike cable, that is) with your tape about to run out and no easy way to shut it off? There's a way to avoid this calamity by running a pair of wires from the recorder motor out to a switch located at the microphone. When you want to turn off the recorder, you have a switch literally at your fingertips.

Mount the switch conveniently (I used a plastic box) and fasten it near the microphone with masking tape. If the mike cable is not too long, you may be able to tape the switch wires directly to it. But this may induce hum; if so, you will have to keep the wires separated.

At the recorder end, you can add a new jack to accept a plug for the switch wires, or you can do as I did, unsolder the speaker wires from the earphone jack and rewire the jack to the motor.

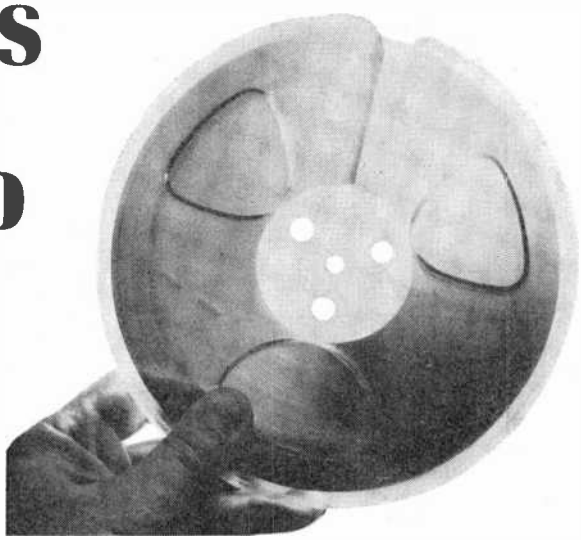
Now, when I pull out the plug, the recorder's motor works normally. When I plug in my remote wire, I can turn off the recorder from the other side of the room. *—Homer L. Davidson*



Remote switch in plastic box is handy to microphone, is safe (the box provides insulation), and is a real leg saver.

COUNTER TESTS FOR GOOD TAPE

Five simple checks on the tape you buy



WANT TO KNOW how to "test and tell good tape from all the rest?" The Magnetic Tape Division of Sarkes Tarzian, Inc., has some suggestions in a booklet on tape soon to be released. Try these counter tests next time you're at your dealer's.

Test 1. Check for proper slitting and winding. Remove reel from package and hold it broadside to a bright light. The winding should be smooth from reel edge to reel hub. (Note: light will shine through tape which has an acetate base, but polyester tape will be opaque.) If the winding shows dark spots or ruffled edges, it is not quality tape.

Test 2. Check for layer-to-layer adhesion. Hold the tape broadside to the floor. Unwind about 12 inches of tape from the reel and let it hang free. Superior tape should continue to unwind until you stop it; inferior tape may stick. Tape that sticks will not unwind freely in use, causing wow and flutter. The oxide may even come off in spots.

Test 3. Check for cupping. Hold the reel on a table or other flat surface above the floor. Feed at least five inches of tape past the edge, shiny (uncoated) side down. Superior tape should droop toward the floor, proving that it is truly flat. Inferior tape may stand out stiff instead of wilting. Cupping can cause poor winding and poor tape-to-head contact.

Test 4. Test for bias and/or curl. Stretch out about six feet of tape on the floor and apply tension at both ends. Superior tape should stay flat, touching the floor at all points along its length. Inferior tape may wave in an arc or curl. Tape which curls will not wind evenly. Result: uneven tracking past the heads, especially serious with four-track recorders.

Test 5. Check for sound reproduction. Place blank tape on the recorder. Record program material at appropriate volume level. Play back at the same level setting. The sound from the tape should be identical to that of the original program. If it is not, the tape may be at fault.

There are, of course, many other tests which will distinguish good tape but these must be made with instruments. The tests above are useful because they can be performed in the store, *before* you have made your purchase. -30-

PINPOINT THOSE ERASE TROUBLES

Do your tapes erase clean, or do you hear faint sounds of an earlier recording in the background?

By LEWIS A. HARLOW

INCOMPLETE ERASURE is one recording ailment which always shows up when it's too late. You notice those traces of an earlier recording which ride piggyback on the new signal *after* your recording has been made. By then, you can't get rid of one without damaging the other.

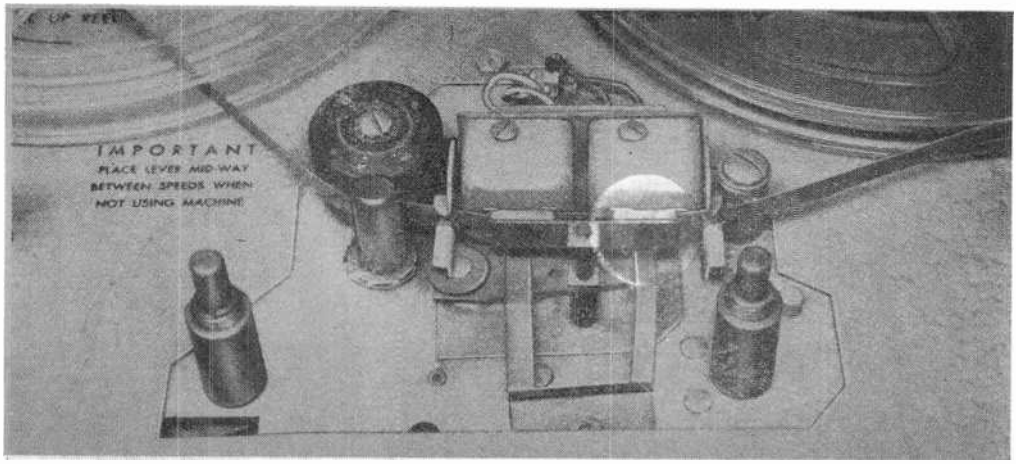
Erase usually is accomplished with an a.c. signal generated in a tube or transistor oscillator circuit. This signal is impressed on the tape through the erase head, which differs from a recording head mainly in its greater current handling capacity and wider gap. The erase frequency can be anything reasonably above the audible range—somewhere between 60 and 100 kc. But more important is power; the signal must be strong enough to do a thorough job.

To check your recorder, make this erase test. Make a short recording on *new* tape. Monitor carefully. Record up to the indicated maximum level, but don't over-record. Then rewind and run the tape through again with switches set for "Record" but with the volume all the way down and all inputs disconnected. The tape *should* be thoroughly erased. Now, rewind and play the tape with playback volume full on. You may hear hum and hiss but you should *not* hear a trace of the previous signal. If you do, check for the following:

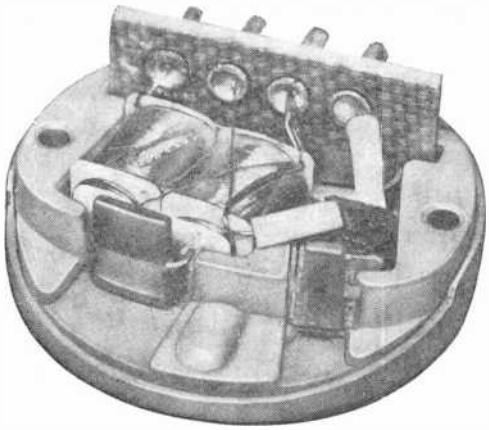
Dirty Erase Head. Symptom: partial rather than total failure to erase. A common trouble, it is caused by iron oxide accumulating on the pole-piece of the erase head and forming a metallic barrier to the erase current. Solution: clean the pole-piece with head cleaner. Apply with a pipe cleaner or Q-tip, rubbing off the reddish residue.

While you're at it, clean the other heads, too. They probably need it.

Switch Trouble. This usually develops in recorders used only occasionally, since the abrasive action of the contacts keeps



Heads are visible when cover is removed. On this recorder, the tape moves from right to left. Thus, head on right is erase head (it contacts the tape first). Clean this pole-piece thoroughly with head cleaner.



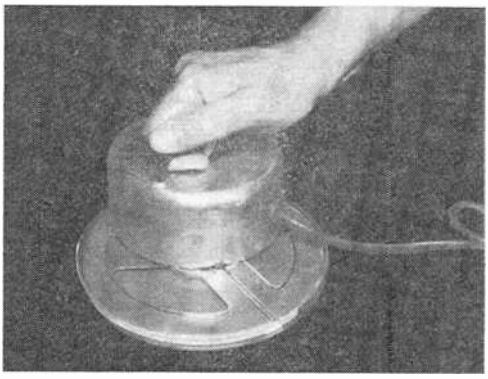
All-purpose head has two plug-in pole-pieces which should be replaced when worn. Smaller pole-piece at right is erase head; record/play is on the left.

them cleaned. But if you develop a noisy switch, exercise it 20-25 times or so to repolish its contacts. If this doesn't help, apply liquid cleaner to the contact points. Then, exercise and test again.

Warning: don't bend the contact points of switches. They are factory-adjusted for years of service. "Improving" them may do more harm than good.

While your recorder is open, check for breaks in long runs of flexible wiring. Heads and switches are often located near mechanical components and wires there are not as protected as they are, say, inside an amplifier.

Tube Trouble. Usual symptom: total erase failure. Your tube placement chart will identify the erase oscillator tube. (If it does not, you are probably erasing with an audio output tube switched into "record" service.) Solution: test the oscillator tube and replace it even if the tester reads "fair." This may be necessary often, since erase and audio output both are heavy-duty services.



Bulk erasure is essential if your recorder has no erase head. Make three slow passes around the reel, turn the reel over (with degausser still on) and degauss the other side. Slowly remove the degausser, turning it off when it is an arm's length away.

Blasts. An erased tape that is quiet except for occasional weak blasts does not necessarily indicate a faulty erase system. *It is possible to put more volume onto a tape than an erase system is designed to remove.* Solution: *two* passes through the erase system, or external bulk erasure.

Tapes From Other Recorders. Not all erase heads plow the same width of path. Not all erase heads are mounted at the same height above the bottom margin of the tape. If you made a tape on one machine and are going to record over it on another, better use a bulk eraser first. Or, use a fresh reel of tape.

Voltage Checking. Now, and not before, is the time for troubleshooting with a VOM or VTVM and schematic, if your erase trouble persists. Check voltages at the oscillator tube socket. Then trace continuity through the oscillator coil and all the way to ground through the coil in the erase head.

Coils are rarely at fault. Resistors and capacitors fail occasionally. You may also find a short due to a wire touching ground, or weak insulation.

Worn Erase Head. Checking for a worn erase head comes last because it is the least likely. Wear will damage an erase pole-piece by widening its gap. But while this is happening, the record/play pole-piece is wearing just as fast. You'll notice missing highs due to a worn playback head long before the erase gap wears out. It is a good practice to replace the erase head when you replace the playback head. That way, wear will *never* be a cause of erase failure. —30—

QUICK CURES FOR SICK RECORDERS

A refresher course in some obvious tape recorder troubles

By GLEN F. STILLWELL

YOUR recorder is sick. It won't play and it won't record. You haven't much time to fix it because in fifteen minutes there's a program you just *must* record. Your objective: find the trouble *fast.*

Diagnosing sick recorders, like troubleshooting any electronic device, is a pat procedure in which you ask yourself

(1) What does it do?

(2) What doesn't it do?

(3) What is the relationship between what it does and what it doesn't do?

In the answers lurks a clue to the trouble.

Making a Diagnosis. Most tape recorder trouble is due to loose or faulty connections. Poor reproduction is rarely a product of electronic malfunction, especially with units under five years old.

Chances are your patient is suffering from simple mechanical failure: if the tape won't move; if it will move but can't touch the heads; if it will play back but won't record; or if it moves at an uneven pace.

If your recorder "won't work at all," you can check out the electronics in a jiffy. Plug in a mike and listen over the monitor circuit (headphones or loudspeaker). If the sound comes through, you can eliminate amplifiers as the source of trouble.

If the tape runs and the amplifiers are okay but the machine *still* won't record, the problem is related to the heads—bias oscillator, connecting wires, dirty gaps or, in extremely rare cases, the heads themselves (tape heads are like TV picture tubes—always suspected but almost never to blame).

Typical Cases. Noisy operation can be harder to eradicate than no operation at all. Look at these "ferinstances."

A well-known recorder developed a strange rhythmic clicking noise that defied detection until the instrument was opened up. Turned out the noise came from a loose pulley belt slapping a tube shield. Cure: Replace the belt and tilt the tube shield.

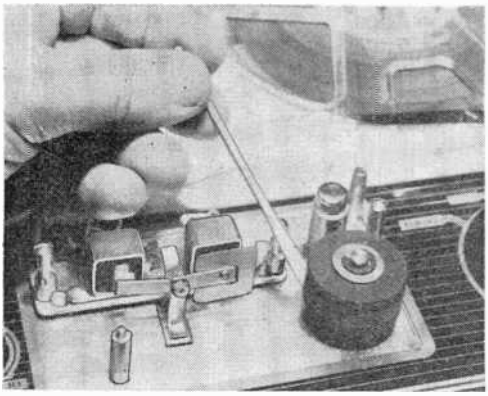
Another recorder made a squealing sound. The motor and drive system seemed to be okay. The trouble was in a counter, cured by a tiny drop of oil.

A Wollensak howled like a homesick pup. Turned out to be a microphonic tube that otherwise scored 100 in a tube checker. Replacement fixed it up.

The owner of a new recorder always suspects the worst when his machine won't justify its claims. Yet the trouble usually is something which can be easily fixed. For example, a German-made recorder became partially inoperative. The owner thought it was the heads. He was overjoyed to learn it was nothing more serious than a hidden, but blown fuse.

Another machine tested perfectly yet made no sound. The monitor circuit was okay, heads were okay. Tapes made on it played back okay on other machines. The trouble: shorted speaker wires.

Often the trouble is nothing which needs "repair" at all, like the portable with a clever switch under the playback level control to disconnect the speaker in order to prevent feedback. Pulling the knob out turned the speaker off. Sure enough, one owner took his recorder to a service shop, complaining "no



Many problems can be avoided by regularly cleaning heads, tape guides, and roller with head cleaner. Use a Q-tip, apply liberally, and wipe away oxide.

sound." The repairman wearily flicked the switch with his finger and the instrument came to life.

This illustrates how often trouble is due to a lack of understanding of the instruction book, or to an owner who simply neglects to read the instructions at all. Recorders differ, and while the basics of tape recording are constant, the fine points of mechanical design can throw you for a loop. Even a veteran recording engineer must read the book before operating a battery recorder bought for his children.

Troubles and Cures. "Poor" sound is seldom reason for lugging a recorder back to the dealer. Usually it is something which can—and should—be fixed by the owner, right then and there. Here is a list of recording troubles with suggestions for curing them.

1 Mushy, muddy, unclear sound. Probably due to recording at too high a volume level. The recording indicator (either a meter or a light) gives an indication—*not a guarantee*—and experience is needed to learn just where the needle should be for good signal-to-noise ratio without distortion. Cure: practice.

2 Tearing, ripping, shredding sound when using a microphone. Probably caused by talking too close to the mike. Microphone diaphragms are so sensitive that they can vibrate from air currents set in motion by sounds 25 to 50 feet away. No wonder they "shatter" horribly when the voice is only an inch or so away, shouting.

To use a mike properly, either speak *across* it in a *normal* tone of voice or hold it far enough away to accommodate your speaking volume. Again, the answer is *practice.*

3 Weak playback, or playback which fluctuates in volume. Check for dirty heads. Use head cleaner and a Q-tip. Clean the heads monthly and this problem will never arise.

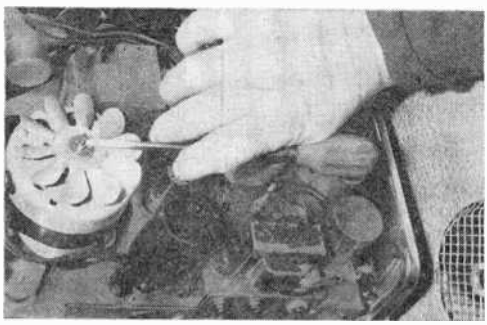
4 Sharp, raspy sound that comes and goes. Probably a loose connection, a plug not pushed all the way in, or a frayed shield on a connecting cable.

5 Hum, just a trace. Could be recorder location. Try a different spot and see if the hum changes. If your recorder is sitting in a strong a.c. field, you'll get hum on playback (but not on record, so it won't get on your tapes). If moving the recorder doesn't help, try turning the plug around.

6 Hum, lots of it. May mean no ground between recorder and source. Check the cables. With a high-impedance mike, it could be pickup by the cable. Even short cables can be hum-sensitive. Cure: a low-impedance mike and cable transformer. Temporary cure: lift the cable off the ground or reorient it and choose the quietest location.

7 No hum, no scratch, plenty of monitor volume but markedly less volume on

(*Continued on page* 97)



Mechanical troubles outweigh electronic problems. Bent fan blades can cause noise by chattering on case. Cure: bend the blades back where they belong.

BUILD...

SOLID-STATE SLOT CAR SPEED CONTROL

Turn your slot racing car into a mighty fast cat, yet maintain absolute speed control every inch of the way

By JAMES FISHBECK

SIMPLE TO BUILD, inexpensive to own, a dream to operate! We're talking about a transistorized slot racing speed controller that let's you run your model racing car almost like the pros do at Le Mans. From the instant you start, all the way through the sloping, winding, pretzel-shaped speedway, till your car zooms across the finish line, you'll enjoy the full pleasure of instant and complete control over your racing car's speed and performance.

Because the push-button type of speed controller controls the car's speed by applying a series of pulses, the acceleration is in steps, rather than through a smooth, linear variation from low speed to top speed. This new solid-state speed controller uses a carbon potentiometer wired to a d.c. amplifier to provide a

smooth variation in resistance, which gives your car finger-tip speed control and all the power it needs to perform with style and class.

How It Works. The speed controller consists of a dual amplifier and two separate potentiometer throttles—one for each amplifier (Fig. 1). Each amplifier output drives a separate lane of the speedway.

Potentiometer *R1* is shown connected across the d.c. power pack supplied with the racing car set. Its center tap is wired to the base of emitter follower *Q1*, thereby controlling the output of this stage. The output of *Q1* is directly coupled to the base of *Q2*, the power output stage, which supplies power to the track through *F1*. The other amplifier operates in the same way.

Since the power pack is nothing more than a step-down transformer feeding into a full-wave rectifier, it puts out an unfiltered d.c. which is quite suitable to run racing cars. Because the transistor amplifiers do not perform well with pulsating d.c., a filter capacitor (*C1*) is put across the power pack output to filter out the ripples before they get to the amplifier.

If you operate a speedway with more than two lanes, you can build a separate amplifier for each lane with no degradation in performance (as long as you don't exceed the wattage rating of the power pack). Just be sure you use identical components in all the amplifiers and speed control potentiometers.

Construction. Except for the two speed controller potentiometers, all parts, including the power pack supplied with the slot racing set, are mounted on a 2″ x 5″ x 7″ aluminum chassis (Figs. 2 and 3). The two speed controller po-

PARTS LIST

C1—500-μf., 25-volt electrolytic capacitor (Cornell Dubilier BBR 500-25 or equivalent)
F1, F2—1-ampere fuse (Littelfuse 3AG)
Q1, Q3—2N109 transistor
Q2, Q4—2N554 transistor
R1, R3—5000-ohm carbon potentiometer, linear taper (IRC-CTS Q11-114 or equivalent)
R2, R4—1000-ohm, 1-watt, 10% resistor
TS1—4-terminal screw-type terminal strip (Cinch-Jones 17-4 or equivalent)
1—2″ x 5″ x 7″ aluminum chassis base (Bud AC-402)
2—3¼″ x 2⅛″ x 1⅛″ aluminum Miniboxes (Bud CU-3017A)
Misc.—Two miniature fuse posts (Littlefuse 342014), multiple-conductor intercom cable, power pack from existing racing set, two knobs, mounting hardware, transistor sockets, rubber grommets, hookup wire, etc.

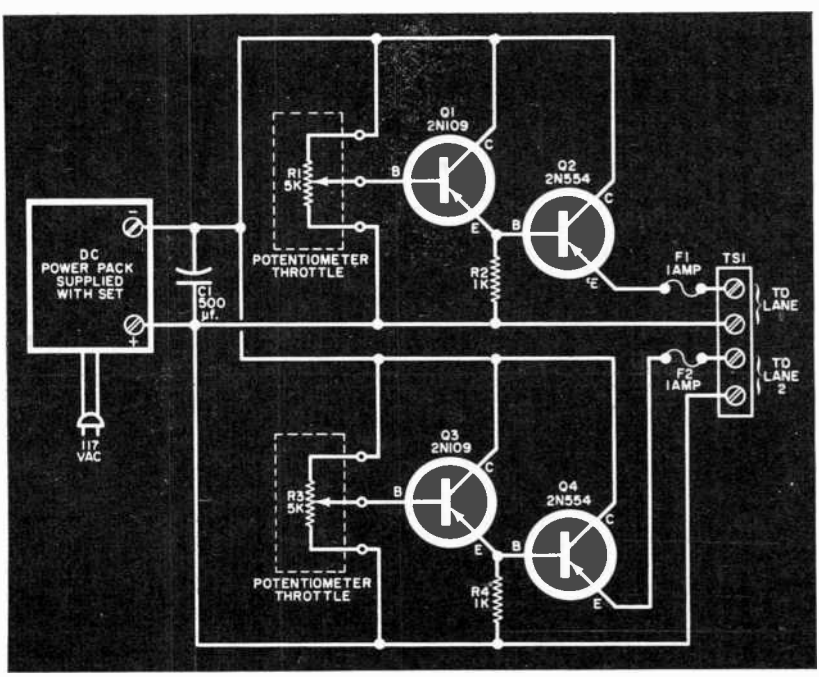


Fig. 1. In this two-lane speed controller, each channel is a mirror image of the other. The speed control potentiometers are mounted on individual chassis, and are connected to the amplifier circuit by long cables. For compactness, mount the slot racer power pack on top of the amplifier chassis.

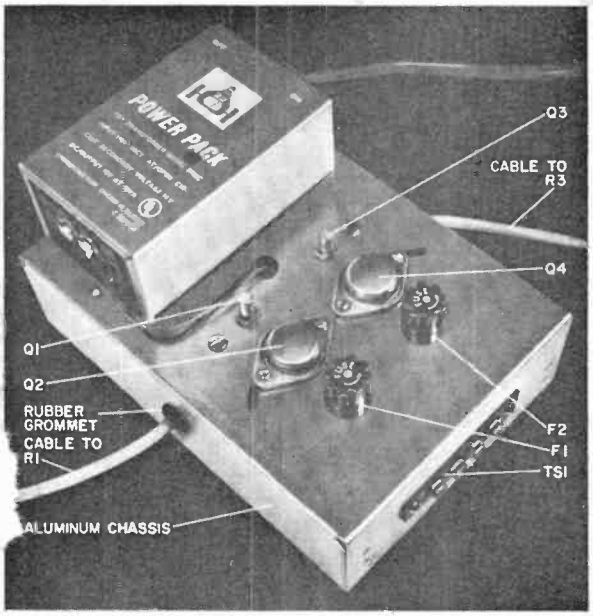


Fig. 2. Large chassis allows plenty of room for mounting the power pack. Use mounting kit for Q2 and Q4, and be sure to mount Q1 and Q3 on sockets. Cables at sides of chassis go to speed controllers.

tentiometers are mounted on individual 3¼" x 2⅛" x 1⅛" aluminum Miniboxes. After drilling, punching, and deburring the chassis, insert rubber grommets through all cable entrance holes.

If your power pack is too large to fit on the size chassis recommended, get a bigger chassis. The size suggested happens to be convenient, but you have complete freedom to select the packaging that best suits your needs. Incidentally, the layout of components is not critical, either. Just use good practices to come up with a professional looking job. You *must* mount the two small transistors (*Q1* and *Q3*) on sockets, however, and you *must* use mounting kits for the power transistors (*Q2* and *Q4*).

After you have mounted each potentiometer on its Minibox, wire it up as shown in Fig. 1 using the three-conductor flexible cable (you can make the cable any length you wish). Connect the other end of the cable to the main chassis.

Check It Out First! Having completed all your wiring, you are now itching to fire up the unit and race away . . . but don't, yet. You'd better go over all the wiring, very carefully, and check it out against the schematic. Above all, you'll want to make certain you haven't reversed any of the leads to the power pack, as this could play havoc with your transistors. If everything's okay so far, wire the output terminals to the track and plug the unit in.

If either car runs in the wrong direction, reverse the track leads to that lane. Do not reverse the leads at the power pack to correct this condition. Should either controller potentiometer work backwards, that is, if the car increases speed when the knob is rotated counterclockwise, reverse the two cable leads across the potentiometer end terminals.

If one car tends to run slowly when the potentiometer controlling that car is at full throttle, one of the transistors in the amplifier associated with that lane is defective. To determine which transistor is at fault, remove the smaller transistor (*Q1* or *Q3*) from its socket. (CAUTION: always turn the power off when removing or inserting any transistor.) If the car still runs slow with the transistor removed, replace the larger transistor. If the car doesn't run at all now, replace the smaller transistor. -30-

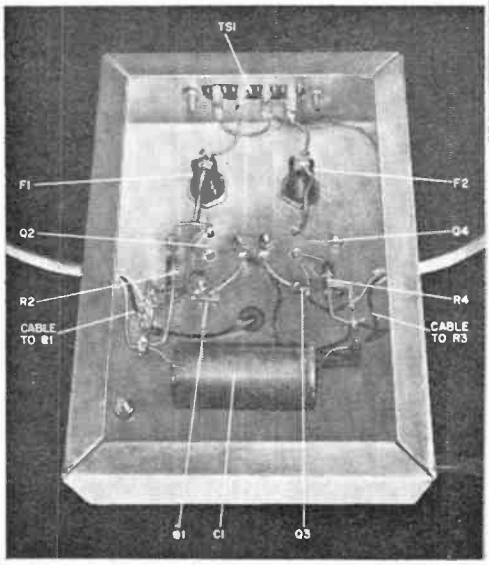
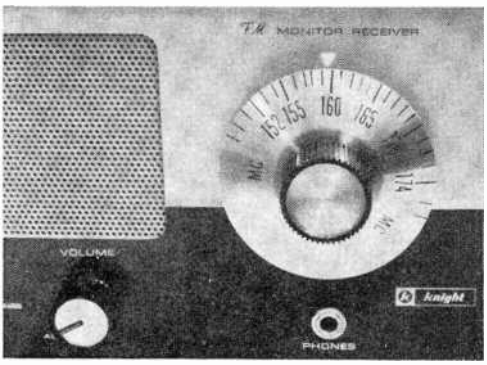


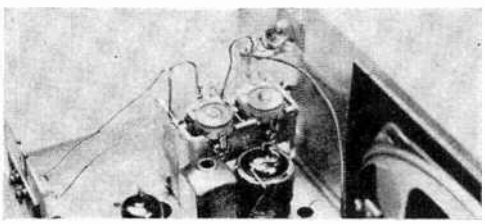
Fig. 3. This underchassis view shows parts layout and wiring. Capacitor C1 is wired across the power pack output to provide filtered d.c. to the amplifiers. Use rubber grommet at all cable entrances.

KNIGHT-KIT KG-221 FM MONITOR RECEIVER

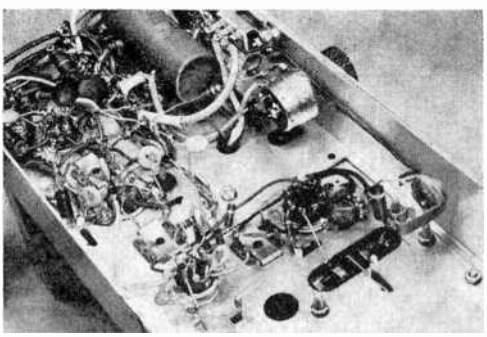
EQUIPMENT REPORT



Receiver vernier tuning dial covers 152-to-174 mc. FM band for police, fire, civil defense, other emergency services, and U.S. Weather Bureau broadcasts.



The receiver front end comes factory-preassembled and tuned, and no further alignment is necessary.



This underchassis view shows ample room for all parts and wiring. Component layout is not critical.

WELL, at long last! A major kit manufacturer has produced a police/fire receiver. This is one item that's been missing from the kit catalog for years. Allied Radio's Knight-Kit KG-221 monitor receiver can be wired from scratch in less than eight hours and—as a 152-174 mc. FM receiver selling for $39.95—it's a real bargain.

We actually wired the unit ourselves (the front end comes preassembled and prealigned) to get at the facts. We found the instructions easy to follow, and when we were through with the wiring, we plugged the unit in. It worked fine, and as the manufacturer claimed, no alignment of any kind was necessary.

The KG-221 features a transformer power supply with a silicon diode rectifier, and has five tubes and one transistor. The transistor is a part of an all-electronic squelch circuit that's adjusted by means of a front panel *Squelch* control which silences the receiver when a station is not transmitting.

The unit has a 3″ x 5″ speaker, and is said to provide an output of one watt (we didn't measure the power output but the volume was loud enough for room listening). The KG-221 also has a *Phones* jack and a *Speaker/Phones* switch right on the front panel to allow a choice of reception.

In operation, the receiver was found sensitive enough to pick up traffic several miles away, just using an ordinary TV "rabbit ears" antenna adjusted to the proper length. We think it is well worth its modest price.

For those who prefer to work in the 30-50 mc. band, Allied Radio offers the Knight-Kit KG-220, which is similar to the KG-221 in other respects. -30-

HOME VIDEO TAPE RECORDING—WHEN?

By WALTER G. SALM

With all the noise and furor, is home video tape ever going to get off the ground?

A YEAR or so ago, there was a magic word spiraling to fame—and the word was "Telcan". The word turned out to be mostly mythical. Telcan's promise of low-cost TV tape recording for home entertainment simply went unfulfilled. And the British-owned Telcan, after much corporate juggling, simply slipped out of sight.

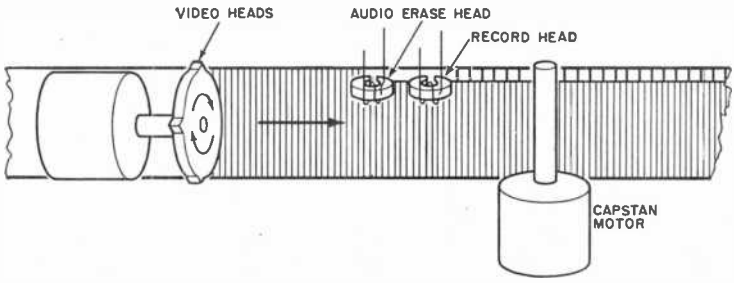
But the need still exists. A popularly priced home-entertainment television tape recorder that doesn't require an engineering degree to operate will find plenty of buyers.

Good TV taping, like hi-fi audio recording, depends on the maximum possible frequency response of the tape and head combination. One rule of thumb: the faster the tape speed past the head, the higher the possible frequency response. This response can be further improved by narrowing the head gap, an expensive process, and possibly using finer milling in preparing the tape's oxide coating—also expensive.

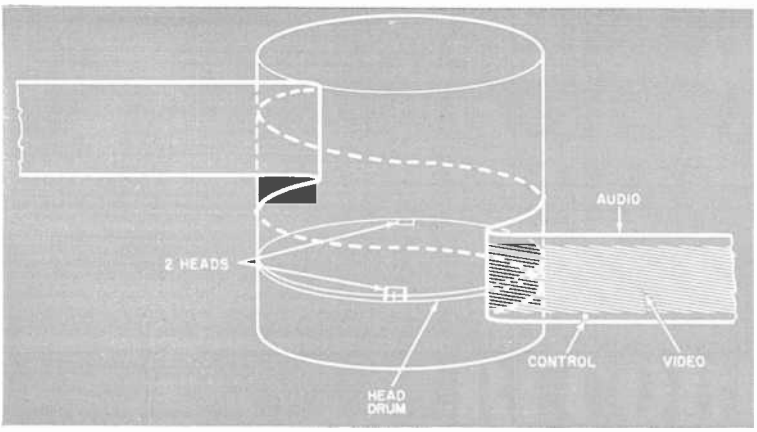
When Ampex initially developed TV tape recording, the only feasible way of obtaining this high tape speed was by rotating the record/playback head assembly. The *transverse* system that resulted is still standard in the broadcast industry. Transverse recording uses 4 recording/playback heads rotating at a 90-degree angle to the direction of tape travel. Two-inch-wide video tape is used and it moves past the rotating heads at 15 or 7½ inches per second. At 15 ips, this is equivalent to an effective tape speed of 1500 ips. This speed means that the tape machine can record frequencies of 4 to 5 mc.—more than enough for broadcast-quality recording.

Understandably, transverse machines are costly and use expensive instrumentation-grade tape. The machines are big and bulky, complicated to operate, and are certainly not intended for home use. But the transverse machine was the first TV tape recorder and these original Ampex TV broadcast machines started a major revolution in programming techniques.

The helical scan was developed in response to the need for lower-cost, simpler-to-operate equipment for closed-



Ampex invented this scheme of transverse tape recording in 1956. Two-inch-wide tape moves past the revolving heads at 15 or 7½ ips. This technique is used in the majority of TV video tape recorders by the major broadcasters.

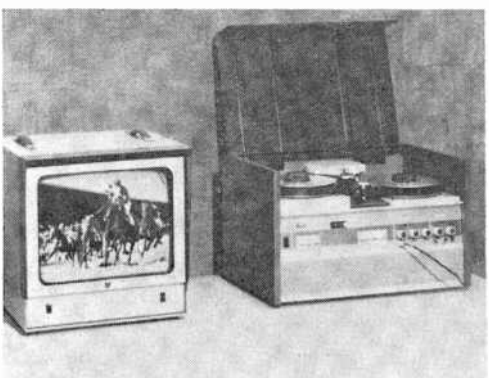


In the helical scan video recording technique, the tape moves around a drum in a diagonal curve. One or two recording heads scan the tape and in some machines near-broadcast quality pictures are obtained. The tape width can be ½ to 2 inches, and the speeds can vary from 3.75 to 9.6 ips.

circuit and educational TV systems. This type of tape scan uses one or two heads mounted on a rotating drum that scans a diagonal path or "helix" across the tape. Tape widths can vary from one-half to two inches, and tape speeds can be from 3.75 ips to 9.6 ips. Naturally, the faster speeds produce better frequency response. At 9.6 ips, effective tape speed past the head is nearly 1000 ips and usable bandwidth up to 3 mc. is possible. Helical-scan machines are called "closed-circuit" or "industrial" recorders, since this is their principal application. Prices are usually less than $10,000 and some recorder decks go below $1000. Average cost is $4000 (e.g., the Norelco EL 3400).

As this is written, there are two helical machines on the market that can qualify as home-entertainment recorders —the Ampex Model HVR, with a $1085 price tag and the Sony TCV-2010, which sells for $995, including a built-in 9-inch TV monitor.

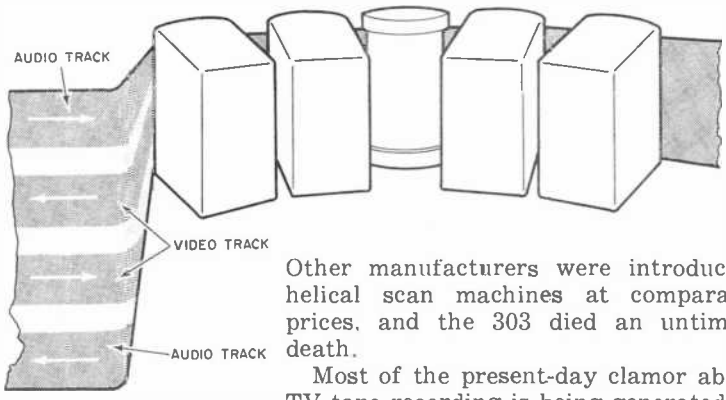
Both the Ampex and Sony recorders are transistorized. Both are compact—about the size of a large, conventional stereo recorder—and are at least as easy to operate as a stereo recorder. The Ampex takes a 1-inch tape and plays at 9.6 ips or half that speed in the more expensive 2-speed model. The Sony uses a ½-inch tape and plays it at 7.5 ips. Reproduced picture quality on both units is more than adequate for home TV viewing and good enough for most closed-circuit systems. Both manufacturers have made up attractive "packages" using the unit in a TV console. Both sell "accessory" TV camera systems for shooting home "TV movies". It has been rightfully claimed that the cost of tape is lower than for a comparable playing time of home movie film. In addition, the TV tape has the added advantage of instant sound tracks and instant playback.



The Norelco Model EL 3400 is priced near $4000. This machine is capable of excellent quality pictures due to the use of helical scan (see above).

The longitudinal scan is mechanically the simplest technique. It is exactly the same as the scan used in ordinary tape recorders, with one difference—the tape whizzes past one stationary recording head at a speed that would be called "fast forward" on audio machines. This is 120 ips and eats up a lot of tape. Pulling tape at this speed wears down the heads very, very fast and has a marked tendency to wear out tapes. The ill-fated Telcan was a machine of this type, but it was plagued by electronic and magnetic troubles.

Some engineers claim that longitudinal scan just won't work and they may



The simplest video recording technique is the old longitudinal scan method used in voice and music recorders. To get the necessary TV information on the tape, it must be pulled past the heads at very high speeds. The Wesgrove recorder (see text below) uses this idea. While the system works, it wears down tape recorder heads rapidly.

be right, if you are talking about providing high-quality pictures at low cost. But the proof of the pudding is another ill-fated machine—the Ampex VR-303, a longitudinal scan machine that sold for a brief period early in 1965 at $3950. The machine produced very good quality pictures on ½-inch tape at a speed of 100 ips! The tape was recorded half-track, so with flip-over, a single reel would play up to 50 minutes. But what a reel! It was 12½ inches in diameter and held about $60.00 worth of special tape. Other manufacturers were introducing helical scan machines at comparable prices, and the 303 died an untimely death.

Most of the present-day clamor about TV tape recording is being generated by the latest British entry—Wesgrove. Priced at less than $500 (wired; $392, kit), this longitudinal scan machine is definitely in the home-entertainment category. Unfortunately, picture quality leaves much to be desired. Tape pulling speed, tape size, and head wear dog the footsteps of Wesgrove. Even though the heads are replaceable ($12 each) the user would need to splice several lengths of Mylar tape together on a 12-inch reel to obtain 30 minutes playing time. The cost of one such reel will come close to

If the longitudinal scan method can be made to work, most experts agree that Fairchild Camera's recorder will be the most economical. Tests have shown that this recorder renders good-quality pictures from ¼-inch tape moving at 60 ips.

$50. That s one fly in the ointment. Another is the observably poor quality of the reproduced picture. Of course, it is to the manufacturer's credit that the thing works at all at these prices, but it is just not the sort of picture you're accustomed to seeing on your TV set.

If the longitudinal recorder can be perfected and sold for $400-600, it may be the brainchild of Stewart Hegeman. Last of the vanishing breed of free-lance inventors, Hegeman has demonstrated a 60-ips recorder with remarkably good picture quality. His company, Par, Ltd., has granted an option to Fairchild Hiller Corp. to sell this recorder to the military. Hegeman will be remembered for his hi-fi developments in amplifiers, tuners, and speaker systems.

Another company pushing hard on the longitudinal scan is Fairchild Camera and Instrument Corp. Its scientists have managed to get good pictures from ¼-inch tape at a speed of only 60 ips, which makes the machine economical where tape is concerned. Another feature is that it records a composite signal —video, audio, and horizontal hold—all on a single channel. While Fairchild has demonstrated working models of this machine, they plan to license it rather than manufacture it themselves. "We're just not in the home-entertainment equipment business", says a company official, "and we don't expect to start in it now."

Wesgrove is one of the two British manufacturers that introduced low-cost TV tape recorders. This particular machine is available as a kit for $400.

The new Ampex home TV tape recorders will sell for about $1300. This is a helical scan recorder and should be capable of recording color TV signals.

To date, Fairchild has reached licensing agreements with at least two manufacturers and production is scheduled to start in 1966. The machine will sell for about $500, including a monitor. Instrumentation-quality tape long enough for ½-hour playing time per track (2 hours total) should cost about $15.

Bandwidth of the new machine, at 60 ips, is claimed to be 2.8 mc.—more than enough for clear, clean pictures on home TV sets. Engineers have also recorded color using ½-track recording and a more sophisticated electronics package.

The Fairchild machine sounds very promising, but it is at least one year from your living room. In the meantime, it is likely that the price tag on helical scan machines will drop. By early 1967, recorders may be available for $400 to $500. If this happens, and the machines use modestly priced tape and provide good picture quality, the industry will then face a standardization impasse that may not be resolved for several years. Chances are that helical scan will win out, at least temporarily, since longitudinal-scan manufacturers will probably continue to work at slower tape speeds for greater economy.

What of the future? Clearly, there will be further price breakthroughs in the helical-scan units. Longitudinal scan still requires final development before it can be mass-produced. By mid-1966, a helical-scan recorder priced below $500 will probably be announced, but it won't be

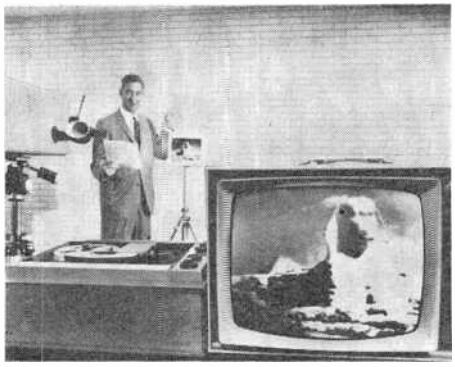
available much before Christmas. This machine will probably use ½-inch tape that should be in volume production about the same time that the recorder hits the market. The head will carry a 1000-hour guarantee and replacements will sell for less than $25.00.

Low-cost TV cameras for home use will make home-taped home "movies" more and more common by this time next year. Tape rental libraries will start opening, offering movies and shows at daily rentals lower than the price of a pair of tickets to the neighborhood movie house. Inviting favored neighbors in to view the show and splitting the rental with them will become common practice. And this rental service could sound the death knell of pay-TV.

TV tape recorders will sprout in unlikely places. They are already in use by golf pros and in public-speaking classes. Theater and movie shooting rehearsals will provide "live" commentary to the actors during breaks. The uses are almost unlimited.

And, in your own living room, there will no longer be favorite TV programs missed because you are out for the evening. An automatic timer hooked into the recorder will preserve the show for later viewing—complete with commercials. That's one problem they haven't quite licked yet! -30-

Sony's $1000 recorder is attracting considerable public attention. With a tape width of ½ inch and a 7.5-ips speed, the picture quality is quite good.



TV PICTURES ON PHONOGRAPH DISCS

AN important development by Westinghouse, called "Phonovid," is a system that records TV pictures on high-quality phonograph discs and slow-speed audio tape. Phonovid does not produce moving TV images, but a series of still photos. One 12-inch 33⅓-rpm record can hold 400 still pictures along with a sound track.

Heart of the unit is a storage device that "builds up" the TV image from the slow-scan recording. One complete picture takes several seconds of playing time to produce, and the previous image is held on the picture tube until the next one is ready for display.

The system is useful for schools, meetings, presentations, and other situations that require a slide-type program with narration. Basic prices are high—several thousand dollars for a playback system—but Phonovid has the big advantage of using low-cost LP records and slow-speed audio tapes. -30-

PHOTOFLOOD DIMMER

Half-wave rectifier cuts line voltage to reduce light and heat when setting up scenes to photograph; also extends lamp life and increases photographer's control

By L. M. DEZETTEL

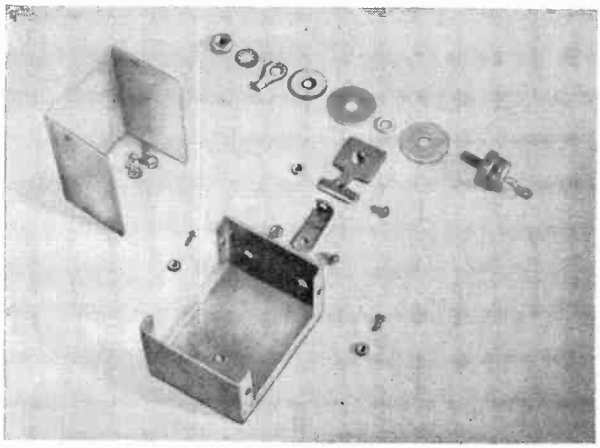
PHOTOGRAPHERS working with photofloods will find this dimmer a real money-saver. Built into a multiple outlet box, it cuts the line voltage to one or more lamps, when switched in, thus greatly extending lamp life as well as allowing greater versatility in light control.

How It Works. The dimmer consists of a silicon diode connected in series with the a.c. line feeding three of the four outlets in a commercially available strip-type outlet box. Selection of the diode and type of box depends upon the number of lamps needed and their wattage rating.

For example, two 500-watt floods and one 500-watt spotlight draw a little less than 13 amperes; therefore, a four-switch, four-outlet box with at least 6-ampere sockets and a 15-ampere fuse should be selected. Motorola's 1N3210 diode can handle up to 200 peak inverse volts at 15 amperes of current. However, you can use any diode that is capable of handling at least this much voltage and current.

A slight circuit modification in the outlet box is all that is needed to enable you to switch the diode in or out of the circuit, as shown in the wiring diagram. When *S1* is in the on position, the diode is "jumped" out of the circuit and the full amount of line voltage is applied. When *S1* is in the off position, the diode is in the circuit and only half of the a.c. line waveform reaches the lamps.

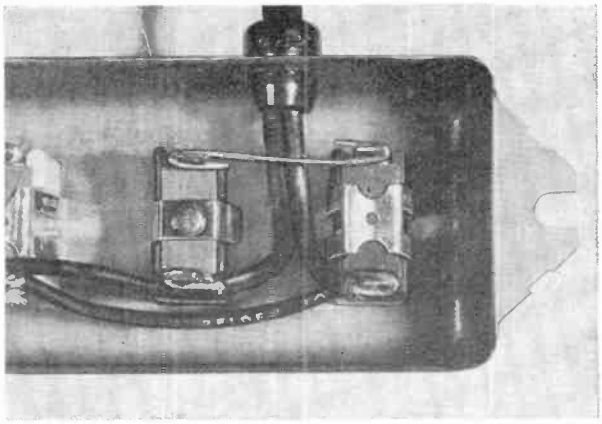
This modification leaves the outlet next to *S1* out of the dimmer circuit, and enables you to get full-line voltage



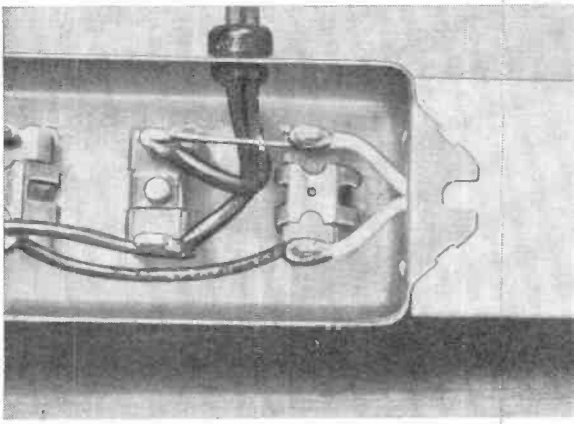
Mount the diode inside the Minibox using the hardware shown. Phonograph cartridge weight, attached to chassis with a bracket, serves as the heat sink.

PARTS LIST

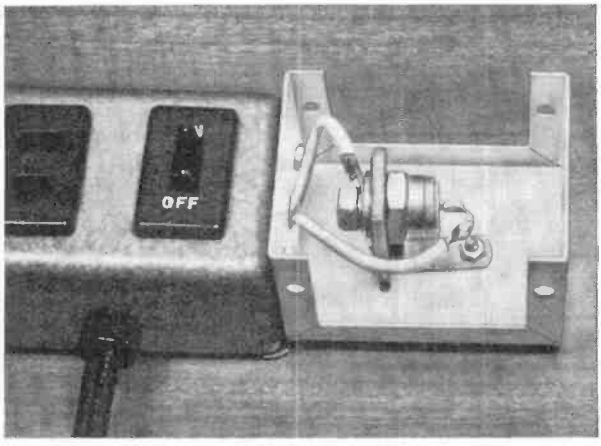
1—Multiple-outlet box (CBC Type SS-CB or equivalent)
1—1N3210 silicon diode rectifier (Motorola or equivalent)
1—2¾" x 2⅛" x 1⅝" Minibox (Bud 300A or equivalent)
1—1½" x 2 x 1/16" piece of metal for heat sink
Misc.—½" x ½" angle bracket, 6-32 machine screws and nuts (4), mounting bushing and washers for rectifier



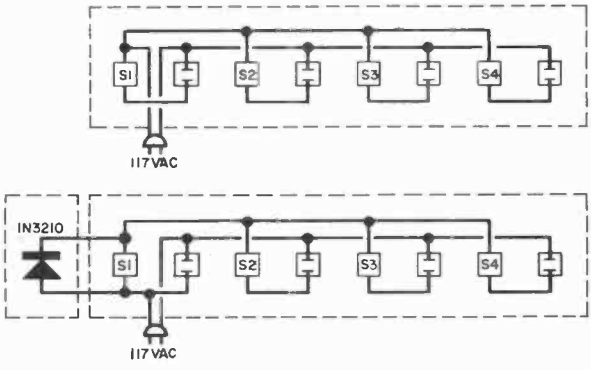
Drill a 3/8" hole through one end of the outlet box and Minibox, as well as two 5/32" holes on both sides of 3/8" hole for mounting boxes together.



Diode leads fed through the 3/8" hole are connected across the first switch. Note change in line cord connection. These two changes are all that's needed.



As diode is too large to fit inside outlet box, separate Minibox must be used. Connected as an extension to the strip-type outlet, it is screw-mounted.



Wiring of outlet box before alteration (top). Bottom diagram shows how S1 is rewired to switch diode in and out of the circuit to control the outlets.

from it at all times. The other three switches control their respective sockets, as before.

Construction. Mount the diode in a 2¾" x 2⅛" x 1⅝" Minibox and attach the box to the multiple outlet strip as shown. Feed the diode leads through a 3/8" hole previously drilled through both boxes. Two 5/32" holes are drilled on either side of the 3/8" hole to accommodate a couple of 6-32 machine screws and nuts to hold the boxes together.

A small piece of metal, at least 1/16" thick, can be used as a heat sink for the silicon diode. (In this particular unit, an old phonograph cartridge weight was used.) Drill a 3/8" hole near the top of the heat sink to hold the diode. A 5/32" hole drilled at the base of the heat sink permits attachment to a right-angle bracket.

Mount the rectifier using the hardware as shown in the illustrations. The white nylon bushing fits inside the 3/8" hole to center the ¼" stud on the rectifier, and to keep the stud from making electrical contact with the heat sink. Place a mica washer on either side of the heat sink.

Before using the dimmer, check with an ohmmeter to make sure that the diode is electrically insulated from the Minibox. Center the diode and bracket assembly before drilling a 5/32" hole in the bottom of the Minibox to mount the right-angle bracket. -30-

ENGLISH-LANGUAGE NEWSCASTS TO NORTH AMERICA

Prepared by ROBERT LEGGE

TO EASTERN AND CENTRAL NORTH AMERICA

COUNTRY	CITY	TIME—EST	TIME—GMT	FREQUENCIES (MC.)
ALBANIA	Tirana	7 p.m.	0000	7.265
ARGENTINA	Buenos Aires	10 p.m. (Mon.-Fri.)	0300 (Tues.-Sat.)	9.69
AUSTRALIA	Melbourne	7:45 a.m.	1245	11.84
AUSTRIA	Vienna	*7 p.m., *8 p.m.	0000, 0100	9.77
BULGARIA	Sofia	7 p.m., 11 p.m.	0000, 0400	6.07
CANADA	Montreal	7:15 a.m.	1215	5.97, 11.72, 15.32
CHINA	Peking	8 p.m., 9 p.m.	0100, 0200	7.035, 9.48
CUBA	Havana	10 p.m.	0300	6.135
CZECHO-SLOVAKIA	Prague	10 a.m. (Sun.)	1500 (Sun.)	15.20, 15.285, 17.825
	"	8 p.m., 10:30 p.m.	0100, 1330	5.93, 7.115, 7.345
DENMARK	Copenhagen	7:30 a.m.	1230	15.165
ECUADOR	Quito	*9:00 p.m.	0200	9.745, 11.915
FINLAND	Helsinki	7:15 a.m. (Tues., Sat.)	1215 (Tues., Sat.)	15.185
GERMANY	Cologne	8:30 p.m.	0130	6.075, 9.64
HUNGARY	Budapest	7:30 p.m., 8:30 p.m.	0030, 0130	7.305, 9.833
	"	10 p.m., 11:30 p.m.	0300, 0430	7.305, 9.833
ITALY	Rome	8 p.m.	0100	5.96, 9.63
JAPAN	Tokyo	7 p.m.	0000	11.78, 15.135
NETHER-LANDS	Hilversum	4 p.m.	2100	6.085, 9.59
	"	8:30 p.m.	0130	9.59 (via Bonaire relay)
NETHER-LANDS ANTILLES	Bonaire	*7 a.m.	1200	11.82
	"	*7:35 p.m.	0035	11.82
NORWAY	Oslo	11 a.m. (Sun.)	1600 (Sun.)	15.175, 17.825
PORTUGAL	Lisbon	9 p.m., 10:45 p.m.	0200, 0345	6.025, 6.185
RUMANIA	Bucharest	8:30 p.m., 10 p.m.	0130, 0300	5.98, 9.57
SPAIN	Madrid	8 p.m., 9 p.m.	0100, 0200	6.13, 9.615
SWEDEN	Stockholm	9 a.m.,	1400	15.42
	"	11:15 a.m.	1615	15.42
	"	8 p.m.	0100	5.99
SWITZERLAND	Berne	8:15 p.m.	0115	6.08, 6.12, 9.535
UNITED KINGDOM	London	11 a.m.	1600	11.84, 15.30
	"	5 p.m., 6 p.m.	2200, 2300	6.195, 7.13, 9.51, 9.735
	"	7 p.m., 9 p.m.	0000, 0200	6.195, 7.13, 9.51, 9.735
U.S.S.R.	Kiev	7:30 p.m. (Mon., Thurs.)	0030, (Tues., Fri.)	7.31, 9.665
	Moscow	5 p.m.	2200	7.15, 7.31, 9.665
	"	6 p.m., 7 p.m., 8 p.m.	2300, 0000, 0100	7.15, 7.205, 7.31
	"	9 p.m., 10 p.m.	0200, 0300	6.07, 7.15, 7.31
	"	11 p.m., 12 Mid.	0400, 0500	7.15, 7.31, 9.665
VATICAN CITY	Vatican	7:50 p.m.	0050	5.985, 7.25, 9.645

TO WESTERN NORTH AMERICA

COUNTRY	CITY	TIME—PST	TIME—GMT	FREQUENCIES (MC.)
ARGENTINA	Buenos Aires	10 p.m. (Mon-Fri.)	0600 (Tues.- Sat.)	9.69
AUSTRALIA	Melbourne	6:30 p.m., 7:30 p.m.	0230, 0330	15.22, 17.84
CHINA	Peking	7 p.m., 8 p.m.	0300, 0400	7.08, 9.457
	Taipei	6:50 p.m.	0250	9.72, 11.825, 15.345
CUBA	Havana	9 p.m.	0500	6.135
GERMANY	Cologne	7:10 a.m.	1510	9.735, 11.795
	"	8.55 p.m.	0455	6.145, 6.16, 9.575
JAPAN	Tokyo	7:15 p.m.	0315	11.78, 15.135
KOREA	Seoul	7 p.m.	0300	11.925
SPAIN	Madrid	7 p.m.	0300	6.13, 9.615
SWEDEN	Stockholm	6:30 p.m.	0230	5.99
SWITZERLAND	Berne	7 a.m.	1500	15.305
THAILAND	Bangkok	8:15 p.m.	0415	11.91
U.S.S.R.	Moscow (via Khabarovsk)	7 p.m., 8 p.m.	0300, 0400	9.54, 9.735
		9 p.m., 10 p.m.	0500, 0600	9.54, 9.735

*Non-news broadcasts. Some additional broadcasts are beamed to North America, but are not included here since they are not expected to be heard satisfactorily during the winter months.

SHORT-WAVE LISTENING

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

WE'RE CHANGING OVER TO GMT

IN 1955, when your Short-Wave Editor first became associated with POPULAR ELECTRONICS, a survey was taken to determine the approximate geographical location of the majority of the DX'ers who were reporting to the existing short-wave column. It was found that the majority was located east of the Mississippi River, most of them in states bordering on the Atlantic Ocean. So it was decided to list all operating times exclusively in EST, in conjunction with the 24-hour system.

Recently another survey was taken, the results of which indicate that the readers of and contributors to this column are now generally distributed throughout most portions of the United States. Some areas of the far-midwestern states and sections of the Rocky Mountain states have fewer DX-'ers than other areas, and the Atlantic Coast continues to have the greatest numbers. But the DX'ers in the southern states and Pacific Coast regions have greatly increased. In addition, readers in a large number of foreign countries have been expressing increasing interest in the hobby.

For a long time most of the short-wave broadcasting stations have given their operating times in Greenwich Mean Time (GMT); a limited few are still releasing their schedules in EST. The American Radio Relay League, which represents tens of thousands of amateur radio operators, adopted GMT several years ago. And portions of the bulletin of the Newark News Radio Club (the largest and oldest short-wave club in the nation) have been changed over to GMT. The majority of the other short-wave clubs and virtually all of the foreign clubs use GMT exclusively.

Taking all of these various items into consideration, it has been decided to change the times in this column from EST to GMT. This decision is expected to cause a bit of hardship—short-lived, we hope—for East Coast DX'ers, but is expected to win the overwhelming approval of DX'ers from virtually every other part of the U.S., in Canada, and in the foreign countries.

The adoption of GMT will become effective on January 1, 1966. As of this date, readers are requested to submit all reports in GMT rather than in EST. For Eastern Standard Time DX'ers, this will mean adding five hours to the local time. Those in Central Standard areas should add six hours; those in Mountain Standard areas, seven hours; and the Pacific Coast reporters, eight hours.

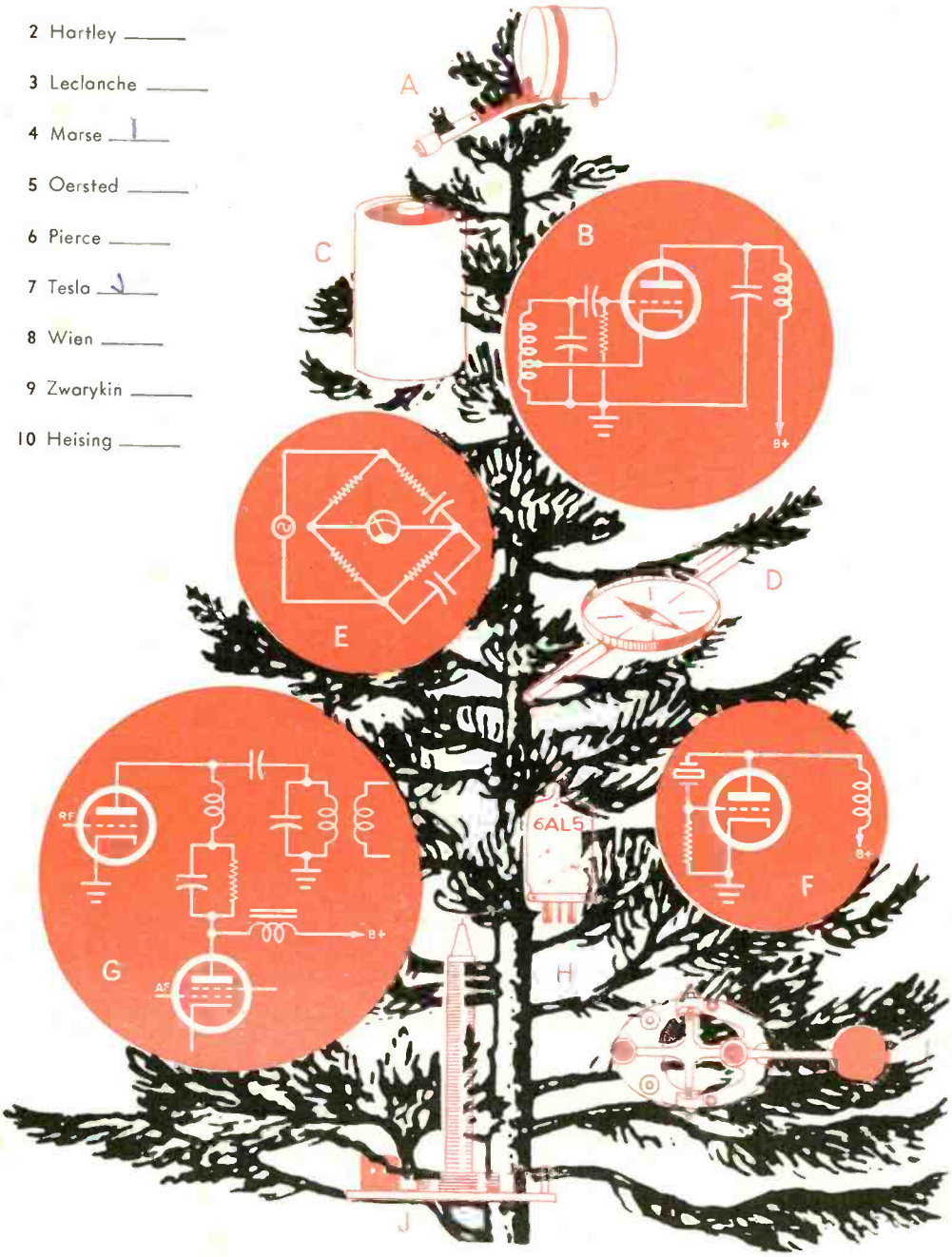
(*Continued on page* 105)

Father and son operators Paul D. Haney, KØEKH, (left) and Paul A. Haney, KØWGE, of Shawnee Mission, Kansas, divide their time between short-wave listening and amateur radio. They have a total of 30 countries and all 50 states between them. Equipment: a Collins 75S-1 receiver, a 1000-watt transmitter, and a TH-4 rotary beam antenna.

ELECTRONICS HISTORY QUIZ

By ROBERT P. BALIN

1 Fleming _____
2 Hartley _____
3 Leclanche _____
4 Marse 1
5 Oersted _____
6 Pierce _____
7 Tesla J
8 Wien _____
9 Zwarykin _____
10 Heising _____



Many present-day electronic devices have been around for a long time, and some still bear the names of their inventors. Try matching the names of the well-known scientists listed above (1-10) with drawings A-J of the devices or circuits they helped develop.

(*Answers on page* 104)

AMATEUR RADIO

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

HOW TO SERVICE YOUR OWN EQUIPMENT

SERVICING your own equipment can be fun. In addition, it eliminates the time you would have to be off the air while the equipment was at the factory being serviced. And any person capable of passing an amateur examination should be capable of performing the greatest percentage of the servicing of his own gear. Doing the job requires only the instruction/service manual that comes with the equipment, and a test meter.

Either a 20,000-ohm-per-volt volt-ohm-milliammeter with a 5000-volt scale or a vacuum-tube voltmeter is equally suitable. Possibly the VOM is slightly more desirable for some transmitter checks, and it has the advantage of not having to be plugged into the 117-volt power line to operate. The VTVM, however, is slightly better for making measurements in a few low-voltage, high-resistance circuits found in receivers—the a.v.c. circuit, for example. But the choice between the two types is pretty much a matter of personal preference. Actually, a 1000-ohm-per-volt VOM will do almost as well as either a 20,000-ohm VOM or a VTVM for routine amateur equipment servicing; its main disadvantage is its inability to give accurate voltage readings in low-voltage, high-resistance circuits.

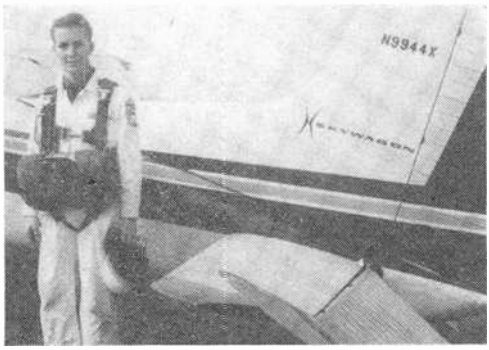
The most intelligent first step in servicing any piece of electronic equipment is to read the instruction manual. Then eliminate obvious possibilities before tearing into the unit. Are the antenna, speaker, microphone, and/or key connected? Is the antenna changeover relay operating properly? Are all the tubes lit? Is the trouble limited to certain bands or modes of operation? Has a fuse blown?

It is fairly common for a fuse to blow in properly fused equipment for no apparent reason. Therefore, if a fuse does blow without any other evidence of

AMATEUR STATION OF THE MONTH

Bill Paul, WB6KGG, of San Francisco, Calif., started his amateur career with a bang: his very first Novice CQ was answered by a Mexican amateur. Retired from the Police Department with a spinal injury, Bill has lots of time to be on the air. With his Hallicrafters HT-37 transmitter, Hammarlund HQ-180 receiver, and an inverted-V antenna, he has worked 41 states and 3 continents, mostly on CW. Bill will receive a one-year subscription for submitting this winning photo in our Amateur 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, and some details on your ham career and on the equipment you use. Entries go to: Amateur Photo Contest, c/o Herb S. Brier, Amateur Radio Editor, P.O. Box 678, Gary, Ind. 46401.

Henry Wilkens, WA5LBM, spends his time on the air and in the air. When not operating his ham gear, he likes to sky dive, even though he says it isn't as exciting as ham radio. See p. 103 for details.



Mike Kersenbrock, KH6FON, of Kaneohe, Hawaii, made some 400 contacts in 29 states as a Novice. A Hallicrafters HT-40 transmitter and an SX-140 receiver did the job, mostly on 15 meters. Check with Mike if you need a Hawaii contact and QSL card.

trouble (such as a burning smell), just install another fuse of the proper rating. If the equipment then works properly, all is well, although you should watch the unit carefully for the next few days for signs of intermittent trouble. Of course, if the new fuse immediately blows, you have a metering job to do.

Electronic equipment instruction manuals invariably include a schematic diagram showing all resistance, capacitance, and other component values. In addition, they usually contain separate charts showing voltage and resistance readings to be expected from various test points (usually the tube socket terminals) to ground. Unplug the unit from the power line and start measuring resistances at the indicated points. When you find a large discrepancy—say 20% —between the listed and measured resistance values, carefully check all components connected to that point either directly or indirectly.

In a transmitter recently serviced by your Amateur Editor, for example, pin #3 of the 6146 output tube had a listed resistance of 22,000 ohms, but the measured resistance was zero ohms. Inspection of the circuit diagram showed a 22,000-ohm resistor and a 0.005-μf. capacitor between the pin and the chassis. In addition, there was a 47,000-ohm resistor between the terminal and the B+ line. Deducing that the capacitor had probably short-circuited—a common trouble—we unsoldered one side of it from the circuit and measured its resistance. It was shorted; so we replaced it with another capacitor *of the same type and capacitance*. As a precaution, we also measured the 47,000-ohm resistor. When the capacitor shorted, it effectively connected this resistor directly across the B+ voltage to ground, causing several times the normal amount of current to flow through the resistor. This might have changed its resistance or burned it out completely. Fortunately, it did neither.

The above illustrates the theory behind troubleshooting with an ohmmeter: find a point in the circuit where the measured resistance differs from the specified resistance and start checking all components associated with that circuit. In general, resistors should be within 10% of their specfied values; capacitors should show a very high resistance (after an initial meter "kick" as the larger capacitors charge up); chokes, coils, and transformer windings should show low values of resistance—usually well under 200 ohms, except for a few audio transformer windings which may run up to a few thousand ohms.

It is always wise to troubleshoot a defective circuit thoroughly before applying power. Nevertheless, resistors that change value or capacitors that become leaky after the unit is in operation for some time are usually much easier to run down by making actual voltage

(*Continued on page* 101)

SOLID STATE

By LOU GARNER, Semiconductor Editor

HO, Ho, Ho," chuckled the Department Store Santa Claus as he hoisted the seven-year-old up on his knee. Winking at the child's mother standing nearby, he continued . . . "and what do *you* want for Christmas?"

"Gosh, Santa, lotsa things," the bright-eyed youngster replied, "but mostly a pair of three-transistor Citizens Band walkie-talkies with superregenerative receivers."

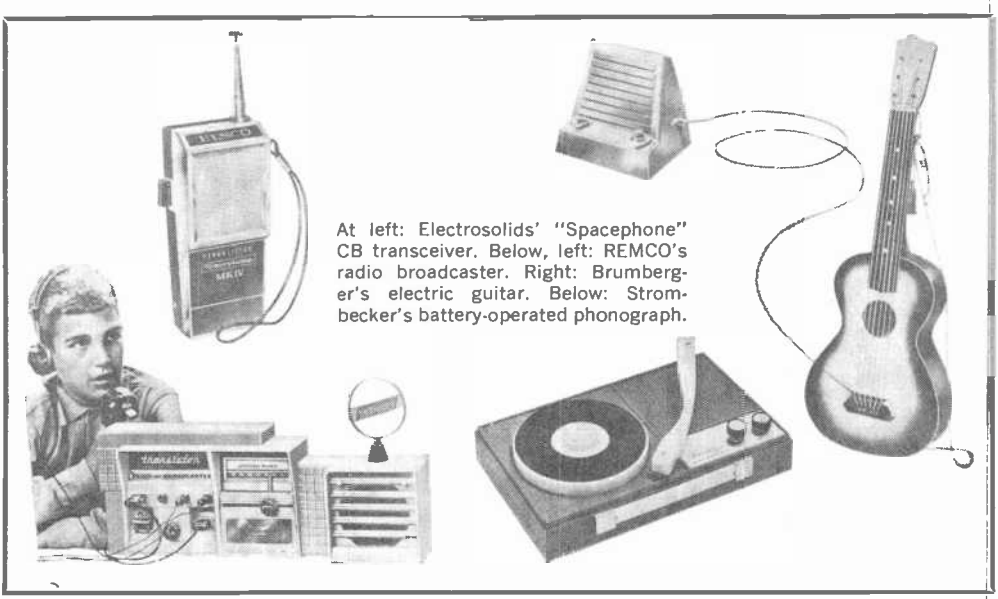
Far-fetched? Not in the least! In fact, if present trends continue, Santa's helpers will have to bone up on their electronics knowledge *just to understand* the younger generation. Each year toy manufacturers have introduced an increasing number of electronic items. This has been made possible. of course, by the availability of transistors, diodes, and other solid-state devices, allowing the use of safe, reliable, and inexpensive circuit designs in the various products.

This year, CB transceivers designed for the younger generation are going over big in toy stores across the land. One firm, Electrosolids Corporation (12740 San Fernando Road North, Sylmar, Calif.), offers seven different models dubbed "Spacephones." These range from a three-transistor set retailing for $9.95 or less in kit form to a seven-transistor design, with an operating range of 1½ miles, retailing for less than $35 a pair.

Lafayette Radio (111 Jericho Turnpike, Syosset, L.I., N.Y.), has a low-priced transceiver which, in a direct appeal to youngsters, is called an "Army Commander Walkie-Talkie" and is described in Lafayette's latest catalog as a unit which "looks like . . . and works like a real U.S. Army two-way radio." A three-transistor job with a ½-mile range, it features a superregenerative receiver.

Allied Radio (100 N. Western Ave., Chicago, Ill. 60680), devotes six pages in its latest catalog to several Knight CB transceiver kits, with the copy for the lower-priced units aimed directly at the younger set. The Model C-100, a three-transistor unit selling for less than $9, is described as . . . "great for adults and kids alike who enjoy camping, hunting, fishing, hiking, and outings."

Record players have always been popular with preteens and teen-agers. Today, the once almost universal acoustic child's phonograph has been replaced by a variety of



At left: Electrosolids' "Spacephone" CB transceiver. Below, left: REMCO's radio broadcaster. Right: Brumberger's electric guitar. Below: Strombecker's battery-operated phonograph.

transistorized battery-operated designs. The "Galaxy 100" is typical of the new breed. It plays either 33⅓- or 45-rpm records and is part of a broad line manufactured by Strombecker (4646 West Lake St., Chicago, Ill. 60644).

Beatle and Rolling Stone preteen fans who strive to imitate their heroes will get a big boost from a low-cost electric guitar manufactured by Brumberger (34 34th St., Brooklyn 32, N.Y.). Sold through toy and department stores, the instrument carries a list price of only $14.95, including a fully transistorized amplifier.

REMCO Industries, Inc. (200 Fifth Ave., New York 10, N.Y.) is offering a "transistor radio and broadcast system" that works, for only $11. Wonder what NBC or CBS will say about this.

Not all of the current emphasis is on "play" toys, however. Educational electronic kits are being produced by a number of manufacturers, including International Rectifier, Heath, Allied Radio (Knight), Norelco, Lionel, and Philmore. Although many of the current offerings are multi-project experimenters' kits emphasizing circuit construction, others—such as the "Geniac" and "Minivac" kits—emphasize computer techniques.

Reader's Circuit. Submitted by Garry Boross (13 Fisher Ave., Nanuet, N.Y.), the general-purpose signal injector circuit in Fig. 1 has a number of potential applications in the home laboratory. Developing a spike-like waveform rich in harmonics, it can be used as a signal source to check headphones, loudspeakers, audio amplifiers and both AM broadcast and s.w. receivers. If a hand key is used in place of the power switch (*S1*), the unit will serve as a code practice oscillator. As an additional bonus, according to Garry, the device can produce a series of evenly spaced bars on a TV screen when attached to the set's antenna terminals, simplifying linearity adjustments.

Garry uses a pair of transistors in a common-emitter configuration to form a familiar collector-coupled multivibrator. Resistors *R1* and *R3* serve as base resistors and *R2* and *R4* are collector load resistors. Cross-coupling is provided by *C1* and *C2*, while *C3* is an output coupler to isolate the load. Circuit power is supplied by *B1* through *S1*.

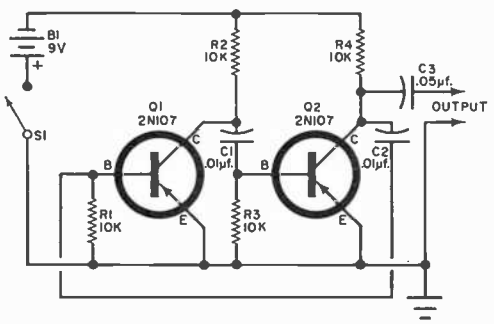


Fig. 1. Schematic of a general-purpose signal injector circuit submitted by reader Garry Boross.

Standard components are used throughout. Transistors *Q1* and *Q2* are general-purpose *pnp* types (CK722's, 2N107's, or 2N109's). All resistors are half-watters. Capacitors *C1* and *C2* are low-voltage disc ceramics, while *C3* is a 600-volt tubular paper capacitor. Switch *S1* can be a s.p.s.t. toggle, slide, or rotary type. Finally, *B1* is a Burgess 2U6 or 2N6 9-volt transistor battery.

Neither the layout nor the wiring is critical and the individual builder can follow his own construction preferences when duplicating the circuit. Use either an etched circuit board, a metal chassis, or perforated phenolic board to hold the components. The completed unit can be housed in a plastic or metal box, as preferred.

Manufacturer's Circuit. The VHF variable frequency (sweep) oscillator described on the back page of a condensed catalog recently put out by the Vari-L Company, Inc. (207 Greenwich Ave., Stamford, Conn. 06904) should be of particular interest to hams, students, and advanced experimenters. Covering the frequency range from 170 to 240 mc., the circuit features the use of a

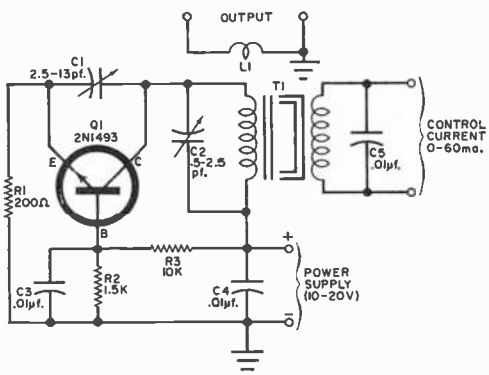


Fig. 2. This Vari-L variable frequency oscillator covers a frequency range from 170 to 240 mc.

Vari-L saturable core current-controlled inductor, and is shown in Fig. 2.

Transistor *Q1* is used in a common-base configuration as an r.f. oscillator. The feedback path necessary to start and sustain oscillation is provided by emitter-collector capacitor *C1*. Base bias is furnished through

(*Continued on page* 98)

ON THE CITIZENS BAND

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

YOUR CB Editor has received a dramatic account from Joe Stubblefield, KKV5779/WA5NRH, of the tornado that ripped through Hale Center, Texas, last June, and the dangerous risks taken by CB'ers in order to warn and protect farmers and residents in the vicinity. It was estimated that at least 100 lives were saved through the efforts of CB radio operators, nicknamed "Minute-Men." The same group has stood guard over Hale Center for the last ten years during each tornado season.

LIVES SAVED BY TEXAS CB'ERS

CB'ers risked their own lives by staying with their transceivers until minutes before the tornado struck. Among those highly lauded for their actions were Carl Rastetter, KKV1192, and Jack Dunlap, KKV5114. The two patrolled F.M. Road, two miles due east of Cotton Center, heading directly into the storm to seek out its intensity and report to the CB Civil Defense Center in Hale Center. A bolt of lightning no doubt saved *their* lives—the flash revealed that the black funnel was directly in front of their automobile. Whipping the car in the opposite direction, Rastetter shouted his findings over the air, warning that the twister was headed straight for Hale Center.

The two men stayed directly ahead of the storm, leaning on the horn to warn as many farmers in the area as possible. In their race to beat out the tornado (staying close enough to report changes in its direction), they could only watch as the twister bore down on the Floyd Shackelford farm. It destroyed the farm, and killed Mrs. Dorothy Shackelford. Rastetter and Dunlap were among the first to give aid.

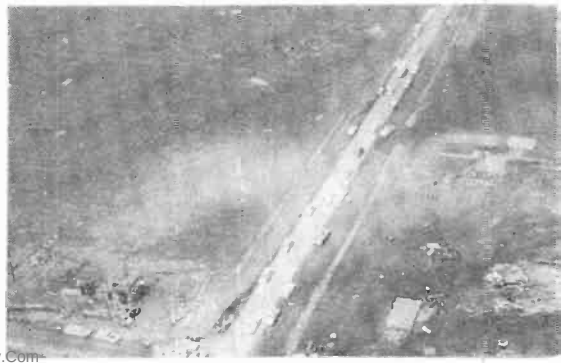
The CB'ers at the home base stations went into action immediately upon receiving the news that the tornado was bearing down on the city. Many of them got into their mobile rigs and drove around Hale Center, honking their horns, and spreading the word. The tornado warning siren was activated for a solid 30 minutes. It was reported that the CB'er in charge held the warning button down until the tornado was but one block from him, then fled, but not before falling debris from the twister had smashed his car.

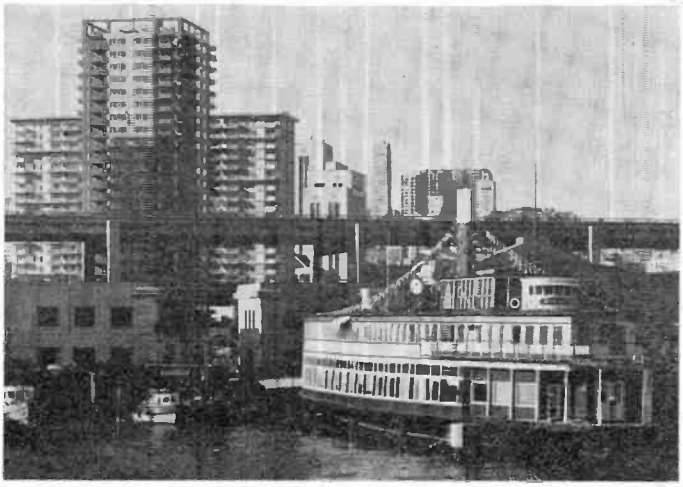
In Joe Stubblefield's own words: "The tornado was visible for 15 minutes as it zigzagged across the countryside. . . . Then with a frightening rumble like a dozen freight trains, or a fleet of jet airplanes, it came screaming into the city. . . . After de-

(*Continued on page* 88)

The tornado that swept through Hale Center, Texas, last June, demolished three farm homes (including that of Floyd Shackelford, below, right), left five dead, and hundreds homeless. The CB'ers in the area risked their lives to warn and protect others

Photos by Hale Center American





Converted ferry was stripped of machinery and engines, and connected to city water, gas, electricity, etc. Problem was to prevent the hull from rusting away without yearly dry-docking.

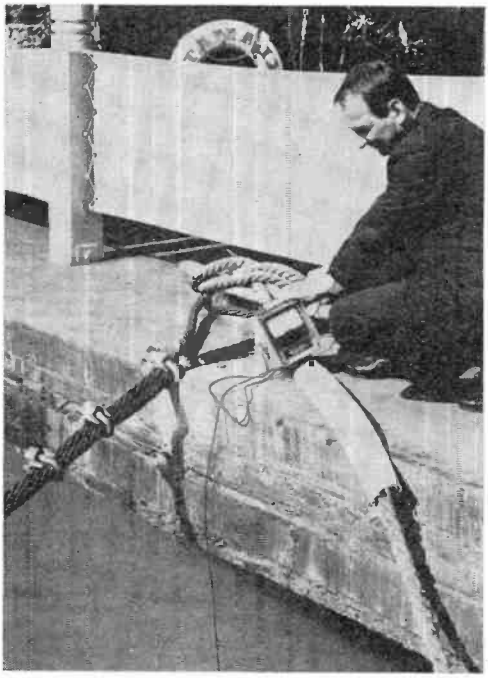
REVERSE CURRENT KEEPS FERRY AFLOAT

WHEN the San Francisco firm of J. Walter Landor ran out of space, it simply bought one of the last of the Bay ferryboats. The company tied the boat up to a dock and converted the topside into offices. Keeping the steel hull of the 40-year-old ferry from scuttling the studios and staff was a problem.

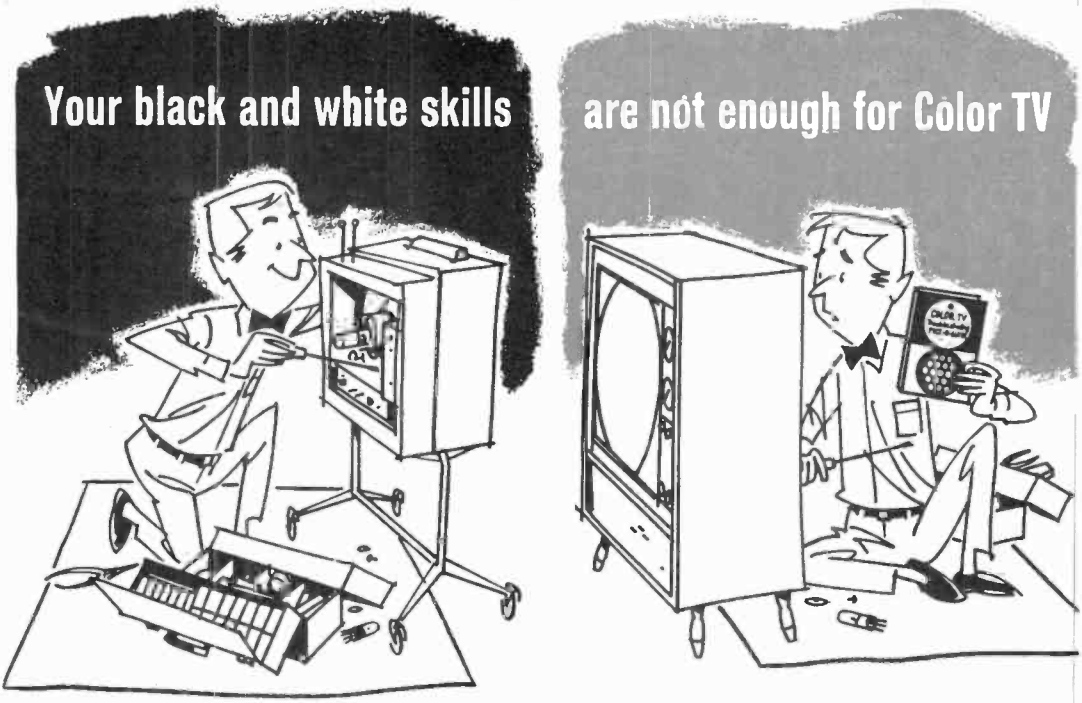
A permanently moored ferryboat is corroded by the electrolytic action of sea water. One ampere of d.c. will wear away 20 pounds of steel each year. To overcome this action, designer Alexis Tellis dropped four carbon anodes over-side and fed them d.c.—reversed to the corrosive action of the hull. A solid-state rectifier supplies 0.85-0.95 volt to the rods. More voltage damages the paint; less voltage corrodes the hull.

—William P. Brothers

Designer Alexis Tellis examines one of four carbon anodes dropped around steel hull. Anodes, charged with d.c. equal to that ferry would ordinarily lose by electrolytic action, counteract current flow.



Electrical potential of steel hull is measured every month. Brass studs brazed to hull give solid electrical contact, accurate reading. Amount of d.c. current required depends on exposed hull area.



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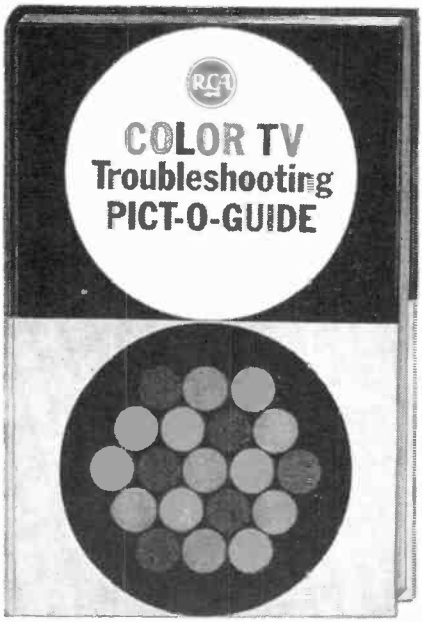

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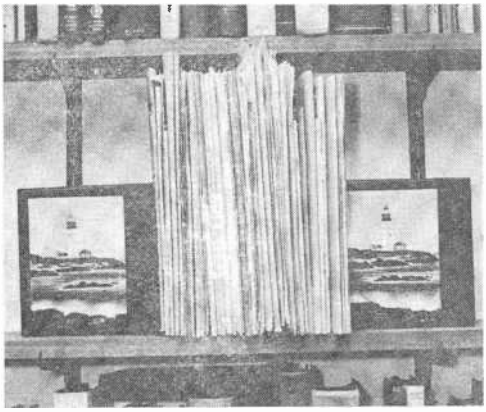
CIRCLE NO. 35 ON READER SERVICE PAGE

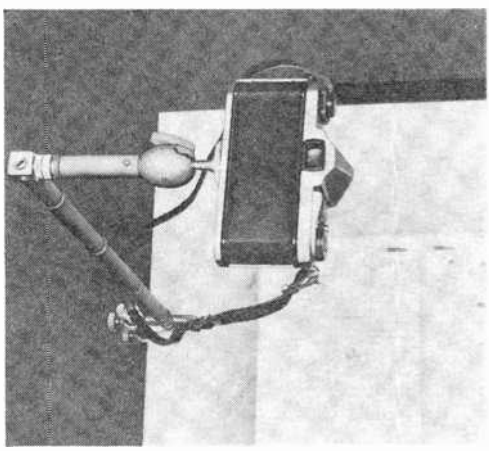
MICROFILM YOUR MANUALS



Getting cramped for space? Why not dump that clutter?

WHETHER your electronic interests are concerned with ham radio, hi-fi gear, or general experimentation, before long you collect a mass of instruction manuals covering construction and alignment of kits, operation of test equipment, and servicing notes. You start by lining them up on a bookshelf, and the result is anything but neat. If a file drawer is available in a cabinet or desk, you soon fill that to overflowing with manuals. Something has to be done. I solved the problem of storage, and threw out all my instruction manuals. Not the information contained therein . . . just the manuals.

Initially, I tried to record the information from the instruction manuals on tape. This worked until I came to a schematic diagram. It was then that I uncovered the ultimate answer—copying the instruction books on film. Using 35-mm. black and white film, with a 36-exposure roll running about 85 cents, the cost is pretty low.



Your best bet is a single lens reflex rigidly mounted over the book. One page fills a film frame.

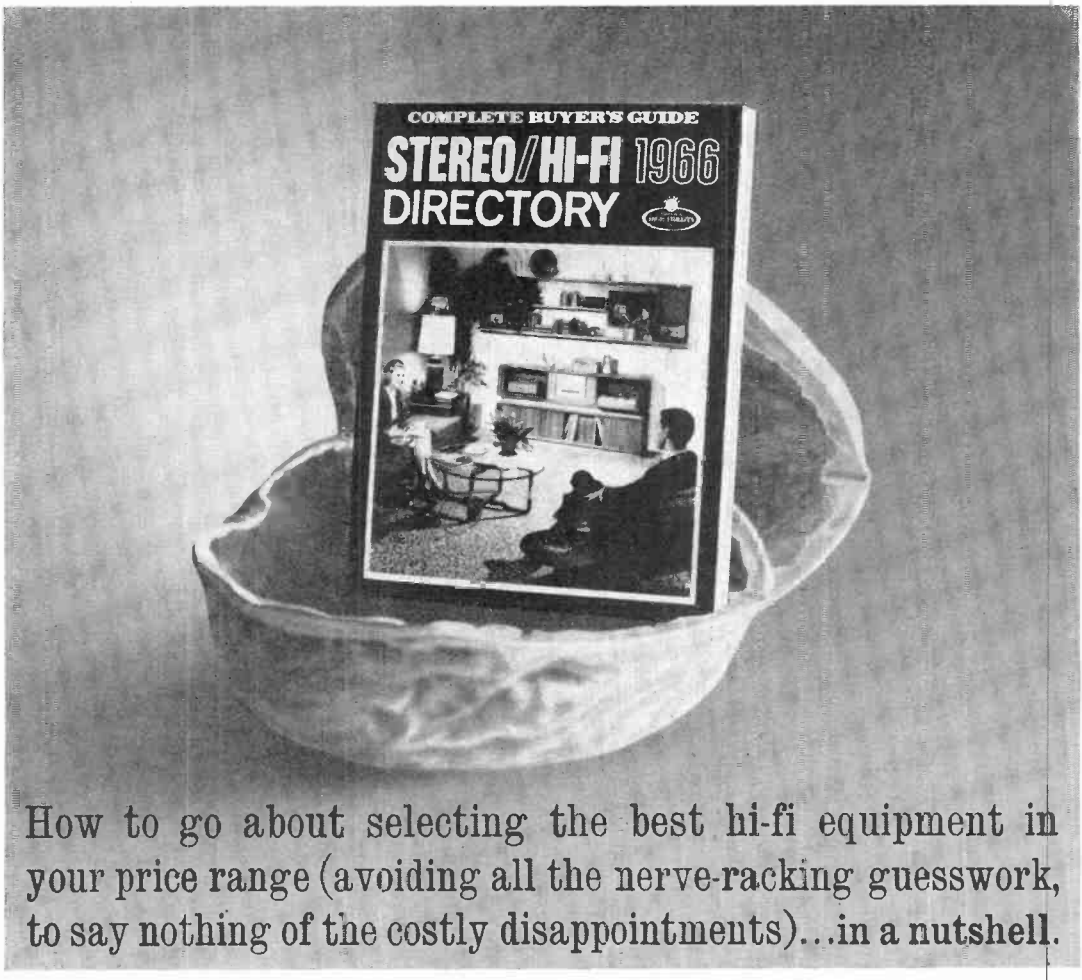
Most of what you photograph is straight line work, and preservation of tone gradients is of no consequence. Kodak high-contrast copy film is your best bet, but any black and white film can be used. A rigid support is needed for the camera. You only have to focus once for each book, as the camera-to-page distance remains constant. Set a pair of No. 2 photofloods at either side of the book to provide good lighting.

It's important that the manual pages lie absolutely flat. Try cutting the pages out of the books and placing a sheet of glass over each page to be copied. Check through the camera viewer to be sure that no glare is reflected from the glass.

Don't throw the pages away until after you see the negatives. If the negatives are good and black in the white areas, and crystal clear in the printed areas, then you can start junking the instruction books.

There are several ways of retrieving the information stored on the film. One method is to mount the negatives in cardboard slide mounts. They can then be projected with any slide projector. As you are dealing with high contrast black and white, ordinary room lighting will not interfere with the projection. If you have a film strip recorder, keep the film in strip form and use the projector to view the information.

—Byron G. Wels, K2AVB



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The ultimate in fire and police receivers Our TM Monitoradio combines the reliability of transistors with a three-way power supply to stay on-call 24-hours a day. Features: your choice of high or low bands, vinyl-laminated steel case, electronic squelch. **$99.95**

☐ DR-200 MONITORADIO

Our finest two-band, tunable FM receiver Features: provision for tunable (high or low bands) operation and/or two crystal-controlled frequencies; power transformer for 120 V AC operation only; all-electronic squelch; illuminated slide-rule dial. **$169.50**

☐ EXCITING NEW WORLD TRAVELER!

Roam the world without leaving home—This four-band SWL set brings foreign, aviation, emergency, military and maritime broadcasts into your home with three times the sensitivity of comparably-priced units. It has a transformer power supply to eliminate possible electrical shocks (hot chassis), and these features: noise limiter on/off switch; separate mixer, oscillator and tube sections; and headset phone jack. **$69.95**

☐ PR-35B FM RECEIVER

Our lowest-priced emergency receiver—Features: Transistorized squelch circuit, temperature compensated superhetrodyne circuitry to minimize drift, 4-inch speaker, rugged plastic cabinet. **$59.95**

☐ FLIGHT MONITORADIO

Tune in on the exciting world of aviation This unit out performs "commercial grade" aircraft receivers. Features: built-in 5-inch speaker, illuminated slide-rule-calibrated dial, scratch- and mar-proof vinyl-laminated steel cabinet. **$79.95**

☐ TUNABLE MOBILE RECEIVER

This is the one the pro's use—Features: 12 VDC power supply and cord, fully-tuned RF stage for better image rejection, 3-gang condenser, built-in electronic squelch, illuminated slide-rule dial, ventilated metal cabinet, universal mounting. **$114.95**

Regency

A 12-Month Warranty is yours with Every Regency Receiver

Regency Electronics, Inc.
7900 Pendleton Pike • Dept. PE-12
Indianapolis, Indiana

CIRCLE NO. 36 ON READER SERVICE PAGE

time you get what really want for Christmas?

Just leave this ad lying around where your wife (or husband) can find it.

How to use this readers' gift-hinting service . . .

Sure, you could use some more shirts. Socks would be nice, too. But wouldn't you *really* rather have one of these Regency or Metrotek beauties?

So go ahead. Put a check in the box above the one you've been wanting. Then leave this ad lying around some place where your wife (or husband) can't miss it.

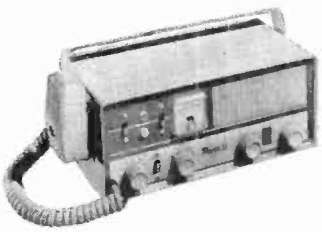
This isn't very subtle. But it's better than just telling her outright. You can bet she'll get the hint. And you won't get surprised with another hand-painted tie.

To make it really easy on her, write the name and address of the Regency or Metrotek dealer nearest you somewhere on this ad.

☐ NEW! COLT 23

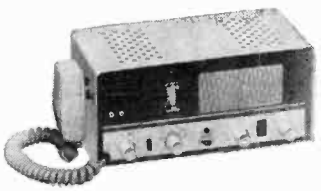
Every channel crystal-controlled—You can get crystal-controlled transmission on all 23 CB channels . . . when you choose the new Colt 23. What's more, this transceiver has many of the features that you'd expect to find only on sets costing much more: double conversion superhet receiver, illuminated "S" meter, automatic noise limiter, positive squelch control, mobile mounting bracket, built-in AC and transistorized 12 VDC power supplies. Complete with channel 11 crystal. **$129.95**

☐ NEW! PACER II



Eleven crystal-controlled channels for industry's lowest price—is just one of the reasons why Pacer II is your best buy in CB transceivers. It also gives you a built-in, solid state DC power supply, an ANL switch and a big, easier-to-read "S" meter. Plus these important features: 23-channel superhet receiver, positive squelch control, and a quick-change, external crystal socket. Comes complete with channel 11 crystal, mobile mounting bracket, carrying handle, AC and 12 VDC power cords. **$99.95**

☐ NEW! MUSTANG II

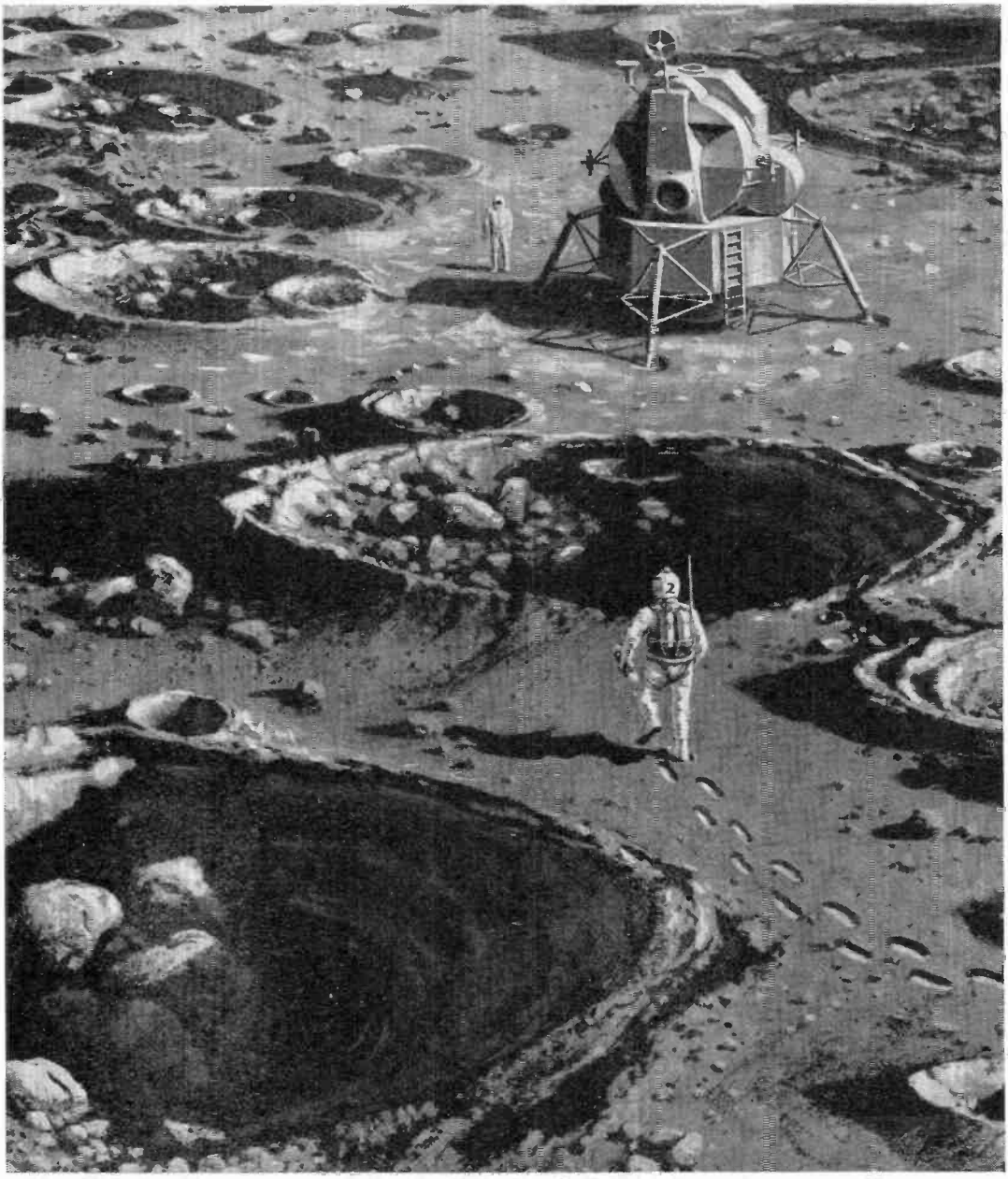


Get started in CB for less than $80—When you choose our new Mustang II, you get the perfect answer to a low-cost start in CB. What's more, Mustang II has eight crystal-controlled channels, a quick-change, external crystal socket; "S" meter; spotting switch; 23-channel, tunable receiver; positive squelch control. And this fine unit comes complete with channel 11 crystal, PTT mike, 12 VDC power supply cord. **$79.95**

METROTEK
ELECTRONICS, INC.

a subsidiary of Regency Electronics, Inc.
7900 Pendleton Pike • Dept. PE-12A
Indianapolis, Indiana

CIRCLE NUMBER ON READER SERVICE PAGE



It will take thousands of electronics technicians to put man on the moon

will you be one of them?

To put men on the moon requires an army of electronics technicians working behind the scenes. These technicians will be men who, like yourself, started their careers with a healthy interest in electronics, and the foresight to realize what a major role electronics will play in the future. Many of them will have taken their first step in this exciting field by sending for the free book from RCA Institutes. This book, more than any other, shows you how much more you get with RCA Institutes Home Training, and how thousands of men, like yourself, have built, and are building the most rewarding careers the field of electronics has to offer. Read how right this minute, you can do the same!

Compare RCA Training With That Of Any Other School

Here Are 6 Solid Reasons Why Your Choice Should Be RCA:

1. Wide Choice of Courses. RCA Institutes lets you learn at home in your spare time the major fields of electronics with complete, step-by-step, easy to understand courses. Choose from the following:

- Communications Electronics
- FCC License Preparation
- Mobile Communications
- Automation Electronics
- Automatic Controls
- Industrial Applications
- Nuclear Instrumentation
- Digital Techniques
- TV Servicing
- Color TV Servicing
- Transistors
- Electronics Fundamentals (in English or Spanish)
- Computer Programming
- Drafting

Each of these home training courses gives you the latest, up to the minute training you need to start toward a successful career in the electronics field of your choice!

2. New, Easier Way to Learn. Only RCA Institutes gives you an exclusive, fast, easier way to master the essentials of electronics. The RCA "AUTOTEXT" Instruction Method, a system of programmed instruction developed by RCA, and introduced by RCA Institutes will help you learn almost automatically. Programmed instruction has been proved with thousands of students—even those who have had trouble with ordinary home training methods in the past. For those just starting out in electronics, there's no better way to begin!

3. Top Quality Equipment. RCA Institutes assures you of prime quality equipment in the kits furnished to you with the courses you take. The essential instruments you build with these kits are yours to keep and use on the job. And each one is complete. You never have to take apart one piece to build another as some home training courses require you to do! Compare what RCA gives you with any other school.

4. Personal Guidance. You may receive personal guidance every week from one of the many top instructors in the field at RCA Institutes to help you with your home training program. Conveniently located in the heart of New York City.

5. Liberal Tuition Plan. RCA Institutes offers you the most economical possible method of home training through its Liberal Tuition Plan. You pay for lessons only as you order them. If, for any reason, you should wish to interrupt your training, you may do so and you will not owe one cent until you resume the course. No long-term obligations, ever!

6. Ideal for Beginners and Advanced Students. If you are already in electronics, RCA Institutes advanced home training courses will help you get ahead faster and secure your future, by teaching you the most recent developments in your field. If you are just starting out in electronics, RCA electronics fundamentals courses will give you the foundation you need for building a career!

IF YOU PREFER CLASSROOM TRAINING, RCA OFFERS YOU THE BEST.

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

OUTSTANDING PLACEMENT RECORD

RCA Institutes Resident School has a Free Placement Service available to all students. In recent years, 9 out of 10 who used this service have found their jobs waiting for them on the day they graduated! And many of these jobs are with top companies in the field—such as IBM, Bell Telephone Labs, General Electric, RCA, and radio and TV stations and other communications systems throughout the country!

PLAN FOR A SUCCESSFUL FUTURE IN ELECTRONICS NOW! SEND FOR FREE BOOK! CHECK HOME TRAINING OR CLASSROOM TRAINING. NO OBLIGATION. NO SALESMAN WILL CALL. USE ATTACHED POSTCARD.

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A Service of Radio Corporation of America
350 West 4th St., New York, N.Y. 10014

THE MOST TRUSTED NAME IN ELECTRONICS

ON THE CITIZENS BAND

(*Continued from page 77*)

molishing three farm homes . . . it bounced into town from the west . . . aimed at the heart of the business district . . . down 5th and 6th Streets . . . smashing everything in its path, destroying homes, automobiles, and trees."

In its five-minute path of destruction through the city, the tornado left hundreds homeless and five dead. It left the business district practically a shambles, destroying the new City Hall and two new fire engines; it destroyed a new $265,000 Baptist church, the grade school, the post office, a two-story hotel, and 22 stores. An automobile agency was also destroyed along with 110 new cars, 15 of which had been blown over onto a new freeway underpass just built in the heart of the city. Some 200 homes were destroyed or badly damaged. The total financial loss was estimated at more than two million dollars.

Hale Center Texans will undoubtedly long remember those five minutes as well as the courageous CB operators who, with the aid of their Citizens Band Radio facilities, saved the lives of so many citizens.

CB'ers in Canada. CB'er R. A. Tabberer, 17W6327, of Prairie Village, Kansas, was highly impressed with the handling of his request to the Department of Transport in Canada for a Tourist Radio Service license. His two trips into the country during August and September (combining business with a vacation) took him into Ontario, Saskatchewan, and Alberta. He voiced his praises in a letter directed to the DOT, thanking them for the privilege of being able to use his CB gear in Canada "if and when the need arises."

If you are planning a trip into Canada, be sure to apply for a TRS license at least 30 days before entry, and remember that the DOT wants to know your name and address, your CB call-sign, class of service (Class D), and the period of time you intend to be in the country. Keep in mind also that U.S. CB'ers must follow General Radio Service rules and regulations when operating in Canada, and that only GRS channels 4 through 22 may be used.

In making an application for a TRS license, send your request to the DOT office nearest the Port of Entry at which you plan to enter the country. Address your request to the Regional Superintendent, Radio Regulations, Department of Transport, at one of the following locations:

PORTS OF ENTRY	REGIONAL OFFICE
British Columbia	739 West Hastings St. Vancouver 1, B.C.
Alberta	Federal Building 9820 107th St. Edmonton, Alberta
Saskatchewan, Manitoba, Ontario, east including Port Arthur	Winnipeg General P.O. Bldg. 266 Graham Ave. Winnipeg 1, Manitoba
Quebec	Regional Administration Bldg. Dorval, Quebec
Ontario, excluding Port Arthur and west	25 St. Clair Ave. East Toronto, Canada
New Brunswick, Nova Scotia, Prince Edward & Newfoundland	Federal Building P.O. Box 42 1081 Main St. Moncton, New Brunswick

Club News. E.D.C. is the abbreviated reference given to several CB teams in the Lake County, Illinois, area involved in "Emergency Disaster Communications." Lake County is divided into seven areas, each one having an assigned control captain and an assistant in charge of a team. All units are supplied with a directory containing unit names, addresses, call-signs, and

(*Continued on page 92*)

FALL OUT!

The all-new *Fall* 1965 edition of ELECTRONIC EXPERIMENTER'S HANDBOOK is *out*—available to you right now! 148 pages—30 challenging new projects—complete plans, parts lists, how-to instructions, pro tips and techniques. Scintillating entertainment, sheer fun, sure way to sharpen your skills! Clip out coupon and mail *today!*

NOTE: Electronic Experimenter's Handbook is now published twice yearly—Spring & Fall editions. **$1.25**

GET THE DELUXE GOLD EMBOSSED LEATHERFLEX-BOUND EDITION . . . $3

A valuable "first"—a collector's item that belongs in your electronics library.

ZIFF-DAVIS SERVICE DIVISION, Dept. EEH
589 Broadway, New York, N.Y. 10012

Yes! Send me a copy of the Fall, 1965 ELECTRONIC EXPERIMENTER'S HANDBOOK as I've indicated below:

☐ **$1.25 enclosed,** plus 15¢ for shipping and handling. Send me the regular edition. ($1.50 for orders outside U.S.A.)

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

name _____ please print PE-125

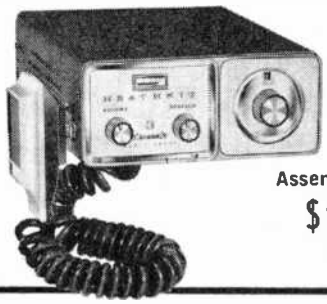
address _____

city _____ state _____ zip code

PAYMENT MUST BE ENCLOSED WITH ORDER.

Have You Seen These New

New 23-Channel 5-Watt All-Transistor CB Transceiver



Kit GW-14
$89.95

Assembled GWW-14
$124.95

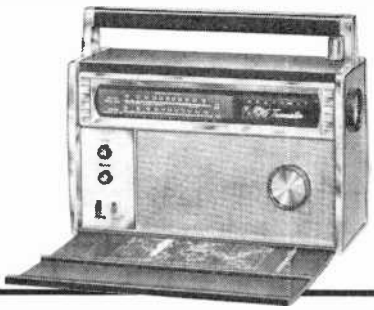
23 crystal-controlled transmit & receive channels for the utmost reliability. Low battery drain . . . only .75 A transmit, .12 A receive. Only 2⅞" H x 7" W x 10½" D . . . ideal for car, boat, any 12 v. neg. gnd. use. "S" meter, adjustable squelch, ANL, built-in speaker, PTT mike, aluminum cabinet. 8 lbs. Optional AC power supply, kit GWA-14-1, 5 lbs. . . $14.95.

New Fully Automatic Electronic CW Keyer

Kit HD-10
$39.95

All-transistor circuitry. 15-60 words per minute. Solid-state switching—no relays to stick or clatter. Convertible to semi-automatic operation. Built-in paddle. Self-completing dashes. Variable dot-space ratio. Built-in sidetone. Keys neg. voltages only, such as grid-block keying. Transformer-operated power supply. Fused. 6 lbs.

New All-Transistor, 10-Band SWL Portable



Kit GR-43
$159.95

10 bands tune longwave, broadcast, FM and 2-22.5 mc shortwave. 16 transistors, 6 diodes, 44 factory-built & aligned tuned circuits. Two separate AM & FM tuners, two built-in antennas, 4" x 6" speaker, battery-saver switch. Operates anywhere on 7 flashlight batteries or on 117 v. AC with optional charger/converter GRA-43-1 @ $6.95. Assembles in 10 hours. 17 lbs.

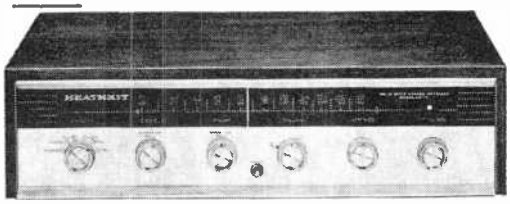
New Deluxe 5-Band SSB Ham Transceiver

Kit SB-100
$360.00

Full SSB-CW transceive operation on 80-10 meters. 180 watts PEP SSB—170 watts CW. Switch select for USB/LSB/CW operation. Operates PTT and VOX; VOX operated CW with built-in sidetone. Heath SB series Linear Master Oscillator (LMO) for true linear tuning. Mobile or fixed operation with appropriate power supply. 23 lbs. . . Accessory mobile mount, SBA-100-1 . . . $14.95.

Gift Ideas From Heath?

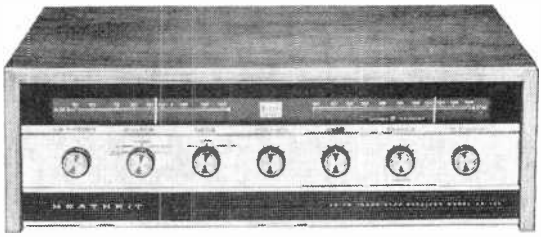
New 30-Watt Transistor FM Stereo Receiver



Kit AR-14 $99.95 (less cabinet)

31 transistors, 11 diodes for transparent transistor sound; 20 watts RMS, 30 watts IHF music power @ ±1 db, 15-60,000 cps; wideband FM/FM stereo tuner, two pre-amplifiers, & two power amplifiers; compact 3⅞" H x 15¼" W x 12" D size. Assemble in around 20 hours. Mounts in a wall, or optional Heath cabinets (walnut $9.95, beige metal $3.95). 16 lbs.

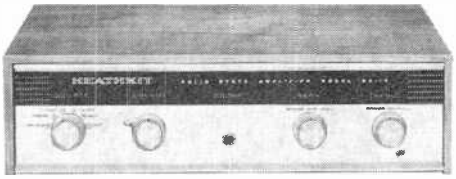
66-Watt Transistor AM/FM Stereo Receiver



Kit AR-13A Now Only $184.00

Just add 2 speakers for a complete stereo system. Boasts AM/FM/FM stereo tuning; 46-transistor, 17-diode circuit for natural transistor sound; 66 watts IHF music power (40 watts RMS) at ±1 db from 15-30,000 cps; automatic switching to stereo; preassembled & aligned "front-end" & AM-FM IF strip; walnut cab. 35 lbs.

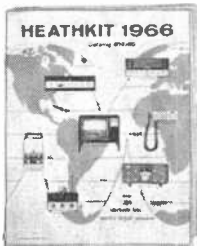
New 30-Watt Transistor Stereo Amplifier



Kit AA-14 $59.95 (less cabinet)

17 transistors, 6 diodes; 20 watts RMS, 30 watts IHF music power @ ±1 db 15-60,00 cps. Accommodates phono, tuner, auxiliary . . . 4, 8, 16 ohm speakers. Bookshelf size: 10¼" D x 3" H x 12" W. Install in a wall, or Heath cabinet (walnut $7.95, beige metal $3.50). 10 lbs. . . . Matching FM/FM stereo tuner available @ $49.95.

HEATHKIT®



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Heath Company, Dept. 10-12
Benton Harbor, Michigan 49023

☐ Enclosed is $_____ plus shipping. Please send model(s)

_____

☐ Please send FREE 1966 Heathkit Catalog.

Name_____

Address_____

City_____ State_____ Zip_____

Prices & Specifications subject to change without notice. CL-226

CIRCLE NO. 16 ON READER SERVICE PAGE

telephone numbers. Important emergency phone numbers, such as those of the police and fire departments in all the areas involved, plus State Police, Civil Defense and civil offices, are also included. Some team members act as field men for the Red Cross and participate in emergencies by looking the situation over, then making a report to the control captain, who, in turn, notifies the Red Cross and advises them of specific needs to cover the situation.

The St. Anthony's CB Emergency Group, Denver, Colo., was organized in August, 1962, by St. Anthony's Hospital for the purpose of using CB radio as a means of communicating in conjunction with Civil Defense. According to the setup, convoy leaders are to determine the use of one of three routes to escort doctors, nurses, anesthetists, and other personnel to a Civil Defense hospital located underground at Georgetown, Colorado. The hospital is completely stocked with all items vital in a time of disaster. Communications involving CB'ers are to include the passing of information from a base station at the hospital to relay stations at Bergen Park, Squaw Mountain, Empire, and Georgetown. The relays would be tied in with the mobile rigs in each member's auto. Every fourth Sunday of the month, at 5 a.m., CD test runs are held by the group. In order to qualify as a participant, each member must have a CB transceiver and be licensed to operate his gear under CD and FCC regulations. Each member is also registered with Civil Defense and carries an identification card.

CB Chatterbox editor Don Cortright, Cereal City Citizens Radio Club, Inc., Battle Creek, Mich, advises that the club has received a license from the FCC for 75 units. The purpose of the application was to enable members to continue to use channel 3 for club business without infringing upon interstation restrictions. Use of the club call-sign has been restricted to members for club activities, and is being handled under the control of the executive board. Only members who sign an agreement to the above (which Don states is required by FCC regulations) are issued a unit number.

1965 OTCB Club Roster. The following list of clubs reporting in for the first time wraps up our tabulations for this year. If your CB club has not been listed in this column, or if your group has not reported during 1965, start the new year right by sending the details now to: 1966 Club Roster, POPULAR ELECTRONICS, One Park Avenue, New York, N. Y. 10016.

Chicago, Illinois: Four Points Radio Organization. Club publishes a well-written monthly newspaper, *The Four Pointer*. Staff includes Warren Shulz, editor; Ed Schwartz,

NEW Heathkit® All-Transistor 23 Channel 5-Watt CB Transceiver

Kit	Factory Assembled
$89.95 (LESS AC POWER SUPPLY SHOWN)	$124.95

Transceiver Kit & 46 Crystals . . . . $169.90!

- ★ 23 crystal-controlled transmit & receive channels
- ★ 14 transistor, 6 diode circuit for cool, instant operation and low battery drain—.75 A transmit, .12 A receive
- ★ Full 5 watt performance . . . minimum of 3 watts RF output, plus 3 watts audio modulating power
- ★ Front panel "S" meter indicates signal strength & relative power output . . . aids in alignment
- ★ Adjustable squelch control eliminates speaker hiss during standby
- ★ Automatic noise limiter minimizes noise from ignition systems, electric motors, etc.
- ★ ½ uv sensitivity for 10 db signal plus noise to noise ratio
- ★ Built-in PM speaker
- ★ Easy to build with circuit board construction
- ★ Attractive TURNER ceramic PTT microphone
- ★ Handsome die-cast, chrome-plated front panel with rust-resistant aluminum charcoal gray cabinet
- ★ Includes power cables & crystals for 1 channel (Specify) and gimbal mount for versatile installation
- ★ Base mount AC power supply for "fixed" station available soon

Kit GW-14, 8 lbs. **$89.95**
Assembled GWW-14, 9 lbs. **$124.95**
Kit GWA-14-1 AC Power Supply for "fixed" station operation **$14.95**

FCC license required. Use must comply with Part 95 FCC Regulations.

Compact "Fit-Anywhere" Size!
Only 2⅞" H x 7" W x 10½" D . . . ideal for car, boat, jeep, tractor, any mobile installation.

Complete 23-Channel CB Crystal Pack . . . $79.95!
Regular $135.70 value! 46 transmit & receive crystals for complete GW-14 operation. Order GWA-14-2, 1 lb.

4 Money-Saving Reasons To Buy Heathkit CB!
1. New Lower Prices On All Units
2. 5% Discount On Any Two 5-Watt Unit Buy
3. New Lowest Cost All-Transistor 5-Watt Transceiver . . . Kit Or Wired!
4. Lowest Crystal Prices . . . $1.99 Each With Order Of One Or More Transceivers!

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Prices & Specifications subject to change without notice. GX-142R

CIRCLE NO. 16 ON READER SERVICE PAGE

REACT editor; and Dan Sonneborn, junior auxiliary editor. Club president is Don Hahn.

Lowell, Massachusetts: Highway Emergency Locating Plan. Organized last July, the main purpose of this group is to aid motorists in distress. They monitor channel 9, and are presently organizing chapters across New England and Massachusetts. The Lowell H.E.L.P. group is the only rescue organization in Lowell currently approved by the Mayor. Present officers are: Raymond Reynolds, KBD0312, regional director; Daniel Enis, KKA9973, assistant regional director; Michael Lekakos, KKA-6667, membership director; Ted Macopoulas, KMA0535, treasurer; and Lester Griffin, KKA8502. control monitor.

Somers Point, New Jersey: Coastal Communications League. Organized in March, 1963, this club was immediately called in by Civil Defense to assist in a fire emergency —a dry spell had created several fires in woods and farm areas. Members used walkie-talkies on fire trucks, on their own mobiles, and at a base station, and covered the area for 48 hours in search of additional fire hazards. Since then CCL members have aided the New Jersey Marine Police in locating missing or overdue boats on the river and in the bay area, and have participated in traffic control at special events. Officers include: Edward Leopold, president; Paul Heriegal, first vice president; William Hodson, second vice president; Cathy Heriegal, secretary; Marie Cramer, treasurer; and a five-member board of directors.

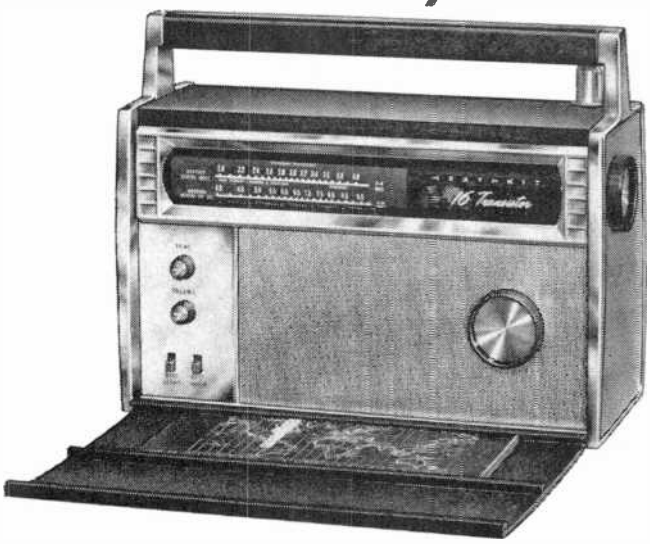
Other clubs reporting: In *London, Kentucky*, Laurel 11 Meter Club; in *Bethesda, Maryland*, Radio Associates of Montgomery County, Inc.; in *Woodbridge, New Jersey*, Raritan Area REACT; and in *Norristown, Pennsylvania*, the Junior Citizens Band Club.

I'll CB'ing you—next year!

—Matt, KHC2060

'Round The World Cruise Only $159.95

DEPARTURE TIME:
10 Hours After
Opening The Carton



Travel Anywhere In The World, First-Class, On Longwave, Standard AM, FM, and 7 Shortwave Bands with this New Heathkit All-Transistor Portable

Tour The Voice Capitols Of The World. Your round-trip ticket to unsurpassed global listening is always ready when you own this superb new Heathkit 10-Band Portable Radio. Seven Bands tune 2-22.5 mc shortwave, marine and amateur stations. Longwave 150-400 kc tunes aircraft and marine stations. FM Band, 88-108 mc—full coverage—full fidelity. Standard AM band 550-1600 kc. All with a sharpness of tuning that permits receiving stations you've never heard before.

16 Transistors, 6 Diodes, 44 Factory-Built And Aligned RF Circuits assure cool, instant operation, superior performance, long life, and easy assembly. Two separate AM and FM tuners are ready to drop into place (the FM tuner and IF strip are the same components used in deluxe Heathkit FM Stereo equipment).

Two Built-In Antennas . . . one in carrying handle for AM, and 5' telescoping whip for FM and Shortwave.

Convenient, Versatile Controls. Like the Battery-Saver Switch that reduces power to 150 milliwatts for normal indoor listening (cuts battery drain as much as 35%), or boosts power to 500 milliwatts for strong, outdoor reception. The handsome rotating turret dial scale is directly driven by a 10-position selector, permits easy viewing of any single band (a log scale is provided for re-locating unknown stations). There's a battery saving Dial Light switch for nighttime use; Automatic Frequency Control with on-off switch for drift-free, accurately tuned FM; a big, 8½ revolution Tuning knob easily separates stations; a combination on-off-volume control; and a continuous Tone Control for listening as you like it.

Big 4" x 6" Speaker, plus earphone for private listening.

Inexpensive, Flashlight Battery Power. Uses 6 "D" size batteries to operate the radio, plus 1 "C" battery for the dial light (batteries not included). Also operates on 117 VAC with the optional converter/charger available.

Deluxe Styling Matches Its Deluxe Performance. Jet black extruded aluminum front and back panels contrast with luxurious chrome-plated, die-cast end pieces to present a rugged, handsome unit you'll be proud to take anywhere. Hinged front and back panels open and close easily thanks to special magnetic edges . . . no cumbersome snaps or latches. Inside the front panel you'll find a hard-bound "listener's guide" book containing frequencies of worldwide Shortwave and U.S. FM stations plus a special map for easy conversion of world time zones. It travels snugly in its own special slot in the front panel.

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CIRCLE NO. 16 ON READER SERVICE PAGE

PULSE POWER PACK

(*Continued from page* 46)

different color wire for each lead to avoid confusion. It's also a good idea to lace the wires as shown, to facilitate mounting and removal of the circuit board.

As a final word, observe that the two 1" standoffs are secured with the bottom screws of the power transistors. If you happen to use metal standoffs, do not let them come in contact with any of the components on the circuit board. If you can get non-metallic standoffs, you should do so.

Operation. After you have completed the wiring, check out the unit thoroughly before plugging it in, and thus save yourself from a possible headache later on. Connect the output jacks (*J3* and *J4*) to the tracks (at this point polarity doesn't matter).

Before turning the power switch *on*, set the *CRAWL* switch (*S2*) to the *off* position, and flip the *DIRECTION* switch (*S4*) to *FWD*. Also, turn the *THROTTLE* control fully counterclockwise but without turning off the switch that's ganged to it (you will hear a distinct "click" if the switch is turned off).

Now, flip the *PWR* switch to *on*. If the trains move at all, *R13* is too high in value and must be reduced. Successively try a smaller resistor (reduce the resistance by about 10% in each step) in place of *R13* until you find one that will just cause the train to stand still. When you do, leave that resistor in. Slowly rotate the *THROTTLE* clockwise; the train should start up and run forward. If it runs backwards, simply reverse the leads to the tracks.

Turn the throttle counterclockwise, but without flipping *S3* off. Then turn the *CRAWL ADJ* knob fully counterclockwise and flip *CRAWL* switch *S2* to *on*. Your train might growl a little but it should not move. Now slowly rotate the *CRAWL ADJ* knob clockwise until the train begins to crawl real nice and slow. As you give it some throttle, your train will increase in speed realistically—as if it were coming out of Grand Central Station.

Slow down the throttle as you come in to a station and let the train crawl a bit. When you are ready to stop, just rotate the throttle fully counterclockwise until *S3* clicks off for a full stop. With a bit of practice you'll soon be driving your train like the old pros and enjoying many hours of real pleasure. Man, that's railroading! -30-

QUICK CURES

(*Continued from page* 58)

playback. Probably a magnetized playback head, erasing away the signal as it is recorded. Use a head degausser.

8 Squealing, when tape is moving. Probably a glazed spot on a pressure pad or tape guide. Use head cleaner on a Q-tip and soak the pads. Let dry before using.

9 Jerky tape motion. Could be sticking brakes on feed-reel spindle. Adjust but *do not oil.* Recorders today seldom need oiling.

10 No highs. A common problem. Could be caused by magnetized heads, by a playback head out of alignment, by loss through an over-long cable connecting recorder to source, or by use of a microphone to pick up the sound of a loudspeaker instead of a direct connection to a high-level output.

Highs sometimes are lost in the input cables when two sources are joined with a "Y" connector.

11 No playback, no record, no nothing. Tubes or indicator lights dark. Baffling to the beginner, this is one of the easiest things to fix. Check the a.c. cord—is it plugged in? Turn on a light —maybe your current is off. Check the fuses in the basement. Plug a lamp into the same socket as the recorder. If it lights, you know you've got power *to* the recorder. Check for a fuse on the recorder. It may be blown. If the tape motor operates but the tubes won't light, look for another fuse on the electronic chassis. Also, suspect a fuse if the tubes light but the motor won't run.

Fuses *do* blow occasionally for no apparent reason, and a blown fuse does not necessarily indicate trouble. But two in a row mean something is definitely amiss, and it's time for you to call a repairman. -30-

"If I don't like a program, I just shut it off."

SOLID STATE

(*Continued from page 76*)

voltage-divider *R2-R3* bypassed by *C3*, in conjunction with emitter resistor *R1*; this resistor also acts to "float" the emitter above ground. Capacitor *C4* serves as a bypass across the power source.

The frequency of operation is determined by the tank circuit comprised of *C2* and the primary of current-controlled inductor *T1*. Because the inductance of *T1*'s primary coil is a function of the control current applied to its secondary winding, it follows that the oscillator frequency is controlled directly by the applied control current. The output signal is inductively coupled from the resonant tank through *L1*.

The components used in this circuit are by no means inexpensive. Transistor *Q1* is a 2N1493 *npn* r.f. type. Transformer *T1* is a Vari-L MP-1 current-controlled inductor; this unit has a primary inductance of 0.1 μh. when no control current is present and 0.051 μh. with a control current of 60 ma. Coil *L1* is a hand-wound "hairpin" coil mounted in close proximity to the tank circuit. All resistors are half-watt composition types. Capacitors *C1* and *C2* are small ceramic type trimmers, while *C3*, *C4* and *C5* are low-voltage ceramic disc capacitors. The power source is not critical and d.c. or battery supplies of from 10 to 20 volts can be used.

As is true of all VHF circuits, careful layout and "clean" lead dress are essential for optimum performance. Signal leads should be kept as short and direct as is practicable, to keep distributed capacities to a minimum. However, as long as good wiring practices are observed, the builder can follow his own inclinations with regard to construction methods.

Capacitors *C1* and *C2* are adjusted *after* the wiring has been completed and checked. In general, *C1* is adjusted for best operation under load, while *C2* is adjusted to establish either the upper or lower frequency limit (with the control current either at maximum or minimum). Afterwards, the desired operating frequency can be obtained by adjusting the control current itself. Approximately 4.5 volts are required to furnish the required maximum control current. If a d.c. source is used, the circuit will oscillate at a fixed frequency established by the control current amplitude. If an a.c. source is used, the circuit will "sweep" through a given frequency range at a sweep rate determined by the frequency of the a.c. source.

Transitips. Almost every experimenter knows that source and load impedances *must be matched* for optimum circuit performance and for maximum power transfer between, say, an output amplifier and its loudspeaker load. This is true whether we are dealing with d.c., a.c., audio, or r.f. circuits. Of all these circuits, the high-frequency r.f. ones are the most critical. At d.c., low a.c., and audio frequencies, an *exact match* is not as essential as you might suppose and, in practice, fairly good results can be obtained with a relatively poor impedance matching.

No, your textbooks aren't wrong! Maximum power transfer *does* occur when impedances are matched, but the loss of power with even a relatively large mismatch may be negligible. An example will illustrate our point. Referring to Fig. 3, we have a 10-volt d.c. source with an internal resistance (*R*) of 100 ohms, and a choice of three possible loads: 100 (*R1*), 200 (*R2*), and 50 (*R3*) ohms. Let's see what happens as each load is connected to the source.

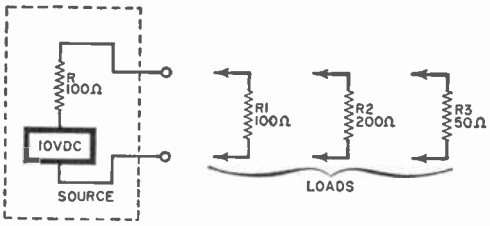

Fig. 3. Source and loads used to demonstrate wide latitudes of impedance mismatch that can be tolerated when operating in the low-frequency spectrum.

When *R1* is connected, the total resistance in the circuit is 200 ohms. Using Ohm's law for d.c. power, $P = E^2/R$, we can determine that a total of 500 milliwatts is developed. Half of this, 250 milliwatts, is delivered to the load, while the other half is dissipated internally by *R*.

Now, suppose we double our external load and connect a 200-ohm load (*R2*) in place of *R1*. Again, using the d.c. power law, we can determine that approximately 333 milliwatts are developed—two-thirds of which (222 milliwatts) is delivered to the load. Compared with the 250 milliwatts for the matched load impedance (*R1*), you can see that the difference is only about 10%.

Now, let's cut the load impedance in half and connect the 50-ohm load (*R3*) in place of *R1*. Applying the same mathematical equation, we find that approximately 666 milliwatts are developed this time, only one-third of which is delivered to the load (222 milliwatts). As you can see, it doesn't make

any difference which way you go, a 50% mismatch only results in a 10% loss of power to the load.

In practical terms, this means that the hobbyist has a good deal of leeway when choosing substitute components, particularly where audio output transformers and loudspeakers are concerned. For example, if your circuit calls for a 1000-ohm center-tapped transformer, and you have only an 800-ohm unit on hand, you can use the latter without a noticeable loss of power. Similarly, if your transformer has a tap for an 8-ohm loudspeaker, but your speaker has a 6-ohm voice coil, you can use it without trouble. Normally, up to a 50% misatch in load impedance will not cause any noticeable distortion.

There are exceptions, of course. If an amplifier is operated near its maximum output, a smaller-than-normal load impedance may cause distortion. Where inverse feedback or carefully balanced output circuits are used, as in critical high fidelity amplifiers, a severe mismatch can result in a change in the circuit's frequency response. Finally, a high load impedance in high-power circuits can result in dangerously high primary voltages being present; this could damage transistors or other components.

Product News. Motorola Semiconductor Products, Inc. (Phoenix, Ariz.) has expanded its line of low-cost plastic-encapsulated *silicon* transistors to include *pnp* as well as *npn* types. The new *pnp* units include the MPS706, MPS834, MPS2894, MPS3639 and MPS3640. All are switching types, which means that they can be used at r.f. and audio frequencies as well.

If you're interested in developing fair amounts of power in the UHF region, and if price is no object, you might consider the new PT4690 power transistor recently introduced by TRW Semiconductors, Inc. (14520 Aviation Blvd., Lawndale, Calif.). An *npn* silicon planar type, the PT4690 can deliver up to 6 watts at 250 mc. with a gain of 8.5 db . . . and 6 watts at 400 mc. with a gain of 5.0 db.

While on the subject of high frequencies, Texas Instruments, Inc. (13500 North Central Expressway, Dallas, Texas) is now producing a pair of transistors capable of delivering a usable amount of power at up to 2.5 gc. (*gigacycles*). Designated as types TIXS12 and TIXS13, the units offer a guaranteed power output of 250 milliwatts at 1.5 gc. and, as oscillators, are capable of driving harmonic generators to provide power at 12 gc. and beyond.

That closes our story for now. Have a Happy Holiday Season! —*Lou*

AMATEUR RADIO

(*Continued from page 74*)

measurements. But be very careful in making them; the voltages in amateur gear are high enough to kill.

FCC News. After extending the time for filing comments and counter comments on FCC Docket 15928 which would modify amateur regulations (it was reviewed in our July column), the FCC is now considering the proposals contained in this Docket in the light of the over 2000 comments received on it. One interesting effect of the proposals, which will not go into effect under any circumstances for at least a year, is the 10:1 increase in the number of amateurs now taking the Extra Class exam.

The consensus of those taking the exam is that the 20-wpm code test is easier than the written test—probably because most applicants are prepared for the code test. But many applicants underestimate the scope of the written test. From personal experience, we can report that simply being able to answer the questions in the Extra Class section of the ARRL *License Manual* is not sufficient preparation for the test. The questions in the actual examination are often completely different from those in the *License Manual.* Furthermore, one of the examination questions may require combining the information contained in a couple of *License Manual* answers. In addition, the applicant is asked to draw ten of the diagrams shown in the General and Extra Class sections of the *License Manual.*

However, by using the *License Manual* as a study guide in conjunction with the ARRL *Radio Amateur's Handbook* or a similar text, you should be ready to pass the Extra Class written examination within a few months. The big secret is to read each question in the *License Manual* and refer to the *Handbook* index for the pages on which the subject is covered; then study these pages until you understand both the answer and the theory behind it.

News From the Club Papers. The Denver Radio Club's *Round Table* reported

that, on April 22, the Society for the Prevention of Blindness asked Jim, WAØCHT, for help in locating a cornea needed to restore the eyesight of a woman. Through the Eye Bank Network and Ted, WØNTI, a fresh cornea was rushed by plane from Iowa City to Denver the next morning, and the operation was successfully performed that evening.

A San Francisco Radio Club *News* item would seem to refute the generally held belief of Advanced Class licensees that the FCC's proposal to renew Advanced Class licenses as General Class licenses is unfair. It reported that in the question and answer period following a speech by Mr. William Grenfell, W4GF, of the FCC, at the ARRL National Convention at San Jose, Mr. Grenfell pointed out that immediately after the last Advanced Class examination was given in December, 1952, the essence of the Advanced Class examination was included in the General Class examination. In other words, any amateur who has qualified for a General Class license since 1953 actually holds an equivalent to the old Advanced Class license. The FCC's proposal to abolish the Advanced Class license completely, therefore, appears to be merely the recognition of an existing fact.

During a 20-meter contact with Bob, OX4FR, on August 25, he told us that all U.S. personnel operating in Greenland would henceforth be using the prefix "OX" at the "request" of the Danish Government. This information was later verified by the ARRL and the FCC. Bob, formerly KG1FR, also said that it is necessary to include a stamped self-addressed reply envelope with your QSL card to the station for a quick reply, because their postage funds are very limited.

News and Views

Bill Dundas, WN2TDA, 2 Stiles, Painted Post, N. Y., runs 60 watts to a 30-year-old transmitter and receives on a Hallicrafters SX-110. The old exhaler must work, because Bill has 20 states, Guatemala, Puerto Rico, and Canada in his logbook. A dipole antenna does the yard work, while a Heathkit DX-60 transmitter and a Lafayette HA-230 receiver occupy the back-up positions . . . **Mike Zuhajewski, WA8MCQ,** Rte 3, Paw Paw, Mich., says he is going broke answering letters since an item on his effective station appeared in "News and Views," but he still offers help to prospective amateurs. His 8'-high "long wire" has now made 51 contacts in nine states and Canada, but he has discovered that eight to 16 watts doesn't get out as well as 50 watts! . . . **Allan Sarkin, WN6PTT,** 9115 S. Strub Ave., Whittier, Calif. operates on 80

meters using a surplus ARC-5 transmitter with a crystal-controlled adapter. He receives on either a BC-454 receiver or a Knight-Kit R-55 helped along by a surplus FL-30 audio filter between the receiver and his phones for increased selectivity. Allan is quite concerned about the many attempts by certain groups to detach the hams from the 10-meter band. At the same time, he points out one way to combat these efforts: use the band.

Clair "Bruce" Bruce, WN7DAJ, Box 346, Hebo, Ore., works 80 and 40 meters with his Johnson "Ranger" transmitter and National NC-125 receiver, and separate dipole antennas about 40' high. Bruce has 24 states and Japan, and will work *you* if you need an Oregon contact . . . **Jerry Van Vactor, WNØLYO,** 611 10th St., Spearfish, S. D., has worked 32 states and a handful of VE6's and 7's. He'll sked you if you're looking for South Dakota on 40 meters (preferably) or 15 meters, although his call letters will probably be WAØLYO when you read this. Jerry uses a Knight-Kit T-150A transmitter, a Hy-Gain 14AVQ vertical antenna, and a Lafayette HE-30 receiver . . . **Nusryl Malayuthro Adams,** #7C Pemuda St., Padang, Minang, Kabau, Indonesia, is very much interested in amateur radio but unfortunately the Indonesian government doesn't share his enthusiasm at the moment; so his chances of getting on the air in the immediate future don't look very bright. But one or two of you might like to write to him to give him the "scoop" in the U.S.A. We would suggest keeping the comments nonpolitical.

David Cherry, WN1DGJ, 34 Linden Ave., Wakefield, Mass., celebrated passing his General examination by writing to us. With his Novice career drawing to a close, Dave's logbook shows 32 states, including California and Oregon, Canada, Puerto Rico, and Mexico, all worked on 80 meters. He used an EICO 720 transmitter, Conar 500 receiver, and an 80-meter dipole, 30' high. Occupying prominent spots on his shack wall are a 20-wpm code certificate and a Rag Chewers Club certificate . . . **Henry Wilkens III, WA5LBM,** 4402 Oakside, Houston, Texas, is one of those who have another hobby besides ham radio. It's "sky diving"—that's jumping out of an aeroplane and hoping your parachute opens—but he says it isn't nearly as exciting as amateur radio! Henry started as a Technician and then got his General ticket. He still works some 6-meter phone with a Heathkit "Sixer" or his Knight-Kit T-60 feeding a 3-element beam, but you will find him more often on 80- or 40-meter CW. A Knight-Kit R-55A and a Hallicrafters SX-71 handle the receiving chores, and his low-frequency antennas are dipoles. An 8' x 10' tool shed in the back yard is the WA5LBM ham shack.

Emory M. Kiger III, WAØFKD, Box 26, Nevada, Mo., worked 44 states as a Novice using a Heathkit DX-40 and a Hallicrafters SX-99 receiver. Since getting his General ticket, he has pushed the total up to 48 states worked and confirmed. At present, however, Emory is more interested in traffic handling than completing his WAS . . . **Russ Hobby, WN2SET,** 2732 Harvey Ave., Oceanside, L. I., N. Y., has worked 22 states with his Knight-Kit T-60 transmitter and "Star Roamer" receiver. Russ is studying electronics at RCA Institutes now, which keeps him off the air—except on weekends . . . **Denny Fergusen, WN4WYC,** 212 Piedmont Ave., Rockmart, Ga., spends most of his time on 15 meters, since he has a 3-element beam for that band. A Heathkit DX-40 transmitter pushes electrons up the feedline and a Hammarlund HQ-145C receiver pulls them back down again. Den has worked 45 states, New Zealand, France, and England . . . **David P. Robbins, WN1DTZ,** R.F.D. #3, Belfast, Maine, probably doesn't realize what he is starting when he offers to sked anyone needing Maine on 15, 40, or 80 meters. Everybody needs Maine! Dave transmits on a Hallicrafters HT-40 running 75 watts to feed a

Hy-Gain 80/40 meter "trap" dipole. He receives via a National NC-140 receiver and has 16 states worked.

Before we run out of space, let us all wish each other a Merry Christmas and a Happy New Year. Remember, this is your column; keep your "News and Views" and pictures coming. And we'd like to thank all those who have been sending us their club bulletins; they are most helpful. Address your letters to: Herb S. Brier, W9EGQ, Amateur Radio Editor, POPULAR ELECTRONICS, P. O. Box 678, Gary, Ind. 46401.

73, *Herb, W9EGQ*

HISTORY QUIZ ANSWERS

(*Quiz on page 72*)

1 — H John A. Fleming applied for a patent for his diode vacuum tube in 1904. It utilized the Edison effect principle discovered 20 years earlier.

2 — B Ralph V. Hartley invented the oscillator circuit that bears his name. It uses a parallel-tuned tank circuit with a tapped coil to provide the feedback voltage.

3 — C Georges Leclanche invented the dry cell using a solid depolarizer in 1868. To this day carbon-zinc dry cells are known as Leclanche cells.

4 — I Samuel F. Morse and his co-workers, Leonard Gale and Alfred Vail, demonstrated their electromagnetic relay telegraph in 1838, using the original version of the dot-and-dash code. The manual key, adopted later, was actually invented by Vail.

5 — D Hans C. Oersted discovered, in 1819, that a magnetic field existed around a current-carrying conductor.

6 — F George W. Pierce was the first to apply a piezoelectric crystal to a vacuum-tube oscillator circuit. This circuit, which now bears his name, is basically a crystal-controlled version of the Colpitts oscillator.

7 — J Nicola Tesla invented the high-frequency oscillator transformer known as the Tesla coil in 1891.

8 — E Max Wien developed the basic principles of a.c. bridges, and published a collection of his bridge networks in 1891. The Wien bridge is used to make capacitance and frequency measurements.

9 — A Vladimar K. Zworykin invented the television iconoscope in 1923.

10 — G Raymond A. Heising developed the constant-current form of plate modulation that bears his name. This method of modulation is widely used in high-power broadcasting stations.

SHORT-WAVE LISTENING

(*Continued from page 71*)

Some of you may prefer to continue the use of local time in your reports. If you do, please indicate clearly exactly what time zone you are using so that the proper conversion can be made here.

In adopting GMT, we shall continue using the 24-hour clock. The hours from 1 a.m. to noon are expressed as 0100 to 1200; from noon to 11 p.m. as 1200 to 2300. A time of 3:15 p.m. EST, therefore, converted to GMT would read 8:15 p.m.; and on the 24-hour clock, it would be 2015 GMT.

Copies of Leaflet J (Time Conversion) are available from your Short-Wave Editor (for a five-cent stamp) and may help you to make your conversions quickly and correctly. The leaflet briefly explains the difference between EST and GMT, and the 24-hour system; it also includes a conversion table for all of the U.S. time zones and a listing of times in a number of countries around the world.

"SweDX." The fortnightly DX program which is produced by *DX-Alliansen* and broadcast over *Radio Finland* is now entirely in English. Known as *SweDX* ("Swedex"), it can be heard every two weeks on the following schedule: Fridays at 1145-1200 on 9555, 11,805, and 15,185 kc., and at 1645-1700 on 6120 kc.; and Saturdays at 0800-0815 on 9555, 11,815, and 15,185 kc. Reception reports and suggestions are most welcome and should be addressed to SweDX, Fack, Bromma 1, Sweden. Reports that include one IRC will be confirmed by three QSL cards, one each from *DX-Alliansen,* Finlands DX Club, and *Radio Finland.*

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* (Greenwich Mean Time listings begin with the next issue) and the 24-hour system is used. Reports should be sent to SHORT-WAVE LISTENING, P. O. Box 333, Cherry Hill, N. J. 08034, in time to reach your Short-Wave Editor by the fifth of each month; be sure to include your WPE identification, and the make and model number of your receiver.

Angola—*R. Ecclesia,* CR6RB, Luanda, has been frequently noted on 4935 kc. opening in Portuguese at 0030 but fading by 0115 or later. There is a world news bulletin around 0045.

Australia—Listeners to *R. Australia*'s N.A. xmsn at 0714-0815 should now tune to 11,840 kc. This replaces the 31-meter channel.

Belgium—Brussels has been noted on 6165 kc. with non-stop music and a beautiful signal at 1905.

Brazil—Two Brazilians currently being heard on the West Coast are *R. Brasil Central,* ZYY2, 4995

DX States Awards Presented

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

Fifty States Verified

Thomas E. Brannan (WPEØCLV), St. Louis, Mo.
Mike Ferguson (WPE8EET), St. Joseph, Mich.
Robert Eddy (WPE8EQW), Newport, Ohio
Doug Bowles (VE4PE1A), Brandon, Manitoba, Canada
Michael R. Fletcher (WPE4DPS), Robins AFB, Ga.
Joseph Hueter (WPE3EP), Philadelphia, Pa.
Dave Siddall (WPE1EBN), Hyannis, Mass.
Rick Malchetske (WPE9HBT), Menasha, Wis.
Eugene W. Carlson (WPE9HAM), Andover, Ill.

Forty States Verified

David Johnson (WPEØELO), Denver, Colo.
Thomas Winfield (WPE9GMB), Bristol, Wis.
Stephen Schmidt (WPE2IXG), Webster, N. Y.
Denis Frank (WPE8FBQ), Farmington, Mich.
Silvio Marini, Jr. (WPE4IIO), East Point, Ga.
Jan Marcus (WPE2NJF), Westbury, N. Y.
Harry Gish (WPE5EGI), Baton Rouge, La.
Victor J. Lipinski (WPE4HTV), Alexandria, Va.
Richard F. Little (WPE5CBD), Fort Worth, Texas
David H. Kaplan (WPE1FIJ), Hartford, Conn.
Thomas V. Arko (WPE8FJ), Fort Monroe, Va.
George E. Hall (WPE2KOR), Saddle Brook, N. J.
Chas. J. Matterer (WPE6DGA), San Leandro, Calif.
Gerald Georgopolis (WPE1ENG), Lawrence, Mass.
Dubby Hay (WPE4GPC), Rome, Ga.
M. P. Frutchey (WPE4PC), Winter Park, Fla.
William Gillroy (WPE1GEI), Stamford, Conn.
Marvin E. Robbins (WPEØMW), Broomfield, Colo.

Thirty States Verified

Douglas McKirahan (WPE9HSZ), Oak Park, Ill.
Dave Maidenberg (WPE9HTK), Marion, Ind.
Timothy Kilby (WPE4HKU), Sperryville, Va.
Phil Swingley (WPE9HLR), Muncie, Ind.
Thomas Solomon (WPE1GCO), Methuen, Mass.
Frank Fox (WPEØELD), Inman, Kansas
Harry Nechetsky (WPE4IIL), Niceville, Fla.
Steven Dress (WPE3GAS), Chambersburg, Pa.
Stuart Fichtner (WPE8HWH), Vandalia, Ohio
Louis Votto (WPE1GAI), Hamden, Conn.
Richard C. Purdy (WPE8ERW), Detroit, Mich.
Kenneth M. Deschere (WPE2LVK), Poughkeepsie, N. Y.
Allen L. Miller (WPE8GAR), Taylor, Mich.
Marvin E. Robbins (WPEØMW), Broomfield, Colo.
William Alisauskas, Jr. (WPE2FXN), Haledon, N. J.
Jack Page, Jr. (WPE5DXH), Pontotoc, Miss.

Twenty States Verified

Aldridge Salisbury (WPE4HLD), Falls Church, Va.
Harlan Lassegard (WPEØEGM), Mitchell, S. D.
Michael Kraley (WPE2NFS), New Rochelle, N. Y.
Allen Laverty (VE3PE2CY), Kingston, Ont., Canada
Steven Price (WPE7CGT), Longview, Wash.
Anthony Casamassima (WPE2NPC), Maspeth, N. Y.
Edward Madej (WPE1GEM), Indian Orchard, Mass.
Jim Kamis (WPEØELK), Grandview, Mo.
John Richards, Jr. (WPE6GAX), Palo Alto, Calif.
Wayne Matus (WPE2NPO), Valley Stream, N. Y.
Bruce Ewenstein (WPE2MEH), New York, N. Y.
Bob Fugate (WPE9HUB), Eau Claire, Wis.
David Bursky (WPE2NOP), Brooklyn, N. Y.
Mark Worley (WPE6GBE), Roseville, Calif.
Robert Wigelsworth (VE3PE2EN), London, Ont., Canada
Adelard Beaupre (WPE1FVO), Putnam, Conn.
Jay Coffeen (WPEØEGE), Aurora, Colo.
Brent Jones (WPEØEJW), Kansas City, Mo.
L. Bruce Meyer (WPE7CBW), Portland, Ore.
Bruce Hovermale (WPE2MSG), Livingston, N. J.
Marc Filippi (WPE2NPY), Demarest, N. J.
Jeff Steinwedel (WPE8IJV), Cuyahoga Falls, Ohio
Wayne Pier (WPE2MBH), Asbury Park, N. J.
Don Falle (VE2PE1IB), Beaconsfield, Que., Canada
Bob Davidson (WPEØEIA), Denver, Colo.
Harry Dence, Jr. (WPE4IKY), Cynthiana, Ky.
Robert Bruhns (WPE2NTQ), Huntington, N. Y.
Patrick Richardson (WPE9GLO), Chicago, Ill.
Jim Elliott (WPE3GIC), Camp Hill, Pa.
Jimmy Atkins (WPE4IKX), Winston-Salem, N. C.
Stan Gordon (WPE3GHF), Greensburg, Pa.
Kenneth Cutler (WPE2NTD), Atlantic City, N. J.
Steve Kennedy (WPE4IAX), Sarasota, Fla.
Richard Lawrenson (WPE1QY), Jacksonville, Fla.
Michael Honeycutt (WPE4HKF), Nashville, Tenn.
Bruce Popkin (WPE2IOC), Huntington, N. Y.
David Vorkapich (WPE8IKJ), Campbell, Ohio
Charles Buckley (WPE5DWW), Albuquerque, N. M.

kc., Goiania, around 2100, and PRN9, *Radiodiffusora de Seguranca,* Seguranca, on the odd frequency of 9295 kc., fair to good around 2100 with news in Portuguese and pop music.

When propagation conditions are good, look for ZYR232, *R. Universitaria Santos Dumont,* San Jose dos Campos, 17,725 kc. This is an experimental station operated by college students and has been noted at 1800-1850 with pop music and frequent anmts in Portuguese. The station is rated at only 1000 watts although the signal seems to indicate higher power.

In August, *R. Mayrinck Veiga,* Rio de Janeiro, 9575 and 11,775 kc., closed down on orders from the government. Rumors persist that the station has been granted permission to operate again but monitoring has not located any signals.

Bulgaria—Sofia was noted on 15,312 kc. (down from 15,320 kc.) with Eng. to Africa from 1410; a musical period started at 1415.

Canada—*R. Canada*'s newest schedule reads: to Australian areas at 0225-0335 in Eng. on 9625 and 5970 kc., and to Europe (I) for service forces at 0555-0714 on 17,820 and 15,320 kc. (and on 5970 kc. to Northern Canada); to Europe, N.A., and the Antilles in Eng. at 0715-0813 and in French at 0816-0844 on 17,820 and 15,320 kc. (also on 5970 kc. at 0715-0813 to Northern Canada and on 11,720 kc. at 0816-0844 to the Antilles); to Europe (II) in Ukrainian, Russian, Czech, Slovak, Polish, German, and Hungarian at 0845-1130 on 17,820, 15,320, and 11,720 kc. (the 11,720-kc. frequency is beamed to Northern Canada at 1016-1029 and 1131-1159); to Africa in Eng. at 1333-1415 and in French at 1415-1458 on 17,820, 15,320, and 11,720 kc.; to Europe (III) in French at 1500-1545 and in Eng. at 1545-1652 on 15,320, 11,720, and 9630 kc.; to Northern Canada (I) in French and Eng. at 1658-1746 on 15,190, 11,720, and 9625 kc.; to Caribbean and Latin American areas in Eng. at 1758-1830, in Portuguese at 1830-1900, and in Spanish at 1900-1946 on 15,190, 11,725, and 9625 kc.; to Northern Canada (II) in Eng. at 2130-0205 on 11,720 and 9625 kc. (also at 0055-0130 on 5955 kc. to Europe).

Cape Verde Islands—Station CR4AC, *R. Barlavento,* 3930 kc., was heard at 1850-1900 with symphonic music. This one is difficult to catch due to ham radio QRM.

Central African Republic—*R. Bangui* is scheduled from Monday to Friday at 0030-0130, 0730-0900, and 1100-1600, Saturdays at 0030-0130 and 0730-1800, and Sundays at 0100-1600 on 5035 and 7220 kc.

Ceylon—English xmsns of *R. Ceylon* beamed to Europe, the Near East, and Africa are broadcast daily on 15,330 kc. at 0300-0415. The Commercial Service has been noted recently signing on at 2030 on a new frequency of 15,225 kc.

Chile — Station CE597, *Emissora Presidente Balmaceda,* Santiago, 5975 kc., has been heard with closing multi-lingual anmts (including Eng.) at 0005, giving a complete ID and requesting reports.

Cuba—Schedules from this country change frequently but here is the latest: Eng. to N. Europe at 1510-1640 on 11,735 kc.; Eng. to N.A. at 2200-2330 and 0000-0100 on 6135 kc.; Eng. to South America at 1550-1650 on 11,760 kc.; French to Mediterranean areas at 1200-1310, 1610-1640, 0200-0230, and 0400-0430 on 11,705 kc.; French to Europe at 1400-1510 on 11,735 kc.; French to N.A. at 2330-0000 on 6135 kc.; Creole to the Caribbean at 0600-0700 and 2100-2200 on 6060 kc.; and Arabic to the Mediterranean at 1310-1355, 1530-1610, 0230-0330, and 0430-0530 on 11,705 kc.

Dominican Republic—*R. Santo Domingo TV,* reportedly operating as a clandestine station, is noted on 7550 kc. and is barely audible in nearby areas at 1700 with local news.

Ecuador—Station HCVC3, *R. Centinela del Sur,* Loja, has moved up from 5024 kc. to 5060 kc. and has a live show around 2030-0000 on Fridays; reports go to Casilla 196, Loja. Station HCZP1, *R. Rumichaca,* Tulcan, is on 3785 kc. (not on 3950 kc.

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as some sources claim) at 2000 with commercials, then a world news bulletin relayed from *R. Atahualpa;* reports go to Casilla 42, Tulcan (Carchi). Station HCEH3, *R. Progreso,* Loja, moved from 4706 kc. to 4723 kc., and now to 4734 kc., where it suffers from Leopoldville QRM after 2300 s/on; programs are mostly listeners requests and may run to past 0200.

England—London was noted on 15,912 kc. with single-sideband language talks at 1030-1045.

Ethiopia—Revisions of the schedule given here last month include: Eng. to Ceylon at 0815-0830 on 9755 kc.; Eng. to W. Africa at 1400-1445 on 11,875 kc.; Eng. to India at 0830-0900 on 15,410 kc. English to S. Africa at 1400-1415 on 9705 kc. replaces the 1315-1415 xmsn listed last month. Other xmsns remain the same.

France—Station ORTF, Paris, was noted on 7215 kc. closing in German at 1634 with an IS. The 11,830-kc. outlet was noted closing with Eng. news at 1345, to return at 0015, on 19 and 25 meters.

European readers will want to look for Paris's German xmsn weekdays at 1300-1400 (Sundays at 1340-1430) on 1277 kc. The station is especially interested in obtaining reception reports in German with the SINPO code being used. Reports go to *Office de Radiodiffusion Television Francaise,* Abteilung Deutschland, Maison de l'ORTF, Paris 16, France.

Germany (West)—*Der Suddestsche Rundfunk,* Stuttgart, has tourist information in German, French, Eng., Dutch, and Scandinavian languages during the summer months at 0415-0530 on 6030 kc. *Der Bayerische Rundfunk* still has daily news in German, Eng., and French at 0300 on 6085 kc.

Ghana—English from Accra is now on this schedule: on 6070 kc. to W. Africa at 0945-1030, 1200-1245, 1500-1545, and 1630-1715; on 9545 kc. to S. Africa at 1500-1545 and to W. Africa at 1630-1715; on 11,800 kc. to Sudan and Ethiopia at 1330-1415 and to Europe at 1550-1635; on 15,190 kc. to Sudan and Ethiopia at 0900-0945; on 17,910 kc. to E. Africa at 0945-1030; and on 21,545 kc. to S., S.W., and S. E. Africa at 0945-1030. Reports go to P. O. Box 1633, Accra.

Iceland—Reykjavik is again testing, at 1430-1600 on 9630 or 9640 kc. weekdays, and at 0730-0900 and 1600-1630 on 11,780 kc. Sundays.

Iran—Teheran was noted on 15,110 kc. at 1515-1530 in Eng. dual to the much stronger 11,730-kc. channel.

Iraq—Baghdad, 9555 kc., heavily QRM'ed by Damascus and others, was noted with Arabic chanting at 1703.

Italy—Rome was heard once in a test broadcast on 6095 kc. to the Caribbean and N.A. with continuous pop music from 2320 to 2325 s/off, said to be dual to 9760 kc. A new outlet on 15,150 kc. has been heard from 1340 s/on in Italian to at least 1450 but it was heavily QRM'ed.

Korea (North)—Pyongyang has been found on 15,895 kc. in Korean or Chinese at 2320 with music, and on 15,505 kc. with classical music at 2332, followed by talks in English with frequent ID's. It was off the air by 2355, returned at 0000, very weak. The two stations were not operating in parallel.

Liberia—According to anmts from *R. Vatican,* the *Dutch Catholic Radio Association* plans to open a new station in Liberia, to be called the *Voice of Africa.* It will be financed by Catholic sponsors in

SHORT-WAVE ABBREVIATIONS

anmt—Announcement	N.A.—North America
Eng.—English	QRM—Station interference
FCC—Federal Communications Commission	R.—Radio
ID—Identification	s/off—Sign-off
IS—Interval signal	s/on—Sign-on
kc.—Kilocycles	xmsn—Transmission
kw.—Kilowatts	xmtr—Transmitter

the Netherlands and Western Europe, and languages to be used will be Eng., French, Swahili, and Arabic. No information is yet available as to the frequencies to be used.

Malaysia—*R. Malaysia,* Kuala Lumpur (?), 6175 kc., has been heard from 0525 with both Malay and Eng. ID's.

Maldive Islands—*Male Sinico Radio,* Male Island, 15 kw., operates at 2030-2300 on 7150 kc., at 0200-0430 on 9552 kc., and at 0730-1230 on 3223.5 kc. News in English is given at 2200, 0400, and 1200; the remainder of the programs are in Eng., Japanese, Tamil, Hindi, and Sinhalese. The studio is not yet completed, which explains the bad modulation reported by some during the Eng. xmsns.

Nepal—*R. Nepal,* Kathmandu, 11,880 kc., has raised its power to 100 kw. and signs on at 0100, according to European sources.

New Zealand—*R. New Zealand,* Wellington, operates to the Pacific Islands at 0100-0345 (s/off is at 0300 Sundays on 6080 kc.) and 1200-1445 on 6080 and 9540 kc. and at 1500-0045 on 15,280 kc.; to Australia at 1500-1730 on 9540 kc., at 1745-0045 on 15,110 kc., and at 0400-0645 on 6080 and 9540 kc.; to Antarctica on Sundays only at 0315-0345 on 6080 kc. The station abandons the Home Service relay for its own programs weekdays at 1745-1900. There is a program in Esperanto on the last Thursday of each month at 0330-0340 and 0630-0640.

Peru—Station OAX8R, *R. San Jose,* 4825 kc., finally veried after three years. It is located at Indiana, Dep. de Oresto, in the deep Amazonic jungle, from which it gets its name, *La Voz Cultural de la Amazonia.* The schedule is 0500-2100 weekdays; 0500-1000 and 1400-2100 Saturdays; and 0900-1200 and 1400-2100 Sundays. The station uses a Bauer xmtr rated at 1 kw. and has a Collins 250-watt unit in reserve. Reports go to *Escuelas Radiofonicas,* Apartado 218, Iquitos.

Portugal—According to recent anmts, Lisbon is making a survey to see if they should broadcast in French to N.A. next autumn on 6185 kc. and other wavelengths if necessary.

Rwanda — The new 250-kw. relay xmtr of *Deutsche Welle,* Cologne, to be located at Kigali, is expected to be on the air by the end of 1965. *Deutsche Welle* has also announced that two more high-powered relay stations will be constructed—one in S. Asia and one in the Caribbean.

South Africa—One new 250-kw xmtr may be in operation by the time you read this; another is expected to start operating in March, 1966, at which time there will be a daily Eng. broadcast to Europe. When all four xmtrs are in operation in late 1966, there will be services to Europe in Eng., German, French, Portuguese, Dutch, and Spanish.

Surinam—*Stichting Radioomroep Suriname,* a new government station, is on the air with 1000 watts on the medium waves; it will increase to 50 kw. by the end of this year. A short-wave service is expected in 1966. No frequencies were listed.

Sweden—*R. Sweden*'s Eng. service to N.A. is now at 0900-0930 on 15,420 kc., and at 2045-2115 and 2215-2245 on 9705 kc. Other changes: the xmsn in French and German at 0430-0530 will be on 6065 and 9620 kc.; a new xmsn to the Far East will be broadcast in Eng. and Swedish on 15,195 kc. from 0600; French to Canada and Eastern N.A. is at 1115-1145 on 15,420 kc.; the Spanish xmsn at 1830 will be replaced by a French program on 9620 and 11,705 for West Africa and South America.

Clandestine—A new clandestine station has been noted almost daily. The call is *R. Euskari, La Voz de la Resistencia Vasca.* The station is using both Basque and Spanish and is working for the underground Basque Liberation Movement. Said to be mobile, the station is evidently scheduled, at 1400-1700 on 15,020 and 13,250 kc., although other reports list the frequencies as being 15,007 and 13,230 kc. Reports are welcomed at B. P. 59, Poste Centrale, Paris 16, France.

A station identifying as *The Voice of the Blue Eagle* has been noted around 19,100 kc. at times between 1350 and 1510 with classical and jazz music. A letter from the FCC mentioned that the station had been located and the operator warned, but other details were not given. The station has been heard since that letter was received. —30—

SHORT-WAVE CONTRIBUTORS

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Radio Voice of the Gospel, Addis Ababa, Ethiopia
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INDEX

TO VOLUME 23

July-Dec., 1965

HI-FI/STEREO AND AUDIO

PHOTOGRAPHY

PRODUCT REPORTS

SHORT-WAVE LISTENING

TELEVISION

TEST EQUIPMENT

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—30—

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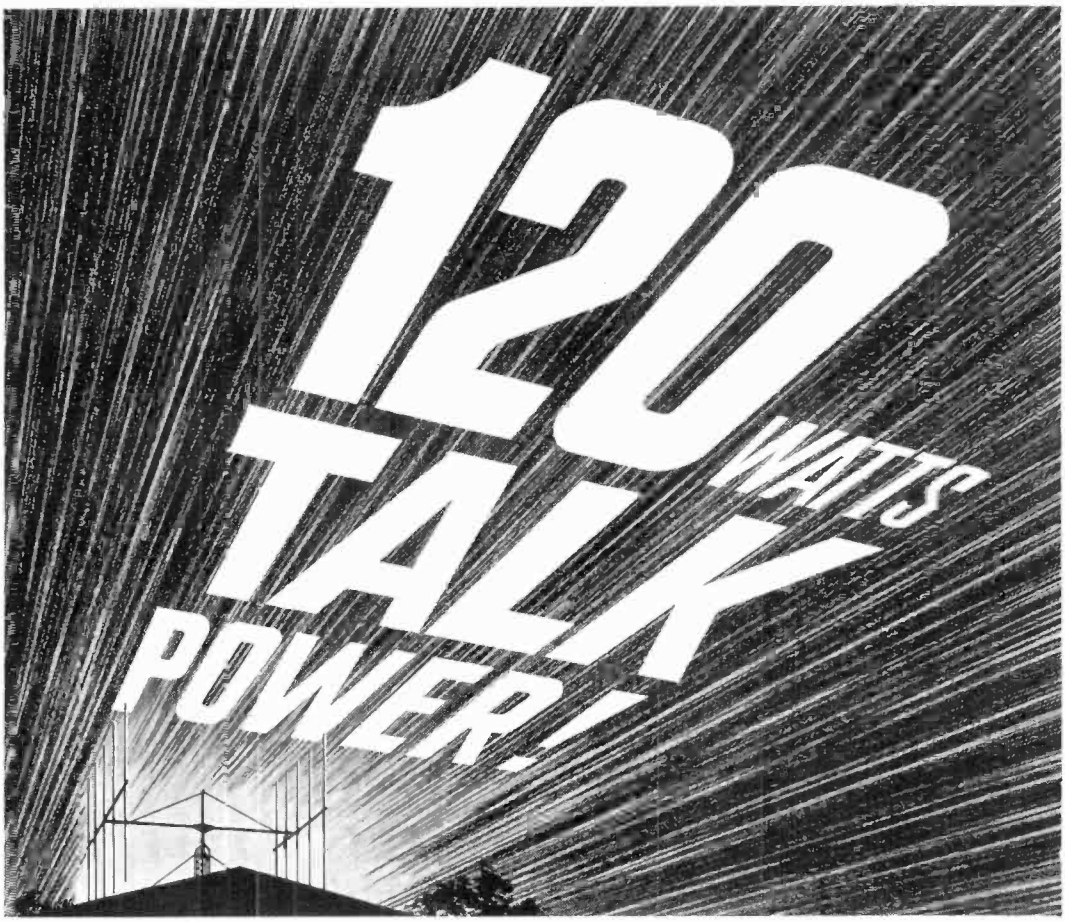

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