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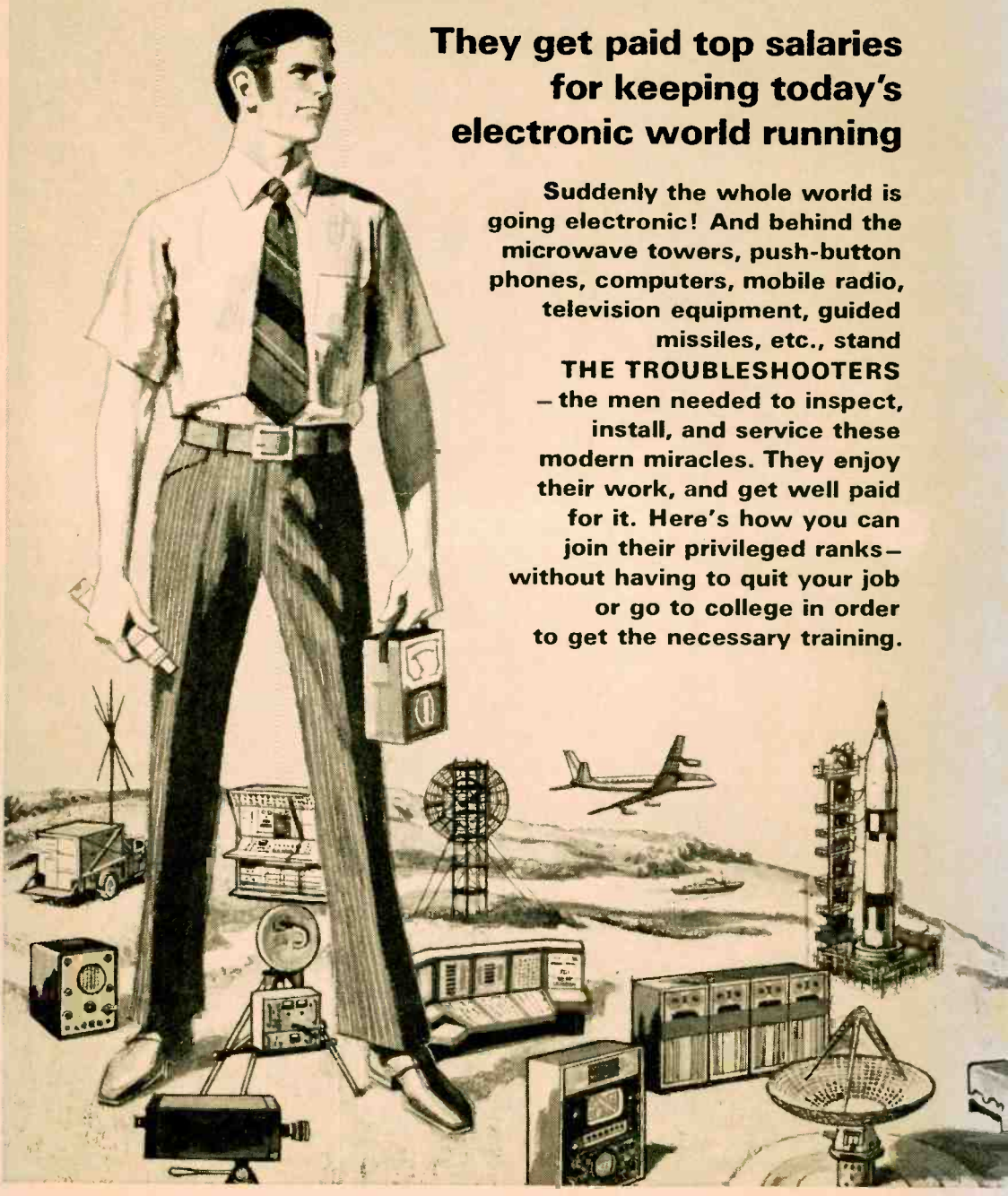
Inside the Superheterodyne Circuit—Its History and Theory

Check Out Lafayette's Dyna-Com 23 CB Walkie-Talkie with Kathi

A DAVIS PUBLICATION

Join "THE TROUBLESHOOTERS"



They get paid top salaries for keeping today's electronic world running

Suddenly the whole world is going electronic! And behind the microwave towers, push-button phones, computers, mobile radio, television equipment, guided missiles, etc., stand **THE TROUBLESHOOTERS** – the men needed to inspect, install, and service these modern miracles. They enjoy their work, and get well paid for it. Here's how you can join their privileged ranks – without having to quit your job or go to college in order to get the necessary training.

Just think how much in demand you would be if you could prevent a TV station from going off the air by repairing a transmitter . . . keep a whole assembly line moving by fixing automated production controls . . . prevent a bank, an airline, or your government from making serious mistakes by servicing a computer.

Today, whole industries depend on Electronics. When breakdowns or emergencies occur, someone has got to move in, take over, and keep things running. That calls for one of a new breed of technicians — The Troubleshooters.

Because they prevent expensive mistakes or delays, they get top pay — and a title to match. At Xerox and Philco, they're called Technical Representatives. At IBM they're Customer Engineers. In radio or TV, they're the Broadcast Engineers.

What do you need to break into the ranks of The Troubleshooters? You might think you need a college degree, but you don't. What you need is know-how—the kind a good TV service technician has—only lots more.

Learn at Home . . . In Your Spare Time

As one of The Troubleshooters, you'll have to be ready to tackle a wide variety of electronic problems. You may not be able to dismantle what you're working on — you must be able to take it apart "in your head." You'll have to know enough Electronics to understand the engineering specs, read the wiring diagrams, and calculate how the circuits should test at any given point.

Learning all this can be much simpler than you think. In fact, you can master it without setting foot in a classroom . . . and without giving up your job!

For over 37 years, the Cleveland Institute of Electronics has specialized in teaching Electronics at home. We've developed special techniques that make learning easy, even if you've had trouble studying before. Our AUTO-PROGRAMMED® Lessons build your knowledge as easily and solidly as you'd build a brick wall — one brick at a time. And our instruction is personal. Your teacher not only grades your work, he analyzes it to make sure you are thinking correctly. And he returns it the same day it is received, while everything is fresh in your mind.

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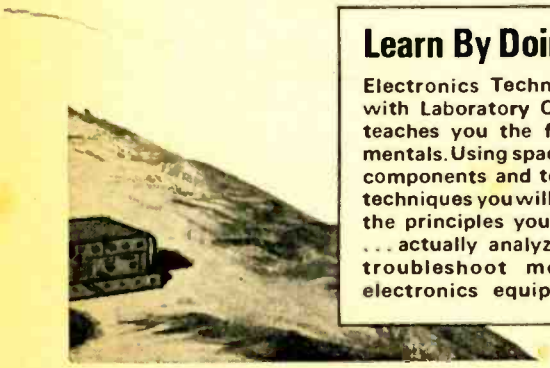

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CIRCLE NO. 15 ON PAGE 17 OR 103

ELEMENTARY ELECTRONICS including ELECTRONICS DIGEST (Vol. 13, No. 6) is published bi-monthly by Davis Publications, Inc., at 229 Park Ave., S. New York, N.Y. 10003. One year subscription (six issues)—$3.95. Second class postage paid at New York, N.Y. 10003 and at additional mailing office.

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e/e elementary Electronics

Dedicated to America's Electronics Hobbyists

☆ Cover Highlights

Cover photograph by Walter Herstatt

AUTHORS IN THIS ISSUE

James A. Fred, Herb Friedman, Jorma Hyppia, Don Jensen, C.R. Lewart, Julian S. Martin, Kathi Martin, Steve A. Money, Jack Schmidt, Hank Scott, Harry Stavert and the e/e Editorial Staff.

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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.

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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.

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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 designed 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.

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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
- PLIERS-CUTTERS
- VALUABLE DISCOUNT CARD
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- TESTER INSTRUCTION MANUAL
- 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.

Progressive "Edu-Kits" Inc., 1189 Broadway, Dept. 564DJ Hewlett, N.Y. 11557

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CIRCLE NO. 10 ON PAGE 13 OR 103

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Nov./Dec. 1973 Vol. 13/No. 6
Dedicated to America's Electronics Hobbyists

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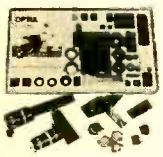

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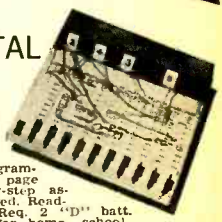

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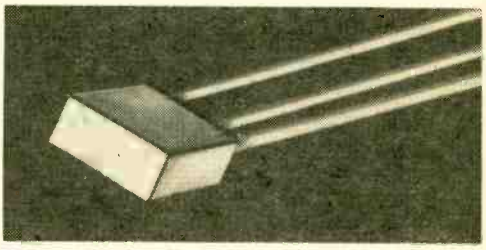
CIRCLE NO. **31** ON PAGE **17** OR **103**

Hey, look me over

Showcase of New Products

Hybrid Speed Control

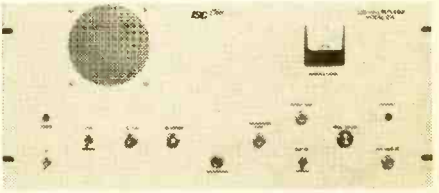
Hug Electronics has developed a new miniature control (3 amps continuous duty) that will vary the speed of small fractional hp AC motors. Its small size makes it easy to install in hand-held electric tools and small appliances such as mixers and blenders. A potentiometer used in conjunction with the HA-1 Control is all that is required for motor speed



control. Control unit senses armature voltage with varying load conditions and regulates RMS current through series wound field and armature. The manufacturer has made the HA-1 Control available two ways: control only for $5.95, or with a potentiometer at $6.95. Hug Electronics, P.O. Box 37, Arlington Heights IL 60004.

220 Repeaters For Rent

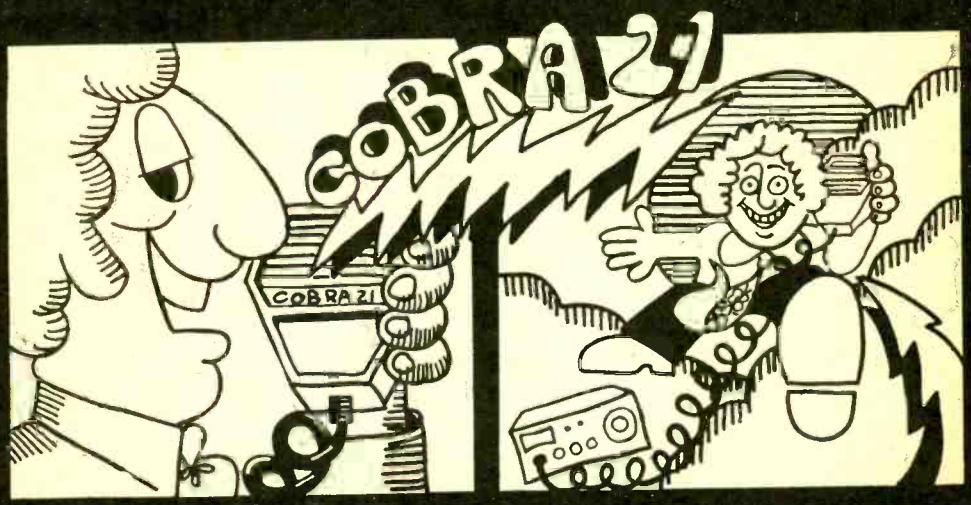
A new 220 MHz repeater program has just been announced by Clegg, Lancaster, PA in an effort to bring vigorous 220 activity to radio amateurs from coast to coast. A new



Clegg repeater, valued at approximately $1200, can be leased to amateurs at special club rates of only $25 per month. The low monthly rental fee can be further reduced with club member purchases of the FM-21 transceiver, a 220 MHz FM unit. The repeater is leased complete (except antennae and feed

CIRCLE NO. **16** ON PAGE **17** OR **103** →

Now there's a CB radio with too much talk power.



Put punch in your voice, from a block away to the fringes of your range. New Dyna-Mike gain control puts out absolute modulation. So much talk power you'll have to turn it down.

An important feature, but only one that makes this fantastically low-priced CB radio the best CB value on today's market.

The Cobra 21 with crystal filter, dual conversion receiver; transmits and receives on all 23 AM channels. Features 60 dB adjacent channel rejection that completely eliminates bleedover.

Extra large Power S Meter let's you monitor your set's performance easily even when it's tucked under the dashboard.

And you get switchable automatic noise limiter, P.A./external speaker jack, large built-in speaker and detachable mike.

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$129.95 with mike

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HEY, LOOK ME OVER

line) with features that include automatic identification, all solid-state construction, and built-in timers. It operates at 10 to 15 watts, and uses a Phelps-Dodge Tx/Rx duplexer. Clubs may write to Phil Theis K3TUF, Clegg Division, International Signal and Control Corporation, 3050 Hempland Road, Lancaster, PA 17601, or telephone him at (717) 299-3671 for more information. If you wish, circle No. 52 on the Reader Service coupon.

2-Meter Ham Radio Ampkit

Designated the Heathkit HA-202, a new kit-form amp can be used with any 2-meter exciter delivering 5-15 watts, and can boost output to 40 watts nominal, while pulling a maximum of 7 amps from a 12-volt DC system. The all solid-state circuitry combines emitter-ballasted transistors with a highly efficient heat sink to permit high VSWR loads without the need for complex sensing circuits. An internal changeover relay and relaxed circuitry automatically switches the unit for transmit and receive modes. The HA-202 kit can be assembled easily in approximately four hours, and can be mounted out of the way in the car's trunk or under the dashboard. Transceiver connecting cable and antenna jack are supplied. Mail order price is $69.95 FOB Heath Company, Benton Harbor, Michigan 49022. For additional information, circle No. 1 on Reader Service Coupon.

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After years of use in technical laboratories, Dust-Off, the professional dusting instrument, is being introduced to industry and the consumer by Falcon Safety Products, Inc. along with a new smaller version, Dust-Off Junior. These handheld "go getters" whisk away lint, dust or dirt from virtually all surfaces which can't be touched and in places which can't be reached. For cleaning everything from precision equipment, office machines and computers to photographic negatives, stereo equipment and electric shavers. Whatever the

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If you already have stereo in your car, there's no need to miss out on the fun of four-channel. Our Auto Quatravox, plus two flush-mount speakers, connects easily to your present stereo radio or tape player for startling four-channel enhancement of any program or recording. Listen to front speakers only, rear only, or balance all four. 18-foot cables, hardware included. Save $6.90. $16.99*

Above with Surface-Mount Speakers. Just hang speakers anywhere in car without installation. Save 10%. $16.99*

Realistic Auto Quatravox Alone. Just add two speakers of your choice. Takes minimum space, only 5½x 2½ x 1-3/4". $9.95*

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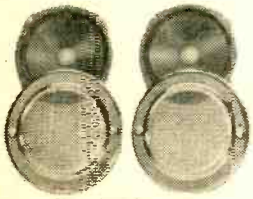

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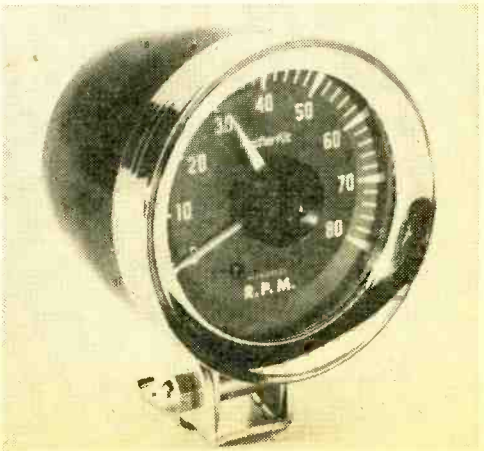
CIRCLE NO. 32 ON PAGE 17 OR 103

HEY, LOOK ME OVER

chore, they tackle it with a burst of pure, dry Freon gas. And their special pressure controls let you choose from a delicate puff to a powerful blast. Dust-Off is supplied with a long lasting 15-oz. canister, complete with reusable heavy duty chrome trigger valve and nozzle. It sells for $9.95. 15-oz. refills are $1.75 each. Dust-Off Junior is just as powerful; packed with a full 8-ozs., it keeps blasting right down to the end. It has a flexible extension nozzle for precision dusting, and the built-on retaining ring prevents nozzle loss and holds it against the side for compact carrying. Dust-Off Junior sells for $2.75. The cleaning pros—Dust-Off and Dust-Off Junior are available through local photography and other outlets. For more information, circle No. 57 on Reader Service Coupon.

Tachkit

New Archerkit Auto/Marine Tachometer kit reads engine speed from zero to 8000 rpm on any 4, 6, or 8-cylinder engine with a 12 volt electrical system. Step-by-step instructions are provided for assembly, calibration and installation. The unit may be mounted in any



position, and the rotatable bezel adjusted for best visibility of the 3¼-in. lighted dial. All-electronic circuit design compensates for normal changes in voltage and temperature for readings with ±2% accuracy. Deflection angle is 240°. The Archerkit Auto/Marine Tachometer Kit, complete with cables and mounting hardware, is priced at $19.95. Archerkit products are available at more than 180 Radio Shack and Allied Radio Stores from coast to coast. For more information, circle No. 55 on Reader Service Coupon.

Microphone Floor Stand

A triangular-based general purpose microphone floorstand is being introduced by Atlas Sound. Utilizing new manufacturing methods, model MS-50 combines high quality and modern styling with a low suggested retail net of $8.75. The U.S.-made stand features the famous Atlas Sound wearproof

grip-action clutch and a scuff-resistant steel base with protective pads and anti-tip provisions for stability. To ensure long-lasting "as new" appearance, the stand-base and the lower half of the cold-rolled steel tube assembly are color-coordinated in gloamed black and the upper tube is chrome plated. Atlas Sound's Lifetime Guarantee applies to the new stand. Adjustable height 35-in. to 63-in.; base size 14½-in.; weight 6½ lbs.; tube threads ⅝-in.—27. Additional information may be obtained from Atlas Sound, by circling No. 53 on Reader Service Coupon.

CB Right in Sight

A new low-priced, ultra-compact Citizen's Band mobile transciever is announced by Midland Electronics Company. The large backlighted S/RFO meter and "Luma Dial" channel indicator have been placed on a special top panel, especially designed to be "right in sight" for the driver in normal under-dash

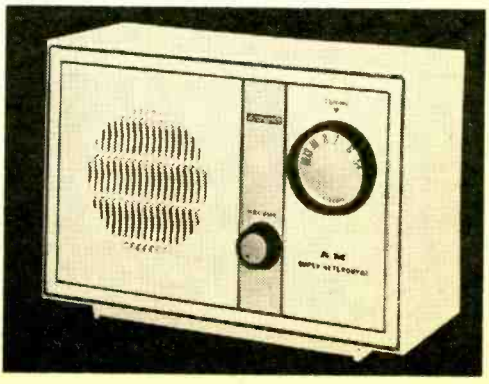
HEY, LOOK ME OVER

installations. Channel numbers are extra large and easy to read. All controls, on/off/volume, variable squelch, channel selector, are clearly marked. Physically the smallest 23-channel transceiver Midland has ever offered, this all-new unit is just 5⅛-in. wide, 2 inches high,

9 inches deep and weighs only 3 pounds complete. Using a synthesided 23-channel circuit and advanced integrated circuitry, it transmits with full 5-watt RF input and contains a sharply selective dual conversion receiver with tuned RF and AGC. Automatic noise limiter and fully variable squelch are also provided. Complete with a full-size plug-in mike, clip and mounting bracket, Midland's Model 13-862 carries a suggested retail price of $99.95. For further information on this and other Midland Citizen's Band transceivers, circle No. 58 on Reader Service Coupon.

Superhetkit

For the student, beginner, or occasional kit builder, Radio Shack is offering a new, easily assembled tubetype AM table radio kit by Archerkit. The superheterodyne radio has four tubes, plus a rectifier, and includes an automatic volume control circuit which helps maintain a constant volume level. Tunes the standard 535-1650 kHz AM broadcast band. In ivory case, 5¼x7¾x4-in. with 3½-in. speaker. Operates on 117 VAC. The Archerkit



AM Radio kit complete with detailed, step-by-step asembly instructions is priced at $14.95. Archerkit products are available at more than 1800 Radio Shack and Allied Radio stores coast to coast. For more information, circle No. 60 on Reader Service Coupon.

Cleaning Kits for Recorders

Nortronics has introduced four new inspection and cleaning kits for cassette, 8-track and reel-to-reel recorders. Three of the four new kits contains exactly the right Nortronics QM-Series recorder care products required to inspect and clean cassette, 8-track cartridge and reel-to-reel recorders, respectively. The fourth kit in the series, called "Every Head Needs Cleaning", contains products expressly for cleaning all magnetic heads. QM-Series recorder care products contained in the new Nortronics kits are specifically engineered to achieve effective results with complete safety for delicate machine parts. Model QM-6 Inspection & Cleaning Kit for all cassette recorders and players is priced at $9.90. Model QM-7 Inspection & Cleaning Kit for all 8-track cartridge machines is priced at $9.90. Model QM-8 Inspection & Cleaning Kit for all reel-to-reel recorders is priced at $9.90. Model QM-9 Every Head Needs Cleaning Kit contains 100 Nortronics QM-502 6-in. QM-Tip Cleaning Swabs and a 3-oz. can of QM-103 Spray

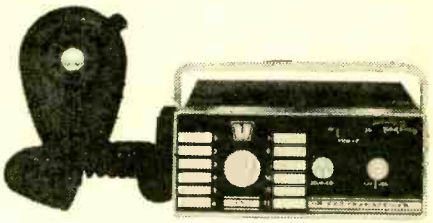
Tape/Head Cleaner. Priced at $3.35. All four kits are supplied with detailed instructions for use. For complete information of Nortronics Inspection & Cleaning Kits, contact the nearest Nortronics dealer or circle No. 64 on Reader Service Coupon.

Regency's New FM Transceiver

An all new 12-channel, 220-MHz FM transceiver for amateur communications in the 220-225 MHz range, is now in production by Regency Electronics, Inc. The all solid-state,

HEY, LOOK ME OVER

American-made HR-220 is compactly designed for dash mount, measuring 2¼-in. x 5½-in. x 7½-in. The 12-channel transmitter puts out 10 watts minimum from a 13.8 V DC power supply with phase modulation and automatic deviation limiting. Each crystal controlled channel is equipped with an individual trimmer capacitor for frequency netting. Built-in VSWR Bridge Limiting Circuitry protects the RF power amplifier. The 12 channel receiver has an audio output of 5 watts. A noise operated squelch system provides for clear reception. Sensitivity rates at 0.4 microvolts (nominal), 20 db quieting. At $239.00, the unit comes complete with factory installed transmit and receive crystals for 223.50 MHz. Hand-held plug-in, ceramic mike is included as is the dash mounting bracket. The HR-220 is now available through Regency distributors nationwide. For more information, circle No. 66 on Reader Service Coupon.



2-In-1 Dispenser

A unique 2-in-1 dispenser is now available for home, auto and equipment repairs. An entirely new concept in packaging and automatic dispensing developed by Devcon, this dispenser, called "DEV-TUBE," consists of a molded plastic container with two separate compartments and two pistons for dispensing. "DEV-TUBE," developed primarily for dispensing 2-part epoxy adhesives and other components, is easy to use. The resin (A) and hardener (B) are in the separate compartments. Just snip off the end of the double nozzle, push the double piston, and exactly equal parts of A and B are metered out, side by side. The nozzles can be closed with a special double cap. The "DEV-TUBE" will stand erect on the shelf until needed again. "5-Minute" Epoxy in the new "DEV-TUBE" dispenser is now available through hardware, automotive, and other stores throughout the United States. A single unit lists for $1.50. If you can't pick up a unit locally, circle No. 62 on Reader Service Coupon.

Like What You See? See what you Like? Whatever it be, you can get all the facts and more from manufacturers of products and services listed on "Hey, Look Me Over" by circling their number on the Reader Service Page. ■

ELEMENTARY

READER SERVICE PAGE

ELECTRONICS

• The Editor of ELEMENTARY ELECTRONICS offers readers an easy way to get additional information about products and services advertised in this issue. Also, if you would like more information about any new product mentioned in our column "Hey, Look Me Over," it's yours for the asking. Just follow the instructions below and the material you requested will be sent to you promptly and at no cost.

• The coupon below is designed for your convenience. Just circle the numbers that appear next to the advertisement or editorial mention that interests you. Then, carefully print your name and address on the coupon. Cut out the coupon and mail to ELEMENTARY ELECTRONICS, Box 886, Ansonia Station, New York, N.Y. 10023. Do it today!

NOVEMBER/DECEMBER 1973 Void after March 31, 1974

ELEMENTARY ELECTRONICS

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Please send literature for the numbers I have circled. I understand this is a free service and I am limited to 12 circled numbers.

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41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70

Are you a subscriber to this magazine? ☐ Yes ☐ No

Do you now own Police/Fire/Aero receiver(s)? 71 ☐ Yes 72 ☐ No

If your answer is yes, please check appropriate box:

73 ☐ Mobile 74 ☐ Base 75 ☐ Portable 76 ☐ Used in your work

Name (Print Clearly) _____

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One Born Each Minute

I have a Cactus 2000 receiver made by Cactus Electric Co., Japan. The tuner needs servicing, and I need a schematic. Do you know where I can get one?

—J.W., Vancouver BC

I must get about 100 letters like this each month. No, I don't know where to get a schematic diagram for the Cactus 2000, or the Boxer 29, or the Pramton RV-400, or whatever. Most of these brand names are private brand names for department stores or multiple retail outlets that like to make large markups on imported junk. Schematics? Practically impossible to obtain. Once they are sold out, they dream up a new name and do it all over again by changing the nameplate on an identical piece of junk.

S-8 on Noise

I have just purchased a house in a small midwestern town and I am plagued with an electrical interference problem on my CB equipment. My rig runs an S-unit reading of from 6 to 8 almost all of the time. The only exception being right after a rain when everything is wet. If you can tell me what the solution would be, it would be greatly appreciated, if there is a solution other than moving?

—N.D.C., LaHarpe KA

Outside of keeping a garden sprinkler running continuously on your roof, I cannot offer any suggestions. Maybe one of our readers can offer a suggestion?

Soft Sell

I'm just starting in electronics and have a *low*

(Continued on page 22)

Hank Scott, our Workshop Editor, wants to share his project tips with you. Got a question or a problem with a project you're building—ask Hank! Please remember that Hank's column is limited to answering specific electronic project questions that you send to him. Sorry, he isn't offering a circuit design service. Write to:

Hank Scott, Workshop Editor
ELEMENTARY ELECTRONICS
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CIRCLE NO. 32 ON PAGE 17 OR 103

HEY, LOOK ME OVER

(Continued from page 18)

budget. I would like to know where I can get Westinghouse, Signetics, and RCA IC's and other solid-state items at low prices.

—C.S., Johnstown PA

Some people never read the ads in a magazine. Read those in this magazine and your question will be answered. Also, take a look at the *Literature Library* page. Lots of parts catalogs are offered for the asking. Get with it today!

Little Green Men

When I turn on my set the color is green for about 10 seconds. Then it's normal thereafter. What can I do?

—N.K., Linden NJ

Turn on the set, close your eyes and count to ten slowly.

Wants to Tango

Hank, I've been listening to shortwave bands for six months now and find the hobby the greatest. Right now I'm a loner because I don't belong to any group, no one talks to me about my hobby, even reading material is scarce. Can you recommend a good SW journal or club?

—D.M., So. Charleston WV

If you have read Don Jensen's *DX Central Reporting* in every issue of ELEMENTARY ELECTRONICS, you'll learn a lot. But Don will be the first to tell you to join a club. And joining is easy because there's a terrific SWLers club in your home town—*North American Shortwave Association*. Write to them at P.O. Box 8452, South Charleston, WV 25303 and include $1.00 for a sample copy of FRENDX —their monthly publication. It's worth the time and money. In fact, ask them to send you a membership blank. I'm sure you will want to join up.

New to CB

Since I'm relatively new to CB, I'd like to know where I could get a book of definitions about certain CB terms. Also, about how many CBers use the 10-Code signals?

—D.S., Cheney WA

The editors of ELEMENTARY ELECTRONICS publish a CB YEARBOOK that's tops for beginners. Pick up a copy by sending $1.25 to Davis Publications, Inc., 229 Park Ave. South, New York NY 10003. As for your question on how many CBers use the 10-Code—too many!

I Was Close

In the May-June issue of *ELEMENTARY ELECTRONICS*, you said, "The RMS value is the root of the mean of the square of a series of values." This is wrong!

—R.B., Larchmont NY

I dug back almost 20 years into my memory to talk about rms when I should have dug into a good reference book. My friend, Bookworm, who does Bookmark, is still laughing. I received about 20 letters and five phone calls pointing out the error. I checked a mathematical dictionary and discovered that the root mean square is "the square root of the arithmetic mean of the squares." I'm sorry, and thank you for reading this column carefully.

Big Noise

On page 107 of the Spring/Summer 1973 edition of *Electronics Hobbyist* there is an article on noise pollution. The article is good as far as it goes, but *Tipster* only has a range between 50 dB and 85 dB. What would it take to increase the range from 0 dB to 190 dB?

—T.M., Huntsville AL

The quietest room is at 25 dB or maybe less. And, I have been led to believe, 190 dB will kill a listener (even with ear plugs). Tipster does its job, for wider measurement ranges, rent or buy professional equipment.

Lend A Hand, Boys

Would you tell me how I could get hold of a Lafayette KT-200 Shortwave receiver that is in good condition?

Robert Leo Hart, Jr.
1817 Evergreen Street
Alton IL 62002

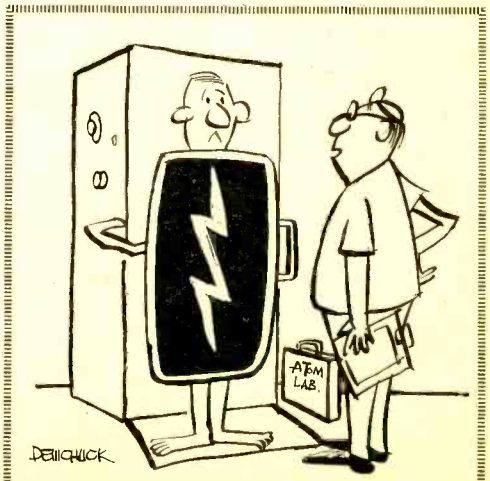
Robert must have his heart set on this Lafayette rig for some reason. So, lend a hand boys. If you can help out, write direct to Robert.

Likes to Broadcast

Where can I buy a transmitter to broadcast on BCB with a power output to range from 3 to 5 miles without having an FCC license?

—T.W.Y., Brinkley AR

Nowhere, unless you want to tangle with the FCC. ■



"Hmm, you say you always get flashes?"

newscan

Electronics in the News!

Telephone Demolition Derby

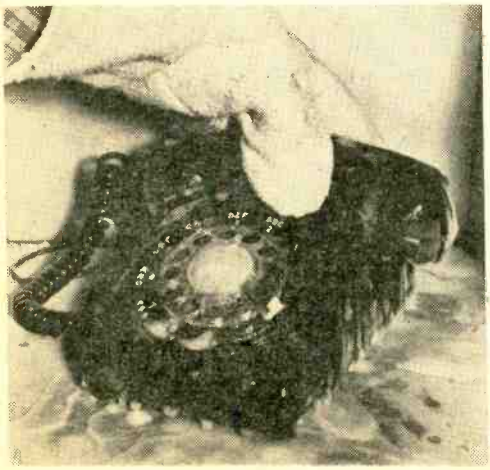
Most people think of a demolition derby as a spectacle where daring drivers crash cars for fun and prizes. Western Electric has a sort of demolition derby for telephones, only it's not for fun and there are no prizes. Engineers in the Performance and Reliability Laboratory at WE's Indianapolis Works pound, shake, freeze and roast the telephones made there. They compress years of wear into hours to find out how communications equipment will perform 15 to 20 years from now.

In a closet-like corner of the laboratory is a high frequency vibrator that simulates the vibrations a phone would receive sitting atop a dishwasher or washing machine or in an area of high intensity sound.

The jounces of a thousand miles of truck travel are compressed into an hour by another machine designed to test the packaging of telephone equipment.

In another test, telephone numbers are dialed mechanically as many as a million times during a three to four week period to simulate the use an average dial would receive over a 20-year life.

Telephones and components are tested for electrical performance in temperature chambers.



Temperatures as low as –40 degrees Fahrenheit in a test chamber subject telephones to climatic conditions found in some parts of the continental United States.

NEWSCAN

An engineer sets up equipment he designed to test the durability of telephone dials. In a period of three to four weeks, it will repetitively dial up to a million times.

There they are subjected to extremes from -40°F to 140°F which is about as cold or hot as it gets anywhere in the continental U.S.

Not far from the frosted phones is the dust chamber. There telephones of the type used in coal mines or along highways are tested to determine the effects of dust and atmospheric pollution on the seals in the outer casings. In the chamber, about the size of a refrigerator, sets are blasted automatically every hour for a week with a fine mixture of carbon dust, lampblack and silicon.

Why is the equipment subjected to all these tests? The basic reason is cost. It costs more to send a telephone company installer to repair a damaged phone than the price of the phone itself. So it helps the company and the telephone user for Western Electric to build telephone equipment right the first time.

Your '74 Car is Going Electronic

There is a quiet revolution going on in Detroit these days, triggered by tiny electronic devices that will make the family car safer, more reliable and more economical. Most people are just beginning to realize the impact that solid-state electronics will have on the design of automobiles in the years immediately ahead.

The reason automotive designers are taking a creative look at electronics is that solid-state devices such as integrated circuits offer such advantages as long life, high reliability, low power consumption, low cost, compactness, light weight, and cool operation. By the end of this decade, the automotive industry should be using $3 billion worth of electronic components and devices

(Continued on page 29)

DX central reporting

A world of SWL info!

BY DON JENSEN

☐ DX clubs have been with us since the early days of radio. Long ago, listeners learned that such organizations were useful, giving DXers a chance to communicate with and learn from others with similar hobby interests. Clubs serve a very real and very important need in the DX hobby.

Today, in North America, there are about eight to ten major DX clubs in operation. Also, there are an unknown number of new, small—usually struggling—clubs with only a handful of members each. Large or small, these clubs, with members scattered across the continent, maintain contact by means of regularly issued bulletins or magazines.

As long as these bulletins, the only real unifying factor they have, are published, these clubs operate successfully. Unfortunately, with the very small clubs, limited funds and limited manpower make the job of cranking out monthly bulletins very difficult. So, we find countless of these fledgling clubs struggling along unsuccessfully and, shortly, vanishing from the DX scene.

For the DXer who wants to start his own club, a far better choice, I feel, is to concentrate on organizing a small group of local listeners and forget about "going national."

In the past year or so, there have been a number of these local groups formed around the country. In most cases, the groups, maybe five to 20 DXers each, don't try to tackle the tremendous job of putting out a DX bulletin. Usually they affiliate with one of the big national clubs which do have bulletins. The "locals" concentrate on person-to-person contacts with other DXers in their own communities.

In Norfolk, Va., for instance, there is ODDX, the Old Dominion DXers, a local organization of SWLs linked loosely to the large North American SW Association. In Chicago there are the CAD-Guys, a dozen or so Chicago Area DXers. The BAD-Guys all live in the Greater Boston area. And there are numerous similar local organizations elsewhere.

What do they do? Usually they just have informal get togethers, perhaps over a dish of spaghetti or a hamburger supper, discuss DX,

DX CENTRAL REPORTING

swap yarns, show off recently acquired QSLs, pass along listening tips, and, in general, have a good time.

They may meet regularly, once or twice a month, rotating the meeting place among the homes of the members. Or, they may just get together occasionally, but keep in regular telephone contact.

Sometimes an all-night DXing session is on the agenda; sometimes members head for a campground or park for some al fresco listening with portable receivers and temporary antennas strung from trees.

Yes, local DX groups can be interesting, educational and a lot of fun. Try it! You'll like it!

Tip Topper. A small island in the far reaches of the North Atlantic has been in the headlines in recent months because of dispute with Great Britain over its off-shore fishing grounds.

The island is Iceland, a sparcely populated but feisty little country just south of the Arctic Circle. For Icelanders, the frigid waters that surround this tight little isle are a prime natural resource. In these waters are found the cod which, caught by Icelandic trawlers, are an important source of income. The problem is that British fishermen also are seeking the finny catch.

For many years DXers have considered Iceland a major shortwave catch as well. Iceland's station with the tongue-twisting name, *Rikisutvarpid* was long active on shortwave, but was generally considered a tough logging. Then the broadcaster left the air some years ago.

Now *Rikisutvarpid* is back on shortwave, albeit on a very abbreviated schedule. And DXers are taking advantage of the situation to add another rare country to their totals.

The station broadcasts on an out-of-band frequency of 12,175 kHz, which makes it easier to locate for most listeners. Its off-beat wavelength means that it is relatively free of interfering stations and it is hard to confuse this one with other broadcasters. This is a distinct advantage, since none of the programming is in English.

The transmitter is used for point-to-point utility transmissions most of the time, but for about one hour a week, from 1200 to about 1300 GMT, Sundays, it relays broadcasts from the medium wave outlet of *Rikisutvarpid*. These programs apparently are intended for the Icelandic fishing fleet at sea. Signals from the station's 5.000 watt transmitter have been regularly reported Sunday mornings in North America recently.

Rikisutvarpid, the *Voice of Iceland,* has been a good verifier since its return to shortwave. If you manage to log the station one Sunday morning, you can get one of its at-

(Continued on page 94)

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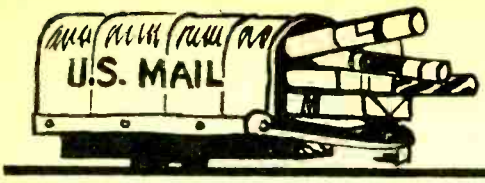

LITERATURE LIBRARY

101. Kit builder? Like weird products? *EICO's 1973* catalog takes care of both breeds of buyers at prices you will like.

102. *International Crystal* has a free catalog for experimenters (crystals, PC boards, transistor RF mixers & amps, and other comm. products).

103. See brochures on *Regency's* 1973 lineup of CB transceivers & VHF/UHF receivers (public service/ business bands—police, fire, etc.)

104. A pamphlet from *Electra* details the 6 models of the Bearcat III, a scanning monitor receiver.

105. Send for free literature of *R. L. Drake's* receivers—"For the ultimate in Shortwave Listening."

106. Before you build from scratch, check the *Fair Radio Sales* latest catalog for surplus gear.

107. Get *Antenna Specialists'* cat. of latest CB and VHF/UHF innovations: base & mobile antennas, test equipment (wattmeters, etc.), accessories.

108. Want a deluxe CB base station? Then get the specs on *Tram's* super CB rigs.

109. For magnetic nutdrivers exclusive with *Xcelite*, see them illustrated and described in Tool Catalog 171. They come in ¼" and 5/16" sizes, with color-coded, fixed handles in regular, extra long, and super long styles. There are midget pocket clip types and interchangeable shanks for Series 99 handles, too.

110. *Bomar* claims to have C/B crystal for every transceiver . . . for every channel. The catalog gives list of crystal to set interchangeability.

111. *A Turner* amplified mike helps get the most from a CB rig. This free brochure describes line of base & mobile station models.

112. *Midland* has recently published a 4-color brochure illustrating and describing over 40 CB and scanner products.

113. *EDI (Electronic Distributors)* has a catalog with an index of manufacturers' items literally from A to Z (ADC to Xcelite). Whether you want to spend 29 cents for a pilot-light socket or $699.95 for a stereo AM/FM receiver, you'll find it here.

114. Get all the facts on *Progressive Edu-Kits* Home Radio Course. Build 20 radios and electronic circuits; parts, tools, and instructions included.

115. *Olson Electronics'* 244-page fully-illustrated 1974 catalog carries leading national brand products in all electronics categories.

116. *Trigger Electronics* has a complete catalog of equipment for those in electronics. Included are kits, parts, ham gear, CB, hi fi and recording equipment.

117. Get the HUSTLER brochure illustrating their complete line of CB and monitor radio antennas.

118. *Teaberry's* new 6-page folder presents their 6 models of CB transceivers (base and mobile): 1 transceiver for marine-use, and 2 scanner models (the innovative "Crime Fighter" receiver and a pocket-size scanner).

119. *Burstein-Applebee's* 1974 catalog has 276 pages of radio/TV electronics bargains. Selling for $2, it is offered free to our readers.

120. For a colorful leaflet on the Golden Eagle Mark III SSB receiver and the Mark III SSB transmitter, write to *Browning Laboratories.*

121. *Edmund Scientific's* new catalog contains over 4000 products that embrace many sciences and fields.

122. *Cornell Electronics'* "Imperial Thrift Tag Sale" Catalog features TV and radio tubes. You can also find almost anything in electronics.

123. *Radio Shack's* 1974 catalog for electronics enthusiasts has 180 pages, colorfully illustrated—a complete range (kits & wired) of hi-fi, CB, SWL equipment and parts.

124. It's just off the press—*Lafayette's* all-new 1973 illustrated catalog packed with CB, hi-fi components, test equipment, tools, ham rigs, and more.

125. *Mosley Electronics* reports that by popular demand the Model A-311 3-element CB beam antenna is being reintroduced. Send for the brochure.

126. *RCA* Experimenter's Kits for hobbyists, hams, technicians and students are the answer for successful and enjoyable projects.

127. *B&F Enterprises* has an interesting catalog you'd enjoy scanning. There are geiger counters, logic cards, kits, lenses, etc.

128. *Avanti* antennas (mobile and base for CB and VHF/UHF) are fully described and illustrated in new cataolg.

129. A new free catalog is available from *McGee Radio.* It contains electronic product bargains.

130. Semiconductor Supermart is a new 1973 catalog listing project builders' parts, popular CB gear, and test equipment. It features semiconductors.—all from *Circuit Specialists.*

131. *Heath's* new 1974 full-color catalog is a shopper's dream—chockful of gadgets and goodies everyone would want to own.

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Ansonia Station
New York, N.Y. 10023

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NEWSCAN

(Continued from page 24)

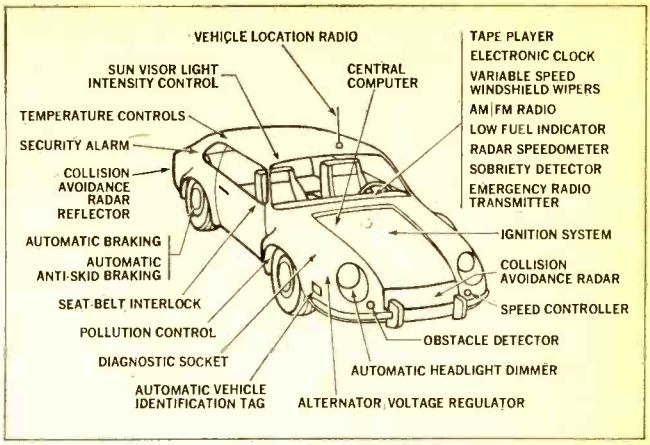


Diagram shows some of the present and future solid-state electronic systems for future automobiles.

for automotive systems such as obstacle detectors, anti-skid braking systems, sobriety detectors, variable speed windshield wipers, and ignition systems which reduce pollution.

Already the industry has started to feel the influence of solid-state equipment which is controlled by transistors or by complex integrated circuits no bigger than the head of a pin. Perhaps one of the most dramatic inroads of solid state electronics in the automotive field was the introduction of electronic ignition by the Chrysler Corporation as standard equipment on all 1973 model Chrysler, Dodge and Plymouth cars. Electronic ignition improves combustion, thereby reducing pollution, a prime goal for Detroit in light of Federal regulations being imposed on the automotive industry.

While Detroit does expect to pass the cost of electronics on to the consumer, total operating costs of a car may actually be reduced. For example, Chrysler says that its electronic ignition system significantly reduces tune-up problems by eliminating the condenser and distributor points. An average car driver, using electronic ignition, can eliminate two tune-ups in the first year he owns a car. The costs of those tune-ups exceed the cost of electronic ignition. And since the car derives better mileage, he quickly recovers more than the initial cost, according to Chrysler.

It is estimated that by 1980 auto manufacturers may be spending as much on solid-state elec-

(Continued on page 88)

LITERATURE LIBRARY has been expanded

Use Coupon on Left!

132. *E. F. Johnson's* 1974 full line of CB transceivers and accessories equipment is featured in a new 16-page brochure. A 4-color folder on monitor scanner line is also offered.

133. If you want courses in assembling your own TV kits, *National Schools* has 10 from which to choose. There is a plan for GIs.

134. Get the new free catalog from *Howard W. Sams*. It describes 100's of books for hobbyists and technicians—books on projects, basic electronics and many related subjects.

135. *Sprague Products* has L.E.D. readouts for those who want to build electronic clocks, calculators, etc. Parts lists and helpful schematics are included.

136. The 1972-73 edition of *Tab Books'* catalog has an extensive listing of TV, radio and general servicing manuals. Also listed are books on audio and hi-fi, basic technology, and test equipment.

137. The *Drake* Model SPR-4 Receiver is programmable to meet specific requirements: SWL, amateur, laboratory, broadcast, marine radio, etc. This leaflet gives complete information.

138. *Leader's* catalog features "Instruments to Believe In." They have a complete line for industry, education and service, featuring oscilloscopes/vectorscopes, many generators, accessories, etc.

139. *B&F Enterprises* has an interesting catalog you'd enjoy scanning. There are geiger counters, logic cards, kits, lenses, etc.

140. *Pace Communications* has a packet of information for you. The "Citizens two-way radio" answers all the questions from how to operate one to how much they will cost to operate. A booklet on Pace's scan/monitors to keep you informed is included, and another on the same subject features equipment for public safety. An additional full-colored booklet covers all of their communications equipment for personal and professional use.

141. *Pearce-Simpson* has a booklet, "Citizens Band Radios & Scanners," which pictures and describes the various models in this line. A section on CB antennas is included. A second booklet, "Electronics," presents a wide variety of marine instruments for communication. Price sheets accompany both booklets.

142. For the latest information on CB transceivers by *Courier*, send for their literature.

143. Featured in *Siltronix's* brochure are single sideband/AM citizen band transceivers, pictured and described with extra features and specifications listed. VFO sliders for monitoring are pictured as well as export models of linear amplifiers. A wattmeter and microphones round out their collection.

144. *Lee Electronics Labs* has an inexpensive circuit analyzer, which is featured in this catalog.

145. Available from *Royce Electronics* (a new name in electronics manufacturing) is a 16-page catalog for CB'ers. See their base and mobile transceivers, accessories and test instruments.

146. Hear your favorite music through a set of the *Abraxas* 4 speakers. They contain a rugged 12-inch longthrow woofer with a 22-oz. Alnico magnet, a 5-inch sealed-back rubber damped midrange, and 2-3-inch dome tweeters —all for $180 each.

MORE BARGAINS IN SURPLUS ELECTRO-OPTICS from B & F ENTERPRISES

Just off the press our Best Catalog yet with 104 illustrated pages of Surplus Electronics, Optics, and Much More...

NICKEL CADMIUM BATTERIES

- ☐ 0.5 ampere hour 1.25 volt sealed button cell ..... 2 for $1.00
- ☐ Vented 4.0 ampere hour cell, plastic case $2.75
- ☐ 24 volt pack, sealed cells, mfg sonotone, size 12" x 1¾" x 1½" capacity 0.6 ampere hours $11.75

MOLEX SOLDERCON CONNECTIONS

Molex soldercon connections for I.C's. With these you can build low cost I.C. sockets by just cutting off the number of connections required, i.e., two strips of seven for 14 pin socket.

- ☐ 500 Molex soldercon $4.75
- ☐ 1000, Molex Soldercon $7.50

LED READOUTS

Popular OPCOA SLA-7, without decimal point, 0.27" numeral height, we formerly sold these at $4.25, and they sold extremely well. Because of a fortunate purchase we can offer them at a super-low price. Use for clocks, counters, calculators

SLA-7 Readouts $2.50

GIANT NIXIE TUBES ALPHANUMERIC

Burroughs B7971 alphanumeric nixie tube. Giant 2½" character height. Forms all letters of the alphabet, and numerals 0 thru 9. Consists of 15 segments in "star" matrix. When used as numeric display only, it is wired as a seven segment display, requires 170 volts D.C.

This is the same unit we use in our Giant Clock.

B7971 tube, brand new with used socket $7.50
B7971 tube, removed from equipment $2.50
Socket for above (only with tube) ..... $.50
4 for $7.50

LOW COST/HIGH QUALITY COPY LENSES

We have two new lenses available, both in production quantities. Excellent for opaque projectors, copy cameras, and inexpensive enough to have around the lab for all kinds of optical breadboarding.

Copy Lens 1, 1¾" dia. mount, 4½" focal length, speed F 5.6. Covers 5" x 5", 9 x 9 at 1:1 conjugates. Manufactured by Ednalite.

LCEO 1 ..... $6.00

Copy Lens 2, 2-1/16" dia. mount, 9½" focal length, speed F 5.6. Covers 9 x 9 inches at infinity, 14 x 14 at 1:1 conjugates. Manufactured by Ednalite.

LCEO 2 ..... $9.00

Both lenses for $13.50
Two(2) of each type for $25.00

POWER RESISTOR ASSORTMENT

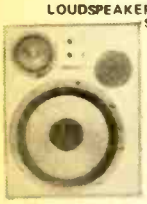
We are always getting requests for power resistors to use in testing amplifiers, power supplies, etc. This is an assortment of resistors of various values ranging in power from 5 watts to 100 watts. If you use just one, it is easily worth twice the cost of the entire assortment.

Sh.Wt. 2 lbs. PRA (10) $1.00
6 bags of 10 6PRA (10) $5.00/6

2.25 AMPERE VARIAC

This is a useful item to have for variable power supplies, testing, heater control, etc. 0-115 vac in, 0-130 volts out. Removed from equipment ... $6.00
Add $1.00 for postage and handling.

LOUDSPEAKER SYSTEM COMPONENT SPECIAL!



We have made an excellent purchase of an excess inventory of a local manufacturer's speaker systems, although we are not allowed to mention the mfg's. name, the specs should make it self-evident. The woofer is a 12" free-edge, (acoustic suspension) unit, with 2" voice coil and a No. 2 magnet. The mid-range is a 5" sealed back speaker and 3-½" flare dome tweeter for best high frequency dispersion.

Crossover between woofer & mid-range is by an R-L-C network, while high frequency crossover is by an R-C network. Balance controls are provided for both mid-range and tweeter. Plans for a suitable enclosure are provided. The level controls provide frequency response to suit room acoustics, with realism that will delight even the most critical listener. Response – 25 to 20K • Hz., Power – 40 watts RMS. Impedance – 8 ohms.

Sh.Wt.12 lbs.

- ☐ LSCS $36.00
- ☐ 2LSCS ..... 2 for $65.00

TELSA COIL KIT

Here's a truly basic kit for those who like to "troll their own." All the parts for an exciting adventure into high-frequency, high voltage. Add your own metal housing – a small chassis or universal box is ideal.

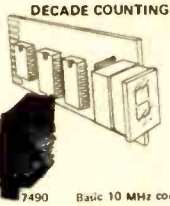
Tesla coils are patterned after the design of Nikola Tesla (1857-1943) an American electrical genius who built versions many feet tall. His dream was to light and power entire cities with energy radiated from such coils – but no luck!

Today's Tesla coils are popular with experimenters and students, and especially for science fair and educational demonstrations. Ours is a high-frequency push-pull oscillator coupled to a television flyback transformer, which steps up an external 12 VDC power supply to many thousand volts.

SPECIAL NOTE: Although current output is relatively low, some hazard is inherent in all high voltage devices. This kit is intended for the experimenter who is mature enough to observe reasonable precaution in its use.

TESLA COIL KIT $7.50

DECADE COUNTING UNITS WITH READOUTS



Always one of B & F's most popular items, now revised to include drilled boards, I.C. sockets, and right-angle socket for readout. Arranged so that units can be stacked side by side and straight pieces of wire bussed through for power, ground and reset. Several different units are available as follows:

- 7490 Basic 10 MHz counter. Used in frequency counters and events.
- 74196 Same as 7490 except presettable 50 MHz unit. Used where higher speed and/or presettability is required.
- 74192 Bi-Directional Counter, 32 MHz operation. Has two input lines, one that makes the unit count up, the other down. Uses include timers, where the counter is preset to a number and counts down to zero, monitoring a sequence of events, i.e., keeping track of people in a room by counting up for entries and down for departures.
- 7475 Adds latch capability. Used in counter so displays continue displaying frequency while new frequency is being counted for uninterrupted display.
- 7447 Basic decoder module. Drives basic seven segment display which is included for all modules.

NEWEST DCU!

This DCU combines all of the features of our other counting units, that is, high speed counting, up-down operation, storage, and preset. In addition it includes a comparator (7485) and a thumbwheel switch in order to provide comparison and preset capability. With this combination you can do the following:

1. Count up or down at speeds to 33 MegaHertz.
2. Store previous count during new count.
3. Preset to any number, count down (or up) and generate a logic level when count of zero is reached. Stack several units and generate logic level for any count greater than zero.
4. Preset to zero, count up (or down) and generate a logic level for any number greater or equal to the number preset in the thumbwheel switch. Stack several DCU's and generate a logic level showing whether number is greater than, equal to, or less than numbers Preset on switches.

- ☐ 910 K 7490-7447 Counter $8.25
- ☐ 910 LK 7490-7475-7447 Counter $9.25
- ☐ 911 LK 74196-7475-7447 Counter $10.25
- ☐ 912 K 74192-7447 Counter $9.25
- ☐ 913 K 74192-7475-7447-7485 Universal DCU $14.50

I.B.M. POWER SUPPLY REGULATOR PARTS!

Like-new assembly surplus from the I.B.M. Company contains the following: (6) 150-Watt transistors, (6) heat sinks, (6) .15Ω 5W resistors, 12V, 20 Amp circuit breaker, a 16-ohm 100-Watt resistor, 50-Watt resistor, terminal strip, (2) 16-pin P.C. edge connectors for regular cards. An 8000 mfd, 15V computer grade capacitor is also provided. All in a nice mounting – looks as if it could be a neat unit to make a lab-type power supply. Unit is sold as an assembly, or in parts. Quantity is limited.

Sh.Wt. 20 lbs. IBMPSRA $7.50
3 for $20.00 IBMPSRA $20.00/3
8 for $52.00 IBMPSRA $52.00/8

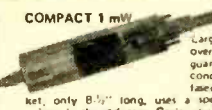
Heat sinks capable of dissipating 150 watts of power
Price ..... $1.00 ea.
Transistors, 2N441 or 2N442 type, TO-36 case ... $1.00 ea.
Heat sink with transistor ..... $1.50 ea.
4 for $5.00 ..... $5.00/4
Connectors, 2 for $1.50 ..... $1.50/2
Capacitor, $1.50 ..... $1.50 ea.

HEWLETT PACKARD SOLID STATE NUMERIC INDICATOR

These fantastic L.E.D. indicators have built-in decoder/driver with memory. They use a 4 x 7 dot array for much better readability. They are packaged in a standard Dual-In-Line (DIP) package with built-in contrast filter. Completely DTL TTL compatible. HP part number 5082-7300 (right hand decimal)

HP 5082 ..... $9.75

COMPACT 1 mW LASER TUBE



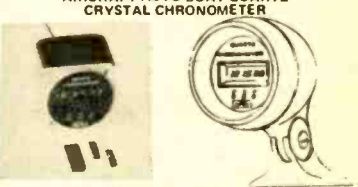
Large manufacturer sells his over-stock tubes to us, all guaranteed to be in perfect condition. Most compact 1mW laser tube (TEM.) on the market, only 8½" long, uses a special tapered bore design, unique in the industry. Cavity design, internal hemispherical mirror system with co-axial mounting of all elements, maintain beam alignment and power stability under mechanical stress and changes in temperature. SPECIFICATIONS: red laser, 1mW power, TEM., 632.8mm wavelength, 1.10mm beam diameter, 0.85 mrad divergence, linear polarization, size 8.5 x 1.75" diameter. These can be useful for alignment systems, measurement systems, and for illumination, etc. In equipment such as levels, transits, ranging, inspection displays, holography, etc. Operation life beyond 10,000 hours. This is not a toy tube, but a laser designed to meet rigid industry standards. List price is over $200.00 each.

Sh.Wt. 3 lbs. CImWLT $97.50
2 for $180.00 CImWLT $180.00/2
10 for $850.00 CImWLT $850.00/10
100 for $7500 CImWLT $7500.00/100

Portable supply – operates from 12 vdc input. Useful for field experiments with laser. Available only with purchase of tube.

Price $25.00

AIRCRAFT AUTO BOAT QUARTZ CRYSTAL CHRONOMETER



Revolutionary!, was the reaction of our customers when they saw our latest kit. Measuring only 2½" x 2½" x 23/8", and accurate to 10 seconds a month, this chronometer promises to entirely replace mechanical clocks in cars, boats and airplanes.

Fits into a standard 2¾" instrument panel cutout. The displays are bright L.E.D. displays that should last a lifetime. Setting controls are recessed and operate from a pointed object such as a pencil point or paper clip, in order to keep non-authorized hands off. The clock should only have to be reset at very great intervals, or in the event of power loss (i.e., replacing battery in car). The clock is wired so that the timing circuits are always running, but the displays are only lit when the ignition is on, resulting in negligible power drain. The low price is only possible because of a new one chip MOS clock. Operates from 10-14 Volts D.C. An accessory unit which mounts on the back adapts the unit to 20-28 volts for twin engine aircraft and larger boats using 24 Volts ignition. Know how disgusted you are with the usual car clock? Order this fine unit now for rallying, sports events, navigation, or just to have a fine chronometer that will give you a lifetime of superbly accurate time.

- ☐ Quartz Chronometer, Kit Form $69.50
- ☐ Quartz Chronometer, Wired $99.50
- ☐ 24 Volt Adapter $10.00

New-Style AUTO/BOAT/PLANE QUARTZ CRYSTAL CHRONOMETER

As you can see from the illustration, we have provided a new enclosure for our most popular kit, the ARIES Model AR-720K Quartz Crystal Chronometer. This enclosure can be mounted in many convenient variations, i.e., over or under the dashboard, over the center drive tunnel, or under the roof above the windshield.

- ☐ Automotive style quartz crystal chronometer ... $75.00
- ☐ Same assembled, calibrated, tested $99.00

Send in an order and get on our special custom customer Mailing List.

CATALOG: Check reader's card or write.

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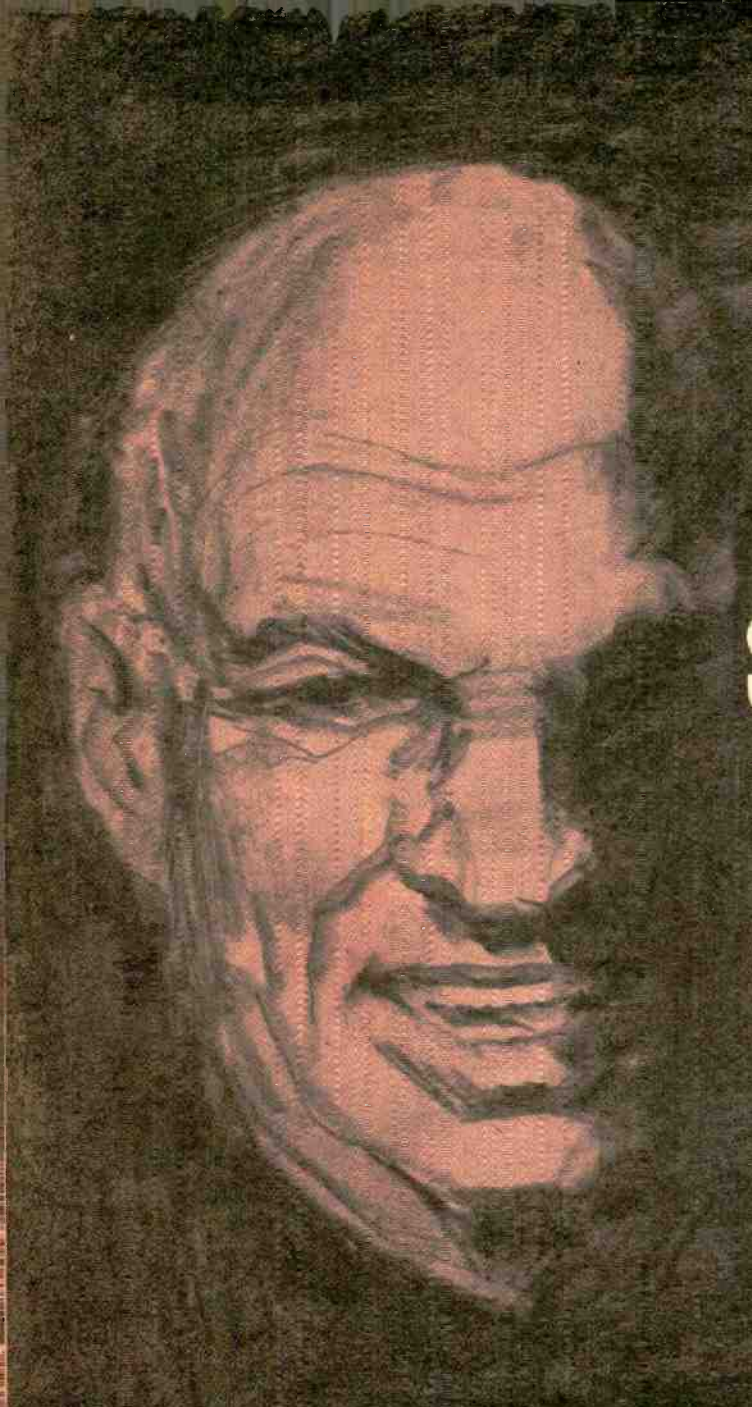

THE SAGA OF THE SUPERHET

by Harry Stavert

Major Armstrong's super circuit helped defeat the forces of the Red Baron and kind during WW I only to stumble on the economics of the post-war world before finding complete acceptance.

Major Edwin Armstrong was too busy to take time to contemplate the superior performance of his newly developed radio receiver which was spread out on the laboratory table before him. He and his assistants had been in France only a short time but they had already witnessed the war devastation wrought upon the countryside. But at this time they were probably too far from the front lines too feel the earth-shaking rumble of the German Army Big Bertha guns which gave evidence of the last desperate attempt by the enemy to stem the sweep of the American Expeditionary Forces across France. The year was 1918 and World War I would soon be drawing to a close.

Armstrong called his new radio a superheterodyne and his genius helped save the day for the Allies. When American troops jubiliantly landed on French soil they were hopelessly unprepared with any type of electronics which would

intercept those faint German communications signals. Armstrong, with a host of significant radio developments already to his credit, was commissioned to go to France and solve the problem.

Those first scenes in that French radio laboratory with its vast array of radio components and with those large electron tubes glowing like embers under a witches' caldron, must have looked as impressive as a Saturn V launch. But the code signals that filled the room were a far cry from what was to come—for the days of radio broadcasting as we know them were a mere two years away. Little did Armstrong realize that he had created the most important radio circuit the world had ever seen. For every present day TV set or radio bears his mark—they all use that same basic circuit concept born in the mind of this great radio genius.

At the Beginning. Let's take a look at some of the things that led Armstrong down the path of the superhet. First of all, the early radio designers quickly found out that it wasn't easy to build an RF amplifier that would work at high frequency. By high frequency I mean 1500 kHz—the top of the broadcast band! This was mostly blamed on the tubes available at that time, triodes, which had so much interelectrode capacity that the plate energy would sneak back across to the grid and force the circuit break into oscillation. At the low end of the broadcast band, the RF amplifier was OK; but as the frequency increased, so did the whistles and screeches.

Armstrong reasoned that if the tubes worked well at low frequency, why not somehow convert the high frequency antenna currents to a low frequency within the radio receiver. He already knew that if two RF signals were mixed together their frequencies magically add and subtract to produce, among other things, a frequency which is the difference frequency between the two. Why not make some kind of an electronic *lash-up* which would mix the incoming antenna signal with one generated in the radio set to procuce a low frequency difference? Then follow this up with a narrow band RF amplifier that would amplify this nice low frequency without problems with oscillation.

Well, the Major did just that and let's take a look at one of Armstrong's first circuits. This is shown in simplified form in Fig. 1 and we see the oscillator tube V8 with its associated components. It is made to oscillate by feeding plate energy back to grid circuit and tuned by the L2-C2 combination. These oscillation currents are induced in the pickup coil L1 which is connected in series with the loop antenna. This arrangement allows the incoming signal from the loop, tuned by C1, to be mixed with the oscillator frequency tuned by C2 and fed to the control grid of V1—the mixer stage. The voltage variations in the plate circuit of V1 are a mixture of the radio station's frequency plus those produced by the oscillator which combine to produce the difference of the two.

How It's Done! The mixing operation can go something like this. If C1 (See Fig. 1) is tuned to the station frequency of 1000 kHz and C2 to 1100 kHz, the difference frequency from the mixer is 100 kHz. Transformers T1, T2, and T3 are wound to resonate at 100 kHz and, together with V2, V3, and V4, constitute an amplifier adapted to amplify this 100 kHz difference signal. This section of the receiver was called the intermediate frequency amplifier, or IF amp. After demodulation in V5 and after going through audio amplifiers V6 and V7, out comes the voice program. For every new setting of the mixer tuning, the oscillator is tuned exactly 100 kHz above it. So the purpose was accomplished—the mixer-oscillator combination converted every incoming signal to a nice comfortable low value that made the IF amplifier feel at home.

Results. The circuit's sensitivity and selectivity proved to be astounding. Coast to coast reception became a reality with the *superhet*. One proud owner of that period bragged that his set would amplify a weak signal so well that if a fly walked on the antenna wire it would come out of the speaker sounding like a jungle war dance.

Problems. With the coming of the radio broadcasting era in 1920, you would think that the superhet would naturally be the only way to build a radio receiver. But all was not rosy in superhet town. For one thing it was too expensive! A good triode cost about $6.50 per copy and, considering an 8-tube lineup, that would take a small bundle for tubes alone, taking into account what the dollar was worth in 1920. In fact, there were only a few components that were avail-

A completely restored superheterodyne receiver, a 1924 Radiola, was the result of the pioneering efforts and developments of Major Edwin Armstrong and his early staff.

able for less than a $5 bill. Transformers, tuning coils, variable condensers, etc., all fell into this high-price bracket. Besides, the circuits were complex and difficulty arose from the fact that the oscillator was separately tuned because ganged tuning capacitors had not yet been invented. This allowed the operator to set the oscillator to a frequency on either side of the incoming signal which placed every station at two points on the oscillator dial. For example, the mixer tuned to 1000 kHz and the oscillator to either 900 kHz or 1100 kHz would give a difference of the required 100 kHz, so the station would show at both points.

Another problem reared its ugly head. The mixer was very broad in its tuning and powerful off-frequency locals could come pounding in even with the mixer set at 1000 kHz. If the operator had chosen the 1100 kHz spot for the oscillator and a powerful local was also broadcasting on 1200 kHz,

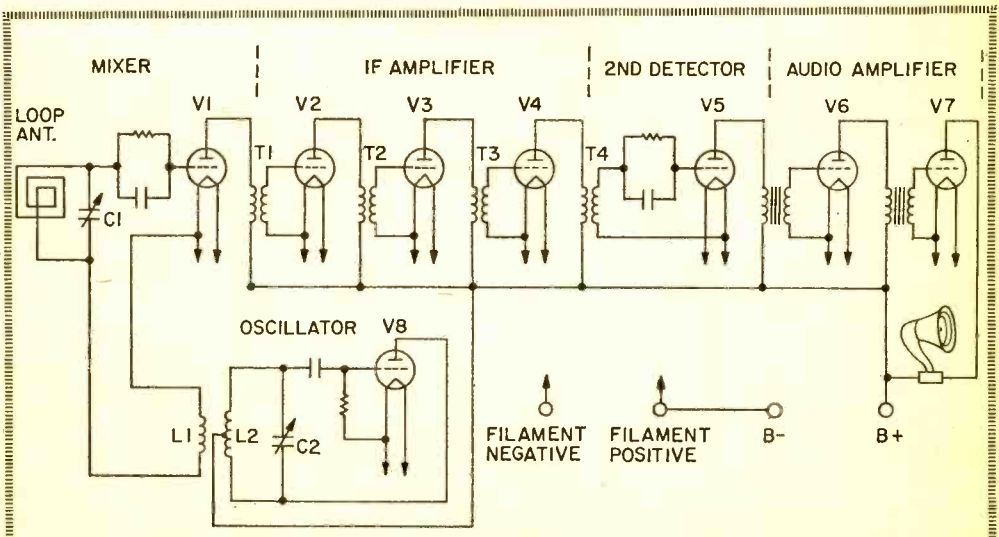

Fig. 1. A very early superheterodyne circuit varies very little in basis from today's circuits used in modern receivers. The local oscillator stage, V8, pumps the mixing signal to the antenna. A great idea at the time, but the circuit radiated some of the signal into the ether. This would cause considerable noise and jamming with today's billions of receivers.

it too could make its way into the mixer and produce the required 100 kHz which would really make a cat fight in the speaker. This latter problem, where the difference frequency is produced by a station you don't want, is called an image, and plagues low cost superhets more or less to this day. You might be able to teach a little old lady to work all the levers on her Stanley Steamer, but there would be no chance to expect her to puzzle out the oscillator tuning. Because of this and other problems, the ultra sensitive and selective superhet was temporarily left to the very experienced experimenter or radio amateur.

The TRF Had Its Day. With the skyrocketing popularity of radio broadcasting, the home entertainment center featured not the superhet but instead a tuned radio frequency receiver—TRF for short. Early radio magazine ads showed home life on a cold snowy night with a warm fireplace crackling and everyone seated comfortably around the TRF and listening attentively while Dad readjusted the three main tuning dials. Outside was a massive long wire antenna installation carefully rigged to hold up one or more strands of copper wire at a great height.

Regeneration. The radio usually was a 5-tube set with a tunable low cost RF amplifier. It was an instrument to behold by those just introduced to the electron art, but with all its squeals and whistles it left a lot to be desired. Armstrong was one of the first to recognize that in order for the superhet to make its appearance in the living rooms of America he had to reduce its cost and simplify its tuning. He began work, determining to reduce the number of tubes without chopping the performance. One way was to make the mixer tube also double as an oscillator. Consider the circuit shown in Fig. 2. Here the mixer stage is also made to oscillate by virtue of the plate signal fed back to the grid circuit through the inductive coupling of L1 and L2. If C1 is tuned to say 1100 kHz, then any 1000 kHz broadcasting signal that can struggle into broad tuning L1 will also be impressed on the grid and we have a resulting difference frequency of 100 kHz. It is then fed to the IF amplifier in the usual way. What's wrong with this scheme is that C1 is actually detuned from the desired 1000 kHz broadcast station so we lose sensitivity.

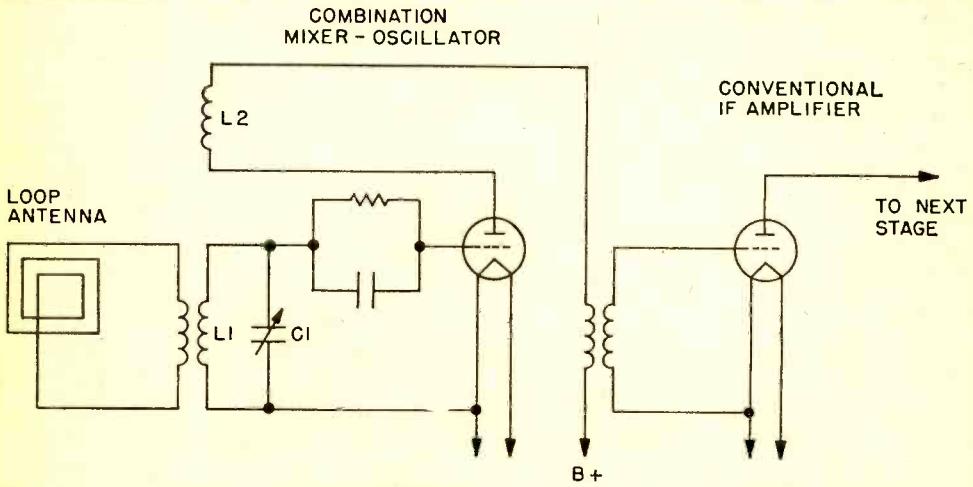

Fig. 2. Don't confuse this circuit with a regen receiver—actually, it is a superhet-type. Capacitor C1 is tuned to 100 kHz above the antenna signal and mixed in the first stage.

Next let's try the circuit shown in Fig. 3. Here the oscillator is set in motion by using the same general scheme of inductive plate to grid feed-back through T2. The radio station's modulated signal comes in on T1. Notice that L1 and L2 are connected in series. We can tune the L1-C1 combination to 1000 kHz and the L2-C2 combination to

1100 kHz. We then have in the plate circuit of V1, the 1000 kHz signal from the radio station plus the 1100 kHz feed-back oscillator output which combine to give us our good friend the 100 kHz difference frequency. It sounds easy but it turns out that it was practically impossible to tune. In reality, the tuning of C1 and C2 are only 100 kHz apart and if you change the setting of C1 it interacts to alter the tuning of the L2 and C2 network and visa versa. So you would have to be an expert to keep up with that tuning marathon.

Armstrong's staff finally came up with the solution to the dilemma. They used the same circuit as in Fig. 3 except that C2 is tuned to produce an oscillator frequency exactly ½ of that used during the marthon bout. In other words, with C1 tuned to the usual 1000 kHz, C2 is tuned to 550 kHz instead of 1100 kHz. But why do that? Well, oscillator circuits in those days were rich in harmonics, so appearing at the IF transformer is not only the 1000 kHz, component but also the second harmonic of the oscillator frequency, or 1100 kHz, which produces the nice 100 kHz needed for the IF amplifier. This placed the mixer tuning and oscillator tuning far apart in frequency by a factor of 100% and therefore practically no interaction exists between the two. So now we have a satisfactory mixer and oscillator in the same tube! This was a major receiver circuit breakthrough.

More Tricks. Armstrong wasn't satisfied with this. He needed to sharpen up the tuning of the mixer to eliminate the image frequency problem mentioned earlier. An RF amplifier ahead of the mixer was in order, but how to get it without adding another tube? He solved this by going ahead and adding the RF tube ahead of the mixer but also let it double as an IF amplifier. Armstrong was getting tricky.

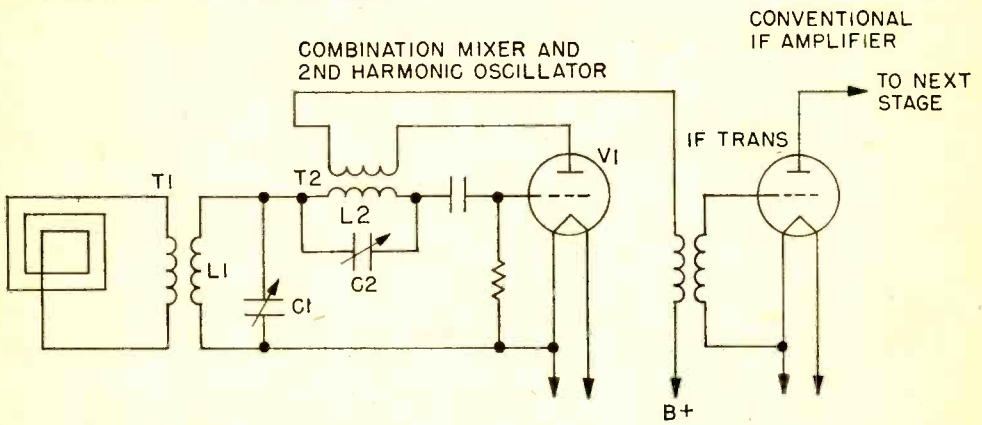

Fig. 3. Once you read the text explanation on how this circuit works, it will be difficult to understand that it works at all! Tuned circuits L1-C1 and L2-C2 interact, making it practically impossible to tune the receiver. Amstrong had to tune L2-C2 to half the desired mixing frequency to obtain the second harmonic for signal mixing.

Refer to Fig. 4 and we will see how he did it. The modulated signal comes in on the loop which is tuned to our usual 1000 kHz station by C1. This is amplified by RF amplifier V1 and is fed through L3 to the input of the 2nd IF transformer. (Note how V2 is bypassed.) Since the 2nd IF transformer is tuned to pass 100 kHz only, the 1000 kHz signal can't get through and stops there. Notice that while this was going on the RF energy is also passed inductively to L4 and mixes with the oscillator frequency by virtue of the same hookup shown in Fig. 3. C2 is tuned to 550 kHz and the components of the station signal and the 2nd harmonic of the oscillator show up in the plate circuit of V2. Obviously a 100 kHz difference is generated, which is routed back to the primary of the 1st IF transformer. It passes this frequency real well and impresses it back on the grid of V1. Now, V1 is looking at two signals, the modulated station frequency at 1000 kHz and the 100 kHz difference. Tube V1 amplifies both signals

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just fine and passes them on through L3 again and to the 2nd IF transformer which passes the 100 kHz component real well. The IF amplifier gladly amplifies it before passing it on to the following vacuum-tube stages.

So Armstrong now had another breakthrough. He had succeeded in incorporating all the virtues of a well designed superhet by using six battery-powered triode tubes. In conjunction with the packaging engineers of RCA, this circuit made its appearance in 1924 as the Radiola Superheterodyne. It sported a built-in loop antenna making the big long-wire antenna unnecessary. You might say that this was the beginning of public acceptance of the superhet. It wasn't low cost ($286 without batteries); but thousands were sold because affluency was becoming more common in the dawn of the great business boom of the mid 1920's. It was not too difficult to tune, although the separate oscillator tuning caused repeat points for every station. However, careful adherence to the instruction book reduced this. So now the little old lady with the Stanley Steamer could easily tune in these distant stations and have no difficulty in separating the Merry Old Chief of the Kansas City Night Hawks from Harry Reser's Clicquot Club Eskimos.

A New Dawn! The introduction of the Radiola Superheterodyne in 1924 breathed new life into the radio fan fraternity. The radio magazines of the day now featured a vast array of superhet circuits encompassing all sorts of theoretical advantages. Gerald Best, McMurdo Silver, Robert LaCault, and Jackson Pressley were some of the popular figures who offered design innovations. The public's hunger for selective reception of distance stations spawned bigger and better sets. Competition among radio manufacturers was bringing down the price of tubes and parts, so one didn't have to be quite as economically minded when cooking up a *super circuit*. Our friend the radio experimenter now bragged that his set tuned so sharply that when *tuning in a duet, it came through as a solo!* Superhet kits began making their appearance with easy step-by-step instructions for the not-so-learned radio fan.

With the advancing state of the art, the operating frequency of the IF amplifier started to increase. Instead of the popular 50 kHz and 100 kHz, in the early days, values of 175, 262, and 370 kHz made their appearance to help reduce image frequency. It is a well-known fact that 455 kHz is the popular one today. How did we ever settle on that value? This is kind of a mystery, but one reason already mentioned is to help reduce image frequency. For example, go back to the case of tuning the mixer to a 1000 kHz station, the oscillator would be tuned to 1455 kHz to produce a difference of 455 kHz. Now, if the mixer also allowed a 1910 kHz signal through, it would produce a 455 kHz difference and would come through on top of the 1000 kHz station. But it would be a pretty lousy mixer that would be so broad as to allow this to happen.

But there is a bit of folklore that had more to do with pegging 455, and it had something to do with harmonics. Notice that the second harmonic of 455 KHZ is 910 kHz. In the late 1920's there were no U.S. stations broadcasting on 910 KHZ. It was reserved for the Canadians. Legend has it that 455 was selected to protect the IF am-

Every grandfather today can recall the Philco Model 80 design with its remarkable circuit innovations. Designed to sell during the Depression days, the Model 80 brought laughter and hope into the homes of Americans.

They had kits in the good old days! This photo shows a beautifully restored 1925 battery-operated Remler superhet receiver available to advanced experimenters in kit form only. It featured eight triodes and required a magic touch at the knobs to make it work properly.

plifier against interference. An improperly shielded 455 kHz IF amplifier would easily let a 910 kHz (2nd harmonic) station get through if you had a powerful one nearby. So, unless you lived on the border, this arrangement would help protect against that problem in your early superhet.

Bye-Bye TRF. With the further loosening of the economy, the general public began finding out about the superhet and the TRF began losing favor. In the late 20's the superheterodyne circuit flourished, with the appearance of the big $400 consoles which featured a single tuning dial and tremendously improved audio quality.

Since necessity is the mother of invention, when the bottom dropped out in 1929 the radio designer had to come up with something that could be had for a few bucks. Next came the entrance of the cathedral-shaped table radio.

Radio designers now had to resort to all kinds of tricks in order to drastically reduce cost but still maintain good selectivity and tone quality.

One of the marvelous examples of such a play is the 1931 vintage Philco Model 80. All the superhet action is done with two tetrode tubes! Add a pentode audio stage and a power supply rectifier (4 tubes total) and you have a very fine set to sell for about $19.95. The circuit is shown in Fig. 5 and it operates something like this. Connected to the plate of the 236 mixer-oscil-

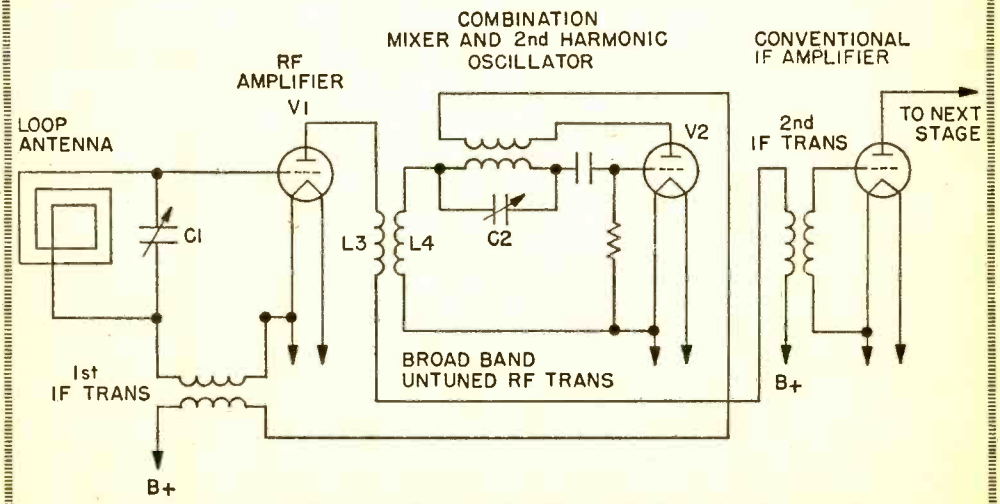


Fig. 4. Here is a circuit that defies analysis at first glance. The combination mixer and 2nd harmonic oscillator circuit operates like the circuit in Fig. 3. This receiver circuit was first used in 1924.

lator, V1, is an oscillator coil with its tank circuit tuned 455 kHz higher than the incoming signal. This energy is transferred by pickup coil L2 in series with the cathode bias resistor R1, so the plate current in V1 will vary at the oscillator rate. Also, the plate is varied by the incoming signal on the grid so we end up with the difference frequency of 455 kHz which is passed on to the IF transformer. They couldn't afford an IF amplifier tube, so they made up for it by introducing a little positive feed-back in the 2nd detector by virtue of coupling coil L3. Believe it or not, even though the actual circuit contains 8 trimmer capacitors which needed peaking up, the Philco Model 80 home receiver really performed with the one-dial tuning at that.

By now the little old lady with the Stanley had lost all her money in the stock market crash. She may be forced to drive a used Model T Ford, but she's fortunate in one way—she only needs a $20 bill to get a first class table model superhet that would eat alive her old Radiola Superheterodyne.

The radio development that finally sounded the death-knell to the TRF radio and made the superhet the front runner for good and all was the advent of the pentagrid converter tube. One of the first was the type 2A7 and was basically two tubes in one and allowed the mixing and oscillator action to happen in one envelope. All previous attempts described so far using conventional tubes depended upon the signal frequency and oscillator frequency being impressed on the same control grid. This arrangement loses efficiency as the oscillator frequency goes up because the signal and oscillator voltages get out of balance. The pentagrid tubes provided electronic shielding between the two functions and eliminated all the loading and detuning problems. The type 2A7 was the grandfather to the 6K8, 6SA7, 6BE6, etc., which were so popular in the twilight hours of tube type radio.

History will certainly call Edwin Armstrong "Mr. Superheterodyne." His contributions were a major factor in leading the way to awaken the giant that we have come to recognize as the fabulous electronics industry. ■

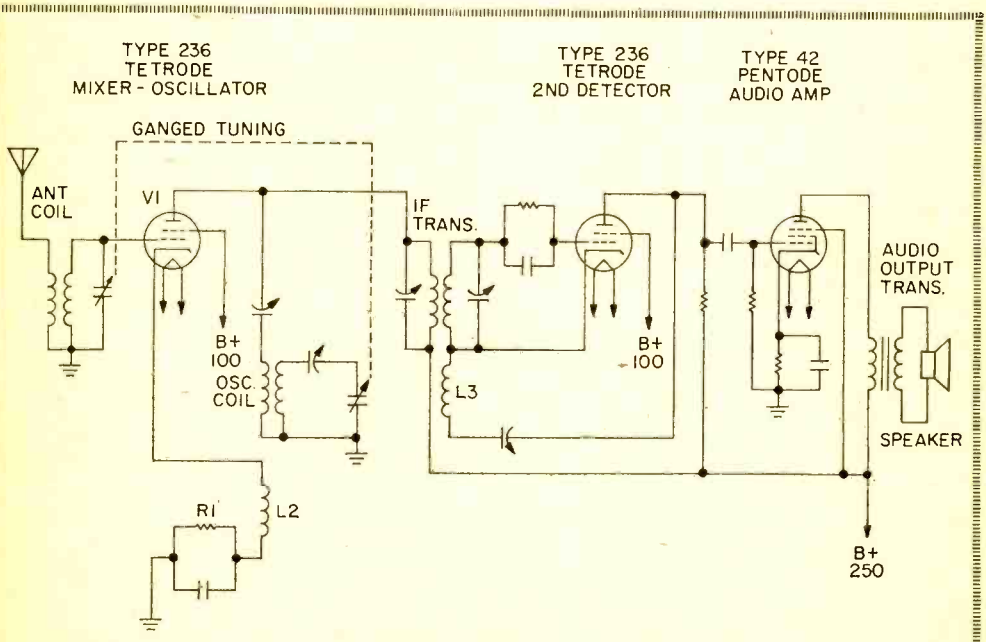


Fig. 5. Now the superheterodyne circuit is shaping up to resemble the circuit used today. One knob tuning was now a reality with the invention of the ganged tuning capacitor. This circuit was used in the 1931 Philco Model 80. The tetrode and pentode vaccum tubes were relatively new. A rectifier tube, not shown, provided DC voltage eliminating the need for expensive wet-cell batteries.

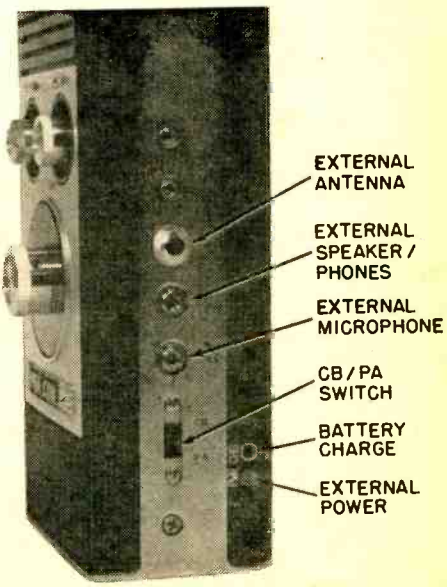
by Kathi Martin KAI0614

KATHI'S CB CAROUSEL

WITH all the shady characters a girl is likely to run into these days, one of the things I don't do is take off on a trip without full CB gear in the car; so imagine my chagrin when the day before I'm off to Mt. Snow some clod—without a driver's license—pushes my trunk into the back seat and my friendly fender-bender-mender can't get my gear out!

So there I was with a rented car twice the size of an aircraft carrier and no CB rig, no way to shout for HELP (channel 9, natch) if the wheels break down on some dark, lonely road. But leave it to the boys in our test lab to figure things out. They were right when they handed me a clip-on rain gutter antenna and a Lafayette Dyna-Com 23 walkie-talkie and said the package would solve all my CB problems.

The Dyna-Com 23 is a *full feature* 23 channel, 5 watt CB rig built in a walkie-talkie cabinet. It is normally powered by 10 alkaline or flashlight-type penlight batteries, or 12 ni-cads. It features both *volume* and *squelch* controls, a combination *S/RF/battery* meter, a *PA/CB* switch, telescopic an-



Yup, that really is a full feature, 23-channel, 5-watt rig Kathi is using (see top photo). Close up view (left) shows how compact the Dyna-Com is. Side panel (right) is packed with the little extras every CBer wants. Circle No. 68 on Reader Service Coupon for more info.

tenna and jacks for an external antenna, external speaker or earphone, and external microphone. The jacks are normally covered with screw-in caps. Separate jacks are provided for a battery charger and/or AC power pack.

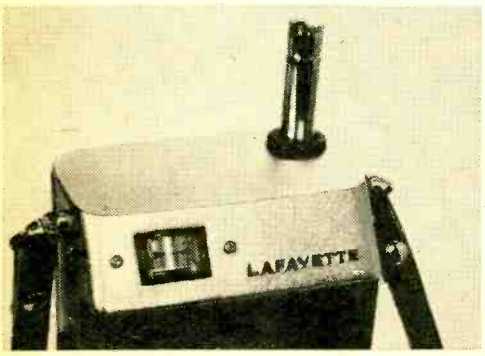
The frequency synthesized transmitter and receiver sections are full-scale, like right out of a top quality base unit. The receiver features a mechanical filter, and performance checked out (after I got back) with a sensitivity of 1 μV for 10 dB signal to noise plus noise (S+N/N) ratio, with a 50 dB adjacent channel rejection. The transmitter put out 2.5 watts RF into a 50 ohm load with a fresh set of alkaline or flashlight-quality batteries. (Since alkalines were hard to come by in back-country general stores I wound up using Eveready's 4-for-a-buck kind. Offhand, I would estimate I was using two sets of flashlight batteries when I could get by with one set of alkalines.) The transmitter section features a compression type modulator (Lafayette's *Range Boost*) that requires just a little more than a whisper for 100 percent modulation, and there is 100 percent modulation limiting. Actually, stations I worked had no idea I was using a walkie-talkie, and I got solid copy each and every time.

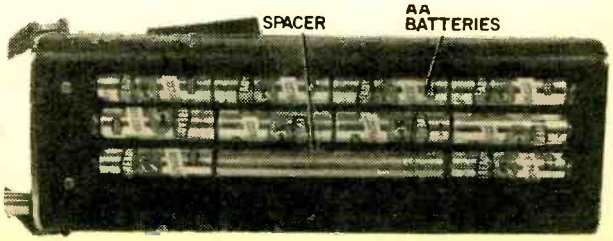
Those Mini Jacks. At this point you might be wondering how I got rave results from a walkie-talkie—even a 5-watter—inside a car. If you recall I mentioned several accessory jacks, which are located on the side of the Dyna-Com 23. All are of the miniature type, and the test lab crew had installed a PL-259/mini adaptor on the end of the clip-on rain gutter whip. I simply placed the rig on the seat (held down by the passenger seat belt) and plugged the whip into the walkie-talkie, thereby giving me a "full size" mobile station. When I left the car, I either unplugged the whip and put the rig in the trunk or slung the rig over my shoulder (it has straps) and carried it along.

Another instance where those accessory jacks paid off was at Lake George, one of the most beautiful places in the world, up in New York's Adirondak Mountains. I was assisting a local photographer take some water skiing pictures. He was in the photo boat with a small 100 mW rig and I was in the towboat, but I just couldn't hear his instructions over the scream of 135 horses. I borrowed the earphone from a transistor radio, plugged it into the Dyna-Com 23, and from then on it was strictly 100 percent copy.

Back At The Ranch. I hated the thought of giving the rig back to the lab crew. This is the kind of equipment I like to have around because there's always some use for it. Thanks to "Big Herb" it's now sitting on my desk as a portable base station equipped with a set of ni-cad batteries and installed on a small AC power pack. Whenever I need a walkie-talkie, I simply lift the Dyna-Com 23 out of the base, pull the antenna and power supply plugs and I'm off and running.

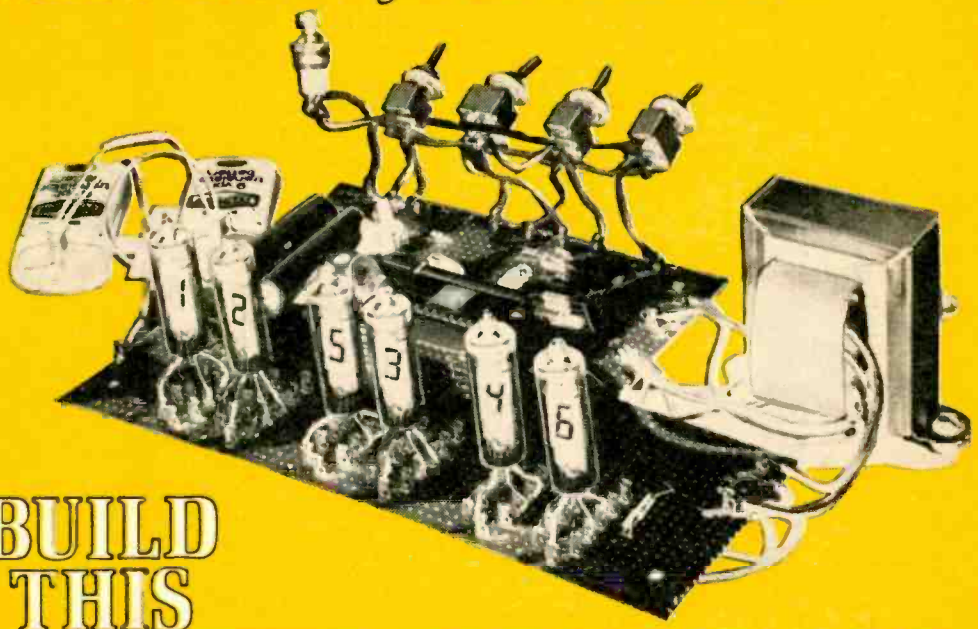
Summing Up. As the lab crew said when they first gave me the Dyna-Com 23, it *is* a real *problem solver!* But more than that, it's a fine piece of equipment, really a full-feature, 23 channel, 5 watt base station in a hand sized cabinet. The basic transceiver complete with crystals for all 23 channels costs $129.95. Nicad batteries, a spare plug-in battery pack, a battery charger and an AC power pedestal are optional accessories. For additional information circle No. 68 on the reader service coupon. ■





A small triple-threat meter (above) serves as the Dyna-Com's battery condition indicator, relative S-meter, and power output indicator. Power is supplied by 12 ni-cad cells or 10 carbon-zinc penlight batteries. A metal spacer (right) takes up the space of two unused cells.

Time from your hands...



BUILD THIS ELECTRONIC CLOCK

Turn a few parts into the darndest digital calendar-clock you've ever seen!

by C. R. Lewart

You can **see** the advantages of a digital clock! Particularly this one! It has big, bright, bold numerals that display time, date, and your electronic interest and skill to all who view it. And as you would expect, we turn a complex electronic instrument—the digital clock—into a very elementary electronic project!

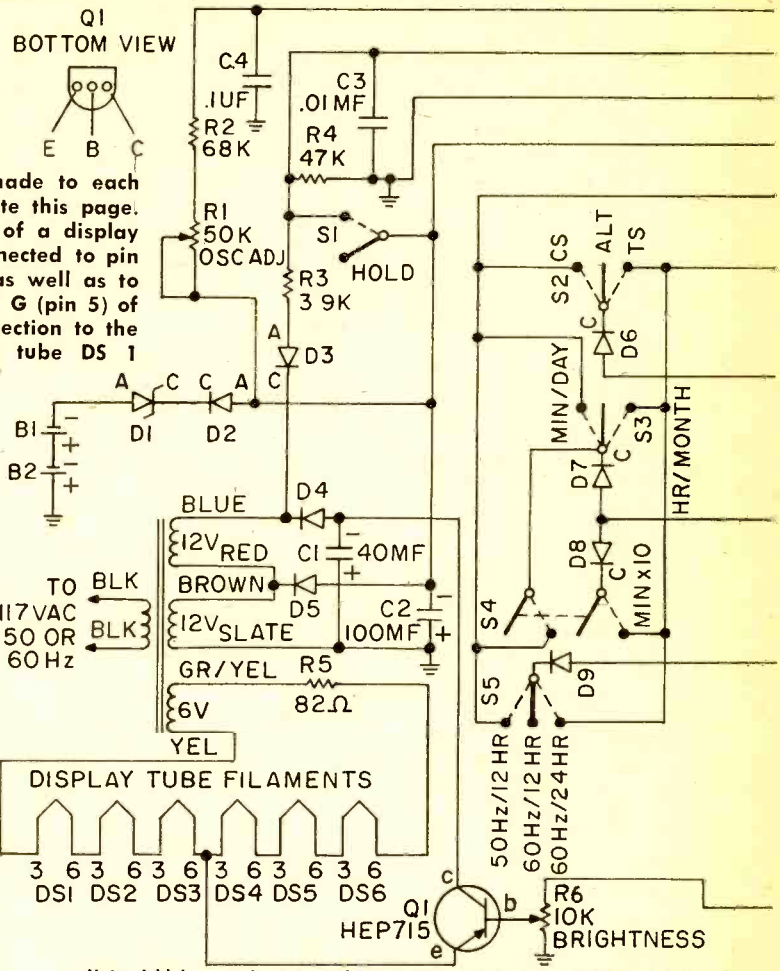
How did we do it? By putting together the ideal marriage of a popular clock-on-a-chip IC (integrated circuit) and a new fluorescent-anode type display tube that can be driven directly by an IC.

What does that mean to you? A set of twenty driver transistors you don't need; extensive wiring on a high-priced circuit board you don't need; an extra high-voltage power supply for cold-cathode display tubes you don't need. And there's more.

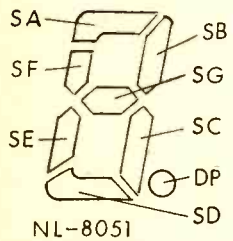
Convert to a 24-hour clock in a snap. Flip a switch on the rear panel to convert your clock immediately to a 24- or 12-hour time display. Plus, a pair of ordinary 9-volt transistor radio batteries keep things ticking electronically while you move from one outlet to another or until a power interruption or brownout is over. This little trick is done with a built-in oscillator that feeds the counter until 60 (or 50) Hz voltage is restored. Yep! there's even a switch that gives the correct time from either a 50 or 60 Hz power line.

As You Can See, the electronic clock described here was designed to provide a large number of features and make construction simple.

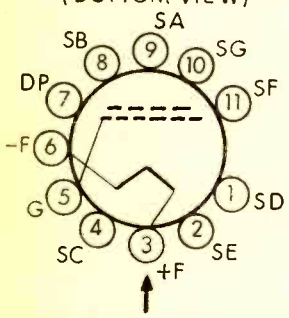
e/e ELECTRONIC CLOCK



Eight of the ten connections made to each display tube are shown opposite this page. For example, the SA segment of a display tube (pin connection 9) is connected to pin nine of all the display tubes as well as to IC 1 pin 15 and R13. Only grid G (pin 5) of each tube has a separate connection to the integrated circuit. For display tube DS 1 it is IC 1 pin 3; for DS 2, it is IC 1 pin 4, et cetera



NL-8051
BASE CONNECTION
(BOTTOM VIEW)

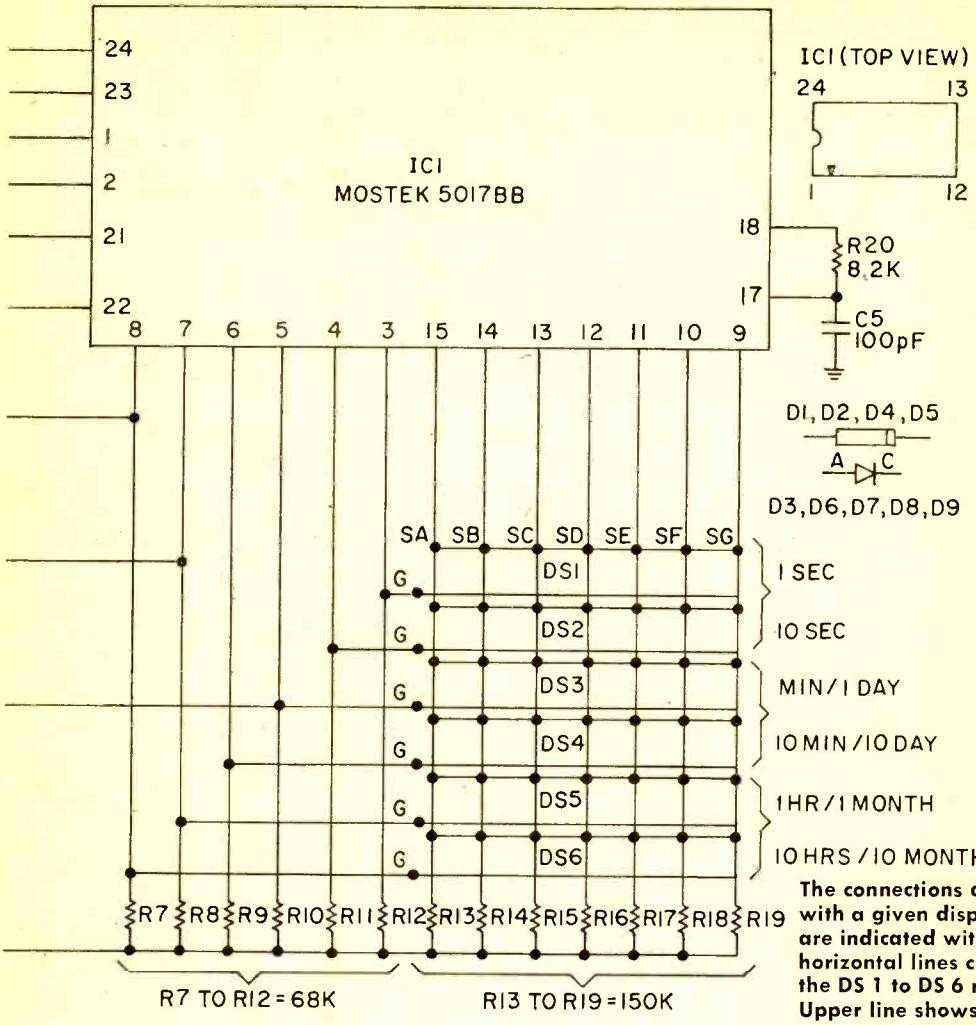


Note: Add jumper from top of R6 to "c" of Q1. Or, pull Q1 and R6, tie resulting 3 wires together and eliminate brightness control.

Note: Capacitors C3, C4, and C5 can be voltage rated at 100 VDC or better.

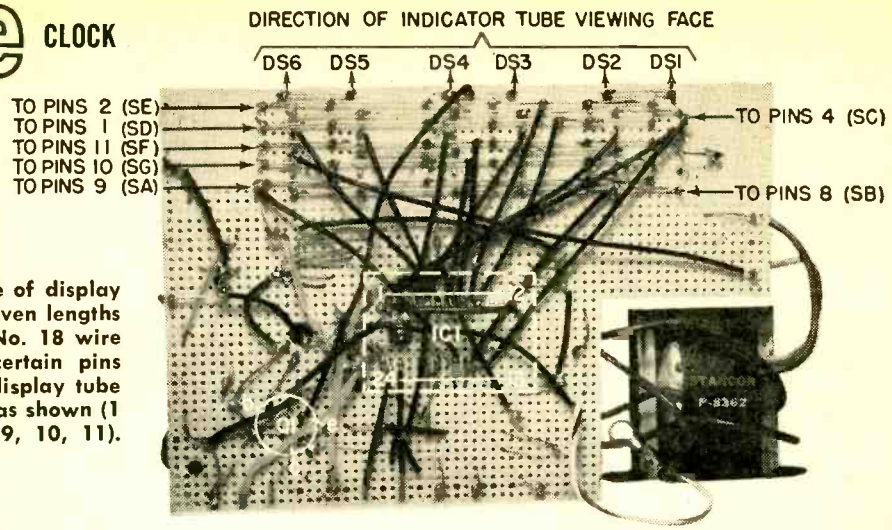
PARTS LIST FOR DIGITAL CLOCK

B1, B2—9-volt transistor portable battery (Radio Shack 23-464 or equiv.)
C1—40 uF, 50 VDC electrolytic capacitor, subminiature type, value not critical (Radio Shack 272-1027 or equiv.)
C2—100 uF, 35 VDC electrolytic capacitor, value not critical (Radio Shack 272-1016 or equiv.)
C3—0.01 uF printed-circuit capacitor (Radio Shack 272-1069 or equiv.)
C4—0.1 uF printed-circuit capacitor (Radio Shack 272-1069 or equiv.)
C5—100 pF ceramic disc capacitor (Radio Shack 272-123 or equiv.)
D1—Zener diode, 6-volt (Radio Shack 276-621 or equiv.)
D2, D4, D5—Silicon power diode, 1N4001 (Radio Shack 276-1101 or equiv.)
D3, D6, D7, D8, D9—Silicon signal diode, 1N914 (Radio Shack 276-612 or equiv.)
DS1-DS6—Fluorescent display tube, National NL-8051 (write to National Electronics, Inc., Box 269, Geneva IL 60134 for name and address of nearest local dealer; or write to Circuit Specialists Co., Box 3047, Scottsdale AZ 85257 enclosing $5.00 for each unit required, shipped postpaid.
IC1—Mostek 5017BB (available from Circuit Specialists Co., Box 3047, Scottsdale AZ 85257 for $24.95 postpaid)
Q1—2N3906 (Radio Shack 276-2012 or equiv.)



The connections associated with a given display tube are indicated with two thin horizontal lines closest to the DS 1 to DS 6 reference. Upper line shows the seven segments; lower, the "G".

R1—50,000-ohm potentiometer (Radio Shack 271-219 or equiv.)
R2, R7 through **R12**—68,000-ohm, ¼-watt resistor (Radio Shack 271-1800 or equiv.)
R3—39,000-ohm, ¼-watt resistor (Radio Shack 271-1800 or equiv.)
R4—47,000-ohm, ¼-watt resistor (Radio Shack 271-1800 or equiv.)
R5—82-ohm, ¼-watt resistor (Radio Shack 271-1800 or equiv.)
R6—10,000-ohm potentiometer, miniature type (Radio Shack 271-218, 271-223 or equiv.)
R13-R19—150,000-ohm, ¼-watt resistor (Radio Shack 271-1800 or equiv.)
R20—8,200-ohm, ¼-watt resistor (Radio Shack 271-1800 or equiv.)
S1—Spdt, normally open pushbutton switch, miniature type preferred (Radio Shack 275-1547 or equiv.)
S2, S3, S5—Spst, neutral center subminiature toggle switch (Radio Shack 275-325 or equiv.)
S4—Dpdt subminiature toggle switch (Radio Shack 275-1546 or equiv.)
Note: Although switches S3 and S4 should have been specified as spring-return-to-neutral-position types, they were not because they are difficult to obtain. If not available, make substitution.
T1—Filament transformer, Stancor P-8362. You can also series-connect the secondary of two inexpensive 12 V transformers (Radio Shack 273-1385) plus use a 6 V unit (Radio Shack 273-050) in place of the multi-secondary unit.
Misc.—24-pin IC socket with solder tabs (Allied 746-0906 or equiv.), 3-in. x 8-in. x 6-in. aluminum cabinet, wire, blue or green plastic light shield, etc.



Underside of display board. Seven lengths of bare No. 18 wire connect certain pins of each display tube together as shown (1 2, 4, 8, 9, 10, 11).

Let's go over the list of features:

A display of time (hours, minutes, and seconds) alternates with the date (month and day of the month).

At the flip of a switch, the display changes from a 12-hour to a 24-hour mode.

A stand-by battery operates the clock during power failures (most other clocks reset to zero even during momentary power failures).

A simple adjustment of the seconds display is provided, with a hold button to stop the counting and a 50/60 Hz switch to speed up the counting by 20 percent.

Display intensity can be adjusted.

Multiplexing of the display tubes (a sequencing time-system) eliminates a "rat's nest" of wires (display is seen without annoying flicker or blanked-out digits).

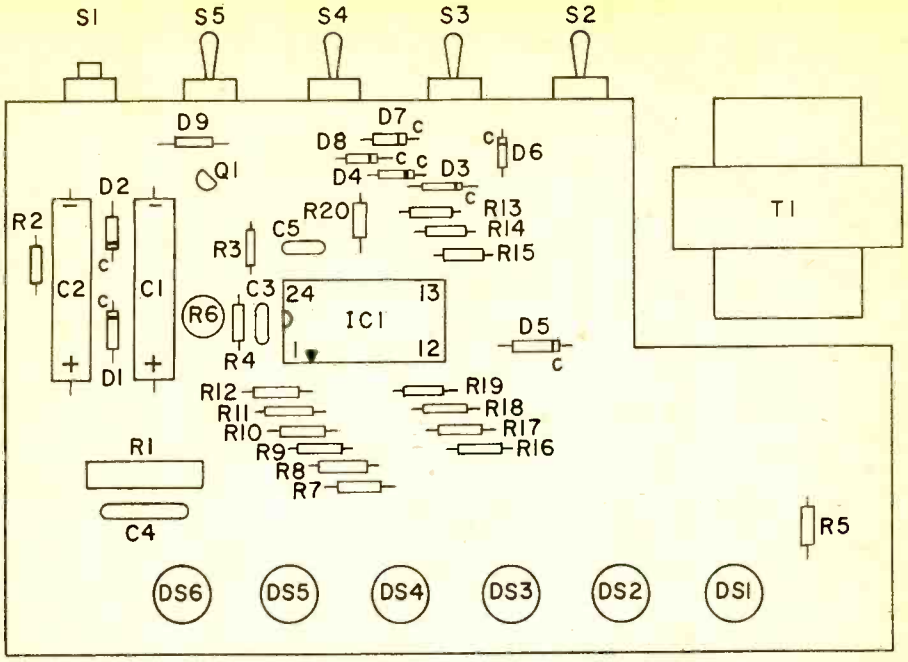
An economy model cuts out seconds display, brightness control, battery switchover, 50/60 Hz and 12/24-hour switchable features, if you wish.

A handsome face for your finished clock

More Info. The construction of the clock was kept simple by selecting an IC requiring a minimum number of connections and by choosing fluorescent display tubes which can be driven directly by the IC. The complete circuit uses, in addition to its IC brain, four to six display tubes, a power transformer, only a single transistor (if you want brightness control), twenty resistors, five capacitors, and nine diodes. If you don't care about the seconds display, you omit two display tubes with associated components. Compare this clock to a well-known digital clock kit with over twenty transistors and over fifty resistors! Anybody even moderately handy in electronic construction should have no difficulty building the clock in a few hours.

How Does It Work. The MOS integrated circuit consisting of over a thousand transistors divides the 50 or 60 Hz line frequency into seconds, minutes, hours, days, and months. A decoder on the same IC operates the individual segments of the display tubes, which are operated in multiplex mode. This means that the IC sends signals to the first display tube, then the second, and so forth, and then starts with the first tube again. This mode of operation simplifies the wiring to the IC, since all like segments in the display tubes can be wired in parallel and connected to a single pin on the IC. Therefore, seven pins on the IC control the segments of all the display tubes. Just four or six other pins on the IC (one per tube used) control individual tubes with a connection to their control grids.

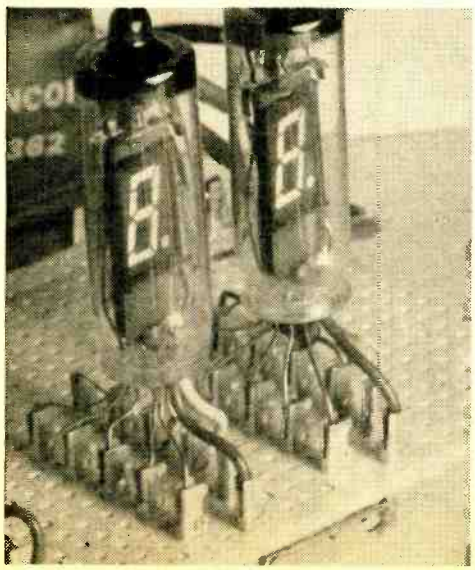
Additional logic on the IC provides for



Top of the board showing a suggested location of all discrete components that are used in this circuit. Resistors R 7 through R 19 are grouped as shown to facilitate their connections to the integrated circuit.

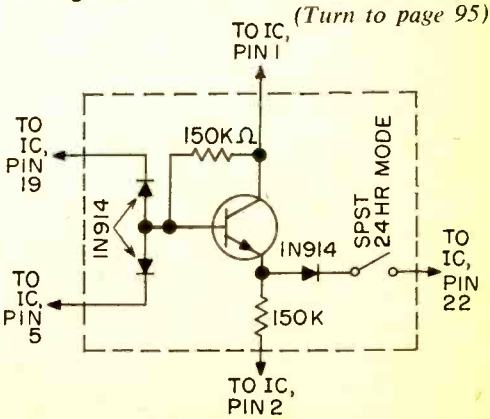
alternate time/date and 12/24-hour display. When the AC power line is disconnected, the stand-by battery takes over and an internal oscillator controlled by C4, R1, and R2 substitutes for the line frequency. To conserve power, the display tubes are *not* lighted during the stand-by operation, but the clock runs as usual.

Display tube mounting using push-in clips. Stagger the eleven clips as shown and strap like pins together with bare wire on underside of board. See photo on opposite page.



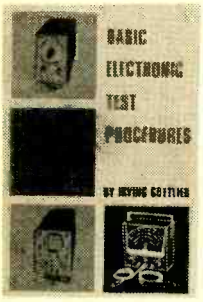
Construction Hints. Use approximately a 4½-in. x 6-in. piece of perfboard or vectorboard with holes spaced at 0.1-in. Insert the display tube leads into push-in terminals and run parallel wires between the display segments. Use a socket for the IC, but do not insert the IC before all the construction is finished. Be careful in handling the IC before inserting it. Static electricity may damage it. The clock case has to be grounded to the wire connected to pin

(Turn to page 95)



December display circuit for 24 hour clock fans. Transistor 2N3904 base is same as Q1.

Test Tome. *Basic Electronic Test Procedures* by Irving M. Gottlieb is a mammoth step-by-step guide to all types of basic electronics measurements—using simple, inexpensive test instruments. The ability to make meaningful measurements and to put the resulting information to work is essential in any area of electronics. Of course, the job is much easier with an



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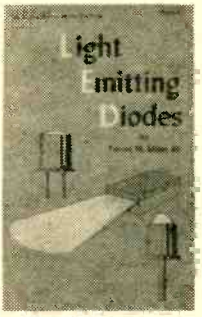

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tal of silicon carbide. Today this discovery has attained commercial application in the form of the Light Emitting Diode (LED). A new book, *Light Emitting Diodes* by Forrest M. Mims, III, covers the topic of light emitting diodes very thoroughly, starting with the theory of semiconductor emission and details of physical construction. LEDs are experiencing important new developments. In recent years the field has literally exploded, largely as a result of the demand for LED displays in electronic calculators and digital equipment. Published by Howard W. Sams & Co., Inc.; get more information by circling No. 69 on Reader Service Coupon.

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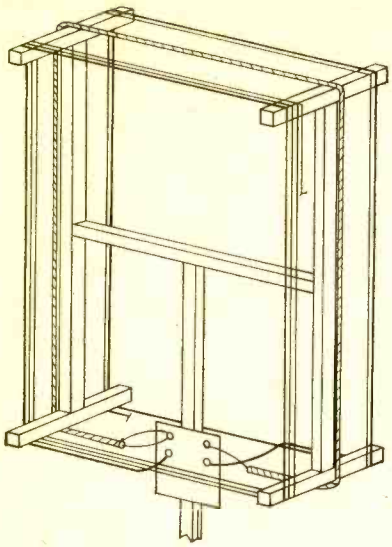
(Continued on page 106)

Broadcast Band DXers...



LOOK AGAIN TO A LOOP

Build this rotatable antenna. Nulls out beat interference. Helps track down tough dog BC band DX.

by Steve A. Money G3FZX

HAVE YOU TRIED DXing the BC band yet? If not, then maybe you're missing out on a whole section of the DXing hobby. It can be more interesting than short wave DXing although the stations are not usually as far away. The more distant stations are certainly much harder to log than the big international short wave broadcasters but are often much more interesting to listen to.

In another year or two we shall be coming to the minimum of the current cycle of sunspot activity. At this time reception on the higher frequency band, such as on short wave, becomes poor. On the lower BC band frequencies the opposite is true and the band really starts to come to life from the DX point of view.

Many of the stations you are likely to hear will be from the North American continent. With a little more careful listening however South America and the other continents. An advantage of working on the BC band is that nearly all of the programs will be in English so you can put all those foreign phrase books back on the shelf. Some Canadian stations broadcast in French and most programs from Mexico are in Spanish but these should not be too difficult to sort out.

Listening Hints. The best time to listen for BC band DX signals is during the winter months. Signals tend to be weaker in the summer and often there will be a high level of noise from electrical storms which makes reception difficult. Generally the more distant stations will become audible as darkness falls and reception of DX should be possible until dawn. Conditions often vary from one night to the next so that one can never be sure what surprises are in store at the start of a night of listening. Maybe this is one of the things that makes BC band DXing so fascinating.

Apart from a reasonable receiver and an effective antenna all you need is a lot of patience. What sort of antenna? Well that piece of wire strung up across the shack may be OK for logging the local station but it's not going to be so hot for DX reception. Because there are so many stations using the BC band it will be found that there are often two or more stations coming in on the same frequency. The result is a confusing jumble of signals with one or other of them coming out on top as the rest fade out. Listening under these conditions can be very tedious and the identification of the individual stations can be almost impossible. On the short waves it is possible to get over this by using a directional type antenna such as a rotary beam.

BCB Beam Problems. Rotary beam antennas come rather large when they are designed for operation on the lower frequency BC band. If we take a mid band frequency

of 1 megahertz then the length for a half wave antenna element works out at some 500 feet. Imagine a three element beam on that sort of scale. The mind boggles. Now if you just happened to own a ranch out in the wide open spaces of Kansas or Wyoming and had a few hundred dollars to pay for the erection of one or two towers, then you too could have yourself a full size BC band beam antenna. I guess most of us ordinary mortals who live in or near the city can always dream of such things. Usually the back lot in a city house or apartment is so small it's difficult to swing a baseball bat let alone erect any fancy antenna system. Apart from that, the neighbors might not appreciate the aesthetic beauty of a 500 foot antenna tower casting a shadow over their house!

In Britain the BC band enthusiasts face very much the same problems. An added difficulty is that in many city owned houses and apartments, the erection of an antenna, even for TV or FM radio reception, is forbidden. With a certain amount of native cunning however, a way round these problems was soon discovered and now even the guy in a high rise apartment block can listen to DX.

Back in the old days of radio, before transistors and ferrite rod antennas were even thought of, the so called portable radios used battery operated tubes. In those old type radios the antenna consisted of a large coil of wire wound around the inside of the case. This type of antenna is called a loop or frame antenna. In most of these radios the loop antenna was made less than a foot square and was not too sensitive, but it did have a directional pick up pattern. For DX-ing it seemed that a bigger version of the old loop antenna, in combination with a modern communications receiver, might prove to be quite effective. In practice it was found that a loop antenna four feet square would give good signal pick up and provide remarkable directional properties when it was properly coupled into the receiver.

The Loop Works? The easiest way to understand the operation of a loop antenna is to consider it as just one square turn of wire mounted vertically. The signal is usually taken out by breaking into the bottom side of the turn. Figure 1 shows the general idea. Now when a radio signal passes through the loop it will cause a voltage to be induced into each of the vertical sides of the turn. These two voltages will be roughly equal in amplitude.

Suppose the loop is set up so that it is facing broadside on to the direction from which the signal is coming. The two sides of the loop will now be at exactly the same distance from the transmitter antenna. This means that the voltages induced in them will be exactly the same and in phase with one another. Each of these voltages will try to make a current flow around the loop. Since the two currents will be trying to flow around the loop in opposite directions, they will cancel one another out. As a result no current actually flows around the loop and no signal is transferred to the receiver.

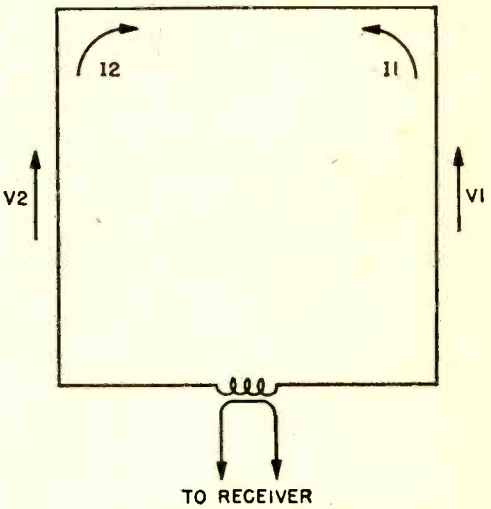


Figure 1 shows currents in an operating loop facing the signal. Currents induced, equal in magnitude but opposet in phase, cancel to cause an antenna null point.

If the loop is now turned so that it is end on to the direction of the signal, one side will be nearer to the transmitter than the other. Although radio waves travel at the speed of light, it will take a short time for the wave to travel from one side of the loop to the other. As a result the signal induced in the far side of the loop will lag behind that in the near side. There is now a phase difference between the two voltages induced in the loop and the currents that they produce will not cancel out completely as they did before. As a result there will now be some current flowing around the loop and this current will cause a signal to be transferred to the receiver.

The position of the loop at which the signal is cancelled out is usually quite sharply defined. If the loop is rotated only a few degrees in either direction from this position the signal rapidly rises towards its maximum level. Thus although a station in a particular direction may be almost completely cancelled out, other signals coming in from points only a few degrees off in direction will be almost unaffected. By using this type of antenna at least some of the advantages of a rotary beam antenna can be obtained.

Practical Loop Antennas. So far we have assumed that there is only one turn on the loop. In practice a single turn does not give a lot of signal pick up. Greater output can be readily obtained by simply increasing the number of turns so that the antenna becomes a short coil. In this case the signal pick up increases directly with the number of turns used. The size of the turns is also important. Pick up is directly proportional to the area enclosed by the loop coil.

A further increase in the signal output from the antenna can be achieved by tuning the loop to resonance. This can be done by connecting an air spaced variable capacitor across the ends of the loop winding.

A loop antenna which has sides 24 inches long will need a winding of 13 turns. The turns should be spaced ⅜ inch apart so that the total width of the winding will be about 4 inches. If the loop size is increased so that the sides are 4 feet long, then only 9 turns will be required. In this case the turns should be set ¾-inch apart to give a total coil width of 6 inches.

The tuning capacitor should be an air spaced type with a maximum capacitance of 500 pF. If a capacitor of only 365 pF is used, it may not be capable of tuning the whole BC band. With the smaller tuning capacitor it is necessary to switch a 150 pF fixed capacitor in parallel with the main tuning capacitor when stations at the low frequency end of the band are being received.

Receiver Coupling. It is not practical to couple the ends of the loop winding directly to the receiver input since under these conditions the loop will not work properly.

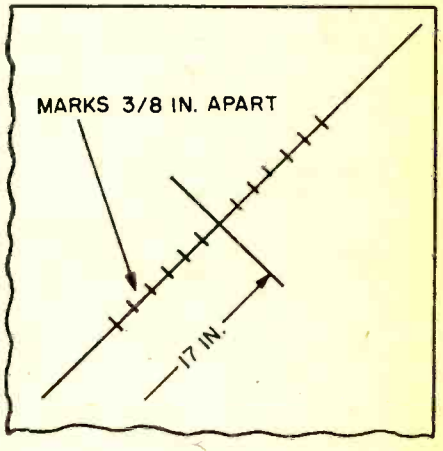


Figure 3. Tap in 13 nails at each diagonal of your 2-foot/side loop as shown. Then wind a thirteen turn spiral of #20 wire.

The easiest method of coupling is to use a link coil. One extra turn is wound alongside the main winding and the ends of this coupling turn are taken to the receiver input terminals.

Better performance is obtained if the link turn is made from a length of RG-11U or similar coaxial cable, using the center conductor as the link turn. One end of the cable's outer braid should be joined to the grounded end of the link turn. The cable shield will act as an electrostatic screen between the main loop and the link turn. This arrangement improves the directional effect of the antenna. The feeder cable used to join the link turn to the receiver input terminals may be either a twisted pair or another length of coaxial cable.

Some kind of support frame will be required to hold the loop winding in place. The actual construction method used will

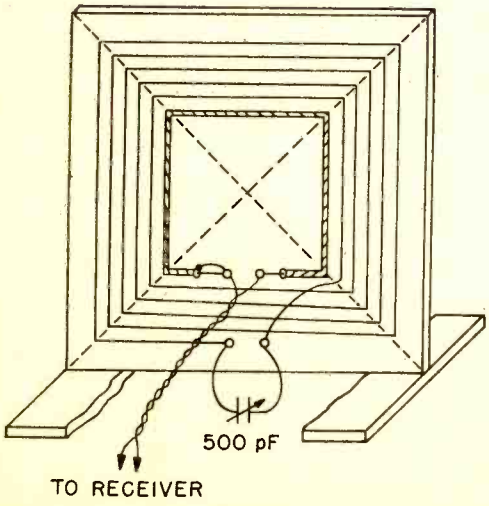
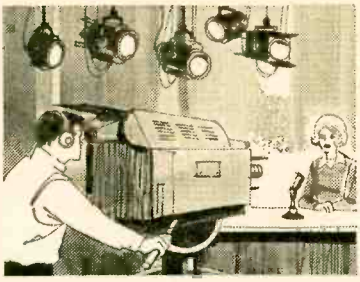
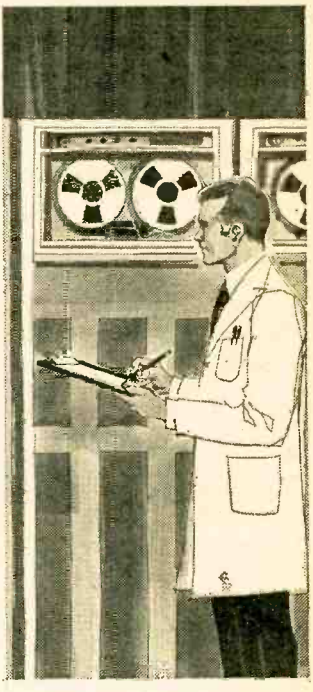


Figure 2. Simple 2 or 4-foot loop is built on plywood. Center pickup loop is coax connected to twisted pair lead-in shown.

Great careers





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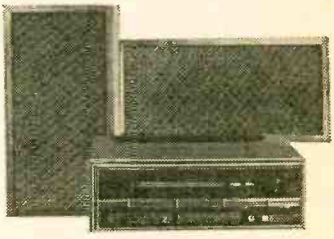

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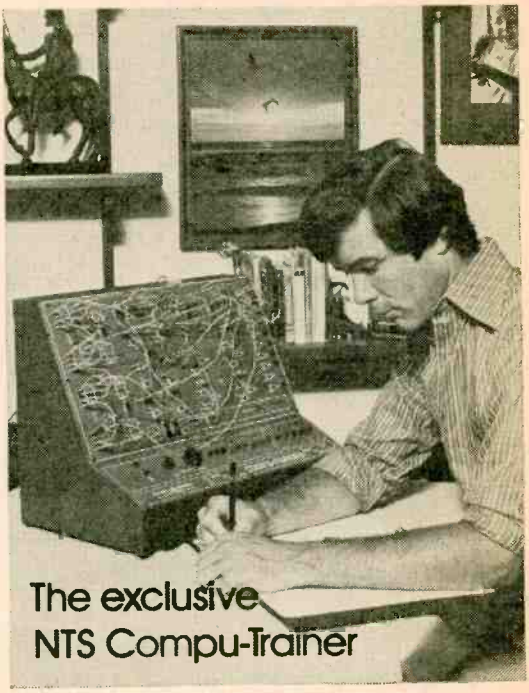

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depend upon your skill in the woodwork shop.

Making The Support Frame. A very simple method of construction is as shown in Figure 2. Take a sheet of plywood some six inches larger than the size of loop desired. For a 2 foot square loop the board will need to be 2 feet 6 inches square and at least a ¼-inch thick. For a four foot square loop the board should be at least ⅜-inch thick.

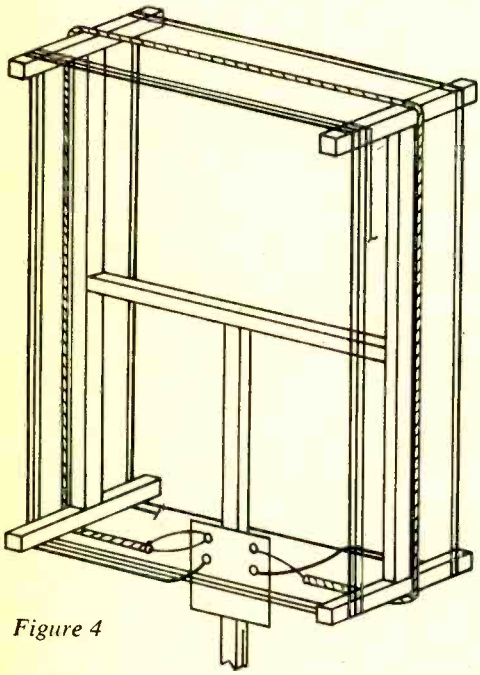


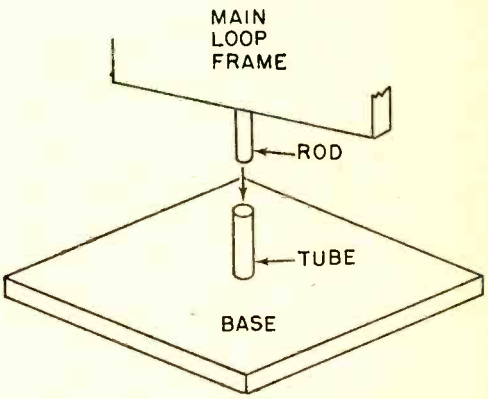
Figure 4

Deluxe "H" frame model for home builders shows center conductor of coax pick-up loop connected to lead-in terminals. Tuning cap connects to bottom terminals.

Mark out the diagonals across the board. Now mark off points 17 inches from the center along each of the diagonals. Still working along the diagonals, mark off 12 points ⅜-inch apart, six on each side of the 17 inch mark as shown in Figure 3. Repeat the pattern at each of the corners. Drive a panel pin or small nail part way into the board at each of the marked points. You should now have a total of 52 pins in the board.

For the loop winding you will need about 120 feet of #20 stranded plastic-covered hook up wire. Start at the bottom and wind a turn around the inner set of pins. Now work out in a spiral winding turns around the other pins until there are 13 turns on the board. As you go along, anchor the wire in place by bending the pins down over it. Join the two free ends of the winding to a pair of terminals or binding posts near the bottom of the board. Put four more pins in the board near the inner set of pins and wind the link turn around them. Fix the link turn in place and take its ends to another pair of terminals. The tuning capacitor can now be mounted on the board and connected across the main winding. Finally the feed cable should be connected from the link turn to the input of the receiver.

For Carpenters Only. A rather more elegant method of construction is as shown in Figure 4. In this case the support frame is in the shape of an "H" and is made up from 1 inch by 1 inch timber. The joints may be either half lap or mortise and tenon according to your skill at woodwork. At the tip of each arm of the "H," a spreader of 1-inch x 1-inch timber is fixed on to hold the winding in place. Cut 13 "V" shape notches along the outer edge at ⅜-inch intervals.



Simple indoor rotating system for your loop can help lower interference from stations on top of the one you are tuning.

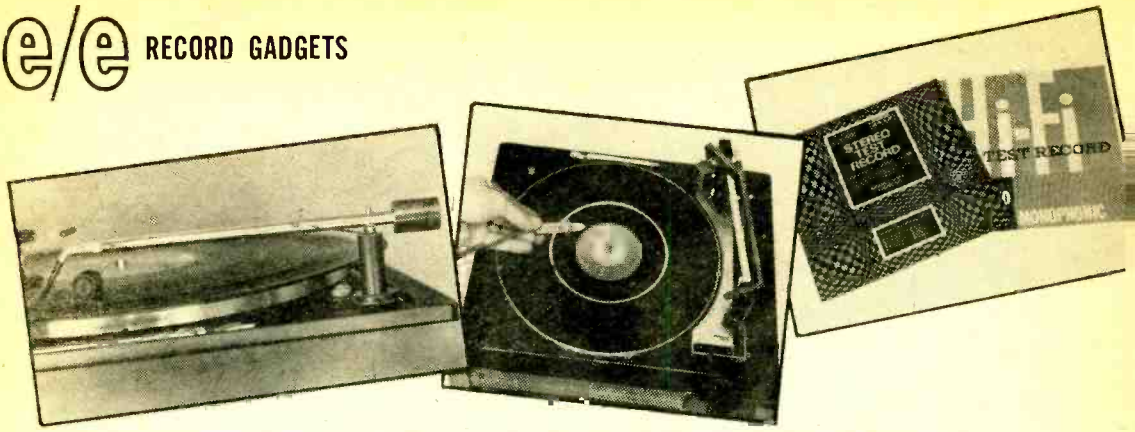
Using The Loop Antenna. Actually, using the loop is simplicity itself. First of all tune the receiver to the station or channel you want to listen to. Now peak up the signal to maximum by adjusting the loop tuning capacitor. If there is some interference from another station then rotate the loop until it is reduced to a minimum. It only remains for me to wish you happy hunting and maybe one day you will achieve Heard-All-States on the BC band! ■

The Little Gadgets That Keep Your Records in Good Shape

by Jorma Hyypia

There's only one way you can have absolutely clean records that will reproduce the recorded sound as perfectly as the quality of your sound equipment permits, without bothering to clean the platters regularly. That is to put your stereo hi-fi equipment into a listening room in which the humidity is carefully controlled and the air is filtered before it gets into the room, and where there is a changing-room foyer—preferably with a sauna bath—where you can switch from street clothes to sterile listening garments. And even then, you may risk a nervous breakdown by discovering some vagrant dandruff on your prized discs.

If this type of record protection seems a bit extreme, the only real problem is deciding what type of record care accessories will keep your records adequately clean, with minimum effort. But right there we run into a snag because opinions differ as to what degree of cleaning is really *adequate.* However, most of us will agree that *some* degree of record cleaning, and changer



Bib Groov-Kleen dust remover (left) has brush and velvet roller that track the record much like the tonearm. There are several other products like it on the market attesting to their worthiness. Audiotex Phono Strobe disc and neon light (center) quickly check accuracy of any four turntable speeds. If your recordings sound flat, your strobe disc may indicate belt or idler-wheel slippage. You can use your ear as a test instrument if you own either the Audiotex stereo test record or the Lafayette Hi-Fi Stereo-Monophonic test record.

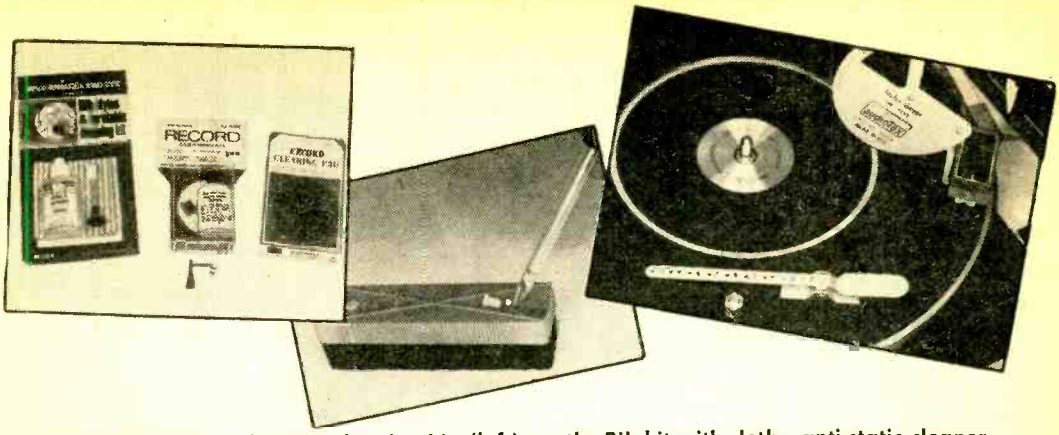
or turntable maintenance is needed not only to ensure reasonably clean sound reproduction, but also to minimize the inevitable degradation of prized discs. The fact is that if you play dirty records, each successive play-through must be slightly poorer than the preceding play; if your stylus is plowing through a mess of abrasive crud in the record grooves there *has* to be both wearing away of the signal pattern in the groove and the addition of minute scratches that your hi-fi equipment will faithfully try to interpret into audible sound.

If you have an ultra-light tone arm system that can provide stylus pressures of only a fraction of a gram or more, you may think that you need not worry much about record erosion. This is true in the sense that you don't have to worry about *plastic deformation* of the record surface, which you *did* have to worry about when stylus pressures up to several grams were common. But you still have to worry about *abrasive degradation* which results when the stylus drags sharp dirt particles along the groove. Remember that the contact area between the stylus tip is so very small that even if the measured stylus pressure is only a gram or two, the actual point-of-contact pressure is literally thousands of pounds per square inch.

The Static Demon. Discophiles who sin enough to be denied entry into whatever heaven is set aside for hi-fi fans will probably be doomed to wiping dust off phono records with a wool sock for all eternity. It's that Demon Static that really causes most of the record dust problem. If you don't believe this, pull some discs from their jackets and see if they are not covered with dust; the odds are that they will look utterly filthy, and the dust you see is only a small part of the total crud which includes particles too small to be seen by the naked eye but which, in the microcosm of a record groove, can be as damaging as a rolling boulder. Almost all of the dust is there because it was attracted to the record by static electrical charges built up on the record surface. It's obvious that if the static charge can be reduced to negligible levels, keeping records clean will be a cinch.

For this reason, record cleaning kits that provide anti-static materials in one form or another have become very popular. Which type of cleaning kit you should use is largely a matter of personal preference; but you may find that cleaning is easiest if you combine the use of two or three different kits, of the kind shown in the accompanying photo.

The basic rule is to avoid using excesses of any fluid materials. This is especially true if the applied material leaves a long-lasting film that could act as a glue to hold dust particles in the groove. Many experts advise against any preparations containing silicone compounds for this reason. What you need instead is a material that will tend to remove any remaining residues of previously applied anti-static materials during the cleaning process. Unfortunately, you can't be sure what commercially available materials meet these requirements since you don't know what the preparations contain. To be on the safe side, you should choose



Off-the-peg-board record cleaning kits (left) are the Bib kit with cloths, anti-static cleaner and brush; Radio Shack powder-puff applicator, fluid and brush in a plastic storage box which also includes a tonearm brush; and an Audiotex (GC Electronics) velvet powder-puff pad for dry cleaning. Radio Shack velvet-covered record ionizer and cleaner (center) takes water through a small opening. Audiotex stylus gauge (right) requires a steady hand to hold gauge. Tonearm is raised only one-eighth inch to take reading.

an application method that avoids the use of excesssive amounts of chemical materials.

It's very easy to apply too much material when using an aerosol spray record cleaning material; and yet I would not hesitate to recommend use of such materials with the proviso that you use as little as possible and only to give a badly soiled record a preliminary cleaning that can then be maintained by other means. The anti-static spray, I find, is most effective in reducing static charges.

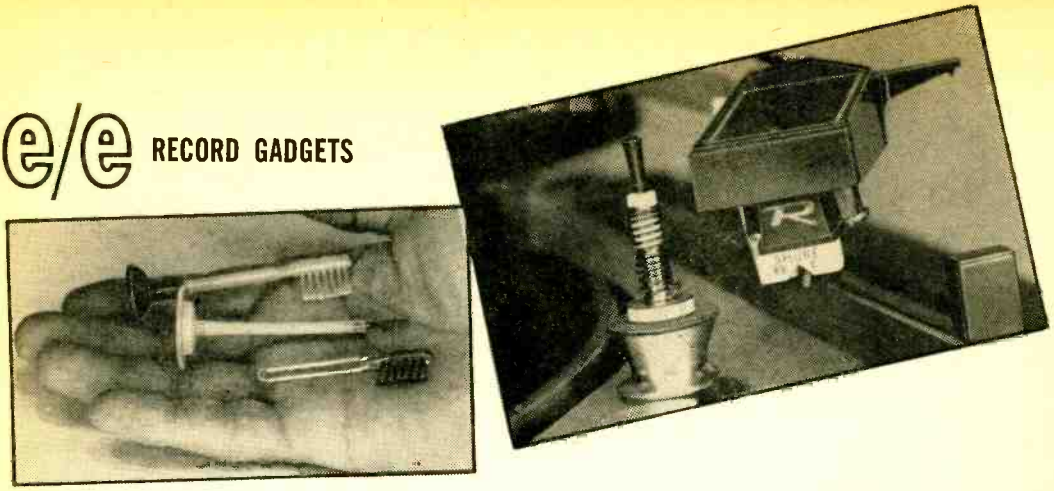
You are not so likely to over-do the application if you must first apply a few drops of anti-static fluid to an applicator which may be a velvet powder-puff or a miniature dish cloth made of some kind of synthetic material. If you have already treated a record with anti-static material, and it looks very clean to the eye, the best procedure is to dry-clean with a velvet powder puff to just brush out any small particles that may be in the record grooves.

To restate, I clean really dirty records that clearly need a good shot of anti-static material with an aerosol spray. If I see only a very little dust on the record when it is to be played, I may just dry-clean with a powder puff. If there is some evidence of static build-up, I pick up the ionizer pad just described to add a little extra anti-static material while wiping out the grooves. That's *my* current procedure; it is offered only as an example of a reasonably good record cleaning procedure, not necessarily as the best for everyone. The photos at the top of the pages in this article show some recommended products.

If you tend to be ultra-fastidious, you might like to look into a deluxe cleaning kit of the kind made by the Watts company in England (see photo). Frankly, I don't have the patience to learn how to use it—largely because, it seems to me, the directions are unnecessarily confusing. I never can remember the difference between a preener and a humid-mop. If you have the patience to work out the proper procedure, I would be the last to discourage you because you could wind up having the cleanest records in the county.

Some time ago the Watts people came out with a record-cleaning device called the Dust Bug which consists of a brush and velvet covered roller attached to the end of a long, counter-balanced arm. The brush and roller actually "track" along the turning record at the same speed as the stylus-bearing tone arm. Thus it keeps on sweeping the record grooves clean just ahead of the stylus. Essentially the same piece of equipment is on the market under several other names. We show Bib's Groov-Kleen for no special reason except that we happened to have this particular model on hand. Lafayette sells a similar Robins Professional Groovemaster PB-12 for $6.99 net, also a less expensive version identified as the PB-10 Professional Record Sweep for $3.98 net. GC Electronics company's version, called the Record Dust Off, is catalog-priced at $4.95.

Bear in mind that devices of this type are *not* intended for major cleaning. You should not put a record having a strong static charge and a visible layer of dust on your turntable and expect the system to do



Stylus cleaning brushes (left) of various designs can be purchased individually or as components of anti-static cleaning kits. Top two brushes are designed to stand on end. Robbins Kleeneedle stylus brush (right) wipes the stylus on changers during operation.

anything more than drag the debris around and around, thereby perhaps doing more harm than good. These gadgets are intended for use on *clean* records. What's the point? It picks up all the dust that is settling down on your record while it is being played.

Incidentally, the velvet roller doesn't turn during use; however you can turn it by hand to expose a clean surface between each record change so that the roller need not be cleaned too often. You can also apply a bit of anti-static fluid to the roller to keep static charges under control. This device obviously will not work with a record changer unless you use the changer as a single-record turntable.

Start Clean. Here we've been talking about keeping your records clean, but what about those records that are already dirty? Best treatment for greasy discs is soap and water. Set the kitchen faucet running with a gentle stream of lukewarm water. Remove dishes and silverware that can damage your LPs. In fact, some clean new sponges at the bottom of the sink will protect discs that accidently slip from your hand.

Let the water flow over the surface of the record for about one minute. Caution: if the water is hot, your records will warp. Flush both sides of the disc. Next, pour a few ounces of a previously prepared solution of Ivory Liquid, 1 part Ivory to 10 parts water, on the record surface and swish around with a new soft sponge. Do both sides, then flush the soap away with lukewarm water for about one minute per side. Be sure your hands are free of the soap also. Once the record is clean, gently shake excess water off the record, then stand it on edge, resting it against a clean upright surface until the record is dry. Return it to its record envelope, but not its stiff cardboard jacket. Allow the record to stand a few hours, giving whatever water remains time to evaporate at normal room temperature. Now your record is clean and ready for playing.

Stylus Care. It's very easy to be scrupulously fussy about keeping records clean, and be downright sloppy about keeping the *stylus* clean. This doesn't make much sense because a clod of crud on the stylus can do a lot of damage to even an ultra-clean record. To solve this problem, all you need do is carefully brush the stylus with a small brush now and then. Just remember to always brush the stylus from back to front so as to apply pressure in the same direction as in normal play. You can mess up a costly cartridge easily by brushing in the wrong direction.

Now I will tell you about a neat little stylus-cleaning gadget that seems to violate the back-to-front brushing rule just stated. It's a brush fastened to a small metal base that can be stuck onto your record changer chassis in such fashion that the stylus passes through the bristles on its travels to and from the record. Obviously, the brushing action has to be from side to side, rather than back to front. But here's the saving factor. If it is properly positioned, only the very tips of the brush will contact the stylus and the brushing action is bound to be far gentler than similar brushing done by hand. As shown in the photo, a brush of this kind may be far too high for changers that have low-slung tone arms; however, you can

For the ultra-fastidious discophile, Watts of England offers a deluxe record care kit (left) containing such dust-chasing gadgets as a brush and velvet wiper, humid-mop, stylus cleaner, Preener, and other items including anti-static fluid and a detailed application manual. Sliding weight on Shure (right) stylus provides accurate readings from ½ gram to 3 grams. On a perfectly flat platter lock end notch onto turntable spindle.

move the brush down to a height of about ¾-inch by discarding the threaded rod, nut and spring and by jamming the plastic bristle holder into the hole in the base.

Stylus Pressure Gauges. Maintaining the proper stylus pressure is important both in terms of achieving top sound reproduction and in minimizing record and stylus wear. Even if your record changer has a calibrated knob with which to set the stylus pressure, you need a gauge with which to make certain that the calibrated knob is accurate.

The most common types of gauges consist of a flat metal arm that see-saws on a balance point. You lower the stylus to a marked point on one side and adjust a weight on the other side until the balance point is obtained. The Shure stylus force gauge SFG-2 shown in the photo features a sliding weight and a small mirror system that help make the balancing procedure easy. With the stylus in one marked position, you can measure pressures from ½ gram to 1½ grams; by placing the stylus on a second mark, you double the readings to weigh in the 1 gram to 3 gram range. Obviously this gauge would be useless with a system that requires a stylus pressure in excess of 3 grams.

A very different type of gauge, made by Audiotex, is also shown. This is a hand-held scale having a dangling hook that is caught under the edge of the tone arm. You just lift the tone arm and read the scale. However, you need a steady hand to use this device successfully and, more important, you must be careful to lift only just enough to *barely* raise the stylus from the record surface because even a quarter inch extra lift can introduce an error of a gram or more.

Whatever type of gauge you buy, be sure that the pivot point moves very freely, without the slightest hint of binding. Also be sure that a balance style gauge is placed perfectly horizontally on the turntable. A notch at the end of the Shure balance is intended to be locked to the turntable spindle provided the turntable is flat all the way to the center. If, as shown in the photo, the center portion of the turntable is concave, placing the gauge in the normal position would introduce a tilt that would lead to inaccurate readings.

We said at the outset of this section that you should not trust the calibrations on your stylus pressure knob on the record changer. There's bound to be a sharpy here and there who will ask why there should be any better reason for trusting the accuracies of the gauges. There isn't, really—a fact I discovered by making accuracy checks on various samples I had around. I won't tell you which models were found to be less than perfect because I have no way of knowing whether the defect is characteristic of all units of this kind or whether I just happened to get a one-in-a-thousand lemon.

To make sure that your stylus gauge is accurate, use *new* U.S. coins as standard weights. First, check your stylus pressure in the normal way, then place a new dime on top of the tone arm, just over the stylus, and make a second reading. The dime should increase the reading by just about 2¼ grams. A new penny should increase the weight by a little over 3 grams, and a new nickel by

(Continued on page 98)

CB coffee break

THIS ISSUE'S COLUMNIST—JULIAN S. MARTIN, KMD4313

Many, many months ago the EIA (Electronic Industries Association) proposed a new class of citizens radio service for the 220 to 222 MHz band termed "Class E." In basic perspective the new Class E band contained 80 channels spaced 25 kHz apart with FM (narrow band FM) modulation only. The tentative proposal split up the 80 channels into specific use-groups: interstation mobile units, emergency calling, traffic advisory, weather advisory, calling channels, interstation base/mobile, intra-station mobile, business-only base/mobile, marine 1 watt, intra-station 1 watt, in-plant 1 watt, traffic control 1 watt and road condition information 1 watt.

At first glance the use-groups appear to be a hodge-podge, the type of useless garbage produced by a committee—when two or more individuals without a constructive thought force a "unanimous consensus" on the one guy with any brains. But a little background information easily clarifies the apparent "jumble" of Class E services.

Spectrum's Gone! We have run out of frequency spectrum. The police, fire and other public safety services have virtually no more frequencies available for their expanded services. The mobile radio business operators such as taxi and truck dispatchers are now stacked on the same frequencies in relatively close geographic separation, producing a "waiting line" for transmissions. This leaves nothing for the new technologies. For years we have talked of installing low power transmitters on our highways to warn of traffic problems, but we have no commercially-feasible frequencies available for this service. Large plants have need for interference-free walkie-talkie operations, but the technology for the available frequencies plus a limited market results in almost astronomical equipment costs (like $500 and up for a single walkie-talkie). Another problem is in the marine field, where two boats just a few hundred yards apart might blast away at each other with enough power to carry hundreds of miles.

While any of the modern communications problems could be resolved on an individual basis, equipment costs are inversely proportional to the amount of equipment sold —the fewer the individual components or units the higher the cost. By combining all the new technology services within a narrow frequency range the EIA insures that one specific type of equipment will be suitable for many services and applications, eventually producing a dramatic reduction in costs which will open all modern services to the average person. For example, the same mobile unit used for inter- or intra-station mobile communications could also pick up traffic advisories, weather advisories or road condition announcements. In a similar manner, a truck arriving at a factory's loading dock could switch from his mobile channel to the plant's local 1 watt in-house channel.

(In a similar manner, the typical Class E CBer would also have access through his equipment to all the other services.)

Obviously, if we have universality of equipment, the individual costs will be relatively nominal, and what are presently esoteric ideas—such as roadside traffic information—become immediate possibilities.

What's To Come. To provide the universality of equipment the EIA has proposed a more or less standard level of performance for all services and equipment. For example, all transmitters would use FM (narrow band) modulation and would be limited to 25 watts output (100 watts for public safety services) for the base station. The antenna would be limited to 20 feet above a man-made or natural object within 500 yards, or 60 feet above existing terrain, whichever is higher. This will provide a *reliable* working communications range of 10 to 20 miles. In addition, all transceiver equipment will have a switch cutting power to the antenna to 1 watt, thereby allowing

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HEY HERB

THE AUDIO ANSWER MAN

by Herb Friedman

HEY HERB: A while back you virtually condemned electronic speed control for turntables on the basis our electric supply was so superior to the foreign electric companies there was no need for added expense. I just want you to know I've gone through several months of "brownouts," with my records wowing like Edison's original cylinder recordings. I think you were way off base.

You're right. I apologize. Never, in my wildest dreams did I imagine our "wonderous" utilities could louse up the electric supply as bad as they did. I had the same summer you did. Fortunately, I received a Dual 701 (with electronic regulation) in the middle of my first brownout, and the electronic control really pulled me through. The local utility claimed only a 5% voltage drop, but I usually get 120 VAC (hard line) and was down to a shade under 100 volts. I don't know what bull the utilities are handing out, but a 20 volt drop isn't 5%. The way things are going, we'd all better start looking into the electronically regulated turntables.

HEY HERB: I use my cassette recorder for syncronized slide projector control. One of the stereo tracks contains the program while the other track gets 3 kHz pulse which causes the slide projector to change slides in sync with the program. But the pulses leak through the program, causing rather annoying low level beeps behind the program. Is there any way to easily eliminate the 3 kHz crosstalk?

Nope. With rare exceptions cassette crosstalk is in the −35 to −42 dB range, a value easily heard as crosstalk or "spill". I suggest a reel-to-reel recorder, or better yet, a quadraphonic model which will give you three program tracks (plus slide sync track) allowing some fancy or artistic sound-on-sound or reverberation effects.

HEY HERB: What is a "monitored fast forward"?

A monitored fast forward is a new feature for cartridge decks—and I'd like to see it on cassettes. The playback amplifier is left on at low volume during fast forward so the user can hear the program running through at the faster speed. The program material sounds high pitched (like pixies), but the user can easily spot or cue up to the desired program. It's a lot better than working blind, with the monitor (output) muted.

HEY HERB: Can I parallel the outputs of two Dynaco Stereo 120 amplifiers to double the power output?

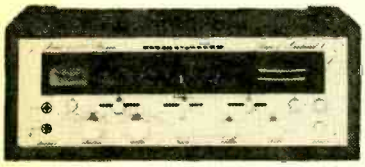
Never, never, never. You can't pull this stunt with any consumer type transistor amplifier. Each amplifier will act as a virtual short to the other, and the amplifier will probably push out so much power the output transistors will be instantly destroyed. You most likely got this idea from the new quadraphonic amplifiers with "strapped" outputs for stereo. Actually, most use a special bridging circuit (with no common speaker connection)—usually designated *bridge* or *BTL*—so the amplifiers are electrically isolated from each other, only the speaker load is common to both amplifiers. Another form of "strapping" does connect the amplifiers in parallel, but through isolation resistors, so that the total power gain is about 10% to 20%. For example, if each amplifier can deliver 10 watts the total output from two strapped amplifiers is 11 to 12 watts. This contrasts to the *bridge* connection which provides slightly more than twice the power of one amplifier; two 10 watt amplifiers bridge-connected will produce 20 or more watts output.

HEY HERB: A Sherwood amplifier I'm considering has a surround sound rear speaker connection, but the salesman says it is a stereo amplifier that produces synthesized 4-channel. How can a stereo amplifier produce 4-channel sound?

The salesman is just using the wrong terms. The amplifier has a Dynaco type rear speaker connection that *extracts the ambient sounds of the recording location from the ordinary stereo program.* It is extremely effective on "live" recordings, as opposed to studio recordings made from a multi-track mixdown. Actually, nothing is synthesized from a Dynaco connection (or decoder), you hear what is really concealed within the stereo program. The overall effect is really "four dimensional" rather than 4-chan-

(Continued on page 101)

Four Ways To 4-Channel



◀ The Marantz 4220 is the most economical "Stereo 2 + Quadradial 4" receiver in their new line, at $299.95; the optional cabinet is $24.95. In Quadradial mode, the rating is more than 8 watts continuous power per channel. For stereo, a power-bridging circuit combines the front and rear amplifiers for 20 watts per channel.
Circle No. 54 on the Reader Service Page.

◀ Fisher's QP-44 headphones can be used for either stereo or 4-channel listening, depending on the position of the switch on the left earcup. Weighing only 24 ounces, and provided with a 10-foot coiled cable and color-coded plugs, the QP-44 is $69.95.
Circle No. 56 on the Reader Service Page.

◀ The Edgemont home entertainment center, Model RE-8484, by Panasonic, features an AM/FM-stereo radio, 4-channel cartridge player, and automatic CD-4 record changer with built-in CD-4 demodulator. The Edgemont amplifier is rated at 40 watts PMP; each speaker enclosure houses a 6½-inch air-suspension speaker; the price is $399.95.
Circle No. 61 on the Reader Service Page.

◀ The BSR Quasi-Quad 4-channel conversion system is a passive matrix enhancer packaged with two rear-channel speakers. The adapter has controls to adjust matrix blend and rear-speaker loudness, and to select four different sonic effects to suit different kinds of music and personal taste; $59.95.
Circle No. 59 on the Reader Service Page.

e/e tunes in with the... Jolly Roger Scanner Receiver

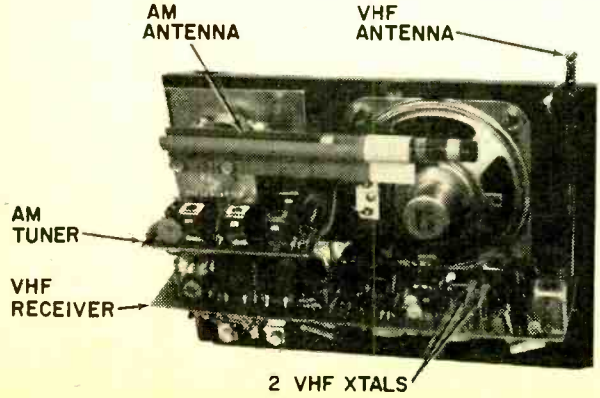
TALK ABOUT GREAT IDEAS. Heres a winner for sure. It's an AM broadcast band radio with a built in two-channel crystal controlled VHF receiver that can be used as a BCB radio, a VHF *scanner*, or a BC radio with a VHF override.

The Jolly Roger JR-1 is housed in a plastic portable radio cabinet 8-in. W x 5⅝-in. H x 3-in. D. Offhand, it appears to be an ordinary BC radio, one of those "quality" models with an oversize 3½-inch speaker. But when you look really close you find a few extra features in addition to the volume and tuning controls. First, there's a switch labeled *BC-AUTO-HF;* then there's another switch labeled *CH. A-SCAN-CH. B.* Finally, there are two small indicator lamps, one marked *CH. A,* the other *CH. B.*

These extra features represent control circuits for a unique idea built into a Plain Jane cabinet. Remove the back cover and you find what appears to be two separate receivers. The basic receiver is a two-channel VHF scanner (a 2-channel UHF model is available if you wish) with sockets for user-selected crystals, a crystal filter IF amplifier, an adjustable squelch, and electronic switching for an external audio input. Directly over the printed circuit board for the VHF receiver is a small board containing an AM BCB tuner. The audio output from the BCB tuner is fed to the VHF receiver board where it shares a common audio output amplifier.

When the front panel selector switch is set to *BC* the JR-1 functions as an ordinary AM broadcast band radio of exceptional quality (it even has a vernier tuning control). When the selector switch is set to *HF,* the JR-1 functions as a straight two-channel VHF receiver which can be used to receive only channel A or B, or to scan between the two. A light emitting diode shows which channel is being received.

When the selector switch is set to *AUTO* the JR-1 functions as an ordinary BCB radio with an override VHF receiver. Normally, reception is on the broadcast band, but as soon as a signal appears on the VHF channel(s) the BCB audio is disconnected and only the



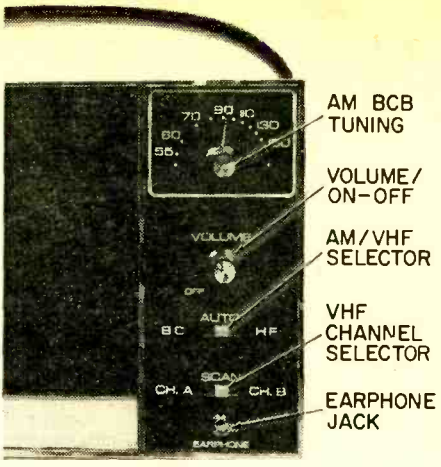
The VHF printed circuit board comprises the complete VHF receiver and the switching for the AM tuner which is directly above it. Note antennas for each frequency band. Circle No. 63 on Reader Service Coupon.

VHF signal is heard. As soon as the VHF station stops broadcasting the JR-1 automatically restores BCB reception.

To provide the most convenient and fuss-free reception, the VHF squelch adjust and a BCB level balance are accessible through the back of the cabinet. Once the squelch control is adjusted to eliminate interstation (no-signal) VHF noise, only an actual signal will override the BCB reception. The BCB level balance adjustment is set so that the speaker output level from a BCB station equals that of the VHF station; in this way you are not disturbed by an excessively loud or low volume level when the receiver switches back and forth between BCB and VHF reception.

The Jolly Roger receiver is normally powered by four internal D-size cells, but there is an accessory power jack, and a line-powered 6 VDC power pack is supplied with the JR-1. The AM rod antenna is mounted inside the cabinet; a telescopic VHF antenna pops out of the top of the cabinet. An earphone output jack is also provided.

Both the batteries and crystals are easily changed by removing the back of the case which is secured with two screws. The batteries fit into an ingenious compartment molded into the back of the cabinet; when the two cabinet back screws are secured, the battery terminals are forced against giant-sized copper straps which insure 100 percent battery contact reliability. The crystal sockets are located directly at the front of the printed circuit board, relatively far removed from other components, and even a child can change crystals without fear of damage to the tuned circuits.

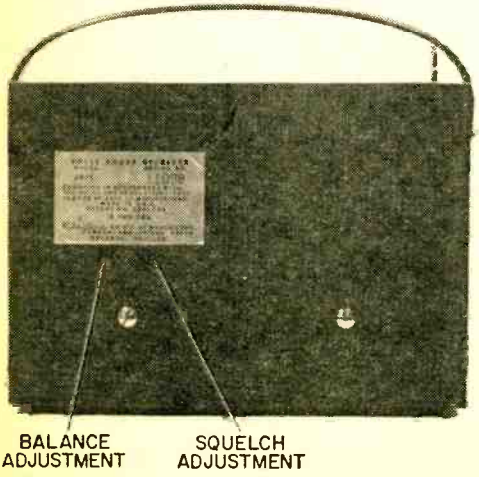


Except for a couple of extra switches, the Jolly Roger JR-1 looks like any quality portable radio. If desired, VHF signal can override broadcast band AM signals.

Performance Plus. Since the Jolly Roger is designed and intended for use strictly as a portable receiver there was no way we could make meaningful measurements. Instead, we compared the JR-1 performance against that of other portables and some base equipment with telescopic antennas. To start, the AM BCB radio is outstanding, far outclassing any portable radio we have yet to hear or use. The sound is big, with notably low distortion and virtually no background or interstation noise. As a VHF receiver, the JR-1 is similarly outstanding. The crystal filter IF amplifier provided razor-sharp selectivity almost, if not actually, the equal of many expensive base receivers. Sensitivity appeared equal to most base receivers (with telescopic antenna) and a lot better than most portable and pocket VHF receivers. Overall, the Jolly Roger's BCB and VHF performance is most impressive.

The scanner switches between the two crystal controlled channels approximately eight times per second, virtually insuring the first word or syllable of each transmission is not lost; even in the override mode, the complete VHF transmission is received.

(Continued on page 102)



The VHF squelch control and AM/VHF volume balance controls are accessible through holes in the back of the case.

PUT A TAPE PLAYER IN YOUR CAR

For more info circle 51.
Radio Shack 12-1825 Cassette/FM Radio combo

It might not come out as high fidelity, and most certainly the sound will be fighting road noise for your attention, but from every viewpoint an automobile tape player will give you endless hours of pleasureable sound-in-motion. No longer will you have to put up with hard-sell announcers squeezing obnoxious commercials between musical selections *they* think are the top forty. Fact is, some stations just keep repeating their idea of the *top ten*.

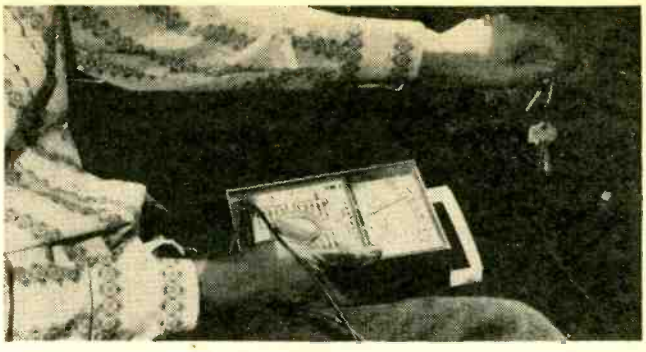
In all likelihood, *your* personal top forty, or thirty, or ten are the records and tapes you purchased for in-home high fidelity listening. And while you might not believe it, if you're a typical record collector the investment runs well into several hundred dollars worth of records alone, not including reel-to-reel tapes, cassettes and cartridges (either pre-recorded or dubs).

Yet it takes less than $100 to equip your automobile with a cassette or cartridge player that will allow you to utilize your record and tape collection on the road. Fact is, you can not only dub your hi-fi collection onto cassettes and cartridges for auto use, you can get prerecordings of golf tips from the pros and even language lesson tapes to turn those hours of concrete-ribbon watching into productive hours for which you usually don't have the extra time.

Do-it-yourself! Of course, if you've investigated adding a tape player to your car you've probably run into estimates of $150, $200 or even more, and its more than likely you've been turned off by the high costs. But the plain truth is that these estimates represent a *shop installation*, and installation fees often run several times the basic cost of the equipment. As a typical example, if your car presently has two rear speakers (or two dash speakers) all you need for stereo listening is a tape player which sells as low as $30, a speaker switch worth about a buck, and about an hour of your time for installation. But if you can't, or won't, put in an hour's effort, and you depend on a shop for installation, the total cost of the tape player system can easily run upwards of $125, not to forget the "extra" equipment you might be talked into: like "high fidelity" coaxial speakers, trunk-mounted reverberation generators, or an anti-theft lock for the tape player (once a thief is inside your car he can take the player *and* the locking device).

Start Planning. All things considered, the rockbottom cost way to go sound-in-motion is by doing the installation yourself. First thing to consider is *do you want cassette or cartridge*. If you go the cassette route you are limited to stereo reproduction (the least expensive installation). If you chose cartridge you have a choice of stereo or discrete 4-channel (quadraphonic), though the equipment costs for 4-channel can run in excess of $100. As a general rule it is wise to utilize the same type of equipment in your car as you do in your home; this way, you can easily make your own tape dubs from records or other tapes.

e/e IN YOUR CAR



First trick is to find a 12-VDC line from the battery to power the tape player. Select one from the batch that comes from the ignition switch. Connect a meter to the line and determine whether it's hot full-time, only when the ignition is on. Pick the one you want.

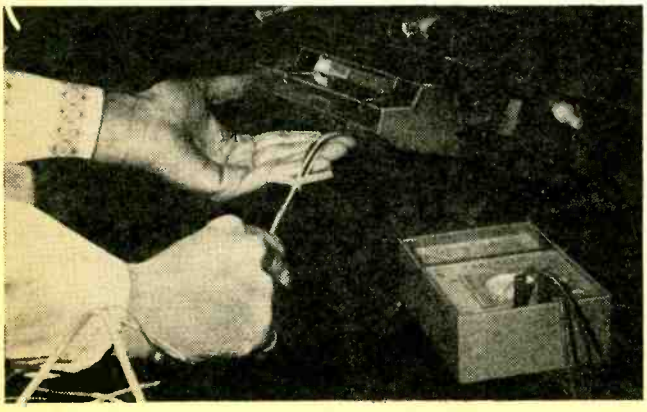
Next step is to consider what you already have built into the car in the way of speaker equipment. Some modern cars are supplied with two front speakers for an ordinary AM radio or an optional FM stereo radio. The speaker wiring in a car is of the plug-and-socket variety, easily spliced into, so the speakers can be switched to a tape player. A typical installation wiring diagram is shown in Fig. 1. Any DPDT switch available from auto supply or electronic stores can be used (Radio Shack 275-405, 275-403 or equiv.).

Hard Work Is Done. Most modern cars have speaker mounting holes pre-cut in the deck behind the rear seat. These holes are covered by the "cardboard' trim of the deck which is easily trimmed away with a pocket knife or simply punched out with your fist. You can obtain low cost "stereo speakers" with matching grills which exactly fit the pre-cut holes. (Radio Shack 40-299 or 40-300 can do the job, depending on hole size.) In this manner your front speakers serve for the radio while the rear speakers handle the tape player. Keep in mind that the large space of the trunk, into which the rear of the speakers work, makes an excellent speaker enclosure and the rear speakers will usually provide a richer, more mellow sound in comparison to dash-mounted speakers.

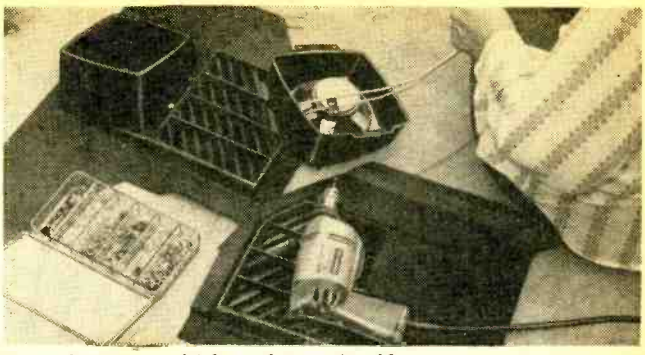
Finally, if you don't care to rewire the dash speakers or work through the trunk to the deck you can always obtain "auto" speakers—small, usually decent quality speakers mounted in a sloping enclosure specifically intended for mounting and installation directly on the dash or deck. In the typical installation shown in the photographs we have selected "auto" dash-mounting speakers (Radio Shack 12-1844 or equiv.) simply to illustrate the maximum equipment needed.

After you have decided on your speaker arrangement or connections it's time to install the player. Every player we have seen is supplied complete with power and speaker cables, all the wires you'll need to complete the installation. Often, the wires are pre-soldered to a connector which plugs into the player, though many rock-bottom priced players have the wires connected directly to the player.

Get Started. Select a mounting location for the player as close as possible to the driver so he can reach the tape slot without undue stretching, but make certain the player does not interfere with the driver's right foot—the one that works the gas and brake pedals. A choice location is under the dash directly above the transmission hump,



The player should be mounted under the dash so that its controls and tape loading slot are convenient to the driver. Make certain the player's location does not interfere with the driver's right foot. To dress speaker wires so they do not fall or flop about, use wire twists that come with packages of plastic food bags. Radio Shack's 12-1844 surface mount 5¼-in. speakers are used here. Circle No. 50 for more info.



Speakers can be attached to the kick panels located to the sides and under the dash. They are easy to remove, so take them out and mount the speakers. Before you do so, check to see that you clear the parking brake pedal. Next, attach about 20 inches of wire to the speakers. This wire can be cut from the harness supplied with the tape player. Be sure to observe color code requirements.

or directly on the hump itself. Most players are supplied with a mounting brack for under dash installation. The players intended for mounting on the hump are supplied with specially shaped mounting assemblies.

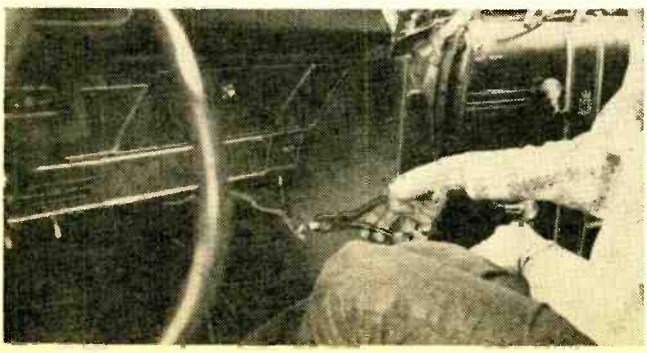
After the mounting bracket is installed, locate a wire behind the dash which has "full time" battery voltage. For example, the cigar lighter, or the accessory connection on the fuse block if the block is easily accessible. You do not want to use a power wire which only has voltage when the lights or other electrical accessory are in operation. After all, you might like to just sit in the car and listen to music without the engine running or having the lights on. Best way to be certain you have a full-time power wire is to check with a voltmeter; if the meter reads 12 VDC without the key in the ignition lock and all accessories are off you have located the correct power wire.

If your tape player has a power/speaker connector socket install the power cable at this time. Either splice directly into the power wire or use (preferably) a Scotch no-solder splice; a plastic device that is slipped over the power wire and the wire to the player. When the device is squeezed with pliers a metal bar pierces the insulation on both wires, providing a solid, fully insulated splice. The splicing device is usually supplied with all but the unexpensive units.

Next step is to install the speakers. Life will be a lot easier if you connect about 20 inches of wire to the speaker terminals before the speakers are installed—regardless of the type speakers used. If you cut off a 20 in. section of speaker wire from the cables supplied with the tape player you'll find they are *polarized*: one wire is usually copper colored while the other is aluminum, or the insulation is of different colors. Connect the same wire to the same terminal on each speaker. If you don't use part of the wire supplied with the player get a small spool of plastic insulated wire specifically labeled "speaker wire," as this wire is similarly *polarized*. Make certain you solder the wires to the speaker terminals. Don't just wrap the wire around the terminals and assume it will stay in place—it won't.

After the speakers are mounted, secure the tape player in its mount, connect the speaker and power wires and *install the fuse in the power wire's fuse holder*. Do not assume the fuseholder has a fuse in it because you haven't found a loose fuse. For some reason, many tape players we've seen have been supplied with an empty fuseholder, and no fuse to be found in the shipping carton. If this happens to you just hop down to your local auto supply shop—it's a standard automotive type fuse.

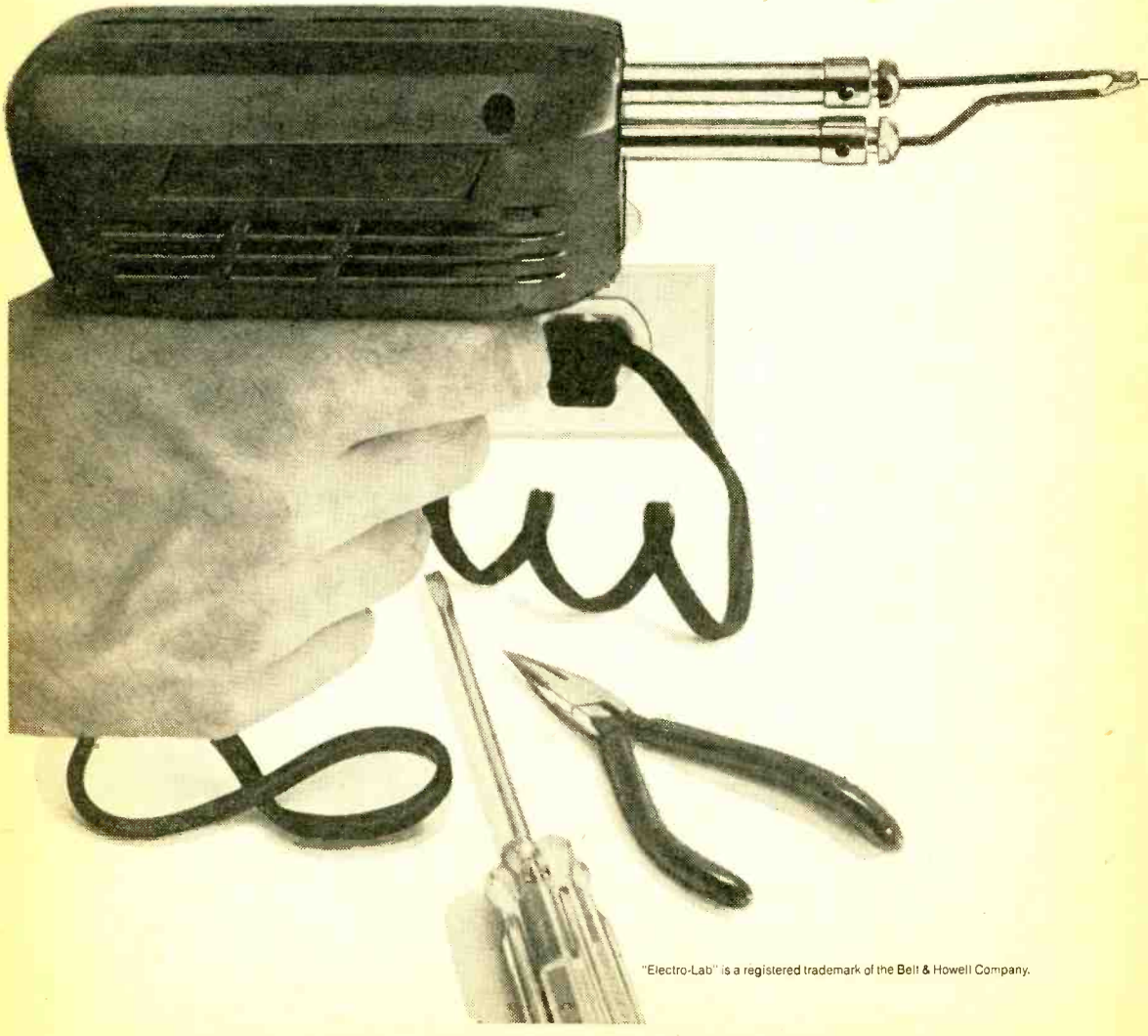
Final Check Out. When you are certain all wires are correctly connected and the player is rigidly secured to its mount it's a good



While you can always splice the cut ends of the speaker harness wires, it's easier to use Scotch no-solder splicing clips. Available in automotive supply stores, the clips speed splicing and give a safer, surer connection and insulation. One squeeze of a pier does the job. Stow away all cables carefully under the dashboard.

IF YOU CAN USE ANY OF THESE TOOLS...

...you can build yourself a Bell & Howell solid-state 25-inch diagonal color TV... and maybe build a whole new future while you're at it!



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If you're already handy with a set of tools, here's a way to pick up a pretty thorough knowledge of electronics: build yourself a solid-state color TV as part of a complete learn-at-home program from Bell & Howell Schools.

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Your color TV project is probably the best way for you to learn the most advanced "state of the art" concepts of sophisticated electronics circuitry. It's part of a complete at-home learning program prepared by skilled instructors at Bell & Howell Schools. Mail the postage-free card today so that our representative can bring you all the facts at no obligation.

It doesn't matter if you've never had any training in electronics before. Nobody's going to start throwing "diodes" and "capacitors" at you right off. You start with the basics. You take it one step at a time. You walk before you run. And you'll be amazed at how quickly you start to feel comfortable with things that seemed complicated at the beginning.

Attend special "help sessions" if you like

In case you run into a sticky problem—or you want to discuss your project with an instructor—come in and see us. We've scheduled special "help sessions" regularly at the Bell & Howell Schools and in many other cities throughout the U.S. and Canada. Drop by. Meet an expert instructor in person. Talk over any rough spots with him—and with other students. You'll enjoy the chance to "talk shop."

Master the most up-to-date solid-state circuitry

Solid-state is here to stay. Not just color TV but almost every type of electronic device will eventually move farther and farther in the direction of *total* solid-state circuitry. Get to know the most advanced "trouble-shooting" techniques for these sophisticated circuits. You'll find an almost irresistible demand for your skills.

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No matter where you look, the amazing technology of electronics is becoming a bigger and bigger part of the picture. More and more automotive parts and diagnostic instruments are electronic. Many large manufacturing plants use sophisticated electronic systems—controlled by a few skilled electronics technicians. The increasing use of two-way radio . . . the huge promise of cable television . . . the astonishing growth of electronic data processing all open doors to exciting new career opportunities for the man with thorough training in electronics. In fact, the day may come when the man who does *not* have electronic skills will be severely handicapped in many industries.

Why you should get your training from Bell & Howell Schools

Skilled instructors at Bell & Howell Schools—carefully selected for their knowledge, experience and teaching ability—plan each program with the utmost care and attention. Each year, they spend over $200,000 improving programs to keep them up-to-date with the latest technology. Many Bell & Howell Schools graduates have used their home study training to get started in exciting new careers or businesses of their own in electronics. You could too!

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To make sure you get practical experience with instruments used daily by professionals, you build yourself a Design Console, an Oscilloscope and a Transistorized Meter (see details at right). These are the three instruments you'll work with constantly—both during your program and thereafter.

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When you complete your course, we will help you in your search for a job in a field of electronics that fits your background and interests. Although we cannot guarantee jobs to our graduates, this placement service is available at *any* time after you graduate.

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25-inch picture (measured diagonally)

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■ **Design Console** Use this to rapidly "breadboard" circuits without soldering. Equipped with built-in power supply . . . test light . . . speaker . . . patented plug-in modular connectors.

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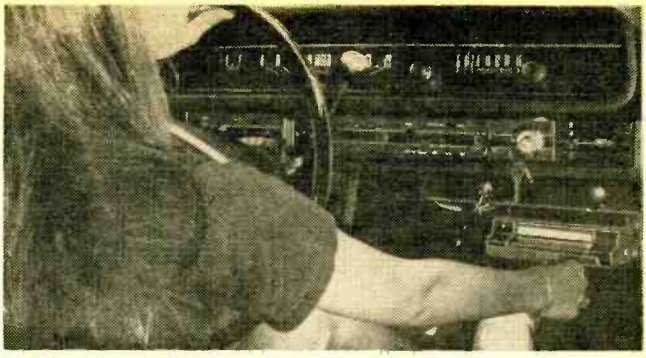
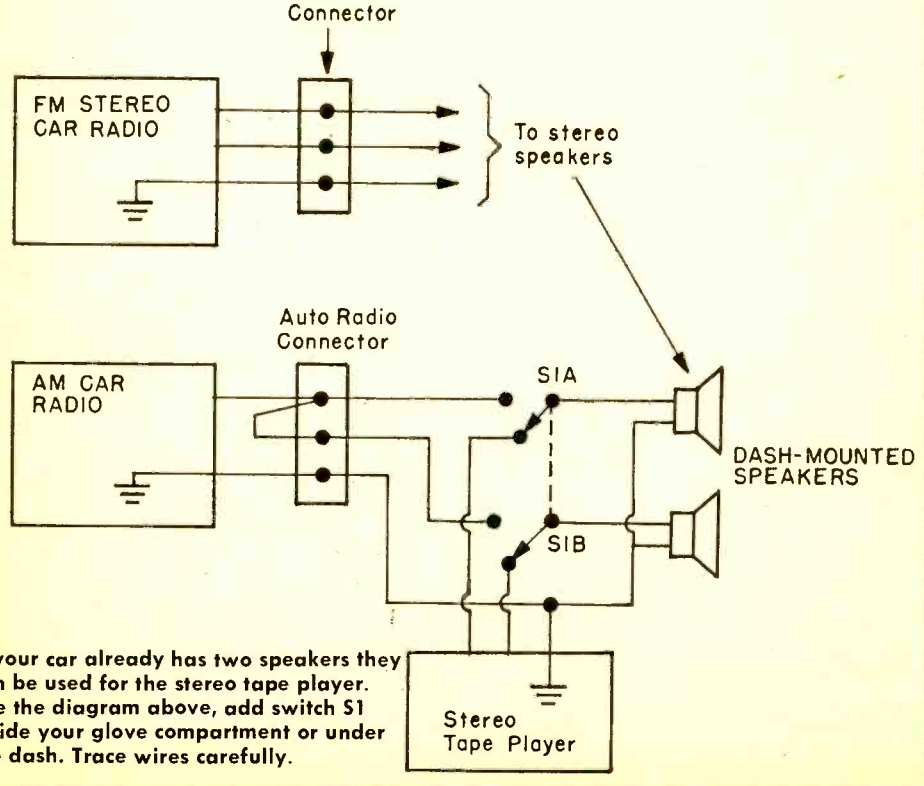
e/e ... IN YOUR CAR



Kathi, our CB editor, takes the wheel for a spin down the highway listening to her favorite cassette recording. Right now she's on a Billy Paul kick. That's good, because the editors get very upset when anyone takes their Lawrence Welk tapes from the office.

idea to test if the *ground* (common) connection is actually a low resistance connection to the car's body. In most tape players both the common speaker wire and the negative battery connection are the same wire and/or terminal, with the connection to the car body made through the player's mount. Clip the negative lead of a DC voltmeter rated 0-15 VDC or higher to the dashboard (make certain the paint isn't insulating the test lead from the metal dash) and the positive lead to the tape player—any exposed metal part or the mounting screws. The meter should indicate zero (no voltage). Turn on the tape player or insert a cartridge or cassette to apply power and make certain the meter still reads zero. If the meter shows a voltage reading under either condition, the player requires a separate ground wire to the car body. Ninety nine times out of a hundred a tape player does not require a separate ground wire, but every once and a while the ground connection through the tape player's mount is a relatively high resistance, so don't be surprised if it happens to you.

If the ground checks out you're all set for music. Just plug in a cartridge or cassette, sit back, enjoy, and watch the road. ■



If your car already has two speakers they can be used for the stereo tape player. Use the diagram above, add switch S1 inside your glove compartment or under the dash. Trace wires carefully.

ANTIQUE RADIO CORNER

by James A. Fred

You probably never realized that there is a group of old radio collectors who may not be aware that they are radio collectors. Almost every automobile built since 1931 had part of its total production equipped with a radio.

The first auto radios operated from the 6-volt car battery for the filament voltage and used three 45-volt "B" batteries. The next step was the dynamotor to supply the 180 volts needed for the "B" voltage. A dynamotor had two windings, one used the 6 volts from the car battery to spin the armature via one commutator, on one end of the shaft, and the other winding generated 180-volts DC, and delivered it through another commutator at the other end of the shaft. The next improvement was to use a vibrator, power transformer, rectifier tube and filter capacitor to supply the high voltage. This type radio continued until the late 1950's when the transistor came into use in the auto radio.

Bill Lear, the prolific inventor, is credited with the development of the car radio. He joined with Paul Galvin to manufacture the first Motorola auto radios in the early 1930's. Today Delco Electronics at Kokomo, Indiana is the largest radio manufacturer in the United States, making 20,000 radios every day.

Most automobile collectors try to find an original car radio, that is working, to install in their old car. One of the earliest auto radios was made by the Atwater Kent Mfg. Co. There were three models made and if you can find one of these you have a rare one indeed. Aside from the accidental collector, there is a growing number of collectors who have no intention of putting their radios in automobiles. Some are trying to get one of each model manufactured while others are content to have a radio from each manufacturer for each year.

It is getting more difficult to restore old auto radios. Tubes are still plentiful, but vibrators are becoming a serious problem. Especially those for 1940-1941 Cadillacs, 1936

Auctioneer, Paul "Mike" Burns, a former mayor of Fort Wayne, Ind. and a ham radio operator, offers a home-made communications set (left) to bidders. Note a Crosley receiver on the table. Mike took pride in describing an AC Dayton receiver (right).

ANTIQUE RADIO CORNER

Buicks, the 1936 Cord, and others with special pin arrangements. Sometimes all you can do is to open up the old vibrator and solder a modern replacement type to the pins in the base and reassemble the vibrator. To a real dyed-in-the-wool collector or radio restorer this is no drawback. If you have never collected auto radios why don't you give it some thought?

Radio Collectors at Flea Market. The Rocky Mountain Antique Wireless Club held their second meeting of 1973 on May 5. The meeting was held at the Bonanza Flea Market in Denver, Colorado.

The Club had many antique radio receivers for sale at the flea market, but sales were very slow. This may have been due to a lack of buyers, the weather, or buyer resistance to the prices.

All radio collectors living within driving distance of Denver are invited to write to Woodrow F. Wells, Club Secretary, 1638 Quebec St., Denver, Colorado 80220 for details on how to join their club.

IHRS Holds Spring Meet. One of the most enjoyable parts of collecting anything is meeting with others who enjoy the same hobby. I strongly urge collectors of antique radios to get together and form state or regional societys. You will get much pleasure from meeting fellow collectors and swapping, buying, and selling radio equipment.

The Indiana Historical Radio Society had its spring meet on April 29 in Fort Wayne, Indiana. A short business meeting was held and a speaker from the Magnavox Corporation traced the history of the company from its beginning in California to its move to Indiana. Magnavox will long be remembered for the horn speakers they produced in the early 30's.

Photo by John Noble

Nipper, the RCA mascot, stands guard at the doorway to room displaying antique radio equipment at the Indiana State Museum.

The highlight of the meeting was an auction sale of radio receivers, horn and cone speakers, tubes, spare parts, and books. The excitement was contagious as bidders tried to top each other's bids. A few collectors got so carried away they ended up buying items they didn't even want.

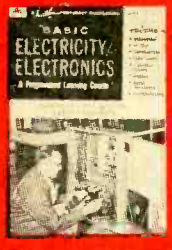
If you would like help in forming your own club the address of the IHRS can be found in the free fact sheet for antique radio collectors which was offered free in the last Antique Radio Corner. (Just drop a note to the magazine.) I am sure the

(Continued on page 102)

Mike Burns can't keep the bidders down as two prospective buyers look over an early-vintage, home-made superheterodyne receiver before the hot and heavy bidding began.

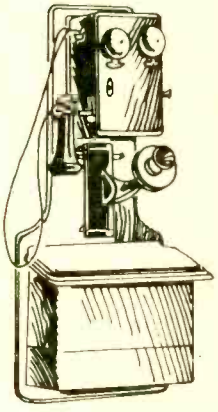
e/e

ALL NEW BASIC COURSE in ELECTRICITY & ELECTRONICS



This series is based on BASIC ELECTRICITY/ELECTRONICS, Vol. 1, published by HOWARD W. SAMS & CO., INC.

UNDERSTANDING TELEPHONE OPERATION



What You Will Learn. You will find that a telephone system is a simple electrical circuit. Parts of the telephone circuit convert sound into electrical signals. Other parts change the electrical signals back into sound. As a result, conversations can be transmitted through wire for extremely long distances.

You are familiar with the mouthpieces and earpieces of a telephone. When you finish, you will understand how these parts work. You will also learn something about how they are connected in an operating system.

(turn page)

THE MECHANICAL TELEPHONE

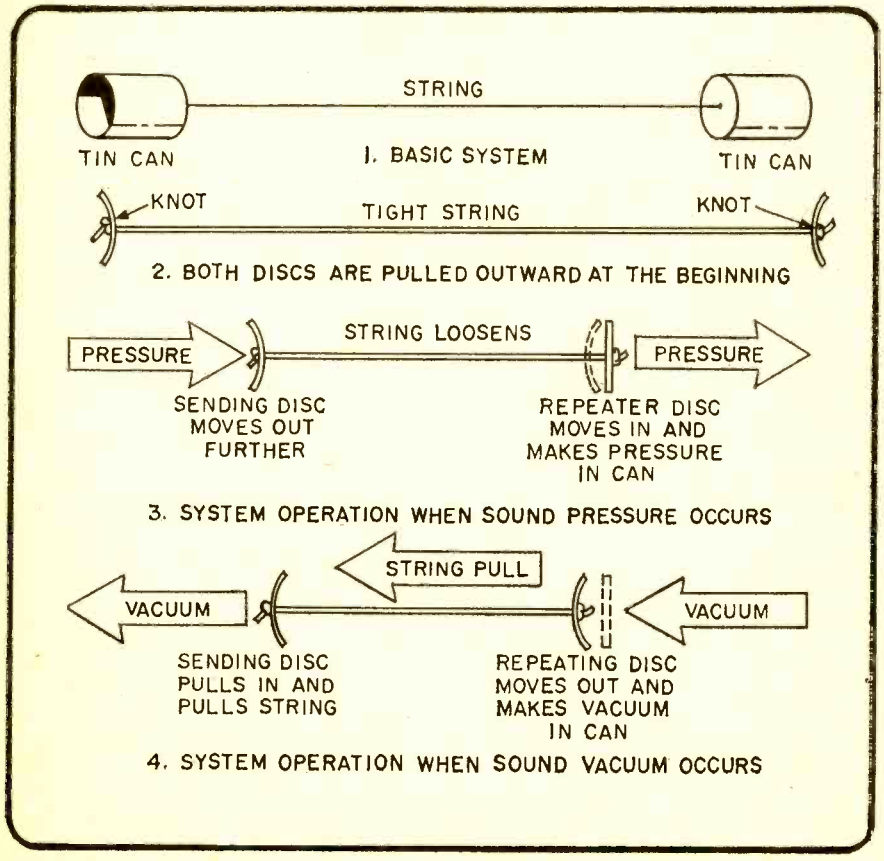
Have you ever built a mechanical telephone using a pair of tin cans and a length of string? If you have, you know sound can be transmitted through a string. As crude as this mechanical system is, it demonstrates many of the principles used in the modern telephone.

The figures in the box below illustrate how a mechanical telephone system operates.

Note that the key part of the mechanical telephone system is the flexible metal disc at the bottom of each can. Speaking into the can causes sound waves to strike the disc and make it vibrate.

The vibrations from one disc are carried to the other disc by a tightly stretched string. The second disc repeats the in-and-out motions of the sending disc and develops varying air pressures in the can. These are sound waves which are crude reproductions of the original sound waves.

SIMPLE MECHANICAL TELEPHONE



QUESTIONS

Q1. Vibrations, representing sound, travel down the string of a(an) ---------- telephone system.

ANSWERS

A1. Vibrations, representing sound, travel down the string of a mechanical telephone system.

Q2. ----------, **representing sound, travels down the wires of an electrical telephone system.**

A2. **Electricity** (or electrical signals), representing sound, travel(s) down the wires of an electrical telephone system.

Principles of sound

A study of the basic principles of sound reveals how a mechanical (or electrical) telephone system works. Sound is made up of vibrations. Differences in sound are determined by their *frequency*—the number of times per second a sound vibrates. A high tone (a shriek) has a high frequency—several thousand vibrations per second. A low tone (deep bass voice) has a frequency of only a few hundred vibrations in a second.

Each tone has a specific frequency. A tuning fork, for example, vibrates and creates a sound tone at the frequency for which it was designed. The same is true of piano or violin strings, the skins of a drum, or your vocal cords.

Air consists of a large number of extremely tiny particles, several million per cubic inch. When sound causes these particles to vibrate, they alternately pack together and fly apart at the frequency of the sound. Packing together creates instantaneous areas of high pressure and flying apart develops a condition of less-than-normal pressure (approaching a vacuum).

As the areas of changing air pressure strike other adjacent air particles, the process is continued. This is the manner in which sound travels through air. When the changes in air pressure strike a flexible disc (or *diaphragm*), it vibrates. The vibrations are at the same frequency as the original sound.

In the mechanical telephone, the sending disc transmits its vibrations to a tightly stretched string which, in turn, sets up the same vibrations in the receiving disc. In the modern telephone, proper design and the use of electricity result in excellent reproduction of sound.

QUESTIONS

Q3. **Frequency of a sound indicates the number of times it will** - - - - - - - **in a** - - - - - -.

Q4. **Sound vibrations set up corresponding changes of air** -.- - - - - - -.

ANSWERS

A3. Frequency of a sound indicates the number of times it will **vibrate** in a **second.**

A4. Sound vibrations set up corresponding changes of air **pressure.**

THE ELECTRICAL TELEPHONE SYSTEM

The basic telephone system consists of a *mouthpiece* connected to an *earpiece* by electrical wires. This system permits conversation in one direction only. For two-way conversation, each end of the system requires a mouthpiece and an earpiece.

Sound Into Electricity

There are two basic methods of converting sound into electrical signals. One method causes current already flowing in a circuit to vary in accordance with the frequency of the sound. The other method converts sound into a varying voltage which, in turn, causes a varying current to move through the circuit. How each method is accomplished will be discussed further.

When the current signals (varying at the rate of the sound) arrive at the earpiece, the process is reversed. If the signal is the type superimposed on an existing current, the variations are received by a material that expands and contracts with the signal frequency. If the mouthpiece develops a voltage to cause a fluctuating current, the current develops a similar voltage in the earpiece.

Basic Parts of a Telephone

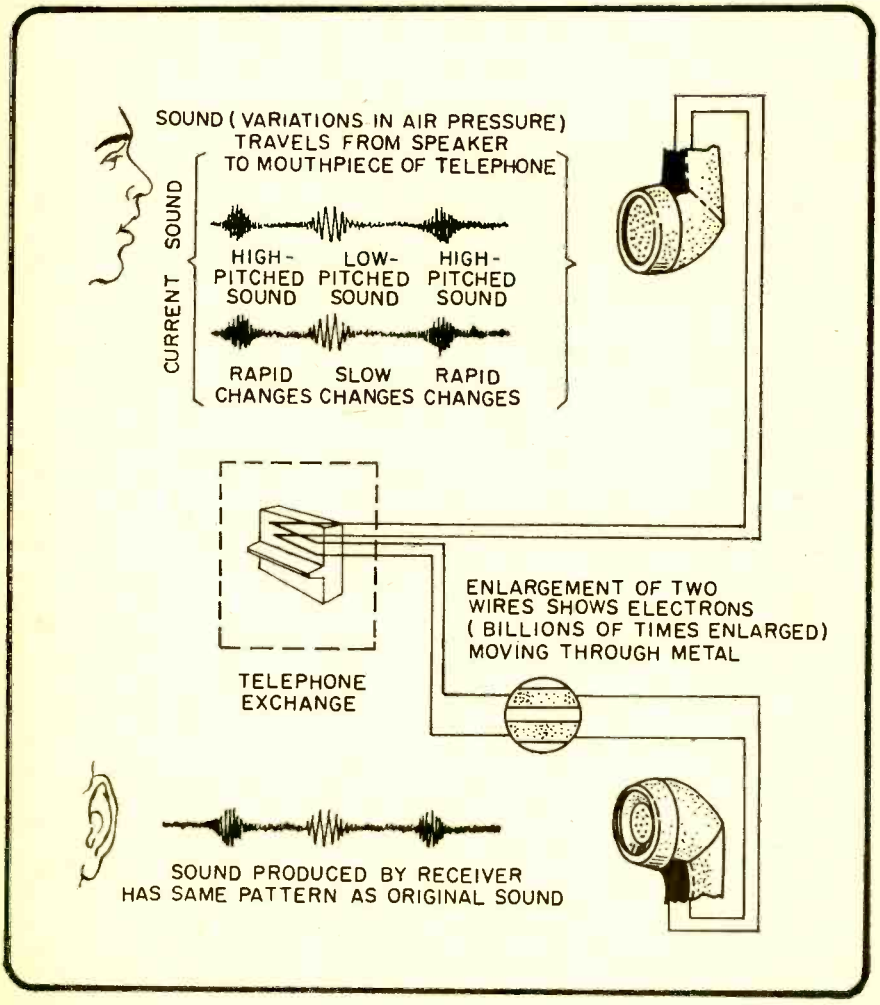
The working parts of a telephone mouthpiece (often called a *transmitter*) and an earpiece (sometimes called a *receiver*) are usually identical. The mechanism or material used to produce a varying current depends on the method used. Since all vibrations enter or leave

the telephone as changes in air pressure, the transmitter and receiver both contain a diaphragm. Other parts of the mouthpiece include wires, terminals, and materials to hold the parts together.

Connections

In a large telephone system, several lines are connected through a switchboard.

ELECTRICAL SOUND PATTERNS



QUESTIONS

Q5. A(an) - - - - - - - - - - connected to a(an) - - - - - - - - - by wires is the simplest telephone system.

Q6. - - - - - - - in a telephone line varies at the frequency of the original sound.

ANSWERS

A5. A mouthpiece (or transmitter) connected to an earpiece (or receiver) by wires is the simplest telephone system.

A6. Current in a telephone line varies at the frequency of the original sound.

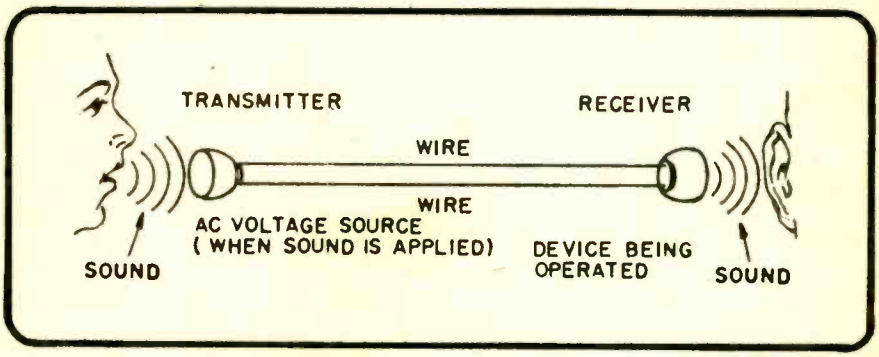
Q7. Vibrating air pressure strikes a (an) ..... in the (mouthpiece, earpiece).

A7. Vibrating air pressure strikes a diaphragm in the mouthpiece. (The earpiece diaphragm causes vibrating air pressure.)

COMMERCIAL TELEPHONES

As you can see in the illustration, a telephone system is actually a simple circuit.

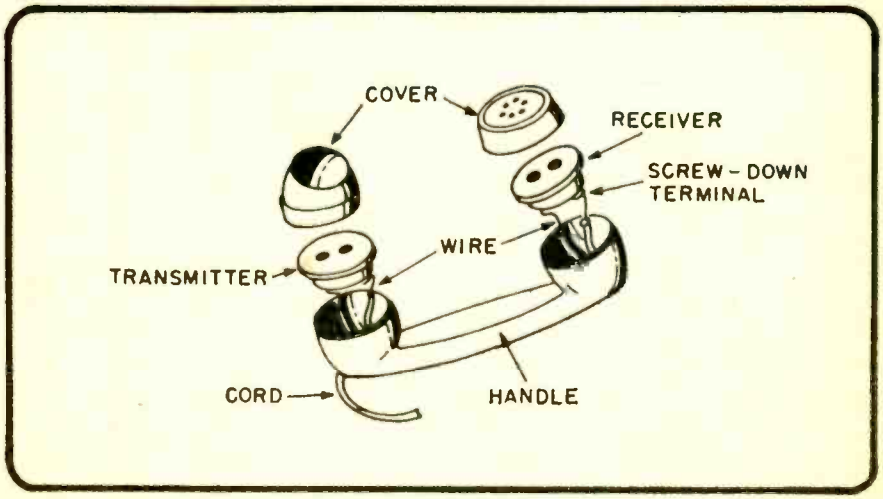
THE BASIC TELEPHONE CIRCUIT



In most commercial (home) telephones, the mouthpiece and earpiece are contained in a single handset. An exploded view of the main parts of a handset is shown.

The transmitter contains a diaphragm resting against *carbon granules* (grains). The granules are loosely packed with enough freedom to expand and contract in volume.

A BASIC TELEPHONE HANDSET

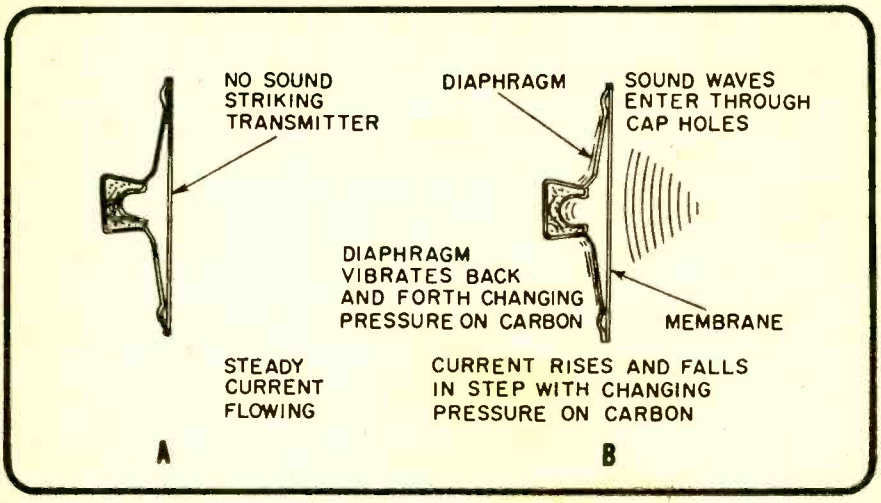


Transmitter Operation

Part A in the illustration shows a drawing of the transmitter with no sound applied. Part B demonstrates what happens when sound strikes the diaphragm.

When the handset is lifted from its cradle, a steady current from the phone system starts to flow through the carbon granules. Sound striking the diaphragm places a varying pressure on the carbon. When the granules are packed tightly, current in the circuit increases. When the diaphragm releases its pressure, the granules become loose and less current flows.

TELEPHONE TRANSMITTER OPERATION



The transmitter diaphragm vibrates in response to the frequency of the sound. Packing and loosening of the carbon follow the vibrations of the diaphragm, and current in the phone line varies with the density of the carbon. Therefore, the current varies at the same rate (frequency) as the original sound.

In a commercial system, the varying current is routed to the desired receiver through a central telephone office.

QUESTIONS

Q8. When a commercial telephone handset is lifted from its cradle, a(an) ------ ------- flows through the transmitter.

Q9. When the carbon granules in the transmitter become more densely packed, (more, less) current flows.

Q10. At what rate does the current vary in the phone line during a conversation?

ANSWERS

A8. When a commercial telephone handset is lifted from its cradle, a **steady current** flows through the transmitter.

A9. When the carbon granules in the transmitter become more densely packed, **more** current flows.

A10. During a conversation, **current varies at the same rate, or frequency, as the original sound.**

Receiver Operation

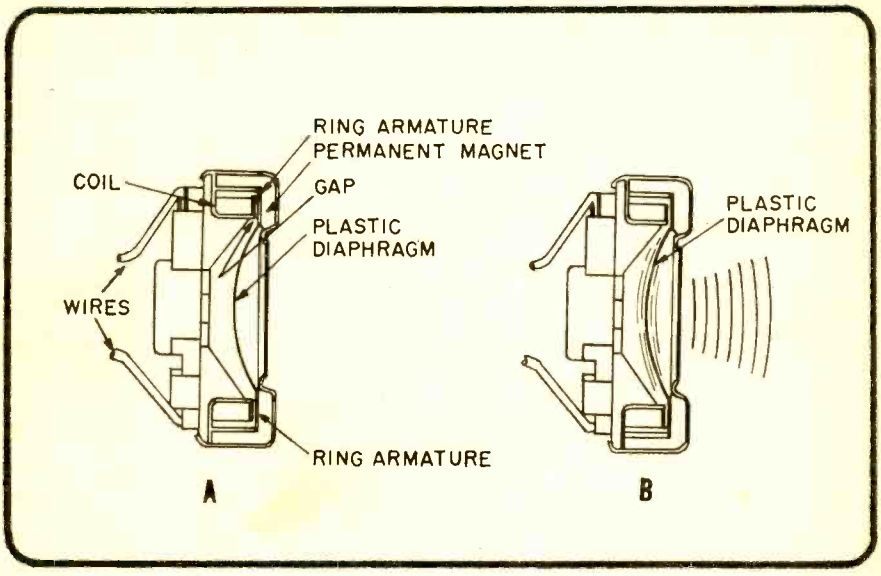
The method of converting the current back into sound is slightly different. Part A in the illustration shows a typical receiver used in a commercial phone system.

Part B shows that the diaphragm vibrates when a sound-varying current passes through the receiver. The current passing through the coil develops a magnetic field which varies in strength with the changes in current. Thus, the field developed by the current periodically repels and attracts the steady magnetic field of the permanent magnet, causing the magnet to which the diaphragm is fastened to move back and forth. This action reproduces the original sound.

SOUND-POWERED TELEPHONES

Another application of a simple electrical circuit is the sound-powered telephone system. It is used only for short distances because of its limited range.

TELEPHONE RECEIVER OPERATION



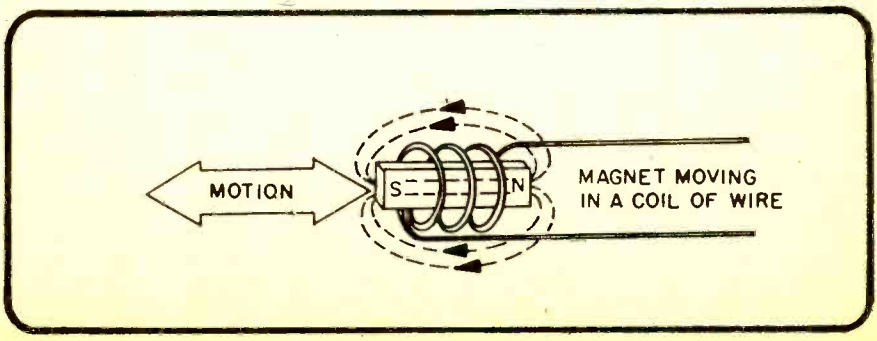
Induced Current

Transmission takes place in sound-powered phones because of the ability of a magnet to *induce* current in a coil of wire. A bar magnet has a north (N) and a south (S) pole. Actually, when the magnet is suspended in air, the north end of the magnet points toward the north geographic pole. Such a magnet has a magnetic field existing in the space surrounding it, with the lines of magnetic force taking the directions shown.

The next illustration shows a bar magnet being moved back and forth inside a wire coil. As the magnet moves, its magnetic lines of force cut across the turns of the coil. This causes an induced current which will actually flow if the ends of the coil are connected to a circuit.

The current reverses direction each time the motion of the magnet changes direction. The amount of current that flows depends on the strength of the magnetic field, the number of turns in the coil, and the speed at which the magnet is moving. Increasing any of these factors increases the amount of current.

INDUCING CURRENT IN A COIL



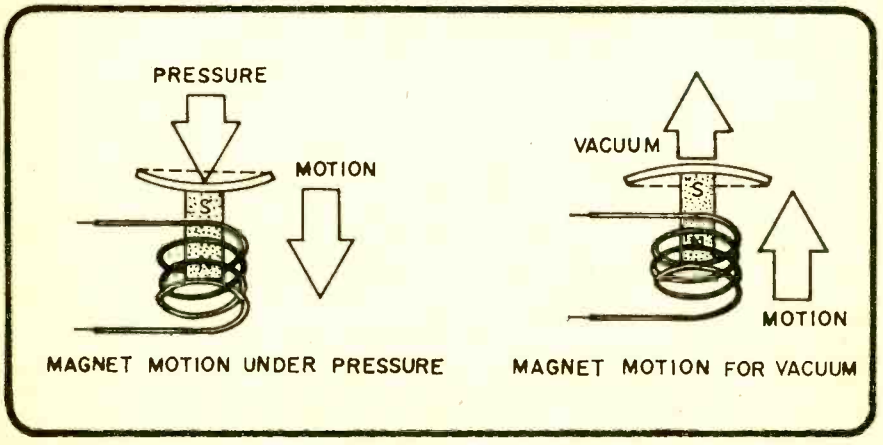
QUESTIONS	ANSWERS
Q11. Current flowing in phone lines at the time when no sound is present is (DC, AC).	A11. Current flowing in phone lines at the time when no sound is present is DC.
Q12. Current flowing during sound transmission is (DC, AC).	A12. Current flowing during sound transmission is AC.
Q13. What causes a recever diaphragm to vibrate?	A13. A varying current develops a changing magnetic field which repels and attracts a magnet connected to a diaphragm.
Q14. A magnet is surrounded by magnetic ----- of -----.	A14. A magnet is surrounded by magnetic lines of force.
Q15. A magnet moving inside a coil ------- current in the coil.	A15. A magnet moving inside a coil induces current in the coil.

Sound-Powered Transmitter

The transmitter of a sound-powered phone makes use of the induced-current principle. As shown, a bar magnet is fixed to the center of a diaphragm. The diaphragm is fastened to the transmitter in such a way that the magnet is over the center of the coil.

As in other phones, this diaphragm vibrates at the frequency of the sound waves striking it. As it vibrates, the bar magnet moves back and forth within the coil. This induces a current which changes direction at the same frequency as the sound. If the transmitter is connected to a sound-powered receiver, current will flow back and forth through the circuit.

A DIAPHRAGM-OPERATED MAGNET



QUESTIONS	ANSWERS
Q16. The amount of current induced in a coil can be increased in two ways. Describe them.	A16. Induced current can be increased by adding more turns to the coil or increasing the magnetism of the magnet.
Q17. A sound-powered phone system	A17. A sound-powered phone system does

(does, does not) have current flowing in the connecting lines during a silent period.

Q18. Why will the induced current in this system change at the same frequency as the sound?

not have current flowing in the connecting lines during a silent period.

A18. Induced current changes at the rate of the moving bar magnet. Since the magnet is fastened to the diaphragm, the induced current will change at the same frequency as the sound.

Sound-Powered Receiver

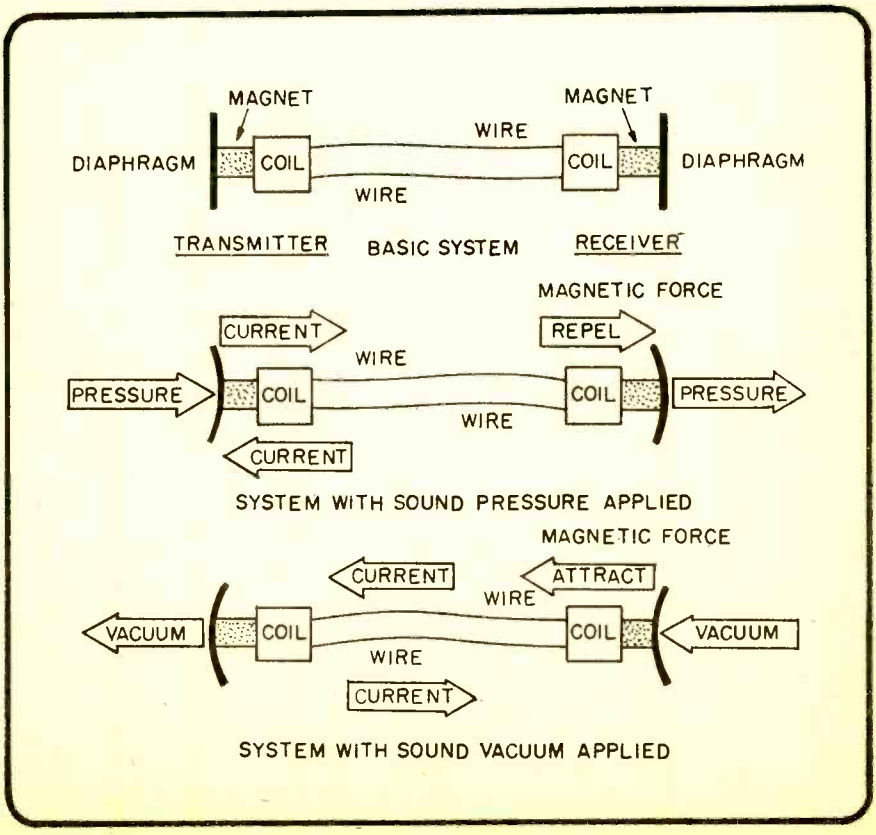
The mechanism in the receiver is identical to that in the transmitter—a coil, a magnet, and a diaphragm. Current flowing back and forth in the receiver coil develops a changing magnetic field. The bar magnet responds by moving back and forth at the same frequency as the current, causing the diaphragm to reproduce the original sound.

Sound-Powered System

The illustration shows the transmitter and receiver connected together as a working system.

The two bottom figures demonstrate how the induced current changes direction with the motion of the transmitter diaphragm. The corresponding effect upon the receiver diaphragm is also shown.

BASIC SOUND-POWERED TELEPHONE



WHAT YOU HAVE LEARNED

1. A basic telephone system uses all the principles of a simple circuit.
2. The operating principle of any telephone system is the ability of the transmitter and receiver diaphragms to vibrate in unison. The transmitter is the cause and the receiver is the effect.
3. Sound vibrates at a frequency determined by its pitch.
4. Sound vibrations cause changes in air pressure.
5. Changes in air pressure cause a thin metal or plastic diaphragm to vibrate. A vibrating diaphragm also causes changes in air pressure, producing sound.
6. In a commercial phone system, a steady current flows through the circuit during periods of silence. This current is varied when sound waves strike the diaphragm, the resulting vibrations exerting and releasing pressure on carbon granules.
7. At the receiver end, the changing current produces a varying magnetic field which repels and attracts a magnet connected to a diaphragm. This action reproduces the original sound.
8. Another type of phone is the sound-powered system. This type uses induced current for signal transmission.
9. An alternating current is induced in a coil by the back-and-forth motion of a magnetic field.
10. A sound-powered transmitter develops an induced current caused by the vibrations of a diaphragm.

Newscan

Continued from page 29

tronic systems as on the engine in every car they make. The reason is that the new integrated circuits can be used to sense and process electronically the information needed to command such functions as steering, braking and collision avoidance. They can bring the speed and precision of electronics for the first time in a practical way to a wide range of control, timing and sensing tasks that have been performed by cumbersome mechanical means, or not performed at all.

Where will electronics be in the cars of 1974 and beyond? Today, the consumer sees solid state voltage regulators, alternators, radios and tape players, electronic ignition, and air conditioning controls.

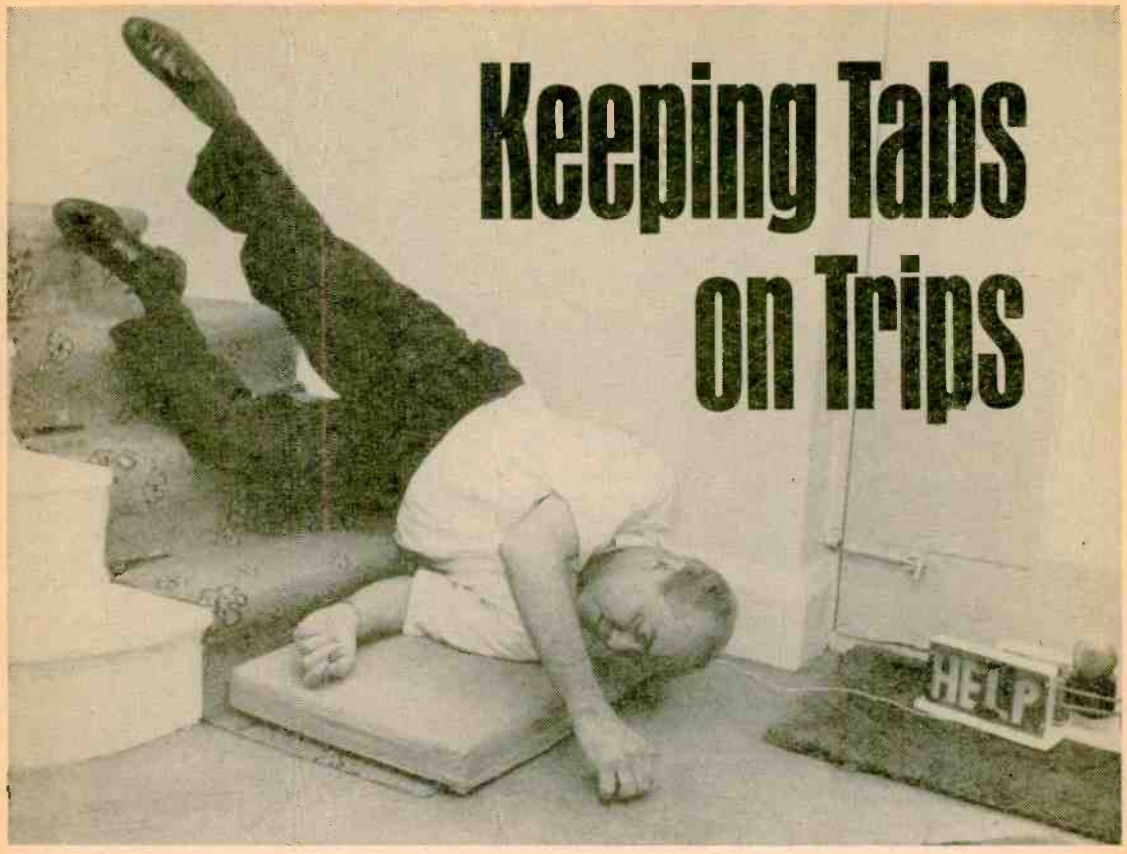
To comply with Federal safety regulations, Detroit cars in 1974 will be equipped with seat belt interlock systems. That means a driver will not be able to start his car unless his seat belt is fastened. The complex signal processing involved in the system utilizes integrated circuits.

A few luxury cars today employ adaptive braking systems, that is, braking systems that sense skids and automatically adjust the braking pressures on individual wheels to control the skids. In response to Federal legislation, 1974 model trucks will be equipped with new anti-skid braking syotems. And the systems will be solid-state. Similar braking systems will find

(Continued on page 94)

Would-be auto mechanic Ernestine Williams points to the virtually maintenance-free electronic ignition system on a 1974 Chrysler car. The ignition system significantly reduces tune-up problems by eliminating the traditional distributor points and condensers.

Keeping Tabs on Trips



It sounds unlikely, but a stair mat might be instrumental in saving many lives.

Yes, a padded wooden mat at the bottom of the stairs might indeed be a life-saver, according to Douglas Wells, a 50-year-old London engineer. The idea is that anyone falling on the mat would activate an alarm bell and a flashing light outside the house. The system, Wells thinks, might be especially useful in houses where old people live alone.

Wells originally got the idea for his mat after his neighbor, an old lady, tripped and fell down a flight of stairs. Three days later she was discovered. Dead. She needn't have died, Wells thinks, if immediate help had been to hand. Help would have arrived if a system like this had been installed.

The mat itself is designed along simple and easily installable lines. It is a wooden platform covered with foam rubber and washable canvas and mounted onto a sprung steel bar. It will support the normal weight of a person without activating the alarm, but as soon as a dead weight falls on it the visual "Help!" sign and bell are switched on. Power comes from a battery that has been kept deliberately small to minimize the risk of shock, and even if the old person rolls off the mat the alarm will continue to sound until help arrives. *—Joe Gronk*

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2. **NEW GR-104C Portable Black & White TV**.....**129.95*** Now the ultimate portable TV has positive detent tuning on all 72 UHF channels as well as VHF. All solid-state circuitry, plus brilliant 12V shell bond picture tube puts black & white entertainment anywhere. Plugs into wall outlet, or runs from 12-volt DC automotive system with adapter included — or becomes completely self-contained with optional rechargeable battery-pack base. Mailing weight, 35 lbs. Optional GRA-104-3 battery pack 42.95*, 9 lbs. Outdoor Sun Shield 1.95*, 1 lb.

3. **NEW GD-1003 Electronic Air Purifier**.....**$139.95*** An easy-to-build 3-evening project. Removes 99% of airborne pollen and 95% of all other contaminants. Has 2-stage electronic operation; washable collector cell; replaceable charcoal filter; 2-speed fan; attractive walnut and gold finish. Purifies air in 20′ x 20′ room in minutes. Mailing weight, 46 lbs.

4. **NEW AS-1039 Ultra-efficient Speaker System**.....**$44.95*** Just 5 watts drives it to booming volume. Uses 8-in. woofer in vented bass reflex enclosure and exponential rectangular horn tweeter with separate level control. Response, 70 to 15,000 Hz. Impedance, 8 ohms. Maximum input 25 watts. Walnut-tone vinyl covered cabinet and green, brown and gold grille board shipped assembled. Measures 21″ H x 12″ W x 10½″ D. Mailing weight, 28 lbs.

5. **NEW AS-1042 Acoustic Suspension Speaker**.....**$34.95*** Uses 8″ long throw woofer and 3½″ shallow cone/dome tweeter for flat frequency response from 40 to 18,000 Hz. External high-frequency control tailors the "highs" to your environment. Requires as little as 10 watts, can handle up to 25. 8 ohms impedance. Walnut-tone vinyl covered cabinet and brown and black grille board shipped pre-assembled. Measures 19″ H x 10″ W x 8¼″ D. Mailing weight, 22 lbs.

6. **NEW GD-3209A Deluxe Garage Door Opener**.....**$139.95*** Ultra-quiet, ultra-reliable screw drive system that you can build and install over a weekend. All electronics shipped pre-assembled. Has ⅓-hp motor, automatic safety reversing plus adjustable slip clutch, automatic time delay light, external adjusting knobs for up/down travel. Includes 1 transmitter. GD-3209B, same as above with 2 transmitters, 154.95*. Mailing weight, 66 lbs. For jamb & pivot doors and GDA-3209-2 adapter, 14.95*, 7 lbs.

7. **NEW AD-1013 4-Channel Audio-Scope**.....**$199.95*** A sophisticated solid-state oscilloscope designed for monitoring the home audio system. Displays stereo or 4-channel signals for separation, phasing, relative strength, multipath reception, center tuning, etc. Has exclusive triggered sweep for stable, jitter-free trace. Designed to complement Heathkit AR-1500 Receiver. Mailing weight, 19 lbs. AR-15 and AJ-15 owners, add ARA-15-1 adapter, 24.95*, 1 lb.

8. **NEW GD-1018 Solid-state Lamp Dimmer**.....**$7.95*** Controls lamp brightness from full illumination through mood-setting dimness to complete invisibility. For single and multiple lamps not exceeding 300 watts total. Extends filament life, eliminates the need for costly 3-way bulbs. A great starter kit. Can be assembled easily in 1 evening. Mailing weight, 2 lbs.

9. **NEW CM-1045 Small-engine Tune-up Meter**.....**$39.95*** Solid-state tach/dwell/volt/ohm meter for all 2 and 4 cycle engines, 1 through 4 cylinders. In many cases permits checking entire small-engine ignition without tearing down flywheel assembly. Built-in tachometer has handy snap-on inductive pickup, reads from 0-3000, 0-15000 rpm. Completely portable, uses 3 1.5-volt batteries (not supplied). Mailing weight, 5 lbs.

10. **NEW HD-1234 Coaxial Switch**.....**$9.95*** A neat accessory for the amateur radio enthusiast. Designed to switch one RF source to any one of several antennas or RF loads while grounding the unused outputs. Two switches can be used to switch up to four antennas/loads to four different components. Standing wave ratio is 250 MHz, 1.1:1 max. Power capability is 1000 W (2000W PEP). Mailing weight, 2 lbs.

11. **NEW GD-600 Photoelectric Lamp Switch**.....**$5.00*** Low-cost home protection in a simple, enjoyable kit. Solid-state circuitry turns light on at dusk, turns it off at dawn. Adjustable sensitivity control sets switch to operate at various levels of light and darkness. Can be used with single or multiple lamps not exceeding 300 watts total. Easy, single circuit board design can be assembled in 1 evening. Mailing weight, 1 lb.

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CIRCLE NO. 1 ON PAGE 17 OR 103

Newscan

Continued from page 88

their way into automobiles over the next few years.

RCA has successfully tested a radar speedometer for use with anti-skid braking systems. Unlike present speedometers, which record the wheel speed, the radar unit provides the true ground speed of the car and this information improves the performance of the anti-skid systems.

In addition, RCA engineers expect that the radar speedometer will one day replace mechanical speedometers. The mechanical systems have to be designed, or adjusted, specifically for the vehicle they are installed on, depending upon the size of the wheels and rear-end gear ratios. One model of the radar speedometer, which is mounted outside the vehicle with only the display inside, could be used for all types of cars and trucks, regardless of their wheel sizes and gear ratios.

By 1980 every car will be equipped with a central processing unit, or small computer. The computer will process many functions from speed and mileage to engine performance and obstacle detection. But the computer will do more than read out performance and display it for the driver. For example, information on engine temperature and RPM, fuel flow and temperature, fuel mixture, etc. will be measured and compared. The computer will then send control signals via power transistors to the engine and fuel system to improve engine efficiency and performance. All this without any action by the driver. ■

DX Central Reporting

Continued from page 26

tractive grey QSL cards by sending your report to *Rikisutvarpid*, Iceland State Broadcasting Service, Post Office Box 120, Reykjavik, Iceland. Reports in English are acceptable but you should include several International Reply Coupons (IRC's) for return postage. You can buy them at your post office for *22 cents each*.

Bandsweep. (Times in GMT, frequencies in kHz): **4832**—One of the stronger Latin American signals on the 60-meter band most evenings is *Radio Capital* in San Jose, Costa Rica. Programming is in Spanish, naturally, but even if you don't know the lingo, you should be able to pick out the *"Capital"* in the ID . . . **4855**—Word is out that Indonesia, which has been an almost exclusively shortwave country, is in the process of making a changeover from SW to medium-wave frequencies. Though the switch will take about five years, now is a good time to hunt for the regional *Radio Republik Indonesian* stations, such as this one at Palembang, Sumatra, before they're gone for good. Try this one about dawn . . . **6015**—A station that has a reputation for very listenable programs is the *Swiss Broadcasting Corp.* This is a good bet for beginners, who can hear its English language transmission at about 0145 . . . **6147**—*Radio Citadelle*, Cap Haitien, is not an easy catch in this crowded band, but you may be lucky enough to find it operating in French around 2345. If you can write a bit of high school French, send your report to the station's 22-year-old engineer, Denis Bastien . . . **9715**—Another old friend of SWLs is the *Far East Broadcasting Corp.*, a missionary station located at Manila, Philippines. Best time to hear this one is during the early morning hours. Around 1400 to 1500, programs are in Japanese and other Asiatic languages, but you may find an English identification at 1435 . . . **11840**—The novice listener, when he begins SWLing, seems to find a certain few stations particularly interesting. His first loggings of *Radio Japan*, *Radio Moscow* and the *BBC* fall in this category. Another is *Radio Australia*. If you are looking for this one, listen in about 1900, West Coasters! Others may find RA on 11765 around 0700.

(Credits: John Tuchscherer, Wisconsin; Jon Williams, Indiana; Scott Reeves, Maryland; Randy Malko, Quebec; Ernst Lohe, Virginia; George Castello, California; Gladys Martin, Brooklyn; Bill Davis, California; North American SW Association, Box 8452, South Charleston, West Virginia 25303)

Backtalk. "Several stations I have heard on shortwave have remained a mystery to me," writes Louisville DXer Mark Hittinger. "The FCC suggested that I write to some other electronics magazine, but they didn't answer."

Well, Mark, for you—and the FCC—the identities of the CW stations (transmitting in international Morse code) which you asked about are: KOK, ITT World Communications, Los Angeles; KPH, RCA Global Communications, San Francisco; WWC, RCA Global Communications, North Chatham, Mass.; and IAR, Maritime Radiotelephone Service, Rome, Italy.

"Don't expect to find any English programs on the Dominican (Republic) stations," we wrote in DX Central Reporting (May-June). But Bob Berlinger, Ossining, N.Y., takes exception to that, noting he heard English announcements over Radio-TV Dominicana, 9505 kHz, one night.

Righto, Robert, this Dominican outlet has aired a few English announcements, apparently in an attempt to drum up tourist trade to the island republic. But it doesn't seem to be a

regular feature.

"I heard a station called Voice of the OAS at 2350 GMT in the 31 meter band. I would appreciate any info you have on this station."

This query comes from Dave Zidel, Park Forest, Ill.

This program is produced by OAS, the Organization of American States, and is broadcast over the shortwave transmitters of the Voice of America, in the same way that UN and AFRTS programs are aired by VOA stations.

Programs are mostly in Spanish, although Portuguese and French are also used. This is scheduled from 2345 to 0030 GMT. For more information, and perhaps a QSL, you might try writing Radio and TV Division, Department of Information and Public Affairs, Organization of American States, 17th St. and Constitution Ave. NW, Washington, D.C. 20006.

Digital Clock

Continued from page 49

1 of the IC, as shown in the schematic, otherwise stray RF fields may cause the clock to run fast or slow. You may want to put a piece of green or blue plastic in front of the display tubes for better appearance.

Clock Operation. Selection of various modes of clock operation and setting of time and date are all controlled with only four toggle switches mounted on the back of the cabinet. Switch S2 *cal set, alt-off, time set* is used to command the IC to receive the time or date; in the center-off position, the time (for eight seconds) and the date (for two seconds) are alternately displayed. Switch S3 *min/day, off, hour/month* is used to set minutes or days in one position, and hours or months in the other position. Its normal operating position is center-off. Switch S4 *min. x 10, off* advances only the tens of minutes display. Switch S5 *50 Hz, 12 H, 24 H* selects between 24 hours at 60 Hz operation, 12 hours at 60 Hz (center position) and 12 hours at 50 Hz. The 50 Hz operation and the hold button, S1, are used to adjust the seconds display to coincide with the WWV time signal. Always set the calendar first, and then the time, since advancing the calendar could change the time from p.m. to a.m.

Also, notice that when the clock is operated in the 24-hour mode, it will indicate zero for the month of December, instead of 12. If you plan to operate the clock in the 24-hour mode and would like the correct

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(Continued from page 96)

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FREE Catalog lists resistors, tubes, transistors, rectifiers, condensers, tools, tuners, etc. etc. Hytron Hudson, Dept. EE, 2201 Bergenline Avenue, Union City, New Jersey 07087.

TELEVISION PROJECTOR KIT. Bele Electronics Corp. 138 Hialeah Drive, Hialeah, Florida 33010.

AMAZING: Precise AC calibration source you can build from ordinary parts. Plans $2.00. Total. Box 251, Ridgewood, N.J. 07451.

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(Continued from page 95)

month indication for December, you will require an additional switch, an additional transistor, two diodes, and two resistors, as shown in the schematic.

Adjustments. There are only two adjustments: R6 controls the brightness of the display, and R1 determines clock accuracy during battery operation. Adjust brightness control R6 to your liking. A good way to adjust R1 is to listen to WWV and disconnect the clock from the power line for one minute at a time. Depending on whether the clock is then slow or fast after reconnecting it to the power line, you turn R1 one way or the other.

The clock assumes that all months have 31 days, so don't forget to advance the date indication on February 28 (or 29 if it's Leap Year) to March 1, otherwise you'll wind up with February 31, which is a pretty unlikely date! Do the same thing with April 30, changing it to May 1, and so on with June, September, and November. ■

Those Little Gadgets . . .

Continued from page 63

about 5 grams.

Record Changer Maintenance. Assuming that you have spotlessly clean records, that the Static Demon is kept at bay, your stylus is clean and tracking at the proper pressure, all you need to worry about is the condition of your changer and associated amplifier system.

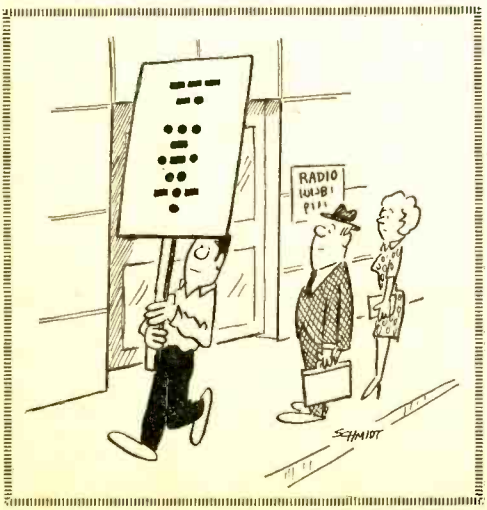
If your prized records don't sound the way they once did although they appear to be in excellent condition, you may be experiencing trouble with your turntable drive system. It's a simple matter to check the turntable speed by means of a stroboscopic disc and a small neon light, as shown. If the appropriate band of markings on the turntable is turning correctly at 33 rpm, disc will appear to stand still; if the markings drift more than just a little, your turntable drive system needs servicing. Do not attempt to use the strobe disc to check for wow because the markings on the disc are not imprinted accurately enough for this, and the hole in the disc may be slightly off center; thus you may be diagnosing wow when there is none.

A much better way to test for possible wow, rumble, flutter, hum, stereo spread and separation, speaker phasing and channel

identification, frequency response and efficiency of cartridge/stylus tracking is to use a test record. Either of the records shown in the photo serves this purpose quite well. But whatever record you use, bear in mind that it is *extremely* difficult to make a *perfect* test record for sale at the prices you would be willing to pay. So use a little common sense when you evaluate your hi-fi system with these records. Where you seem to detect a fault—and especially if it appears to be a marginal fault—use some other test method if possible to verify your suspicions before you junk your system and blow hundreds of dollars on a new system that may be no better than what you have now.

Another salient point: before using the test record, give it an anti-static treatment if it appears to be charged, and certainly do not use it until it is clean. To test for the presence of static charge, even when there is not much dust on the record, hold the disc close to but not actually touching your forearm. The hairs on your arm will stand up and wave around if the record is charged. Ladies who will not admit to having hair on their arms will feel a definite electronic "breeze."

Only in this just-mentioned way should you allow record maintenance to become a hair-raising experience. If your record cleaning process becomes so complicated that the hairs on the back of your neck rise just at the thought of preparing a record for playing, you are going overboard in the quest of perfection. Keep your records clean, but don't let this objective lead you to disc-ochondria—obsessive concern about sick discs. ■



CB Coffee Break

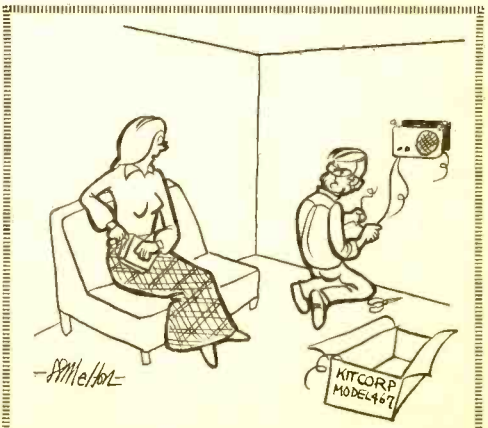
Continued from page 64

intermix of equipment with various services.

Naturally, no proposal is ever accepted at face value. At the time we go to press the FCC is soliciting comments from all phases of the communications industry regarding Class E CB. Some of the FCC's interests are in the area of expediting communications, others seek to avoid the problems common to Class D. For example, the FCC has requested opinions concerning automatic station identification built into the equipment; in this manner even the total novice will be assured of proper station identification; at a specific time interval the station will be automatically identified. The FCC has also asked for opinions on recommended receiver characteristics to avoid the condition of continuous upgrading. A specific level—a high level—of performance will be designed into the Class E system and all equipment will meet the requirements.

On the other side of the coin the FCC is interested in Class E's effect on Class D; the feasibility and desirability of phasing out Class D, or perhaps phasing out the personal or business use of Class D in favor of the survivors' use. For example, if all business operations were moved to Class E all 23 channels in Class D might be available for personal use.

Regardless of the final determination on the uses and allocation of the Class E channels, the FCC is firmly determined there will be no repetition of the Class D viola-



"Terrific! Just what I always wanted for our 2-room efficiency—an intercom."

tions such as "working skip." The FCC has requested comments on the feasibility, desirability and legality of equipment confiscation under certain conditions of illegal operations.

Class D Hangs On. Naturally, no one need worry about an immediate shift to Class E, or obsolescence of present class D equipment. If the wheels of justice grind slow, the wheels of the FCC grind even slower. If previous history of "FCC studies" serve as an indicator of action, you'll have depreciated or "used up" many a Class D transceiver before you're literally pushed into Class E.

Though Class E does not loom in the immediate future it is still exciting to think that the vast potential of Class E has come about directly through the efforts of Class D CBers. Until Class D, few of those in power seriously believed two-way radio equipment should be put in the hands of the untrained common-folk, people with little or no training or experience in electronic technology. And most certainly, no one believed the commoners would get two-way radio without stiff licensing requirements. But class always tells; while there have been flagrant violations of the Class D rules, and we most certainly have our share of oddballs and misfits, the average Class D CBer has proven not only that the typical taxpayer is capable of efficient operation of a two-way radio system, but also that he is entitled to the advantages of the new technologies offered by Class E.

Just as Class D was the wave of the future of the 1950's, so too will Class E be the wave of the future of the 1970's. ■

Hey Herb

Continued from page 65

nel, but it's a rock-bottom cost way to improve stereo sound. Matrix recordings sound quite good through a Dynaco decoder. The instrument arrangements (in the four corners) aren't usually what the record producer intended, but most listeners find it pleasant; some think it's spectacular and some just don't care for it. It's like anything else in this world. Try it, you might like it.

HEY HERB: I have been using an outdoor, weatherproof speaker in the back yard and I'd like to change to something that will really deliver high fidelity sound. Is there any reason I can't use something like an AR7a or ADC 404 if I place it in a waterproof box which I'll open

only when I want to use the speaker?

You're on the right track for barbecue hi-fi, but I think the excess outdoor humidity, not to forget extreme temperature range, will cause the woofer cone to deform, possibly shifting the voice coil so it rubs—producing a raspy sound. Since the speakers you have in mind are small to begin with, why not simply mount a handle on the speaker (s), install an outdoor shelf and move the speaker (s) outdoors when needed. An ordinary phone plug and jack will provide an easy though secure connection for the connecting wires.

HEY HERB: Since CD-4 records contain frequencies as high as 45 kHz, how can the signals be properly reproduced by ordinary hi-fi equipment, which is specified to only 20 kHz?

Somewhere along the line you *have lost track of how CD-4 works.* The signals from the phono pickup, which do extend to 45 kHz, are fed into a *special demodulator* which uses the ultrasonic signal (s) to create four distinct outputs with a 20-15 kHz frequency range. The main amplifier receives signals only in the 20-15 kHz range, there is no ultrasonic signal passing through the main amplifier. If you use a CD-4 demodulator accessory with a 4-channel amplifier the accessory's output is 20-15 kHz. You only have to worry about the input to the demodulator; for this reason the turntable's output cable must be replaced with low-capacity shielded cables to avoid attenuating the ultrasonic signals before it get to the demodulator. Once the signal is in the demodulator, you've no further problems. ■

Jolly Roger

Continued from page 68

The volume balance between the BCB and VHF reception is as good as the user decides to make it as long as both signals are relatively strong. As would be expected with any type of radio, either BCB or VHF, balance is almost impossible if one of the two signals is relatively weak.

The VHF model can accommodate crystal frequencies up to 12 MHz apart; the UHF model (which we did not test) can accommodate frequencies up to 24 MHz. Frequencies outside the specified bandwidths are received with reduced sensitivity.

Summing Up. The Jolly Roger JR-1is a real winner. It is particularly attractive to CB'ers involved in REACT programs, auxillary police and firefighters, and just plain folks who want to keep on top of all the action, who want to relieve the boredom between calls by listening to the BC radio.

The Jolly Roger JR-1 complete with a line-powered power pack is priced at $79.95. Crystal certificates are $5.00 each. For additional information circle No. 63 on the reader service page. ■

Antique Radio Corner

Continued from page 78

IHRS will be happy to help you get started. Write to the President and enclose a SASE.

Atwater-Kent Mfg. Company. As I promised last time, I have some interesting information for you from an advertising brochure published by Atwater Kent in 1929.

The Atwater Kent factory comprised two identical plants situated in Philadelphia, Pennsylvania. When building 1 was completed it was the largest radio factory in the world. When building number 2 was completed the total floor space covered 32 acres. This was an area greater than 28 football fields side by side.

Atwater Kent operated one of the most self sufficient radio factories in the world. In this plant all the screws, nuts, and binding posts were turned out. All the knobs, sockets, coil forms, and other parts were molded, transformers and coils were wound and completed, sheet metal was stamped, pressed, and spun to the shapes necessary for radios, steel panels, table model cabinets, and speaker housings were fabricated. Here the cadmium and nickle plating was done, as was the baked enameling for control panels.

One out of every ten employees was an inspector, and each receiving set was subjected to 752 visual and electrical tests before it was shipped.

Dayton Ham Convention. I had heard that one could pick up old radios at ham radio conventions. I also had heard that the Dayton, Ohio ham convention had the largest radio flea market in the United States. So on April 28 I went to the Dayton Amateur Radio Convention. The parking lot had cars with license plates from many states, some were from the east coast. I was amazed that

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(Continued from page 102)

people would drive that far, but when I reached the flea market area I knew one reason why they were there. There were several acres full of cars, trucks, and station wagons. There was much WW II surplus, commercial test equipment, tubes and yes, there were antique radios, horn and cone speakers, tubes, meters, test equipment, and you name it, it was there and for sale.

Everything was inexpensive except the old radios and horn speakers. Tubes went as low as 25¢ each, while used 201A's were $1.00 each. A 3-inch Pilot TV receiver was priced at $60.00 and was still there when I left. The asking price for a 5-tube Dayfan was $80.00 with no takers. An Atwater-Kent cone speaker was priced at $5.00 which I felt was a fair price.

I met four collectors there that had corresponded with me and later found two more letter writing friends were there. The flea market covered so much ground I probably missed other antique radio collectors who were there. If you live within driving distance of Dayton, Ohio I recommend that you visit the Ham Convention. Who knows I may meet you there next year.

Private Radio Museums. It is surprising how many antique radio collectors have private radio and wireless museums where they have their collection on display for enjoyment by fellow collectors. Some museums consist of a room in their home, or in some cases they will build a special building to house their collection.

Visits to private museums usually must be arranged in advance either by mail or telephone. When writing be sure to write at least one month in advance and enclose a SASE for a reply. In order to help you plan your museum stops during your vacation I have prepared a two page list of private radio museums with addresses and telephone numbers when available. To get your *free* list send a long self-addressed, stamped envelope to Antique Radio Corner, Elementary Electronics, 229 Park Avenue South, New York NY 10003.

Next time we will tell you about a private museum housed in its own building built by an Indianapolis man. There will also be photographs of the building and some of the radios in his collection. There will be a story about a new use for a burned out radio tube. We will also have other interesting features to make the radio collecting hobby more fun for you. So long till then. ■

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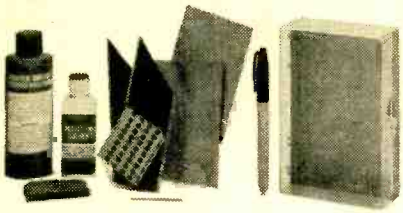

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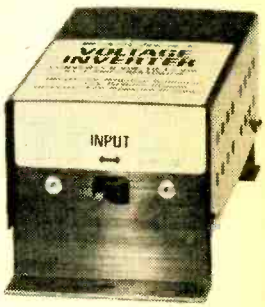

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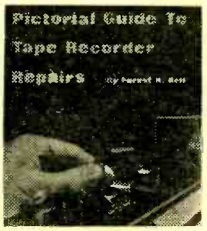

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of well-lighted surroundings. The special section on color TVs can save you a bundle on the cost of repairmen. There are ideas for burglar alarm installation, speaker systems for every budget, a household intercom system and scores of other projects. Unusually well-thought-out diagrams, photographs, charts and schematics make the book especially easy to follow. For the info, circle No. 67 on Reader Service Coupon. ■

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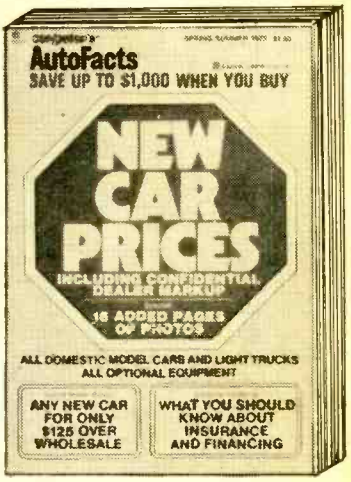

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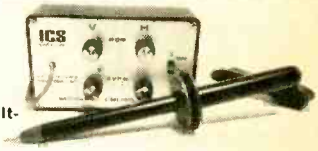

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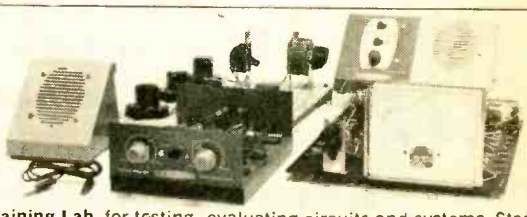

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