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May, 1966
FRANKLY, gentlemen, I would enjoy a resumé on a bloodhound with the unlikely name of Zelda much, much more than a rundown on your bearded Uncle What's-His-Name (UNCLE TOM'S CORNER, Mar. '66 EI).

Zelda got but passing mention when we introduced Uncle Tom because we felt that he, not she, deserved introducing. But since you've asked for it, here goes. Uncle Tom reports that Zelda's arrival on the New York metropolitan scene from her rural birthplace seems to have set the pace for her later adventures (she showed up a day late and at the wrong airport). Despite all efforts to instruct Zelda in the finer points of tracking and trailing, she acknowledges no odors of lesser magnitude than a 5-cent stogie and few sounds other than a call to dinner. Spending most of her time sleeping, she sometimes awakes silently to watch Uncle Tom at work (though she has remained awake long enough at various times to appear on a TV program). Content with such triumphs, Zelda scorns Hollywood and its inevitable name-change requirements (imagine a bloodhound named Kim or Lana) and seems resolved to let Lassie keep her lead. For companionship during Zelda's sleeping hours, Uncle Tom has Cindy, a second-hand pooch of dubious ancestry (Cindy mysteriously appeared one day in the front seat of Uncle Tom's parked car and has stayed on for the fun).

Can I hook up a speaker that has a 20- to 30-watt rating to an amplifier with an 8-watt output? They both have 8-ohm impedances.

Merrill Nelson
Eden Prairie, Minn.

Yes.

Re your LAST STAND FOR BRASS POUNDERS article (Mar. '66 EI), I say down with the soft life, up with the tough, rough (but winning). Call me Hardway Harry if you've a mind to, but life without brass pounders never will be the same.

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MASTER MAZE ... Confronted with what looks like something from a behavioral science laboratory, the man in our photo well could be inspecting the floor plan of a new and more frustrating mouse maze. Thing is, the three-foot-square negative getting the once over not so lightly at RCA's Somerville, N. J., plant is a photomask for integrated circuits. Size of the letter o on a typewriter, the devices will be packed with up to 40 components.

...electronics in the news

Digital Trumpet ... If the people at New York's Bell Telephone Laboratories are able to continue synthesizing the sounds of musical instruments, time may come when computers will make like symphonic ensembles. Impossible? So effectively have French physicist Jean Claude Risset (at blackboard) and his associates synthesized the tone of a trumpet that professional musicians can't tell it from the real thing. Next step: a violin, and then who knows? An orchestra, maybe.

Monster Blitz Machine ... Most any electronic hobbyist well knows the hair-raising tricks and the lightning-like sparks Van de Graaff generators can create whenever they have half a mind to. The laboratory and classroom versions nearly everyone has ogled serve the highly useful (if solely decorative) purpose of revealing the way speeded-up particles act. But these junior-size, demonstrator-type, science-fair-style generators have built-in limitations. Much larger generators are needed to determine the effects high-energy particles have on matter, which explains why Toshiba of Japan has seen fit to come up with the monster blitz machine in our photo. Largest spark machine in all Japan, it generates a static charge of 10 megavolts and incorporates a number of improvements better to help it produce the white and crackly stuff that normally comes only from the heavens.
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ITEMS... Mailing or carrying exposed film to photo-processing centers after just 20 to 30 exposures may become a thing of the past if a camera developed by Aeroflex Laboratories of Plainview, N.Y., catches on. The unique camera makes use of a system called multiplex-recording photography and is capable of capturing up to 500 full-size pictures on a single negative. Though processed in the usual way, the film must be viewed on a special device.

Demonstrations recently performed the aid of a human subject and a dog at the New York University Medical Center show that it now is possible to induce sleep and even to anesthetize with electricity. (Technicians simply placed electrodes over the eyes and on the backs of the necks of the participants.) Though it is not known why such stimulation produces its effects, the demonstration verified that the procedure for anesthetizing requires less voltage and more current than that for sleep induction.
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CITIZENS BAND / HAM RADIO

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MARKETPLACE

Prognosticative ... The information dispensed by this little converter well could make it standard equipment for most anyone who drives a car and wants to be a hop, skip and jump ahead of surprise changes in the weather. Fliers and skiers, for example, often must place long-distance calls to obtain vital pre-flight forecasts and ski information. Thing is, the Spasors converter supplies it free of charge. Nestled beneath the dashboard and connected to the car radio, the 200- to 400-kc converter keeps drivers and passengers in touch with the latest regional forecasts and important flight information from the nearest station in the FAA's Transcribed Weather Broadcast network (TWEB). A plug-in connector and simple mounting procedures make the compact 5- x 3- x 1½-in. unit easy to install. $29.95. Spasors Electronics Corp., 1090 Morena Blvd., San Diego, Calif. 92110.

Companionable ... Barked shins and blinking electrical-system idiot lights—sometimes reminders of mobile CB-rig installations—likely won't trouble the CBer who puts an Escort II in his car. This compact, solid-state rig is a mere 2¼ in. high and draws only 1.5 amperes in the transmit mode. But size notwithstanding, the Escort II boasts an input of 5 watts on 11 channels. The superhet receiver section sports dual conversion, automatic noise limiter and adjustable squelch. Operating with one crystal per channel, the Escort II helps cut crystal costs. Further, a built-in TVI filter is intended to keep the smiles on the faces of the nearby idiot-box watchers. $239.90. Pearce-Simpson, Inc., Box 800, Bis-cayne Annex, Miami, Fla. 33152.
Who makes the only great amplifier for $99.50?

You do... with the new Fisher KX-90 StrataKit.

Now, for the first time in high fidelity history, you can own a truly distinguished stereo control-amplifier for less than $100—if you are willing to build it yourself.

Fisher refuses to compromise quality. Therefore, even at $99.50*, the Fisher KX-90 StrataKit incorporates the same basic standard of fidelity as the most expensive Fisher components. Take away its price tag and it would still excite the admiration of the fastidious audiophile.

With 40 watts of clean power, the KX-90 can drive even inefficient speakers to their maximum performance level. Superior output transformers make certain this power will not fall off steeply at the frequency extremes. Advanced preamplifier features, including rocker switches and complete phono/tape facilities, provide unlimited flexibility.

It's all yours if you follow directions. And that's no problem with the exclusive Fisher StrataKit method. No experience is necessary. Assembly takes place by simple, errorproof stages (Strata). Each stage corresponds to a separate fold-out page in the uniquely detailed instruction manual. Each stage is built from a separate packet of parts (StrataPack). Major parts come already mounted on the extra-heavy-gauge steel chassis. Wires are precut for every stage—which means every page. All work can be checked stage-by-stage and page-by-page, before proceeding to the next stage.

The end result is a Fisher stereo control-amplifier that is fully equal in performance as well as reliability to its factory-wired prototype. Fisher guarantees this. And who should know better than Fisher?

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WALNUT CABINET, $24.95 OVERSEAS AND CANADIAN RESIDENTS PLEASE WRITE TO FISHER RADIO INTERNATIONAL, INC., LONG ISLAND CITY, N.Y. 11101.

May, 1966
In today's electronics boom, the demand for men with technical education is far greater than the supply of graduate engineers. Thousands of real engineering jobs are being filled by men without engineering degrees—provided they are thoroughly trained in basic electronic theory and modern application. The pay is good, the future is bright...and the training can now be acquired at home—on your own time.

How to become a "Non-Degree Engineer"
The electronics boom has created a new breed of professional man—the non-degree engineer. Depending on the branch of electronics he's in, he may "ride herd" over a flock of computers, run a powerful TV transmitter, supervise a service or maintenance department, or work side by side with distinguished scientists on a new discovery.

In military-connected work alone, 80% of the field engineers are not college trained. Yet they enjoy officer status and receive generous per diem allowances in addition to their $7,000 to $11,000 a year salaries.

In TV and radio, the Broadcast Engineer is the man with a 1st Class FCC License, whether he has a college diploma or not.

But you do need to know more than soldering connections, testing circuits and replacing components. You need to really know your electronics theory.

How can you pick up this necessary knowledge? Many of today's non-degree engineers learned their electronics at home. In fact, some authorities feel that a home study course is the best way. Popular Electronics said:

"By its very nature, home study develops your ability to analyze and extract information as well as to strengthen your sense of responsibility and initiative."

Cleveland Method Makes It Easy

If you decide to advance your career through home study, it's best to pick a school that specializes in the home study method. Electronics is complicated enough without trying to learn it from texts and lessons that were designed for the classroom instead of the home.

The Cleveland Institute concentrates on home study exclusively. Over the last 30 years it has developed techniques that make learning at home easy, even if you once had trouble studying. Your instructor gives the lessons and questions you send in his undivided personal attention—it's like being the only student in his "class." He not only grades your work, he analyzes it. And he mails back his corrections and comments the same day he gets your lessons, so you read his notations while everything is still fresh in your mind.

Students who have taken other courses often comment on how much more they learn from CIE. Says Mark E. Newland of Santa Maria, Calif.:

"Of 11 different correspondence courses I've taken, CIE's was the best prepared, most interesting, and easiest to understand. I passed my 1st Class FCC exam after completing my course, and have increased my earnings by $120 a month."

CIE Assures You an FCC License

The Cleveland method of training is so successful that better than 9 out of 10 CIE men who take the FCC exam pass it—and on their first try. This is despite the fact that, among non-CIE men, 2 out of every 3 who take the exam fail! That's why CIE can promise in writing to refund your tuition in full if you complete one of its FCC courses and fail to pass the licensing exam.

This Book Can Help You

Thousands who are advancing their electronics careers started by reading our famous book, "How To Succeed in Electronics." It tells of many non-degree engineering jobs and other electronics careers open to men with the proper training. And it tells which courses of study best prepare you for the work you want.

If you would like to cash in on the electronics boom, let us send you this 40-page book free.

Just fill out and mail the attached card. Or, if the card is missing, write to:

CIE
Cleveland Institute of Electronics
1776 E. 17th St., Dept. El-63
Cleveland, Ohio 44114

Accredited by the Accrediting Commission of the National Home Study Council, and the only home study school to provide complete coverage of electronics fundamentals plus such up-to-date applications as: Microminiaturization • Laser Theory and Application • Suppressed Carrier Modulation • Single Sideband Techniques • Logical Troubleshooting • Boolean Algebra • Pulse Theory • Timebase Generators—and many more.
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(In Mobile Installations)

Only the Squires-Sanders Noise Silencer eliminates noise caused by ignition, power lines, etc. Only two transceivers have this exclusive feature—the Squires-Sanders "23'er" with full 23-channel capability (all crystals supplied) at $235 and the "SSS" 5-channel model at $185. Other features include an ultrasonic receiver and a powerful, long-range transmitter (special high efficiency RF output amplifier clipped and filtered audio, 100% modulation). 12 VDC power supply. Squires-Sanders Inc., Millington, N. J. 07446.

BROADSIDES
Pamphlets, booklets, flyers, application notes and bulletins available free or at low cost.

With more and more appliances yielding their line cords to nickel-cadmium batteries, most everyone is interested in learning more about how these little powerhouses work. Some of the nickel-cad's secrets are revealed in bulletin BA-125, which also discusses what can be expected from such cells. Get your copy from Sonotone Corp., Elmsford, N. Y. 10523.

A glance through the thousands of science items in the new Edmund catalog 661 likely will spark the imagination of any junior scientist or electronic hobbyist. Items like crystal-growing kits, science fun chests and large-size magnets are only a few of the listings. A free copy can be yours by writing Edmund Scientific Co., 107 E. Gloucester Pike, Barrington, N. J. 08007.

In addition to providing data on Jensen's entire line of hi-fi speakers and headphones, catalog 165-L orients the novice to the hi-fi facts of life and advises how a monaural system most economically can be converted to stereo. And as an additional bonus, money-saving information on how to build your own speaker enclosures appears on the closing leaf of the 24-page catalog. For your free copy, write Jensen Mfg. Div., Muter Co., 6601 S. Laramie Ave., Chicago, Ill. 60638.

Most hobbyists realize the virtues of wire-wound resistors for certain critical low-noise audio and RF applications, though even a wire-wound can turn some strange tricks. Catalog 14-RG takes the guesswork out of how these resistors perform under a wide range of conditions. For your free copy, write Hi-Q Div., Aerovox Corp., Cinema Plant, 1100 Chestnut St., Burbank, Calif. 91502.

Wading through the multiplicity of solid-state components that perform similar or identical functions can be bewildering as design-it-yourself color TV. Thing is, the Semiconductor Replacement and Interchangeability Guide and Price List by Semitronics maps the way to quick and correct replacements for solid-state components. A copy can be had for 25¢ from Semitronics Corp., 265 Canal St., New York, N. Y. 10013.

Quick and easy introduction to meters and electronics can be had by reading Best Ways to Use Your VOM and VTM. A copy can be yours for 50¢ from Allied Radio Corp., 100 N. Western Ave., Chicago, Ill. 60680.

Electronics Illustrated
EMERGENCY COMMUNICATIONS
WITH PEARCE-SIMPSON'S

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RCA Electronic Components and Devices, Harrison, N.J.
Are you for real with that facial fuzz? I've noticed that everyone who resorts to wearing a beard just to get attention is either an oddball or a creep, or both.

Sal Venetucci
Evanston, Ind.

You would notice that, you little devil.

I've been wondering why nobody ever has thought of TV with stereophonic sound. It seems like the next logical step.

Ronald Cardiff
Frankfort, Ky.

The FCC already has been asked by Philco and General Electric to permit stereocasting on TV. Uncle Sammy is trying to figure out how stereo will affect picture and sound quality, also stereo bandwidth requirements, cost and complexity of equipment, etc. I'm trying to figure out whether stereo will make TV twice as good or twice as bad.

Thought you'd be interested in this. When I moved to the sticks from the big city, I took my TV antenna with me, installing it on the roof. My neighbors all laughed and told me that I would need a special deep-fringe anodized million-element monster, such as they all had. I was the one with the last laugh because my beat-up old city-dweller antenna brings in Bullwinkle as well as their super-duper specials. Any comments?

R. Van Praag
Islip, N.Y.

Bully for Bullwinkle!

I'm a Novice ham operator and would like you to pass along the word to any lid who may be reading your column, especially one who lives down the street from me. The word is that it's bad operating practice to bone up on CW techniques over the air, especially with 10-minute CQs followed by an endless rendition of your call-sign. Novices, because of their inexperience, generally are very bad operators. Why not read them the riot act to get them all in line?

R. Radke, WNHMUD
St. Paul, Minn.

Once, in the remote past, I undertook the assignment of a magazine article which berated Novices for certain poor operating practices. As soon as the publication went on sale, I was greeted by a delegation of Novices who had come to protest my stand. There they stood, hollow-eyed, silently clutching pictures of Wayne Green. If you think that I'll ever knowingly let myself in for something like that again, you're crazy.

Can you give me any information on a mobile CB transmitter which can be used with a receiver converter?

Stan Rondrian
Red Lion, Pa.

The only mobile CB transmitter I ever saw was made years ago by Philmore Mfg. Co. It was a dandy little unit but never seemed to catch the fancy of CBers. Maybe some manufacturer will take another whack at one someday.

Ladies Take Notice Department. Just so the ladies won't think that it's completely a man's world, here's one male who stands

[Continued on page 24]
LEAVE EARTH BEHIND AND COME EXPLORE...

Journey to unknown worlds and discover that, under a different sun, all things are new.

A FAWCETT GOLD MEDAL BOOK

Buy this Fawcett Gold Medal Book from your paperback bookseller. If sold out, send only price of book plus 10¢ for postage and handling to Fawcett Gold Medal Books, Fawcett World Library, Greenwich, Connecticut. If order is for five or more books, no postage or handling charge is necessary. Please order by number and title. No Canadian orders.

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

UNCLE TOM'S CORNER

Continued from page 23

with them in their universal gripe that line cords on household appliances are too short. Apparently, it's just about impossible to operate an iron without an extension cord, and countless electric clocks, lamps and table radios also seem to fall in this category. Placing a heavy-duty line cord on an iron is a wasted safety measure if the line cord has to be plugged into an extension cord to reach the wall outlet.

★ After pioneering broadcasting, TV and even color TV, General Sarnoff (head of RCA) should hang his head in shame at the sad state of broadcasting today.

Charles Soldaro
El Paso, Tex.

Probably sulks all the way to the bank.

★ I'm confused about all the talk of the advantages of the various types of single- and double-sideband CB rigs on the market. Can you give me a nutshell summary of which I should buy?

Ken Felcher
Rogers City, Mich.

Briefly, only someone else with similar equipment will be able to decipher a single-sideband CB signal—and since there aren't enough of these sets around to fill a breadbox, you'd be talking to yourself most of the time. Double sideband looks great on paper, but it might just as well have been omitted from most of the CB set designs I've seen. Stick with plain, unadulterated AM, and suffer along with the rest of us.

★ There's a pirate CB station I keep hearing on my CB rig and I wonder if anybody else has heard them. I heard him on Channel 23 using the call-sign KDZ768—obviously a phoney since it doesn't even conform to standard CB type calls. How do I report this bootlegger to the FCC?

Lawrence Vajic
Union, N.J.

Don't be too hasty about turning in this bootlegger—he's legal. When your letter came in, I checked FCC records and found that KDZ768 is a station in the Business Radio Service, owned by a radio and TV sales company in Paterson, N.J. They're licensed
to operate on 27.245 mc, which is not a CB channel (it's between CB channels 22 and 23, though). Better get your receiver calibration corrected and leave the CB policing to Uncle Charlie (that's the FCC to you, Gramps).

★ I've got a broadcast radio with a ground on the chassis but nothing hooked to it. I got the idea to use it for a ground on my antenna and was surprised to find that if you plug the set in one way, it's a ground. With the plug reversed in the power outlet, it's hot. What do you think?

    W. Martin
    Limestone, W.Va.

About what?

★ Colorful TV Dept. With the big push to unload color TV sets on the public, you'd think that TV stations would exercise a little more effort in standardizing the quality of the color they transmit. Sometimes there's barely enough color involved to make the thing worth the effort; other times the color is so out of whack you wonder if we've been invaded by green Martians. Anybody for blue cucumbers?

★ Seriously, what about the names of some of the recordings you'd suggest as best bets to show off a high fidelity sound system?

    Arthur Dollinger
    Chevy Chase, Md.

If you really want to know, the last recording to give me a jolt was by Harry Horlick and his A & P Gypsies.

★ This isn't in the realm of electronics, but I did notice in the March EI that you were a coin collector. In your opinion, what is the most overpriced and overrated American coin? What about the most underrated?

    Jerome Wratten
    Tucson, Ariz.

By far the biggest swindle ever pulled on coin collectors was the so-called 1960 small-date penny. Dealers and speculators have run up the price on the coin far past its true value. Another coin which the speculators created is the 1955-S penny. I think that Mercury dimes (before 1940), 1943 (steel) pennies, silver war nickels and Walking Liberty halves are the ones to watch for in the future. They're all underrated today but quietly are getting scarcer by the minute.

May, 1966
Some Plain Talk from KODAK about Tape:

Sobering thoughts about slitting... and making the best basically better

A wise man once said, “Baloney’s basic worth is unaffected by the manner in which you slice it.” Maybe so for baloney... but certainly not for sound recording tape. Slicing, or to be technically correct, slitting quarter-inch ribbons of tape from the 42-inch-wide master web in manufacture takes a pretty sharp eye. This slitting operation is important to your pleasure since the closer the tape comes to being dimensionally perfect, the better is the azimuth relationship between the recorded signal and the reproduce head. Like it in plainer English? Then consider some examples of poor slitting... and what they sound like.

“Drunken” slitting and others. Variations from the ideal occur if tape is too wide, too narrow, or if its width varies. If the tape is too wide, it may actually override the guides on your tape deck. If the tape is too narrow, it may see-saw as it passes by the head. Either way, you’re in trouble. Variations also occur if the edges are not straight. One such variation goes by the name of “drunken” slitting. Sound bad? You bet. The edges snake even though the width is constant (see drawing). As a result, on playback the output varies as the tape weaves past the reproduce head... causes a warbling of the signal. This is a type of distortion the human ear is most sensitive to. You wouldn’t like it.

Drunken slitting, a dramatization

Quality-control makes the difference. Standard industry specification calls for a tolerance on width of ± .002 inches. To start, we hold ours to ± .001 inches. And to make things more interesting we make our test over a twelve-inch span to equal or exceed guide spacing on most tape recording equipment. Next, not relying on eyeball tests as others do, we test for drunken slitting or fluted edges by actually running the tape with a recorded short wavelength signal through a tape recorder. This “drunkometer” test helps us spot any tape that’s had even one beer. The slightest whiff, and out it goes. Lastly, Kodak Sound Tapes have to go under the microscope where we watch for rough or dirty edges. When you buy Kodak Tapes, you know they’re clean.

Best base better? Strength and toughness sound like they mean the same thing... but they don’t quite when it comes to a tape base. Take a piece of spaghetti. It’s stronger when it’s dry... but tougher when it’s wet—harder to break, that is, and not just because it’s slippery. Designing a tape base, you’re always up against the problem of making it strong so it doesn’t stretch... and tough so it doesn’t break. Today’s DUROL base, the best there is, is now more resistant to shock abuse and carelessness. It’s even tougher than before while it still retains the strength that made it famous.

Kodak tapes—on Durol and Polyester bases—are available at most electronic, camera, and department stores. To get the most out of your tape system, send for free, 24-page “Plain Talk” booklet which covers the major aspects of tape performance. Write: Department B, Eastman Kodak Company, Rochester, N. Y. 14650.

EASTMAN KODAK COMPANY Rochester, N. Y.

Electronics Illustrated
A memorable El Special Report proving that in Washington you always color the tape red and the tax money gone.

IT ALL started in the early summer. There was unexpected music from the sky and unaccountable voices were heard on radio. “This is the Voice of the Blue Eagle relaying the Blue Eagle Radio Network,” said the mystery station. Then came jazz music it called the Blue Eagle Blues.

The strange transmissions were interfering with commercial broadcast stations. Scores of people who heard the signals wondered about them, a few were worried and some even were alarmed. Were these the voices of an unseen enemy? Of a foreign power plotting against the country? Of the saucer people from outer space?

Though the Blue Eagle’s voices and music were heard in many communities
they seemed to center on Baltimore, a location that would appear grimly suitable since, more than a century before, it had seen part of the life and the macabre death of master haunter Edgar Allan Poe. And, just three decades back, the phantom invaders from Mars had been landed not far away by Orson Wells. It was spook territory, all right.

What does an aroused citizen do when he’s being haunted by a radio spook that has no rational explanation? In the case of at least one Baltimorean, a young DX radio enthusiast, you write to the Federal Communications Commission. Are they not the police of the airwaves, the masters of the ether? Who is the Blue Eagle, this chap asked the FCC, and what’s going on?

Back came the answer on official FCC stationery: “The station which you intercepted was unlicensed. Engineers from field offices of our Field Engineering Bureau located the station and while not actually observing the station in operation, contacted the suspected operator and warned him of the possible results and penalties of such unlicensed operation.”

It was a straight enough answer and seemingly explained away the mystery. An unlicensed operator. Probably somebody getting his kicks out of knowing people were hearing his voice. Certainly not an unheard-of event. So the embarrassing episode was buried.

Only it wouldn’t stay buried. Within days after the letter arrived in Baltimore the Blue Eagle was on the air again, sounding just as mysterious as ever and causing just as much interference.

And, in view of later developments, the content of the letter was odd, indeed. It was not until late last fall that anyone was able to piece together even a major part of the Blue Eagle story, though the episode had begun in June. The whole story still is not known and no official account of what really happened ever has been released. The nearest thing to an official explanation is a second FCC letter, written two months later in response to a query about the Blue Eagle from a Canadian: “Regarding ‘The Voice of the Blue Eagle,’ what has been observed [heard by you] was U.S. Government intermittent testing of broadcasting operations and related facilities for world-wide use. Because it is a Government operation, it is not licensed by the Commission and the identification ‘The Voice of the Blue Eagle’ is used in lieu of a call sign.”

A comparison of the two letters might make one wonder whether the FCC really did know what was going on. Especially in view of the fact that both were signed by the same member of the FCC staff.

To make things trebly confusing, the Baltimore DXer, after receiving the first letter, called the FCC field engineer in his city and told him what had happened. Reported he: “Though I was engaged in conversation for about ten minutes I didn’t find out much. He told me that the person who first wrote me at the time was not aware that the Blue Eagle was authorized.”

Since when does an engineer in the field have more up-to-date information on a policy matter than a member high on the FCC staff (he was that) at ground-zero in Washington? The answer, it appears, is when eagles turn blue.

As with most mysteries, there was a rational explanation of the Blue Eagle phenomenon.

The story, to be sure, starts in Washington, where good, dedicated public servants sometimes appear to be spending most of their time coloring the tape red. And the eagles blue. The idea evidently originated in the Pentagon—the idea of taking a large aircraft and outfitting it with generators and broadcast, short-wave and television transmitting equipment. The result would be a truly mobile radio-TV station that could become an instant Radio City anywhere in the world. The exact mission would depend on what missions might be available. If the need arose it could be met immediately. A somewhat similar plan had been used successfully by the Voice of America when it equipped

Electronics Illustrated
a Coast Guard cutter, the Courier, with broadcast gear and anchored it in the Agean Sea between Greece and Turkey.

The scheme in time was farmed out to the Navy, which rounded up one of its available Constellations, a four-engine semi-antique with three tails, and set about converting it into a Radio-TV Central with wings. Two broadcast transmitters, two short-wave rigs and a UHF television station went into the fuselage. It was quite a load, as tests proved in short order.

Though the Navy and the others in the Defense Department and other government departments that became involved in the project presumably had no desire to bamboozle the FCC, the possibility probably didn't cause them to lose any sleep. The FCC has charge of radio and television frequencies and of licensing stations to operate on them but, it develops, the agency does not license other government departments under the theory that, as one FCC staffer put it, "we're all working for the same Uncle, anyway." The agency does try to establish frequencies for other government departments and also tries to keep their stations in the slots they're supposed to be in. As a courtesy, or perhaps just in theory, other departments let the FCC know about which frequencies they are using or intend to use. Trouble is, bureaucrats sometimes are jealous of others of a feather and guard their independence zealously.

Once the Navy got its prize project together it had a problem of giving it an identification. A licensed station would have a call sign. But this one wouldn't be licensed. It had to have a name. To some unknown and unheralded worker came the idea of calling it the Blue Eagle, presumably because there is a bird of that description in the Navy's seal. One could assume it had nothing to do with the only other famous blue eagle, the one flown by the National Recovery Act of the Depression.

Now the fun began. Testing was required and, since the various stations would be transmitting on the wing, that was where the tests would have to be conducted. Up went the Blue Eagle. And up and down the East Coast it flew, transmitting all the while. The programs may have been put together before the plane took off but, from the way things went, it seems doubtful—more like material improvised high in the sky. Crewmen evidently took turns making like disc jockeys. There was jazz, popular songs, country and western ditties, even relays of the British Broadcasting Corporation and the programs of two nearby commercial radio stations, WLDB and WMID, in Atlantic City, N.J. Signals from the latter apparently were picked up off the air and simply retransmitted.

The Blue Eagle first was heard at 19.1 mc, usually fixed-station territory. The signals were of fair strength in the Washington-Baltimore area, though they tended to fade from time to time and the so-called programs had a maddening way of disappearing right in the middle of a musical selection. The 19-mc signals were a puzzle to short-wave listeners but caused no trouble. The trouble started when the Blue Eagle began squawking in a new place in the spectrum. This second signal came on at 532 kc, just 3 kc below the bottom edge of the broadcast band, and it was what made the Blue Eagle into an outlaw station because it caused interference with commercial stations, mainly those in Baltimore. (The role of Baltimore in the flights of the Blue Eagle apparently was just that of innocent bystander; the Connie, based in the Washington area, simply happened to fly toward Maryland.)

It was after these instances of interference (due to harmonics) that the FCC was queried and, having been told little, could explain little. The exact meaning of that account wherein FCC field engineers located the station, contacted the suspected operator and warned [Continued on page 117]
Astronauts who rocket their way into the heavens leave most of us fascinated by all those esoteric measurements that get back to darkest Texas from outer space. Just how do they know all those things (including intestinal reactions to space lunches)? Answer is to be found in this slim and interesting volume on telemetry—the science of getting a measurement here of something going on out there.

As it happens, the subject is one that hasn't been discussed a great deal in print, and the introduction here is a good one. True, it doesn't explore and detail all of today's immensely complex applications of telemetry. But it does provide a good basic familiarity with both hardware and theory, including uses of time-division multiplexing. Anyone who wants to keep up with today's—and tomorrow's—communications can read it profitably.

Physicists can be fun. By Wilhelm H. Westphal. Hawthorn Books, New York. 207 pages. $3.95

Let's begin with the premise that none of us needs this book. We understand all about energy and inertia, don't we? And friction, sound, buoyancy, heat, time—all those things? Point is, each and every one of us knows someone who didn't, or never will, make it through high-school physics with much success. This book is for just such a soul, for it really delivers on the promise in its title.

In sprightly style, it tells you why all kinds of things happen: why a raw egg doesn't spin as easily as a hard-boiled one, why soup cools when you blow on it, why that perpetual-motion machine you've been concocting won't work too well. Only thing it doesn't explain is why people have trouble with physics courses. Answer, presumably, is that most physics texts aren't written nearly as well, let alone as entertainingly, as this volume. Give this book to someone deserving—even if that someone is you.

Scr Experimenter's Manual. Radio Corporation of America, Harrison, N.J. 80 pages. $0.95

Organized around RCA's KD2105 experimenter's kit, this little book offers a baker's-dozen-plus-one of easy-to-build SCR projects that many will enjoy building. The projects include timers, battery chargers, light-operated switches and a speed control for model trains and cars. Well put together, this should be a welcome spare-time companion.

By Tim Cartwright

GOOD READING

ABC's of Telemetry, by Alan Andrews, Howard W. Sams & Bobbs-Merrill, New York & Indianapolis. 95 pages. $1.95

Taken from The ABC's of Telemetry discussed above, our illustration shows the necessary gear for a basic telemetry system. Input transducer in drawing A also is referred to as a signal conditioner, sensing device, pickoff and end instrument.
SOUP-UP FOR AC/DCs

By HERB CENAN

ANYONE looking for a good, cheap table radio—one with decent sound quality, reasonable sensitivity and a fair number of operating conveniences—doesn't have to go far. True, you couldn't find such a set on the market for under $30. But hike up to the attic or down to the basement, dig out that old All-American 5 and you've got the makings of a darn good table radio. All it takes is an evening's work and a few bucks' worth of parts.

In its day the AA5 was a major breakthrough in consumer electronics. It used but five tubes and about as many resistors and capacitors as you have fingers. And, thanks to a relatively large cabinet and a 4- or 5-in. speaker, the AA5 delivered pretty good sound.

What's more, it was built to last and last and last. Even that old squawker you've held onto just for spare parts can be rebuilt for like-new performance. Or you can go all-out and add a tone control, instant-on, extra sensitivity for DXing, even extra selectivity to untangle howls and groans when night-time DX rolls in.

A new lease on life for the AA5 starts with capacitors. Years of high ambient temperatures probably have caused the capacitors to leak like washerless faucets so the first job is to replace all paper capacitors. But only paper ones. Ceramic or molded capacitors in the oscillator circuit could foul up the alignment if replaced so leave them alone. Also replace the filter capacitors with new ones having at least the capacitance ratings of the originals. If your radio sports a value not commonly available—such as a dual 70/40 µ—substitute the next highest rating, an 80/40, say.

Since you will be dropping solder blobs in the chassis, this also would be a good time to add instant-on and a tone control. Instant-on idles the heaters at reduced current with the plate voltage off. Within a second or so of turning on the power switch the radio comes on, just like a transistor portable. And don't worry about shortening tube life; it's clicking tubes on and off that burns them out.

To add instant-on, simply connect a silicon rectifier rated at 200 PIV, 500 ma (or higher) across the power switch as shown in Fig.
SOUP-UP FOR AC/DCs

1. Make certain the SR's cathode—the end marked with a + or band—is connected to the line side of the switch. The SR's anode connects to the side of the switch that feeds the heaters and rectifier plate (if the SR is reversed the whole radio stays on).

**Addition** of a tone control—actually a high-cut (low-pass) filter—allows you to get a more balanced tone from the speaker. Further, since you now can reduce your set's high-frequency response, it often makes copying DX stations a little easier. The necessary components appear in color in the circuit in Fig. 2. A .05 μf capacitor usually is adequate for C1, but if you want a little more bass you might try a .1 μf.

Capacitor C2, a .001 μf, 500 V ceramic disc, is needed only if adding the tone control causes a buzz. Whether you get the buzz or not depends on the wiring layout of the radio. First try just C1 and R1 (a 20,000-ohm, linear-taper potentiometer); if the sound is clean forget about C2. Potentiometer R1 is installed on any clear spot on the front apron; if the chassis is too crowded you may find it necessary to use a miniature pot.

So long as you have a wooden cabinet you'll have no trouble cutting the hole for the tone control's shaft. If the cabinet is Bakelite or plastic, use a sharp, high-speed drill.

With all the drilling and soldering completed, vacuum the solder blobs and metal chips from the chassis; then blow the dust off. If the tuning capacitor originally was noisy—if you got Rice Krispies (snaps, crackles and pops) every time you tuned in a station—spray the tuning capacitor's plate with No-Noise, Contact-Kleen or similar product and rock the capacitor back and forth several times. Should the noise persist, repeat the procedure.

The foregoing will result in a good-sound-

![Fig. 1](image1.png)

**Fig. 1**—A single component, a 500 ma, 200 PIV diode (SR1), brings instant-on to any AC/DC radio.

![Fig. 2](image2.png)

**Fig. 2**—Simple tone control consisting of C1 and R1 improves audio quality, helps in DX work.

**Electronics Illustrated**

www.americanradiohistory.com
simple it is to pull off this trick. Just connect a short length of solid, insulated hookup wire to the plate of the IF amplifier and a similar wire to the grid, then twist them together two or three times to form a gimmick.

Turn on the radio (if you've replaced the antenna coil align the receiver first). If you can't hear any signals or if you get squeals cut off a small section of the gimmick. Keep repeating the cut-and-try until the signals suddenly boom in without squeals. A properly trimmed gimmick can turn a jumble of stations into individual, in-the-clear signals. Don't forget to pull the plug before snipping away at the gimmick; high voltage is present. When you have the right length, tape the ends of the insulated wires.

Final step is to install a complete set of new tubes and align the radio. And to do the job right, buy or borrow a signal generator. First, connect one lead of a 150-V AC volt-meter to a ground, such as a cold-water pipe, and the other lead to the chassis. Insert the radio's plug in the outlet and turn the power on. If the meter indicates full line voltage reverse the plug to put the chassis at ground potential.

Next, set the tuning capacitor's plates to full open, connect the signal generator's ground lead to the radio chassis and connect the generator's output lead through a .01 μf capacitor to the mixer's input grid—the grid which connects to the antenna coil. Set the generator to the radio's IF frequency and adjust the generator for minimum output. If you have a VTVM, connect it to the radio's AVC buss (usually across the volume control), set the generator for no-modulation and align for maximum negative voltage. Lacking a VTVM, you can turn the receiver's volume control full on, set the generator for

![Replacing old-style loop antenna with modern ferrite rod permits addition of external long-wire.](image)

**internal modulation** and align for maximum speaker volume. In either instance, be certain the signal generator is at its minimum usable level.

**Alignment** chiefly consists of using an insulated alignment tool to adjust the IF transformers for maximum output. Unless junior has screwed the loose screws tight, even an old radio should require just a slight trimming for peak alignment. On the other hand, addition of the gimmick may have thrown the alignment off considerably.

Now disconnect the generator's output lead and set the generator to 1000 kc for RF alignment. If you have a loop antenna it's a single adjustment. Place the generator's output lead near the loop or clip it over the loop. Set the radio dial to 1000 kc and adjust the oscillator trimmer for maximum output. (The oscillator trimmer is the one for the small set of tuning capacitor plates.) Then adjust the antenna trimmer (the one for the larger plates) for maximum output.

If you are using an adjustable rod antenna, place the generator's output cable near the coil or clip it to the rod. Adjust the oscillator as previously described. Then, pushing the rod's coil with an insulated alignment screwdriver, position the coil for maximum output at 1000 kc. This done, set the dial and generator to 1600 kc and adjust the antenna trimmer for maximum output.

The receiver now should exhibit reasonably linear sensitivity over the entire BC band. For extra sensitivity at some particular frequency, just peak the antenna trimmer for that frequency. Such adjustment may give little effect on loop or fixed rod antennas, but it can increase sensitivity appreciably with an adjustable rod antenna.

![Gimmick causes IF amplifier to be on edge of oscillation, increases selectivity significantly.](image)

Fig. 3—Gimmick causes IF amplifier to be on edge of oscillation, increases selectivity significantly.

**May, 1966**
"He’s a good worker. I’d promote him right now if he had more education in electronics."

NOW! TWO NEW PROGRAMS!
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Electronics Illustrated
Could they be talking about you?

You'll miss a lot of opportunities if you try to get along in the electronics industry without an advanced education. Many doors will be closed to you, and no amount of hard work will open them.

But you can build a rewarding career if you supplement your experience with specialized knowledge of one of the key areas of electronics. As a specialist, you will enjoy security, excellent pay, and the kind of future you want for yourself and your family.

Going back to school isn't easy for a man with a full-time job and family obligations. But CREI Home Study Programs make it possible for you to get the additional education you need without attending classes. You study at home, at your own pace, on your own schedule. You study with the assurance that what you learn can be applied to the job immediately.

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The germanium-vs-silicon argument raging in the transistor world (with Scott and Sherwood plumping for silicon and Harman-Kardon for germanium) reminds me just a bit of the triode-pentode hassle in the days when tubes were king. That olden-day dispute was resolved not by a victory for either protagonist but by the appearance of new circuits (like Dave Hafler's and Herbert Keros' ultra-linear hookup and a whole new breed of superior output tubes (e.g., the EL34, 6550 and KT88). This one well may meet like fate.

From the best information I can get from engineers not emotionally involved in the current set-to, silicon vs germanium is no more pertinent than triode vs pentode. Both types have strengths and weaknesses, each belongs in different applications and neither is a do-all-and-end-all. So let others fend and feud. Simply choose your equipment on what always has been the only reasonable grounds —on the basis of what sounds and stands up best.

The noise from the silicon-germanium hassle may have obscured the important arrival in audio of the field-effect transistor. As you may be aware, the FET sports an almost perfect square-law characteristic, which is another way of saying it makes a good tuned RF amplifier.

With previous RF transistors, designers had to back off a bit from theoretically maximum sensitivity to prevent overload and cross-modulation. But with the FET it's possible to achieve both maximum sensitivity and selectivity—assuming only that the circuits men have the time, patience and brainpower to figure out how to use it properly. (I tack on this last because the field-effect device, though around for a while now, is just beginning to appear in tuner circuits. Scott is using it in a couple of its receivers, KLH in a tuner and receiver as well as complete music systems.)

The so-called modular music system (a space-age term for what once was known as a component setup) continues to gain in popularity. Benjamin and Harman-Kardon have joined Fisher, KLH and Scott in the modular field and now we have a new wrinkle—the modular system built around tape and only tape with no provision for record-playing.

Ampex offers several tape-only combinations (one of which, the 865/815 combo, is shown in our photo). And Wollensak (3M) is marketing the 5300 combination, with others in the offing. It will be interesting to watch their progress since the new reel-to-reel entries at this point look more promising commercially than the home cartridge machines. Prices on the new tape modulars, incidentally, range from roughly $280 to $440.

It's still a bit early for predictions but it looks as though the FCC's recent edict that [Continued on page 120]
SPECIAL CB SECTION

El again presents what has proven to be one of its most popular bonus features—a Special Section on Citizens Band Radio. For added convenience, an index to our Special CB Section appears below.

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Antenna Control Center page 62

THREE years of club-house controversy are over. Washington lawyers have put away their briefs. And a million CB signals never again will hop, skip and jump with the old abandon. The end came on April 26, 1965—the day when tough, toothy new CB regulations became the law of the land. Where 23 channels existed, there now are seven or 16, depending on whom you talk to. Silent periods are 5, not 2 minutes. Further, there now are crystal-clear definitions of what you can and cannot do on the band.

Have the new rules killed the mass of heterodynes heard nightly in the Bronx? Or grounded the skip specialists in the South, perhaps cut down some California kilowatts? In talking to FCC officials, club presidents, equipment makers and CB operators we got answers on both sides of the line. Some argue there's not one whit of difference on the band. Others speak of swift, sudden changes. Who's right? In something so vast and seething as Citizens Band Radio, both observations are proving correct.

As this is written, a live CB transceiver sits nearby. The antenna, high on a hill, picks up signals from dozens of towns within a 30-mi. radius. As we search the 23 channels we encounter CB at its best—and worst. The worst usually is during evening hours. An example is what just came in on channel 15.
By uttering less than a dozen words, one operator has just violated at least six regulations. He said simply, "This is Captain Kidd in Halifax, N.S.; can anyone hear me?" There are plenty of takers, plus one youngster who follows the Captain's lead, goes to another channel and solicits calls under the name Big Red from Sydney, N.S.

Away from the band's mid-section, even during nighttime activity, we note plenty of room for any station wishing to communicate with its own units. But not all are within the limits set down by the rules, including the following exchange between a Unit 1 and a Unit 2.

**Male voice:** "I thought I'd talk to you while I did the dishes."

**Female voice:** "Come on over and do mine when you're through."

A substantive message? You decide. In any case they're on a proper channel using proper identification.

During the day (in this area, anyway) CB shines with virtue. It buzzes with people going about their business, all the while enjoying solid benefits of two-way radio. We can hear a gas station dispatching a repair vehicle to a stranded customer, a delivery truck reporting to its office, a TV serviceman being directed to his next call by his wife. No conflict, plenty of channel space, no rule-twisting.

Another tack is to look at CB license applications and what happened to them when the new rules took hold. Our chart (see last page of this article) shows a sharp fall in license activity during that critical period. But to get an interpretation of what the drop means we asked the FCC's William Grenfell, who heads CB from Washington, what he thinks.

"Applications are averaging a little lower than a year ago," he said, "but I think it would be speculation to conclude that the new rules have caused the change."

Others suspect that the curve downward was affected strongly by a seasonal, year-to-year fluctuation. Thus CB has held up nicely under fire—much as it did back in March 1964 when struck by an $8 license fee.

But as U.S. citizens merrily continued to plunk down cash for licenses, CB manufacturers braced for trouble. Not only did they face a predicted dip in sales, they also were on the verge of the economic doldrum that occurs every summer. Four of CB's leading manufacturers relate a near-identical story of what happened.

"In June and July of last year," reports one, "we think the new rules caused a sizable dip. But now everything's on the upswing. There's no reason to believe the comeback won't continue."

Another remarks, "We noticed an effect from the beginning of May up until September. There was a drop-off in our business but it was coupled to the normal summer slump. We're completely out of it now and, in fact, have added many new dealers."

The two other CB makers echo the pattern: temporary fall-off, then a return to brisk sales.

Sharpest difference of opinion concerns what's happening on the air. One club president roundly denounces the new system for dividing the
band. He thinks it's created what he labels the Horrible 7—meaning channels 9 through 14 plus 23, which are set aside for stations of different call-signs. Ramming stations into a tight space, he argues, raised a screaming mass of heterodynes few can penetrate. Worse yet, since club members operate under different call-signs, they're stuck on the Horrible 7.

That club president eloquently supports his case by relating what happened after a recent mid-air collision that caused a commercial airliner to crash-land in the club's area. To contact rescue officials and offer his four-wheel-drive vehicle he had to transmit on normally-forbidden channel 2.

One report from Florida tells of a CB operator working, in rapid succession, stations in Texas, New York and Illinois. Skip talk, of course, was illegal even under old regulations. But this character added insult to injury by conducting skywave contacts on channels 15, 17 and 19—numbers not assigned even for inter-station use under the new rules.

Whether such blatant disregard of the law has diminished under tighter rules still is open to speculation. In the months following the rules change, however, there has been no major increase in the number of violation notices issued by the FCC. This suggests that, by and large, there is compliance with the channel-dividing provision.

"It's a lot quieter on the band," reports R. W. Drobish of Hallicrafters in Chicago. Richard Lehman of New York's ECI makes an observation that could hold true for much of the country: "The main thing that's changed is selection of channels"—implying that there's still chit-chat between different stations but that they at least are not interfering with serious operators on the other 16 channels. Up in New England, FCC engineer-in-charge N. A. Hallenstein cautiously notes: "There's been some improvement but not a marked one."

CB Chief Grenfell sums it up: "If you use the number of violations as a barometer, then little difference is reflected. I've had people tell me that 'In my town there has been a lot of changes.' Others say they couldn't notice any change at all." Mr. Grenfell stresses that the number of violations depends on how many man-hours are spent in monitoring. And this activity is not significantly different from what it was in the past. One CB operator makes this dry comment on the subject: "Everyone knows the new rules are in effect. The problem is that there are a lot more CBers than FCC monitors."

Since some band inhabitants believe any new rule is made to be broken they've revived a scheme for defeating the tightened version. It's not a new trick but one that has enjoying increased use in many sections of the country. It goes something like this:

Let's say KXXX wants to get on the air and gas about anything with anybody. He hits the mike and says, "This is KXXX, Unit 1." (Pause.) Anyone out in radioland who hears the come-on and wants to join the fun gets on and says, "This is Unit 2..." To a third party listening, this might sound like a legal exchange between two units of the same call-sign. What's more, they can do it on any of the 23 channels since they're units of what passes for the same station.

Whether lawbreakers now are running greater risks goes back to the
Life With the New Rules

monitoring problem. An important function of the new regulations is to aid FCC men in spotting offenders. And this job is getting easier since most violations tend to occur in two-station contacts (the ones now confined to the seven prescribed channels). But it will take more men and equipment to handle the job. It really boils down to more money.

At one time it was believed that the $8 license fee would supply these funds. Congress, however, shows no sign of letting the FCC have the needed money, which now resides in the U.S. Treasury.

Despite its under-funded condition, the Commission has scored one spectacular victory since the new rules went into effect. It happened in the courts. For the first time an operator was tried, convicted and sentenced to one year in prison on a charge of transmitting obscene, indecent and profane language. This in itself is not news, since there have been similar cases. What is significant is that it was the first time the sentence wasn't suspended immediately in a case of this type. (At this writing the man is out on $5,000 bail, still faces the sentence.)

There's no question but that there's been a frightening impact on many CBers who've heard of the case. They'd almost believe that uttering gol-dang-it on the air well could bring the feds crashing through the door. But there's no reason for this feeling and a closer look shows why. Richard Everett, FCC attorney who worked on the case, supplies the background.

The man was no ordinary CB operator. He left a tattered trail that ultimately led to a five-count indictment. At no time did he hold a license in his own name. He used his wife's call. And her ticket was revoked because of improper operation by both parties. A fine, too, was levied. Then he filed for his own license—following it up with filings by his mother, father and two brothers. The Commission designated all five members of the family for a hearing but no one showed and the applications were dismissed.

One thing that really disturbed FCC men in the Boston area, where this happened, was that the man also duped a lot of otherwise innocent CB operators into violating the law. He twisted the rules and tried to create loopholes.

The case has its share of irony, too. After the offender had been sentenced to jail on the obscenity charge, his lawyer withdrew from the case. The judge had to file the man's appeal. Though this case sent shock waves through CB, it must be emphasized again that this was no average CBer trapped in some minor transgression. The case was long and

[Continued on page 114]
SO long as it's working, a walkie-talkie is an extremely reliable, rugged electronic device. But when it gives up the ghost it becomes a giant migraine headache.

When it comes to servicing walkie-talkies, you'd think a conventional signal generator would be the answer. But a generator has only rough calibration at 27 mc and it's useless for alignment. And a 5-watt rig, more often than not, will overload the walkie-talkie rather than provide a useful test signal.

What you need for alignment is a crystal-controlled signal generator with an adjustable low-power output. You also need an audio signal for testing the modulator and speaker/mike. A remote indicating field-strength meter (FSM) for measuring the walkie-talkie's RF output at a distance also is a must.

The Walkie-Talkie Tester sports all these features. It's a modulated crystal-controlled RF generator whose signal you use to align the walkie-talkie's receiver. It also puts out an audio signal at just the right level so you can check if the walkie-talkie's modulator is working or if its speaker/mike is defective. Finally, it's a sensitive remote-indicating FSM.

Construction. Component values are critical, therefore, make no substitutions. The Tester is built in the main section of a 4 x 5 x 6-in. Minibox. A large cabinet is needed to prevent the whip antenna from tipping over the cabinet.

First, build the modulator/AF oscillator, on a piece of 2 7/16 x 3 3/8 in. (stock size) perforated board, following the pictorial in Fig. 1. Cut off the yellow and green leads on T1's secondary and use only the white and brown. Set the board aside and go on to the oscillator.

Put punch back in your transceiver with this all-in-one service instrument.
Walkie-Talkie Tester

The construction of coil T2, which is wound on a stock form, is critical so take care when winding it. If it isn't a neat job, start over again. First, tensilize a 2-foot length of #22 enameled wire by clamping one end in a vise and pulling the wire until it goes dead slack. If the wire is not tensilized it will unwind after you wind the coil. Scrape about 1/4-in. of insulation from one end and solder it to lug C near the mounting screw.

Run the wire along the form for 1/8 in. and then wind 5 closewound turns. Bring the wire away from the form to make a loop, bring the wire back to the form, twist the loop once at the form and then wind 6 more turns. Solder the wire to Lug A. Scrape away the loop's enamel insulation, twist it tightly and tin it with solder.

In the center of the coil right over the loop, wrap a single turn of #22 wire as shown in the detail sketch in Fig. 1. Twist the loop's leads on the side opposite the form's lugs. The single-turn link should have 6-in.-long leads. Cover the coil with coil dope or radio service cement and set it aside to dry for about 24 hours.

Now build the oscillator on the front of the cabinet. Connect all leads, except the lead from J1, to the modulator board and connect the battery. Install a 2 1/4-in. wide by 4-in. long shield, cut from a section of scrap aluminum.
Fig. 3—Modulator is built on a 2 7/16 x 3 3/4-in. piece of perforated board. Drill holes in corners and mating holes in cabinet bottom for mounting.

num, from the top of the cabinet to the antenna L-bracket. Drill a 1/8-in. hole in the shield, as shown in the pictorial, pass one lead from the single-turn link (D) through the shield and solder it to S1. The remaining link-lead (E) connects to the ground lug on normally-closed jack J1. Make certain that the lead from R3 to J1 is connected to lug that’s lifted when a plug is inserted.

Next, install the FSM section (at the left of the antenna in Figs. 1 and 2). No problems here as L1 is a stock coil; just push its tap out of the way. Complete all wiring, install the collapsible antenna using a grommet in the top of the cabinet. Finally, connect the antenna to S1.

The FSM’s remote indicator is built in the main section of a 2 1/4 x 2 1/4 x 4-in. Minibox as shown in Fig. 6. Any layout will do.

Checkout and Operation. Plug a third-overtone CB transmit crystal into SO1, extend the antenna and set up your 5-watt rig or a walkie-talkie nearby. Either should be tuned to the same channel as the crystal in the Tester. Put a knob on T2’s slug-adjustment screw. Set S1 to osc and from the full counter-clockwise position, adjust T2’s slug until you hear the Tester’s signal on the 5-watter or the walkie-talkie. If necessary a slight adjustment of T2’s slug will rubber (shift) the oscillator’s frequency slightly. This will be indicated by a fall in the 5-watter’s S-meter indication or by distortion of the tone in the walkie-talkie.

The Tester is deliberately designed to shift the crystal frequency as many walkie-talkies are not exactly tuned to the channel frequency. And it is important that the walkie-
Walkie-Talkie Tester

talkies be aligned to each other's operating frequency, regardless of what it is.

Before you attempt to do anything to the walkie-talkie, be sure to get hold of a copy of its schematic. In addition to the schematic, try to obtain a diagram showing the physical location of all parts so you can quickly find the RF and IF transformers and coils.

To align a walkie-talkie set-up, place the Tester across the room from the walkie-talkie. Then extend both the walkie-talkie's and Tester's antennas. Adjust T2's slug if necessary, to get the oscillator working. Then adjust T2's slug again for maximum 5-meter indication on the 5-watt or for undistorted tone on the walkie-talkie. Collapse the Tester's antenna until the signal received by the walkie-talkie being aligned is just audible.

Now, align the walkie-talkie receiver's RF and IF transformer for maximum audio output. Keep the Tester's signal at the lowest readable level by collapsing the antenna or moving the Tester farther away to prevent the walkie-talkie's AVC from masking the alignment adjustments.

If the walkie-talkie just produces an unmodulated carrier, disconnect its speaker and connect it to J1. If the speaker is okay you'll hear a weak but clean tone. If the speaker checks out, connect the leads that went to walkie-talkie's speaker to J1. If the walkie-talkie's modulator is defective there will be no modulation of the carrier (as received on another walkie-talkie or the 5-watt).

You can then signal-trace as you'll have a steady tone feeding into the walkie-talkie. If you can drive the tone through the modulator—even if it sounds distorted—the defect is probably in the speaker or switching leads.

The remote FSM is used to tune up the walkie-talkie's transmitter. Extend the Tester's antenna all the way, set S1 to fsm and plug the remote indicating meter into J3 using shielded cable. Set R7 to about mid-position and activate either an operating 5-watt transceiver or a walkie-talkie. Using a plastic alignment tool, adjust L1 for maximum meter indication. Use R7 to keep the pointer on-scale.

To peak the walkie-talkie's transmitter, place the Tester as far as possible from the walkie-talkie. Stand the walkie-talkie upright—away from metal objects—and peak-up the transmitter for highest meter indication.

After the transmitter is peaked, check to make sure it starts by pressing the push-to-talk button. The FSM should indicate as soon as you press the button. If it doesn't, slightly detune the oscillator, tuning first on one side and then the other until the oscillator starts each time the button is pressed.

Fig. 6—FSM remote is built in a 2 1/4 x 2 1/4 x 5-in. Minibox. Parts placement is not critical. Connect it to Tester with RG174/U coax cable.

PARTS LIST

ANT.—12 section, collapsible antenna (Lafayette 99 R 3008 or equiv.)
B1—6 V battery (Eveready 724 or equiv.)
C1, C3, C9—.001 µf, 500 V ceramic disc capacitor
C2—25 µµf, 500 V ceramic disc capacitor
C4—30 µµf, 15 V electrolytic capacitor
C5, C7—25 µf, 75 V ceramic capacitor
C6—1 µf, 75 V ceramic capacitor
C8—62 µµf, 500 V silver mica capacitor
D1—1N34A diode
J1—Single closed circuit phone jack (Switchcraft 12A or equiv.)
J2, J3—Phono jack
L1—CB transceiver oscillator coil (1,650 kc IF) Lafayette 32 R 9099
M1—.050 µµf DC microammeter
Q1—2N274 transistor
Q2—2N217 transistor
Resistors: 1/2 watt, 10% unless otherwise indicated
R1—33,000 ohms
R2—22,000 ohms
R3—2,700 ohms
R4—82 ohms
R5—270,000 ohms
R6—10,000 ohms
R7—1,000 ohm, linear taper potentiometer
S1—Miniature DPDT toggle switch
SO1—HC6/U crystal socket
T1—CB modulation and audio output transformer; primary: 500 ohms, center tapped. Secondaries: 8 ohms and 3,000 ohms. Lafayette 99 R 6132
T2—Oscillator coil wound on a J. W. Miller No. 42A999GC1 coil form (Lafayette 34 R 8948).
See text.
XTAL—Third overtone CB transmit crystal
Misc.—4 x 5 x 6-in. and 2 1/4 x 2 1/4 x 5-in. Miniboxes, perforated phenolic board, flex clips, battery holder, terminal strip, shielded cable

Electronics Illustrated
What's really new in CB EQUIPMENT?

By DAVID WALKER

THIS IS the year of the triple-S CB rig—small, silicon and Samaritan. Small because the change-over from comparatively big tubes to tiny solid-state devices is in full swing. Silicon because this is the transistor that's unseating the older, weaker germanium type. Samaritan because much CB equipment now is designed with an eye on the H.E.L.P. program which, if hopes get over the hurdles, may manage to put CB in a large percentage of the nation's 70 million cars.

As for front panels, you can forget about that old Oh Boy, a Remco Toy! jazz. Now you'll declare: The Truth to Tell, It Apes Bell Tel. Reason is that a new seriousness pervades CB gear as manufacturers size up markets that well may set today's near-million CBers to playing second fiddle. Makers, in fact, envision CB spilling into the business world with all the din of a Niagara while capturing the general public's fancy in a manner few foresaw. And therein lies the explanation of why an increasing number of rigs sport such banners as: Fits anywhere! Under $100! More reliable! Simpler controls!

Gone is the glitter many one-time special features once held. PA function, combination S- and output meter and speech compressor now are old hat simply because they've become standard equipment on so many sets. Even the 23-channel rig, which some said would fall before the new FCC rulings, now is available in a surprising number of new models. But not all CB features thrust forward with equal alacrity. Single sideband and selective call currently generate about as much excitement as a waltz in a discotheque.

What's happening behind the self-assured, low-profile 1966 models? For one, solid-state puts backbone in the claim that new sets are more reliable. At least one manufacturer, Kaar, recently extended its guarantee to two years on some models. And unless you pull some devil-may-care stunt in the manner of one CBer we know, much of the maintenance headache does disappear. (That CBer hit his mike button with no antenna connected and popped the final RF transistor.)

Though transistors star in the new sets, they by no means are
What's really new in CB EQUIPMENT?

ubiquitous. Some manufacturers elect to go the route of the hybrid—semiconductors in some circuits, tubes in others. The Browning Raven, for example, relies on a two-Nuvistor front-end to receive the weak signals. Nuvistor developer RCA, on the other hand, proclaims all-silicon transistors in its new Mark 10.

Another CB maker applauds solid-state but says it is no easy feat to handle the heat-dissipation problem. Fact is, CBers will have to keep this firm's rigs out of the hot-air blast from a car's heater in winter, just as they will have to let things cool a bit before firing up if the car has been standing in summer sun. But these precautions seem a pittance to pay for units that draw about the power of a pilot lamp while receiving, not much more when transmitting.

Some trends in new CB gear indicate greater operating conveniences, others reflect new attempts at improving circuits. More manufacturers (USL, Sonar) now provide front-panel sockets for quick change of receive crystals. Several producers (International Crystal, Tram and Demco) offer control heads—small separate units which mount under the dash while the main circuits hide in the trunk. Significantly, the Tram XL-100 rig includes two novel features to keep it tamper- and theft-proof. There's a key-operated switch (like a car ignition) for turning on the power and a special mounting bracket to padlock the whole thing to the dash.

In another business-like lineup of new CB equipment, two transceivers can be called unusual: the Lafayette HB-600 and the Squires-Sanders Thor Eleven. Either or both could be the bridge between CB, the related business band and H.E.L.P.

The Lafayette unit takes a bold step in the direction of a dual-purpose rig that includes virtually all CB features and provision for operation on the adjacent business band. Full 23-channel CB coverage is built in, with extra crystal positions for two business-band frequencies.

Known as the CB Commander, the Lafayette set also has attracted considerable attention for its technical sophistication. It incorporates one of the most elaborate noise-silencer circuits found in any CB transceiver today. Rave notices captured by this circuit can be explained on the grounds that it utilizes a receiver-within-a-receiver rather than the conventional one- or two-stage limiter. As detailed in Fig. 1, that second receiver is devoted solely to processing and squelching noise.

The Squires-Sanders Thor Eleven is a 30

Fig. 1—Lafayette HB-600 tosses out conventional one- or two-stage limiter in favor of noise silencer that is a receiver-within-a-receiver. When noisy CB signal enters regular receiver, noise receiver picks up identical noise (but less CB signal) on nearby frequency. Noise is amplified separately, then converted to DC pulses which, fed into regular receiver, tend to cancel out any similar noise on signal frequency.
A watt transceiver now in a hang-fire state. Awaiting the outcome of a H.E.L.P. proposal to increase power on two 27-mc frequencies, the rig will be pegged in the under-$500 class. It's intended for those services that best would aid the CB-equipped motorist, be they emergency vehicles, ambulances or what have you.

In another Squires-Sanders rig there's evidence of what's happening to conventional CB transceivers that anticipate the H.E.L.P. program. The SS 23'er has a color-coded dial marked for quick identification of channel 9 (the present, unofficial H.E.L.P. channel).

And Raytheon, one of the earliest outfits to hop on the H.E.L.P. bandwagon, now markets the TWR-7. This tiny all-transistor set, according to the maker, is as easy to use as a telephone and can operate on a nearly-dead car battery. Raytheon is counting on distribution through Ford dealers to reach the motoring public. Price of the TWR-7 is $129.95.

Other manufacturers also are scaling down prices and simplifying equipment to gain access to wider markets. Pearce-Simpson has announced its six-channel, all-transistor Sentry for $99.90. Multi-Elmac's Citi-Fone, an eight-channel unit, goes for $99.95. And Hallmark Instruments takes a new and different swipe at H.E.L.P. by offering the Banner 85, an eight-channel job that also contains an AM broadcast-band receiver, for $99.50.

One technical tidbit which just may catch
What's really new in CB EQUIPMENT?

on is a simple speech-compressor circuit in USL equipment. It relies on a photocell and lamp in a feedback system that automatically keeps audio modulation high (see Fig. 2). Still more important is the advent of low-price mechanical filters, which promise to set the pace in receiver selectivity.

If kit-building is your dish, there's good news. Prices have been reduced on simple, stripped-down models by Heath and Allied Radio. The Heath GW-12A, a one-channel job with superhet receiver and push-to-talk mike, now is a low $34.95. (Heath also gives a 5 per cent discount if you order two or more 5-watt transceivers.) Allied's low-cost Knight-Kit is the C-540, which contains AC power supply and superhet receiver. Price is $44.95; $5 more brings you a mobile power supply.

At the higher end of these lines are new sets by both kit makers. Important news from Heath is the GW-14, which meshes with the trend toward extremely compact, solid-state, all-channel operation. Construction centers on a single circuit board to reduce chances of error. Crystals for one specified channel are included in the kit price of $89.95; a crystal package for 23-channel coverage (46 crystals) is an additional $79.95.

The new big rig from Allied is the Safari I, a mostly-tube set that includes all channels at $129.95. Construction of the complex frequency-synthesizer section, which makes possible all-channel operation, is simplified by a preassembled and factory-aligned module.

EICO, long a leading kit producer, currently is readying two new transceivers which mark that company's transition into the field of solid-state CB. Though final specs are not available at this writing, one is an all-transistor 23-channel set that features frequency synthesis and a crystal filter. Price reportedly will be under $200. A companion model, less expensive, will have 12-channel capability with plug-in crystals. Tentative tab is on the shy side of $150.

Unlike other recent models in the EICO CB line (Sentinels 23 and 12), these new units will be offered in both kit and wired form. Preassembled and factory-tuned sections, especially in the critical frequency-synthesis section, lead EICO to feel it has licked one of the big problems in any kit-built model.

While manufacturers slick up their wares with semiconductors, the antenna people are having a ticklish time advancing the state of their art. Progress comes with grudging slowness in an area boxed in by height restrictions and limits imposed by textbook theory. Yet these boys won't be caught napping in an effort to feed CB's appetite for more power.

One entry by Antenna Specialists is the Scanner, an electronically rotated beam. Three fixed vertical elements are combined in various ways by remote relays to shift the pattern to the desired direction. A somewhat different non-rotating affair is the Hy-Gain Co-Phaser, which electrically combines two identical base-station antennas for added gain in several switch-selected directions.

[Continued on page 113]
BUY a transistor portable and it likely is Japanese. Put up a TV antenna and it well may be a Yagi. Fool with tunnel diodes and you can thank Esaki. And even CB antennas now sport an oriental touch. Produced by Hy-Gain, the so-called Duo-Beams were developed by Charles Liu who heads the company’s 35-man staff of engineers. Liu was born in China, lived in Formosa and now contrives new antennas in Nebraska.

Duo-Beams are the high-and-mighty antennas of the CB field. Twin beams, stacked side by side, supply the most signal gain you now can get and still crawl under the legal height restriction. But a talk with Liu reveals that Duo-Beams really sprang from a long-time problem that’s been a bogle to many a beam designer. Though it is called mast lighting, it has nothing to do with light. It is caused by part of the beam’s signal hitting the supporting mast in light-like fashion.

The evil of mast lighting is shown in our sketch. In a traditional beam radio energy spills off the elements and hits the mast below. Now the mast becomes an element—it has been illuminated—so it fires back a signal. Gone is the sophisticated symmetry that engineers slide-ruled into the design. Instead of firing a lobe of signal straightaway, the beam flicks out the signal in less than optimum fashion. Trouble stems from wandering watts.

Symmetry of dual-beam antenna accounts for removal of mast as radiating element. Traditional beam (at left) radiates from elements and mast. But pairing of elements in dual-beam is said electrically to prevent watts from wandering onto mast.

But look at the two-beam arrangement. Sure, soup from two separate antennas strikes the mast. But since the effect is equal on both beams, you can forget about it.

Hy-Gain president Andy Andros proudly says: “We’ve achieved phase zero. The beams don’t ‘see’ the mast anymore.” Still another bonus is the fact that this balancing act makes the intruding coax line disappear... electrically, that is.

Six-Buck Blooper... Tacked on the back of every solid-state rig should be this bit of doggerel:

If in caution you desist, Sir,
You'll pop your last transis-tor.

For though the semiconductor continues to come on with much hoopla, not nearly enough has been said about some important precautions. Transistors simply can’t take the kind of abuse you can heap on tubes. Fact is, you must follow the book to grab the benefits of solid state. Take the matter of output load.

CB sets—tube or transistor—are designed to work into a 50-ohm load, presented by line and antenna. But let’s say no antenna is connected. Hit the mike button and you sock the final RF transistor with a whopping voltage that like as not will cause breakdown of the semiconductor material. Big, wide-spaced elements in a tube try to laugh off such shocks but delicate semiconductor junctions wither.

[Continued on page 114]
El Reports on

Heathkit GW-12A

Bearing a price of only $34.50, the Heathkit GW-12A presently is the lowest-cost 5-watt CB transceiver on the market. Its lack of frills and one-channel design make it the ideal H.E.L.P. (Highway Emergency Locating Plan) transceiver. Both transmitter and receiver are crystal-controlled (the receiver is not tunable) and the two crystals (supplied) are inside the cabinet. Only a volume and squelch control are on the front panel.

The GW-12A is designed for 117-VAC operation only. The $39.95 Model GW-12D operates on 6 or 12 VDC and 117 VAC. Its DC power supply rides piggy-back on the rear chassis apron as shown in our photo on the next page.

The Circuit

The GW-12A's seven-tube circuit is stripped to the bone. The superhet receiver has one 455-kc IF amplifier and no RF amp. The signal from the antenna is coupled directly to the mixer. The receiver includes an always-on noise limiter and an adjustable squelch. Transmit/receive switching is done electronically; that is, there is no relay.

The RF output is link, rather than pi-net, coupled to the antenna and is designed to work into a 50- to 70-ohm antenna system.
The design of the kit is in keeping with the GW-12A’s basic approach to CB—simple and straightforward. Though the rig’s overall size is small by contemporary equipment standards—53/8 x 83/8 x 61/2 in.—the components are well spaced. A beginner will not have difficulty assembling the kit.

**Construction & Alignment**

Similarly, the construction manual has been prepared for the beginner. There were more and simpler pictorials than are usually found in a Heath manual for a kit this size. We assembled the kit in about 6 hours.

The IF and RF transformers and coils are not supplied pre-aligned. However, we found alignment presented no problems and could be done without instruments. The coils were close enough to correct settings to enable us to receive a signal from a nearby transceiver. Using the signal from another rig, we aligned the receiver for maximum AVC voltage. If you don’t have or can’t get a VTVM, you can tune in a weak station and simply align for maximum volume. Since the receiver is crystal-controlled you just peak the front-end for maximum volume.

To align the transmitter you tune up the oscillator and final RF amplifier for maximum brilliance of a supplied dummy-load lamp.

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**How It Worked**

In spite of the stripped circuit and low price, we considered the GW-12A’s performance quite good. Measured sensitivity was a shade less than 1 microvolt for a 10db signal-plus-noise ratio (1 µv for 10db S+N to N, wherein the sensitivity rating of 1 µv indicates the amount of signal required at the antenna terminals to produce an output 10db above the internal noise when added to the internal noise level itself). Adjacent-channel rejection was 20db—just about adequate to prevent interference from a moderate-strength signal on an adjacent channel.

The transmitter final’s 3.94-watt input power produced a 1.4-watt output into a 50-ohm dummy load. Modulation was capable of reaching 100 per cent at an average voice level and was clean but hollow.

The GW-12A is rugged and will stand up well in mobile service. Both the chassis and the cabinet are made of extra-heavy steel. A mobile bracket is not available since the cabinet is meant to be attached permanently to an auto’s underdash. Because of this method of mounting, the GW-12A cannot be moved easily from car to base station.

To sum it up, the GW-12A delivers quite good performance for the price. If you’re looking for a rock-bottom-price transceiver capable of just getting the message through under modest- or no-QRM conditions, the GW-12A will fill the bill perfectly.

Similarly, if you like easy-to-operate equipment you’d want the GW-12A. What could be easier to operate than just a volume control, a squelch control and a push-to-talk switch?
The Knight-Kit C-540 transceiver is a compromise design. That is, it combines the ease-of-operation and price advantages of a single-channel transceiver with the multi-channel flexibility of more expensive rigs. Although it has a single-channel transmitter, the crystal socket is mounted on the front panel. This permits you to change the transmitting frequency conveniently by plugging in another crystal.

The receiver is tunable over all 23 channels. There is no provision for crystal-controlled receive. Two useful features on the C-540 are a noise-limiter on-off switch and a tuning-dial pilot lamp.

The $44.95 Standard model is for base use (that is, it is equipped with a 117-VAC power supply only). The Universal model, available for $49.95, has all the operating flexibility of more de luxe transceivers. The Universal model power supply works on 117 VAC and 12 VDC.

Power-supply switching is taken care of by the input-power cable. Connect the AC cable and the power supply connections are set up for 117 VAC. When the DC cable is used, the internal vibrator is connected.

Like most other basic transceivers the C-540's circuit has no frills. The receiver section has one stage of 455-kc IF amplification. The antenna is coupled directly to the mixer since there is no RF amplifier. The squelch is adjustable and as we said, the noise limiter has an on-off switch. Transmit/receive switching is electronic (no relays).

The transmitter output is link (rather than pi-net) coupled to the antenna and is designed to feed into a 50-ohm impedance.

**Putting It Together**

Typical of Knight-Kits intended for the beginner, there are loads of pictorials so that each one covers just a few construction steps. All resistors are supplied on a marked card and color-coded lengths of hookup wire are precut to size.

While the assembly, even for someone who has not built a kit before, should present no problems, there is one thing to watch out for. The chassis we received had edges like a razor blade. Therefore, before you start assembly smooth all chassis edges carefully with a file.

Another problem involved the panel-support brackets, which are welded to the cover. One of our brackets was broken off and was packed with the power transformer. Also, one shield-base tube socket was missing.

Though the IF transformers are supplied prealigned, the RF and oscillator coils must be aligned. Generally speaking, the front-end could be aligned by tuning in a CB station or by using a 5-watt transceiver or walkie-talkie to provide the test signal.

Naturally, if the test signal is a received station alignment can be quite a problem since the stations go on and off the air. The preferred procedure is to provide your own test signals with another transceiver, or better yet, a pair of walkie-talkies—one operating on channel 1 and another on 23.

The procedure without instruments is to tune in a station on channel 1, with the dial set to channel 1, and adjust the oscillator coil slug for maximum signal strength. Then the dial is moved to channel 23 and a trimmer on the main tuning capacitor is adjusted until the high-end signal is received at the correct dial marking. Since the coil slug and capacitor interact to a considerable degree, it takes many tries before the dial finally is calibrated.

Unlike crystal-controlled transceiver kits, which do not require critical receiver oscillator alignment, the C-540's receiver oscillator must be precision aligned. We found the receiver oscillator adjustment to be critical. So much so, in fact, that even when we used a stable signal generator for dial calibration it was difficult to maintain calibration. The slightest vibration and the dial calibration is off. Just lifting the transceiver slightly and dropping it on a table is enough to detune the receive oscillator.
We would assume, due to the detuning caused by mild shock and vibration, that a few bounces in mobile service could shift the tuning out of the band. We would suggest that after you have completed the receiver oscillator alignment you seal the slug with a drop of wax—such as is done in transistor radios.

The IF prealignment was almost perfect and an instrument alignment made no significant improvement in the receiver’s performance.

The transmitter alignment required adjusting only the RF power amplifier final’s tank coil. The transmitter oscillator coil is pre-aligned at the factory and is wax-sealed. You must not touch it. The RF output coil is peaked by tuning for maximum brilliance of a supplied dummy load lamp. Construction and alignment took us about 12 hours.

**How It Worked**

Considering its low price, the C-540’s performance is quite good. The mid-band sensitivity is under 2 microvolts for a 10db signal-plus-noise to noise ratio. Adjacent channel rejection was 20db—just about adequate to avoid interference from all but strong signals on adjacent channels.

The transmitter delivers 2.3 watts into a 50-ohm load. But this is with an input power of 6.2 watts. Needless to say, this exceeds the legal input limit of 5 watts. To stay within the rules you should reduce the input power to 5 watts. Since the transmitter’s RF final is a pi-net, rather than pi-net, coupled to the antenna, the input power cannot be reduced by adjusting the loading. You either will have to increase the value of the final’s screen-dropping resistor to lower the screen voltage or reduce the B+ voltage to the final RF amplifier.

The modulation, which reached 100 per cent at average voice levels, was notably clean and crisp—as good as that found in the most expensive transceiver.

While the cabinet can be screwed to an auto’s underdash for mobile mounting, a separate quick-release mobile bracket is available for $4.95. The bracket screws to the dash and the transceiver is slipped in and out of it. Notwithstanding the receiver oscillator coil adjustment, which may prove too critical for mobile service unless the slug is sealed with wax, the C-540 has the most convenient mobile mounting of the budget-price transceivers.

We also should point out that the C-540 is available in package deals in which a saving can be realized if two transceivers are purchased with antennas. One package, which costs $123.95, includes a base transceiver with a ground-plane base antenna, a mobile/base transceiver, a mobile whip antenna, a mobile mounting bracket, coax cable, a book on CB and two transmit crystals.

Taking price into account, the C-540 delivers better than average performance. The transmitter portion of the circuit is comparable to that found in transceivers priced much higher. And while its overall performance really is in the basic or single-channel class, channel hoppers will find the variable tuning and quick transmit-crystal changing a decided asset.
THE Lafayette Comstat 9 transceiver kit was not in production at press time; therefore, our tests were made on a pre-production wired model that will be essentially the same as production models.

The Comstat 9 is a low-cost kit which compares favorably, in terms of performance and convenience, with transceivers in the $100 to $150 class. Though the $59.95 price may appear low, you should realize that the crystals, vibrator, DC power cable and the mobile mounting bracket are extra.

The receiver section is very much like that of the so-called quality transceivers of a few years back. It includes an RF amplifier, mixer, tunable oscillator, single stage of IF, noise limiter and adjustable squelch. Tunable coverage is of all 23 channels. Nine channels are crystal-controlled. Eight receive crystal sockets are inside the cabinet and the ninth is on the front panel.

We found the receiver sensitivity for a 10db signal-plus-noise to noise ratio to be 1 µv. Adjacent-channel rejection, which we found to be nearly 30db, is obtained by making the IF stage slightly regenerative.

The transmitter has a switch which allows you a choice of either 5-watt or 100-milliwatt input power.

The transmitter, which utilizes a single-tube combined oscillator-doubler and final, uses half-frequency crystals (13.5 mc). The final output circuit is a pi-net with a broad range of adjustment.

When tuned for maximum output into a 50-ohm load, the transmitter delivered 2.4 watts—but the input power was 6.0 watts. Since 6.0 watts is more than the 5-watt legal limit, you must reduce the input power. The pi-net enables you to lower it easily. When we reduced the input power to 5 watts, the output power was 2 watts. Push-to-talk switching is electronic.

There are sockets for 9 transmit crystals. Eight are inside the cabinet and one is on the front panel. The received audio was clean, and modulation easily reached 100 per cent and had good quality.

Attractively styled, the Comstat 9 has a coil-cord ceramic mike and a heavy-steel cabinet. It looks like top-of-the-line equipment. Additional features include a panel-mounted neon modulation indicator and a headphone jack.

The required extras must be taken into account when you consider the Comstat 9's price. For example, to the basic price of $59.95 you must add $2.25 for each crystal. Therefore, the rig plus one set of receive and transmit crystals would cost $64.45. Add a conventional vibrator ($1.89) and a DC power cable ($1.50) and the total cost goes up to $67.84. A solid-state vibrator is available at $5.95. If you want a mobile bracket, tack on another $1.50.

As far as assembling the kit is concerned, we'll have to hazard a guess as we didn't build this one. There are only seven tubes, the chassis is large and the wiring on our model wasn't packed in layers. Therefore, the kit would probably go together as easily as any other comparable kit.

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Rear of Comstat 9. Switch at left of rear chassis apron is used to select 5-watt or 100-mw input power. Crystal sockets are at right of chassis.

Electronics Illustrated
YOU would think batteries were going out of style the way walkie-talkies use them up. Not only do pennies spent on batteries add up to mucho dollars each month but it's a sure bet a battery will do a fast fade just when you need it most.

You know the scene. You're on a picnic or camping or hunting or perched on the roof trying to orient a TV antenna while your wife watches the screen and you're listening either for others in your party or for your wife. Then just as you hear something other than static from the speaker and press the button to answer, the extra current drain is too much for the battery and away it goes to join the big rig in the sky.

But power is available for free—enough to keep the receiver running all day without removing a bit of energy from the battery. This means that when a call is received the battery is ready to put out a strong signal. The free power comes from Old Sol himself—the sun. Just make a minor change in the transceiver's wiring and plug in a solar cell. As long as the sun shines you've got free power to run a walkie-talkie's receiver, or in an emergency, even its transmitter. The only restriction is that the walkie-talkie must be powered by a 9-V battery, such as a Burgess 2U6 or equivalent.

The Hoffman model HSB-9 solar cell we use delivers 9 to 10 volts with sufficient cur-
SUN POWERED CB

rent for small walkie-talkies—about 15 ma. At higher current drains the voltage falls. However, the cell can deliver about 8.5 V with a 20- to 25-ma current drain. This amount of current often is enough to drive a three- or four-transistor walkie-talkie when transmitting.

Installation. All that's required is a slight modification of the receiver's power supply connections, as shown at the bottom of this page. The schematic diagram at the left shows the normal battery connection. The modification is shown at the right. A miniature jack (J1) is connected in series with the battery's positive lead. When the cell is not plugged in battery current flows through the normally closed contacts to the circuit. When the cell is plugged in, the plug opens the connection and the cell's output goes to the transceiver.

Select a part of the transceiver's case which is not jammed with components and mount J1. But remove all the guts, including the speaker, before you do any drilling. To avoid melting the plastic case with the soldering iron, solder the leads to J1 before it's installed. Put the guts back in and solder the battery leads to J1.

The cell has a ball-joint mount. Two mounting cups and epoxy cement needed to glue the cups to the transceiver's case are supplied with the cell. Cement one cup on the back of the case near the top. Cement the other cup on the top of the case. Make certain it is mounted away from the antenna to allow the cell to be turned.

Operation. Snap the cell into the top or rear cup and orient it so it faces the sun. Then plug PL1 into J1. When the power switch is turned on the transceiver will operate as if the battery was being used. To transmit, pull the plug out and press the push-to-talk button.

PARTS LIST

<table>
<thead>
<tr>
<th>Part</th>
<th>Description</th>
<th>Supplier</th>
<th>Price</th>
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<td>Subminiature phone jack, Switchcraft Tini-Jax No. 42A, Allied 44 U 985 or equiv.</td>
<td><a href="http://www.americanradiohistory.com">www.americanradiohistory.com</a></td>
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<tr>
<td>PL1</td>
<td>Subminiature phone plug, Switchcraft Tini-Jax No. 750, Allied 41 U 520 or equiv.</td>
<td><a href="http://www.americanradiohistory.com">www.americanradiohistory.com</a></td>
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<tr>
<td>Solar Cell</td>
<td>Hoffman HSB-9, Olson Electronics BA-114, $7.98 plus postage.</td>
<td><a href="http://www.americanradiohistory.com">www.americanradiohistory.com</a></td>
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The photo at the left shows where we placed the jack and one solar-cell mounting cup on our walkie-talkie. The photo below shows where we mounted another cup for the cell. This extra cup is used to store the cell when it is not in use. The two containers hold the epoxy cement and, like the two plastic cups, they are supplied with the cell.

The schematic above shows the normal connection of the walkie-talkie's battery. The switch usually is on the back of the volume control but it could be elsewhere.

Modification of rig for solar cell operation. Connect cell's positive lead to plug's tip. Be sure to keep polarities straight when connecting battery and lead from switch to the jack.
CB's Biggest BOONDOGGLE

By ALEX KARLIN

THE NATION'S CBers, like most every other variety of electronic hobbyists, have had their share of odd goings-on. But those invisible national clubs, even the operators without bona-fide handles hold less than a birthday-cake candle to certain events of last summertime. Fact is, CB's Biggest Boondoggle makes others of CB's weirdos seem tame as Sunday dinner at grandma's.

It actually is difficult to say exactly where the crazy quilt picked up its first stitches. But a little back-tracking may enable us to unravel the threads individually and thus better comprehend the manner in which the boondoggle grew.

First, we have CBers themselves—a group of sometimes ordinary, sometimes unusual people who have found a rather unique way of turning something little more complex than a telephone into a gigantic hobby. Next, we have the fact that these same CBers (and there are hundreds of thousands of them) are wont to frequent all sorts of gatherings of the clan. And whether called Coffee Breaks, Jamborees, Eye-Ball QSOs or Hootenannies, all seem attractive to CBers as mud-holes to water buffaloes. Travel to these conventions frequently is over great distances and by almost unbelievable modes of CB-equipped vehicles—bicycles, motorcycles, roadsters and aircraft of all vintages. (An ad we noted recently for one of these affairs was promoting The 90th Meridian Citizens Band Radio Club Rally/Fly-in Drive-in Breakfast.)

Also figuring in our boondoggle was a man the Elyria (Ohio) Chronicle-Telegram has described as all of the following: millionaire, engineer, inventor, ordained minister, professional writer, lecturer and psychologist. Sixty years of age, Ray C. Moore of Avon, Ohio, was yet another of the nation's near-million CBers (call-sign, KHI4084). And his was the job of riding herd over a CB jamboree that long will live in the minds of many.

Recipe: into one 200-acre park, place a large helping of plain promotion; then add odd and sundry CBers, slightly agitated. Call it: The Lorain County (Ohio) CB Jamboree And Campout.

Mr. Moore had the will to create a CB jamboree to end them all. (Advance publicity
described the get-together as the Little World’s Fair, The Biggest Show On Earth.) It was to be held July 17 and 18, 1965, a time, according to Moore, “when no other club or organization in the world will hold a jamboree.” (Records indicate that at least seven other CB jamborees were scheduled for that very weekend, some in neighboring West Virginia and Indiana.)

And it would be something big, with no less than $5,000 in prizes of one sort or another. Moore was to ride round the grounds, dressed in a lavish oriental potentate’s costume, in a pony cart pulled by Nubian slaves, who, in turn, were to be attended by yet more slaves.

Arrangements with numerous local tradesmen anticipated the throng. Moore predicted about 90,000 CBers would show, arriving in some 30,000 vehicles. A food market promised to have a large tent filled with a refrigerated van for milk and other perishables. Over two dozen ice-cream trucks were brought in from the Goodie Ice Cream Co. of Pittsburgh. Chairs and tables were rented to the tune of $700; $2,000 worth of tents were leased; with high confidence 123,000 tickets were printed. And though total investment in the Jamboree was an estimated $40,000, Moore himself was confident that CBers would pour some $12.5 million into the area during their two-day excursion into his land of the Arabian Nights.

As for advance publicity, thousands upon thousands of fliers were sent out, and the local paper provided extensive coverage for several months in advance of the shindig. Moore was quoted as reporting a month before the festivities that advance ticket sales were upwards of 10,000.

Things decidedly were building to a definite crescendo, though some thought they detected distortion in the symphony only a few days before J-Day. Area businessmen started to scoff at some of Moore’s predictions for the Jamboree. Moore was unruffled, saying
that his national prestige among CB operators would pull them in from 50 states and two countries. He also was heard to comment that the only thing small about this Jamboree would be the way it compared with the one he was planning for the following year.

Came the big day, and Moore was on hand, decked out in flowing robes (as promised) to greet the multitudes. The entertainers—disc jockeys, folk singers and assorted Nubian slaves—had begun to arrive. Unfortunately, the expected 90,000 CBers were about the only ones who didn't seem particularly interested in the lavish spectacle. About 4,000 showed up.

Saturday, first day of the Jamboree, was to see a talent contest (according to Moore's schedule) with $100, $50 and $25 prizes. It was held, but winners received no cash awards.

Saturday also was supposed to have offered a beauty contest for girls 6 - 10, but lighting problems allegedly prevented it. Re-scheduled for Saturday night, it finally was held on Sunday. The $200, $100 and $50 prizes were not awarded, but contest winners received notices explaining that they would be contacted by mail regarding the prizes.

Another beauty contest, for girls over 16, was re-scheduled for Saturday night, eventually canceled altogether.

Other promised prizes (for such things as most unusual costume, most distant car caravan, etc.) were not awarded. One man, who had brought a $300 CB rig to be sold to the Jamboree people as a registration prize, was grumbling he hadn't been paid.

When the father of one small girl became irate and demanded the $250 prize money she had won in a contest, it reportedly was awarded. Thing is, disappointed winners claimed this was the only cash prize actually given out.

About 3 o'clock Sunday afternoon a report went around the Jamboree grounds that [Continued on page 120]
Twist a switch for your choice of three skyhooks or two dummy loads.

By VERNON SIMMS

THAT mess of antenna cables, adaptors, coax connectors and dummy loads—toss it all out and install the Antenna Control Center. Connected to your CB transceiver, the Center will permit you to connect conveniently as many as three antennas or two dummy loads to the rig’s output. Then, at the twist of a switch—and that’s a lot easier than plugging in and removing half a dozen connectors—you have your choice of skyhook or test load.

And there’s no need to remove the Center from the line. It can remain connected permanently to your receiver. It has no effect on SWR and will not cause significant loss of power to the antenna.

Here’s what the Center will do:

Antennas. As we said, the Center enables you to hook as many as three different antennas to your rig. Maybe you want to shift from ground-plane to directional beam or collinear to quad. No need to fumble at the back of the rig—you can make a quick changeover with a rotary switch. This function is valuable for making instant comparisons between two or three different antennas.

On The Air. Ever wonder whether you’re really getting out or just heating up the microphone? Glance at the Center’s meter and you’ll know whether RF is going to the antenna. And no matter what the switch position, the meter samples continuously and indicates whether there’s RF in the line.

The meter also gives warning if something’s wrong. That is, its indication should be about the same each time you hit the push-to-talk switch. If there’s a provision on your transceiver for peaking the final the Center will be an invaluable aid in tuning up.

Dummy Loads. The Center also can connect either of two dummy loads to your rig’s output. One load is the old standby, a No. 47 pilot lamp. Main purpose of this indicator, which will glow brightly when you

Built in a 3 x 5 x 7-in. cabinet, the Antenna Control Center enables you to connect any of three antennas or two dummy loads to your rig.
transmit, is to give a quick check of modulation. As you speak into the mike, varying lamp brightness tells you whether audio is modulating the carrier.

The second dummy load is used when you have to troubleshoot the rig. It's resistive and is a close match to the transmitter's output impedance (unlike the lamp). It lets you run lengthy tests on the transmitter portion of the transceiver without violating the law or interfering with others on the channel.

**How It Works**

Your CB rig's output is fed via socket SO1 (see schematic) to the wiper of selector switch S1. From there, RF can be fed to either of the three output connectors depending on S1's position. A fourth position on S1 sends the signal to the lamp. The fifth position applies the signal to the resistive dummy load. The three load resistors add up to 48 ohms—a close enough match to the 50-ohm transmitter output. Wattage of each resistor is sufficient to provide a safety factor when fed the typical 3-watt output of a transmitter.

The meter circuit takes an insignificantly small amount of signal from the wiper of the selector switch and applies it to a diode detector circuit which converts RF to DC for the meter. A control pot (R5) permits you to adjust the meter's sensitivity.

**Construction**

Here are some tips you should keep in mind:

- Signal from CB rig is fed into Center at connector SO1 at right. Antennas are plugged into three connectors at left. Watch the polarity of D1 when installing it. End with color band gets connected to junction of R4 and C1. Shield on coax from S1 to SO2, SO3 and SO4 is grounded at connector end only and not at S1. Shield on coax from S1 to SO1 is soldered to P1 and to R5's case.
Antenna Control Center

mind when building the Center in a 3 x 5 x 7-in. Minibox. Use short lengths of RG58/U coax to connect the three antenna sockets to the selector switch. The wire shields, however, are soldered only to lugs placed under each socket’s mounting nut. Trim off the shields at the other end and do not connect them to the selector switch.

The coax from SO1 to the switch should have its black jacket removed completely. This permits you to solder the shield to both R5’s case and to the ground lug on pilot lamp Pl’s socket. Note that the ground lug is the one closest to the lamp. The other lug is connected to, selector switch S1 with a spaghetti-covered piece of No. 16 wire. This arrangement will hold the lamp socket in place. The bulb should protrude through the panel in a 3/8-in. dia. rubber grommet.

The resistor load, R1, R2, R3, is self-supporting. Be certain that none of the resistor leads shorts to the case. Other components are soldered to a five-lug terminal strip two of whose lugs are grounded. Avoid excessive heat on diode D1’s leads while soldering.

Operation

Run any convenient length of RG58/U coax from your transceiver’s output to SO1. If you don’t wish to place the center on or next to the rig, it can be wall-mounted so it’s within easy reach. Connect the cables from your antennas to the output connectors SO2, SO3, and SO4.

Output side of Center. Scrape away the paint on Minibox under connectors to make sure there is good contact between connectors and the cabinet.

PARTS LIST

C1, C2—.001 µf, 500 V ceramic disc capacitor
D1—1N60 diode
L1—2.5 mh RF choke
M1—0.1 ma DC milliammeter (Lafayette 99 R 5040 or equiv.)
Pl—No. 47 pilot lamp and socket
R1, R2, R3—16 ohm, 2 watt carbon resistor
R4—10,000 ohm, ½ watt, 10% resistor
R5—50,000 ohm, linear taper potentiometer
S1—1 pole, 5 position rotary switch (Mallory 3115J or equiv.)
SO1-SO4—SO-239 coax connector
Misc.—3 x 5 x 7-in. Minibox, 5-lug terminal strip, grommet, solder lugs, 2 ft. RG58/U coax.

The meter sensitivity may vary from one switch position to the other because of the different antenna. Therefore use R5 to keep the needle from going off scale. An indication about halfway up the scale is most desirable. Finally, if your rig is a transistor job, don’t switch to an antenna position that does not have an antenna connected to it. No harm would be done to tube sets, but a transistor rig might be damaged if operated without a load.
THAT latest rage, the auto tape player, is great if you're willing to listen to prerecorded tapes only. But we'll bet there are many times when you'd like to be able to play a tape you made at home or record a tape on the road.

For example, if you're a salesman a recorder in your car will enable you to write orders quickly. Or you could tape reminders to yourself, ball-game scores or important broadcasts. And don't forget the children, who can be entertained by stories taped in advance of a long trip. Here's how we installed a $40 tape recorder in our car.—Homer L. Davidson

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We installed a Japanese-made Aiwa recorder, which handles 3-in. reels at 17½ or 3⅞ ips. It operates on 6 V and is push-button controlled. Latest model, TP-706, is available from Allied Radio (stock No. 79 U 970 MX) for $39.95. It has a jack on the front panel into which you feed 6-V power. Push button on mike starts and stops machine. Other jacks are for external speaker and high-level input.

Start by taking a 5 x 10 x 3-in. aluminum chassis (Premier ACH-401 or equiv.) and cut away 10-in. side with nibbling tool. Smooth all edges and cover with tape. Bolt shown is on bottom and is used to hold recorder in place. Drill holes in the top of the chassis to hold it to underside of the dashboard.

Mount resistor to drop voltage to 6 V on back of chassis. As recorder draws 100 ma, value should be 60 ohms. Use 100-ohm adjustable type and adjust slider with recorder operating to set voltage. Positive lead goes to the sleeve in plug.
The job is done. The recorder is about 3 in. deeper than the chassis; therefore, operating push buttons, level meter, volume control and speaker will protrude just the right distance. Cement a small magnet on back of mike so it can be held to dash when not in use. To remove recorder for use in home, loosen underchassis screw, disconnect power plug and slide unit out.

After resistor has been adjusted, install the chassis under the dash with self-tapping screws. Connect negative power lead to car chassis and positive lead to cold or accessory lug on ignition switch.

Adjustable wirewound resistor and fuse holder should be mounted on back of chassis. Because resistor will be difficult to get to after unit is mounted, measure the dropped voltage with recorder operating before installing chassis under the dash. Fuse should be a .15 A type 3AG.
JUDGING from the hundreds of logs that reached EI’s DX Club offices shortly after official opening of our Fifth Award Period, many DXers anticipated this Period and were awaiting its arrival. Applications are being processed as speedily as possible, though the heavy volume has slowed operations. The Fifth Award Period will close April 30 and all applications for Awards must be postmarked before midnight of that date (see ALL-CONTINENTS AWARD FOR HAMS & SWLS! Jan. ’66 EI).

In the get-it-while-it’s-rare department we now have French Guiana, New Caledonia Is. and French Somaliland. Reason is that France soon will be building powerful SW relay bases in each of these territories. Of the three low-power stations currently in operation, only R. Noumea in New Caledonia recently has been reported in North America. Station transmits on 3355 kc until 0530 EST sign-off.

Hams looking for a way to log the Mediterranean might watch for WA4FTO/MM on 20 meters. As the MM indicates, he’s marine mobile and often operates from these waters.

Paul R. Poolman of Oneonta, N.Y., is the first in North America to report hearing R. Ulan Bator’s (Outer Mongolia) new 25-meter transmitter on approximately 11850 kc (frequency often runs a little higher). Paul turned the trick at 1725 EST.

Deutsche Welle’s African relay at Kigali, Rwanda, now is operating with all of 250 kw. Best time to try for it is at 1245-1330 EST when station has English for West Africa on 17805 kc. Logging should be no great problem. Reports go to DW’s headquarters at Cologne, W. Germany. Nor is the DW relay the only potent new station in Rwanda. The Kigali government’s own broadcast voice, Radiodiffusion de la Republique Rwandaise, also has boosted its power. Don Jensen (Wisconsin) reports reception on 6030 kc. Sign-on is at 2300 EST.

CP75, R. La Cruz del Sur, at La Paz, Bolivia, seems to be heard regularly on the West Coast until 1845 PST sign-off. Frequency is 4985 kc.

R. Athens on 11720 kc proves a hard one to pin, since the B.B.C. also has Greek transmissions on this channel. Thing to do is try for R. Athens after the British sign off at 1430 EST.

Long-wave broadcast station TFU at Reykjavik, Iceland, was heard this winter around the Great Lakes area on 209 kc. Seems to peak shortly after 1830 EST.

Those who have yet to log Kenya—and that means most of us—might try for the East African Telecommunications Co. station (telephone) on 10730 kc. H. L. Chabourne (California) logged this one at 1515 PST.

Vilnius, Lithuanian S.S.R., now has English for North America Sundays at 1730-1800 EST on 7110 kc. (That frequency should delight hams, hi!) Station is delivering powerful signals to the East Coast.

West Coast BCB fans will be interested in learning that R. Peking frequently makes it through on 1040 kc during early a.m. hours. Who knows? One of these March mornings it even may show up east of the Mississippi!

Anyone having trouble picking up strife-torn Santo Domingo should try for R. Santo Domingo Television on 6090 kc evenings. Station also is heard mornings at 0600 EST.

Propagation: Because days in the northern hemisphere are longer during the summer [Continued on page 113]
FOR many amateurs, the goal of ham radio is only a log full of long-distance QSOs. All too often this results in a power race in which operators pile on more and more watts until a full gallon, the legal limit, is reached. Unfortunately this usually ends up being very expensive, may not accomplish much and is a poor way to develop genuine hamming skills.

Why not go the other way? That is see how many QSOs you can make with hardly any power at all. That takes technique! (See THE DAVIDS IN GOLIATH LAND, July, '65 E1) In other words, if you can make a QSO with a half watt when your neighbor uses a half gallon to do the same thing, you're the better operator.

The way to enter the contest of low-power hamming is with the Flexible Flea—a 20, 40 and 80-meter CW transmitter whose input power can be varied continuously from 100 milliwatts to 5 watts. One way to start the game is by establishing a contact with 5 watts. Then you progressively reduce the power to see how little it takes to maintain the contact. Or, you can simply start off at the bottom with say, 200 milliwatts, to see how far you can get with this power. The longer the range you can get with low power, the greater feeling of accomplishment.

Operation on the three bands is achieved with plug-in coils. The input power of the final (and only stage) is indicated directly on a calibrated panel meter. (On the last page of this article there's a scale which you can cut out and paste on the face of your meter.) A 6AK6 tube is the crystal-controlled oscillator. It is followed by a pi-net output, designed to feed 50 to 72-ohm antennas.

Construction

Mount the components on a 5 x 7 x 3-in. aluminum chassis as shown in our pictorial in Fig. 1. Install variable capacitors C9 and C10 with nuts or washers between their frame and the chassis to keep their fiber side-insulators from touching the chassis.

As in all RF circuits, the wiring to and near V1 is critical. In particular, the grid and plate wiring should be as short and direct as possible.

Install rubber grommets in the top-chassis holes through which wires pass to C9, C10 and R3. Keep the power-supply wiring close
to the chassis and away from the RF wiring around V1.

Since R3 is supplied with only one sliding contact, you'll have to make another contact from a piece of soft aluminum. Cut a strip of soft aluminum, approximately ½-in. wide x 2¾-in. long, and bend it around R3 so the ends stick out. Remove the strip and put a contact dimple in it with a center punch, using a wood dowel for support. Drill holes in the ends of the strip and install the contact on R3 with a spade lug and a mounting screw. Don’t tighten the screw yet.

To prevent ourselves from accidentally touching R3 (which gets quite hot and is also a shock hazard), we made a 1½ x 1½ x 2¾-in. cover for R3 out of a piece of perforated aluminum. We then put flanges at the rear and side of the cover to fasten it to the chassis with self-tapping screws. The cover should be mounted carefully so it doesn’t come in contact with R3’s lugs.

The three plug-in coils (L3, L4 and L5) are made from a 3-in. length of Barker and Williamson No. 3016 Miniductor coil stock as shown in Fig. 4. The holders for the coils and jumper wires are the bases of discarded

Fig. 1—Underside of transmitter. To layout your chassis, take dimensions from pictorial and multiply by about 2. Arrangement of parts in RF section of transmitter is important; therefore, duplicate our layout as closely as possible. The lugs at the left side of switch S2 are S2A.

The Flexible Flea
Adjustment and Operation

Remove V1, L3, L4 or L5 and the protective cover over R3. Connect a voltmeter, set to measure DC voltage, to J2 and turn on AC power. Set S1 to high and adjust sliding
capacitors.

We determined the value of C11 experimentally to match our rig to our 80-meter antenna. You can try another value for C11 for best match to your antenna.

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The Flexible Flea

contact B (Fig. 3) until the VOM indicates about 245 V. Caution: Always turn off AC power before adjusting the contact and do not touch the resistor since it will be hot. Set S2 to low and set contact C so the voltage is about 110 V.

Plug in the 80-meter coil, V1 an 80-meter crystal and connect a 50- to 72-ohm dummy load to J3. (You could use two parallel-connected 150-ohm 2-watt carbon resistors for the dummy load.) Set S2 to high, set R2 full clockwise and set tuning capacitor C9 and loading capacitor C10 full counterclockwise (plates fully meshed).

Hold the key closed and quickly tune C9 for resonance—indicated on M1 by a dip in power. Slowly open the plates of loading capacitor C10 until the power (plate current) rises to about the 1-watt mark on M1. Then retune C9 for a dip and adjust C10 for a 5-watt indication, alternately adjusting C9 and C10 until a dip produced by C9 brings the meter indication to 5 watts. Finally, readjust R2 for 5-watt input power. (See The Radio Amateur's Handbook for explanations on how pi-network operate and are tuned.)

Do not change the setting of C9 and C10. Now, with the key closed and M1 indicating 5 watts, check the B+ voltage at J2 and adjust sliding-contact B until the voltage is 200 V with the key closed.

Do not change the setting of C9 and C10 in the next step: Turn R2 fully counterclockwise, switch S2 to low and close the key. Turn R2 clockwise until M1 indicates 500 milliwatts (full scale). The VOM connected to J2 should indicate 100 V. If it does not, adjust contact C on R3 until the VOM indicates 100 V with the key down. Turn off AC power and install the protective cover over R3.

Connect a 50 to 72-ohm antenna to J3 and try the rig on the air. Always tune the transmitter (as you did with a dummy load) first with 5-watt input power. Then reduce the power as desired (without retuning C9 and C10). Operation below 300 milliwatts input power on 20 meters is not recommended because the transmitter will double and the output power will be much lower.

How it Works

The crystal is the frequency-determining component in a Colpitts oscillator circuit consisting of V1, C1, C2, R1 and L1. V1 functions as a straight-through oscillator amplifier on 80 and 40 meters. In 20-meter operation, V1 doubles in the plate circuit. A key in V1's cathode circuit starts the oscillator and C3 minimizes key clicks.

Potentiometer R4 controls the input power by varying V1's screen voltage over either of the B+ voltages selected by S2B. M1 indicates V1's input power and is switched by
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Fig. 4—Pictorial of 20-meter coil. The three diagrams at the right of the schematic in Fig. 2 show pin connections of coils and the jumpers.

S2A to the low (500 milliwatt) or high (5 watt) ranges.

Plug-in coils L3, L4 and L5 (in conjunction with C9A/B, C10A/B and C11) have jumper connections in their bases to establish the proper L/C ratio in the pi-net output circuit. The RF output is fed to J3, to which can be connected a 52- to 72-ohm antenna.

The two B+ voltages (for high and low ranges) are supplied by voltage divider R3 and the voltage-doubler power supply, which consists of T1, SR1, SR2, C5 and C6.

The resistance values of R4 and R5 were determined by the author to cause M1 to indicate full scale, or 5 watts, when the measured input power was 5 watts.

The resistance values we specify for R4 and R5 should be satisfactory. However, if you want your meter to be calibrated with greater accuracy, here’s the way to do it: Input power is a product of VI’s plate voltage and its plate current.

To determine the power, first connect a dummy load to J3. With the transmitter tuned and loaded (as explained earlier), set input-power switch S2 set to high and measure the voltage on VI’s plate with respect to ground.

Then, disconnect the lead going from the center lug on S2A (see pictorial in Fig. 1) to the terminal strip to which are connected L2 and C7. Set up a VOM to measure current and connect its positive lead to the center lug on S2A and the negative lead to the junction of L2 and C7.

Turn on the power and read the current on the VOM. Multiply the current you read by the plate voltage and multiply them. Compare your answer with the power indicated on M1. If the indication in M1 is low, decrease the value of R4 experimentally. On the other hand, if the indication is high, increase the value of R4.

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VOLTAGE CHART

<table>
<thead>
<tr>
<th>VI pins</th>
<th>S1 set to HIGH</th>
<th>S1 set to LOW</th>
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</thead>
<tbody>
<tr>
<td>key up</td>
<td>key down</td>
<td>key up</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
<td>-38</td>
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<tr>
<td>2</td>
<td>35</td>
<td>0</td>
</tr>
<tr>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>4</td>
<td>6.3(AC)</td>
<td>6.3(AC)</td>
</tr>
<tr>
<td>5</td>
<td>245</td>
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<td>6</td>
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<tr>
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<td>0</td>
</tr>
<tr>
<td>J3</td>
<td>245</td>
<td>200</td>
</tr>
</tbody>
</table>

Notes:
1) 72-ohm dummy load connected to J3. S2 set to high. Transmitter tuned for 5-watt input power. Or, S1 set to low and R2 adjusted for 500 milliwatt input power.
2) 80-meter coil and 80-meter crystal used for test voltages.
3) Voltages measured with a VTVM.

Fig. 5—If the transmitter does not operate properly, measure all voltages at VI’s pins. If they differ from ours above, start troubleshooting.

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Fig. 6—Meter is calibrated in milliamperes, but if you paste this scale over its scale, you’ll be able to read the rig’s input power directly.
ANYONE who still feels transistors are an unproven sales gimmick needs only glance at an up-to-date hi-fi equipment catalog. He then quickly realizes that solid-state equipment has been accepted and that tube equipment is becoming history. And why not, since solid-state circuitry can give equal or better performance, occupies less space and has greater reliability than tube equipment?

One of the finest examples of solid-state integrated-amplifier kit design, packaging and performance we have seen is the $189.95 Scott LK-60. (It’s available assembled as the Model 260 with a price tag of $279.95.)

The LK-60 has practically every operating feature you’d want. There are inputs for tape heads, FM tuner, tape recorder playback preamps, AM tuner or TV sound and magnetic-cartridge record player. Adaptors are available to permit you to connect ceramic cartridges to the amplifier via the magnetic-cartridge input. And there are switched and unswitched AC outlets that can handle 250 watts.

Front-panel controls include an input selector switch, a mode selector switch, concentric bass and treble controls, balance and loudness controls.

The front-panel switches include one marked tape that permits you to monitor a tape recording via the playback head on three-head recorders, a rumble and a scratch filter. There’s a switch marked compensator which converts the control marked loudness to a conventional volume control.

And there’s a front-panel monitor meter that is used to indicate the relative output power of both channels into 8-ohm speakers.

Putting It Together

The LK-60’s flat-lying, spiral-bound construction manual includes many extras, among them a dictionary of hi-fi terms. The book is laid out so instructions and related pictorials are opposite each other. And the pictorials are almost good enough to compete in a pop-art contest. All parts and wires
are shown in their colors. Parts are packaged according to the section in which they’re used.

In a nutshell, the manual is the most complete, foolproof one we’ve seen in a long time. The only thing Scott didn’t do is include a technician to build the kit.

Construction should go smoothly since many parts come mounted on the chassis. Such things as the preamps, driver stages and output stages are factory-wired on printed-circuit boards and have been tested. The builder has only to mount the boards and connect precut interconnecting wires. For this reason we consider it a semi-kit. But a lot of wires must be connected. Our builder’s construction time was about 25 hours.

A light bulb is included with the kit for test purposes. A built-in circuit connects the bulb in series with the AC line. If the kit is wired properly the bulb glows dimly. If something is wrong and too much current is drawn the bulb lights brightly. You then can look for the error without fear of damaging parts. The built-in monitor meter is used to set the bias current and to make balance adjustments.

And if there is trouble, the manual has a detailed section on troubleshooting without instruments. There is technical information for more advanced builders, a section on amplifier theory and a schematic listing each stage’s gain.

**How It Checked Out**

The LK-60’s performance left little to be desired. Maximum sine-wave output power of each channel at 1 kc (both channels driven) was 39, 35.3 and 23 watts at 4, 8 and 16 ohms, respectively.

Frequency response at 1 watt was flat from 5 cps to 26 kc and down 3db at 36 kc. Intermodulation (IM) distortion (60 cps and 7 kc, 4:1) was 0.25, 0.7, 0.58 and 0.83 per cent at 1, 5, 10 and 30 watts, respectively.

Total harmonic distortion (THD) at 1 kc was 0.15, 0.18, 0.15 and 0.29 per cent at 1/2, 1, 2 and 30 watts, respectively. THD at 30 watts was 1.2 per cent at 20 cps and 0.95 per cent at 20 kc.

The RIAA phono equalization was flat within 0.5db from 20 cps to 20 kc. The tone controls, rumble and scratch filters, loudness compensation, phono and high-level sensitivities all met Scott’s claimed specs.

Our measured 57db signal-to-noise (S/N) ratio may appear high compared to a tube amplifier’s but in listening tests the LK-60 sounds as though the S/N ratio is at least 65db or better. The reason for this is that the noise is generated below the limit of audibility.

Other amplifier features are a switch to select output impedance, provision for remote speakers (front-panel switch-selected) and a three-position rear-panel switch that is used to establish the magnetic-phono input sensitivity at 3, 5 or 9 millivolts, for full-rated output. The LK-60’s output transistors are silicon.

In every respect the LK-60 proves that transistors are here to stay and can perform every bit as well as those old tube amplifiers—and then some.

*Reason the LK-60 looked so clean under the chassis is because of high parts density on top. However, all circuit boards are supplied prewired and tested. Bulk of the work is the interconnecting wiring between boards and switches. Low-level preamp boards are mounted vertically in lower-left corner and are enclosed by a shield cover. Black objects between power transformer and preamps are heat sinks for the output transistors.*
THE 212 MYSTERY... Probably the hottest controversy in DX these days can be summed up in one sentence—where is Radio Americas? As most EI readers know, there are those who are willing to stick their necks way, way out and state flatly that this station is not where most people believe it is, namely, on Swan Island. But if not Swan, where?

One answer stems from a series of interesting discoveries. First is that, at 2100 EST, station WRUL (Radio New York Worldwide with transmitters at Scituate, Mass.) airs a half-hour commentary in Spanish by the biggest name in anti-Castro broadcasting, Dr. Luis Conte Aguero. Said commentary from WRUL is picked up and rebroadcast simultaneously by R. Americas.

Next discovery is that R. Americas must rely on WRUL's transmitter No. 4, the only one beamed to SWBC Zone 11, for this rebroadcast. (This Zone includes Cuba, Central America and, of course R. Americas.) Thing is, a check of FCC records reveals that WRUL No. 4 is beamed at exactly 212 degrees. If the location of R. Americas is not a factor this direction indeed would be a weird choice. It misses Cuba except for the extreme westernmost tip and catches only the western end of Central America (Guatemala and tiny El Salvador). Putting it another way, the whole western half of WRUL's signal is wasted on open water and sparsely populated lower Mexico. Without R. Americas, 212 or any bearing west of 210 (Havana) is just too far west to make sense.

While WRUL would not have to beam on R. Americas absolutely, such a procedure certainly is reasonable. A direct-pickup re- lay station requires maximum signal from the originating station because the relay's listeners must contend with double QRM, double QSB distortion and double static. The problem becomes even more acute when the originating station is not a regular point-to-point facility but, as in the case of WRUL, one operating on crowded SWBC bands.

Therefore, if R. Americas were located on the northeast corner of Mexico's Yucatan peninsula (that would be the Cozumel/Puerto Juarez area) or aboard a ship in the Yucatan Channel, 212 degrees becomes a perfectly logical selection. Actually, 212 hits the lower Yucatan Channel but the beam could have been pulled slightly east of the exact location in order to provide at least reasonable reception in the rest of Zone 11.

But let's carry the argument a little further. If for some reason WRUL chose not to beam on R. Americas, Cuba would be the next most likely choice. Further, a beam to central Cuba (202 degrees) or Havana itself would improve Central American reception. True, Guatemala has been the scene of Communist agitation but so has Panama (195 also hits Camaguey) and Costa Rica (202 again). So the possibility that Guatemala would be selected over Cuba and the rest of Central America is remote.

Assuming R. Americas were on Swan, 212 becomes positively absurd. For by beaming at 208.5 degrees, WRUL could hit exactly halfway between Havana and Swan while simultaneously realizing maximum coverage of the entire Central American population. Such a technical coup certainly would outweigh all other choices, including Guatemala.

Added to the 212 mystery are two more pieces of evidence. Northeast Yucatan is geographically excellent for R. America's purposes. Further, it has been known for some time that the R. Americas supply plane stops at Cozumel! Everything considered, the conclusion seems inescapable.

Real location of R. Americas, long thought to be Swan Is., is suggested by 212-degree beam which WRUL aims at the Caribbean mystery station.
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The Most Trusted Name in Electronics

May, 1966
Who would have thunk that distinguished gentleman from U.N.C.L.E. outfoxes

TIME was when spies and spying somehow were unsuitable for mention in polite company. Nations seemed content to agree that such things did not exist. And they more or less didn’t, for espionage agents of that era operated suitcase-size transmitters from closets or attics, using multiple coat-hanger (or perhaps bedspring) antennas. Nice civilized countries reacted with shock when some poor agent got caught. And if, by some horrible twist of fate, the nice civilized country was alleged responsible for said agent, there were loud denials and outraged cries of trumped-up charges.

But things are different now, due in part to James Bond, Napoleon Solo and other masters of the story-book spy. For 007 and his boys have so unveiled and de-Paled the ancient profession that nice civilized nations actually swap captured spies. (Remember the exchange of master Russian spy Colonel Rudolph I. Abel for U.S. U-2 pilot Francis Gary Powers?) Fact is, espionage operations now are conducted in a most blasé fashion. The nations of the world almost would seem to have an unwritten pact saying, OK, so we are all spying on each other. This being the case, let’s at least make our agents a little more comfortable in the process.

When Russian spy Abel was arrested, he had a bulky, sensitive, American-made short-wave communications receiver decorating the den of his pleasant apartment overlooking New York’s picturesque East River. No suitcase equipment for him—and no bedspring antennas either, for his roof sported an extremely practical antenna beamed straight towards Europe.

Radio Swan, yesteryear’s No. 1 mystery station, spoke to spies in 1961 Bay of Pigs fiasco. These are station’s two antennas.

U.S. spies, if we are to believe Russian sources, come equipped with everything from grab bags to game hens. Originally published in a Soviet newspaper, photo shows alleged U.S. spy equipment that includes what appears to be 1) a scrambling device, 2) a transceiver, 3) a battery-operated SW receiver.
007 a mere bandswitch's throw from 49 meters?

It probably is safe to assume that he was not using this equipment to listen to The Happy Station program over Radio Nederland, nor was he following a yodeling contest from Switzerland. He simply was relying on his radio to bring him espionage instructions direct from the Kremlin. And unlike spies of yore, Abel had no need to transmit. Coded messages to him sufficed most adequately.

For our own part, Gary Powers wasn't made to peer at the Russian landscape from the vantage point of an abandoned windmill or a hollowed-out haystack. We sent him in style—in a very powerful, very expensive, very ultra-everything jet aircraft (which for all these superlatives proved incapable of making a hasty enough exit upon its detection).

And as for our own electronics, the Central Intelligence Agency (that's the real-life U.N.C.L.E.) established a powerful broadcasting station right in Fidel's back yard. This was famed Radio Swan, now known as Radio Americas. Of course, the CIA never has admitted any affiliation with R. Swan/Americas, but the station always has operated under only the very sheerest of espionage covers. And it from time to time has treated listeners throughout the world to such cryptic messages as, Attention Stanislaus, the moon is red 19 April. (This, by the way, was an actual message transmitted a few days before the 1961 Bay of Pigs invasion.)

During that invasion, R. Swan directed the entire troop operations in the manner of a command post. Mixed into troop instructions were remarks like, Alert! Alert! Look well at the rainbow. The fish will rise very

Robert Glenn Thompson, an American convicted of spying for the U.S.S.R., was first to reveal shortwave's real role in espionage.

Francis Gary Powers, the U.S. U-2 pilot who lost his plane but saved his person over Soviet soil, was tried in Moscow on espionage charges, later exchanged for Col. Rudolph I. Abel, a Soviet spy arrested in the U.S.
soon...the sky is blue...the fish is red. Look well at the rainbow. Though proof is lacking, such seeming gobbledy-gooks most probably were coded instructions for undercover agents within Cuba.

Almost immediately after the collapse of the Bay of Pigs invasion (which turned out to be a well-intentioned but ill-timed venture of the CIA), the use of short-wave radio by espionage agents really came out into the open. Listeners around the world suddenly began reporting reception of mysterious phantom stations without call-signs. Gone were the Hollywood-like theatrical instructions with references to red fish and blue skies. In their place were coded messages, offered as 4-, 5- or 6-figure groups of numbers by both male and female announcers and in a variety of languages (English, Spanish, German and Czech among them). Thing is, these are not suitcase stations, but high-powered, sophisticated endeavors using directional antenna arrays. Many frequencies are in use, and in some areas of the U.S. such stations actually roll in like locals. Occasionally, music even is played between messages, possibly as a relaxant for agents engaged in some hasty decoding.

These stations dot the short-wave dial, sending their tidbits for agents who are referred to over the air by names like Amedio 32 and Gruppen 133. Instead of call-signs, the stations either do not identify at all, or they use buzzers or musical numbers. (One has been heard on approximately 4050 kc at 1500 EST, broadcasting in German and playing the March From The River Kwai as an ID; another, also in German, has been picked up on 4665 kc groaning out a schmaltzy Strauss waltz called Wienerblut as an ID; still another station—this one in Czech—uses the code name Konets as an ID and is heard around 2130 EST on 9845 kc.)

Most such stations change frequencies and schedules often, but generally a particular station will make use of the same group of frequencies over a given period. (Identical transmissions in Spanish have been heard on 3450 and 4680 kc—the former around 0700 EST, the latter around 1705 EST. Similarly, the 4050-kc transmission in German mentioned earlier simultaneously has been heard on 6400 kc.)

How do agents turn the mysterious numbers into meaningful messages? Such information was not too easy to come by—at least until recently when an American named Robert Glenn Thompson was charged with espionage for the U.S.S.R. He promptly poured out his soul to an Austrian magazine called Kleines Blatt, in the process of which he detailed procedures relating to his own spy station.

[Continued on page 115]
AIM a camera, push the shutter release and the exposure is perfect every time. Send a space vehicle into orbit and forget about the batteries dying since operating power will come from the sun. The magic component that makes all this possible? The semiconductor photocell.

The examples we've used rely on two basic types. The first is a photoconductive photocell. Since it works just like a variable resistor, it also is called a photosensitive cell. The cell's resistance changes in inverse proportion to the intensity of the light striking it. The greater the light, the lower the resistance and vice versa. Thus, the cell is used to control current flow in a circuit.

The other type is the photovoltaic photocell. Also called a solar cell, sun battery or simply a self-generating cell, it generates current when exposed to natural or artificial light.

The operation of both photocells is based on semiconductor action. The material used in the photoconductive cell is cadmium sulphide (CdS). The cell's construction and operation are shown in Fig. 1.

The cell is made by depositing a thin layer of cadmium sulphide, to which electrodes are attached, on a ceramic base as shown in A. During the manufacture of the cadmium sulphide, an impurity is added to convert it to a N-type semiconductor—a material rich in free electrons.

If there's no light on the cell electron activity is low and the resistance of the cadmium sulphide, and consequently between the terminals, is high.

When light energy in the form of photons strike the cell, the cell absorbs energy and electron activity increases. Assume that the cell shown in Fig. 1-B is connected to a battery. Free electrons now will be attracted to the positive side.

As the electrons move to the positive terminal they leave behind what are called holes. The holes, which have a positive charge, are attracted by the negative terminal.

In other words, light energy stimulates current carriers within the cell. The more light, the greater the number of carriers and the greater the current flow. The effect of this, the increase in current, is the same as would be produced by a variable resistor connected to the battery. Lower the resistance and current will increase. The cell, load and battery can be connected without regard to polarity since the action will take place in either direction.

The operation of the photovoltaic or solar cell is more complex. It's made of P-type and N-type semiconductor materials (either selenium or silicon) as shown at the left in Fig. 3. This is the way this cell works:

When the P and N semiconductor materials are joined, a potential barrier region is built up. When the cell is in darkness, holes

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May, 1966

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Fig. 1—Diagram A shows photoconductive cell construction. In B, activity of free electrons is increased by light which causes them to be attracted by positive external voltage. Holes left behind are attracted by negative side. This results in a current flow whose magnitude is determined by light intensity.
Those Multiplying Cells

and electrons (circled plus and minus signs, respectively) move toward the junction because of their mutual attraction. This movement eventually stops.

When light strikes the junction, photons force the electrons and holes across the junction, causing electron-hole pairs to be formed. The activity caused by the combining of the electrons and holes produces a difference in potential between the electrodes, which is indicated by the meter as a current flow.

To witness the operation of a photovoltaic cell, connect one to a meter as shown in Figs. 2 and 3. You now have a simple meter that measures light intensity. The cell to use is an International Rectifier type B2M (Allied 7 U 876). Connect the cell’s red lead to the positive meter terminal and the black lead to negative terminal. If the meter is a 0-100 µA DC microammeter, it will indicate approximately the intensity of light falling on the cell in foot-candles per square foot. The table below converts current to light level.

<table>
<thead>
<tr>
<th>Meter indication (microamperes)</th>
<th>Foot-candles / square foot</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>20</td>
<td>6.4</td>
</tr>
<tr>
<td>40</td>
<td>12.8</td>
</tr>
<tr>
<td>60</td>
<td>26.0</td>
</tr>
<tr>
<td>80</td>
<td>52.0</td>
</tr>
<tr>
<td>100</td>
<td>104.0</td>
</tr>
</tbody>
</table>

The B2M cell can also be used to power a small transistor radio. The cell’s output in sunlight is approximately 0.4 V at 2 mA. If this voltage is too low, connect cells in series to add their voltages. Higher currents can be obtained by connecting several cells in parallel. A series-parallel arrangement boosts both voltage and current.

In electronic parts catalogs you will find other cells (silicon) whose output is greater. Some have nearly a 1-V output at over 20 mA in sunlight. The International Rectifier type S5M, for example, has a 0.6- to 0.85-V output at 18 to 25 mA.

A cadmium-sulphide photoconductive cell can be connected in a circuit in the same way as a variable resistor. But there is one important thing to keep in mind—maximum applied voltage. If you wish to connect the cell in a 117-VAC circuit, choose a cell with a 250- to 300-V rating. Lower-voltage cells
Fig. 4—Photoconductive cell connected in series with two 9-V batteries and a sensitive DC relay can be used to turn on lamp as darkness approaches. Make sure current drawn by external circuit does not exceed rating of the contacts. A 10,000-ohm potentiometer connected in series with the relay can be used to control the sensitivity.

A simple setup in which a photoconductive cell can be used safely with batteries. The cell's ratings and other important details, such as resistance under light conditions, also will be listed in parts catalogs.

Another value that must not be exceeded is the cell's maximum power dissipation in watts. If it's not stated in the catalog, it can be determined by multiplying maximum voltage and current ratings of the cell.

A schematic of the setup is shown in Figs. 4 and 5. This circuit is useful for applications like triggering an alarm or turning on a lamp as darkness approaches. The cell to use is Clairex type CL-602 (Allied 7 U 460). Its resistance is about 3,000 ohms in bright room light and many times higher in darkness. The relay, (Lafayette Stock No. 99 R 6091) is a sensitive DC type (5,000-ohm coil) that closes when the coil current is about 2 ma.

With these specs you find out that the relay requires 10 volts for its contact to close. Here's how: Using the formula $E=IR$, we find that $0.002 \times 5,000 = 10$ V. Since the photocell's resistance is 3,000 ohms when illuminated, it will have a voltage drop across it. Thus, if the required current is 2 ma (.002 A) and cell resistance 3,000 ohms, the voltage drop across the cell will be 6 V. Therefore, about 16 V is required to operate the circuit. Two 9-V transistor-radio batteries in series will do the job.

When using this circuit with 117 VAC, you should enclose it in a cabinet so you don't get a shock. Also, an AC relay that will handle higher voltage will have to be substituted. However, a better approach is to use a step-down transformer to reduce line voltage to a safer level. Then long leads may be run to the photocell and other parts with safety.

—H. B. Morris

May, 1966

Fig. 5—Schematic of photoconductive-cell control device. Sixteen volts is required to provide current to cause relay contacts to close. Clairex cell we specify (not shown above) can handle up to 300 V and can, therefore, be used with AC relay in line-operated circuits. Cell handles up to 75 milliwatts.
EXPERIMENTING with a new project has a special kind of satisfaction—but it has frustrations, too. Like when you’re pawing through the junk box for an inductor. You find one that looks like it might be the right value. When you examine it closely though, you discover to your dismay that the markings have vanished. It’s useless.

Or you have an odd-looking variable capacitor that was removed from a piece of surplus equipment. How would you determine its capacitance range?

Even though you own a VOM and perhaps even a capacitance meter, these two instruments won’t always measure a wide range of resistance and capacitance accurately. It takes an impedance bridge to do this job.

Our impedance bridge turns those unidentifiable parts into useful components. It measures resistance from 0.1 ohm to 14 megohms, capacitance from 1 μf to 14 μf and inductance from 10 μh to 10 hy. Carefully calibrated, its accuracy is ± 5 per cent.

For most measurements, the bridge is powered by a battery. A few ranges however, require a 60-cps signal. Since low-frequency transistor oscillators can be complex, a 60-cps signal from a 6.3-V filament transformer (and, consequently, 117 VAC) is used some of the time when measuring either inductance, capacitance or resistance.

By WALT HENRY
Fig. 1—View down into bridge. Wire selector switches S1, S2 and S3 before mounting them on front panel. Then mount circuit board on bottom of U-section of Minibox with four 1 1/4-in.-long spacers. Connect front-panel controls to circuit board, then install filament transformer T2 and associated components on rear panel. Pictorial of components on rear panel is shown in Fig. 3.

Fig. 2—Circuit board and front-panel wiring. Perforated board is 8 1/2 x 3 1/2 in. To prevent oscillator output from getting to amplifier, put oscillator at right of board and amplifier input at extreme left. Note that shield on wires from BP2 to R11 and from C9 to R18 is grounded at R11 and R18 ends only.

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Fig. 3—After circuit board is installed, mount these components on top of rear panel. We soldered F1 in AC line but you could use fuse holder. J1 and J2 normally are connected with jumper. When checking electrolytics, remove jumper and connect + terminal of 9-V battery to J1, negative terminal to J2.

**BRIDGE TO NOWHERE**

**Construction**

Circuit layout is not critical but for best performance a few points should be noted. When laying out the circuit board be sure the oscillator (Q1) is located to the right of the output end (Q5) of the amplifier to minimize stray-signal pickup. This keeps the oscillator away from the amplifier input at Q2.

The ground wire from the front-panel components to the circuit board should be connected near the second stage (Q3) as shown in Fig. 2. Note that several ground wires are connected to R10 to stabilize the circuit. Filament transformer T2 should be located away from the input end of the amplifier. In our model it is mounted on the top of the back of the U-section of the Mini-box as shown in Fig. 2. One of T2's green secondary leads should be cut short and taped.

So little AC power is consumed that we did not use a switch to turn off power to T2. But since the amplifier is battery powered switch S4 should be turned off when the instrument is not in use. All wiring should be short and direct. Note that shielded wires are used from BP2 to R11 and from R18 to C9. Ground the shield at the R11 and R18 ends only.

To lay out R10's dial as shown on the first page of this article, put 0.1 and 1.0 marks 180° apart on a horizontal line. Then mark off 20° divisions for 0.2 through 0.9. Also mark off 20° divisions for 1.1 through 1.4.

**Test and Calibration**

Set S2 to R and set test freq. switch S1 to 60 cps. Do not plug in the line cord. Turn potentiometers R8, R9 and R10 full counterclockwise. Set S4 to on but leave amp. gain pot R24 full counterclockwise. Measure the voltage with respect to ground on Q5's emitter (point A on the schematic) and on the collector (point B). The voltage at A should be about twice the voltage at B. If it is not, use a different value resistor for R28 to get the proper voltage.

Now measure the voltage on Q2's collector (point C). It should be between 2 and 4 V. If it is not in this range a slight change in the value of R20 will do the trick.

Set range switch S3 to E and slowly turn R24 clockwise. With the gain wide open the meter should indicate below 5 microamps. If it is higher Q2 may be noisy and should be replaced.

Leave S3 at E, turn R24 counterclockwise and plug in the line cord. Connect a 1,000-ohm, 1 per cent calibration resistor to BP1 and BP2 and turn R24 clockwise until M1 deflects almost all the way to the right. Now adjust mult. pot R10 until the meter nulls. It may be necessary to readjust R24. (If you don't get a null go on to the next paragraph.) Loosen the set screw on R10's knob, set the pointer to 1.0 and tighten the set screw. Now connect a 1,000-ohm, 1 per cent resistor to BP1 and BP2. The null should occur when R10 is set to 0.1.

If you don't get a null it is because components are out of tolerance. It probably will
be necessary to change the value of R7A, B, C slightly to get nulls at exactly 1.0 and 0.1. We had to parallel R7 with a 1,500-ohm resistor. An easy way to determine the value of the resistor is to parallel R7 with a 5,000-ohm pot and repeat the above procedure with different potentiometer settings until nulls occur at exactly 1.0 and 0.1. Measure the pot's resistance and solder a resistor of the same value in parallel with R7. If R7 should happen to be too low in value, replace one of the 68-ohm resistors with an 82-ohm resistor and repeat the procedure.

When you are through tighten the knob set screw securely. It is a good idea to check the other ranges, using several resistors of known value. The bridge's accuracy can be increased if R11 through R18 are 1 per cent resistors instead of the 5 per centers specified in the Parts List.

For accurate capacitance measurements, the values of C5 and C6 must be selected; their combined value will be close to 0.3 µf. We obtained the proper value by paralleling 0.1 µf and 0.18 µf capacitors. Connect a 0.001 µf 5 per cent calibration capacitor to BP1 and BP2. Set S3 to E, S2 to C and S1 to 20 kc. Increase the gain (R24) for a full-scale deflection and adjust R10 for null. Try various parallel combinations for C5 and C6 until the null occurs with R10 set at 1.0. Then use a 100 µf capacitor to make sure the null occurs when R10 is set at 0.1. Always adjust R9 or R8 first for sharpest dip. Check other ranges with different capacitor values. For values greater than 1 µf, S1 should be set to 60 cps instead of to 20 kc.

If the capacitor under test is an electrolytic, connect a 6- to 9-V battery to ext. bias jacks J1 and J2. Be sure to observe polarity marks when connecting the capacitor to BP1 and BP2.

Calibration for inductance is accomplished by selection of C7 and C7A. Their combined value normally is about 0.25 µf. We obtained the proper value by paralleling a 0.22 µf and a 0.047 µf capacitor. Connect a 1-mh choke to BP1 and BP2, set S3 to C, S2 to L and S1 to 20 kc. Adjust R8 and R10 for sharpest null and try parallel combinations for C7 and C7A until the null occurs when R10 is set at 1.0. Check out the other ranges with other chokes. For values above 1 hy, 60 cps should be used.

The bridge can be simplified if you're willing to sacrifice some features. For example, if you do not have to measure capacitance above 1 µf, inductance above 1 hy, and resistance above 1 meg, T2, S1, R8, R4, R9, F1, J1, J2 and NL1 can be eliminated. S5 and R33 can be left out if you don't need the battery-test feature.

A less sensitive meter can be used with some loss in measurement sensitivity. For example you can use a 1-ma meter and eliminate R35 and D5. But change R34 to 2,200 ohms.

**Operation**

First, check the battery. With S4 off, press batt. test push button S5. If the meter indicates between 30 and 40 microamps, the battery is good.

For all resistance measurements, set S1 to 60 cps. For capacitance measurements up to 1 µf, set S1 to 20 kc. Above 1 µf, set S1 to 60 cps. Do likewise for inductance up to 1 hy. Set switch S2 to either C, L or R, depending on the component you are checking.

Set S3 to the appropriate position determined from the chart in Fig. 4. Adjust either R9 or R8 (depending on the test frequency) for the sharpest null, keeping R24 turned down to prevent M1 from going off scale.

Then adjust R10 for a sharper dip, turn R24 clockwise and adjust R10 for another null. Now multiply the value on R10's scale by the number in Fig. 4 to get the value of the part.

**How it works**

The bridge contains three major circuits: the signal source (20 kc from the built-in os-

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**Range Switch Position**

<table>
<thead>
<tr>
<th>Switch Position</th>
<th>Multiply R10 by</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>R(ohms)*</td>
</tr>
<tr>
<td>A</td>
<td>10 µf*</td>
</tr>
<tr>
<td>B</td>
<td>1 µf</td>
</tr>
<tr>
<td>C</td>
<td>.1 µf</td>
</tr>
<tr>
<td>D</td>
<td>.01 µf</td>
</tr>
<tr>
<td>E</td>
<td>.001 µf</td>
</tr>
<tr>
<td>F</td>
<td>100 µµf</td>
</tr>
<tr>
<td>G</td>
<td>10 µµf</td>
</tr>
<tr>
<td>H</td>
<td>10 µmeg</td>
</tr>
</tbody>
</table>

* Use 60 cps

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Fig. 4—Cut out this chart and paste on top of cabinet for reference. Set S3 for approximate value of component to be checked. For exact value of part, multiply reading on R10's dial when meter nulls by figure in the appropriate column.

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Fig. 5—Schematic of impedance bridge. Two different test signals are used. The 20-kc signal is generated by Q1 and associated components. The 60-cps signal is provided by T2. Switch S1 selects the test signal and feeds it to bridge. Depending on whether part to be checked is capacictor, resistor or inductor, S2 is used to set up either a Wheatstone or a modified Maxwell bridge configuration. Output of bridge then is fed via range switch S3 to the high-gain amplifier, which consists of Q2 through Q5. Bridge is first coarse-nulled by either R8 or R10, depending on test frequency. Amplifier gain is increased by R24 and bridge finally is fine-nulled by R10. In our model, T1 was an Olson Electronics transformer with lugs. The Lafayette transformer has color-coded leads. Its green and black secondary leads correspond to lugs 5 and 4, respectively. And on the primary side, the brown, red and green leads correspond to lugs 1, 3 and 2, respectively.
oscillator or 60 cps from a filament transformer), the bridge circuit and the amplifier-meter circuit. An AC signal is applied to the bridge circuit and the bridge is balanced by turning R8, R9 and R10. The output from the bridge then is applied to the high-gain amplifier.

The amplified signal is rectified by a diode bridge whose DC output goes to M1. The meter current depends directly on the amplitude of the signal from the bridge. Thus, when the bridge is balanced, the meter indicates a low value, or nulls.

Switch S3 permits you to check component values over a wide range. Switch S2 sets up the bridge for measurement of resistance, inductance or capacitance. The test frequency is selected by S1 and the instrument's sensitivity is adjusted by R24.

The 20-kc oscillator (Q1 and associated components) is a modified Colpitts whose output is coupled through a transistor audio-output transformer (T1) to the bridge. The oscillator's frequency is determined by L1, C2 and C3. The output is a clean sine wave.

The bridge has to have different circuit configurations for measuring R, L or C. Switch S2 makes the necessary changes. For inductance and capacitance measurements, two potentiometers (R8 for 60 cps, R9 for 20 kc) cancel variations in component values.

The four-stage amplifier (Q2 through Q5) has a high input impedance and a high voltage gain. Stability or motorboating problems are eliminated by the upside-down output stage, Q5. The use of this configuration made stage-by-stage decoupling unnecessary. The oscillator is decoupled from the amplifier by R5 and C1. R34, R35 and D5 prevent the meter from being overloaded.

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www.americanradiohistory.com
Change of Mind . . . Transceivers never have appealed to us much because of what we thought was their lack of flexibility. But they do have important advantages, as we found out when we had to give up a 12 x 15 ft. shack and take refuge in a small room just about filled by a desk and some book shelves. We cleared two spaces, a mere 14 and 8 in. wide, and in them placed an EICO 753 transceiver and its matching 751 power supply (see our photo).

Fortunately, we were able to retain our Mosley TA-33 Jr. beam. Hitching the components together in a few minutes, we fired up the rig and in rapid order worked stations in England, Germany, Italy, Sweden, Florida and California. The one-knob tuning is great, the receiver can be offset from the transmitter by as much as 10 kc and there's a choice of AM as well as SSB and CW. We're having a real ball with this compact, handsome setup.

Fooled Again . . . We've remarked before in these columns that it's easy to be confused and confounded by the speech patterns of many hams, both domestic and foreign. Just the same, we recently did a double take when we heard a chap with an unmistakable German call and an even less unmistakable pecan-pie accent repeating "CQ Atlanta Georgia, CQ Atlanta Georgia."

Catch was that we'd forgotten the DL4 and DL5 combinations are assigned to the U.S. forces in Germany and that the boys there always are anxious to get fone patches into the States. Georgia is a particular target for CQs because it is the home of the huge infantry center and many military dependents live nearby. What say we give these calls clear frequencies?

Universal Tongue? . . . Listen to DX on 20 meters in the early morning and you get the impression that English is a required subject in overseas schools. Reason is that practically all foreign hams speak it or at least the American version of it. However, a surprisingly large number of them learn the language the way they learn circuitry . . . by working at it.

This was brought home to us during a long QSO with SM6UG of Sweden. We complimented him on his precisely correct speech and asked him where in the U.S. he had studied. He laughed and said that he never had been outside the Scandinavian countries but had learned to read, write and speak English by reading ham magazines and working American hams daily for several years between 1200 and 1300 GMT (his lunch hour). Wish we could do half as well in Swedish!

Look Ma, No Hands . . . It would seem VOX should be ideal for mobile operation because it enables the driver-ham to keep his hands on the steering wheel. However, traffic noises—horn blasts, especially—too often kick a transceiver from receive to transmit just when the other guy is giving his call. Push-to-talk isn't the answer, either, since it's dangerous if you like to QSO while on the road.

A much better arrangement in the ham shack on wheels is a foot-actuated micro-switch fastened to the floorboard to the left of the brake pedal (or of the clutch pedal, in

*Continued on page 115*
the ABCs of RADIO

By JOHN T. FRYE, W9EGV

PART 5: DETECTION

A few short steps into a radio receiver bring us to the last tuned-radio-frequency (TRF) amplifier or the last intermediate-frequency (IF) amplifier, depending on the particular type of circuit being used. Out of either of these stages comes an amplitude-modulated carrier as depicted in Fig. 5-1A. A single illustration serves for both instances because the only difference between the two signals lies in the carrier frequency involved. With the TRF amplifier, the carrier frequency is the same as the one being transmitted; with the IF amplifier, the carrier frequency at this point is the IF frequency.

But regardless of where it falls in the spectrum, the carrier frequency now has ceased to be important. Having served as the vehicle for carrying significant information from transmitter to receiver and permitting us to amplify the signal or even translate it from one frequency to another (as in the case of the superheterodyne), the carrier has served its major purpose and we are nearly through with it. What interests us now are those bulges and dents in the amplitude of the carrier. We know both were put there by modulating the carrier with various audio frequencies, which themselves were fathered by sounds. We want to recover first those frequencies and then the sounds. How shall we go about it?

Since amplitude goes up and down with modulation, you might think placing this signal on the grid of an amplifier tube would produce plate-current changes which would correspond precisely to the level of modulation. Not so! While instantaneous plate current faithfully would follow the ups and downs of individual cycles of the carrier voltage, average plate current would not change with the comparatively slow undulations in overall carrier amplitude that modulation produces. Here's why.

An unmodulated carrier consists of equal, symmetrical, alternate half-cycles of positive and negative voltages as shown in Fig. 5-1B. In a 1000-kc carrier, only 1/2,000,000 of a second separates consecutive positive and negative peaks. This means that for anything other than the most instantaneous period the two peaks necessarily must be viewed as occurring simultaneously. Thing to bear in mind is that an amplifier is a linear device and responds equally to equal changes in input voltage (see Fig. 5-2). Any plate-current increase produced by a positive half-cycle of the carrier will be offset precisely by a plate-current decrease evoked by the immediately following and equally negative half-cycle. Average plate-current change will be nil.
This still holds true when the carrier is modulated because modulation, as seen in Fig. 5-1A, applies a sort of two-way stretch to the carrier cycles. Any increase or decrease in the amplitude of a positive half-cycle caused by modulation is accompanied by an equal change in the negative portion of the same cycle. To state this algebraically, we could call the amplitude at any given instant $x$, whereupon $x$ when added to $-x$ would be zero for all values of $x$. Adding equal positive and negative values to a quantity produces no change in the quantity, no matter what opposing values are added. And therein lies the explanation as to why average plate current of an RF or IF amplifier in a receiver remains the same whether no signal, an unmodulated carrier or a modulated signal is applied to its grid.

But suppose we increase the fixed negative bias on the grid of our amplifier tube until the plate current is just cut off, as shown in Fig. 5-3. Now any negative-going signal applied to the grid can have no effect, for plate current that already is zero obviously cannot be reduced beyond this point. A positive-going signal, though, will subtract from the negative bias and allow plate current to flow. Further, the greater the amplitude of this positive-going signal, the greater the resulting plate current. Our average plate current now will rise and fall right in step with the average amplitude of the positive half-cycles of the carrier. Far more importantly, this changing average plate current effectively will reproduce the original modulating frequency.

All this should sound familiar. Remember when we combined two frequencies and discovered that the smaller modulated the larger with amplitude variations equal to their difference frequency and then ran the combination through a tube biased to cutoff to obtain this difference frequency in the form of variations in average plate current? We then called the tube a mixer or converter and we named the process heterodying. Now we have a carrier modulated with the varying difference frequencies between that carrier and its twin sidebands. And what we do is pass the signal through a tube biased to cutoff (sounds like a broken record, doesn't it?) to extract the difference, or modulation, frequencies in the form of average plate-current variations. In this case, we call the tube a detector and the process detection.

Though there are several different types of detectors, the power or plate detector just described is used infrequently. Instead, the diode detector shown in Fig. 5-4 is employed almost universally in modern broadcast receivers. The diode can be either a vacuum-tube or solid-state type, since the important characteristic shared by both is that they are about as non-linear as you can get. In other words, they readily pass current in one direction but not in the other, which is precisely the property we need for detection. We shall discuss the tube.

The modulated signal voltage is delivered by the secondary of the...
IF transformer to the plate, or anode, and through R1 and R2 to the cathode of the diode. When the plate end of the secondary is made positive with respect to the cathode by the AC carrier, the plate attracts electrons emitted by the cathode in proportion to how positive it is at that particular time. During half-cycles when the plate is made negative, the plate repels electrons. But electrons attracted during positive half-cycles move down through the IF transformer and R1 and R2 to return to the cathode through the common-ground circuit. And in doing so, they create a pulsing, DC diode current through the resistors with accompanying voltage drops.

These high-frequency pulses charge C1 and C2. However, the values of the components are such that the capacitors do not have time to charge to the peak of the positive pulses or to discharge fully between pulses. Result of this sawing-off-the-peaks-and-filling-in-the-valleys action is to blend together individual carrier pulses. In the end, we have a smoothly-changing DC voltage across C2 and R2 that varies only with the modulation of the carrier. In actual fact, the voltage across R2 is an AC audio voltage superimposed on a DC voltage. But since C4 will not pass the DC component, only the audio voltage is delivered to the audio amplifier.

We still have one more chore for our tired old carrier before we discard it. Large-value R3 and C3 filter out the audio variations in voltage across R2 so the charge across C3 changes only when there is a sustained increase or decrease in overall carrier amplitude. Such fluctuations normally occur when the carrier is subject to fading or when a station of different signal strength is tuned in.

Automatic-volume-control (AVC) voltage developed across C3 from the rectified carrier is applied as automatically varying negative bias to the grids of the mixer and IF amplifier tubes. Thing is, the amount of amplification provided by these tubes varies inversely with the magnitude of negative bias. Any increase in received signal strength tends to deliver more signal to the detector; but this produces more AVC voltage to reduce the gain and cut down on the signal delivered to the detector. Conversely, a decrease in strength of the received signal produces less AVC voltage, permitting the gain of the controlled stages to increase and beef up the signal delivered to the detector. End result is that audio voltage across R2 is maintained at nearly constant value in spite of wide differences in received signal strength.

But how can we hear dots and dashes produced by keying an unmodulated carrier? (Remember that a dead or unmodulated carrier produces no sound.) The answer is simple: we add modulation to the carrier in the receiver before the carrier reaches the detector. To do this we mix the received signal with one generated by a local oscillator called a beat-frequency oscillator (BFO). If the BFO is tuned only a few hundred cycles away from the carrier frequency, it modulates the carrier with a difference frequency falling in the audio range.

We could retune our BFO to beat with each carrier received and mix
the signals at the input of the receiver but a better arrangement is shown in Fig. 5-5. Here the BFO is adjusted to a frequency slightly removed from the IF and is so arranged that its output mixes with the IF signal just before the latter enters the detector. Suppose the BFO is set at 453.5 kc and mixes with a 455-kc IF. Now any signal received will be translated to 455 kc and will be modulated with the 1500-cycle difference frequency between the IF and the BFO frequency. This modulation will be detected in the normal manner and will produce a 1500-cycle tone in the detector output. If desired, the frequency of the BFO can be altered slightly to adjust the pitch of the dots and dashes to suit individual taste.

All our problems have not been solved, however, for our diode detector will not detect FM signals properly. For that matter, the IF stages of an FM receiver are somewhat different, too. Because the FM band runs from 88 to 108 mc, FM sets ordinarily employ a much-higher IF frequency—say 10.7 mc—to improve image rejection. But since the modulating signal shifts an FM carrier back and forth up to 75 kc each side of the center frequency our IF amplifier must pass a bandwidth of 150 kc to accommodate a fully modulated FM signal. We can flatten out the response curve of a tuned circuit by loading it with a resistor placed across the circuit and the response can be widened still further by deliberately stagger-tuning the tuned circuits of the amplifier. Resulting loss of gain can be taken care of simply by adding more stages.

The diagram of a ratio detector used in an FM receiver appears in Fig. 5-6. While we don't have room to explain in detail how the circuit operates, we can discuss what it does. Take a look at Fig. 5-7 to see how the voltage output of a ratio detector is affected by a change in the instantaneous frequency of the input signal. Notice that a voltage is developed as the signal departs from the center frequency. Polarity of this voltage depends on which way the signal has moved and the amplitude of the voltage depends on how far it has moved. Since we know our FM signal is swung back and forth across the center frequency by the modulation we can see that the ratio detector will reproduce both the frequency and amplitude of the modulation.

Still another popular type of FM detector is known as the Foster-Seeley discriminator. The Foster-Seeley responds to both AM and FM signals and, therefore, must be preceded by a limiter stage or stages to remove any amplitude variations in the signal before it reaches the detector stage. A ratio detector, in contrast, inherently rejects AM signals and doesn't require addition of a limiter stage.

NEXT ISSUE: SIGNAL TO SOUND
The TRUTH About That Label

By ROBERT ANGUS  The picture is a confusing one. What one sees depends on what one is looking for. For instance:

• In Wallingford, Conn., a careful housewife checks electric toothbrushes in a discount house to see which ones are approved by Underwriters' Laboratories before making her purchase.

• In Richmond, Va., a city inspector makes an appliance dealer take a Japanese-made tape recorder out of his window because it doesn't carry an Underwriters' Laboratories seal.

• In Daytona Beach, Fla., a retired executive examines an electronic machine that supposedly cures arthritis and is offered by a door-to-door salesman. Seeing a UL tag on the unit, he buys it—only to find that it offers no relief.

• In Oakland, Calif., a confirmed do-it-yourselfer burns his hand on a soldering gun bearing the Underwriters' Laboratories seal.

• And in New York City, a speaker tells the National Electrical Wholesalers' Association that building codes across the country are making it virtually impossible to use electrical equipment not tested and listed by UL in building construction.

What is UL, anyway? And just what guarantees are embodied in its label? When dealing with questions such as these, it's much easier to deal in negatives than positives. For example, UL is not just another consumer testing organization such as Good Housekeeping Laboratories or United States Testing Company. UL tries to make clear that it doesn't approve anything; it merely lists items. Its seal or labels are no guarantee of satisfaction; they guarantee only safety in construction. And the label on the line cord of an electric toothbrush or an AC/DC radio even doesn't guarantee that UL has tested the toothbrush, holder or radio.

Why, then, do some communities insist on a UL label on all electrical products sold by

UNDERWRITERS' LABORATORIES, INC
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stores? And why do many otherwise astute consumers look upon the UL label as a stamp of approval or guarantee of customer satisfaction? Much of the credit for consumer acceptance of the UL label as a sort of papal imprimatur should go to the organization's 50-year public-relations campaign to bring itself to your attention. UL is (and always has been) a nonprofit organization seemingly with no terribly obvious axes of its own to grind, a fact which has helped the public to accept it. There are those, however, who feel that the organization may have oversold itself and its label to John Q. Underwriters' Laboratories, in fact, was created in 1894 by the National Board of Fire Underwriters. At the time, electricity was a relatively new and widely misunderstood source of power. There was a belief that if a light bulb broke (which occasionally happened), it might start a fire in the cloth or celluloid lampshades then coming into use. In other cases, certain electrical gadgets had killed their operators under unusual circumstances.

The underwriters, representing the major fire and life insurance companies, were nervous about the possibility of widespread claims arising from the use of electricity. Accordingly, they bought a building in Chicago, set up an engineering staff and equipped a testing laboratory. The lab's job was to set up standards for construction of electrical (and other types of) equipment, to test models submitted by manufacturers for approval and to encourage the public to buy and use those which passed the test. The UL's job in those days was pretty clear: to save money for the insurance companies by heading off claims.

Since then, UL has grown to an organization employing more than 400 persons in its engineering department alone, with resources in excess of $8.6 million. And it now tests everything from bank safes to line cords; from battery additives and gas-station pumps to soldering irons, tape recorders and hair curlers; from fire escapes to oil furnaces. UL's only concern in testing merchandise, a spokesman tells you, is safety. Will an electrical product start a fire, create injury, possibly kill someone? Will a fire escape stand up under intense heat? Will a fire extinguisher work when it's supposed to, yet not endanger the health of a child who might decide to play with it?

Fire and shock, then, are the two hazards—at least among products you're likely to have in your home—in which UL is interested. To reduce the possibility of either and to reduce the possibility of insurance claims arising from faulty equipment, the Laboratories conduct tests on a year-round basis in specially-built facilities in Melville, N.Y.; Northbrook and Chicago, Ill.; and Santa Clara, Calif. (In Canada, a governmental group, the Canadian Standards Association, serves somewhat the same function and similar governmental testing laboratories exist throughout Europe.)
to move in toward tube because of camera placement; metal projectile ordinarily is held higher to heighten impact. Photos above show tube approximately ⅜-millisecond before and after the impact; photo at far right depicts technician removing all that remains of the CRT.

UL, incidentally, no longer has any connection with the National Board of Fire Underwriters, which went out of business in 1964. It now is affiliated with the American Insurance Association, which elects its board of directors but has no control over day-to-day operations of the organization.

And UL is self-supporting, living in the style to which it has become accustomed through not-so-modest fees for testing and the sale of labels. Not surprisingly, this mode of existence has led some critics to charge that the reason many newcomers to UL testing fail to pass the first time around is so the organization can collect a second fee when it retests.

"That's ridiculous," scoffs UL spokesman Howard Kontje. "We have all the business we can handle. We never have to make work or go out looking for new business."

Even so, the UL listing adds to the cost of the electrical and electronic goods you buy. How much is anybody's guess since most manufacturers aren't talking. But here are some facts: one medium-size manufacturer of electrical cable, sockets, plugs and other equipment has a UL inspector on the premises three hours every working day. The inspector has his own office in the plant and receives a salary and expenses from the manufacturer. (And this is in addition to UL's testing fees and the sale of labels to the manufacturer.)

One high-fidelity component manufacturer says it cost him approximately $750 to have an amplifier tested. "We sold 1,200 units of that model—so the testing alone cost us about 60¢ apiece." Some estimates of UL unit cost have been as low as half a cent on 1,000 ft. of zip cord to $5 each on some tape recorders and other hi-fi components.

Through the years, UL has made some enemies—though they're not easy to find. Those manufacturers who already have UL approval on a product don't want to rock the boat and those who don’t are still hoping for a boat not to rock. Nevertheless, while virtually everybody agrees that UL has done an outstanding job in promoting safety in elec-

[Continued on page 106]
Big BOOM Box

by AL TOLER

GETTING real solid bass out of your stereo system often is like trying to find the pot of gold at the end of the rainbow. First reason good bass is so hard to come by is that at low volume levels your ear's sensitivity begins to drop off around 300 cycles. Strike No. 2 is small speaker enclosures. In many cases the modern trend to bookshelf speakers has resulted in designs that sometimes produce faked bass. Result is there are a lot of midget speakers that really need a swift and hard kick in the low end.

Of course, bass can be increased by cranking up the amplifier's bass control. But since the control takes effect at about 1 kc, it not only raises the bass but increases the mid-range as well. Therefore, though the bass level is increased, the sound still is unsatisfactory.

For knee-bending bass at low volume levels only frequencies below about 200 cycles should be boosted. The low-cost way to achieve this is with our Big Boom Box bass booster.

The booster is a passive (no tubes or transistors) low-pass filter that you connect between your amplifier and speaker to give added oomph to the frequencies below 200 cycles.

For juke-box boom all that's required is a turn of the booster's controls. By advancing R2 the boost at 30 cycles will be about 9db—a real solid window-rattler.

Construction

While layout is not critical—build the booster any way you want—component values are. Under no circumstances substitute a different part for L1 or change the values of C1 and C2. In fact, unless you are trying to keep cost at rock-bottom use quality capacitors for C1 and C2.

L1 is a universal output transformer used as a choke. Cut off the three primary leads and connect to secondary terminals 1 and 6.

Capacitors C1 and C2 are connected back-to-back, that is, connect the positive terminal of C1 to the positive terminal of C2 (or negative to negative). Do not connect the capacitors in series—plus to minus—unless you like distorted sound.

In order to provide an off position for the booster, R2 must be modified. Remove the

When R1 is set full clockwise (wiper to the left) all the signal goes through T1. Since the impedance of T1 gets lower at low frequencies, more bass than treble goes from input to output. C1, C2 and R2 provide additional attenuation of the highs.

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cover by bending the tabs. You’ll see that R2 is a wirewound pot whose resistance wire is wound from one side terminal to the other. The wiper rides on top of the wire. Hold R2 so the exposed rear is facing you and the lugs are pointing up. Using a pair of small diagonal cutters, cut through the wire where it connects to the left lug. To make certain you cut through the wire, cut about 1/16-in. into the form holding the wire. Reach in with a small screwdriver or ice pick and pull the wire away from the terminal, then unwind or pull back a few turns. Check with an ohmmeter to make certain the wiper does not touch the turns when it is fully counterclockwise.

We used phono jacks (see photo), but they cannot be used unless at least one of your amplifier’s output terminals is grounded. On some transistor amplifiers one output terminal is not always grounded.

Using the booster under such conditions will cause the output transistors to be damaged if the metal cabinets of two boosters should touch. To get around this problem, use a two-lug terminal strip (TS1 and TS2) and run a common wire between the input and output lugs (bottom, in schematic) making certain there’s no cabinet connection.

**Using the Booster**

Connect the amplifier to TS1 and the speaker to TS2. Set R1 and R2 counterclockwise—the off position (R1 shorts out T1 and R2 is open). Advance R1 to about 4/5ths of its rotation—a good starting point that will produce a 3db boost at 20 cps. For additional boost just turn R2 slightly clockwise for an additional boost of 3db or so. For more bass continue to advance R2.

The booster is designed for low to moderate listening levels. If you try to produce thundering bass you’re likely to burn out R1 and R2. The booster normally produces a moderate loss of gain, making it necessary to advance the amplifier’s volume control in order to obtain the same effective volume level as when R1 and R2 are in the off position.

**PARTS LIST**

- C1, C2—100 µf, 15 V electrolytic capacitor
- L1—8 watt universal output transformer (Lafayette 33 R 7504)
- R1—20 ohm, 4 watt wirewound potentiometer (Clarostat Series 58. Lafayette 32 R 7295)
- R2—30 ohm, 4 watt wirewound potentiometer (Clarostat Series 58. Lafayette 32 R 7297)
- TS1, TS2—Terminal strip (see text)
- Misc.—3 x 4 x 5-in. Minibox, knobs

*Parts are mounted in main section of 3 x 4 x 5-in. Minibox. R1 is mounted at left, R2 is mounted at right. Output jack is at left, input jack is at right.*

*To add off position to R2, cut wire where it connects to left lug. Then remove a few turns so wiper doesn’t touch wire when turned all way to left.*

**May, 1966**
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trical construction, some electrical experts point to areas in which UL has done less well.

For example, some products listed by UL or carrying a UL label do not perform as advertised and a few don't do the job they're sold to do. An example is the arthritis cure, which turns out to be a little more than an electrical heating pad, carefully insulated and bearing a UL tag.

Why didn't UL refuse to list an item that (later) was considered a fraud?

"That's not our function," Kontje said recently, "although if we found that a unit submitted to us didn't do anything at all we probably wouldn't list it."

The National Better Business Bureau tells the story of a manufacturer of a battery additive who submitted his product to UL for testing as a fire hazard. Upon receiving a listing the manufacturer advertised his product as approved by Underwriters' Laboratories and the product bore the UL seal. UL did nothing until the NBBB protested that the manufacturer was creating the illusion that UL had recommended his product. UL's response was to require the manufacturer to add the words Tested As Fire Hazard Only.

(But in other instances, equipment which has been tested and listed by UL and which has been used in accordance with the manufacturer's instructions has caused injury and started fires.)

As another case in point, the vast majority of AC/DC radios on the market have UL labels on their line cords—despite the fact that some of the sets can be lethal and that the majority of the radios never have been inspected at all by UL.

"There's nothing we can do about that," a UL spokesman says. "The labels are sold to the manufacturer of the line cord, who applies them to his products under the supervision of inspectors. It signifies that the plug, the molding and the cord itself have been tested by us and are being manufactured under our inspection. The manufacturer certainly has a right to display them on his products when he sells them, whether his customer is a consumer, a contractor or another manufacturer." UL's Kontje adds that the tag itself explains (albeit in small print) that it covers the line cord only.

UL also has a tendency to move slowly, an attribute which has acted as a brake on new electrical and electronic industries. High-fidelity components, for example, first began appearing on the market in the late 1940s. Yet it wasn't until 1965 that UL set up standards for testing record changers, amplifiers and tuners as separate items. For this reason, few high-fidelity components have been listed by UL, yet because of local laws only these could be sold legally in such states as Virginia and Oregon as recently as 1964.

The slowness in conducting tests also poses problems, according to Fisher Radio's Fred Mergner. "Whenever we'd come out with a new model," says Mergner, "we'd submit it to UL for testing, putting it on the market at the same time. If the first model didn't pass we'd have to make alterations and submit another. Even if that passed by the time we got the listing it might be a year later and we'd be ready to withdraw it in favor of a new model. But we'd spent all that money with nothing to show for it."

Thing UL has been zealous about is guarding its good name—acting quickly against trade-mark counterfeiters or fly-by-night organizations which have developed similar names.

"Hardly a month goes by that we're not tied up in litigation with somebody about the trade mark," Kontje told EJ. Such fraud usually takes one of two forms: a counterfeit label (sometimes of a regular UL stamp or label by a manufacturer whose product never has been or no longer is listed) or an independent testing laboratory with a sound-alike name.

Although UL in-plant inspectors are in a strong position to cost (or save) a manufacturer hundreds of dollars in the making of a product, there have never been reports of bribes being offered to or accepted by them, so strong is UL's reputation for integrity. It is not unknown, however, for a UL inspector to quit and take a job with a manufacturer whose plant he's been inspecting. In fact, most large electrical and electronic manufacturers have on their top management staffs an executive who once worked with UL. His job consists of liaison with the UL inspector and recommendations to the engineering department regarding product design to meet UL specifications.

To sum up what you should know about that UL label: read the fine print on it. -
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Model HB-500 Small, Quiet, Powerful...only 3” High
109.50  • Mechanical Filter for Razor Sharp Selectivity
• 12 Crystal Transmit and Receive Positions
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HEATH DX-40 and HD-11 Q-multiplier. Will ex- change for tube tester or CB equipment. W. Spitter, Box 248, St. Elmo, Ill. 62458.

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RCA portable TV, Atwater-Kent 511 receiver, other items. Want AM transmitter and antenna tower. Steve Bladek, 46 Lawrence Dr., Paramus, N.J. 07652.

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RCA kinescope, other items. Will swap for trans- mitter or ham gear. Brian Lippey, 169 Polk St., Newark, N.J. 07105.

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RCA 5820 image orthicon tube with camera schematic. Will swap for vidicon camera, CB rig or ham gear. Richard E. Beatie, 1904 E. 114 Ave., Tampa, Fla. 33612.

GLOBE CHIEF 90 transmitter. Will exchange for stereo tape recorder, electric guitar or other stereo equipment. Bob Phillips, Rte. 2, Box 290, Jefferson- town, Ky. 40029.


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(Continued on page 110)
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Continued from page 108

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HEATH TS-5 TV and FM swap receiver. Need transistorized TV, tape recorder and walkie-talkie. R.E. Rosebrough, Rte. 3, Box 75A, Marion, Ohio.
KNIGHT C-100 walkie-talkies and PA system. Will trade for test equipment. Richard Tofness, 4522 Xerxes N., Minneapolis, Minn. 55412.
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TELEPHONE EQUIPMENT, including switches and relays. Will swap for oscilloscope or other test equipment. Lowell Bagley, 13952 Lilard Lane, Dallas, Tex. 75234.
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Notes From El's DX Club

Continued from page 68

months, international broadcasters make much more use of the higher frequencies. As a result, DX in the 19-meter band will be possible from one part of the world or another almost around the clock. The 16- and 13-meter bands also will see increased use and DX in these bands should be fairly good during daylight hours.

Short skip on the higher bands also will be possible from about 0900 to 1500 local time because of increased activity beginning in May. As a result, many stations operating in the U.S. and Canada will be heard with strong signals.

During the night hours DX openings in the 49-, 41-, 31- and 25-meter bands will occur at one time or another. And with sunspots on the upswing transatlantic nighttime DX in the 31-meter band will be possible come summer.

What's New In CB Equipment?

Continued from page 50

Another trend in antennas is the slow migration of the mobile loading coil to the top of the whip for improved efficiency. But the big blast in the antenna field emanates from Hy-Gain. This company has pulled out all stops with a massive antenna whose signal well might ignite a ball of steel wool at twenty paces. And unlike a Volkswagen, the new Duo-Beam 10 will make your house look smaller. For in Hy-Gain's search for more power within that 20-ft. height limitation, they've expanded not vertically but horizontally.

The antenna, which allegedly converts a 5-watt CB signal to 120 watts, consists of two five-element beams stacked side by side and aimed by a heavy-duty rotator. The big Duo-Beam 10 is tagged at $99.95, with lesser models scaled down at $69.95 and $39.95. No one at Hy-Gain will predict the range of a Duo-Beam 10 but it just may give you a mile a dollar under the right conditions.

So the new CB equipment generally promises to be cool, well-behaved and agile at receiving weak, congested stations while shooting signals farther than ever. At some of those prices, who's complaining?

May, 1966
involved. Apparently much justification was found for ending the man's activities.

Is anyone cheering the new rules? No one seems to be delirious with joy but there are positive observations. The rules didn't clean up the band overnight. Yet there is plenty of agreement that for valid use, 16 channels now are less laden with QRMs. Another bright note is from a CB manufacturer. He breathed a sigh of relief when the rules became effective after years of languishing in the proposal stage. "The other shoe has dropped," he said, "and we now can get on with our business."

One shrewd conclusion by the manager of another company: "Consider the guy just getting into CB—the one who comes in under the new rules. He can't complain. He hasn't lost anything."

Finally, you might subscribe to the most optimistic explanation of all. It's the Rip Van Winkle theory of the new regulations. Let's say Old Rip took out his license in September 1958 when the Class D band began. And he operated within the spirit and letter of the old-old regulations, then took a snooze until 1966. After shaking dust from his old superregen rig, chances are he could communicate his business and personal traffic with barely a change from the good old days.

Does this mean that CB's future is secure? The field has its share of CBologists who predict panic on one hand, boom on the other. Here's how we size up CB and its new rules:

We now have some 1 million CBers who have shelled out may be $200 million for equipment. And if past FCC performance is any indication, we foresee no disastrous assault on CB-land. In many decisions of the past the Commission has taken careful note of the public's investment in equipment and has protected it. Examples are technical decisions for color TV (whose images you can pick up in black and white) and stereo-FM (which doesn't obsolete old-time tuners). In the marine field, boat owners were given years to change over to new equipment when higher power became law. In short, if the FCC slaughters CB, it will run neither true to form nor be responsive to a sizable segment of the public. And it should be recalled that the Commission is an extension of the public—not vice versa.

You don't have to be a cockeyed optimist to believe that the new rules ultimately may prove to be a good thing. One reason is that the FCC had to do something about excesses on the band or that agency would have failed to live up to its function, which is to regulate communications. Now that its action is a reality one might say it could have been far worse.

CB still is a viable medium if you want to use it as prescribed back in 1958—for business or personal messages. And who knows? Through some stretch of logic, maybe those seven channels really were created to give the loose operator someplace to go and leave ample room for the upright, law-abiding CBer.

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**CB Corner**

Continued from page 51

forthwith. This mistake runs about $6 per.

Another little-known cause of transistor breakdown lurks in the ignition system of your car. As the starter kicks over the engine, voltage from the battery (and thus the whole electrical system) slips down to as low as 9 volts in a 12-volt system. Then the engine catches. Starter stops, voltage jumps back up. Thing is, this kind of electrical surge may create a voltage spike across the transistor and sluice up the precious silicon. Result: another six bucks cooked.

Morals of our little story are two. First, never operate solid-state with no antenna connected. And be sure the rig's power switch is off before you start the car.

**Hot-Shot Tubes** . . . Some CBers imply that special tubes can work Mars on a clear night. Tube manufacturers do, in fact, offer lines of premium, high-grade tubes that go smack into the sockets of ordinary ones. But is Mars the thing the premiums were made for?

Answer is yes—and no. Point is that these super tubes are largely for industrial and military use. And unless you operate at an altitude of 50,000 feet, accelerate at the G-forces of Gemini or cruise around the Libyan desert, such tubes are a questionable investment.

If you insist on boasting about a jazzy 6201, it'll cost you $2.95 for the privilege. And that works out as roughly twice the price of a homely but fully satisfactory 12AT7.

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How To Eavesdrop

Continued from page 82

His particular station was identified only as Amur ja Lena, and he claimed that he would listen to it each day for his instructions. He copied down all of the numbers sent and then subtracted those numbers from other numbers appearing on a printed card in his possession (a different code-card was used each day). The result of this computation produced a series of numbers which then were related to the positions of letters in master sentences such as The quick brown fox jumps over the lazy dog or Now is the time for all good men to come to the aid of the party.

Let's say that he received a message reading: 2-2-4-7 2-6-4-6 6-5-9-4. Looking at his current code card, he then copied down its first 12 numbers, say: 21-5-7-8 14-12-5-8 36-22-39-20. Subtracting the transmitted numbers from these would provide him with 19-3-3-1 12-6-1-2 30-17-30-16. And checking these figures against a master code sentence for numerical position of the letters would present the actual message: MEET WITH AJAX, for example. Obviously, this isn't a very complicated code, but it also just as obviously is one which no one (no, not even the most adroit computer) ever can break.

And so it goes, with the various espionage headquarters competing for better signal strength and finer audio (just like on the ham bands) and the various agents using quite conventional gear to hear home base. Thousands of DXers in all countries meanwhile stand aghast at the thought of being afforded this most intimate glimpse of actual espionage operations.

Matter of fact, anyone with a short-wave receiver can do some espionage eavesdropping by keeping careful check of frequencies between 3 and 7 mc, where most of these stations congregate. (An actual spy message monitored at 1907 EST on Nov. 17, 1965, was broadcast in Spanish on 4226 kc and read as follows: 30245 52104 54872 10894 96531 23995 39851 22967 90913 27568 48745 20440.) People reading groups of numbers over the air might seem straight from some fantastic TV plot but evidence says they are not. For this is the real thing— even tomorrow's headlines!

Watch Out . . . Carbon tetrachloride, a common dry-cleaning fluid, usually is suggested for cleaning crystals. Unfortunately, its fumes are highly toxic and several deep whiffs can bring on a liver ailment called hepatitis. So be warned. If you want to give your prize rocks a going over take them out of the shack and into the open air. And always work with the wind blowing away from you.

Stamp Act, 1966 . . . When we casually showed our dentist a couple of foreign QSLs he asked eagerly, "Can I have the stamps? They're new ones to me." He almost wept when we said we had drawers full of similar cards.

Naturally, he visited our shack and became so excited about the philatelic possibilities of ham radio that within two months he had his General ticket and was on the air himself. Now he's practically supporting the post office with his purchases of airmail stamps for his outgoing cards and International Reply Coupons for the requested incoming ones.

He also says that ham radio, being a sitting-down activity, is great for a man who works all day on his feet.

The Ham Shack

Continued from page 92

stick-shift cars). Connect this in the relay control circuit, wear one of those lightweight, telephone-operator style headsets and you're in business.

May, 1966
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him of the possible results and penalties is known only to the staffer who wrote the letter. It is easy to see, however, why the engineers failed when it came to "observing the station in operation."

As the summer and the tests wore on the Blue Eagle was reported next on 9530 kc and then 13680 kc. Then it disappeared, later to turn up in Santo Domingo during the thwarted revolution there. Communications on the ground were in a sad state at the time and the airborne station could fill many needs. From there the plane presumably headed west for it soon was being picked up by DXers in California and Washington State.

Despite the measured success the Blue Eagle had achieved in Santo Domingo, the project was not wholly accepted. The Connie, it turned out, was badly overloaded. Such a plane normally has a service ceiling of about 24,000 ft. but that's with a normal load. All that radio and television equipment held it to a much lower altitude. With a mighty grunt the Blue Eagle was able to top 10,000 ft. It was not sufficient to gain a really commanding range for the equipment aboard, particularly for the UHF TV transmitter. The bird started turning into a white elephant. According to one report, the Voice of America was asked whether it had a use for the plane. It declined.

The Blue Eagle next turned up on a Pacific island, reported variously as being either Wake or Okinawa. And there it rested. One rumor that seeped back to the States had the Blue Eagle carrying a small band of nurses to Southeast Asia for a week end. What started out as a lark turned to near tragedy when the plane lost an engine on take-off. It did limp home, however, and settled down for another snooze.

At that point many who knew officially or unofficially of the Blue Eagle considered the project permanently asleep. But the big bird seemingly was playing possum.

At the turn of the year came an announcement out of official American circles in Saigon that revealed the presence in Vietnam of a plane outfitted with, amongst other things, two UHF television transmitters. The [Continued on page 120]
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May, 1966
plane, a Navy Super Constellation, would circle above Saigon, said the announcement, and would transmit programs simultaneously in Vietnamese and in English.

As might be expected, there was one slight hitch. No one amongst the Vietnamese populace owned a TV set, no store in the country could sell one and the Americans had failed to bring sets with them. Naturally, plans were afoot to rectify this situation. A thousand TV sets, it was said, had been ordered by the U.S. aid mission for distribution to groups of Vietnamese, and the American military command planned to bring in 500 receivers. There was one more surprise: the one flying TV station suddenly had turned into two. Now there was a Son of Blue Eagle.

But that would be another story.

CB's Biggest Boondoggle

Continued from page 61

Moore had suffered a heart attack and had been taken home. He was seen leaving the grounds.

By this time, tempers had reached their highest point and isolated disorders had started to break out. In the confusion, a number of CB dealers and tradesmen, who had left their booths unattended while finding out the status of the Jamboree, quickly were relieved of most of their wares.

About an hour after Moore left the Jamboree, sheriff's deputies and state police arrived on the scene. While there was no violence to be taken care of, a number of CBers were discussing the problems of the day in a highly agitated tone (the sheriff called them loudmouths).

Larry Hensler, who said that he was an employee of Moore, announced formal cancellation of the Jamboree at 6 p.m., then promptly closed himself in a building when reporters and CBers tried to speak with him. Richard Honoshofsky, who worked Saturday night and Sunday morning parking cars, tried to see Hensler about being paid the $3 per hour he had been promised. Hensler said he would be contacted later.

A mother of one of the beauty-contest entrants complained she was charged $3.50 for a chest ribbon which all contestants were required to have. The mother argued that advance publicity said all contests would be free.

By this time, the chair-and-table rental man was looking for his $700. And the tent man was grumbling that he already had initiated legal action to get his $2,000.

Within a week after the Jamboree, the Lorain County Prosecutor's department had started an inquiry into the tangled mess, the result of many complaints which had poured in. Contest winners, employees and others wanted to be paid. Even the members of the Lake Erie CBers, Inc., a local club, were wondering if they ever would be paid the $5,000 they said Moore owed them. It seems the idea for the Jamboree had been theirs and that Moore had bought it from them with a note.

Lake Erie CBers eventually obtained a judgment for the $5,000 against Moore, his wife and the Loraine County Caravan Club, Inc., of which Moore was president. But they had little luck immediately in collecting the money, judgment or not. Representatives of a bank were summoned to court to discuss Moore's assets.

As is readily apparent, The Lorain County CB Jamboree And Campout became quite a boondoggle. The Moores left Elyria. Though both sheriff and prosecutor examined the affair, no charges were filed. The CBers involved would just as soon forget the whole thing. Which none of them is likely to do.

Hi-Fi Today

Continued from page 38

FM stations may not duplicate more than 50% of their sister station's AM programing is going to give stereo-FM a boost. Several stations, including New York's potent WABC, have expanded stereo programing to fill the void left by the departing AM material. And more are promising to follow suit shortly.

An important development on the FM front is the increasing number of CATV (community antenna television) concerns offering stereo-FM as well as TV to their subscribers. Benefit here is precisely what it is in the case of TV—a chance for many people to get more and better stereo than they normally could.
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- Basic Electronics
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