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RANDY ACERMAN, Camden, N.J. has his own TV service business. He is the official TV repair center for the Radio Shack store and Goodyear Tire Co. in his area. He says, "I have seen other schools' texts and most can't hold a candle to NRI lessons."



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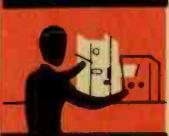
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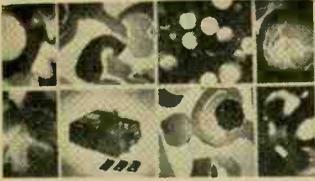
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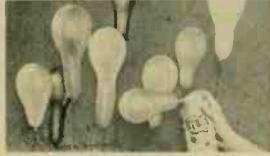
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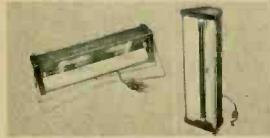
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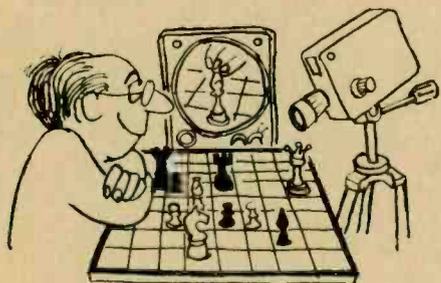
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● LATE CONTESTER

I heard about your contest where the top DXer gets to choose his favorite country and then you pick up the tab to fly him there. But I can't find your July issue anymore and I don't want to miss out on all the fun. Where can I turn for help?

Paul Martinez
Houston, Texas

Right inside, Paul.



● KB4 TO SSTV

I read your story on SSTV (BUDGET TELEVISION FOR HAMS, July '71 EI) and I find it a fascinating facet to an exciting hobby. Can I show a lot of live action such as a polo match or a train wreck?

Charles B. Snyder
Los Angeles, Calif.

Well C.B.S., (Dig those initials), we don't advise it. The result will undoubtedly be a smear. The slow scanning rate is good for sports like, uh, well, like chess.

● SCA AND THE LAW

Your May '71 issue carries a story on building an SCA adapter (FOR SOOTHING MUSIC AROUND THE CLOCK . . . BUILD OUR SCA ADAPTOR) that raises several questions of legality. For instance, I have read that if you are found with one of these things in your home you are subject to a stiff fine. You wouldn't let your readers in for a stint in the poke, would you?

Zachary Muse
Trenton, N.J.

Talk about a Pandora's box! Everyone seems to be concerned about being thrown in the hoosegow for playing some corny

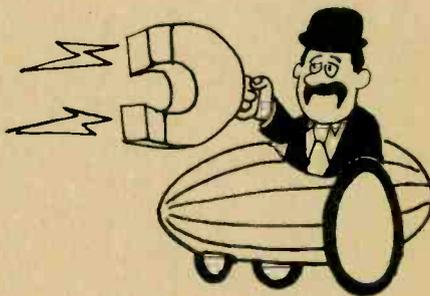
music. Technically there may be some basis to what you say. But it is also against the law for you to tell your wife what your mother-in-law just said on the phone (Secrecy of Communications Act). You don't see anyone jumping out of the closet and arresting you, do you? So, don't sweat the SCA bit. If you're so neurotic, you're going to need something to calm you down, so it might as well be SCA.

● FUZZ FLYING TV

Caught your recent story about the police bands in UHF (THE FUZZ FLIES TO UHF, July '71 EI) and it was a groove. Very informative. Actually, I've been digging the action for some time now, using an old UHF converter for my TV set. Works just fine and when I get tired I can turn on Mister Rogers on one of the neighboring educational channels.

Ron Sullivan
Philadelphia, Pa.

● MAGNETIC EXPRESS



Hooray for the Electric Car (WE GO FOR THE WORLD'S LAND SPEED RECORD, July '71 EI). It's about time somebody came up with a non-polluting machine. It reminds me of those old movies where the hero would hang onto a big magnet and drag himself behind a truck. Now that's what I call clean driving.

Stanley S. Teamer
New York, N.Y.

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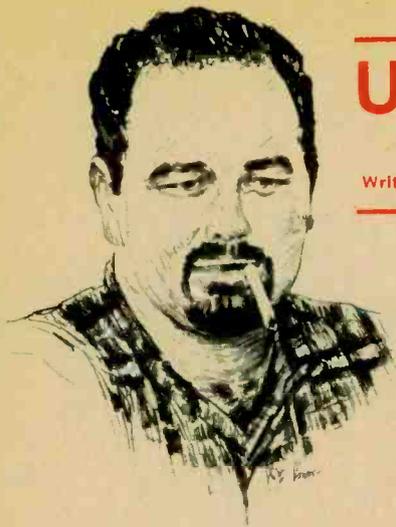
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G.I. Bill



Uncle Tom's Corner

By Tom Kneitel, K2AES/KBG4303

Uncle Tom answers his most interesting letters in this column.
Write him at Electronics Illustrated, One Astor Plaza, New York, N.Y. 10036.

★ Every summer when my father turns the cows out to pasture he puts on the electric fence charger. Every time the charger buzzes I get a bar across my TV set. What do you think about this?

Harlan Branham
North Vernon, Ind.

If the bartender is a nice guy I think you've got it made.

★ What is this station I hear about 2310 GMT on 15.004 mc? Every 10 minutes it ID's in CW "VVV CQ DE RID." I can hear it right through QRM from WWV. Can I get a QSL? Help!

Tom Williams
Hamburg, N.Y.

Wish I could help you, Tom. RID is a mystery station. Believed to be in the USSR, it has been sending time signals for several years now. It has never appeared in any Ruskie lists of these stations so it's probably a military installation, maybe connected with their program for space travel or perhaps missile defense.

★ Recently I heard a station sending CW on about 9.5 mc. The message was simply the number 29934 repeated over and over again. What station was this?

W. L. Milus
Plymouth Meeting, Pa.

As a wild guess, I would say it was station 29934.

★ What's the story on those alarms for traf-fic radar? Are they really effective or do they

sound off while the speeding ticket is being written out?

Pete Skillman
Schenectady, N.Y.

They give you sufficient warning to safely drop your speed 5, maybe 8 mph before you enter the speed-meter clocking zone. If you're doing the Mario Andretti act in a 30-mph zone, forget it.

★ At 6:15 A.M. on 3300 kc I heard a woman reading the following numbers which I have translated from her Spanish: 2847 5756 3969 7929 4574 7323. This was probably a secret spy message and I was wondering if you could get it deciphered for me.

P. M.
Cleveland, Ohio

P.M., you missed part of the message. The beginning goes, "This portion of Sesame Street is brought to you by the numbers . . ."

★ I have been repairing my own eight-track tapes for a while now and I have found the biggest problem to be the splicing torn ends. Besides an automatic splicer, is there an easy way to do this?

T.J.O.
Denham, Mass.

You can get special splicing tape but I have had pretty good luck with Scotch Magic Tape (household variety). Just snip the ends of the recording tape diagonally so they match, stick on the sticky stuff and trim off the excess.

★ I missed that experimental station KC2-X10 which you commented on a few months back, but here's one I'd sure like to nail down. It uses the call sign KB2XYO and is heard on about 8 mc.

Harry Marx
New Iberia, La.

You picked up an experimental transmit-
[Continued on page 10]

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CIRCLE NO. 8 ON PAGE 23

Uncle Tom's Corner

Continued from page 8

ter operated by Hy Gain Electronics in Lincoln, Neb. They operate on 2232, 8000 and 21357 kc and use the rig for testing antennas for the U.S. Navy. If you write to them for a QSL, tell them Uncle Tom sent you. They're old buddies of mine.

★ *Your picture always shows you smoking a cigarette. Don't you read the newspapers?*
Mrs. Virginia Tuttle
Golconda, Nev.

Yes, but my picture doesn't.

★ *For several years now I've heard talk of an incident involving an SWL radio program series that was on shortwave station WRUL (now WNYW) back in the early 60s. Somehow or other you were involved—I think! What happened, or is it a lot of talk?*

Howie Grannito
Duncan, S.C.

The story is that when I went to work as editor of the old DXing Horizons magazine, the publication had a weekly series on that station. My first editorial assignment was to do a story on Radio Swan and its CIA operations. We uncovered many things which led us to believe there was some sort of CIA relationship with WRUL. Just as a lark, we sent WRUL a tape for the broadcast which mentioned our forthcoming Radio Americas story. We mentioned the CIA ties but didn't say anything about WRUL on the program. Nevertheless, WRUL refused to broadcast the program and cancelled the entire series. Funny about that.

★ *In my search of surplus shops I recently came across a receiver which covers 375 mc all the way up to 1,000 mc in one shot. It's a Stoddart NM-50A and the price is about \$300. Can you offer any advice on this set? The several surplus dealers I've asked say they are plentiful but that they don't have any real data on it.*

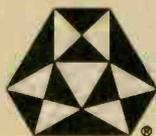
Allen Russell
Sparta, Mich.

[Continued on page 14]

*the tape that
turned the
cassette into
a high-fidelity
medium*



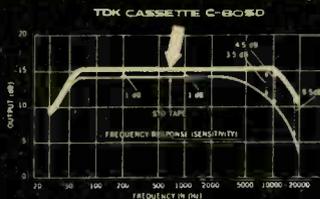
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TDK

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LONG ISLAND CITY, NEW YORK 11103



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NEW GR-371MX 25" square-corner solid-state color TV kit

NEW GD-29 microwave oven kit

NEW IB-101 solid-state 15 MHz frequency counter kit

NEW IB-102 175 MHz solid-state frequency scaler kit

NEW IO-102 solid-state 5" scope kit

NEW IM-105 solid-state VOM kit

Seven new Heathkit® improvement ideas for home or shop

NEW! Heathkit IR-18M 10" chart recorder kit provides 12 different chart speeds...instant pushbutton selection from 5 sec/in. to 200 min/in. Digital logic delivers accuracy unobtainable with ordinary gear trains. Two input ranges permit accurate measurements from 0-1 & 0-10 mV full scale. Hi-Z input minimizes loading. 3-terminal floating input. Light-operated modulator eliminates problems of a mechanical Chopper...operates at 240 Hz to reduce 60 Hz noise. Internal temperature-stabilized reference voltage eliminates troublesome reference battery. Coarse & Fine zero controls allow fast, accurate pen positioning. Other features: versatile pen holder that accepts virtually any writing instrument & hinged top for easy paper loading. For the best value going in a chart recorder, order your IR-18M now. Kit IR-18M, 15 lbs., 149.95*

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NEW! GD-29 microwave oven...the most modern way to prepare food. Cooks up to 70% faster with better vitamin retention. Cooks on glass, ceramics, even paper plates. Low profile design fits under cupboards easily, yet has one of the largest oven capacities in the industry. Operates anywhere on standard 120 VAC current. Kit includes specially prepared cookbook. Kit GD-29, 97 lbs. 379.95* Roll-around cart gives oven easy mobility, Model GDA-29-1, 24.95*

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NEW! IO-102 solid-state 5" scope ideally suited for general purpose service & design work. Features wide DC-5 MHz response, 30 mV/cm sensitivity and 80 ns rise time. Switch-selected AC or DC coupling for greater versatility. Frequency-compensated 3-position attenuator. FET input provides hi-Z to minimize circuit loading. Recurrent, automatic-sync type sweep provides five ranges from 10 Hz to 500 kHz with vernier. External horizontal and sync inputs are also provided. One volt P-P output provides an accurate comparison voltage source. Additional features include a big 5" CRT with high visibility trace; 6x10 cm ruled graticule that can be replaced with a standard camera mount; solid-state zener-regulated supplies for extra display stability and 120/240 VAC operation. An excellent all-around scope that belongs on your bench now. Kit IO-102, 29 lbs., 119.95*

NEW! IM-105 solid-state portable VOM...an extremely rugged, high-ly accurate, low cost meter for hundreds of applications. High impact Lexan® case and ruggedized diode & fuse protected taut-band meter movement will suffer extreme abuse and still maintain specifications. 95° wide viewing area provides high resolution. 3% DC accuracy; 4% AC accuracy; 3% DC current accuracy. Temperature compensated. 8 DCV ranges from 0.25 to 5000 V full scale...7 ACV ranges from 2.5 to 5000 V full scale...6 DC current ranges from 0.05 mA to 10 A full scale...5 ohms ranges from x1 to x10k with center scale factor of 20...5 dB ranges from -10 to +50 dB. Other features include DC polarity reversal switch; front panel thumbwheel ohms zero; self-storing handle and fast, easy assembly. A lot of meter at a little cost...that's the new IM-105. Order yours now. Kit IM-105, 7 lbs., 47.95*

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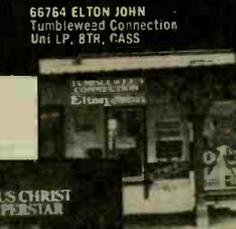
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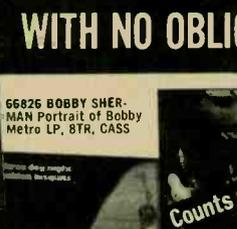
66764 ELTON JOHN
Tumbleweed Connection
Uni LP, 8TR, CASS



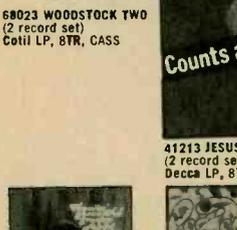
33184 DIONNE WARWICK
Very Dionne
Scept LP, 8TR, CASS



66826 BOBBY SHERMAN
Portrait of Bobby
Metro LP, 8TR, CASS



66030 CROSBY STILLS NASH & YOUNG
Four Way Street
(2 record set)
Atlan LP, 8TR, CASS



68023 WOODSTOCK TWO
(2 record set)
Cotil LP, 8TR, CASS



41213 JESUS CHRIST SUPERSTAR
(2 record set)
Decca LP, 8TR, CASS



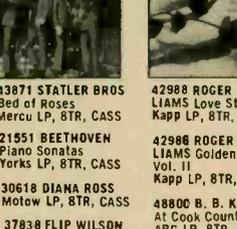
67517 THREE DOG NIGHT
Golden Biscuits
Dunhl LP, 8TR, CASS



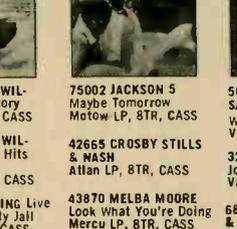
65797 GABOR SZABO
Blowin' Some Old Smoke
Budda LP, 8TR, CASS



42780 LED ZEPPELIN III
Atlan LP, 8TR, CASS



37633 ROD MCKUEN
In The Beginning
Sunsle LP, 8TR



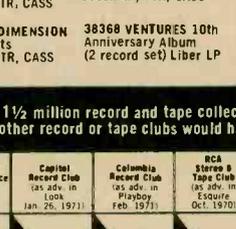
43871 STATLER BROS
Bed of Roses
Mercu LP, 8TR, CASS



42988 ROGER WILLIAMS
Love Story
Kapp LP, 8TR, CASS



44765 SHIRLEY BASSEY
Is Really Something
UniAr LP, 8TR, CASS



21551 BEETHOVEN
Piano Sonatas
Yorks LP, 8TR, CASS



42986 ROGER WILLIAMS
Golden Hits
Vol. II
Kapp LP, 8TR, CASS



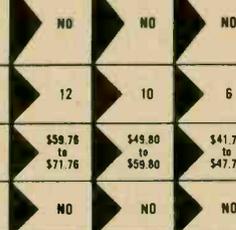
75002 JACKSON 5
Maybe Tomorrow
Motow LP, 8TR, CASS



50506 BUFFY SAINT-MARIE
Wanna Be A Ballerina
Vangu LP, 8TR, CASS



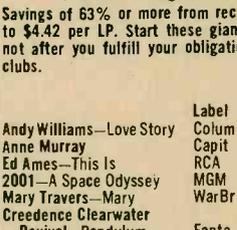
33182 SUSAN SINGS
SESAME STREET SONGS
Scept LP, 8TR, CASS



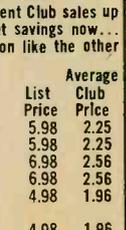
41217 BERT KAEMPFERT
Orange Colored Sky
Decca LP, 8TR, CASS



37838 FLIP WILSON
Flipped Out
Sunsle LP, 8TR



48800 B. B. KING Live
At Cook County Jail
ABC LP, 8TR, CASS



42665 CROSBY STILLS & NASH
Atlan LP, 8TR, CASS



43870 MELBA MOORE
Look What You're Doing
Mercu LP, 8TR, CASS



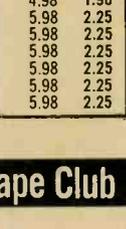
68019 EMERSON, LAKE & PALMER
Cotil LP, 8TR, CASS



21633 RED ARMY ENSEMBLE
Yorks LP, 8TR, CASS



38373 IKE & TINA TURNER
Workin' Together
Liber LP, 8TR, CASS



33099 PDA BACH
Stoned Guest
Vangu LP, 8TR, CASS



16595 VIRGIL FOX
Bach at the Fillmore
Decca LP, 8TR, CASS

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66738 NEIL DIAMOND Tap Root Manuscript Uni LP, 8TR, CASS



55793 BREWER & SHIPLEY Tarkio KamSu LP, 8TR, CASS



38376 CANNED HEAT 'N JOHN LEE HOOKER (2 record set) Liber LP



42784 STEPHEN STILLS Atlan LP, 8TR, CASS



66709 ORSON WELLES Begatting of the President Media LP



65784 MELANIE Letover Wine Budda LP, 8TR, CASS



41537 TCHAIKOVSKY 1812 Overture Yorks LP, 8TR, CASS



41152 WHO Tommy (2 record set) Decca LP, 8TR, CASS



33185 JOSEPH & THE AMAZING TECHNICOLOR DREAMCOAT Scept LP, 8TR, CASS



33183 B. J. THOMAS Most of All Scept LP, 8TR, CASS



67519 STEPPENWOLF Gold Dunhl LP, 8TR, CASS



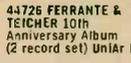
33092 BEST OF BUFFY SAINTÉ-MARIE (2 record set) Vangu LP, 8TR, CASS



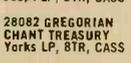
44746 DUKE ELLINGTON 70th Birthday Concert (2 record set) So!St LP



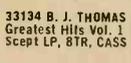
33179 DIONNE WARWICK I'll Never Fall In Love Again Scept LP, 8TR, CASS



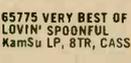
44726 FERRANTE & TEICHER 10th Anniversary Album (2 record set) UniLP LP



28082 GREGORIAN CHANT TREASURY Yorks LP, 8TR, CASS



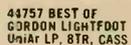
33134 B. J. THOMAS Greatest Hits Vol. 1 Scept LP, 8TR, CASS



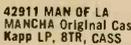
65775 VERY BEST OF LOVIN' SPOONFUL KamSu LP, 8TR, CASS



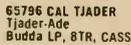
33065 JOAN BAEZ David's Album Vangu LP, 8TR, CASS



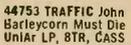
44757 BEST OF GORDON LIGHTFOOT UniLP LP, 8TR, CASS



42811 MAN OF LA MANCHA Original Cast Kapp LP, 8TR, CASS



65796 CAL TJADER Tjader-Atlan Budda LP, 8TR, CASS



44753 TRAFFIC John Barleycorn Must Die UniLP LP, 8TR, CASS

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CIRCLE NO. 7 ON PAGE 23

Uncle Tom's Corner*Continued from page 10*

Actually, it was designed to trace down RFI (interference) and it is really not intended for communications work, although technically, I guess, it must be considered a receiver. Its bandwidth is a megacycle wide at 375 mc, and gets wider as the frequency increases; the sensitivity is a poor 10 μv . Nevertheless, it's worth about three-grand factory fresh and more than \$1,000 on the surplus market. My guess is that the one you have located has none of the books and charts which are necessary to find out how to work the set. Rigs in that condition are plentiful and are next to worthless unless you are an electronic engineer.

★ I've read and reread all of the many problems facing the CB radio service and I've seen scores of suggestions on straightening out the mess. I must confess that I still don't really understand what the whole crazy mess is all about. Does anybody?

*Carl Werner
Avon, Mass.*

There are only three people who really understand it. One is dead. One went insane. And I don't want to talk about it.

★ As a news reporter I get the opportunity to cover some pretty hairy events. At some of the more spectacular, such as accidents, aircraft crashes etc., I see American Red Cross mobile units on the scene. All of them have radio communications equipment in use and I was wondering if you could find out the Red Cross channels in Kentucky. The antennas are low-band (30 to 50 mc) jobs.

*Eric Varden, Sr.
Lexington, Ky.*

The Red Cross uses the same channel throughout the country, 47.42 mc.

★ I've had several of my DX reports to Radio Peking bounce because of improper address. Aren't they in Mainland China anymore? How do I get a letter there?

*Max Waters
Bellingham, Wash.*

[Continued on page 25]



S-120A,
"Star Quest"



SX-133

S-214



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HA-20

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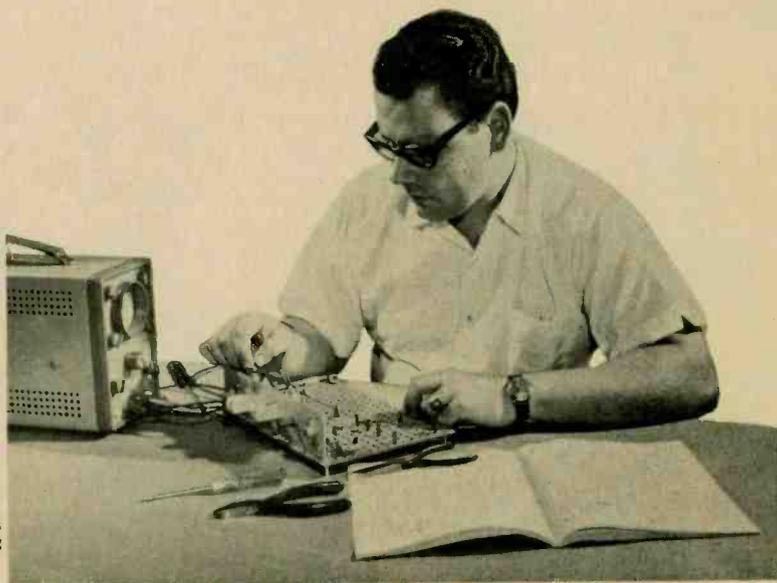
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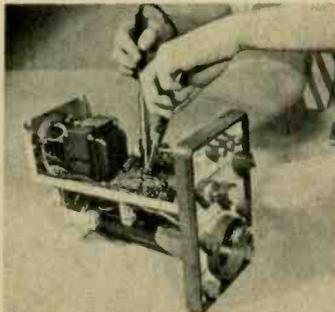
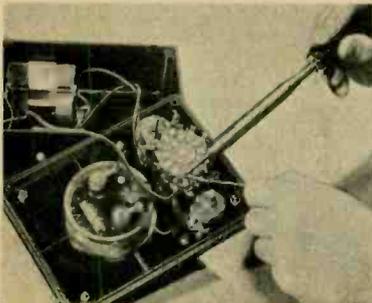
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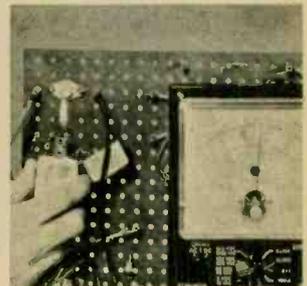
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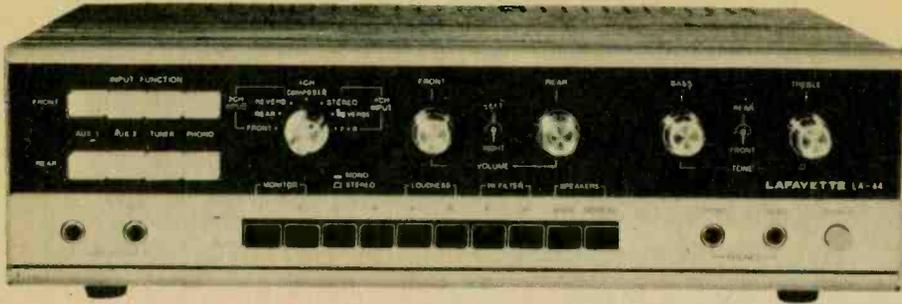
Construction of Multimeter.



Construction of Oscilloscope.

Temperature experiment with transistors.





BEHOLD the Four-Channel Wars. Lafayette Radio has plunged into the combat with the LA-44 four-channel amplifier (top) and Dynaquad 4-Channel Adapter (right). LA-44 has 25 watts per channel (rms) for four discrete sources. Dynaquad adapter uses ambient info on all two-channel programming to produce four-channel sound. \$220 and \$30 respectively. Lafayette Radio, Syosset, N.Y. 11791.

Electronic Marketplace



Light Reading. In addition to digital readout, Triplet has added a *half-digit* feature for decimal readings. Model 6028 Digital VOM has push-button function selection, 100 per cent over-range and AC freq. compensator. \$275. Triplet, Bluffton, Ohio 45187.



Movin' CB. Dynascan's Cobra 6 is designed for mobile use. It has six-channel capability (one crystal supplied), illuminated power/S meter, ANL pushbutton channel selection, external speaker jack and 117-V power pack for base use is optional. Dynascan Corp., 1801 W. Belle Plaine Ave., Chicago, Ill. 60613.

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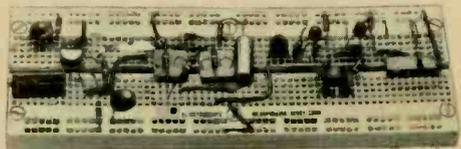
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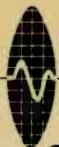
WWV on 5, 10 and 15 mc. An adaptor for CHU in Canada is also available. Complete kit of parts is \$74.95 and the wired version is \$94.95 Caringella Electronics, Inc., Box 327, Upland, Calif. 91786.

Unleavened Breadboard. If breadboarding new circuit designs is a problem, the EL Socket offers a handy cure. Just plug components in the sockets. Each terminal has five tie points; one for the component lead, three for connect-



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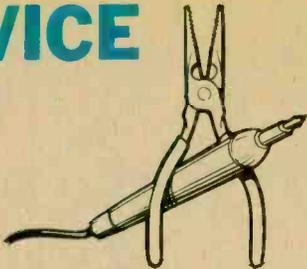
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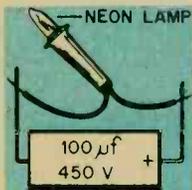
SERVICE TIPS

By
ART MARGOLIS



THICK rugs and solid-state circuits do not mix. If you build up a static charge as you walk across rugs, don't touch FM radio or TV antennas while so charged. Make sure you discharge yourself to a radiator or something else first. These static charges have the ability to blow a front-end transistor if they are injected into the antenna.

Quick check for suspected leakage in a filter capacitor is to charge it up and then attach a neon tester to the leads. If there is little or no leakage the neon will stay lit. If the neon gradually goes out the filter is leaking badly.



Those little TVs can develop troubles you've never seen before. Case in point is the condition of circuit breakers constantly popping. The cause—the anode lead from the high-voltage system to the CRT is rest-

ing against the CRT aquadag coating. Every time it sparks it draws enough current to open the circuit breaker.

A good way to clean out dust in a chassis is with a dry paint brush and vacuum cleaner attachment. Brush the dust gently between the components and suck it up with the attachment. Exercise caution if the attachment is metal like many old ones are. Be sure the chassis is not plugged in! If it is and the vacuum and chassis have opposite polarity, sparks will fly that could damage the cleaner or you.

Trying to decide whether to build your test equipment into a neat wall? Don't do it. Test equipment portability is a must in a service shop. Best bet is to build or buy some sort of roller cart to put all your large test pieces on and then roll the equipment around the shop. That's a lot easier than trying to move a disassembled TV.

Lots of small appliances are purposely designed as throwaways. That's why they seem almost impossible to repair. They are little economic booby traps unless you are careful. Try not to get hooked into losing money on these gadgets.

If you use a photocell to control your outdoor lights and the system does not function after an electrical storm, do not try an immediate repair. It is highly unlikely that the cell was hit by lightning. Photocells often become blinded by high-intensity light such as bright flashes. This difficulty usually wears off after a period of time and your cell should get its sight back in a short while.



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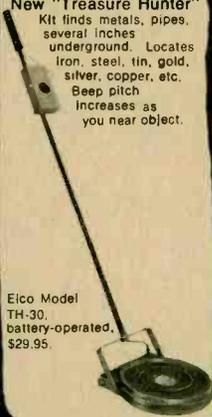
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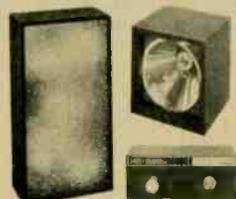
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Uncle Tom's Corner

Continued from page 14

Mail to Peking should be addressed to the People's Republic of China because they refuse all letters addressed to Mainland China, Red China, Communist China or whatever. Likewise, mail to Radio Pyongyang should go to the Democratic People's Republic of Korea.

★ *Here's a simple and basic question. Different stereo manufacturers rate their equipment with different wattage levels—peak power, IHF, rms, etc. This is sort of confusing to someone not too well up on these shadings of words. What's a suitable, non-complicated, guideline to use?*

*Ray C. Andrew, Jr.
APO, New York*

To grossly oversimplify it for you, I would say to use the rms (sine wave or continuous) power rating as your prime consideration. And don't forget these other stereo buying facts: Stereo amplifier power ratings are the total of both channels (a 100-watt amplifier is 50 watts per channel). Also it's well to remember that an amplifier running with only 5-watts output will probably bust all the bases in the house. Don't get hung up on power output levels.

★ *I remember seeing a ham radio station at the 1964 New York World's Fair but, nobody else seems to remember it. Can you help?*

*Kenneth R. Peach
Short Hills, N.J.*

You're probably talking about the strange ARRL-sponsored debacle, K2US, which was located at the Pepsi Pavilion. Hidden away where few people would see it, it was all but impossible to be utilized by visiting ham operators because of the rudeness and security measures of the operators. Eventually somebody set up another station, W2USA, at the Venezuelan pavillion so that ham radio might get a fair shake at the Fair, however the station suffered a series of indignities (cut cables, sabotaged antennas, etc.) that forced it out of existence. If you were referring to K2US, then you were one of the few folks who saw it.

September, 1971

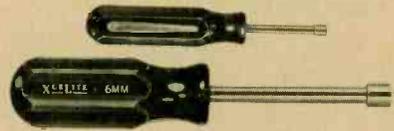
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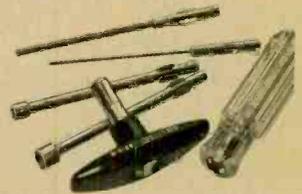
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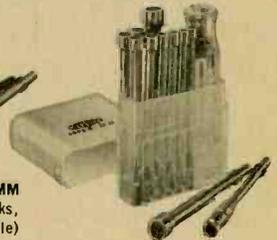
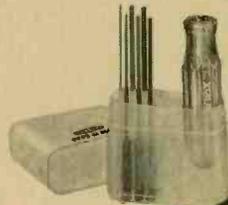


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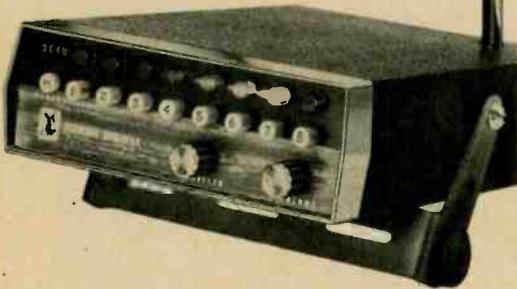
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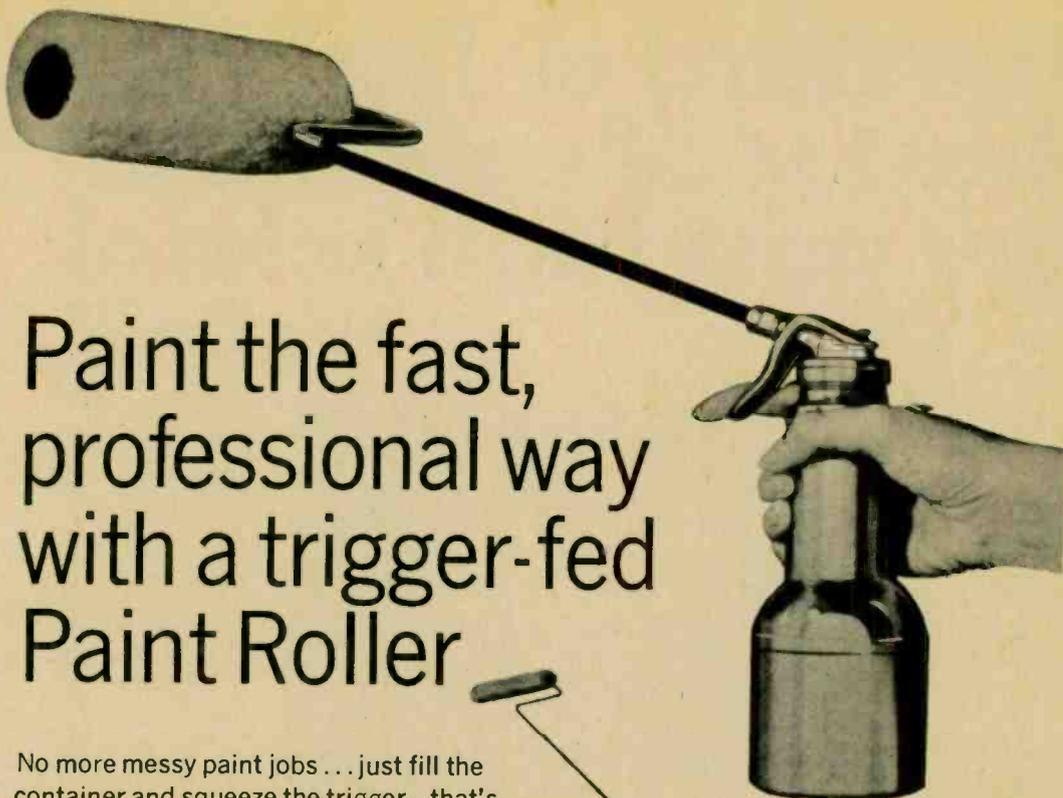
HOPPING mad because you can't locate a defective part in a piece of gear after it's been left on awhile? Chemtronics offers a solution to this problem which they dub thermal intermittents. Not surprisingly, the prescription calls for some of their Super Frost Aid aerosol coolant. To supplement this advice the company has prepared a manual of service procedures centering around use of the big freeze. You may get a free copy of *The Cool Way to Find Thermal Intermittents* from Chemtronics, Inc., 1260 Ralph Ave., Brooklyn, N.Y.

We've just received the 1971 catalog of a firm that we haven't heard from for a year. The company is Burnstein-Applebee and upon seeing their latest listings we were reminded of the specialty-store aura that the company has had for the last 40 years. They carry the entire amalgam of electronics found in many mail-order catalogs, with replacement parts, audio equipment, semi-conductors and TV antennas just a small sampling. They also have things like portable TVs and \$12,000 tape recorders that make this extraordinary reading. Write Burnstein-Applebee, 3199 Mercier St., Kansas City, Mo. 64111 for a free copy.

Staple items on the bookshelves of most designers and experimenters are the **Technical Manuals** published by RCA. They include complete data on such subjects as transistors, linear ICs, SCRs and solid-state hobby circuits. The total library now includes 11 titles, all of which are described in detail in a new flyer from RCA. It goes by the name of publication MF901-C and may be obtained at no charge from RCA Commercial Engineering, Harrison, N.J. 07029.

Full- or part-time servicing your bag? Or perhaps you're into experimenting in a serious way. Life will be much easier with a copy of GC Electronics' Catalog FR-71-72 handy. A sampling of the many things you'll lick your chops over are **chemicals; alignment tools; electronic hardware; phono and tape recorder idler and drive wheels; CRT extension cables; the Audiotex line of stereo, phono and tape accessories; microphones; speakers**—and, well you name it. Write to GC Electronics, Rockford, Ill. 61101.

Bargain time is here again. The Allied Radio Shack Spring/Summer catalog No. 212 proves it. Its 117 pages include the most popular equipment described in detail in their older catalog No. 300. Big things about the new catalog are the important price reductions on many items including Knight-Kits. Get a free copy by writing to Allied Radio Shack at 2725 W. 7th St., Fort Worth, Texas 76107.



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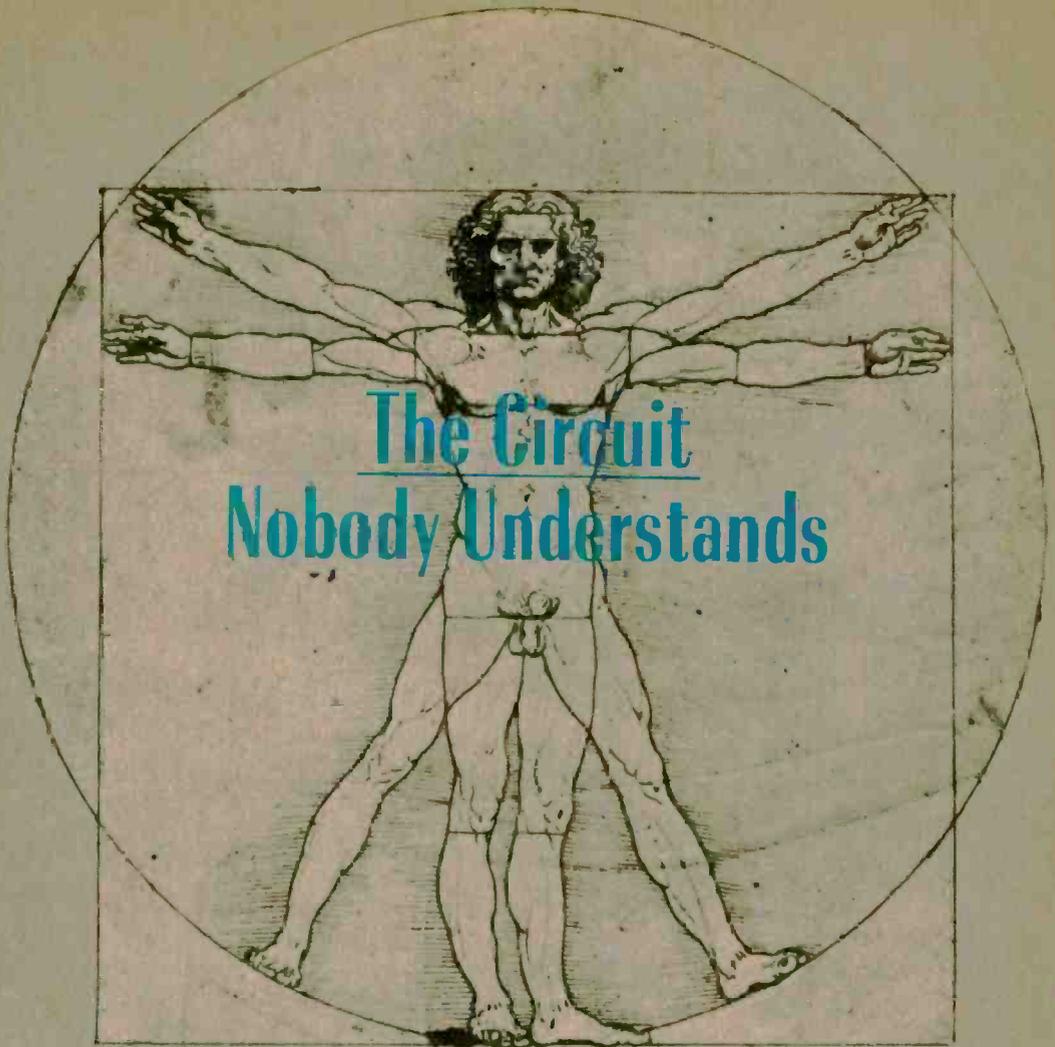
This guide from the U. S. Office of Education tells the story.

It lists 25 technical careers. Describes one- and two-year technical programs on the post-secondary level. Gives information on financial assistance.

To get information on quantity reprints for your students, write: Technicians, P.O. Box 313, Radio City Station, New York, N. Y. 10019.



Advertising contributed for the public good.



By VICTOR KEYLOUN, M.D.

The human body depends upon electricity as much as the electric light. Yet we know little about how this complex system works.

OF ALL the truths and half-truths that have been voiced about the human body, it becomes easy to make glittering generalities about the nature of its existence. One would not be overstepping the bounds of known fact, however, if he were to say that the human body is the most complex electrical device known to man.

A fundamental understanding of electricity helps us to understand the functions of the body. Electricity is common to all living things, from the simplest cell to the phenomenally complex human brain. Electricity, in this context, means a flow of chemical energy with a resultant kinetic energy.

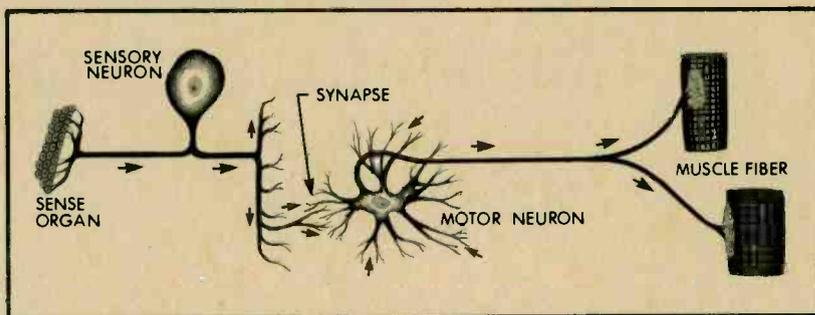
All matter is electrical in nature because of the protons and electrons in its atomic structure. When-

ever there is a difference in charge there is a basis for electricity or the flow of electrons. It is like a ball on the top of a hill; it will roll to the bottom of the hill because of a difference in potential. The proximity of certain metals produces electricity because of this difference in potential. This is the principle of a battery. The human body has innumerable examples of potential differences which result in electrical activity.

The amount of electricity in the human body is small. It can be measured by simple yet delicate electronic devices and is measured in millivolts or microvolts.

Electrical activity in the body is present in every cell, but for

The Circuit Nobody Understands



This is a rendering of the nervous system in action. The sense organ receives the external signal and an impulse is sent to the sensory neuron. The impulse is then dispatched to the motor neuron across the synapse or bridge. The impulse then fires muscles.

practical purposes is concentrated in three separate systems: the central nervous system; the heart, which also includes the chest as its container; and the muscles. Other systems may be included, but the applicability of this is too vague for a discussion such as this.

The central nervous system includes the brain, spinal cord and the nerves which go to and from it. A nerve is a cylindrical extension of a cell. Outside the cell is a solution of sodium salt or ordinary table salt. Inside there is a gelatin composed of potassium salt, or salt substitute. If one took a galvanometer or voltmeter and put one electrode *on* the cell and the other electrode *in* the cell there would be a difference of 90 millivolts with the outside being more positive.

As long as the membrane is intact, this polarity is maintained. When the nerve is activated, there is a sudden rush of sodium into the cell and the polarity reverses so that the inside of the nerve cell becomes positive for just a moment. Then there is a plateau phase. During this time the nerve cannot be activated no matter how much stimulus is applied. For instance, if you stub your toe and do it again quickly, it will seem to have occurred only once. This differs from wire in that with wire, any number of impulses can be transmitted as fast as they are applied. The next phase is repolarization, or the body coming to the rescue to put the sodium and potassium back on the proper side of the cell membrane. During this time the nerve can be stimulated again but a substantially stronger stimulus

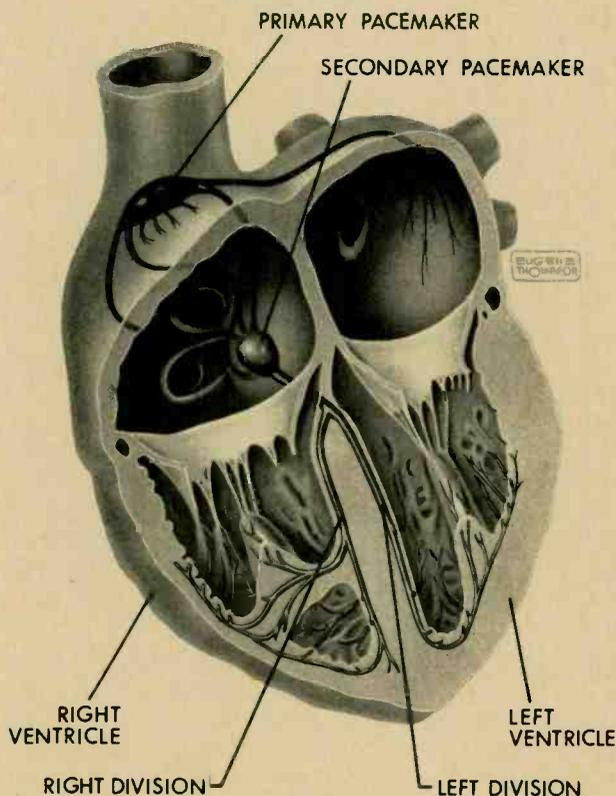
is necessary to fire the nerve. The last phase is the resting level, during which time the nerve may be fired by the usual level of stimulus.

There are many similarities between the electricity in bell circuit and the electricity in the body. As in every electrical circuit there is a source of energy (a battery), a substance to transport the energy (wires), and an object to receive the energy (a bell). The body has similar circuits, some simple and some so complex as to defy comprehension. In every circuit there is a source of energy, the brain, a substance to transport the energy, the nerves, and an object to utilize the energy, muscle tissue. In this general way there is similarity between a bell circuit and the central nervous system of the body. The differences are what make the body so incredibly fascinating.

Electricity flows in bell wire because one electron stimulates another which in turn stimulates its neighbor and so on. This takes place at the speed of light. The electrons themselves don't move that fast but the pulse of current moves quickly. In the body, electricity flows because the sodium at one end of the nerve flows into

the cell and the potassium flows out. This changes the polarity and the sequence flows along the nerve. This event is called depolarization and would look like a firecracker just going off. The speed varies from one nerve to another and is measured in meters per second. The incredible thing about nerves is that almost as soon as depolarization occurs, the body's forces come to the rescue and place the sodium and potassium on the proper side of the cell or repolarize it, thus allowing the nerve to discharge again.

How then do things work in the body? To illustrate some of the previously described examples let us examine a common test performed in the doctor's office, the knee jerk. The doctor strikes the tendon below the knee cap with a rubber hammer. Special sensors realize that the tendon has been stretched, and send



The heart is shown here to emphasize the electrical system of this organ. The primary pacemaker sends an impulse to the secondary pacemaker at a slower rate than to the muscle tissue. This causes the alternate beating of the heart chambers.

this message along the nerve as previously described to the spinal cord. Every sensor has a threshold which must be reached before it can fire the nerve. If the tendon has not been struck firmly enough the impulse will not travel along the nerve and the knee will not jerk. In other words, the impulse either travels or doesn't travel, the all or none phenomenon. Each sensor (heat, touch, pain), has its own threshold. This is why some people can tolerate more pain than others. In bell wire one can transmit 10 or 10,000 V; in humans the nerve either transmits or doesn't. In wire, if there is a great distance between source and end point there may be a fall-off in voltage. With nerves, the impulse arrives exactly the way it was sent.

The Circuit Nobody Understands

"...the human body is the most complex electrical device known to man..."

When the impulse arrives in the spinal cord it is re-directed to many terminals. Immediately, the impulse travels along another nerve to the muscles in the leg. The muscle does its thing—it contracts. Muscles cannot do anything else, just as a bell can only ring or an ear hear or a bulb light up. The end organ, the object, determines what is going to happen. The impulse later travels to the brain where it registers in special areas so that we perceive or become aware that the knee has jerked. This is exactly the same principle as a finger on a hot stove; the arm is pulled away and a few moments later one realizes that he was just burned. There are hundreds of reflexes in the body all designed for protection, few of which a person is constantly aware. They include blinking, coughing, twitching, gagging and the like.

All movement is not reflex. If one wishes to walk, he wills in his brain that certain muscles shall move in a special manner. How the mind activates the brain to reach a threshold to send an impulse to muscles is not totally understood.

The final step in the reflex arc is in understanding how the nerve impulse makes a muscle contract. In the analogy of the bell and battery one only needs to complete the circuit by touching the wire to the bell. In the body, when the fired nerve impulse reaches the muscle, a chemical is produced which bridges the gap from nerve to muscle. If there were no gap the muscles would be jerking all the time, or if the chemical substance produced was imperfect the muscle will never contract. Indeed there are diseases where this chemical, acetylcholine, is present in abundance and muscles are moving without direction or purpose.

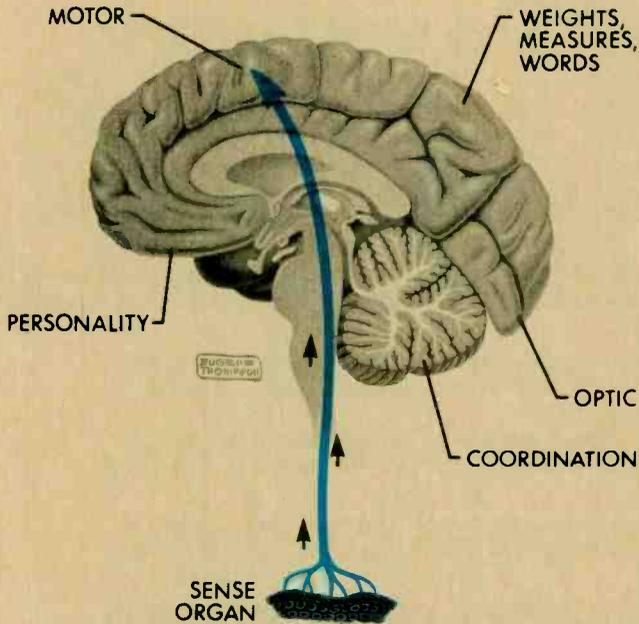
The brain and spinal cord do not exactly correspond to the battery of a bell circuit since they do not generate the electricity. The analogy is good if one considers the spinal cord as that which receives and sends impulses. In fact the battery receives electrons and sends electrons. Nerves and wires have a remarkably close similarity in that they both transmit messages. The bell and muscles are similar in that they respond to a stimulus and do not by themselves do anything.

All the foregoing discussion has been related to muscles and nerves which make the body move. There are other muscles and

nerves which behave somewhat differently. The heart is such an exception.

The heart is a muscle, no more. It is a pump because of its globular design and its one-way valves. You may know that there are two atria and two ventricles, but did you ever consider why they beat alternately instead of all at the same time? The heart is supplied by its own nerves but parts of the nerves are very specialized, and these are called pacemakers or governors. In the right atrium there is a primary pacemaker which sends filaments of nerve to another pacemaker between the ventricles. From this secondary

pacemaker run nerves to each ventricle. When the primary pacemaker fires, an impulse travels to the second pacemaker. During this time the atria are mechanically contracting. When the impulse reaches the secondary pacemaker, the impulse slows down, long enough for the atria to finish contracting. Then it proceeds to the ventricles where the muscle contracts and ejects blood into the circulation. This is an explanation of what happens. How it happens is something else. The how of alternate contraction is totally embodied in the speed of transmission in each nerve. The duration of depolarization in the heart is 0.24 seconds, a very rapid transmission. While the velocity in the atria is rapid, the velocity in the secondary pacemaker is extremely slow, thus affording the atria that little extra time to contract.



The arrow in this picture of the brain shows the path taken by an impulse from a sense organ to the motor area of the brain. This is the kind of path that is taken automatically when you're walking and constantly (but unconsciously) telling your muscles to move in certain ways.

If the velocity of all transmission in the heart were the same the atria and the ventricles would contract at the same time.

If one reviews the action potentials of the different nerves in the heart and compares it with the action potential of nerves, it can be seen that some areas of the heart can be fired rapidly because of a short plateau phase and other areas of the heart have relatively long plateau phases.

Just as one single nerve depolarizes one muscle, the heart also depolarizes, but does so producing substantial energy, voltage and magnetic field. It is this magnetic field that is measured by the electrocardiogram, an instrument which is nothing more than a sophisticated voltmeter.

[Continued on page 96]



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The Listener

By C. M. Stanbury II

SUMMERTIME is a great time of year for many things, but certainly not for television viewing. After the thirty-ninth rerun of all your favorite shows, you're just about ready to call it quits with the tube. You needn't go back to reading Chaucer though, for there is virgin territory on the tube that's ripe at this time of year for DX.

Thanks to an FCC ruling, all TVs sold in the U.S. during the last few years must have UHF tuners. Add to this untapped goldmine a good antenna such as the \$32.95 Lafayette parabolic or one of Jerrold's para-pros and a rotor and you are in the UHF-TV DX business where the fare is far from ordinary.

Unlike VHF in many areas, UHF TV is not hopelessly clogged with locals, semi-locals and images. Reception of UHF DX is made possible by tropospheric propagation, which is a scientific way of saying that you get more DX because of weather conditions. This means that to enjoy the benefits of UHF trop, the viewer and the station he wishes to watch must be within the same high-pressure weather system.

Since most of the stations on UHF are not affiliated with any network, the DX-equipped viewer has a much wider choice of news, musical, sports, religious and special programs than does his VHF counterpart.

On February 20th of this year, the Emergency Broadcast System was accidentally given its first major test and it failed miserably. Apparently the test tape and the tape announcing an actual emergency were mistakenly interchanged and the word went out that the country was under attack. As if this weren't enough of an insult to our defense establishment, the very next day saw a similar error occurring again as one of the wire services malfunctioned and failed to carry the test message.

This kind of a disaster has been brewing for quite some time—the only surprising thing is that it took so long in coming. Late last year a professional broadcaster had these comments about EBS:

"We had some of those white and red cards around here (these cards carry the coded message which is used to identify the transmission as a test or real emergency) but

Entertaining DX

someone must have thrown them out. Most stations consider themselves lucky if their warning receiver is in working order. Station K— doesn't even do on-the-air tests for EBS correctly. Instead of cutting the carrier for whatever length of time is required they just leave it on. We assume that in the case of national attack, we'll get the word from the wire services or the networks."

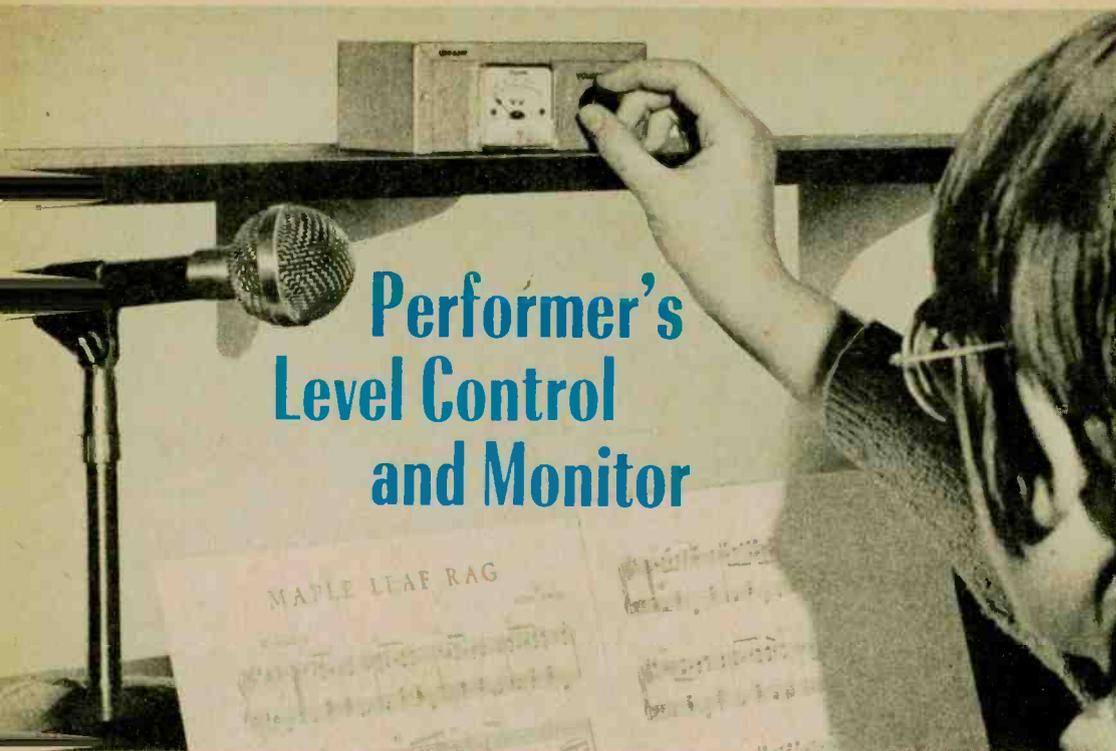
The FCC does not appear to be totally satisfied with this state of affairs and it has announced that it will conduct hearings into the EBS in the immediate future. There has been some concern over the military ability to get on the air with a nation-wide network of portable transmitters. Until that fateful weekend in February nobody thought this could be done without Presidential authorization. That does not appear to be the case.

Tip for rookie SWLs. If you hear a broadcast station in a part of your dial inhibited by CW, RTTY, ships, planes etc., be careful as it may be an image (produced within your receiver) of a station from another band. Tune carefully across it and if that heterodyne (whistle) interference produced varies in pitch, either it or the interfering stations are images, not a real logging.

Propagation Forecast. Sunspot numbers, which have been on a plateau for the past three and a half years, have now begun to decrease. This is very significant news for the SWL and the radio amateur because it means that the usefulness of the higher frequencies, particularly those over the 17 mc international broadcast band, will decrease steadily. Within several years, DX activity in the 10- and 11-meter bands will be nil, except for relatively short skip sporadic-E openings during the summer months and DX in the 21-mc band will have decreased significantly.

For the autumn of 1971, however, sunspot numbers will be sufficiently high to result in some good 10- and 11-meter DX openings, particularly over paths between the U.S. and Africa and South America.

Nighttime conditions will be good to excellent in all bands from 25- to 49-meters, and during the day all bands between 19- and 10-meters should be operational. 



Performer's Level Control and Monitor

By **JOSEPH RITCHIE** PICTURE this predicament. You want to tape yourself practicing the piano but the recorder is installed permanently in a large cabinet across the room and no one is around to ride gain for you. How will you ever be able to set the recorder's level control initially and what will happen when you hit the fortissimo passages?

Use our Performer's Level Control and Monitor. It's a small box (shown above) that contains a level control and VU meter. You set its and your recorder's level controls so the VU meters follow each other. Then while you play you'll be able to see right in front of you exactly what the record level is.

Think of it . . . remote control of a tape recorder or PA amplifier. Rock-band recordings without a recording technician. And best of all, a VU meter and volume control right at each mike.

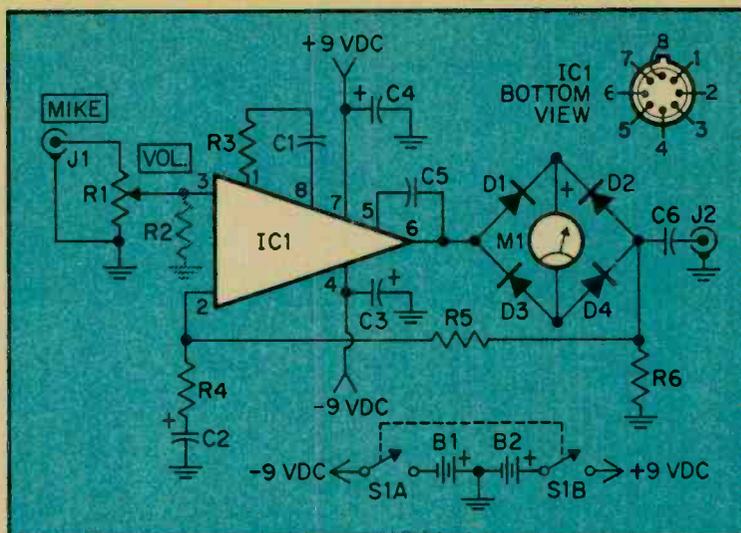
Using a single IC, the Monitor provides microphone-to-low-impedance line-level output. Hang a Monitor on each mike stand and each member of a band can adjust his mike's output to maximum (or desired) sound level without having to run back to the amplifier

to change level. Someone using a PA system can see his own voice level while speaking then make gain corrections to avoid excessively low volume or howling feedback without having to make adjustments at the PA amplifier. Because of its low-impedance output, the Monitor can even be used as a broadcast-station remote amplifier, or a recording or PA remote, and several hundred feet of output cable can be used without signal degradation.

The input impedance is just about anything you need up to 50,000 ohms. It depends on the resistance you choose for volume control R1. The output level is approximately 0.15 V (rms) from a normal mike. The frequency response is ± 0.5 db from 10 to 20,000 cps at a worst-case distortion of 0.5 per cent (total harmonic distortion) using the specified low-cost diodes for D1 to D4.

There is 18db headroom above 0 VU before distortion exceeds 0.5 per cent so that piano or other high-transient-sound recordings can be made at maximum level with no increase in distortion. The maximum input level before clipping is 180 mv—well above normal.

Fig. 1—IC1 functions as operational amplifier whose gain is determined by R4,R5. Output at pin 6 is fed to diode bridge and DC output of amplifier goes to VU meter. Bridge also "switches" output signal so it's available at R6. While it's true diodes breakover voltage introduces crossover distortion, even with low-cost 1N60 diodes, distortion doesn't exceed 0.5 per cent (THD) at normal mike levels. Meter is driven by IC's DC output, hence it must be connected in circuit with polarity shown. Meter's rectifier must be removed to keep distortion low.



The signal-to-noise ratio at 0 VU is 60db (minimum) and partly depends on the quality of the components you use. Better signal-to-noise ratio can be obtained if R3 and R4 are one per cent low-noise resistors and R1 is a professional-type stepped attenuator, though these will add considerably to the cost.

If the Monitor is to be used as a professional broadcast remote amplifier, or as a remote involving line lengths over 100 ft., R6 should be eliminated and a 500:500-ohm line-matching transformer substituted so the output will be *balanced to ground* (for minimum line sensitivity to hum and noise).

Construction. Except for *volume* control

R1 and the batteries all components mount on a 1 3/4 x 4 3/4 in. printed-circuit board that is secured to the back of the meter with the meter's terminal screws (See Figs. 6 and 7). Circuit connection is automatically made to the meter by the screws. The completed assembly is mounted in a 2 1/4 x 3 x 5 1/4-in. Minibox, though any other size metal cabinet can be used. Only the circuit board size is critical.

First step is to make the circuit board, which can be ordinary XXXP stock. Using a strong household cleanser such as Ajax, scrub the copper foil and then rinse thoroughly under running water. Place a piece

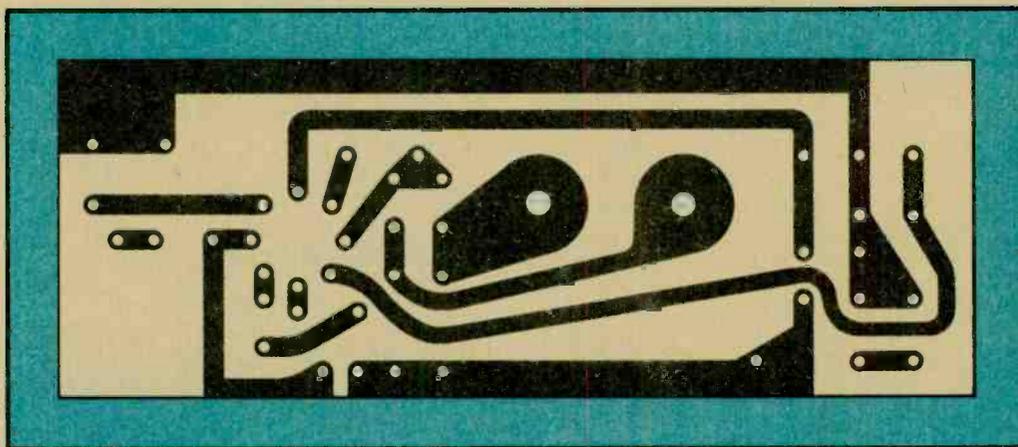


Fig. 2—Full-scale template for circuit board. Cut this out and transfer black foil areas with carbon paper on copper side of circuit board. Text explains how to make transfer and to etch away unwanted copper.

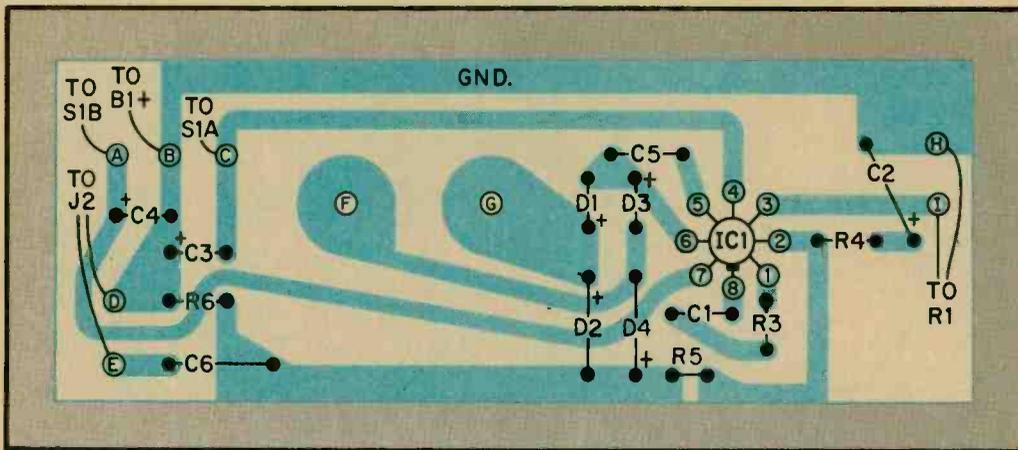
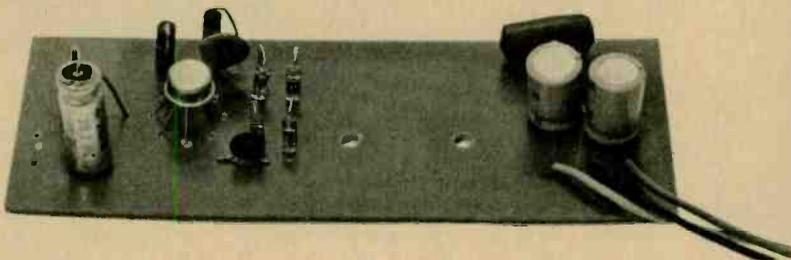


Fig. 3—X-ray view of board shows location of all parts. Tab on IC's case is over pin 8. Check polarity of diodes, electrolytics.

Fig. 4—Note in photo at right of completed board how parts are mounted vertically to save space. Leads at the right go to switch S1.



Performer's Level Control and Monitor

of carbon paper, carbon side towards the foil, over the board and secure both under the full-scale template in Fig. 2. Using a sharp tool, such as an ice pick or punch, indent the copper foil at each component mounting hole by forcing the tool through the template and carbon paper. Then using a ball-point pen, trace the foil outlines using firm pressure so the outline is transferred by the carbon to the foil.

Remove the carbon paper and using a resist pen, such as is supplied with the Allied Radio Shack printed-circuit kit (276-1576) fill in the outlines on the foil. Let the resist dry for a few minutes and then immerse the board for about 45 minutes in etchant solution agitating frequently.

Check the board from time to time and when all the excess copper has been removed rinse the board thoroughly under running water and remove the resist by either scrubbing the board with steel wool or wiping the resist off with a cloth soaked in acetone or rubber cement thinner.

Using a No. 54 drill bit, drill out all the component holes except those for the meter terminals, which are drilled with a No. 26

bit, or any bit that will provide clearance for a No. 4 screw.

Mount all the board components leaving the IC for last. Note that all capacitors ex-

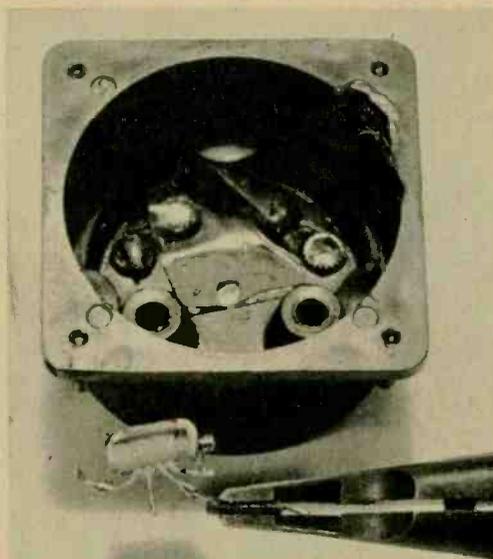


Fig. 5—For minimum distortion, remove rectifier in VU meter. Slip movement out of case, unsolder movement's leads, then snap rectifier out of case.

PARTS LIST

B1,B2—9 V battery (Burgess 2U6 or equiv.)

Capacitors: minimum voltage ratings specified

C1—100 μf , 25-V disc

C2—200 μf , 3-V electrolytic

C3,C4—50 μf , 12-V electrolytic

C5—25 μf , 25-V disc

C6—.1 μf , 25-V mylar

D1-D4—1N60 diode

*IC1— $\mu\text{5B770939X}$ integrated circuit (Fairchild)

J1,J2—Phono jack

M1—VU meter (Lafayette 99 F 50247, modified, see text)

Resistors: $\frac{1}{2}$ watt, 10% unless otherwise indicated

R1—50,000 ohm audio-taper pot (see text)

R2—47,000 ohms (see text)

R3—1,500 ohms

R4—100 ohms

R5—15,000 ohms

R6—560 ohms

S1—DPST toggle or slide switch

Misc.— $5\frac{1}{4}$ x 3 x $2\frac{1}{8}$ -in. Mlnlbox, printed-circuit supplies

*The Fairchild $\mu\text{5B770939X}$ integrated circuit is available for \$5 postpaid from Custom Components, Box 153, Malverne, N.Y. 11565. N.Y. residents add sales tax. Canada add \$1.

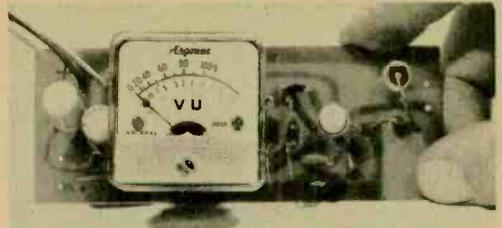


Fig. 6—Monitor board installed on VU meter. If board's terminal holes don't fit meter, enlarge holes. Don't bend the board to get it to fit.

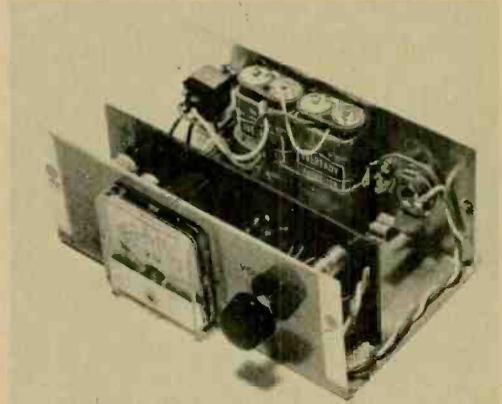
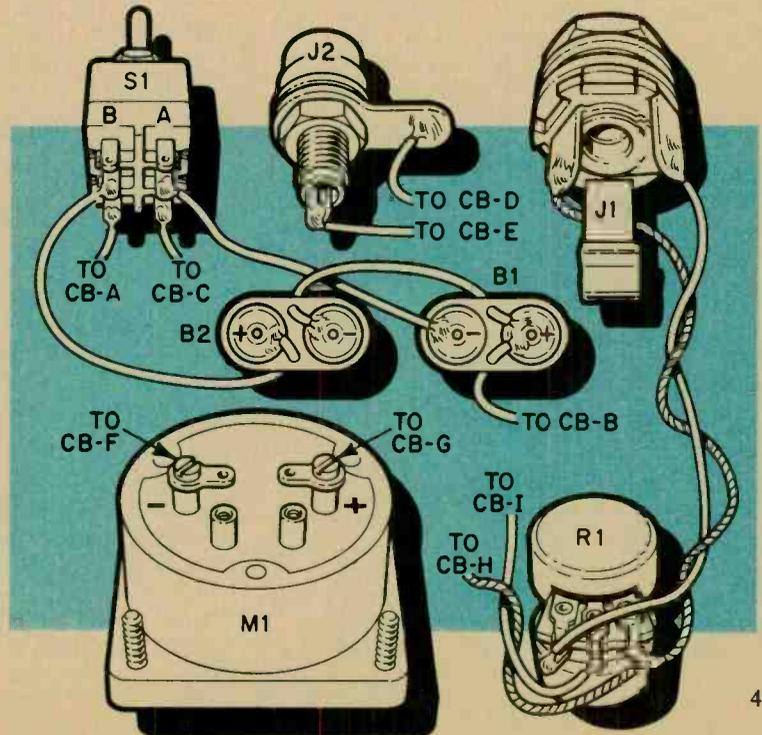


Fig. 7—Batteries are installed on the back of the cabinet and held with a piece of wire passed through solder lugs on each side of the batteries.

cept C2 are the end-mount printed-circuit type whose leads come out the same end. Capacitors C2 is not normally available at low-cost in an end-mount style, but if you can get one, use it. Just make certain that C2 is not so large that it will project past the meter, preventing the assembly from being

[Continued on page 100]

Fig. 8—Pictorial shows wiring to the cabinet-mounted components and VU meter. Jacks J1, J2 should mate with connectors on your equipment. Two unmarked terminals on meter are for internal lamps and do not have connections to them.



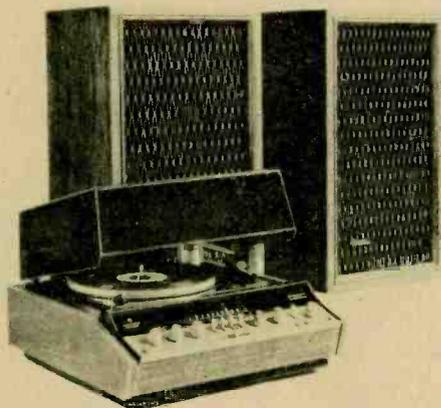
Hi-Fi Today *

By John Milder.

I'VE been wondering whether the stereo compact (or, if you prefer, the three-piece music system) is about to make a comeback. Unless you're a recent convert to hi-fi, you probably remember the impact that the first high-performance compact system, KLH's Model Twenty, had back in 1964. Its success and that of the whole generation of compacts that followed on its heels was so overwhelming with the general public—the people who had always held off from buying separate components—that it appeared to be the wave of the future.

But people, particularly the generation that grew up on rock, became more and more at home with electronic gear and separate components began to steal the show back from preassembled systems. Just as important, compacts stopped at a certain level of quality. Beyond that point, the manufacturer assumed that people would turn to separate components and it didn't seem sensible to compete with components on their home ground. So the compact reached its zenith, then plummeted far below component sales.

The tables seem to be turning once more. With the small size of the average home or apartment these days, there remains a potent argument for taking up less space with



Kenwood's compact entry, the KS-707PS. It delivers 45 watts per channel (rms) at 8 ohms. Speaker systems are included in \$630 price.

The Return of the Compact

music gear. The new generation of receivers, particularly Japanese, have made drastic improvements in the performance you can expect for a modest price tag. This accounts, in part, for the small but significant trend toward a new kind of compact.

The only two of the new breed I've had direct experience with are the Kenwood KS-707PS, which I recently bought for some friends and matched with a pair of Advent speakers, and Altec Lansing's 911A, a variation of which I've been living with for a while now. (The Kenwood is sold only with speakers.) Both are potent products. The Altec—the more ambitious and expensive of the two—is a music center that seems hard to better in any way, with almost 50 watts of steady-state (rms) power per channel and a super-sensitive and selective FM tuner section. It lists at \$499, which isn't exactly in the budget category, but this price is about \$100 less than the same Altec component receiver. The Garrard SL-95B automatic record player and Shure M39E cartridge which are included in the 911A would add substantial additional cost as separate pieces of gear. Also included in the price is a nice table-top cabinet.

The kind of performance which these components offer was not only absent in the first generation of compacts—it wasn't even available in separate components a couple of years ago at this price.

One of the new compacts that must be used with matching speakers is the Electro-Voice Landmark 100, an integrated system that features motional feedback in the amplifier section to heck and correct speaker behavior. It utilizes a distinctive pair of small, irregularly shaped speaker systems that combine direct and reflected sound. I've heard the Landmark 100 in showrooms but haven't had a chance to probe for the kind of things that show up in home use. It sounds good in showrooms, though.

I can't say I think compacts will displace components to the extent some of us once thought they might but this new generation—more like separate components than even before, but with simplicity and space-saving still going for them—are certain to make their presence felt.

EI's Win-the-World Contest Is On!



GRAND PRIZE: Choose your favorite country from those among your QSL cards and EI will fly you there and back via Pan American World Airways, whose motto is "No place in the world is more than a day away from the USA by PAA." Stay as long as you like, see all the sights and maybe visit some of your DX friends. To keep you in touch with the news back home you will receive, as an added bonus, a Hallicrafters CR-44A portable shortwave radio, complete with direction finder. Truly a Grand Prize!

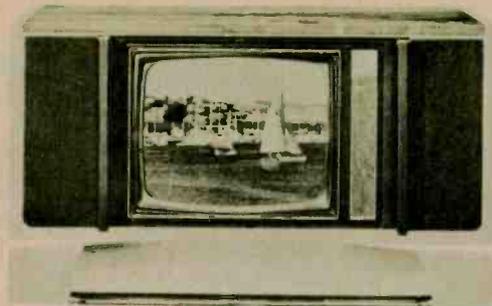
MAKE those final checks in your rig because the EI Win-the-World Contest is set to kick off. That's right, now's the time when you can win that trip of a lifetime—you name the destination!

For those of you who may have missed our July issue, we are repeating our panorama of prizes that you can win by practicing your favorite hobby—radio. All you have to do is get QSL cards for your contacts and those individuals with the most QSLs will win the contest. It's that simple!

It really doesn't matter whether your game is SWLing, amateur radio, or DXing the BCB. Just practice your hobby in accordance with the rules on the next two pages and you may find yourself aboard a Pan Am 747 on the way to the country of your choice or you may be the winner of 99 other valuable prizes.

The Listening Period of the Contest begins at midnight July 15, 1971, not very far away, so you better get everything in order. After this period there will be time for you to collect your QSLs and total them up. Then all you have to do is fill out the entry blank on the last page of this article and send it in before the deadline (read the rules carefully). For those of you that are new to the radio game as a hobby, we have prepared a special beginner's guide which you will find next to the entry blank. Hope to have you with us!

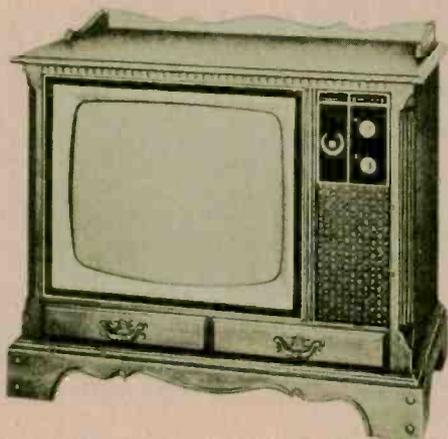
El's Win-the-World Contest!



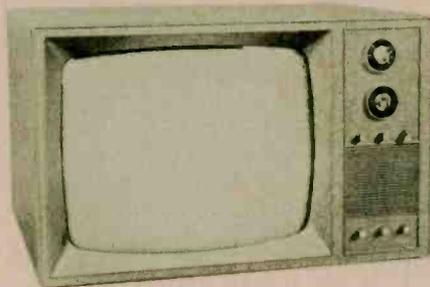
SECOND PRIZE: The futuristic RCA G-2000 color TV is one of 2,000 sets, each a numbered version, comes with a fantastic 23-in. picture tube.



THIRD PRIZE: A Heathkit/Thomas Theater Organ kit. 44-note keyboard and 19 organ voices make this a truly remarkable instrument. Worth over \$1000!



FOURTH AND FIFTH PRIZES: The solid-state Heathkit GR-370 color TV kit. Modular, snap-on circuit boards make it easy to build and service.



SIXTH AND SEVENTH PRIZES: A color TV kit from Conar, a division of the National Radio Institute. Easy to assemble and light as a feather.

RULES

1. Electronics Illustrated's Win-the-World Contest requires a participant to be in radio contact with as many stations as possible within the Listening Period of the contest and to show evidence of these contacts by means of a verifying QSL card or letter.
2. Any legal station is an eligible target. Contestants may choose just to listen to the station, as with SWLing, or they may be in two-way contact with the station, as in amateur radio.
3. QSL cards and letters must indicate the date the station was heard. In the case of some remote or small stations, it is advised that contestants prepare a QSL with this information and send it to the stations with their verification report. Do not send EI any QSL cards with your entry. The winners will be notified when to supply proof of their contacts at a later date. Entries claiming more QSLs than can be substantiated will not be eligible for any prize.
4. Although all radio and television stations are

- eligible in this contest, only one contact with each station will count towards qualification.
5. The Listening Period of the contest, in which contestants will establish radio contact with stations, will begin Midnight EST on July 15 and run until Midnight, August 14, 1971. All QSLs must bear a date within this period.
6. The entry blank for the contest will appear in the September issue of Electronics Illustrated, which goes on sale July 15. This entry blank or a reasonable facsimile must be completed and should be sent to: Electronics Illustrated's Win-the-World Contest, Box 1035, Greenwich, Conn. 06830. To be eligible for the contest, all entries must be postmarked before Midnight, October 31, 1971. Name and return address with zip must appear in upper left corner on front of envelope.
7. The entry with the highest number of QSLs will be judged Grand Prize winner, the entry with the second-highest number will be judged Second Prize winner, etc.

8TH-13TH PRIZES: One of the best way to learn electronics is to study with a correspondence school in the privacy of your own home. For these six prizes, EI will assign the winners to one of the great schools listed below, where they will study the course of their choice absolutely free.



Cleveland Institute of Electronics
1776 East 17th St.
Cleveland, Ohio 44114

ICS
Scranton,
Pennsylvania 18515

National Technical Schools
4000 South Figueroa St.
Los Angeles, Calif. 90037

CREI
Div. of McGraw-Hill
Continuing Education Co.
3224 Sixteenth St., N.W.
Washington, D.C. 20010

National Radio Institute
Div. of McGraw-Hill
Continuing Education Co.
3939 Wisconsin Ave., N.W.
Washington, D.C. 20016

RCA Institutes
320 West 31st St.
New York, N. Y. 10001

RULES

8. In addition to giving the total number of QSLs, each contestant will be asked to break this number down to the number of contacts with each continent. International contacts require more skill than local ones so that in the case of a tie, the person with the greatest number of international contacts in his entry will be judged to be the higher of the two entries.
9. The Grand Prize provides round-trip tourist-class accommodations aboard Pan American and connecting air carriers from the airport nearest the winner's home to any city having regularly-scheduled air service in the country of the winner's choice among those named on his QSL cards, providing travel to that country is not forbidden by law. The winner must provide passport and visa if required.
10. In the case of Prizes 8-13, the editors of Electronics Illustrated will assign each winner to a school and the contestant will be given a full scholarship. He must be academically qualified

for the course chosen (i. e., advanced courses sometimes require prior educational achievements) and must maintain regular academic advancement.

11. All prizes are subject to manufacturer's specification changes.

12. The editors of EI will be the judges and their decisions will be final. All entries become the property of Fawcett Publications, Inc. and will not be returned.

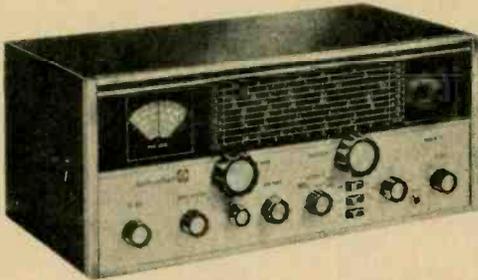
13. The Win-the-World Contest is open to any individual except employees of Fawcett Publications, its wholesale distributors and advertising agencies and their families or employees.

14. Winners of the contest will be notified by mail after the publication of the list of winners in the March 1972 issue of Electronics Illustrated. Winners grant Fawcett Publications, Inc. the right to use their names and photos in connection with promotion resulting from the contest.

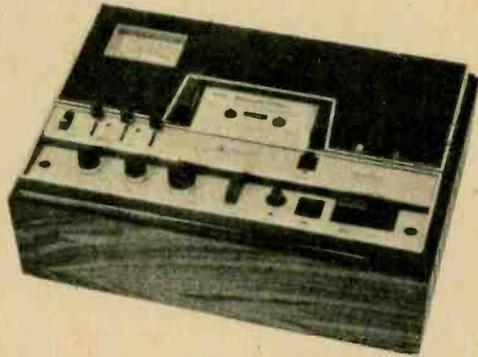
El's Win-the-World Contest!



14TH PRIZE: Hallicrafter's finest communications receiver, the SX-122A, covers AM/CW/SSB. It offers dual-conversion from 535 kc to 34 mc. Digital clock-speaker is included.



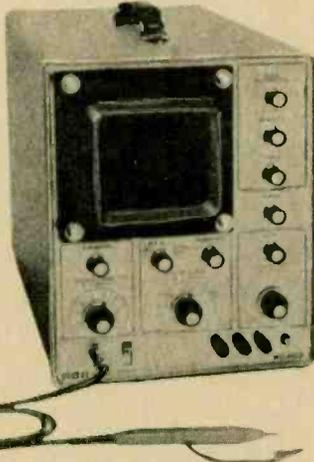
15TH-19TH PRIZES: Hallicrafter's newest entry in the communications receiver market, the SX-133, covers four short-wave and five amateur bands on AM/CW/SSB. Matching speaker is also included.



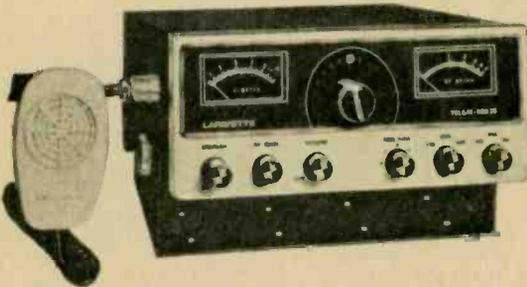
20TH PRIZE: The new Advent 201 cassette tape deck incorporating the Dolby system of noise reduction and a brand new tape transport to make for incomparable listening pleasure.



21ST PRIZE: The Sony STR-6055, a new stereo-FM/FM-AM receiver. 40 watts (rms) per channel at 8 ohms plus the latest in stereo-FM tuner design.

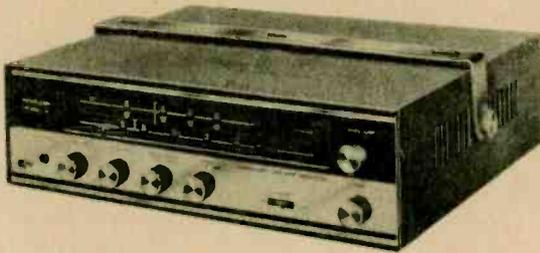
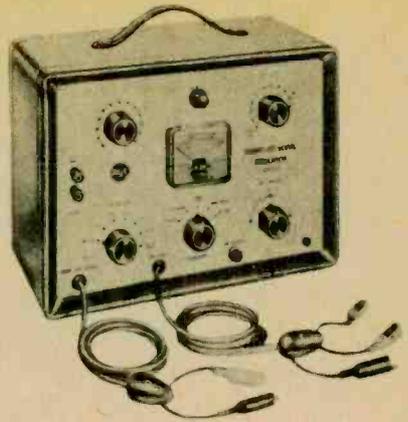


22ND PRIZE: RCA's WO-505A solid-state oscilloscope has 5-in. CRT, flat frequency response to 5 mc and sweep to 1 mc.

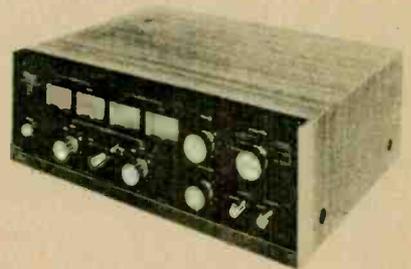


23RD PRIZE: Lafayette Radio's Telstat SSB-25 one of the first CB rigs with SSB on all 23 channels. This results in 46 operating channels and 15 watts PEP input power.

24TH PRIZE: The RCA WR-52A Stereo FM Signal Simulator. This generator produces signals for aligning the RF and multiplex sections of stereo FM tuners and receivers.

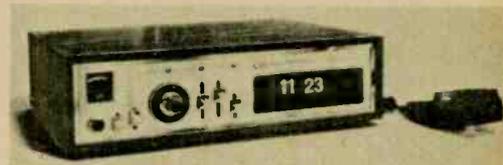
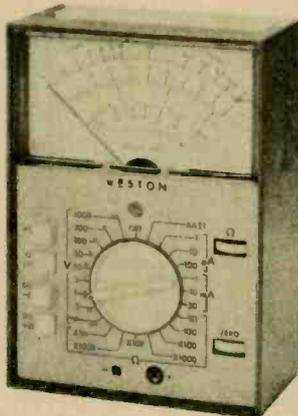


25TH PRIZE: Allied Radio Shack's Patrolman PRO-3 VHF/UHF receiver tunes police and fire departments on 30-50, 152-174 and 450-470 mc.



26TH PRIZE: Sansui's QS-1 Quadphonic Synthesizer converts any standard two-channel stereo system into a four-channel system with addition of only two more speakers.

27TH PRIZE: Weston 666 solid-state VOM is designed for troubleshooting semiconductor equipment. It's protected against overload and is ruggedized. Features include 10-megohm AC/DC input impedance and low full-scale DC range of 100 mv. It also measures AC and DC current as well as resistance.

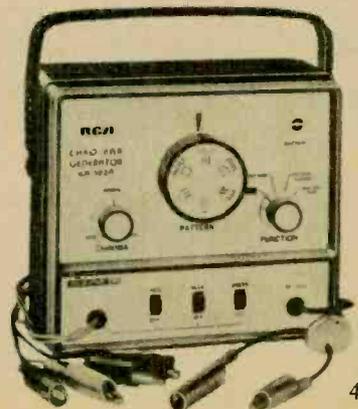


28TH PRIZE: Courier Citation solid-state base-station CB transceiver, has a digital clock, walnut cabinet, and PA capability. It comes with crystals for 23 channels.



29TH PRIZE: Olson RA-280 stereo FM/AM solid-state receiver delivers 60 watts of power, has an FM sensitivity of $2 \mu\text{v}$ and stereo separation of 25db. It comes with two speakers.

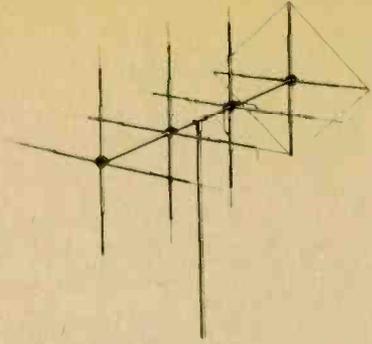
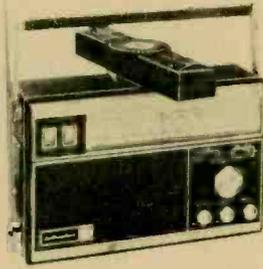
30TH PRIZE: RCA WR-502A solid-state color-bar generator produces color bars, dots, cross-hatch lines, vertical and horizontal lines and blank raster for color TV servicing.



El's Win-the-World Contest!

31ST-35TH PRIZES:

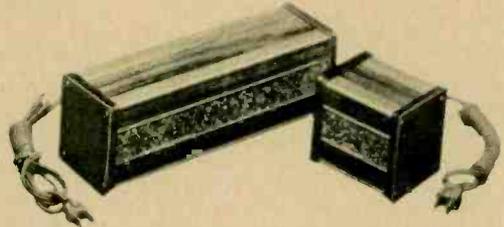
The Hallicrafter's CR-44A Ranger portable short-wave receiver. Covers 30 short-wave services, AM, FM, police and fire and ship-to-shore. Comes with direction finder for three bands.



36TH PRIZE: Avanti's Moonraker CB base station antenna. The antenna combines half-wave cross dipole elements with design reflector.



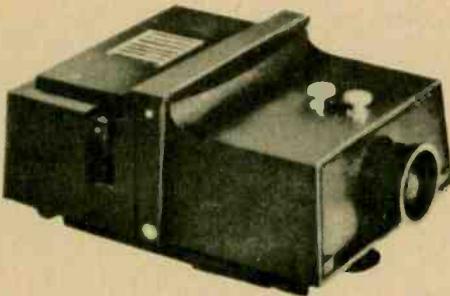
37TH PRIZE: This AMECO R-5A receiver covers 540 kc to 54 mc which includes police, fire, short-wave and ham bands. Fully transistorized and can be used for portable operation.



38TH PRIZE: The DeltaAlert ultrasonic intrusion detector. This device protects against illegal entries over a 150 to 300-sq.-ft. area. Also includes are two powerful DeltaHorns.

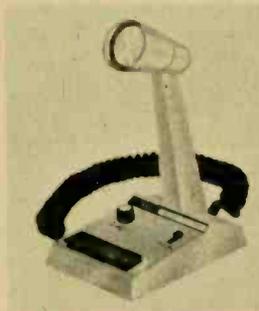


39TH-41ST PRIZES: Combination entertainment-communications receiver from Hallicrafter's, the S-240. Includes BFO and signal-strength meter.



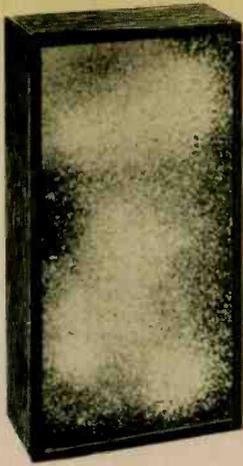
43RD PRIZE: Edmund Scientific's top-of-the line Deluxe Visual Effects Projection Set plus Rippling Color Accessory for exciting light shows.

44TH AND 45TH PRIZES: Hallicrafter's skip-band receiver designed with SWLs in mind. Covers 49-, 31-, 21- and 19-meter bands. Special World Capital Locator.



42ND PRIZE: Two great CB mikes from Turner. Included are a Turner +3 base-station mike with the patented Modugard. Also included is a M+2/U transistorized mobile mike.





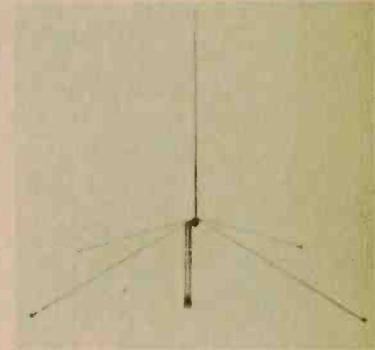
46TH PRIZE: EICO's four-channel color organ, Model 3450, converts sounds to four dazzling colors with the beat.



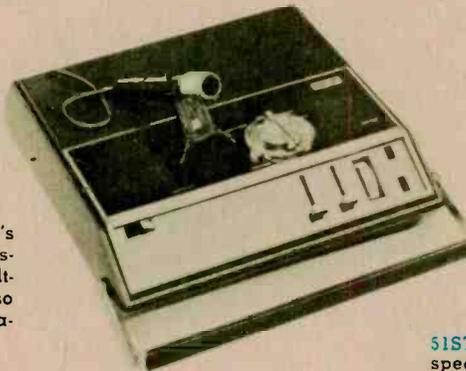
47TH PRIZE: A \$100 credit with Electro-Voice for any equipment in their latest catalog, including this miniature 651C communications mike.



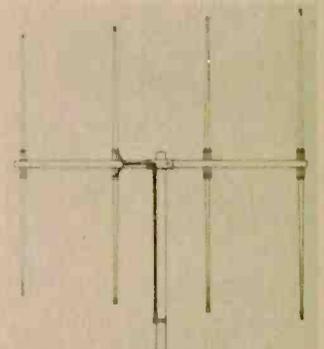
48TH PRIZE: A complete library designed for hams and SWLs from the Howard W. Sams publishers. Many titles to help you improve as a hobbyist.



49TH PRIZE: A \$100 credit for any antenna in the latest catalog of Antenna Specialists, some especially designed for VHF and UHF DX.



50TH PRIZE: Mallory's MCR-1232 portable cassette recorder plus built-in AM/FM radio. Also included are six Dura-tape cassettes.



51ST PRIZE: \$100 credit with Shakespeare, one of the leaders in the CB antenna field. Everything from base to mobile antennas.



52ND PRIZE: A library of the latest bestsellers from the Tab Book Company. Titles run the gamut of all things electronic.

53RD-100TH PRIZES: A one year subscription to the electronics hobbyist's favorite magazine—ELECTRONICS ILLUSTRATED.

Annual Special CFI Section

ELECTRONICS ILLUSTRATED

50c

Build a Ham Antenna Matcher

Capsule Preamp for Mikes

Outboard Soup-Up for Low-Cost Receivers

Pocket SW Receiver

Special Report LATEST IN CB EQUIPMENT

El's Win-the-World Contest

Official Entry Blank

(Please Print)

Name _____

Address _____

City _____

State _____ Zip _____

Breakdown of QSLs
by continent of origin:

Number from
North America _____

Number from
South America _____

Number from Europe _____

Number from Africa _____

Number from Asia _____

Number from Australia _____

Grand Total

 Write this number on the
lower left hand corner of front of envelope.

Mail entry to:

Electronics Illustrated's
Win-the-World Contest
Box 1035
Greenwich, Conn. 06830

A Guide for Beginners

RADIO listeners who would like to enter El's Win-the-World contest may be a bit perplexed about what DX and QSLing are all about. For those of you who have not explored this facet of the hobby, here is a brief rundown to give you the same knowledge possessed by experienced hobbyists.

Simply put, most radio hobbyists have as their goal listening to stations that are as far away as possible. In radio lingo, distance is abbreviated as *DX* and one who goes after the distant stations is known as a *DXer*.

Unlike most fishermen, *DXers* are not fond of telling the-one-that-got-away stories, so by years of trial and error they have established a generally accepted means of proving that they have heard a station.

The listeners send a report to the particular broadcaster giving him information which proves that they heard the station and also info on how well the station came through. In return for this favor (the stations are interested in who's listening) the stations issue a card or letter which often artistically states that the listener did indeed hear the station as he reported. These cards have been given an international abbreviation—*QSL* cards.

The *QSL* card is the basis for our Win-the-World contest. The person who collects the most will win the top prize and so on down the line. Here is how you can get these cards, too.

Tune your receiver to be sure that you have the strongest possible signal so that you can make a clear identification. Note the frequency indicated by your receiver and listen for the station identification which will also list the frequency. More often than not, yours will be off by a few kilocycles. Write down the details of at least 15 minutes of programming, noting the exact time at which each segment begins. It is best to use 24-hour Greenwich Mean Time when sending in international reports. For example, 7:05 EST on September 1 becomes 0005 GMT September 2 (note date change) in *DX* terminology. Also note as much technical data as possible such as signal strength and interference. After you're done listening, put this info in letter form and address it to the station by callsign (if any) and station ID with simply the city of origin as address.



Build a Sub-Batt

CAR radio poop out? Or maybe you don't even have one. Cool it. A pocket transistor radio will do the job—if it's powered adequately. When you're tooling along at 60, the noise level in a car requires a lot of volume. This means a high current drain which results in low battery voltage, distortion and short battery life.

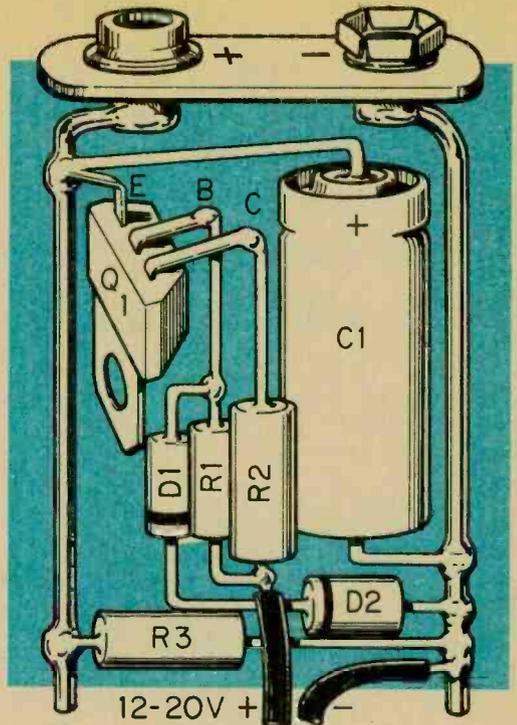
For about \$6 you can build the Sub-Batt to drop and regulate your car's power to operate any 9- or 6-V radio or cassette recorder. The Sub-Batt's output voltage is rock steady and it will deliver up to 200 ma. (With 12-V input; 100 ma with a 20-V input.)

Remove the guts of a dead 9-V battery and save the top connector plate and bottom cover. Build the circuit as shown in the photo and pictorial. Then check operation by applying 12 to 20 V to the input leads. If the output voltage is 9 V, fill the case with epoxy and replace the bottom cover.

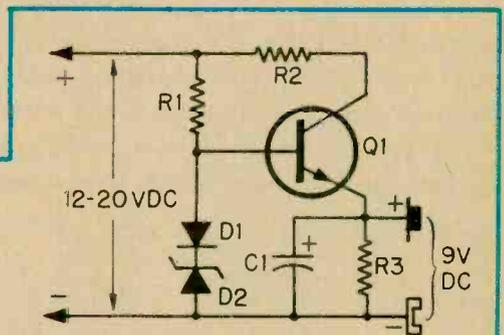
—Lewis J. Newmire, WA7CQX

PARTS LIST

- C1—100 μ f, 12-V electrolytic capacitor (Sprague TE1135 or equiv. 21/64 x 55/64 in.)
- D1—1N4001 diode (Motorola)
- D2—1N4739 zener diode (9.1 V, Motorola)
- Q1—MPS-U02 transistor (Motorola)
- R1—200 ohm, 1/4 watt, 5% resistor
- R2—10 ohm, 1/2 watt, 10% resistor
- R3—1,800 ohm, 1/4 watt, 5% resistor
- Misc.—Dead 9-V battery, No. 14 bus wire, cigarette-lighter adaptor



Solder 1 1/2-in. lengths of No. 14 bus wire (spaced 11/16 in.) to back of connectors on top plate of dead 9-V battery. Install parts as shown using spaghetti to prevent shorts. Make sure tab on transistor Q1 doesn't touch the positive bus.



Zener diode D2 holds output at 9-V if input voltage rises. For 6-V output, omit D1 and substitute a 6.8-V zener diode (1N4736) for D2.

How to get into One of the hottest money-making fields in electronics today— servicing two-way radios!



HE'S FLYING HIGH. Before he got his CIE training and FCC License, Ed Dulaney's only professional skill was as a commercial pilot engaged in crop dusting. Today he has his own two-way radio company, with seven full-time employees. "I am much better off financially, and really enjoy my work," he says. Read here how you can break into this profitable field.

More than 5 million two-way transmitters have skyrocketed the demand for service men and field, system, and R&D engineers. Topnotch licensed experts can earn \$12,000 a year or more. You can be your own boss, build your own company. And you don't need a college education to break in.

HOW WOULD YOU LIKE to start collecting your share of the big money being made in electronics today? To start earning \$5 to \$7 an hour... \$200 to \$300 a week... \$10,000 to \$15,000 a year?

Your best bet today, especially if you

don't have a college education, is probably in the field of two-way radio.

Two-way radio is booming. Today there are more than *five million* two-way transmitters for police cars, fire department vehicles, taxis, trucks, boats, planes, etc. and Citizen's Band uses—

and the number is still growing at the rate of 80,000 new transmitters per month.

This wildfire boom presents a solid gold opportunity for trained two-way radio service experts. Many of them are earning \$5,000 to \$10,000 a year *more* than the average radio-TV repair man.

Why You'll Earn Top Pay

One reason is that the United States Government doesn't permit anyone to service two-way radio systems unless he is *licensed* by the Federal Communications Commission. And there simply aren't enough licensed electronics experts to go around.

Another reason two-way radio men earn so much more than radio-TV service men is that they are needed more often and more desperately. A home radio or television set may need repair only once every year or two, and there's no real emergency when it does. But a two-way radio user must keep those transmitters operating at all times, and *must* have their frequency modulation and plate power input checked at regular intervals by licensed personnel to meet FCC requirements.

This means that the available licensed experts can "write their own ticket" when it comes to earnings. Some work by the hour and usually charge at least \$5.00 per hour, \$7.50 on evenings and Sundays, plus travel expenses. A more common arrangement is to be paid a monthly retainer fee by each customer. Although rates vary widely, this fixed charge might be \$20 a month for the base station and \$7.50 for each mobile station. A survey showed that one man can easily maintain at least 100 stations, averaging 15 base stations and 85 mobiles. This would add up to at least \$12,000 a year.

Be Your Own Boss

There are other advantages too. You can become your own boss—work entirely by yourself or gradually build your own fully staffed service company. Instead of being chained to a workbench, machine, or desk all day, you'll move around, see lots of action, rub shoulders with important police and fire officials and business executives who depend on two-way radio for their daily operations. You may even be tapped for a big job working for one of the two-way radio manufacturers in field service, factory quality control, or laboratory research and development.

How To Get Started

How do you break into the ranks of the big-money earners in two-way radio? This is probably the best way:

1. Without quitting your present job, learn enough about electronics fundamentals to pass the Government FCC Exam and get your Commercial FCC License.
2. Then get a job in a two-way radio service shop and "learn the ropes" of the business.
3. As soon as you've earned a reputation as an expert, there are several ways you can go. You can move *out* and start signing up and servicing your own customers. You might become a franchised service representative of a big manufacturer and then start getting into two-way radio sales, where one sales contract might net

you \$5,000. Or you may even be invited to move *up* into a high-prestige salaried job with one of the major manufacturers either in the plant or out in the field.

The first step—mastering the fundamentals of Electronics in your spare time and getting your FCC License—can be easier than you think.

Cleveland Institute of Electronics has been successfully teaching electronics by mail for over thirty years. Right at home, in your spare time, you learn electronics step by step. Our AUTO-PROGRAMMED® lessons and coaching by expert instructors make everything clear and easy, even for men who thought they were "poor learners." You'll learn not only the fundamentals that apply to all electronics design and servicing, but also the specific procedures for installing, troubleshooting, and maintaining two-way mobile equipment.

Get Your FCC License ... or Your Money Back!

By the time you've finished your CIE course, you'll be able to pass the FCC License Exam with ease. Better than nine out of ten CIE-trained men pass the FCC Exam the first time they try, even though two out of three non-CIE men fail. This startling record of achieve-

ment makes possible the famous CIE warranty: you'll pass the FCC Exam upon completion of your course or your tuition will be refunded in full.

Ed Dulaney is an outstanding example of the success possible through CIE training. Before he studied with CIE, Dulaney was a crop duster. Today he owns the Dulaney Communications Service, with seven people working for him repairing and manufacturing two-way equipment. Says Dulaney: "I found the CIE training thorough and the lessons easy to understand. No question about it—the CIE course was the best investment I ever made."

Find out more about how to get ahead in all fields of electronics, including two-way radio. Mail the bound-in postpaid reply card for two FREE books, "How To Get A Commercial FCC License" and "How To Succeed In Electronics." If card has been removed, just mail the coupon below.

NEW REVISED G.I. BILL BENEFITS:

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Your book on, "How To Get a Commercial FCC License."

I am especially interested in:

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 Broadcast Engineering Industrial Electronics
 First Class FCC License Electronics Engineering
 Electronics Technology with Laboratory

Name _____
(PLEASE PRINT)

Address _____

City _____

State _____ Zip _____ Age _____

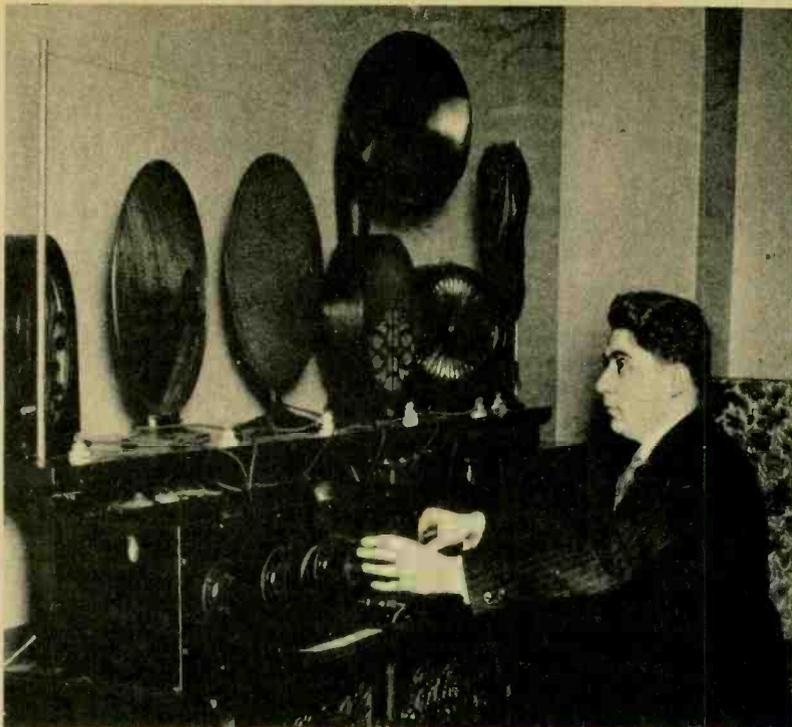
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EI-99

DXing a Bit of Broadcast History

**Ten of the oldest
broadcasters
are still around
on the airwaves
and they are a
great set to DX.**



By ALEX BOWER TWO score and ten years ago our forefathers were hunched over cat's whiskers listening to election returns over KDKA. A small riot might ensue if a broadcast historian suggested that this was the first commercial radio broadcast as we know it today. Be that as it may, most will agree that in the period between 1920 and 1922, radio broadcasting was launched in the U.S. by stations KDKA, WWJ, WLW, WSM and WOR.

Following the Great Crash of 1929, R. Moscow, the BBC, PCJ, HCJB and Vatican radio gave birth to the idea of international broadcasting with shortwave transmitters.

The ten stations listed above form a distinctive set, being some of the foundation timbers of our mass media. All of these stations are on the air today, so that those of us who were not around for the whisker era can still bag these great old stations.

Of course, none of these stations use their original transmitters or antennas and most have changed transmitter sites entirely. The station as an identifiable entity remains and this is the game that the DXer should be after.

In most radio histories, KDKA, a clear channel station on 1020 kc from Pittsburgh

and WWJ, a regional outlet in Detroit on 950 kc, receive most of the limelight for birthing broadcasting. These two are readily heard throughout the U.S. and should present no problems to DXers.

Station WLW is one broadcaster that has made perhaps even a greater contribution than either of those other two stations and yet very little is generally known about it.

In 1932, ten years after its birth, WLW was licensed to operate the world's first super-power medium-wave station on a test basis. Boasting a mammoth 500-kw transmitter, a giant even by 1971 standards, the station came on the air with the experimental call W8XO in 1933. At first, it was limited to daytime hours, but in 1934 the FCC allowed around-the-clock operation. In 1939, the FCC decided that 50 kw was enough for any BCB station and terminated the experimental arrangement. Today, super power medium wave stations are operating all over the world because of the ground work done by WLW—except of course in the U.S.

While all this was happening, WLW also established a shortwave transmitter to relay its programs and it was assigned the call W8XAL. (In this period all U.S. SWBC stations were given experimental identifica-

tions.) During World War II, this station was pressed into the service of the newly established Voice of America and was given the call, WLWO.

The memories of W8XO, W8XAL and the present VOA call are all that remain of the station. The call, WLW, is still around on 700 kc, a clear channel throughout the U.S. and Canada. After a few nighttime tries this one in Cincinnati should be readily loggable on the simplest of receivers. The only time problems will be encountered are when one of the two adjacent frequencies is in use by a local station such as in New York, where another pioneer of radio, WOR, holds down 710 kc with a 50-kw rig.

WOR's most notable contribution has been in the form of its programming—all night talks with celebrities, such as flying saucer freaks, that don't often find their way onto other stations.

WOR might be hard to log west of the Mississippi, but another of the founding

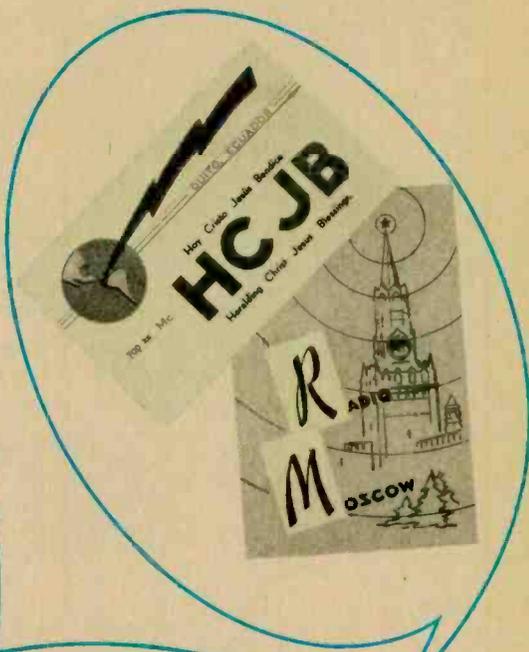
fathers, WSM on 650 kc, can be heard throughout most of the U.S. on this clear channel frequency. WSM is best known for its tireless promotion of the Nashville sound through many programs such as the Grand Ol' Opry which are devoted entirely to this twangy fare.

On the international scene, PCJ appeared in 1928 as privately owned Philips Radio. It later became R. Nederland but it has retained those same call letters. PCJ is assigned only to the transmitter site at Hilversum (Lopik) and for this you should try 11730 kc at 1630 EST. In the evening hours the same identity of R. Nederland is given on

[Continued on page 98]

EI's GUIDE TO ANTIQUE IDs

Station	Freq. (kcs)	Location	Notes
KDKA	1020	Pittsburgh, Pa.	
WWJ	950	Detroit, Mich.	
WLW	700	Cincinnati, Ohio	Transmitter site at Betheny
R. Moscow	many	many	Reports to Moscow
B.B.C.	many	many	Reports to London
WOR	710	New York, N. Y.	Transmitter site in New Jersey
WSM	650	Nashville, Tennessee	
PCJ	11730	Hilversum, Neth.	R. Nederland, 1630 EST
Vatican R.	9615	Vatican State	Transmitter sites at the Vatican and on adjoining Italian territory. Early evenings EST
	11725		
HCJB	11740	Quito, Ecuador	Evenings EST
	11915		



After making dozens of silent films, Douglas Fairbanks, Sr., probably wanted to hear someone talk, hence the early radio set by Freed-Eisemann. Present day QSLs from the antiques are above.

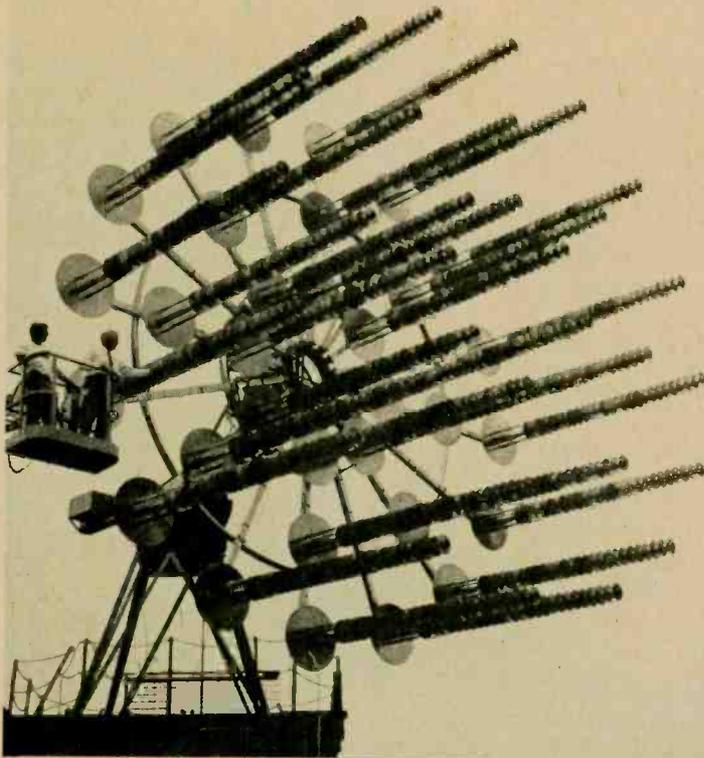


PICASSO CATHODE RAY. You won't believe it, but that business above the man's head is the flight path of a helicopter. It is simulated by a computer using a graphic display. First the pattern of the helicopter is entered on the CRT by means of a light pen. By program, the computer is instructed to move the object in pre-arranged fashion. In this case the computer is moving two rotors on the whirlybird.

Electronics in the News

Foiler for Boozers. General Motors hopes to keep inebriated folks off the road with this ignition interlock system known as Phystester. First the driver punches out a personal, five-digit code. If it fits, the machine comes up with another number that the driver must remember and repeat in a short time. If not the car stays put.





Umbrella Antenna. The idea behind this monster from the Goodyear Aerospace Corp. is that umbrellas are very convenient. They are thinking of using this antenna by sending it into space in a collapsed position. Once there, the antenna would automatically unfold to this configuration to improve air-to-air communications. The project is sponsored by the Air Force.

Charge the tube! A scientist from Bell Labs is shown here adjusting the newest thing in TV—a solid-state imaging device. The scanner uses a principle known as charge coupling which employs a piece of silicon as the medium for coupling light beams with electrodes. The process is expected to be used to carry photos directly by telephone.



Good Reading

By Tim Cartwright

RADIO CONTROL HANDBOOK (Third Edition). By Howard G. McEntee. *Tab Books, Blue Ridge Summit, Pa.* 320 pages. \$5.95 (paperbound).

Mr. McEntee is an authority on model radio control and his book, after many printings, is a bible on the subject. It's no cookbook of construction but a basic description of every major R/C technique.

This edition reflects recent trends in the field; the changeover from tubes to transistors and more emphasis on proportional control and less on simpler escapement systems. You'll discover what all the terms mean—pulse, servo, actuator—and excellent explanations of how electronic signals control the speed of an engine, the position of a rudder or landing gear. Receivers and transmitters are covered in some detail, along with information about the licenses and frequency bands available. The book touches all bases.

If you plan to invest in an R/C model, read this book first because you'll need all the help you can get. I can't forget the look of anguish on a friend's face when he flew his radio-controlled plane for the first time. He stood there furiously punching the transmitter button as the model ignored his commands and flew a straight course. It disappeared in the sky as a shrinking dot. In few other phases of electronic hobbying can a couple of hundred dollars fly out of the window so quickly. Mr. McEntee's book offers some insurance against the pain.

CIRCUIT PROBLEMS AND SOLUTIONS. Vol 3: *Transistor and Tube Circuits*. By Gerard Lippin. *Hayden Book Co., New York, N.Y.* 92 pages. \$3.55.

This is the last book of a three-volume series for students at the technical institute or junior-college level. Although the author states his text can be used without an instructor, the material in the first two volumes is probably too bare and overly mathematical for use beyond the classroom. This final volume, however, contains some handy information for the technician already in the field, especially if he dabbles in design. There's elementary theory on tubes and tran-

sistors, but more valuable is the step-by-step procedure of solving circuit problems. All those Greek letters and symbols which decorate tube and transistor manuals suddenly become clear. The author (an instructor at RCA Institutes) also supplies a useful refresher on that all-time baffler, the decibel.

THE RADIO AMATEUR'S HANDBOOK. 1971 Edition. By Headquarters Staff. *American Radio League, Newington, Conn.* 688 pages. \$4.50.

After continuous publication since 1926, the ARRL still offers the biggest book for the buck. If you don't own at least one edition of the handbook, you're probably reading EI for the first time. The latest edition continues ARRL's slow, but steady shift from tubes to transistors in theory and practical chapters. There are new solid-state projects, as well as added coverage in semiconductor reference tables. Everything is slanted at the ham radio operator, but you'd be surprised at the number of commercial communications products now on the market that were conceived in these pages.

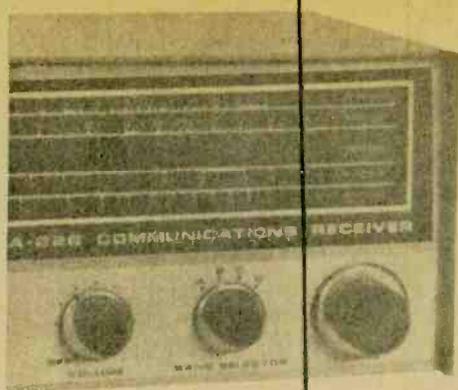
ELECTRONICS EXPERIMENTS CIRCUIT MANUAL. *General Electric, Owensboro, Ky.* 252 pages. \$2.

Like other big electronics manufacturers, GE is wooing the hobbyist with manuals to stimulate the sale of its semiconductors. The circuit descriptions are greatly improved over earlier manuals of this variety. Each project has a clear schematic, complete parts list and helpful illustrations to guide the physical layout. The book contains about four-dozen projects in the categories of audio, automotive, marine, game, home and workshop. These circuits are generally staple items, with no surprises. The text is especially suitable for the beginner who needs more than a scant schematic to construct and operate a device.

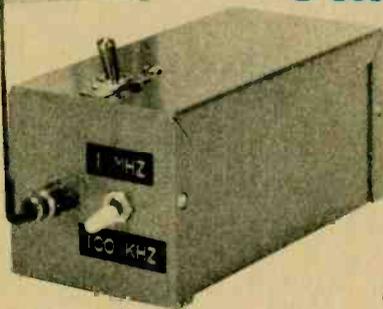
Finally, an ex-Navy man must have slipped in the old line from military manuals: "NEVER WORK ON LIVE ELECTRICAL CIRCUITS WHEN ALONE." If you can do it, you probably live on a commune. Anyway, they don't give the standard rescue technique: "PRY THE VICTIM OFF THE LIVE WIRES WITH A DRY STICK."

And make note of . . .

An Introduction To Field Effect Transistors. By J. Watson. *Siliconix, Inc., Santa Clara, Calif.* 128 pages. \$2.



Dual Frequency Standard for SWLs



*Put tone-modulated markers
on your receiver's dial every 100
kc or 1 mc, and tuning a specific
frequency will be like shooting fish in a barrel.*

By RON BENREY IT'S practically impossible to tune most shortwave receivers precisely to a known frequency. The reasons for this are the broad gaps between the dial's frequency markings, a wide dial pointer and the fact that the set's calibration is probably off to begin with.

The next best thing to an expensive gear-driven accurately-calibrated receiver dial is our Dual-Frequency Standard. It produces marker signals that will appear every 100 kc or 1 mc to pinpoint specific frequencies as you tune. And to make them easy to spot, the markers are audio modulated at about 600 cps.

The Standard is a miniature, ultra-low-power, RF transmitter consisting of a crystal-controlled RF oscillator that is modulated by an audio oscillator. The placement of diode D1 (a non-linear device) in the RF oscillator circuit causes the RF output to be exceptionally rich in harmonics. Thus, there will be signals at every 100 kc or 1 mc up to about 20 mc. Because the higher-frequency harmonics of 100 kc are rather weak, you may not be able to find them past 20 mc on low-cost receivers. However, the 1-mc harmonics will come through on virtually every receiver.

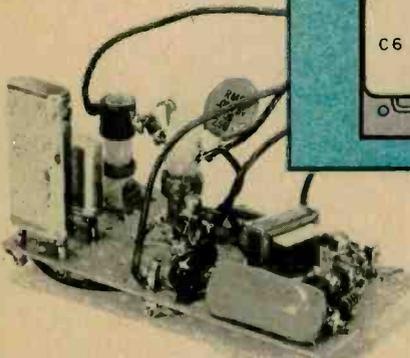
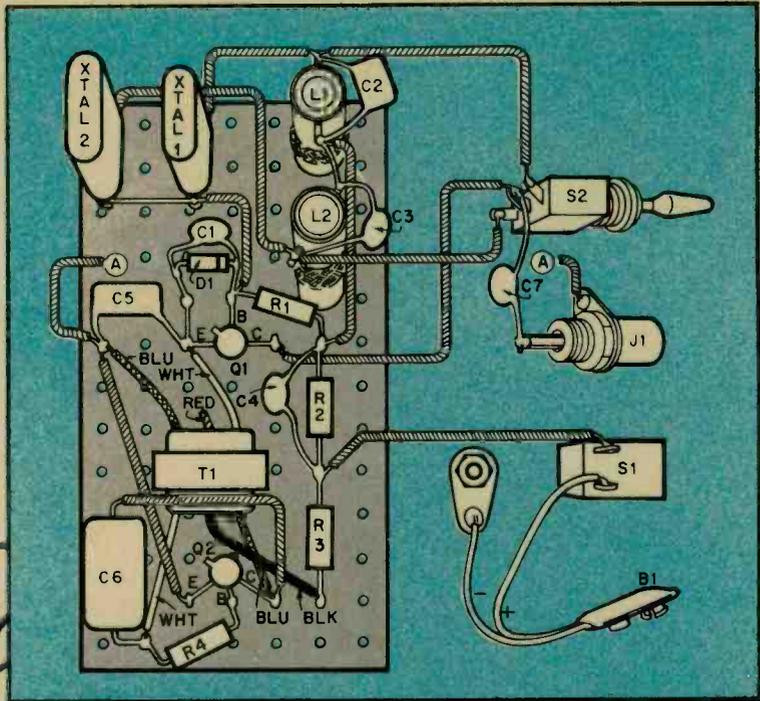
Why two marker frequencies? Because at the high-frequency end of your receiver's dial (above 10 mc) the 100-kc markers would be packed together so tightly that the slightest turn of the tuning knob would encompass more than one 100-kc marker. Thus, 1-mc markers are more practical at high frequencies.

Incidentally, at this point we should review how markers are used in shortwave listening. As a non-electronic analogy, consider how you use the odometer in your car to find an unfamiliar address. Let's say the directions are: make a left turn 3/10 of a mile past Joe's Diner. First you find Joe's Diner, then you watch the odometer tick off 3/10 mi. . . . then you make a left turn.

Finding an unfamiliar, or very weak station with markers is done in much the same way. Let's say you want to listen to a station at 7150 kc (7.15

Dual Frequency Standard for SWLs

Fig. 1—Pictorial at right shows location of parts on 2 x 3 3/4-in. perforated board. Board is mounted in U-section of Minibox; parts at right mount in main section. Lug on negative battery lead goes to cabinet. Photo below shows the completed board before it is installed in the cabinet.



mc). The first step is to locate a strong signal near 7150 whose frequency you know. We'll call it Radio Mammoth on 7050 kc.

You tune in R. Mammoth, then switch on the Standard (set of 100 kc). Next, you carefully turn the tuning knob to a higher frequency. Suddenly, you hear the marker which comes through as a high-pitched tone (about 600 cps). Since the marker signal is a harmonic of 100 kc, it will appear only at multiples of 100 kc on the dial. The first multiple of 100 kc past 7050 is 7100. Thus, your receiver is now tuned to 7100 kc.

As you tune higher, another marker appears. This is 7200 kc. The signal you are hunting for (7150 kc) will be between the two markers.

How it Works

The heart of the Standard is a crystal-controlled RF oscillator built around tran-

sistor Q1. (See Fig. 2.) Switch S2 selects the appropriate combination of crystal and tank circuit (L1/C2 or L2/C3) for operation at either 1 mc or 100 kc.

Transformer T1 is a modulation transformer. It couples the audio signal generated by audio-oscillator Q2 to the RF oscillator, causing it to amplitude modulate the RF signal. The circuit is powered by a 9-V battery, B1.

Construction

The Standard can be built in a 2 1/4 x 2 1/4 x 5-in. aluminum Minibox; all of the circuitry is built on a 2 x 3 3/4 in. piece of perforated board. Wire the board first using push-in terminals for tie points. Parts placement is not critical, but we recommend that you follow the layout shown in the pictorial in Fig. 1.

Be very careful when you attach wires to the lugs on the two coils—a slip of the pliers may yank loose the fine wire leading to the windings. Similarly, use care when you solder the leads of the transistors and diode in place. Grip each lead with a pair of needle-nose pliers as you solder it—it will act as a heat sink and dissipate heat.

Mount T1 on the board by passing its tabs through a pair of holes, and then bend

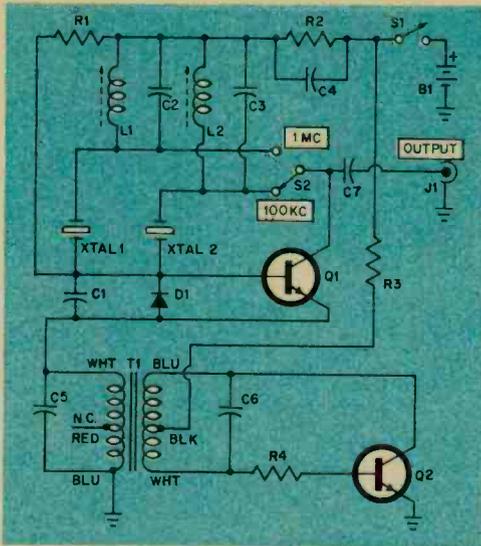


Fig. 2—Switch S2 selects appropriate crystal and tank circuit for 100-kc or 1-mc RF output. Audio modulator consists of parts C5, C6, Q2, R4 and T1.

PARTS LIST

- B1—9V battery
 Capacitors: 15V or higher
 C1—820 μ f disc
 C2—300 μ f disc or mica
 C3—.0075 μ f disc or mica C4—.05 μ f disc
 C5—.002 μ f mylar or paper
 C6—.1 μ f mylar or paper
 C7—390 μ f disc
 D1—1N60 diode J1—Phono jack
 L1—60-140 μ h adjustable RF choke (Calectro D1-885 or equiv.)
 L2—310-860 μ h adjustable RF choke (Calectro D1-857 or equiv.)
 Q1, Q2—HEP-50 transistor (Motorola)
 Resistors: $\frac{1}{2}$ watt, 10%
 R1—470,000 ohms R2—4,700 ohms
 R3—560 ohms (see text) R4—33,000 ohms
 S1—SPST toggle switch
 S2—SPDT toggle switch
 T1—Transistor output transformer; primary: 500 ohms, center tapped; secondaries: 3.2 and 8 ohms (Calectro D1-726 or equiv.)
 XTAL-1—1 mc crystal. (Crystek Part No. CT-6GP1, \$5.50 postpaid. Available from Crystek, 1000 Crystal Drive, Ft. Myers, Fla. 33901)
 XTAL-2—100 kc crystal (Crystek Part No. CT-1LF, \$5.50 postpaid)
 Misc. Perforated board, 5 x 2 $\frac{1}{4}$ x 2 $\frac{1}{4}$ -in. Minibox.

them back on the board's underside. Mount the two crystals by soldering their pins (work quickly and carefully with a hot iron) to two pairs of push-in terminals. Screw in the cores of L1 and L2 so they are within the windings.

Cement battery B1, in place on the main section of the Minibox with epoxy. Since the Standard will be turned on only when you go to tune a station, the battery will last for hundreds of hours.

Mount the completed circuit board inside the U-section of the Minibox using a long screw and a spacer. Apply a layer of tape on the inside of the cabinet so the push-in

terminals protruding through the bottom of the board don't touch the cabinet. Be sure that component leads or wiring do not touch the sides of the Minibox when the board is installed.

Using the Standard

In most applications there's no need to make a direct connection from the Standard to the receiver. Simply solder a short length of stiff wire to the inner contact of a phono plug, and plug the wire into jack J1. Place the Standard close to the receiver's antenna. When you switch the circuit on, you'll hear markers at multiples of 100 kc or 1 mc.

For best results and for sure reception of markers above 20 kc, connect J1 to the receiver's antenna terminals with a short length of coax.

Note: Resistor R3 has been selected to limit audio modulation of the RF signal to a low level to minimize spurious harmonic signals at frequencies other than multiples of 100 kc and 1 mc. If you prefer more intense markers, decrease R3's resistance to 270-ohms.

Similarly, the audio frequency of the marker tones can be changed by using a different value capacitor for C6. Increasing the value will raise the tone; decreasing it will lower the tone.

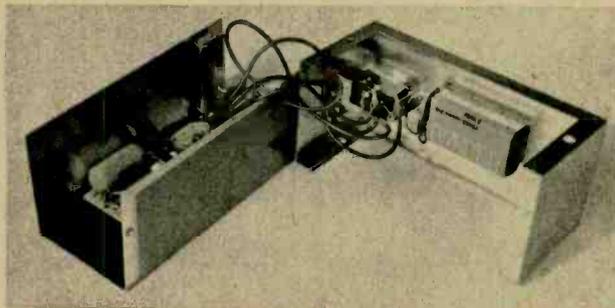
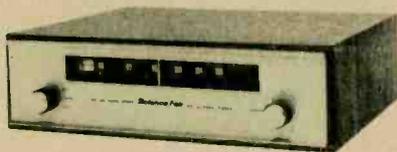


Fig. 3—Tape bottom of inside of U-section of Minibox (left) and mount board with $\frac{3}{8}$ -in. spacer. Switches, output jack, battery go in main section.

Shoestring Stereo



RK-100 Amplifier



Allied Radio Shack

RK-101 Tuner

THE Allied Radio Shack RK-100 amplifier and RK-101 stereo-FM tuner are excellent examples of how emphasis has been put on sound rather than frills.

These *Science Fair* kits are intended, by price and design, for the newcomer to audio kit building. Most components are on one large circuit board in the tuner and one large and two smaller boards in the amplifier. This makes for extremely simple construction jobs. Our builder, who has limited kit experience, completed the tuner in five hours and the amplifier in seven hours. Some of the work that is done off the board, such as soldering components to pots, was a bit crowded, but no real difficulties were encountered. In the amplifier kit there was one instruction error, that if carried out, would cause a reversal of channels. We notified Allied Radio Shack of the mistake.

The \$69.95 amplifier, which comes with a wooden cabinet, has three inputs for magnetic phono, tuner and aux. Outputs are provided for 8- and 16-ohm speakers, headphones and tape recorder. The front-panel controls are an input selector switch, concentric volume controls (one for each channel), dual bass and treble controls, power and a mono/stereo mode switch. On the back

there's a switched-AC receptacle.

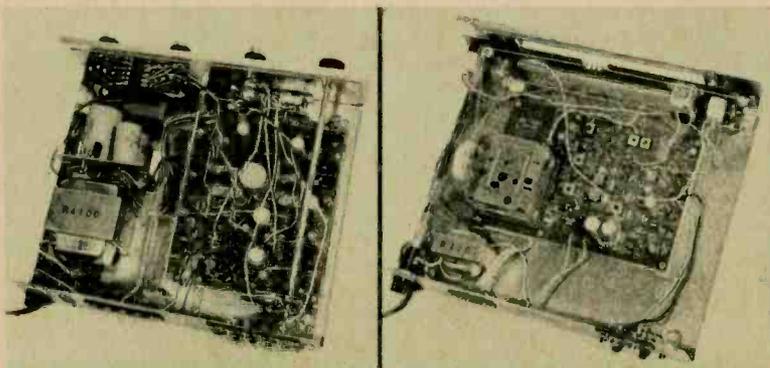
With both channels driven, the amplifier delivered 10 watts (rms) per channel into 8 ohms when clipping started. It delivered 4.8 watts (rms) per channel into 16 ohms.

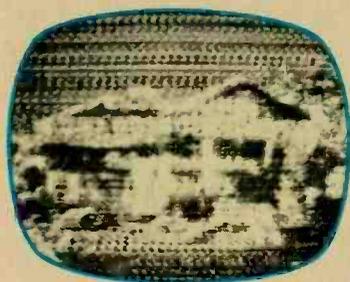
The power bandwidth was 20 to 50,000 cps. This means that the maximum power output (10 watts) per channel into 8 ohms was down 3db (to 5 watts) at 20 cps and 50,000 cps. We, therefore, measured the response at the 5-watt level. From 20 to 20,000 cps it was $-0, +2$ db at a total-harmonic distortion no higher than 0.38 per cent at any frequency. The magnetic input hum and noise was a dead quiet -76 db. Separation was 53db.

The range of the tone controls was ± 10 db at 50 cps; $-8, +7$ db at 10,000 cps. Maximum bass boost was at 50 cps. The fixed loudness equalization provided 10db boost at 50 cps with the volume control open a quarter of the way. Input sensitivities for maximum power output are 5 mv for phono and 200 mv for the tuner and aux inputs.

Most of the amplifier is built on a large printed-circuit board as shown in the left photo below. There are two other small boards and a handful of chassis-mounted parts. [Continued on page 99]

Photo at far right is of completed tuner. Almost all the parts are on circuit board in center. Note front-end at lower left corner of board. Photo at near right is of amplifier. Main circuit board on right side is crowded. Two smaller circuit boards are in power supply section at left of shield. Both kits slip into matching oiled walnut cabinets that are included in price.





Getting an Unbelievably Good Color Picture



By
ART MARGOLIS

YOU SAY Walter Cronkite has the green fringes and the smoke of Gunsmoke looks like pink mist? It's time to call in the service-man. If you would rather not get a second mortgage on your house to pay for his services, you can get your set looking clear as a bell yourself with just ten minutes and a little know-how. You find the time and we'll provide the info.

In order to get an excellent color picture you don't adjust the color at all. Your energy must be directed toward getting a good b&w picture on your color TV. That is the secret. The better the b&w picture you are able to attain, the better your color picture is going to be.

Yes, there are professional service adjustments for color correction, but they are in the realm of alignment procedures and cannot be carried out by the average set owner. These procedures are off limits except for well-experienced service technicians.

To get this good b&w picture, there are three separate procedures to perform that include the manipulation of 14 controls. The first procedure is gray-scale tracking. This is done with seven controls. The second procedure is purity adjustments and utilizes three controls. The third procedure is the static convergence.

Getting an Unbelievably Good Color Picture

You hardly ever have to go through the whole bit. As your set ages and your picture changes for the

worse, it becomes simply a matter of recognizing what particular trouble is occurring and reaching for the right controls to affect a cure. This analysis is not that hard because you are going to be viewing the TV continually. You will perceive a particular trouble and all its little nuances even before experienced serviceman might.

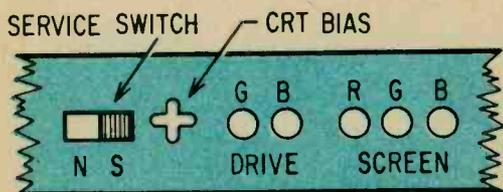


Fig. 1—This represents the layout of most gray-scale tracking controls found on most color TVs. CRT bias may appear as kine bias on set.

The first thing you have to do with our procedure to cure your color ills is to get a b&w picture on your set. With the prevalence of color programming these days, this might not be such an easy task. The best place to turn is to a station that has no network affiliation, as many of these broadcasters show old reruns and movies, many of which are in b&w.

Now that you have a b&w picture, you may notice that areas that would normally be gray or white have a color tint to them. In other words, you have a pink and white or blue and white picture instead of the normal b&w. If this problem is uniform throughout the picture, you undoubtedly have what we referred to earlier as a gray-scale tracking problem. The gray scale represents the various shades of gray that are found in the spectrum between pure white and pure black.

Before you proceed to cure this problem, make sure that it is present throughout the picture. If it is limited to certain areas, this is an entirely different problem and will be discussed later.

Once you have reached the conclusion that your TV has a tinted picture, you set about getting the tint out, or to put it another way, to get your picture to track the gray scale correctly from black through varying shades of gray to white.

There are seven controls mounted somewhere on your color TV to accomplish these ends (see Fig. 1). They are, in the order they are usually manipulated: 1) service switch; 2) red screen; 3) blue screen; 4) green screen; 5) CRT bias or kine bias; 6) blue drive and 7) green drive.

You can adjust these controls effectively without understanding at all what they do. Here's how to proceed:

First, flick the service switch. This makes the picture disappear and causes a horizontal line to appear in the center of the screen.

If you are somewhat familiar with the concept of vertical sweep, which is what you lose when you flick the service switch, you'll know that when this occurs as a result of some malfunction, it's a good idea to turn the brightness control down, or else you'll burn a trace across the screen. Well, you don't have to worry about that with the service switch. It's designed so that no harm will come to the picture tube.

The second step is to extinguish that horizontal line. It is a good idea to view the screen in a mirror so that you can remain at the

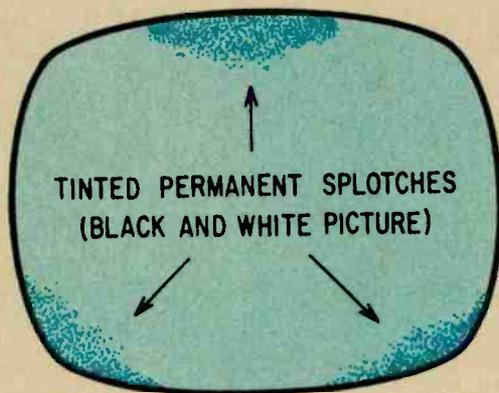


Fig. 2—This is an example of poor purity. It can be cured by degaussing, adjustment of the purity-ring tabs or adjustment of yoke assembly.

back of the set. To get rid of that line, turn down (counterclockwise) the red-, green-, and blue-screen controls.

The third step is to turn each one back up. First advance the red till a faint red horizontal line appears. Then turn the blue so that the combination of red and blue produce a faint purple line. Then bring up the green so the addition of green light results in a faint white line. You may notice that these screen

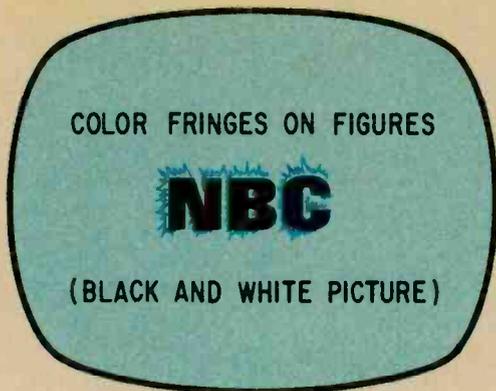


Fig. 3—This is a problem that's found in many color sets—color fringing in a b&w picture. The cure is reregistration by static convergence.

lines are bowed at the center rather than being perfectly straight. If this is the case with your set, it will be extremely difficult to get the three lines to overlap and blend to form a white line. An alternative procedure is to turn each control up individually and then turn it down until the line just disappears. This will produce much the same effect as the other procedure. If all three controls produce light, you have completed the gray-scale tracking adjustments. Reset the service switch and you'll find you should have a true b&w picture.

I guess you are wondering what the other three controls are for. They are there in case of complications.

The first complication that you might come upon as your TV ages will be when you turn up a screen control but it doesn't produce its respective color line.

That's when the CRT bias (or kine bias) control (or switch) becomes useful. Let's take the case where there is no green light even when the green-screen control is turned to its extreme clockwise position. Leave the green-screen control at the extreme clockwise position and set the red- and blue-screen controls at the extreme counterclockwise position.

Then turn the CRT bias control clockwise while watching the screen. At some point green should appear once more. (If it doesn't you have more serious troubles which are out of the realm of this article.) The point at which the green line appears is the correct setting of the CRT-bias control. Now perform the gray-scale tracking procedures as previously outlined.

Why did the green disappear at a lower

setting of CRT bias making it mandatory to increase bias? The emission of the green gun in the picture tube has dropped. It's a sign of picture-tube aging. With this procedure you have extended the life of the tube.

When you adjust the screen controls, you are manipulating the dark areas of the picture so that they appear as black or gray. These dark areas are known as the lowlights of the picture. A problem may also arise with the bright areas on the screen. These highlights are where you expect to see white. If these areas are tinted with color you will have to adjust the last two gray-scale controls—the green and blue drive.

These two controls have the same affect on their respective color highlights as the screen controls had on their lowlights.

Why is there no red-drive control? The red is set by the manufacturer and acts as a reference for the green and blue.

Should there be a color tint in the highlights, correct it with the two drive controls. For instance, if there is a green highlight tint, turn the green drive down ever so slightly. Or if there is a pink highlight tint, adjust both green and blue drive controls until the tint is gone.

If you recall, I said that a tinting problem in one or more specific areas—not across the entire screen—was indicative of a problem that had nothing to do with gray-scale tracking. This is a purity problem. The tint is usually found around the screen edges es-

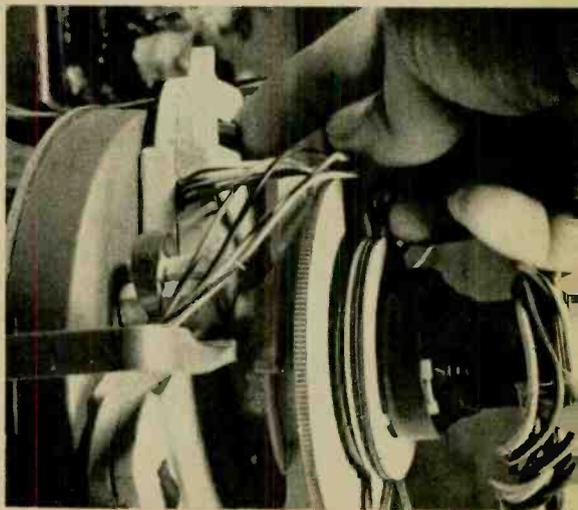


Fig. 4—Here a technician is performing static convergence. Note that he is now adjusting the blue-static magnet which is at 12 o'clock position.

Getting an Unbelievably Good Color Picture

There are three procedures to get rid of purity problems. They are: degaussing, proper beam centering and proper screen scanning.

Restating the term degaussing to demagnetizing simplifies the idea greatly. Like many other metal objects, portions of your picture tube (the shoulder mask) can become magnetized, throwing your picture out of kilter and producing color impurities. A degaussing coil will remove magnetic field found around the color TV tube.

The procedure is simple. Take the coil, plug it in away from the set then lay it flat against part of the perimeter of the tube, back off about six ft. while moving the coil in a circular motion. That's it. You can degauss while the TV is on or off. You can degauss as often as you like.

Lots of TVs have automatic degaussing coils installed in the set. On occasion these sets still need to be degaussed externally. Where can you get a degaussing coil? At any electronic parts distributor. They start at about \$5. If you have a color TV and intend to do your own touchups, it's a good investment.

When degaussing doesn't completely cure the purity problem you'll have to go to the neck of the picture tube and make adjustments.

The neck adjustments cannot be made with a b&w picture. You must make these adjustments with only one color field showing. To be specific, turn down the blue- and green-screen controls and turn up the red. Or you could use two of the color-killer switches to shut off the two guns. This will give you a red field. Your adjustment techniques are going to work toward producing

especially in the corners of rectangular tubes (see Fig. 2). This difficulty is also found at screen center.

the purest red field possible, all over the screen.

To cure the center screen purity problem centering devices called purity rings are installed around the neck of the picture tube. The correct position for the tabs on the rings is usually near but not on twelve o'clock. Lots of times all you have to do is simply turn these two tabs and watch the impurity disappear which means a pure red field. Other times, you must turn the two tabs independently and they can end up anywhere. Anyway they are easy to turn and it will take very little time for the adjustment.

Once the red field is pure, you'll find the blue and green fields are also pure and you can redo the gray-scale adjustments to restore the b&w picture.

The third reason for color impurities on the screen, especially around the edges, is improper beam scanning due to movement of the yoke. This could occur due to aging or moving of the TV set or could become apparent after you degauss or adjust the purity-ring tabs. The yoke adjustment is simple. Loosen the yoke and push or pull it slightly back and forth while watching the screen.

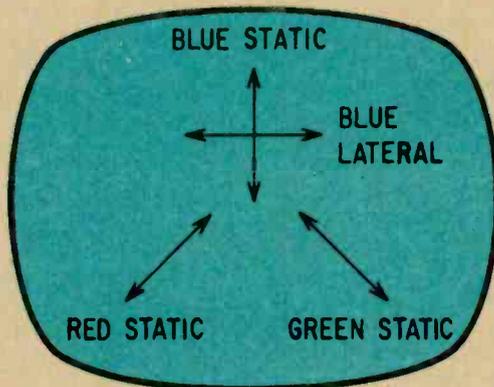


Fig. 5—This shows how the colors will be affected by static convergence. Red and green move diagonally; blue moves up-down and left-right.

Stop and tighten the yoke when the purity problem disappears.

Each of these three procedures to cure purity problems can interact with each other. If they do, simply go back and forth among them until you eliminate the interaction.

The last part of the color TV touch-up involves registering all three colors, one on top of another, at screen center so that no trace of color bleeds out from the black and white. This is called static convergence.

I'll repeat, this procedure is only for screen center. If there is bleeding in other sections of the picture, for instance on the top, bottom or sides, it is out of the realm of a simple touch-up. Fortunately, when you eliminate the bleeding at screen center the rest of the

[Continued on page 102]

The Ham Shack

By Wayne Green
W2NSD/1



A WELL-PLANNED ham convention is an event that is remembered with pleasure for many years by those lucky enough to attend. Lucky in this context, meaning those with the interest and foresight to make the effort to get to the convention.

What happens at conventions that have this impact? Aren't they mostly lots of dull talks and boring exhibits of ham gear? Not if the convention committee is worth its salt, they're not. A good committee will have top-notch speakers and moderators for the talks, will see that most of the manufacturers are there to show and tell with their new products, will arrange for an auction or a swap section for exchanging used gear, will try to have events for every type of amateur interest.

One of the big drawing cards for any convention is the array of prizes to be given away. These usually range from one or two complete SSB stations down to a myriad of smaller prizes. There are so many prizes at some conventions that it is unusual for anyone to go away empty-handed. These prizes are either donated by the more active amateur manufacturers or sold on a cost basis to the convention committee.

In addition to all those nice prizes, a good hamfest will have talks and technical sessions for just about every phase of the hobby. Amateur radio is actually many hobbies, with considerable overlap among the more active hams. While one group lives and dies according to its position on the DX country lists, others are giving up their nights to bounce signals back from the moon.

The ARRL addicts will have an ARRL forum where they can hear League officials reassure them that everything is okay and that rumors of any problems are just the work of scurvy opportunists. Since this is just exactly what they came to hear, it is music to their ears.

The two-meter FM crowd seems to be everywhere at conventions these days, talking

to each other from their cars, with hand units and in general letting everyone know that FM is the In thing. They have their own schedule of talks at many conventions, with slides of snowbound repeater sites, maps of repeater coverage, tales of repeater club wars, and constant one-upmanship with newer and more sophisticated gear.

DX operators, their pockets bulging with rare QSL cards, flock to slide shows of operations on unknown coral reefs, deserts and spots that even the National Geographic Society would find hard to believe.

Members of a hundred different nets get together to meet in person. MARS, AREC, doctors, clerky, traffic, airport managers, you name it and there is a net and they get together. Even the Eyebank Net gets together for an eyeball QSO.

The VHF talks bristle with homebrew receivers and converters, many of them using the latest solid-state devices that are produced from a convenient watch pocket. By the way, do they make watch pockets any more?

The CW men try their hands at the code speed contest and come out with certificates attesting to their abilities. High-speed code is an art form and the practitioners are a breed apart in the realm of 50 words per minute and above. There is something particularly impressive about the nonchalance of the code expert. He is lord and master and he knows it. It is an experience to watch one of these showmen at work. They will turn on a code tape, let it play for a little while, talk with one or two friends for a moment and then turn to the typewriter and let fly. The conversation with friends and onlookers keeps right on as the typewriter clacks away, with pauses that begin to convince the audience that this time the message must have really gotten away from him. But no, the keys flash at incredible speed and he is soon caught up, never missing a beat on his conversation.

The fox hunters are out in force on this day, too. With weird loops and directional antennas sprouting from their cars, they are off in a screech after the hidden transmitter, each absolutely sure that he is going the right way, with each heading off in a different direction. Soon the cars are zipping back the opposite way, again sure of their bearings.

The antenna nuts gather to listen to experts pontificate on quads, spiral arrays and other esoterica. Some of the antenna man-

[Continued on page 103]

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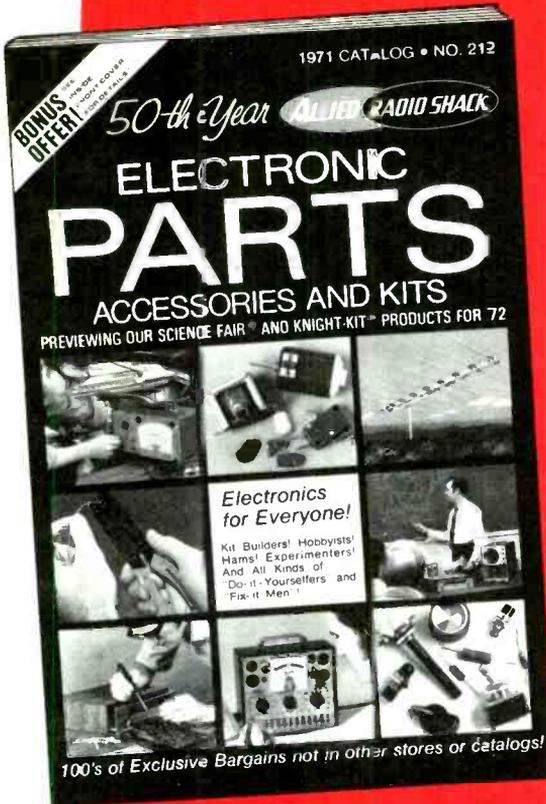
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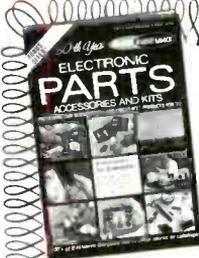
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CB Corner

By Len Buckwalter, KQA5012

The Louvre of CB

OF ALL the far-fetched schemes dreamed up for CB, none quite matches the latest. It's called the National CB Museum and it's being fashioned after the world-famous Baseball Hall of Fame in upstate New York. Unlike other attempts to launch a CB plan with a nationwide base, this one is off to a running start and may well succeed. The idea of a museum devoted to CB has proven so intriguing that it's already won widespread support from CBERs, clubs, CB manufacturers, the FCC and even a U.S. Congressman.

The museum concept has also drawn waves of skepticism from CBERs who have been fleeced by fly-by-night organizations who solicit dollars and then quietly disappear.

To get a closer look at the men behind the museum, I went to Spring Valley in southeastern New York. The idea was dreamed up by the Citizens Radio Assoc. of Rockland, a durable club that's been operating with about 75 members for a dozen years. I've met national CB organizers before—from a pistol-packin' Georgian, to a Chicago boilermaker—but this group operated with professionalism not often seen in CB. Officials were assembled, exhibits were ready on the table and I was invited to ask questions about any part of the operation.

The museum will be filled with artifacts and memorabilia of CB history; the earliest rigs, QSLs and ancient flyers of by-gone jamborees. One section will be a CB Hall of Fame to honor individuals who've done something significant for the service. The museum will maintain the world's largest file of QSL cards. A schematic reference section will offer a complete file of technical dope to anyone seeking outdated service literature. A research library will

house every obtainable publication pertaining to CB. There'll be an FCC exhibit and a manufacturers' display area.

Every phase of the operation including press releases, slick brochures, fund-raising kits and traveling evangelists, smacks of professionalism that's not home-town CB. Yet, the story of how it got started sounds plausible.

It began about a year ago when the Rockland club looked for camping grounds in the Catskill mountains—a two-hour drive north of New York City. The club purchased 40 acres in the town of Kerhonkson

and then split the area in two. Half was retained by the club; the remaining 20 acres were divided into two-acre parcels and quarter-acre campsites which sold to members at \$100 each. With land backing the deal, the total purchase of 40 acres (\$10,000) was easily raised from the sale of parcels to members.

Once the club held the land, members started building an access into it. "Let's name this road after George Nims Raybin," someone said. Raybin, an attorney from the Bronx, had just died (and is almost certain to become CB's first folklore hero). He spent his last

years of retirement bombarding the FCC with legalistic petitions for changes in the rules. Raybin is given credit for two important changes in FCC policy: the setting aside of a special channel (9); and the continuity of call letters, where a license keeps the same letters after renewal.

"We'll build a statue to George Nims," was another suggestion heard among the road-building CBERs in Kerhonkson. But the next remark struck the magical chord: "Let's build a museum."

That launched the [Continued on page 102]



This is not the coat of arms of a CB fanatic. It stands for the proposed National CB Museum, a monument to those 23 channels.



THE COUNTERS ARE COMING!

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By LESLIE POWELL

ONCE upon a time it was called esoteric, engineering overindulgence or a plaything for the affluent. Yet it was always mysterious and intriguing. The bright Nixie-tube readout was a guaranteed show stopper when it displayed the frequency of an input signal in big orange numerals. 15037 kc it proclaimed, unequivocally and with fantastic accuracy. Such was the frequency counter. What a machine it was! But it's a new ball game now.

Formerly aimed at the industrial market at out-of-sight prices, the frequency counter is one of the important fallouts of our rapidly advancing technology. The declining prices of integrated circuits and digital-display devices as well as fierce competition have made the frequency counter a test instrument that almost every hobbyist and service technician can now afford. The day when the frequency counter will compete with a VTVM and a scope for space on a test bench is here.

At one time counter prices ranged upward from \$1,000, depending on the upper frequency limit. Today, wired counters are down to around \$400 while kits start at \$135.

The old-fashioned way of determining frequency involved a scope and a signal whose frequency you knew. Combining the two frequencies in the scope produced a lissajous pattern from which the unknown frequency could be determined. Looking back, this was an inelegant method fraught with booby traps.

THE COUNTERS ARE COMING!

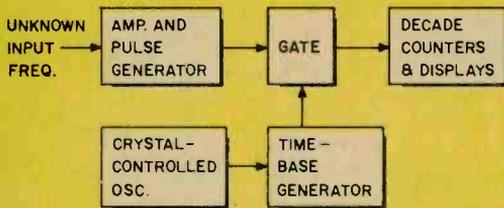


Fig. 1—Basic Counter. Pulse generator converts input signal to pulses. Time-base generator opens gate; counters count pulses in the interval of time the gate stays open.

On the other hand a scope with calibrated, triggered sweep could measure the frequency of a signal. But such a scope is very expensive.

Counters are valuable because modern equipment is extremely frequency dependent.

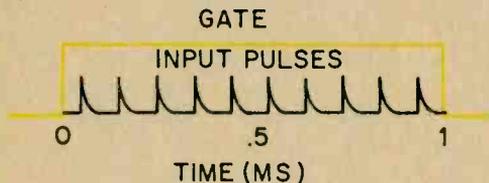


Fig. 2—Assume gate length is 1 ms. Since 10 pulses pass through gate in this time, frequency of signal is 10 cycles/ms or 10 kc.

Using conventional test equipment and techniques you can at best expect to plod along for hours doing a job a counter can knock off in minutes.

For example, the old standard FM detector used two diodes and was easy to service.

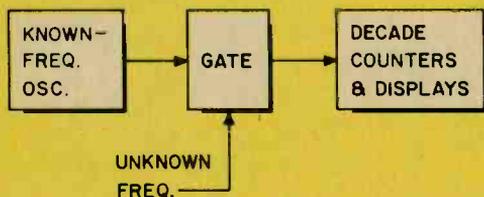


Fig. 3—Counter configuration for measuring low-frequency signals. Here, counting pulses from internal osc. produces higher accuracy.

If a diode shorted or opened a drastic voltage change occurred. But in a modern TV receiver you might find a synchronous detector, with the incoming sound IF being beat against the signal from a fixed-frequency oscillator. If the value of any one of several parts changes, the fixed oscillator changes frequency, the detector goes haywire, and it can take hours to find out what's wrong, because you must first make certain the fixed oscillator is on frequency. A counter will immediately indicate the fixed-oscillator's frequency.

A tape recorder, the Revox A77, uses an oscillator for precise control of capstan-motor speed. A counter is a must for correct speed adjustment; even for a minor repair in the capstan-motor-control circuit. Fact is, more and more consumer and commercial equipment such as adding machines, two-way radios and photographic timers are incorporate digital circuitry, and there is no way to service this gear easily without a counter.

There are two basic types of counters. The frequency counter and the digital counter. Both provide a similar readout by means of devices that form numerals. The frequency counter, the less expensive instrument, does what its name implies—it counts (indicates) frequency. The digital counter is more sophisticated, indicating frequency, random counts per known time interval, total of counts per time interval, ratio between two frequencies or time periods, and a host of other things primarily of value to research and test labs.

For hams, a counter means precise setting of a VFO. For example, got a schedule on 14.125 mc? Simply crank the VFO until the counter displays 14.125 and you are sitting right on frequency.

Or maybe you're an SWL with a typical uncalibrated *calibrated* dial, and you want to dig out R. Sweden on 15375 kc. Simply connect any cheap RF signal generator to a counter, tune the generator until the counter indicates 15375 kc and then tune the receiver to the generator's signal. It's the closest you'll get to owning a gold-plated receiver, and you'll probably be a lot more accurate.

And CBers aren't left out, either. The new super-selective transceivers, and the SSB models, require really precise alignment. Try using a standard signal generator and its dial inaccuracy, no matter how small, will leave you with screeching, hissy AM recep-



Fig. 4—Hewlett Packard 5301A. 10 cps-10 mc.



Fig. 5—Eldorado Electrodata 225. DC-15 mc.



Fig. 6—Heath SM-105A (not kit). 10 cps-80 mc.



Fig. 7—Weston Model 1250. DC to 25 mc.



Fig. 8—Monsanto Model 150A. 5 cps-32 mc.

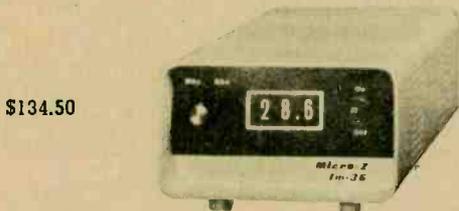


Fig. 9—Micro-Z fm-36. Audio-35 mc (kit).

Fig. 10—Simpson 2725A. 5 cps to 32 mc.



tion, or Donald Duck SSB chatter. But set up the generator with a frequency counter first and you get lab-standard generator calibration. And don't forget that the counter will check the transmitter's frequency tolerance.

While it doesn't appear that a counter has value for the audiophile, consider modern top-of-the line stereo receivers. Those crystal filters or high-Q IF strips require very precise alignment; a counter will turn even a \$20 signal generator into a lab-standard generator. Even the adjustment of the 19- and 38-kc filters requires better accuracy than is built into even a quality audio generator.

Fact is, counters can be used in many unusual consumer applications. For example, tuning an electronic organ is child's play if you use a counter—which is less expensive than commercial organ-tuning devices.

Using a reflecting sensor and a counter, you can end up with a tachometer that can be used to check an auto engine's rpm, or to check speed of any rotating equipment.

How a Counter Works. A frequency counter consists basically of a gate, time-base generator and decade counting assemblies (which include the readout devices) is shown in Fig. 1. The time-base generator opens and closes the gate; the decade counter counts the number of pulses (converted from the input signal) which pass through the gate and indicates the number of pulses on the readout device.

For illustration, assume the input frequency is unknown. The time-base generator has been set to 1,000 cps; meaning, the gate is open for an interval of 1 ms (millisecond). If during the time when the gate is open 10 cycles of the input signal pass through the gate, the decade counter will indicate 10. On the Heath IB-101 counter the decade counters are tied to the time-base selector in such a way that the readout is 10. The time-base selector lamp indicates kHz, meaning the unknown input frequency is 10 kc. Should the input frequency change, the pulses are counted each time the gate opens, and the display changes with the input frequency.

If the input frequency is 1 kc, only one cycle goes through the gate in 1 ms, so the counter would indicate 1 kc. Obviously, the counter cannot count a portion of the cycle, so in Fig. 1, 1-kc would be the lower limit; you could not count 500 cps with a 1-ms gate length. (However, the Heath also has

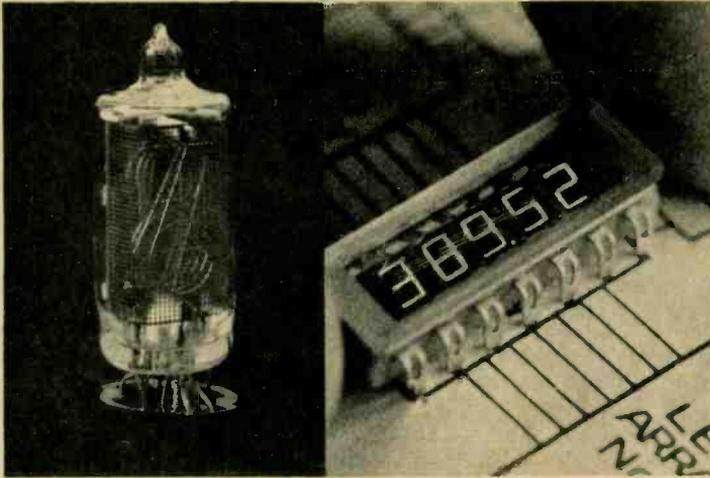


Fig. 11—Nixie tube, used in many counters, is shown in photo at far left. It consists of wires in shapes of numerals 0-9. Principle of operation is same as neon lamp. Solid-state numeric indicator in photo at near right is Hewlett Packard's HP-5082 series. Numerals are formed with seven segments that are made up of light-emitting diodes

THE COUNTERS ARE COMING!

a one-second gate which is explained in the report on their IB-101 counter.)

To get greater accuracy at low frequencies, a different circuit configuration is used to control the gate, as shown in Fig. 3. The unknown input frequency becomes the time base while a much higher known-frequency signal to the input is counted. The display device then indicates the count of the known gate input frequency.

For example, assume that with a known input of 1,000 cps the display indicates 10,000. This would mean the gate must be open long enough for 10,000 cycles to pass through the gate; therefore, the gate must be open for a duration of 10 ms. This means, therefore, that the frequency of the unknown signal is 100 cps.

The counter's selector switch, which determines the known input frequency, also inserts the decimal point in the correct position and the readout would show 100.00. If the selector switch is calibrated in *cps* and *kc*, the counter would indicate 100 with the *cps* position. (The decimal point is generally determined by the selector switch, with extraneous zeros suppressed.)

In precision lab counters the configuration in Fig. 3 is used to obtain very high accuracy when measuring low-frequency signals. In service and test bench counters the circuit in Fig. 1 is used for all measurements

because it provides good low-frequency accuracy at low cost.

A counter's accuracy is determined by the time-base stability plus or minus one count (the least-significant digit). The plus or minus one count is caused by the internal counting circuit and is common to all counters. The time-base stability is determined either by the crystal that provides the reference frequency (clock), or by the 60-cps power-line frequency. In lab counters the crystal is in a heated oven. In service-grade counters the crystal is a trimmer-corrected type (for zero beat) such as you'd find in a 1-mc standard, as used by hams and SWLs. It has a typical stability of 0.002 per cent.



Fig. 12—Heathkit IB-102 scaler (under counter) can divide up to 150-mc signal by 100 or 10. 107-mc readout is of FM generator.

The trimmer is calibrated by zero beating the oscillator output against WWV or a precise known frequency, such as an AM broadcast station whose stability is ± 20 cps.

Display devices are generally one of three types: 1) Nixie (Fig. 11), which is a miniature high-voltage neon glow tube with 0-9 numerals; 2) LED (light-emitting diode), generally a seven-segment device (Fig. 11) with several LEDs in a string forming each segment; 3) Panelescent, a 6-, 8- or 9-segment device in which individual segments are made to glow upon the application of voltage. Since LED and panelescent display are, low-voltage and low-current devices they are used in battery-powered counters.

A low-cost accessory known as a scaler extends a counter's frequency range by dividing the unknown signal before it gets to the counter. For example, the Heath IB-102 scaler can divide by 10 or 100. If set to the $\div 10$ position it will divide the unknown frequency by 10, and feed the output to the counter. If the unknown frequency fed into the scaler is 100 mc, the scaler output into the counter is 10 mc. You simply multiply the counter's display by 10 to get the known frequency. If the scaler is set to $\div 100$, the 100-mc input to the scaler would come out as 1 mc, and you would multiply the counter's readout by 100 to obtain the unknown frequency. Scalers are independent instruments, and you can usually use a Brand A scaler with a Brand B or C counter.

Presently, two counters are available for

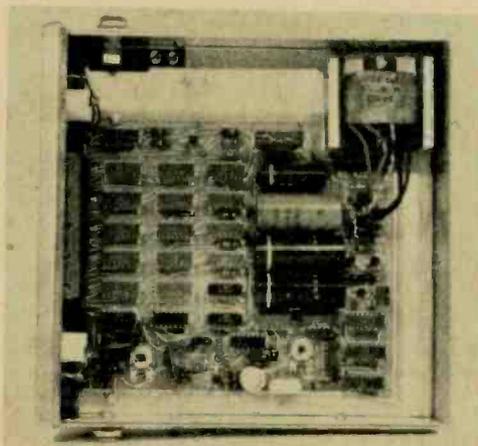


Fig. 13—Parts in Heathkit IB-101 counter mount on single printed-circuit board which fits in frame. Kit has 26 ICs, 8 transistors.

under \$200. One is the \$199.95 Heathkit IB-101 which is intended for general experimenter, service and lab work. Another kit counter is the \$134.50 Micro-Z fm-36.

Additional information about the counters shown in Figs. 4 through 10 can be obtained from the manufacturers: Eldorado Electrodata Corp., 601 Chalomar Rd., Concord, Calif. 94520. Heath Co., Benton Harbor, Mich. 49022. Hewlett Packard Co., 1501 Page Mill Rd., Palo Alto, Calif. 94304. Micro-Z Electronic Systems, Box 2426, Rolling Hills Calif. 90274. Simpson Electric Co., 5200 W. Kinzie St., Chicago, Ill. 60644. Weston Instruments, Inc., 614 Frelinghuysen Ave., Newark, N.J. 07114.

Report on The Heathkit IB-101

The Heathkit IB-101 has a range of 1 cps to over 15 mc. The input impedance is 1 megohm (shunted by less than 20 μmf). The trigger level is set automatically and there's a five-digit readout that provides eight-digit capability. There is only one operating control, the *kHz/Hz* range-selector switch.

Input sensitivity (minimum input signal) is rated at 100 mv from 1 cps to 15 mc. The maximum input voltage is 200 V (rms) from 1 cps to 1 kc. Above 1 kc, the maximum input voltage drops 48 V per-decade-increase in frequency. The internal time-base oscillator is a trimmer-corrected 1-mc crystal. The gate time is 1 sec. for the *Hz* range and 1 ms for the *kHz* range.

First we'll explain how eight-digit readout capability is achieved with five Nixie tubes. Assume the counter is connected to a 12,965,543-cps (12.965,543 mc) oscillator. With the range switch in the *kc* position, the readout will be 12965 (12.965 kc)—the five *most* significant digits of the frequency. When the range switch is set to the *cps* position, the display will be 65543 cps—the five *least* significant digits of the frequency. Since you have the first five digits you are now interested only in the last three, 543, for an eight-digit readout. What this looks like is shown below:

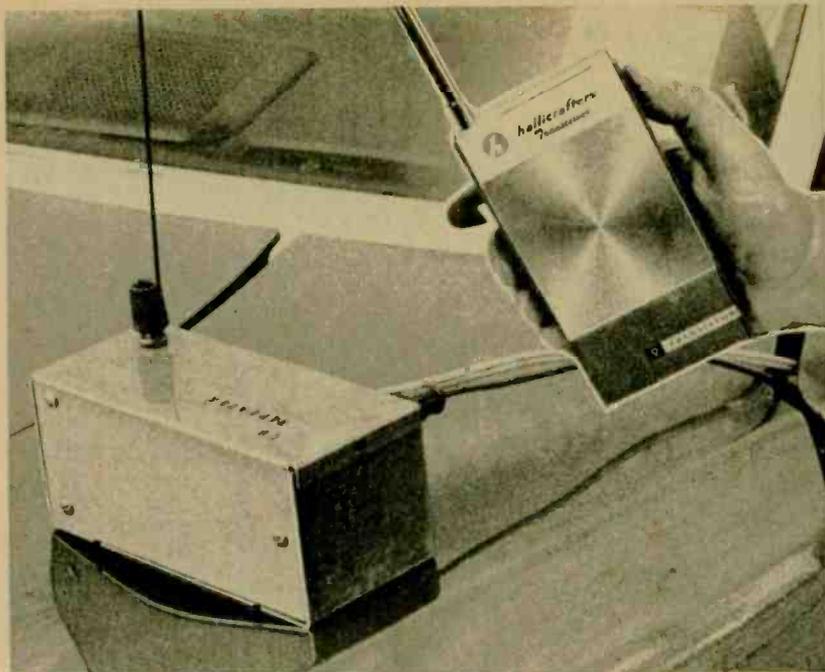
kHz range 12965543
Hz range 12965543

Panel lamps indicate whether the range switch is set to *kHz* or *Hz*. A third panel lamp, marked *over*, indicates whether the range is set correctly. For example, if the switch is

[Continued on page 98]

CB Repeater

By VINCE DANIELS



HIGH atop a mountain sits a repeater that rebroadcasts flea-power ham signals to amateur stations hundreds of miles away. Live TV programs from the far corners of the earth reach you through repeaters in communications satellites. Fact is, all over the world there are sensitive tiny repeaters that pick up a signal and retransmit it to places the original would never get to.

Our voice-operated (VOX) CB Repeater gives you some of the communications flexibility that the commercial repeaters give the big operators. Remember the time you got stuck in the house waiting for a scheduled call? No longer do you have to stay glued to the CB rig. Simply connect the Repeater to your rig (the speaker), tuck a walkie talkie in your pocket and as soon as the call comes in it will be rebroadcast to you in the backyard. When the incoming call goes off, the Repeater goes off automatically.

So why not simply use the walkie-talkie to receive the call you're waiting for? Because the walkie-talkie's receiver is nowhere as sensitive or selective as the receiver in your 5-watt transceiver.

The Repeater is a low-power (about 60 mw) crystal-controlled transmitter that is turned on by your 5-watt rig's audio output. All you need do is connect the power cord and a cable from the Repeater to the trans-

ceiver's remote or external-speaker jack. The Repeater works with all standard and tone-coded squelch circuits because it is keyed only by the signal at the transceiver's speaker. It can be powered by either your car's battery through a cigar-lighter plug, or by a 9-V battery (the large size such as Eveready 246, 266 or 276).

The normal working range is about $\frac{1}{8}$ mile, though you might get reliable reception up to $\frac{1}{4}$ mile with a sensitive walkie-talkie. The range is also affected by the Repeater's antenna. A stiff wire about 12 in. long is good for up to $\frac{1}{8}$ mile; a telescoping whip antenna (such as a 52-in. walkie-talkie replacement, Lafayette 99 F 30082) will increase

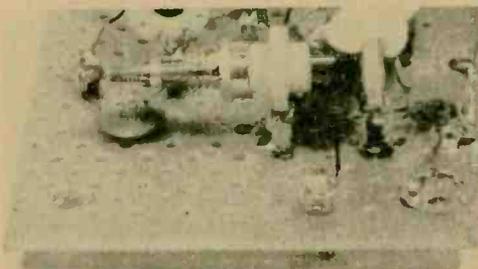


Fig. 1—Coils L2 and L4 are held in place over L1 and L3 by applying one or two drops of GE RTV Clear Seal. No other type sealant should be used.

the range to about ¼ mile. The Repeater's location also affects the range: it is greater when mounted on a car's dash rather than on the seat. It's even greater if mounted outside the car on the hood or roof.

Construction. The Repeater is built on a 2 x 4 7/8-in. piece of perforated board which is mounted on the side of the main section of a 2 1/4 x 2 1/4 x 5 in. Minibox (Fig. 4). The wiring layout of the board is critical, therefore follow ours as shown in Fig. 2. A larger cabinet can be substituted, though RF output jack J1 should be kept close to the board's RF output terminals.

The board must be Keystone G-pattern or equivalent as the extra holes allow more precise positioning of parts. Vector type T28 push-in terminals are used for tie points.

Drill three mounting holes for the board first; don't attempt to drill after the wiring is completed. Coils L1 and L3 are standard, pre-wound, subminiature RF coils. Coils L2 and L4 are wound over L1 and L3 after they are firmly mounted on the board.

Note the *ground* solder lug at the mounting hole next to L2/L4; this is installed dur-

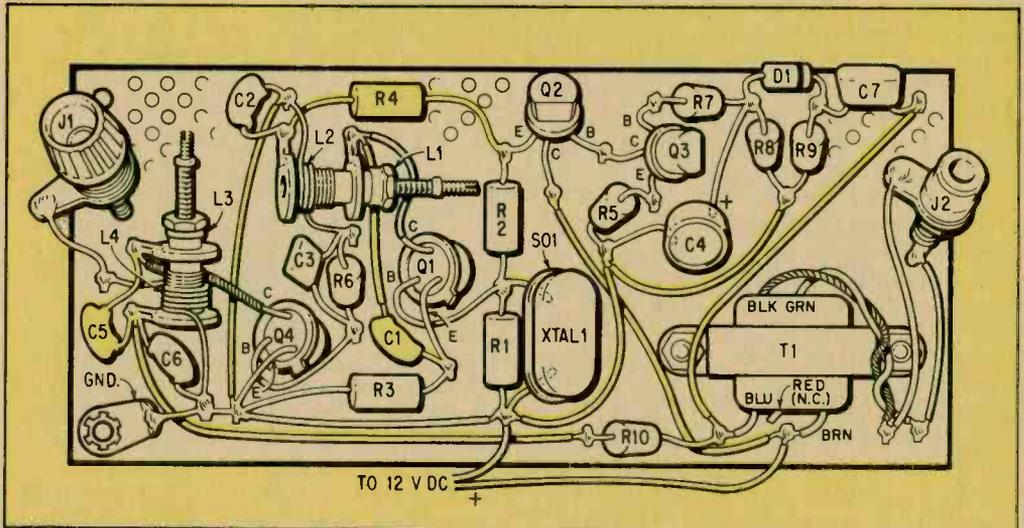
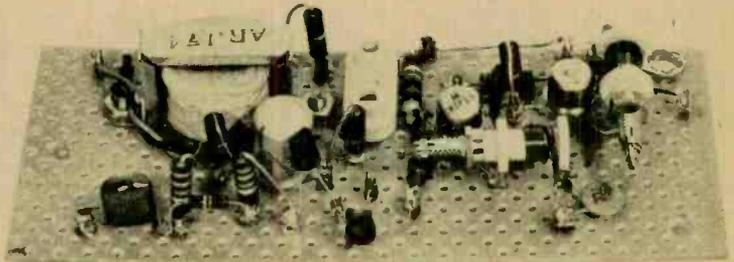
ing assembly of the board. The terminals of L1 and L3 exactly match the G-pattern-board hole spacing. To mount the coils, twist their lugs exactly 90° with long-nose pliers; the lugs will then drop right into push-in terminals spaced three holes apart.

Install L1 and L3 before any other components. Then mount a push-in terminal on each side of L1 and one on the board-edge of L3. Wind L2 directly over L1's winding at the bottom of the coil in the following manner:

Tensitize a 6-in. length of No. 22 enamelled solid wire by clamping one end in a vise and pulling on the other end until the wire goes dead slack. Scrape ¼ in. of insulation from one end of the wire and solder the end to either push-in terminal flanking L1. Pass the wire over the top of L1 and close-wind 1 1/2 turns—wind completely around the coil once, go over the top again and stretch the wire to the other push-in terminal. Scrape off ¼ in. of insulation and solder the wire to the terminal.

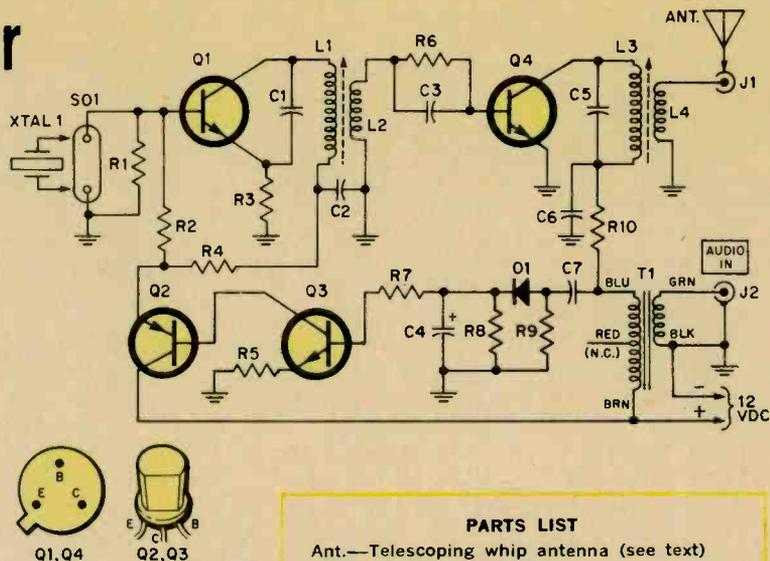
In a similar manner, using a 12-in. length of wire, wind six turns (L4) over the bottom

Fig. 2—Layout of transmitter section is critical and must be almost a duplicate of this. Coils L1 and L3 must be at right angles to each other. Note that resistors are mounted both flat-to-the-board and on end. Parts and wiring in color in pictorial are under board.



CB Repeater

Fig. 3—Q1, Q4 are low-power crystal-controlled transmitter. Modulation to L3 comes from T1 via R5. B+ to oscillator Q1 goes through Q2, which is normally off, hence, Q1 is off. When audio is fed to T1, voltage at T1's secondary is rectified, filtered and fed to Q3, which turns on Q2. When Q2 is on it supplies B+ to Q1, turning it on. When audio stops, C4 discharges and Q1 goes off. Too much audio produces distortion; too little audio and Q1 won't come on.



end of L3. But this time, solder one end of the wire to the ground lug at the bottom of L3 and pass the wire under L3. Connect the free end of the wire to the push-in terminal near the edge of the board. Secure L2 and L4 with a small drop of GE's RTV *Clear Seal*. Don't use any other GE RTV silicone rubber adhesive, such as *Silastic*, as it will affect the coil's inductance.

Complete almost all the wiring associated with Q1 and Q4 first, leaving the mounting of crystal socket S01 and connection until later. Do not install C3 and R6 yet. Also, make certain R2 is in the clear so it can be changed if necessary. Install modulation transformer T1 adjacent to S01, as shown, and then complete the board's wiring.

To avoid soldering heat damage to D1, leave D1's leads 1/2 in. long. During adjustment and check-out you will have to get at Q2's terminals so position Q2 at the edge of the board, and bend the leads so its body is almost against the board.

Checkout and Adjustment. Plug a third-overtone CB transmit crystal in S01. Though any crystal might work, the circuit is designed for low-cost crystals used in tube transceivers—the ones that connect from grid to ground. Plate-to-grid crystals will generally work, though they might not oscillate precisely on frequency.

Set up either a 9- or 12-VDC power source for the Repeater; use the highest voltage you will normally use. Connect a DC milliammeter rated higher than 20 ma in series with the

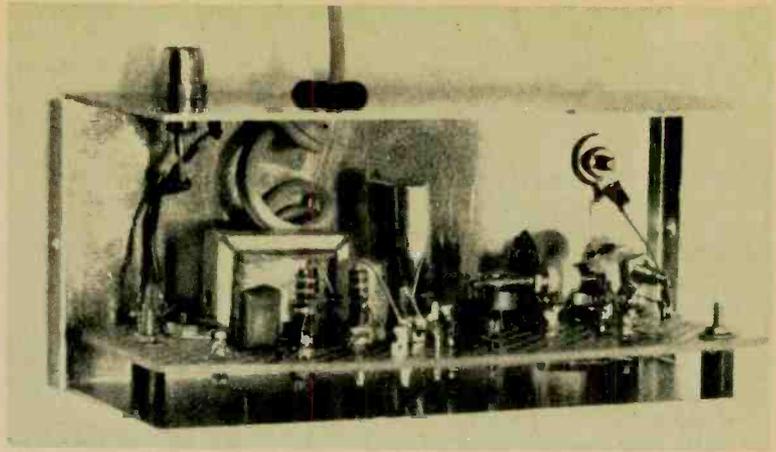
PARTS LIST

Ant.—Telescoping whip antenna (see text)
Capacitors: 15 V or higher
 C1—10 μf disc or silvered mica
 C2, C6—.005 μf disc
 C3—.001 μf disc
 C4—50 μf electrolytic
 C5—20 μf disc or silvered mica
 C7—.05 μf disc
 D1—1N60 diode
 J1—Five-way insulated binding post
 J2—Phono jack
 *L1, L3—1.125 μh subminiature adjustable
 RF coil (J. W. Miller 40A106CBI)
 L2, L2—See text
 Q1, Q4—HEP-53 transistor (Motorola)
 Q2—2N5355 transistor (GE)
 Q3—2N3393 transistor (GE)
Resistors: 1/2 watt, 10%
 R1, R8—10,000 ohms
 R2—100,000 ohms
 R3—220 ohms
 R4—470 ohms
 R5—68 ohms
 R6, R7—1,500 ohms
 R9—6,800 ohms
 R10—820 ohms
 S01—Crystal Socket
 T1—Transistor output transformer; primary: 125 ohms center tapped, secondary: 3.2 ohms (Lafayette 33 F 85721)
 XTAL-1—CB transmit crystal (see text)
 Misc.—2 1/4 x 2 1/4 x 5-in. Minibox, perforated board, push-in terminals, No. 22 enameled wire
 *Note: L1 and L3 are available for \$3.50 each from Custom Components, Box 153, Malverne, N.Y. 11565. Add 75¢ for postage and handling per order. N.Y. State residents add sales tax. No foreign orders.

positive power-supply lead. Short Q2's emitter-collector. Apply power. Using a plastic alignment tool, adjust L1's slug for a maximum meter indication. It will normally be from 2 to 5 ma, though it could be outside this range.

Remove the crystal to check oscillation; the current should drop to almost zero. If

Fig. 4—Circuit board is mounted on side of main section of Mini-box; do not use a plastic cabinet. The audio input and power leads come through the opposite side of the cabinet. Note spacers under board to keep wiring and parts on back of board from touching cabinet. RF output goes to five-way binding post's screw at upper right corner of cabinet.



it doesn't, there is a wiring error. Plug in the crystal again and note the current. It should rise instantly when the crystal is plugged in. If the meter response is not instantaneous (if it takes a second or so to rise), indicating slow oscillator starting, adjust L1's slug slightly until the oscillator starts as soon as the crystal is plugged in. When you are certain oscillation starts immediately, disconnect power and install C3 and R6.

Connect a temporary wire antenna, about 12-in. long, to J1 and apply power. Adjust L3's slug for minimum current. The current will be about 6 ma higher than that of the oscillator alone. Next, tune in the Repeater's signal on a transceiver or walkie-talkie and then remove the Repeater's crystal. The current should drop to almost zero. If it fails to drop to zero, or if you hear hash in the monitor receiver, the repeater is oscillating.

Don't try to eliminate the oscillation by using metal shields. First try shifting Q1's and Q4's leads to a slightly different position. If this fails to stop the oscillation, turn L3's slug clockwise $\frac{1}{8}$ turn at a time until the oscillation stops. Make certain the oscillation is killed by inserting and withdrawing the crystal several times, as the starting of the oscillator can start the self-oscillation.

Disconnect power and remove Q2's collector-emitter short. Connect J2 to the output of a transceiver or portable radio. Make certain the radio's volume is turned completely down and apply power to the Repeater. The meter should indicate virtually zero current. If it indicates greater than 1 ma, there is a wiring error in Q2's circuit.

Turn up the radio's volume to a normal listening level; this should trigger the repeater into operation, indicated by a sharp

rise in the current. Note that when the Repeater is triggered by sound the meter will indicate considerably more current than was obtained when only the transmitter was checked out. The extra current is not in the transmitter—the power is not increased.

When the radio volume is turned down, the transmitter will automatically turn off after a second or so. If the transmitter does not completely turn off, as indicated by a current greater than 1 ma, increase the value of R2 to 150,000 ohms. If the transmitter still does not completely turn off, increase R2 to 220,000 ohms. The correct value will depend on the particular transistor used for Q1, and will be 100,000 to 220,000 ohms.

When you are certain the Repeater is working normally, install the board in the cabinet using a $\frac{1}{2}$ spacer at each mounting screw, and connect the jacks and power cable.

Using the Repeater. You cannot rebroadcast a signal on the same channel as the 5-watt rig is set to because the Repeater's output will jam the 5-watt rig. To allow for the overload-prone input and/or reduced selectivity of some 5-watt rigs, keep maximum frequency separation between the received and rebroadcast signals. As a general rule, if you receive on Channels 1 to 11, rebroadcast on Channel 23. If you receive on Channels 12 to 23, rebroadcast on Channel 1.

The Repeater's antenna can be a 12-in. length of wire for short-range work. If you require a longer range, or a stronger short-range signal, solder a banana plug to the bottom of a walkie-talkie replacement telescoping whip and use the whip extended full length. Changing the Repeater's operating frequency does not require retuning L1 or L3, or changing the length of the antenna.



By
SYLVIA MARGOLIS

A Kingly QSO

The story of a household that comes into the international limelight by carrying on a ham conversation with King Hussein.

LONDON

IN all the 60 years of its history, no event in amateur radio hit the world's headlines with such force and stayed there with such sustained drama as the amateur radio link last September between hams around the world and one of the fraternity's newest members—King Hussein of Jordan.

The situation would have been dramatic enough without amateur radio. The King of Jordan was fighting for his life and throne in the beleaguered capital city of Amman. According to the last news reports that got out of the city, hundreds were dying in a bloody civil war, even the Red Cross couldn't get into Amman to help the wounded and homeless and the King's wife and family had been evacuated. The tough little warrior King, direct descendant of Mohammed the Prophet, stayed to battle it out with the rebels, no quarter expected, none given.

Laurie Margolis, G3UML and his father, Maurice (G3NMR) were among the first radio amateurs to contact Hussein when the King had come on the air in March, 1970. They have one of the much-prized QSLs which the King, in his enthusiasm as a new-fledged radio amateur, had written out by hand.

At 0015 on September 17, my son, Laurie

heard JY1 talking to WA3HUP. It was Mary-Anne Crider and her husband, Charles, who had become so friendly with the King over the air that he had invited them to visit him in Amman. Mary-Anne was already handling the King's QSLs—quite an undertaking once the world's amateurs realized that not only was JY1 a very rare amateur station, but that it was a real live King operating!

The QSO of September 17 that Laurie heard was stilted and brief, but it was more or less a normal amateur radio contact, except for the very deep concern WA3HUP expressed for Hussein's safety and welfare.

The circumstances were extraordinary, particularly when the King acknowledged a casual call from another amateur and gave him a report, as if there were no civil war raging in Amman.

Laurie didn't attempt to break the QSO but he did tape it. Then I called the news-desk of the BBC to tell them what was happening.

At 0630 a BBC Radio Newscar arrived outside our quiet, suburban house. The BBC reporter, David Mellor, interviewed Laurie and transmitted the tape back to the studio, 10 miles away, where it was used at once by a nationwide news program of great distinc-



The Margolis home is besieged by TV crews from the BBC and American networks as word leaks out that the King of Jordan is on the line.

tion, called *Today*.

The London evening papers picked up the story. Our phone began to ring and it didn't stop for 10 days.

By that time Amman had become a silent city news-wise. The world's journalists were trapped inside, at peril of their lives and all lines of communication were cut. Only the tenuous, improbable link of amateur radio survived and the only amateur radio station in Jordan belonged to the King.

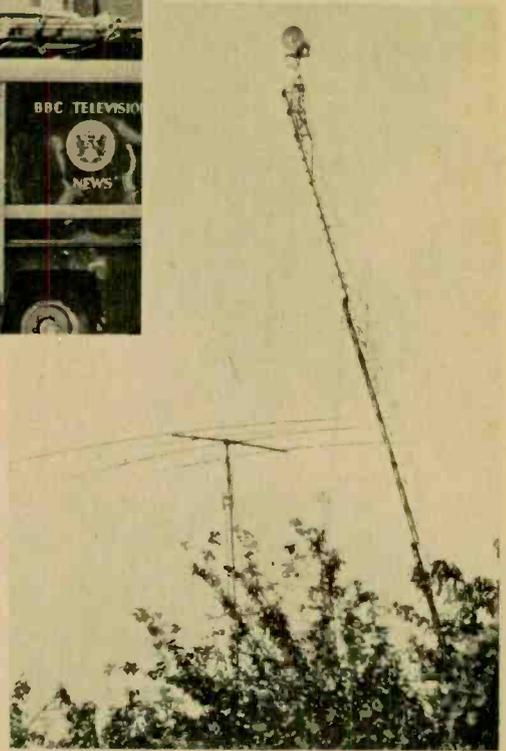
It was on this link that the press were forced to rely. That night representatives of the major British daily papers and press agencies crowded into our home, to listen for the man they know as King Hussein of Jordan, but who was, to us, JY1.

I had warned the reporters that the chances of the King being on the air were remote, considering the circumstances in Jordan; that it was just as unlikely that radio conditions, notoriously fickle, would permit any kind of contact; that the possibility of his talking to Laurie were about 100 to 1 against. They came, all the same.

What happened next is newspaper—and amateur radio—history. Not only did the JY1 keep his sked with WA3HUP again; not only were conditions reasonable; but, when Laurie called "G3UML on the frequency, Your Majesty," the King replied "Stand by, Laurie," and all hell broke loose in our house!

When that historic QSO was over we

Talk about a phone patch! The English leave no stone unturned as they hoist a microwave dish 100 ft. to relay a live television transmission from the Margolis dining room.



played back the tape to the reporters, interpreting the QRM-ridden SSB, word by word for them to write down. The house became a bedlam of pressmen, photographers, dispatch riders and a couple of neighbours, who wandered in to see what all the fuss was about.

Late that night the BBC *Today* team returned and carried away, triumphant, the tape of the QSO, which remains a prize exhibit in their program archives.

Next day the story was on the front page of every British national newspaper. Weeks later I was talking to Philip Howard, reporter on the *London Times*, who had been one of the newsmen in the house when Laurie spoke to the King.

"It was one of those moments, rare in any reporter's life, that make the job worth while," he admitted.

Early the next morning the first TV news

A Kingly QSO

team arrived. By noon there was a queue of teams, including CBS and Radiotelevision Francaise. In the afternoon a gang from the telephone company arrived to install a special line for the mighty BBC, which decided to do a live outside broadcast from the house that night.

Down our once-quiet suburban street loomed three trucks, the smallest the size of a London bus. They parked outside and the largest truck began to sprout a dish antenna on a 100-ft. telescoping tower that dwarfed our poor Hygain antenna.

It was a fine, sunny Friday evening and soon there was a traffic jam on the street, because everybody in the district chose to drive past or stroll past or walk the dog past to see what was going on.

In the BBC TV team there were a director, an interviewer and a dozen or so technicians. What with them, a team from a rival TV organization (keeping an eye on the BBC) and half-a-dozen or so newspapermen, the house was pretty crowded.

A very superior BBC electrician, who of course knew more about electricity than a humble radio amateur, disconnected our garage supply at the fusebox and connected his own installation to the supply. The team emptied the dining room, where we keep the amateur station in one corner and filled the



Just as Laurie began to talk about the King, King Hussein came on the air and within an hour the house was again jammed with newsmen.

space with cameras, lights, tracking trolleys and enough cable to keep a hundred trolley cars happy.

This major BBC exercise wasn't entirely successful. The interview with Laurie was okay, but amateur radio being what it is and kings and civil wars being what they are, there was no king on the frequency that night.

Later Maurice went to switch on some equipment in the garage and got quite a severe electric shock—the BBC engineer had reversed the polarity of the mains when he reconnected the supply!

For the next five days things were quiet, except for the hopeful newsmen camped in shifts on the doorstep and for the constantly screeching telephone. There was even a direct call from Tel Aviv, from the Israeli national radio station Kol Israel, to interview Laurie.

From the city of Amman there was silence.

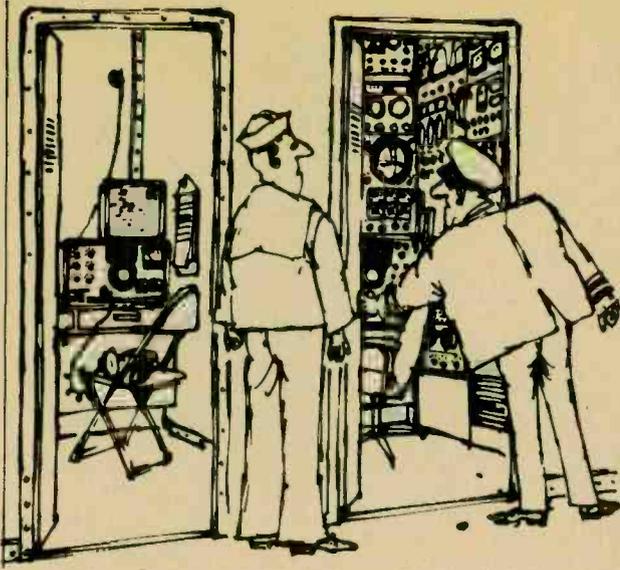
An interesting and surprising thing about radio amateurs became apparent during those anxious days. Everybody knew by then that JY1 appeared occasionally on the air and everybody realised that every QSO was extra precious because it might be the last! Yet, when Mary-Ann and Laurie called JY1 at sked time each evening, the world's amateurs stood by with impeccable (and, let's face it) unusual tact and good manners.

On September 23 the BBC asked if a news documentary film team from a program called *Nationwide* could come and film some background to the story. Be our guests, we

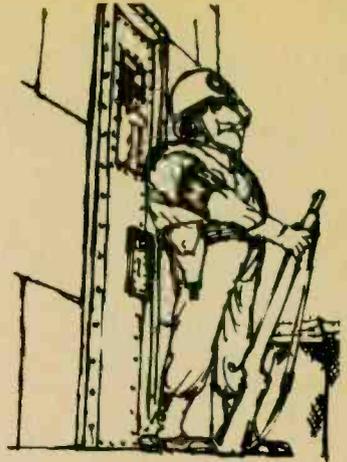
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Maurice (left) and Laurie Margolls prepare their station for its TV debut. Everyone showed up for the event except the star—King Hussein.

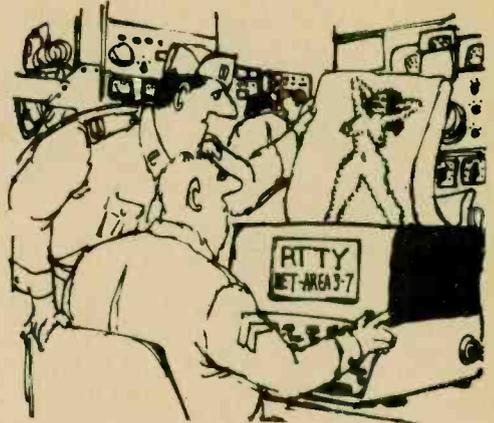


"Beg pardon, Sir, that's the ham shack a few of the guy's have—the ship's radio room is over here."



"... Well, there I was at the console of this 2,000,000 watt transmitter with a 3575 kc crystal from my ham rig in my pocket ..."

Over and Out



"Let's face it, those guys at the Pentagon are good."



"Let me understand this, Sgt.—you say you requisitioned \$18.00 and bought that \$150 electronic keyer at an Army surplus store?"



"I've never seen such a sloppy outfit! Microphonic tubes, 2 IFs out of alignment, AC ripple in the standby receiver ..."

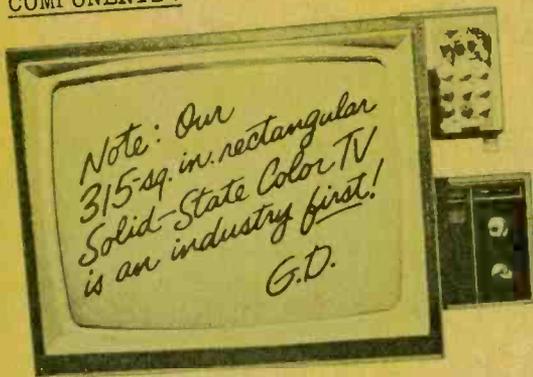
BELL & HOWELL TECHNICAL REPORT

Subject: New Home Entertainment Electronics Systems Program

Competitive Advantages:

- Features first Solid-State Color TV (315-square inch, rectangular screen) Kit for at-home training to build, keep.
- Helps prepare recipient for Color TV Service Business of his own. Covers solid-state circuitry in depth--also other Home Entertainment equipment. Fully updated.
- Provides three additional professional quality kits to assemble, keep, use.

COMPONENTS:



Specifications:

New 25" diagonal, ultra rectangular screen. 315-sq. inch viewing area. 25,000 volt, solid-state design, w/ 45 transistors, 55 diodes, 2 silicon rectifiers. 4 advanced IC's w/46 transistors, 21 diodes. 2 tubes: picture and high voltage rectifier. Solid-State VHF and UHF tuners. 3-stage solid-state IF. AFT standard. VHF power tuning. Also: "Instant On" circuit, automatic color control, noise limiter.

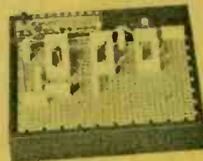
Descriptive analysis:

Modular plug-in circuit board design provides for more than 100 advanced solid-state devices. Insures premium color, sound control, exceptional reliability, easy access. Includes Hi-Fi amplifier for sound output, built-in dot generator, tilt-out convergence panel. Handy Volt-Ohm meter permits initial set-up and adjustment plus detailed trouble-shooting. 315-sq. inch picture tube face transmits entire image. Push button channel advance. AFT module brings in perfect picture, sound

automatically. Easier to service than older, non solid-state sets. Quality components throughout.

Electro-Lab-at-Home Components included:

The Electro-Lab® consists of three units, arriving in 16 shipments which recipient assembles, keeps. All components are professional quality. The circuit DESIGN CONSOLE contains built-in power supply, test light, speaker. Patented Modular Connectors permit plug-in to console to rapidly "bread-board" many different circuits. No soldering or messy un-soldering necessary.



The portable 5-inch, wide-band OSCILLOSCOPE is calibrated for peak-to-peak voltage and time measurements... offers 3-way jacks to handle test leads, wires, plugs. Images on screen are bright, sharp.



The lightweight TRANSISTORIZED METER combines most desired features of a vacuum-tube voltmeter and a high-quality multimeter. Features a highly sensitive, 4-inch, jewel-bearing d'Arsonval meter movement. Registers slightest power surge or lag on large, easily read dial. CONSENSUS: first class gear.



Program is designed to give:

- Understanding of electronic circuits in most home entertainment electronic systems
- Ability to analyze and trouble-shoot a wide variety of advanced solid-state and other TV circuits
- Capability to understand and use test equipment and procedures with special emphasis on TV testing
- Ability to assemble, test and adjust the solid-state TV kit included with the program

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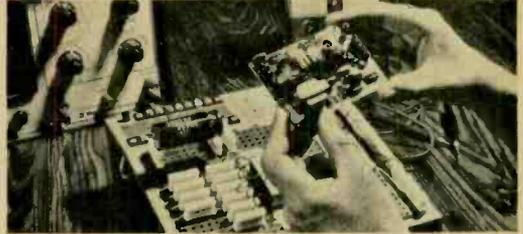
The "specs" at left give a few of the facts. But there are many, many features besides these which you will not find in any set on the market today. Send for all the facts and this is the one you'll want.

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Note: TV picture is simulated.



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Five-Band Ham Antenna with Remote Switching

By **RON LUMACHI, AH**, the luxury of being able
WB2CQM

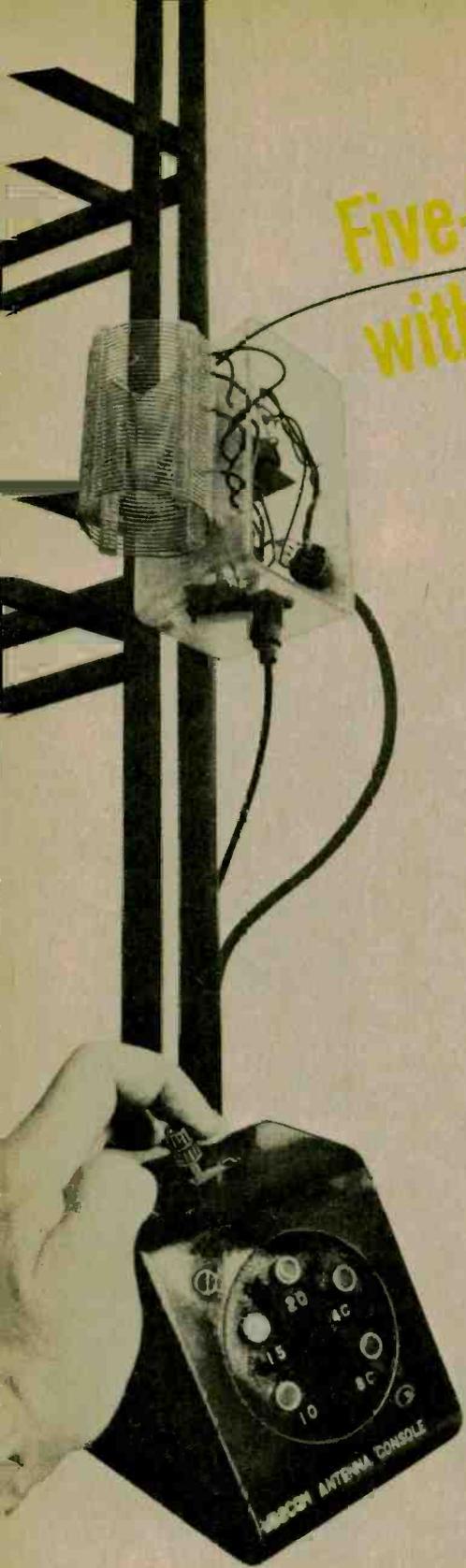
to put up a short length of antenna wire and then from the comfort of your shack flick a switch to tune the antenna to the 10, 15, 20, 40 or 80-meter ham bands. It's beautiful—especially when the antenna is far from the shack and its pouring rain.

Our project provides you with such armchair band switching for great DXing. The setup at the antenna (shown at the left) consists of a two-pole five-position rotary switch with an RF rating of about 275 watts. The switch is turned by a 1-rpm high-torque reversible AC motor. One pole of the switch selects a coil tap for each of the five bands. The second pole, driven in tandem, is connected to five indicator lights in a control box in your shack (black box at bottom left). By watching the lights, you can easily select the band of your choice as the motor turns. When the 20-meter light, say, comes on, the antenna tuning unit has been set up to resonate on 20 meters. All that remains is for you to tune the transmitter.

Construction. Begin by modifying the rotary switch. Bend up the tabs that hold the indexing rollers (Fig. 2, top) in position. Discard the rollers. Cut off the switch shaft at the notch closest to the mounting bushing. Remove the two nuts holding the wafers and two spacers from each side. Re-assemble the switch. Install a shaft coupling between the motor and switch shafts; it may be either metal or wood. The shaft of the switch has a somewhat larger diameter than that of the motor.

Make an L-shaped motor mounting bracket with a piece of scrap sheet metal and cut a notch in the bracket for the motor as shown in Fig. 4. Mount the switch on one end of a 7½x4x4½ plastic food storage box so its shaft is the same height as the motor shaft. Use two ⅜-in spacers for clearance between the box and the switch.

Mount the SO-239 connector (SO2) near the switch and mount the nine-pin socket on one side (Fig. 4). Install the two feed-through insulators (Fig.



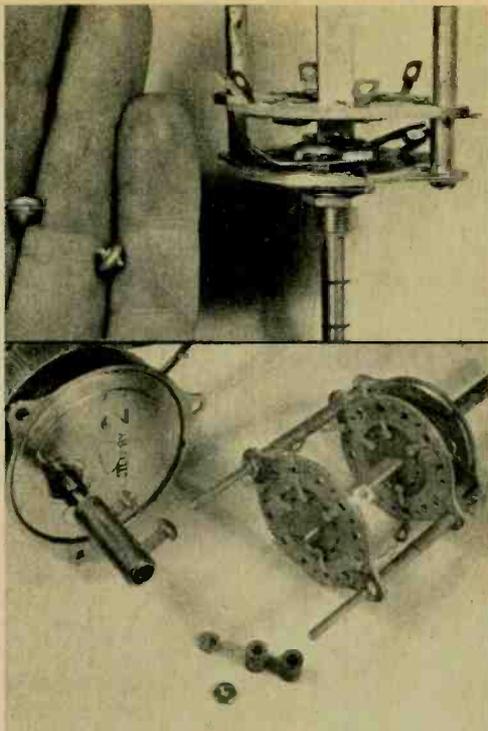
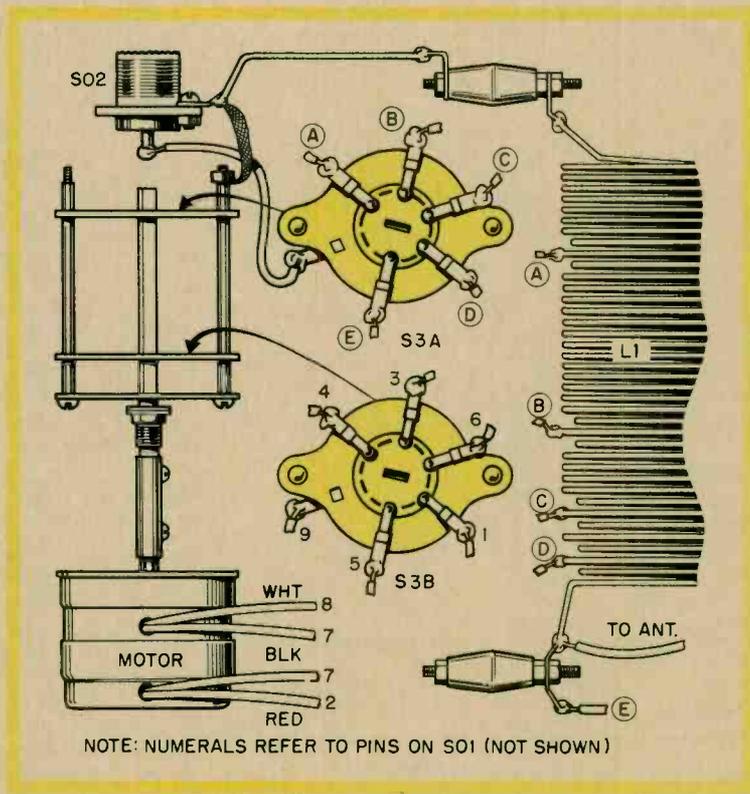


Fig. 2—Remove two indexing rollers (in hand in top photo) and discard them. Bend up tabs that held rollers to prevent binding. Bottom photo shows removed spacer washers. Flat bar through center of wafers must be cut short. Note coupling on shaft of the motor (left).

Fig. 3—Pictorial of motor-driven tuner. Wiper lug of deck S3A is connected to center lug of SO2. The wiper of deck S3B is connected to pin 9 of SO1 (not shown). To simplify soldering to taps on coil, indent turn on each side of indicated tap point (3,7,14 and 30 turns from the bottom of the coil, L1).



NOTE: NUMERALS REFER TO PINS ON SO1 (NOT SHOWN)

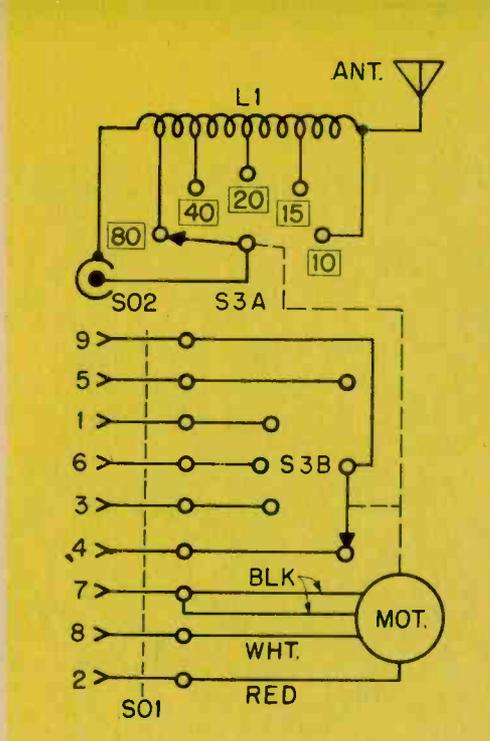


Fig. 1—The schematic of the motor-driven tuner. Tuner is mounted on mast. The antenna is a 22-ft. length of No. 14 wire stretched out horizontally.

Five-Band Ham Antenna

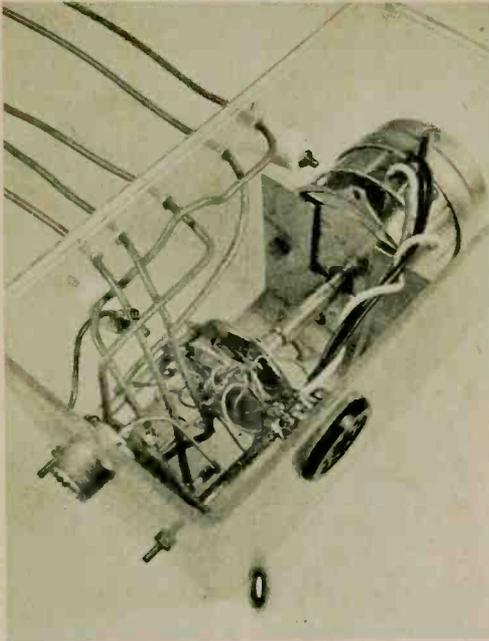
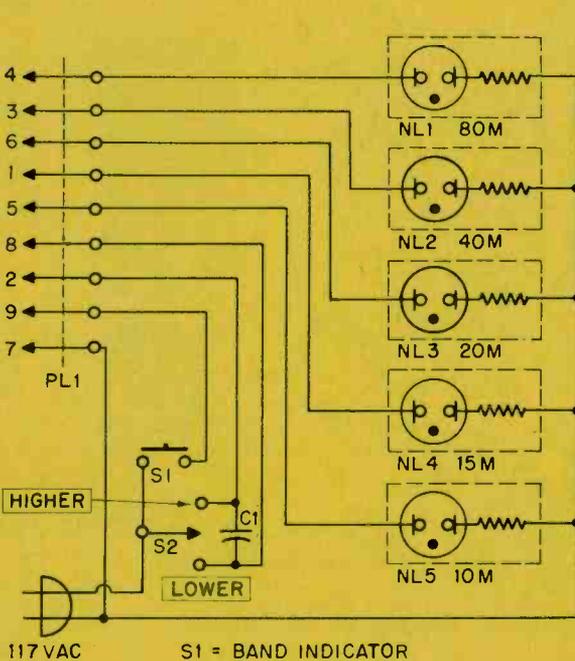


Fig. 4—Tuner. Note how switch is mounted to end of plastic box. Five wires at top get connected to coil. Other wires go to the nine-pin socket.

4) on the other side of the box; they should be about 4-in. apart. Solder 10-in. lengths of No. 14 insulated wire to each of the five lugs of deck S3A (nearest to SO2) as shown in Fig. 3. Drill equally-spaced holes between the feed-through insulators and slip the wires through the holes. Remember that 10-meter-band lug will be at one extreme of the switch's rotation and the 80-meter lug will be at the other. The wires to the coil get attached later.

Connect the wiper of S3A to the center lug of SO2. From the shell of SO2 run a ground wire to the switch frame and a wire to the top end of the coil via a feed-through insulator. This point must be the tie point for the external ground connection. Connect both black wires from the motor to pin 7 of SO1, and hook the red and white wires to pins 2 and 8, respectively.

Using a short length of wire, connect lug 5 of S3B (corresponding to the 10-meter position) to pin 5 of socket SO1 (not shown). In a like manner, connect lug 1, lug 6, lug 3, lug 4 and lug 9 to corresponding pin numbers (1, 6, 3, 4 and 9) in socket SO1. Cut a 4¾-in. length of the coil (39 turns) and mount it on the insulators as shown in Fig. 4. Solder the 10-meter lead from S3A (lug E) to the bottom of the coil as shown in Fig. 3. Count off 3, 7, 14 and 30 turns (D,C,B,A on



PARTS LIST

- C1—5 μ f, 400 V paper or mylar capacitor
- L1—Inductor coil: 8 turns-per-in., 3-in. dia., No. 14 wire, cut to 4¾-in. long. Air Dux No. 2408T. (Jeff Tronics, 4252 Pearl Rd., Cleveland, Ohio 44109. \$6.05 plus postage)
- Motor—100-in.-oz. reversible synchronous motor. (Hurst CA series, specify 1 rpm when ordering. Allied Electronics Corp., 2400 W. Washington Blvd., Chicago, Ill. 60680. \$13.76, plus postage. Stock No. 811C0055)
- NL1-NL5—Neon lamp with built-in resistor (Allied Radio Shack 272-1501)
- PL1—Nine-pin cable connector (Amphenol 86-PM9 or equiv.)
- S1—Single-pole, normally-open pushbutton switch
- S2—DPDT (center off) lever-action switch (Centralab 1455 or equiv.)
- S3—One-pole, five-position, two-section Hamswitch (Mallory 151L, Allied Electronics 851-0951. \$3.47 plus postage)
- SO1—SO-239 coax connector
- SO2—Nine-pin tube socket (Amphenol 78S9 or equiv.)
- Misc.—4-in. wide aluminum sloping-panel cabinet (Bud AC-1610), feed-through insulator (2), nine-conductor cable, plastic box

Fig. 5—Control-box schematic. Neon indicator lamps (enclosed in broken lines) come with built-in resistor. The wiper of S2 is shown in its center, or normally off, position.

L1 and solder the leads from the 15, 20, 40 and 80-meter lugs on S3B to them. These top points on the coil are flexible, however, and will depend upon the particular installation. Attach a 22-ft. length of No. 14 wire to the lower feed-through insulator in Fig. 2. Mount the plastic box at the highest position possible and pull the length of wire out horizontally. A good ground should be connected to the ground end of L1.

The control console is easy to put together. Mount lever switch S2 and band-indicating pushbutton switch S1 on the top of the Mini-box as shown in Fig. 6. Mount the five neon indicator lights in a circle. Install the .5- μ f capacitor, which comes with the motor, beneath switch S2. Use a five-lug and a two-lug terminal strip to keep the wiring neat. The console is connected to the antenna-mounted box with nine-conductor cable, the type used for intercoms.

Operation. To check the position of band-selector switch S3, press S2. The neon light corresponding to the band selected will glow. With your thumb on S1, push S2 to the right. This will cause the motor to turn. If the wiring is correct, the light will go out and the next lamp will soon light. As soon as it glows, release S2. The motor will stop with a little over-ride and you're ready for operation on that band. Move S2 to the left to reverse motor direction at any time.

Keep in mind that S1 will only indicate the relative position of bandswitch S3. A word of caution. Make it a practice to never operate S2 without S1 pressed. Override can easily damage the remote switching unit. If the rotation of the motor does not correspond with the movement of the indicator lights, reverse the red and white motor wires at SO1, or the leads from pins 2 and 8 in PL1 that connect to S2.

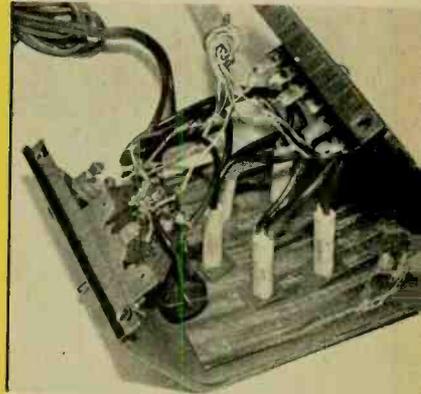
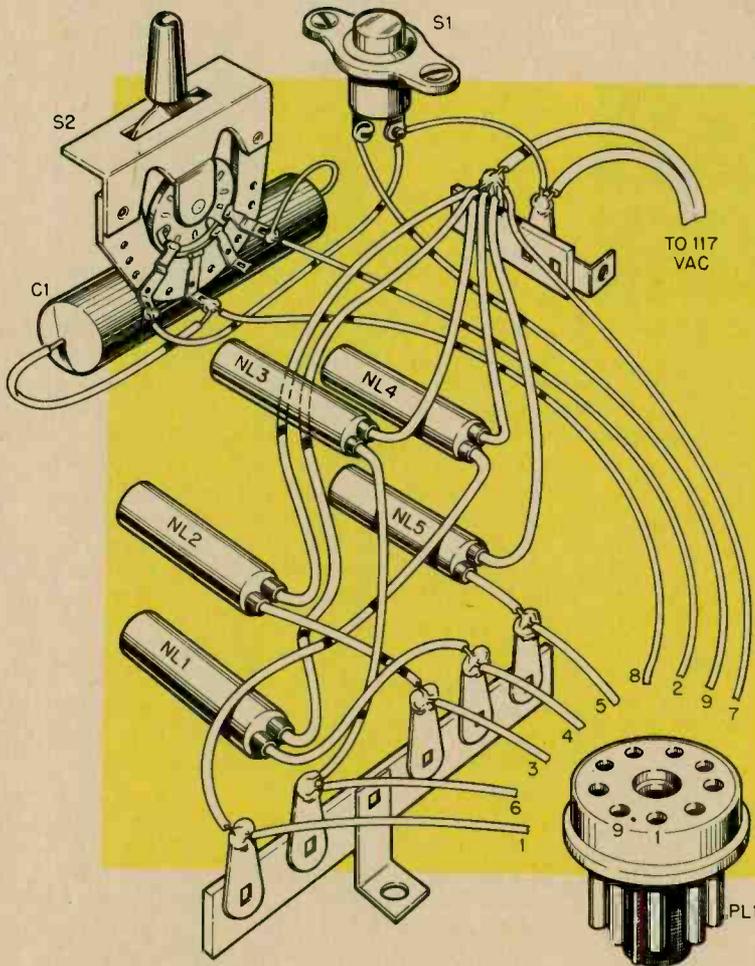
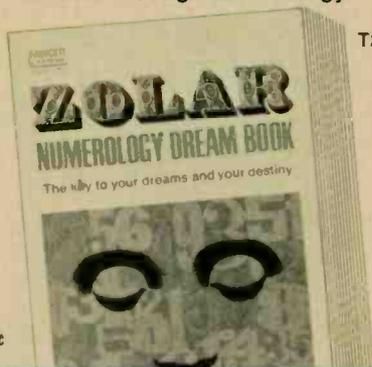


Fig. 6—Pictorial of control box. Layout isn't critical, but to keep wiring neat, use a five-lug and a two-lug terminal strip. Note on two-lug terminal strip at top that mounting lug must not be same lug to which 117-V line is connected. Wires going to PL1 are multi-conductor cable.

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The Circuit Nobody Understands

Continued from page 33

In electrical terms the heart is a dipole in a container, the torso, whose extremities act like wire extensions. When the heart beats, the field which it produces has a force and direction or a vector. To measure this vector or electrical force, electrodes are attached alternately to arms and legs, and the difference in potential is recorded as a positive or negative wave on moving paper. Presently a new technique or vectorcardiogram is in use which measures the electric field of the heart and displays it as a loop on an oscilloscope.

A normally beating heart produces almost identical electrical fields when compared to that of another normal individual. Any deviation from this arbitrary standard represents some form of disease. An interesting tangent medically, is that an electrocardiogram tells more than heart function alone. The electrical field travels through the lung which acts as an impedance. If there is too much lung or too much air in the lung, impedance will be high and the voltage low. Obesity acts in this manner.

One basic assumption about the heart is that nerve impulses travel through the heart on a regular basis. In some instances there is failure to initiate or failure to transmit an impulse; the heart fails to beat and the person faints or even dies. Introduction of a wire through a vein to the heart muscle and connecting it to a battery has cured this otherwise fatal condition. Specialized cadmium batteries are used in conjunction with timing mechanisms and are called cardiac pacemakers. This relatively simple device has given a lease on life to thousands of persons who otherwise would be dead for failure of that electrical impulse to fire the heart muscle.

The least understood organ and therefore the subject of most speculation is the brain. There are many science-fiction-like theories related to the brain and its functions. Rather than dispel the fiction let us consider some of the facts.

The brain is a collection of some two billion cells. Each cell is electrically active, that is, each cell is polarized. When they are all placed close together the voltage is somewhat additive. Brain cells are grouped together according to function. In the back of

the brain are the cells for sight, at the sides are the cells for hearing and in the front are the cells for personality.

The voltage in these groups of cells can be measured by an instrument called an electroencephalogram. Unlike the cardiograph, the encephalogram is imprecise. The heart beats regularly and all together. The brain is constantly functioning. It may be likened to an automobile which is constantly idling and races forward when required. Certain areas idle at higher voltages than others, the highest in the back and the lowest in front.

The brain is also symmetric. The electrical properties are symmetric. The loss of symmetry may be a telltale sign of a brain tumor.

The fact that the brain is idling indicates life. In this era of organ transplantation and machines to support life, it is sometimes difficult to state when a person is dead. The encephalogram helps to clear up the doubt.

Earlier in the discussion it was noted that each nerve cell was polarized. This polarity is applicable to all other cells, especially muscles. While it is possible to provide electrodes small enough to insert into a single muscle fiber, it is certainly impractical. Fortunately, individual muscle fibers are grouped in bundles. If an electrode were placed into an entire muscle and another placed on the skin, it would behave as if electrodes were in a single fiber. The resultant electrical measurement constitutes electromyography.

Electromyography is less precise than the exacting science of electrocardiography, but a little more precise than the vague relationships of encephalography. The myogram can distinguish between a primary muscular disorder and a disorder which is produced by a disease of nerves or a disease in the spinal cord and brain. Thus, by performing a simple electrical test on muscles, one can pinpoint the source of the trouble.

It would be very narrow to consider the body as a jumble of wires, batteries, conductors and transceivers. The body is more magnificently tooled. The property of the body, as in all living things, is polarity—charge or electricity.

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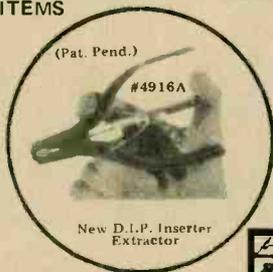
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DXing a Bit of Broadcast History

Continued from page 57

this frequency but it is originating from Bonaire in the Lesser Antilles.

R. Moscow began its career in 1922 and today that ID emanates from more transmitters than the CIA can count. R. Moscow's first SW transmission was in 1929, which puts it second in that category following PCJ.

Experimental transmissions were aired in Britain beginning in 1919, but the BBC did not come into being until three years of private testing had been completed. That famous call did not show up on shortwave until the mid-1930's.

The first missionary shortwave voice was Vatican radio in 1932, followed shortly by HCJB at Quito, Ecuador in 1933. HCJB is the oldest shortwave ID in Latin America and is a cinch to log. Try this one on 11740 and 11915 kc during the evening hours. Vatican radio originally transmitted from the Vatican itself, but has added a transmitter site in Italy under a grant from the Italian government. Vatican radio broadcasts in English to North America at 1950 EST on 9615 and 11725 kc.

So get in the swing with Douglas Fairbanks, Sr. who is shown with some of his DX gear on the bottom of this page. You may not hear voices from the past, but the collection is quite a select one and will look great on the wall of your shack.

The Counters Are Coming

Continued from page 79

set to Hz and the *over* lamp lights, you must set the switch to kHz.

Though the circuitry is elaborate, as it is in any counter, almost all of it is contained in 26 ICs. Construction takes somewhat less than five hours. The kit is assembled on a fiberglass board which has etched wiring on both sides of the board.

Most of the construction consists of soldering to the board the IC connectors into which all 26 ICs are plugged. Even the Nixie display tubes plug in.

Calibration does not require test equipment and is done in a few minutes. First you tune an AM transistor radio to any station and position it near the counter. Then you adjust the 1-mc crystal's trimmer capacitor until you hear a zero beat in the radio. Next, you connect the supplied input cable to an

internal test point and adjust a control until the counter indicates 10,000 cps. That's it.

The result is a counter with an accuracy of ± 0.002 per cent from 0° to 50° C. The counter produces some internal heat, and for maximum accuracy it should have a 30-minute warm-up as Heath specifies.

Our counter had a top frequency limit of 21 mc, 40 per cent higher than the 15 mc minimum specified by Heath. The sensitivity of our model was 100 mv—somewhat better than Heath's specifications. The counter is rock-stable, with no readout inconsistency. It locks onto the frequency and stays there until the input frequency changes; there is no count-up or blinking, just a steady readout.

Kit Report

Continued from page 64

The \$59.95 RK-101 stereo FM tuner also comes with a wooden cabinet. It is a big, open chassis (right photo on the first page of this article) with a moderate-size circuit board. The tuner has AFC, a stereo beacon, a center-channel tuning meter and mono or auto-stereo reception modes.

The front-end is supplied factory wired and aligned; the builder mounts all other parts on the board. All coils and transformers are said to be pre-aligned. We found all coils were not fully aligned; therefore, we couldn't get ultimate performance after the builder-alignment procedure. If you don't have a stereo generator, let a local service shop do the alignment job.

The sensitivity of the instrument-aligned tuner was 5 μ v (IHF) with full limiting occurring at 100 μ v. This is adequate for reception in metropolitan areas. The total-harmonic distortion at the 1,000- μ v test level was 1.1 per cent. Hum and noise were -63db. The frequency response was -1, +1.5db from 20 to 15,000 cps. Stereo separation was 32db at 1,000 cps.

The tuner performance compares favorably with that of equipment in the \$100 class. The \$130 combination of the tuner and amplifier is the closest you'll get to hi-fi performance at shoestring prices.

All in all, we'd say that the RK-100 amplifier and the RK-101 stereo FM tuner make up a very nice budget-priced stereo component system. The kits are available from Allied Radio Shack stores or by mail.

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Level Control and Monitor

Continued from page 41

mounted in the cabinet. If you can use a 50-cps 3db-down point, C2 can be reduced to 100 μ f.

All the resistors and diodes are mounted on end as shown in Fig. 4.

Meter Modification. (These instructions apply only to the meter specified in the Parts List. While other meters might have a similar construction, we can only be certain about the specified meter.) Remove the meter's plastic face by pulling it straight off. Then loosen the two recessed screws on the back of the case (not the terminal screws) to free the meter movement. Hold the meter in one hand and turn it upside-down over the palm of your other hand. The movement will drop into your hand, restrained only by two fine wires that are soldered to the rectifier in the case. (The rectifier's end terminals are soldered to the case terminals.)

Using a fine-tip iron rated no more than 27 watts, unsolder the two wires from the meter *at the rectifier*. (Note carefully which wire connects to the left and right rectifier terminals.) Reach in with long-nose pliers and snap-off the rectifier connections by rocking its leads back and forth several times. Then solder the meter wires to the respective left and right terminals. Insert the movement in the case, secure the mounting screws and snap the cover in place. The VU meter is now a DC meter with a VU scale. Now mount the circuit board on the back of the meter terminals.

If possible, check the assembly for operation before installation in the cabinet. Since the amplifier cannot be operated without a resistor across its input, temporarily connect resistor R2 (10,000 to 47,000 ohms) as shown in the schematic, to replace the volume control. If the Monitor fails to operate or to provide a low-distortion output signal, check that C3's polarity is correct and that the diodes have not been reverse connected. When the circuit checks out, remove R2, take the board off the meter, install the meter in the cabinet and then re-install the board on the meter.

Pot R1 must be a miniature type so it can fit between the board's components and the panel. If you use a different layout, R1 can be a full-size pot or a stepped attenuator. Pot R1's value is determined by the micro-

phone impedance. For low-impedance mikes (50 to 1,000-ohms) R1 can be 1,000 or 2,500 ohms. If the mike is a 50,000-ohm dynamic, R1 should be 50,000 ohms. If a DC unbalance causes a scratching sound when a 50,000-ohm pot is used, install a 47,000-ohm resistor at R2, change R1 to 250,000 ohms and install a 0.1-uf, 25-V capacitor between R1's wiper and the top of R2. This DC isolates R1 from the IC's input.

Jacks J1 and J2 should match your existing connectors. Power switch S1 must break both the positive and negative power sources. Do not try to break only one side or the ground connection; it must be done as shown.

Using the Monitor. Plug a mike in J1 and connect the amplifier, recorder or audio line to J2. Using a test-tone input, or someone speaking into a mike, adjust the amplifier or recorder's gain control so the recorder's meter indicates 0 VU when the Monitor's meter indicates 0 VU. Mark the recorder or amplifier's level control so it can be easily reset to the 0 VU position.

Plug a mike in J1, and then simply adjust R1 for a 0 VU indication on speech or music peaks. The Monitor will then always feed the proper output level.

A Kingly QSO

Continued from page 86

said, although we thought the story had gone cold by then.

The team this time was a small one, just a director, an interviewer, a cameraman (fortunately an ace cameraman) and a few technicians. They were tired and irritable, because they had been working since dawn on a murder case. Out went the dining room furniture, in came the lights and the cameras.

"Sit at the transmitter and we'll get the cameras lined up on you," ordered the cameraman, yawning. He was about to wake up fast.

Laurie sat at the rig and idly twiddled the knobs. Then he said quietly, "He's on!"

All hell broke again. This time the newsmen, frantic to tell their editors that King Hussein of Jordan was still alive and still playing with his amateur radio station, rushed all along the street and commandeered the neighbours' phones, to the bemused delight of the neighbours, even those who grumble about TV!

In December, 1970 King Hussein of Jor-

[Continued on page 102]

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A Kingly QSO

Continued from page 101

dan came to London, where he stayed for several weeks, for a comprehensive medical check-up. The moment he was established in the hospital, a small exclusive private clinic near Marble Arch, he had an amateur radio station installed, with a Drake transmitter, receiver and linear and a Hygain TH3 mounted on the clinic roof, about 50 ft. up.

Laurie and Maurice worked him several times, from both our home and mobile stations. As the King's amateur radio friends, they were among the very few visitors allowed by Special Branch (Britain's equivalent to the C.I.A.) to visit Hussein in hospital.

What did they talk about? Amateur radio, of course.

Getting An Unbelievably Good Color Picture

Continued from page 68

picture will usually become quite satisfactory.

Technicians use a dot pattern on the screen to perform this static convergence. If you can get hold of a dot bar generator and display a dot pattern, fine. If not, use this alternative.

Find a station that is transmitting a still pattern. It can be a test pattern, a stock-market computer display, a news-weather station etc. Inspect the still pattern minutely for color bleeding (see Fig. 3). To correct bleeding you have to move the electron beams so they will attain perfect registry at screen center.

There are four controls around the neck of the picture tube to accomplish this. On the convergence yoke at twelve o'clock is the blue static control (see Fig. 4). Adjusting this makes blue at screen center go up and down. At eight o'clock is the green static. Adjusting this makes green move diagonally from bottom right to top left. (Red and green static controls are often reversed. They still work the same way. See Fig. 5.)

The fourth control is called the blue lateral magnet. It is normally around the neck behind the purity tabs. Adjusting the blue lateral makes blue move from side to side.

With the still pattern as your guide, adjust the four till you get red, blue and green to coincide and produce white at screen center with no color bleeding.

If you turn the channel to a color program, you will note that you have an unbelievably good color picture. We don't guarantee that your result will be as good as ours, as shown in the beginning of this article, but then again you won't have our repair bills either!

CB Corner

continued from page 74

project. One club officer, a TV serviceman by trade, soon designed a model of a rustic building to go on the 20-acre site. The model would be taken around to clubs to gather support. Another club officer, a newspaper reporter, wrote promotional literature that sounded convincing. A third club member, a former fund-raiser, lent his invaluable talents. After plenty of legwork, the town fathers in Kerhonkson approved the site for a museum and George Nims Raybin was selected as the first man for CB's Hall of Fame.

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CIRCLE NO. 19 ON PAGE 23

Their success to date has been remarkable. There have been donations to the cause from clubs and individuals from all over the country. There were letters expressing interest in the museum from E. F. Johnson, the CB manufacturer, Richard Everett, an FCC attorney in Washington and an offer of antique rigs from the Courier company. U. S. Congressman John Dow agreed to speak at the museum's ground-breaking ceremony and will furnish a flag that has flown over the Capitol building in Washington.

I was convinced that the group had a good idea and the know-how to make it work. So I took aim and fired the first salvo: "You guys stand to make a lot of money out of this." (Besides donations and contributions, admission to the museum will be about \$1.50.) The question didn't produce any shock at all.

The land, they explained, is already paid for and incoming donations will go to underwriting the first structure. This will be a small, \$5,000 block building (10 x 20 ft.) to test the basic idea and to prove to the world the club means to carry it through. Further monies will go toward a second, much larger building to house all the planned exhibits. The club expects that future income will cover maintenance.

They pulled out voluminous records which detailed the operation. Any reasonable person, they said, may inspect the books at any time. In a parting remark, club officials asked how they could prove that the National CB Museum wasn't just another quickie conspiracy.

That was an easy question to answer. "Build it," I replied.

Ham Shack

Continued from page 69

Manufacturers put on a great show at these sessions, showing slides of the development and installation of their masterpieces.

Possibly the most important aspect of ham-fests is with fellow hams. Here you get to see and talk with the members of the nets you are in. You can meet the chaps you have ragchewed with for years. You can swap lies with competitors for DX and in contests. Few people look as you imagine from their voices, so there are many real surprises in store for fellows who have talked with each other for years but have never met.

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

FROM OUR MAIL BAG

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

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

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

PRINTED CIRCUITRY

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

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

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CIRCLE NO. 10 ON PAGE 23

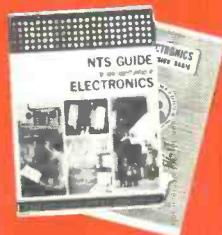
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