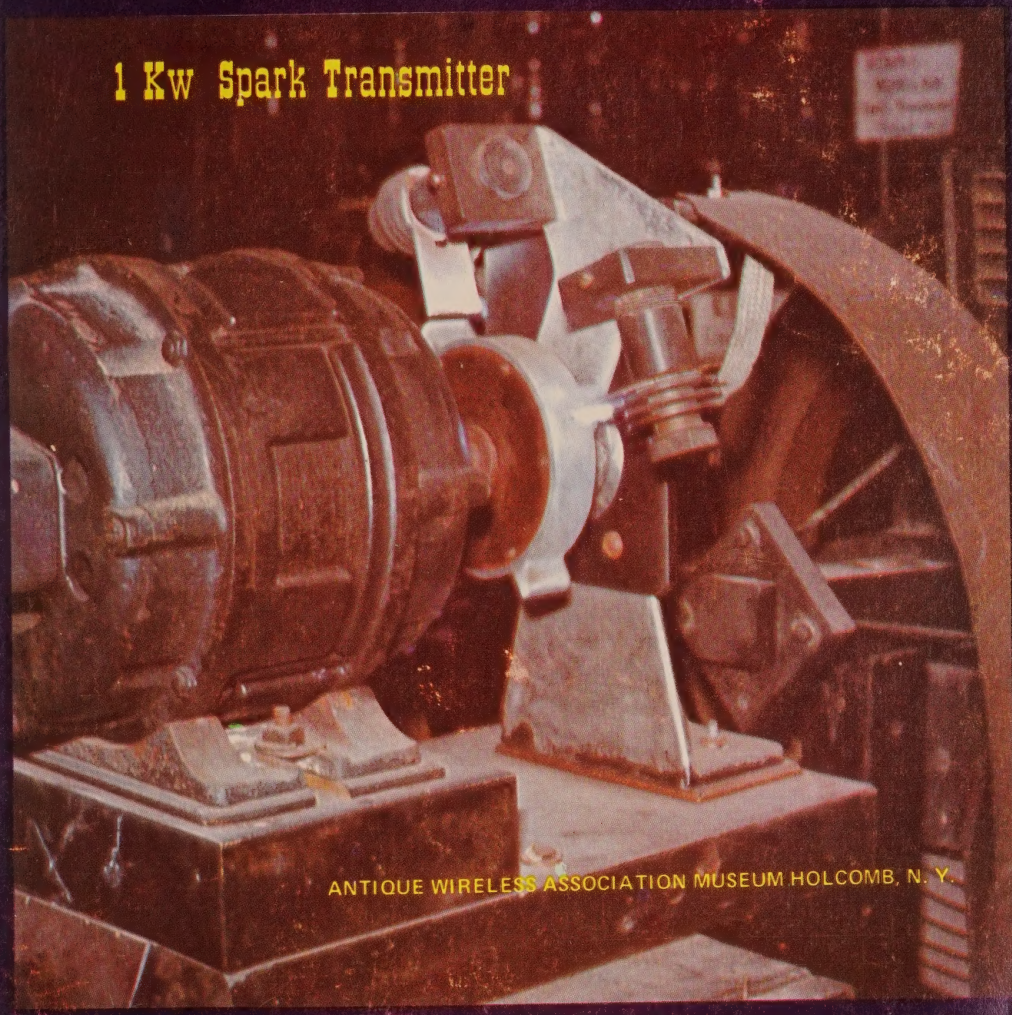
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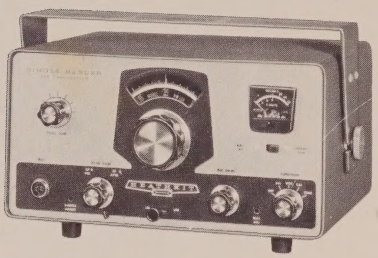
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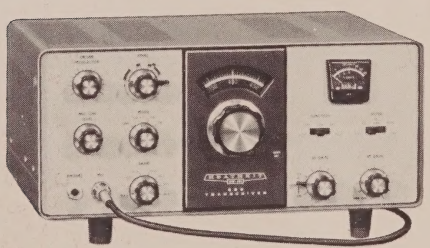
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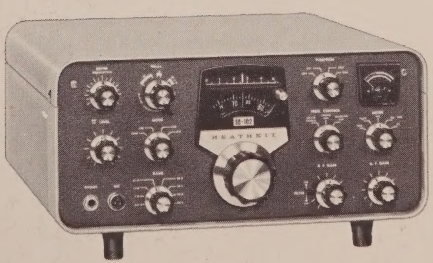
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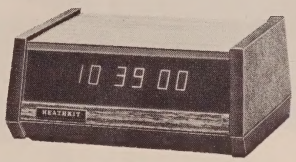
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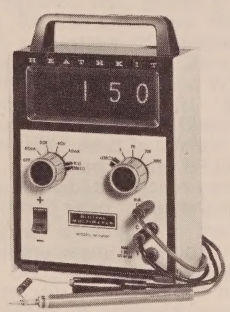
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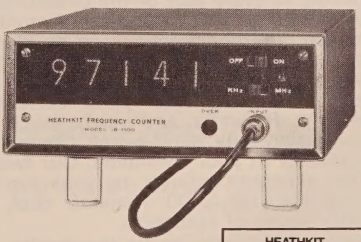
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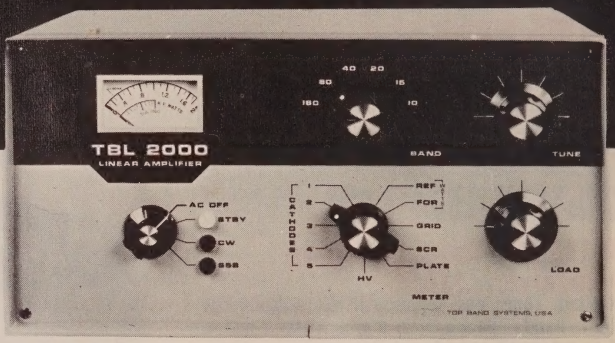
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Offices: 14 Vanderventer Avenue, Port Washington, L.I., N.Y. 11050. Telephone: 516-883-6200.

CQ (Title registered U.S. Post Office) is published monthly by Cowan Publishing Corp. Second Class postage paid at Port Washington and Miami, Florida. Subscription Prices: one year, $6.00; two years, $11.00; three years, $15.00. Entire contents copyrighted 1973 by Cowan Publishing Corp. CQ does not assume responsibility for unsolicited manuscripts. Allow six weeks for change of address. Printed in the United States of America.

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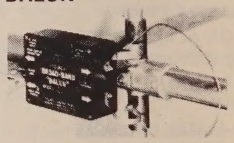
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Ordinarily we bend over backwards to refrain from commenting editorially on W2NDS's ravings, despite the fact that he's been attacking *CQ* in print on and off for many years. It's been our experience that this particular egomaniac thrives on controversy, is usually quite indiscriminate about who he maligns, and pays little if any attention to gathering facts or details before launching one of his many nefarious windmill tilting expeditions.

From time to time during these past years of attempting to peacefully coexist with Wayne, we have found ourselves forced to make an exception to our "turn-the-other-cheek" policy, simply because sufficient readers have requested clarification on one or more of his outrageous accusations. In every instance where we've found such action necessary, we've been most careful to make our replies detailed, accurate, and straightforward. Interestingly enough, though we've put the lie to many of Wayne's rantings, spelled out his half-truths, misstatements, and obvious distorted attacks, we've found that the truth simply shuts him up for a short time. Never has he had the courage or conviction to pursue the issues further, once the facts have been presented publicly.

A typical Wayne Green distortion appears in the December, 1972 issue of *73 Magazine* on page 5. Wayne writes,

"One of the most persistent complaints heard at the Hudson ARRL Convention was a chorus of gripes from Novices about the latest *CQ* action. It seems that *CQ* has been sending Novices a note telling them that they will receive a six month free subscription to the magazine. Then after an issue or two, along comes a note saying that this subscription is an impossible burden and they really should foot their share of the cost and how would they like a two year subscription for $6.00? "

Now, here are the facts. Almost a year ago *CQ* actually began sending free six month subscriptions to newly licensed Novices. More than 15,000 Novices received these subs in their entirety. After almost a year of fulfilling this service, we were hit with a large postal increase and a printing increase almost simultaneously. We did indeed contact those Novices whose free subs had not yet expired (some had already received three, four, or five free issues) and did advise them that the project had become too costly. Those that wished to continue to receive *CQ* were permitted to subscribe at $3.00 for one year, $6.00 for two years, (rates intended to cover only the cost of printing and mailing the issues). This was our method of showing good faith and attempting to keep newcomers up to date on ham radio doings at a low cost. The truth, as you can see, is a far cry from what Wayne's editorial would have his readers believe. In fact, our booth was less than thirty feet from Wayne's at the HARC Convention, and of more than three thousand people that passed by to say hello, only one even mentioned the matter. So much for Wayne's "most persistent complaint."

The important issue at stake here is not simply that W2NSD exagerrates from time to time. It goes much deeper. In fact, a statement by Wayne in his own November *Repeater Bulletin* gives a very clear picture of Wayne's attitude toward libelous attacks on other persons, companies, etc. He states,

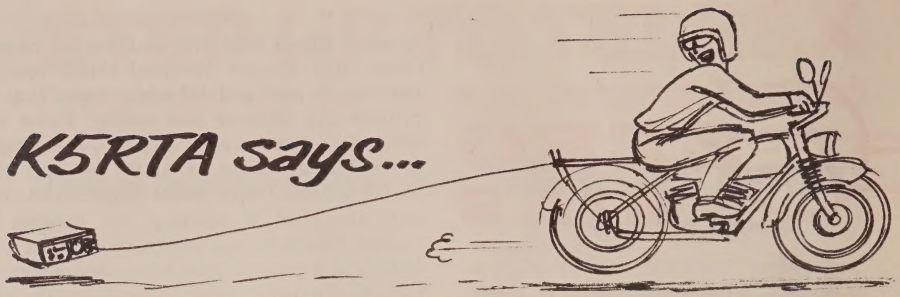
"Let's say you want to unload some inside gossip, but don't want to get hung by someone else for spilling the beans -- no strain, just ask that your name and call be left off the news. As long as I know who wrote it and think it is straight dope it could get printed. I'll see to it that the message gets across without a libel suit."*

"Speaking of libel -- it is usually difficult to collect on this sort of thing these days. You really have to prove that there is a personal motive involved or a business motive. Hopefully, nothing like this will sully the *Bulletin* and we will be able to stick to plain facts."

There you have it, in Wayne's own words -- his utter contempt for the truth, his readers, and his advertisers. This attitude makes for the lowest form of yellow journalism. It's a sad commentary on our legal system that such an individual can be permitted to stretch the law, the truth, and his own imagination to such degrees with blatant disregard as to who might get hurt. It's also sad that we must take precious space in our editorials every so often to make Mr. Green's attitudes, policies, and activities public to those of you who do indeed want the truth. Mr. Green might have done better studying the credo of Lincoln or Jefferson, but unfortunately he chose Joe McCarthy somewhere in the course of his education.

73, Dick, K2MGA

*Editor's Note: He's referring to material sent to him for publication.



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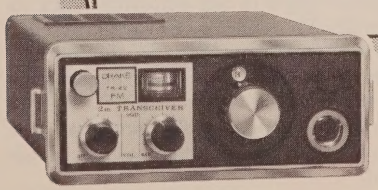
Just have to drop you a note and tell you what a tough little rig the TR-22 is. I have been using mine mobile in the car and on my motorcycle and portable at the office.

Yesterday, I had it strapped to the luggage rack on the motorcycle and was working motorcyle mobile on the way to work. Unfortunately, I took a new road that turned out to be rougher than anything I had previously been on with the radio . I suddenly caught sight of the TR-22 in the rear view mirror bouncing along the pavement behind me. I was doing about about 40 MPH and was dragging the TR-22 by the mike cord. I drug it for at least a block before I stopped.

The carrying case was pretty torn up and the antenna was snapped off right at the case. I returned home and hooked it up in the car and it works like it always did.

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OUR READERS SAY

On Phasing Out A.M.

Editor, *CQ:*

On reading the letter from Paul Abbott, WA2-RJV, I was rather surprised to discover that "Aviation is almost entirely s.s.b. or f.m.–" As an owner and operator of three aviation electronics shops this "fact" rather startles me. To date only the h.f. systems used in aviation are operating on s.s.b. and this activity is generally used only in over water flights and over uninhabited areas such as South America. F.M. in aviation has been restricted to certain functions in navigation aid signals and recently in air-to-ground links for telephone (Ma Bell type).

All communications are simplex a.m. here in the U. S. We now have 360 channels with 720 authorized but will probably go to 1800 instead with 10 kHz spacing. This will still be a.m. with some channels using PCM for data link. By the way, we operate on 118.00 to 136.00 mHz and will be expanding our channels by closer frequency tolerance equipment.

All of this is "Store Bought" and Type Accepted, of course, a great difference from the large quantity of home built gear; a.m., s.s.b., c.w., et. al. on the ham-bands.

I do not believe any means of communicating should be precluded from the ham-bands unless that method can be shown to be technically bad (as was spark and other forms of type B wave). This is particularly true when the justification is that one can buy a rig using a "better" system.

Sideband is great for "communicating" but a.m. and c.w. are just as good or better for "hamming."

T. J. Van Iderstine, W4ADU/0
Muskogee, Oklahoma

Editor, *CQ:*

I think it's about time we "phased out" all hams who propose "phasing out" any mode of operation now allowed on the Amateur bands.

WA2RJV sounds like Wayne Green and it surprises me that you would print anything that has a Wayne Green flavor!

If the lower bands seem too crowded for Mr. Abbott, I suggest he move up on the higher frequencies or get himself a better receiver – there are plenty of good "new and used ones available."

I would like to correct Mr. Abbott on a point or two; S.S.B. has been around the ham bands over 20 years – remember all those ham mags with the articles: "Beat TVI – go S.S.B." so the guys who were not smart enough to build a low pass filter and debug their rigs went down and bought a s.s.b. outfit. Dig that superior technique and ingenuity!

As for the motivation of the standard broadcast station's interest in s.s.b., I think if Mr. Abbott digs a little deeper he will find their chief worry is about the "light bill" – not spectrum space. Incidentally, if they ever come up with a s.s.b.rig that sounds like an a.m. broadcast transmitter– then I'll buy one!

As for "conserving spectrum space" in the ham bands – I invite Mr. Abbott to keep an eye out for past, present and future "Use 'em or Lose 'em" articles on *lack* of use of the ham bands.

After listening to signals from maladjusted s.s.b. rigs with buck-shot as much as 200kHz wide (R-390A) I feel s.s.b. should be allowed only on 1296mHz and above with the other pulse type signals.

Mr. Abbott struck the simile, so I will use it and let him answer his own question: "Phase Out AM?

Why are the popular light planes which are flown by amateur pilots all powered by *piston* engines?

John L. Mohn, W5MEU
San Antonio, Texas

Editor, *CQ:*

I can appreciate Paul Abbott's enthusiasm for s.s.b. as expressed in his letter to the Editor in September *CQ*, but he is entirely wrong in stating, "Aviation is almost entirely s.s.b. –" (page 7). All v.h.f. communication on the aviation frequencies is on a.m. and will continue to be so until some compatible system with equal or better ease of tuning is found.

The pilot of an aircraft does not have time to play with a clarifier control which would be required on present-day state-of-the-art s.s.b. For "old-fashioned a.m." he merely dials up the correct frequency by digital means and the work is finished. To do this same thing with ±20 Hertz accuracy on a 130 mHz signal would require the fantastic stability of ±0.000015%! I don't see this in the near future.

Franklin Swan
Chicago, Illinois

Announcements

Stolen Equipment

Stolen: Elmac AF68 Serial No. 10888, Elmac PMR8 Serial No. 10918 M1070 pwr. supply, RCA Model AR88 that has S-Meter that is not standard equipment. If found, please notify K5LKL.

Oak Park, Michigan

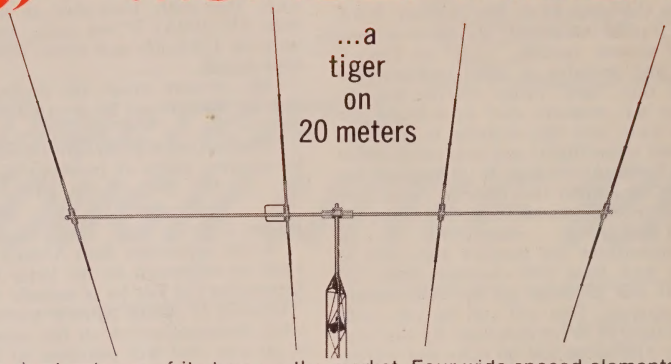
The Oak Park Amateur Radio Club will hold its 4th Annual Swap & Shop at the Frost Junior High School, located at 23261 Scotia, Oak Park, Michigan on Sunday, January 14, 1973. For information, contact the Oak Park Amateur Radio Club at 14300 Oak Park Blvd., Oak Park, Michigan. Advance sale of tickets, $1.25; at the door, $1.75.

Hollywood, Florida

The Hollywood ARC will hold its Operation's Day to celebrate the 2nd Anniversary of its club call, WB4TON from 1700 GMT on Jan. 6, to 2300 GMT Jan. 7. Frequencies will be 70 KHz up from the band edge on cw and 3930, 7230, 14330, 21430, and 28530 on ssb. Certificates will be sent to those working WB4TON on both modes and to those working WB4TON on five bands. Special QSL's sent to all those working WB4TON for an SASE. QSL to W4OZF, 2311 Nassau Dr., Miramar, FL. 33023.

for the most advanced antennas under the sun!

HY-GAIN 204BA MONOBANDER



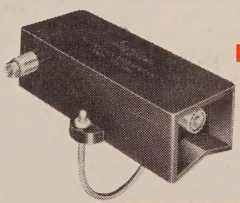
The best antenna of its type on the market. Four wide spaced elements (the longest 36'6") on a 26' boom along with Hy-Gain's exclusive Beta Match produce a high performance DX beam for phone or CW across the entire 20 meter band.

- 10 db forward gain
- 28 db F/B ratio
- Less than 1.05:1 SWR at resonance
- Feeds with 52 ohm coax
- Maximum power input 1 kw AM; 4 kw PEP
- Wind load 99.8 lbs. at 80 MPH
- Surface area 3.9 sq. ft.

The 204BA Monobander is ruggedly built to insure mechanical as well as electrical reliability, yet light enough to mount on a lightweight tower. (Recommended rotator: Hy-Gain's new Roto-Brake 400.) Construction features include taper swaged slotted tubing with full circumference clamps; tiltable cast aluminum boom-to-mast clamp; heavy gauge machine formed element-to-boom brackets; boom 2" OD; mast diameters from 1½" to 2½"; wind survival up to 100 MPH. Shipping weight 51 pounds.

See the best distributor under the sun...the one who handles the Hy-Gain 204BA Monobander.

Model 204BA (4-element, 20 meters).....**$149.95**
Model 203BA (3-element, 20 meters).....**$139.95**
Model 153BA (3-element, 15 meters).....**$ 69.95**
Model 103BA (3-element, 10 meters).....**$ 54.95**



FERRITE BALUN MODEL BN-86

Improves transfer of energy to the antenna; eliminates stray RF; improves pattern and F/B ratio. **$14.95**

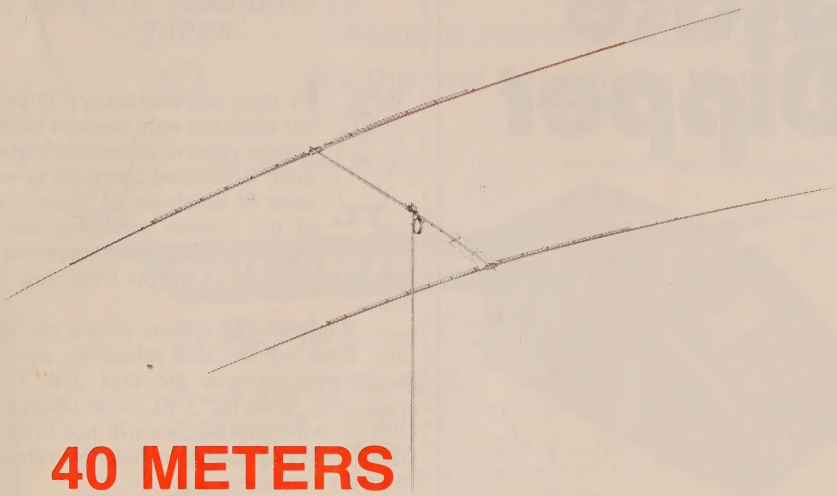
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Order No. 397 **$169.95**

Hy-Gain 402BA...*the 40 meter DX Demon!*

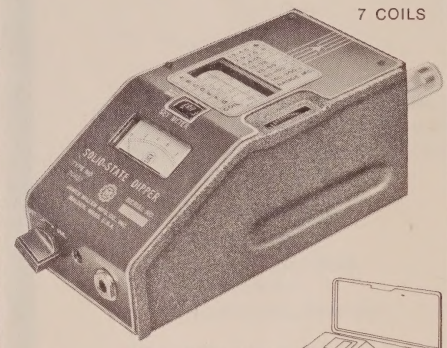
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Q AND A

BY CHARLES J. SCHAUERS, W6QLV*



IT may surprise many *CQ* readers but Q&A not only receives technical queries relative to amateur radio but many diversified questions as well—some of which would "stump" some of the experts, including one well known widely syndicated lady columnist who has helped so many people with their problems.

For obvious reasons we cannot tender any legal advice and refuse to enter any arguments between the OM and XYL—especially when the XYL is anti-ham radio. But do not think that we will not *listen*! We will! If it is possible to help by referral—we will.

2 Meter Mobile Antenna

"I operate 2 meter mobile. The XYL says she won't drive the car with a permanently mounted antenna on the roof. She uses the new car about 40% of the time. Any suggestions?"

Try Hi-Gain's model 265 vertical. It has a special magnetic mount, 3db gain and sticks to the roof at under 90 miles an hour. It is easy to install and remove.

Quick Zener Check

"I have some surplus zener diodes—all are unmarked except as to polarity. Now what I want to do is find the 'rough' regulating point and whether they are shorted or open. How about a quick check without a lot of elaborate equipment?"

Sure. First you should have a metered

Q & A is a free technical assistance program offered by CQ to its readers. We ask your cooperation to enable us to assist as many amateurs each month as possible. Always include a self-addressed stamped envelope with your question. Only one question per letter, please. Before writing to ask where a published article appeared, try to find it yourself by consulting the annual indexes of the various amateur magazines. Mail questions to: CQ Q & A, 14 Vanderventer Ave., Port Washington, N.Y. 11050.

"The thing the whole world yearns after!"



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it's the real thing that's hit the world!"

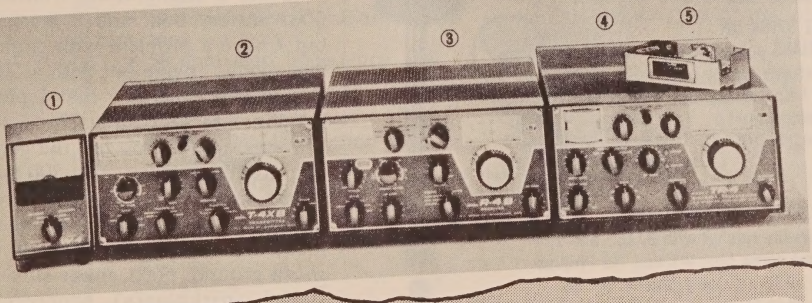
So says this ad clipped from a Japanese ham magazine:

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高感度・高精度でおなじみの世界の本格派がやってきました!
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Japanese radio amateurs save for months to be able to purchase Drake gear. We think you'll agree that is significant in a land which has become famous for its production of electronic equipment.

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power supply (ps), (regulated or unregulated) which will go up to 100 volts or so. The output of the ps should be controlled—either with a Variac or other system. Across the ps connect a good v.o.m., in series with a 1/2 watt resistor, of about 200K. Now connect the zener to the ps output. Adjust the power supply output and the v.o.m. ranges *carefully* until there is very little or no increase in reading of the v.o.m. as you boost the ps voltage—this is the *approximate* zener regulating point. If the zener is *shorted* the ps fuse *may* blow, and if it is *open* the meter will read the ps voltage only regardless of output adjustment.

Wattage measurements require carefully applied loads, temperature checks and *ultimate* regulation.

Effective Ground

"I live five floors above ground level in a new apartment building. My ground (connected to pipes in our bathroom) does not seem very effective. What cooks?"

Maybe plastic pipes! (at least for short runs). Suggest you run up a number 4 or 6 wire from ground through a window. But don't be obvious!

FPM On A Boat

"I use a Hallicrafters transceiver (FPM-300) on my boat and it works beautifully, but I have a problem with engine noise, not my regular engine but with a 500 watt gasoline driven generator that I picked up at a bargain. Any suggestions?"

I assume that you use the generator when you are not moving. The 500 watt gen is no doubt small and located where it is most practical—in or near the engine compartment. Make sure its frame is grounded to *ship's* ground. Next, make sure you have installed sparkplug(s) suppressors. By-pass the output leads of the generator with .001 mfd. ceramics to ground. There are a number of other measures but too lengthy to describe in the space we have.

FTdx 570 Noise Blanker

"My Yaesu Musen FTdx570 has been doing a good job but lately I have one problem. The noise blanker seems to be intermittent. In other words it does not work 100% of the time. What do I look for?"

The noise blanker is connected between the 2nd mixer and the i.f. filter. It could be any one of the following: noise amplifier,



Create a vast improvement in your two meter performance! Get the advantage of 6 db gain transmitting—6 db gain receiving. Both are yours in the Hustler Model G6-144, the antenna designed to establish who is who on two meters.

be "who's who" on two meters with the HUSTLER 6db gain colinear

MODEL G6-144 . . . $39.95

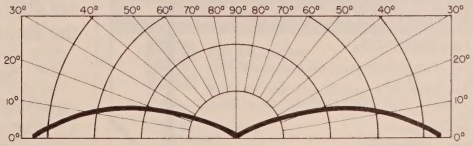
ELECTRICAL:

- 6 db gain over 1/4 wave ground plane
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- 6 MHz bandwidth for 1.5:1 or better SWR
- Power rating—250 watts FM

MECHANICAL:

- Radiator: 119" x 1" — 7/8"-3/8" OD high strength aluminum tubing
- Radials: Four—21" x 3/16" dia. aluminum rod
- SO-239 coax connector
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GAIN: 12 db.
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Model: MY-144-9

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DIPLOMAT - 2
Model: DI-2

DIPLOMAT SPECIAL
Model: DI-2A

For detailed specifications, see your authorized Mosley Dealer or write Dept. 212 . . .

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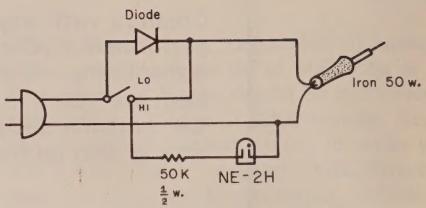


Fig. 1—One method for reducing soldering iron heat.

pulse amplifier, gate control, the 3180 kHz i.f. amplifier or the balanced gate. I'll bet it is a capacitor. Check the two diodes in the gate and look for cold soldered connections. This is a good set. The blanker is well designed.

Western Union Telefax Facs Problem

"I modified two WU telefax machines according to W7QCV's article in the May 1972 *QST*. For awile both worked well but one of the machines is now intermittent. What should I look for?

Check the 10 mf cap (electrolytic) connected to the bottom of the 3500 ohm pot whose center arm is connected to the screen of the 6V6 tube. Next, evaluate the two 10 mf 'lytics (in parallel) which are connected to the screen of the 6V6. If these are not at fault then check *all* capacitors, motors, resistors etc.

Receiver for a Beginner

"I have $125 to sink into a receiver that covers 10 to 160 meters. This will be my first set and I intend of course to graduate to a better set when I get my General license. Any suggestions?"

Try the DX-150A (Realistic) obtainable through Radio Shack (Allied) Stores. It covers the 10 to 160 meter bands and is within the financial range you are thinking of.

Soldering Iron Heat Reduction

"Any way to decrease the heat on my Ungar soldering iron without using a transformer? It is rated at about 50 watts."

Yes. See fig. 1. Thanks originally to the *W6CX Carrier* and *Footprint* pubs, try the idea shown. When the diode (1 amp 400 volt surplus diode) is in the circuit it allows the iron to operate on 1/2 cycle. When the switch is closed the iron is full on. I took the liberty of adding an NE-2H neon in series with a 100k 1/2 watt resistor which will brighten up when full power is on.

[*Continued on page 90*]

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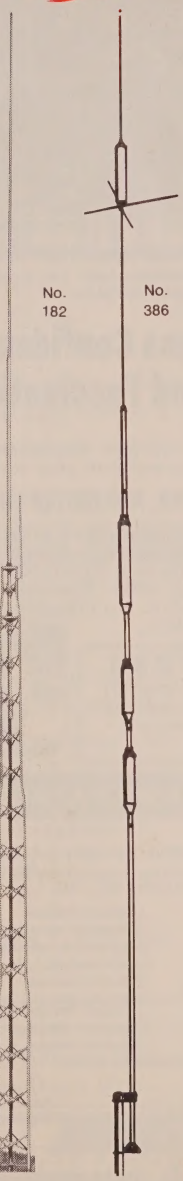
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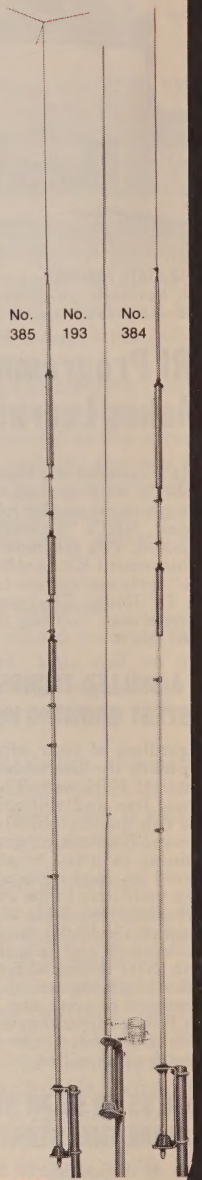
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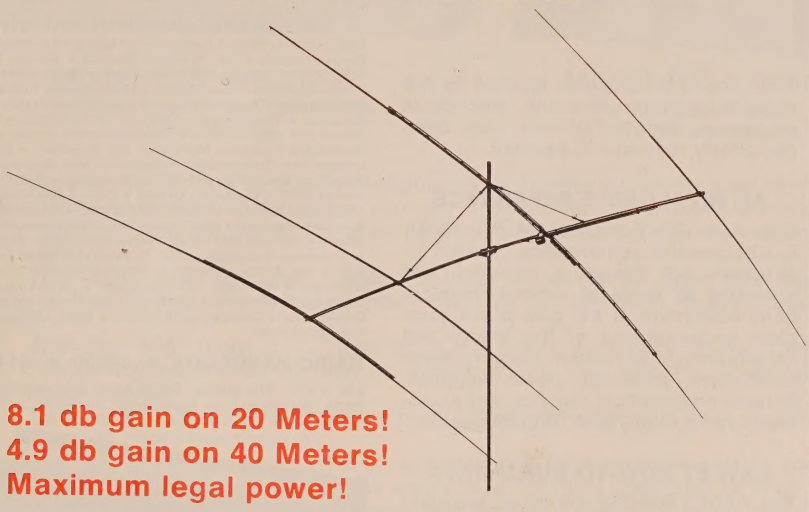
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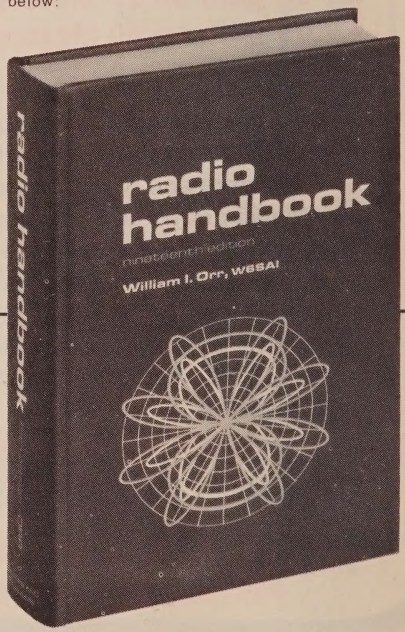
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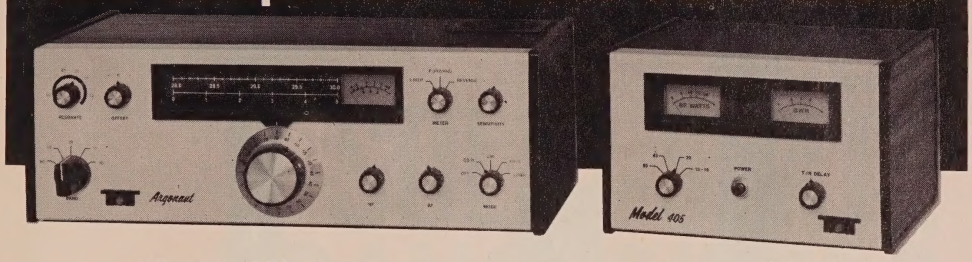
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Model 405 Linear

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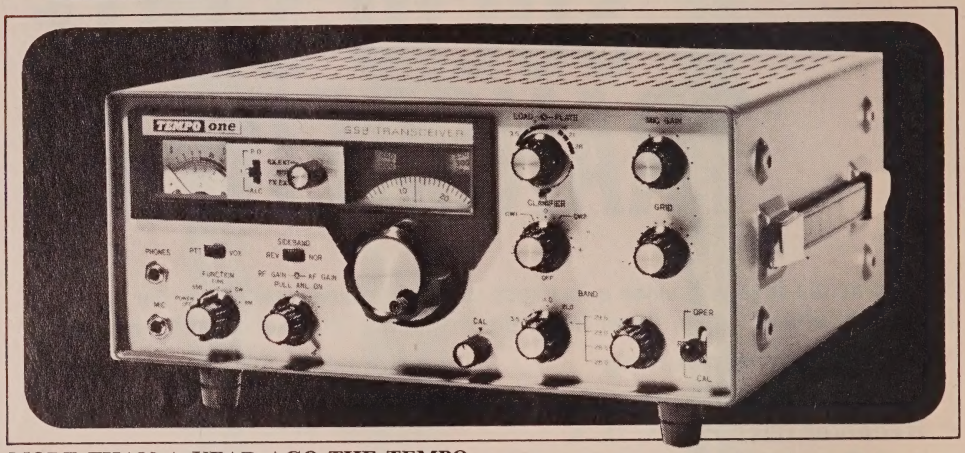
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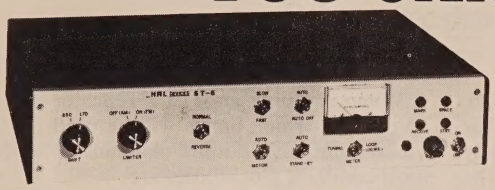
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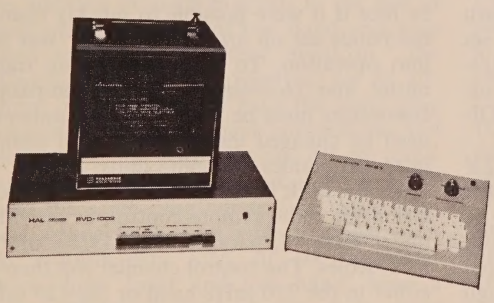
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An RTTY Repeater

Part I—The System and the Terminal Unit

BY BYRON H. KRETZMAN,* W2JTP

THE requirements for a radioteletype f.m. repeater are vastly different from those for a phone repeater, such as those now largely filling the high end of the 2-meter band. The original purpose of those phone repeaters was to extend the communications range of *mobile* units, accomplished usually by locating the repeater on a mountain top or on a high building. Naturally, mobile RTTY stations are virtually non-existant, so the purpose of an RTTY repeater is somewhat different. The primary purpose of an RTTY repeater is to enhance autostart[1], a unique feature of RTTY. RTTY then becomes a "net" operation, with the repeater as an automatic net control station.

Autostart is the capability to send an RTTY message to another station without that station's operator being at his equipment. This is the automatic starting of the Teletype machine, the printing-out of the message, and then the automatic shut-down of the machine, and of the receiver if so set up. This feature of RTTY is equally adaptable to directed messages or messages addressed to all stations, such as ARRL Official Bulletins, for example.

To be sure, a high location for the RTTY repeater is desirable, but, keeping in mind the fact that it is *fixed* base stations that are to be repeated, a centralized location is important, too. All RTTY base stations in the area should be able to get into it without high power or elaborate antennas; and, of course, the repeater output should be easily received.

A very important requirement of the RTTY repeater is that it repeat *only* an RTTY signal. A phone station or even an unmodulated carrier on the input frequency must not turn on the transmitter. This is achieved by having the demodulator of the terminal unit at the repeater key an a.f.s.k. oscillator. The result is a regenerative repeater in its most simple form.

When planning an RTTY repeater it must be decided which bands will be used for the main input and output channels. The two most common possibilities are:

146.10 mHz in—146.70 mHz out[2]
146.70 mHz in— 52.60 mHz out

If 6 meter output of the repeater is contemplated, the repeater locations should be away from TV receivers, particularly if Channel 2 is being watched in the area. The consideration here is public relations; no matter how "clean" the transmitter might be, TVI to the adjacent Channel 2 is always possible, especially in a fringe area.

Many other possibilities exist, of course. Input and output can be crossband or in-band, utilizing the above frequencies and/or frequencies in the 220 and 420 mHz bands.[3] Note that any cross-band set-up makes it real easy to listen to the output of the repeater while its input is being fed. And, it would be nice if it were possible to quickly change the bands set up *after* the repeater was put into operation. To do this, separate transmitter and receiver units with compatible connectors must be used. Only the antennas need be changed then when a band change in made, besides swapping units.

Lastly, an RTTY repeater could have provision for radio remote control, as provided under Part 97, paragraph 97.43(b) of the FCC Rules. The control channel will then be either in the 220 mHz band or the 420 mHz band, in all likelihood. Like the main receiver and transmitter, it would be nice if the control units, too, were capable of being changed-out just by unplugging connectors. Not necessarily a requirement, but something that can be designed into the system is the capability of using the control channel as another RTTY input channel.

Other miscellaneous requirements might include time-clock operation, with all equip-

*431 Woodbury Road, Huntington, N.Y. 11743

[1]Kretzman, B.H., *The New RTTY Handbook*, p. 107.

[2]Mason, J. A., "Towards a National Plan for 2-Meter FM Channels," *QST*, May 1972, p. 64.

[3]Blakeslee, D. A., "ARRL Proposed Band Plans for 220 and 420 MHz," *QST*, June 1972, p. 91.

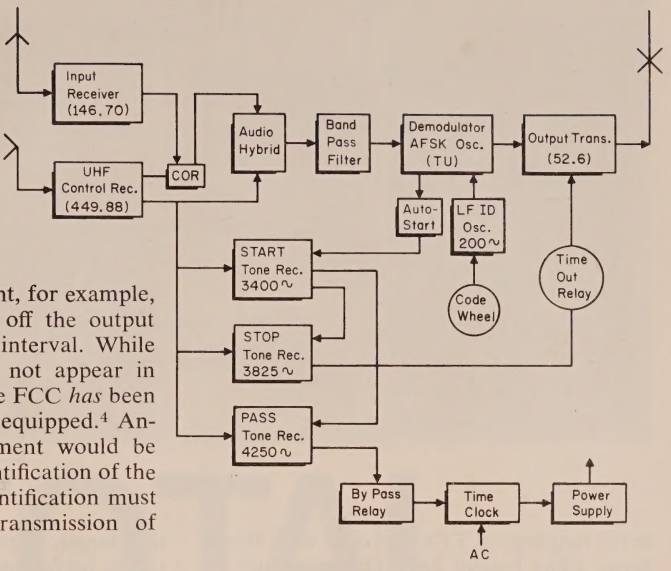


Fig. 1—Block diagram of the RTTY repeater.

ment shut down after midnight, for example, and a time-out relay to cut off the output after a pre-determined time interval. While this latter requirement does not appear in Part 97 of the FCC Rules, the FCC *has* been insisting that repeaters be so equipped.[4] Another miscellaneous requirement would be the automatic continuous identification of the repeater. Obviously, such identification must not interfere with the re-transmission of RTTY.

The RTTY Repeater

The above requirements were met by utilizing Motorola Type -80 equipment. All -80D's were engineered on the building block principle, with separate "strips" for transmitter, receiver and power supply. Each strip becomes a relay rack mounted unit by the addition of angle brackets to the end of each strip. A variety of low band and high band receiver strips, the "Sensicon," the "Unichannel," the "G" receiver; are all different in design yet all have the same plug connectors, with identical connections and identical voltage requirements. All -80 transmitter strips, both high band and low band, have the same plug connectors, with identical connections, and with identical voltage requirements. Also, all -80 transmitter strips, high band and low band, have a pair of 2E26's in the final, and all are rated at 30 watts *output*. Conversion articles on the -80D have appeared in *CQ*[5] in the past, as well as a specialized conversion to the 220-225 mHz band[6] which retained the identical connection and voltage requirement feature as well as the 30 watt output rating.

It was decided to begin this "machine" by making it a 2-meter to 6-meter repeater, using the long-established[7] RTTY frequencies of 146.70 and 52.60 mHz. It was also decided to use a radio control link around 449 mHz, making it possible to utilize a variety of readily-available Motorola Type T-44 u.h.f. strips.

Figure 1 is a block diagram of the RTTY repeater. For the input we used a "Sensicon" PA-8433 tuned to 146.70 mHz. The u.h.f. control receiver is a TU193 tuned to 449.88 mHz. Since it was desired to use the u.h.f. channel as another RTTY input, as well as a control channel, a carrier operated relay (COR) was connected to give the u.h.f. input priority by disconnecting the audio input from the v.h.f. receiver whenever the COR on the u.h.f. receiver was actuated. A simple resistive hybrid isolates the audio output of each of the receivers to permit monitor speaker separation at the repeater site.

The three tone control receivers are fed directly from the audio output of the u.h.f. receiver. The input to the demodulator is fed through a band-pass input filter[8] which passes the standard RTTY tones (2125 Hz *mark*, 2975 Hz *space*) and keeps out voice as well as the three control tones. The a.f.s.k. oscillator, putting out the standard RTTY tones, is keyed by the demodulator, thereby repeating only the RTTY-keyed intelligence and not the tones themselves. This is "regeneration"

[4]Hendrickson, G., "FCC, A Monthly Report," *rpt*, Dec. 1971, p. 24.

[5]Kretzman, B. H., "Putting the Motorola —80D on 2-Meter FM," *CQ*, Feb. 1966, p. 65.

[6]Kretzman, B .H., "The Motorola 80D on 220 Mc FM," *CQ*, Oct. 1971, p. 16.

[7]Kretzman, B. H., "RTTY," *CQ*, March 1963, p. 67.

[8]Wetherhold, E. E., "An RTTY Bandpass Filter for 2125-2975 cps," *QST*, April 1968, p. 19.

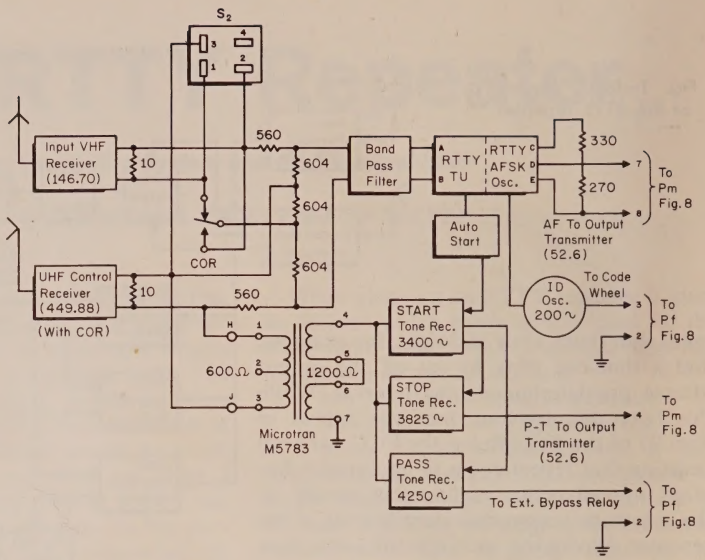


Fig. 2—Expanded block diagram of the RTTY repeater.

in the language of TTY, but in its most simple form. (The baudot code pulses are not reshaped.) The *mark* tone is fed to an autostart detector whose relay keys, through a 3-minute time-out relay, the press-to-talk circuit of the repeater transmitter. Output from a 200 Hz oscillator, keyed by a code wheel for continuous identification, is fed to the input of the audio amplifier of the a.f.s.k. oscillator, a convenient place for the low-level mixing.

Figure 2 is an expanded block diagram, expanded to show interconnections in more detail. Three control tones, transmitted over the u.h.f. control link, provide the means of controlling the operation of the RTTY repeater. A Start tone of 3400 Hz turns on the a.c. to the -80 Power Supply (4), if it has been shut down. A Stop tone of 3825 Hz shuts down the repeater, except for the u.h.f. control receiver and the low-drain transistorized control logic circuits, by turning off the a.c. An ordinary a.c. time clock sets the normal a.c.-on operating time, from 5 P.M. to midnight, for example. Should it be desired to turn on the repeater at some other time for testing, a time clock Pass tone of 4250 Hz is required. (The Start tone will not turn on the repeater a.c. if the time clock has it off.) Various time delays are built into the system for protection, including a 3-minute time delay relay to prevent transmission until all of the tubes are well heated, along with the crystal ovens. Also, to prevent random tones from actuating the control logic, a delay of six to ten seconds is built-in. In other words, the control tone must be exactly on-frequency that length of time before the desired function is performed.

Because all of the control tones are above 3000 Hz, the u.h.f. control receiver, and its companion transmitter at the control point, must *not* have had the usual narrow-banding conversion. (Such conversions put a 3000 Hz low-pass filter in the audio circuit.)

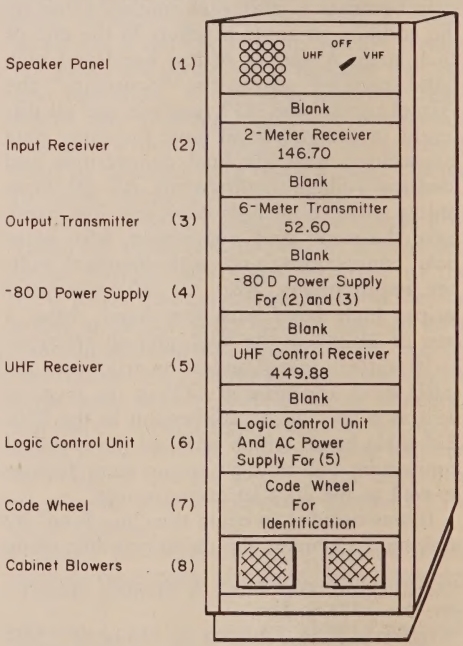


Fig. 3—The RTTY repeater in a 6-foot enclosed cabinet.



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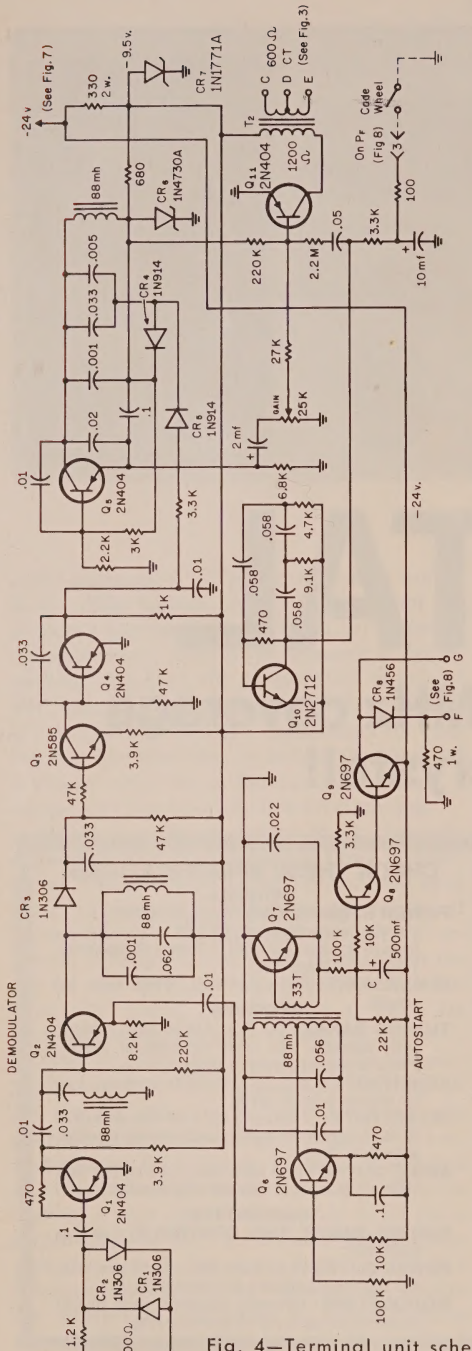


Fig. 4—Terminal unit schematic diagram. Capacitor values underlined are those which are varied slightly to bring that *L*-*C* circuit on frequency.

Construction

Figure 3 shows how the RTTY repeater is racked-up. All rack-mounted units occupy 5¼" of relay rack space. The heart of the RTTY repeater is the logic control unit (6). Besides the logic circuits, this unit contains the terminal unit (TU) and power supplies for all necessary voltages for the logic circuits; and, provides continuous power for the u.h.f. control receiver (5). Power for the -80D transmitter (3) and the -80D v.h.f. receiver (2) is provided by a separate a.c. power supply (4), which is turned on and off by the logic and an external time clock (not shown). The code wheel (7) is shown mounted below the logic.

The cabinet used had only a rear door so the units were mounted with bottoms flush to the front, but with 5¼" blank panels covering the bottom of each chassis. A 3½" blank panel separates each chassis to facilitate cooling. An intake blower (8) or an exhaust fan should be installed in the cabinet. If the environment of the repeater is dusty or dirty, the air circulated through the cabinet should be filtered, with an air interlock to shut down the repeater in case the blower fails or if the filters get clogged.

The logic control unit (6), shown in the photo, is built upon a dynamotor power supply chassis from an -80D mobile set. The removable bottom plate is actually the front panel. Under the chassis is the TU and connections to the logic relays and to the power supply components. A narrow sub-panel mounts the pilot lights and local control push-button switches.

The Terminal Unit

Figure 4 is the schematic diagram of the TU. The a.f.s.k. received through the band-pass input filter enters the TU at terminals *A* and *B*. Limiting is obtained by CR_1 and CR_2. Since the *mark* tone of 2125 Hz is subsequentally used to key the a.f.s.k. oscillator, the *space* tone of 2975 Hz is notched out by the series-tuned *L*-*C* circuit between Q_1 and Q_2, *after* limiting. The collector circuit of Q_2 is tuned to *mark* and diode CR_3 detects or rectifies the *mark* tone to feed the d.c. amplifier Q_3. Transistor Q_4 then is used to key the diodes, CR_4 and CR_5, which frequency-shift the a.f.s.k. oscillator Q_5. Output from the a.f.s.k. oscillator is fed to audio amplifier Q_{11} via a 25K GAIN control. Output transformer T_2 is used to feed the audio input circuit of the repeater transmitter.



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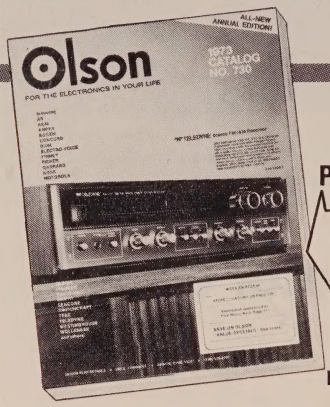
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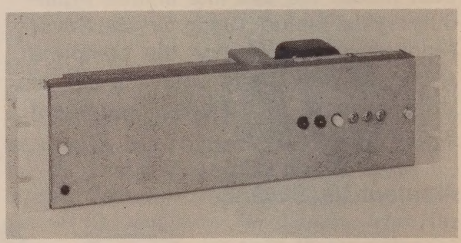
The autostart circuit, used to key-on the transmitter whenever a *mark* tone is received, consists of transistors Q_6, Q_7, Q_8 and Q_9. The 500 mf capacitor C, in parallel with the 22K resistor, determines the time it takes for the repeater to recognize a steady *mark* tone before it turns on the transmitter. Since the tolerance of such high-value capacitors can vary considerably it might be necessary to select a particular capacitor to give the time constant desired. A time constant of 5 to 10 seconds should be satisfactory.

The *mark* amplifier Q_2 is used as an emitter-follower to feed the autostart amplifier Q_6 which has its collector circuit tuned to *mark*, 2125 Hz. This tuned circuit uses the usual 88 mh loading coil as the inductance, but with a 33-turn secondary wound with about the same size wire. The secondary then feeds the autostart detector Q_7. Q_8 is a d.c. amplifier and Q_9 is the relay driver. The coil of the *mark* detector relay K_1 connects to terminals F and G on the TU board.

Transistor Q_{10} is connected in a phase-shift oscillator circuit which is keyed by an external code wheel to provide identification for the repeater. The frequency of this oscillator is approximately 200 Hz. Its output is fed through a blocking capacitor and a 2.2 meg isolating resistor to the base input circuit of audio amplifier Q_{11}. When the a.f.s.k. output at terminals C and E is set to -10 dbm, the code identification tone is approximately 12 db below the a.f.s.k. level, high enough to be heard, yet low enough to not cause interference to the a.f.s.k. tones of 2125 and 2975 Hz.

Part II

Part II, to follow in a subsequent issue, will detail the logic control system, the d.c. power supply which is part of the logic control unit, and the monitor speaker panel. Watch for it. ■



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F. M.

BY GLEN E. ZOOK,* K9STH/5

THE growth rate of f.m. is leveling off. This is not to say that the number of f.m.'ers is not ever increasing, but that the very rapid growth is slowing down. Such is true of most new endeavors. In the early days things are a bit slow, then, after it catches on, the endeavor produces a rapid growth factor and finally begins to level off. This is happening in f.m. The influx of the ready to go f.m. gear produced virtually a sellers' market with supplies often unable to meet demand. But, finally things are getting back to normal. F.m. sales are still high, and newcomers are showing up every day, and the end is nowhere in sight. However, a new type of f.m. customer is beginning to show. This amateur is not looking just to get on f.m., but is looking for the best equipment possible using up-to-date technology and performance.

In the rush to meet the demands of the rapidly growing f.m. market manufacturers had to freeze designs at a level sufficient to meet the technical needs of the majority of potential customers, a sound economic practice. The past two or three years have seen many changes in the face of f.m. Major cities have gone from one or two repeaters to a dozen or more. Wideband techniques are almost a thing of the past. 30 kHz channel spacing is most common, and 15 kHz may not be too far behind. Intermod from both amateur and commercial sources are another source of technical problems. Things go on and on and on.

The time is rapidly approaching for the ready to go f.m. gear to undergo a major redirection in design. Already many rigs are experiencing sever adjacent channel interference in areas using 30 kHz channel spacing. Other rigs cannot remain on frequency within a respectable tolerance. Still other rigs suffer fom severe intermodulation problems. These problems must be worked out to keep the new f.m. customer happy. The first two problems are actually closely related. One must have close frequency tolerances if narrow bandwidths are used. A minimum goal of frequency tolerance is 0.001% (0.0005% is better). Most amateur f.m. rigs can meet this if quality crystals are used. Sure, these cost more than the 0.0025% off-the-shelf crystals, but they have to come.

Strictly narrowband (±5 kHz deviation) transmitters must also appear in the near future. With increased stability and receiver selectivity, sufficient audio recovery and limiting circuits, narrowband will do a better job under crowded conditions. These are not hard to obtain, for the commercials have been doing it for years. If we are to keep our sanity, we must have narrowband equipment. Replacement filters are often available for existing equipment to improve adjacent channel rejection, so why not make them standard? Quality crystals are available, why not make them standard? Deviation has to be set in final testing, so why not set it to an accurate ±5 kHz? Audio recovery and sufficient limiting are available in IC packages these days, so why not include enough?

Intermod is the scourge of f.m. Any receiver can be made to intermod under certain circumstances. The trick is to limit the possibilities. A bit more work and a slight increase in cost are required, but they are going to be necessary. The new breed of f.m. consumers are beginning to request improvements. With an even greater number of f.m.'ers operating in the near future, these consumers will begin to demand better equipment.

No slight is intended to any manufacturer or importer of f.m. gear. The past and present gear has served a very important role in the growth of v.h.f. f.m. Without this gear many many amateurs now enjoying f.m. would not even have realized its existance. Now the time has come to fall back and re-group. Improved equipment will probably cost a little more, but wouldn't it be better to be able to use the gear in the hearts of the cities? Wouldn't it be nice to work 76 and not keep hearing 79 or 82? Wouldn't it be nice if everyone stayed within the passbands of the repeater receivers? Maybe I'm dreaming, but the improved gear has to come. The rumblings are deep but steady, and starting to surface in some parts of the U.S. How about it?!!

Technical Talk

Since most amateurs didn't have much constructing time available during the Holi-

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day Season, the January Technical Talk is going to be completely non-technical! What is going to be covered is some suggestions on holding f.m. hamfests and f.m. forums as a part of general interest hamfests.

During the two years as FM Editor of *CQ* I have seen a number of very good f.m. forums and hamfests, a few darn poor ones (Dick Ross won't let me say damn), and a lot somewhere in the middle. Good f.m. meetings just don't happen. A lot of planning goes into making even a one day stand work well, and, a good two day stand requires about four times the work. F.m. only hamfests or conventions place the greatest burden on the local f.m. organization, for things like getting a place to hold meetings, an exhibition hall, lodging, persuading exhibitors to show up, etc. all fall upon the f.m.'ers. When the f.m. meetings are a part of a larger general interest hamfest or convention there is a somewhat reduced burden on the f.m. group, for the major responsibilities are only the f.m. functions.

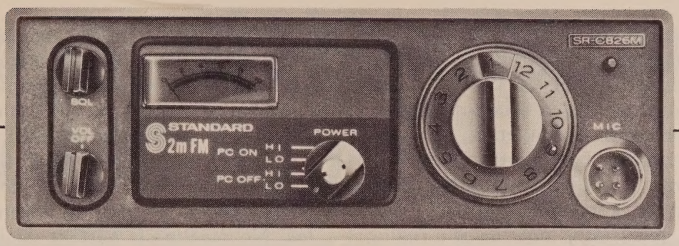
Regardless of whether the f.m. meetings are a part of a larger function or not, things seem to work out best if they are handled in a general logical pattern. Most amateurs will not travel very far for a one or two hour session. It's just not worth the time. The best run f.m. meetings seen by this columnist usually have two or three varied sessions including technical discussion, open forum, and, if desired, a meeting of a state or regional f.m. association. These can be worked in several possible combinations, but the order in which the meetings are held is quite important. Also, the absolute number of meetings is highly dependent on the number of amateurs expected to attend and whether or not the hamfest is f.m. only or part of a larger general interest amateur convention. Of course f.m. only meeting will have many more technical discussion sessions than a general interest meeting.

No matter what else is held, any meeting of a state or regional association should be the very last f.m. meeting held. This matters not if the overall convention is all f.m. or not. The reasoning is simple, this is the most important meeting to be held. Many amateurs will not stick around after a business meeting for technical discussions or forums. Thus, save the most important to last and keep the interest up for the other discussions. If the convention is a two day affair, make the business meeting on the second day, etc.

Technical discussions should be the first items. The actual number of technical discussions will depend highly upon the number of f.m.'ers expected to attend and availability of competent speakers. Many subjects are of interest to the f.m. operator. Topics like receiver design, measuring receiver performance, intermod, antennae and antennae design, even a slide trip through a plant dealing with v.h.f. or f.m. manufacture are usually very interesting. Avoid talks by the local repeater association telling everyone how "they" made the repeater work. These tales are fine for sitting around the bar, but again amateurs will not drive very far to hear them. Contact manufacturers of f.m. equipment and related items for qualified speakers. You'll be surprised at the availability of competent technical speakers.

Now, for these things called "forums." To put it bluntly, a "forum" is nothing more than a big bull session or, for the younger set a "rap" session, with one or more well known f.m.'er. Forums usually start off with a brief talk by the notables and get into an audience participation session rather rapidly. For a forum to get off the ground and stay there, a large number of participants are required. Sessions with twenty or thirty people start to drag very quickly. These are compounded especially when everyone knows each other and have had a few forums together before. You just run out of topics. If possible, the forum should be scheduled as the center meeting. If circumstances dictate a two day convention (e.g. Saturday and Sunday) the forum makes a good first day afternoon session (assuming a meeting of a formal organization the next day). If there is not to be any business meeting, then the forum should be the last meeting.

Some meetings fall flat on their faces due to one thing: lack of communication. If the f.m. functions are to be a part of a larger convention, keep the governing body or committee well informed on what is happening in the f.m. area. Many of the governing committees have years of hamfesting under their belts and can help with the details. Have your own ideas, but listen to the experience too. Communicating with the scheduled speakers is one area which is lacking at most hamfests. Its nice to know what the schedule of events is before arriving at the airport. Don't change times of meetings at the last minute if at all possible. Even an hour change messes things up and can make or break any one session.



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Also don't schedule an f.m. meeting against any important speaker in another room. Persons like Prose Walker of the FCC, high ARRL officials, etc. often touch on topics of extreme importance to f.m.'ers.

Things are a bit of a vicious circle in that amateurs will not usually attend without speakers and speakers will not attend without an audience. A business meeting of a regional or state f.m. association usually assures a satisfactory audience, and the physical size of certain general interest hamfests also promise a number of interested amateurs. It is very hard to get speakers to come in from any distance to speak of to address thirty or forty persons. The presence of any speaker is a gesture of good-will from the firm (amateur or non-amateur related). In the case of the amateur radio magazines this is doubly so. Even if the magazine has a booth set up in the exhibition hall, all subscriptions sold during the hamfest usually won't cover the air fare for just one person, let alone cover total expenses! Showing up at a hamfest serves at least two things: The first is the local publicity for the speaker and for his firm or magazine; the second item in the case of representatives from amateur magazines is the personal contact with amateurs from a different part of the country. Just talking with a number of persons not previously contacted produce numerous suggestions and ideas for articles, columns, editorials, and the like. Believe it or not, we don't get paid any more for coming to hamfests. In my case I do it to meet other f.m.'ers in different parts of the United States and, in some cases, to be a part of a short vacation. As far as costs of travel go, *CQ* foots the bill. I know of no instance where a hamfest has been billed for the services of a speaker by *CQ*.

If possible there should be door prizes of particular interest to f.m. operators. They don't have to be expensive, and, in fact, many manufacturers will furnish very nice items of interest to the f.m. populace at no charge. Just ask for a donation several months ahead. Usually you'll get some very nice prizes. There don't have to be a lot of prizes, but two or three at each session will help bring in the amateur who is a bit undecided about f.m. Just the chance of winning something often brings in a new convert. Remember to provide the winners with the address of the firm contributing the prize. It works wonders if the winner sends along a thank-you note to that firm.

After the convention or hamfest is over things are a long way from being complete. The committee should take time to thank the contributors, speakers, and others who have helped with the meetings. Next, a critical look should be taken at how everything went and steps made to eliminate problems next year, and to stress cooperation within the committee. No meeting is perfect, and there will always be last minute problems which crop up. However, with a bit of long-range planning and a bit of experience these can be converted from major disasters to minor bumps in the road.

Well, enough of this non-technical "Technical Talk" for tihs month. For the new year, more and better construction and modification.

For Newcomers Only

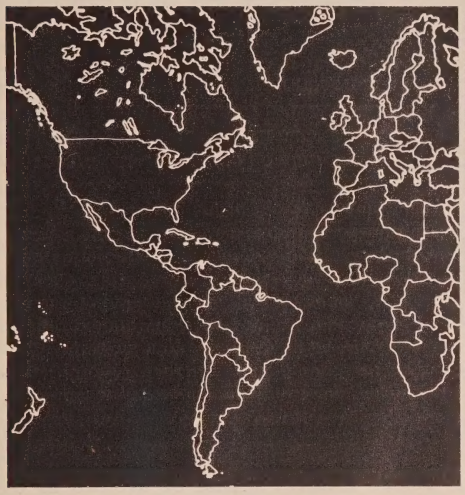
As promised this FM COLUMN is again going to aim a portion of the printed space to items of particular importance to the newcomer to fm. circles. Its both unwise and unfair to keep getting deeper and deeper into f.m. and leave potential f.m. greats behind. Thus, the first edition of "For Newcomers Only."

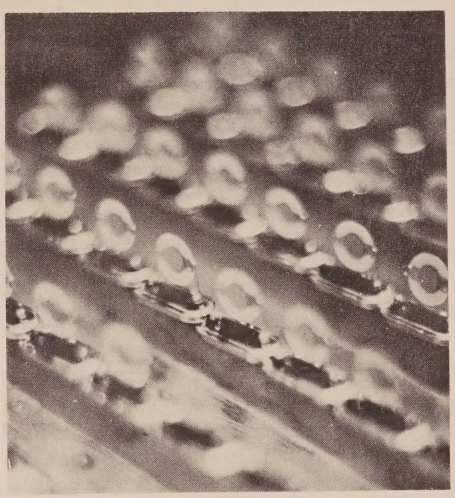
You say that Santa was just by, you say that he left you a brand new f.m. rig; you say that you have heard that f.m. is fun; you say that you don't know a darn thing about it. Well, you're not alone. F.m. is much different both technically and operationally from operations on the low bands (160-10 meters) and from the normal a.m. or s.s.b. phone type contacts. Lets get down to some basic operational practices and to a bit of the differences that occur in f.m. technology.

First of all, f.m. is a channelized operation much like (ugh!) CB. Most equipment utilizes crystal controlled receivers and transmitters. Therefore, it is improper to make a long CQ on f.m. Virtually everyone has squelch and many receivers are monitoring a particular well-used frequency at any time. Therefore, a short announcement that you are on frequency suffices to let everyone know you are around. Something like "W5XYZ monitoring nine-four" or "Anyone on nine-four care to talk, this is W5XYZ" or any simple announcement of presence is adequate. Listen for a while to see how the other operators in the area do it. By the way, always tell what frequency you are listening on,

[*Continued on page 88*]

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A Strictly Modern 210 TNT Transmitter For 80 Meters

BY WILLIAM I. ORR,* W6SAI

Those were the days! For a few dollars, a handful of spare parts salvaged from a defunct broadcast receiver, and a breadboard, the 1931 amateur newcomer could build himself a one tube transmitter and a two tube receiver and get on the air! Countless hundreds of amateurs took this route and the 210 TNT transmitter described in this article was a mainstay of the low power ham station of the early "thirties." This transmitter is a replica of a popular 80 meter c.w. transmitter described in the ARRL Handbook *in one form or another for over a decade. More than a "conversation piece," this little gem can go on the air and will provide you with a lot of fun, if properly operated.*

YES! The problem of building a modern transmitter around 1931's combination of tough operating standards and a lean pocketbook is a serious one, considering the new 1927 Radio Rules. A modern, 1931 note means no sloppy, drifting signals, a d.c. tone and no a.c. buzz. Old style r.a.c. signals are "out" and the Federal Radio Commission keeps a sharp ear tuned for those amateurs unlucky enough to be caught operating with a poorly designed transmitter.

With over 12,000 hams on the air, there's no room for a poor signal! Jam-packed bands mean each amateur must have the best possible note!

Shown in this article is a 1931 model, one tube 80 meter c.w. transmitter that is foolproof, inexpensive and has a steady d.c. note. Depending upon the tube used, an input as high as 50 watts can be run, yet the same circuit will function with a peanut tube running from dry batteries. The construction is in no way complex and the adjustment is easily accomplished by even the inexperienced operator if the detailed tuning instructions are carefully followed.

For a high power operation a type 10 tube is used at 500 volts. Caution should be shown in the choice of the 10. A tube having a thoriated tungsten should be used (type 10 or 210) and similar tubes designed for audio service (310, for example) having an oxide coated filament should be avoided as they tend to develop negative grid current and "run away" when overheated. The transmitting type 10 can be recognized as it burns with an incandescent light, whereas the oxide filament tube burns with a dull red glow.

For medium power (15 watts) a type 245 tube can be run at 350 volts with good success and for low power a 201A operating at 135 volts is recommended. For flea power operation a 199 tube with 90 volts on the plate does a good job. Truly, this is a universal transmitter and a worthy addition for any modern amateur transmitting station!

The Transmitter Circuit

The simple circuit of this fool-proof transmitter is shown in fig. 1. It is the so-called TNT (tuned-not-tuned) arrangement, featuring a high-*C* tank circuit for maximum frequency stability. The untuned grid coil is self-resonant over the 80 meter band, and the exact operating frequency is determined by the tuning of the solidly built plate tank circuit. Excitation is dependent upon the constants of the grid circuit.

Plate voltage is series fed through one of the new, efficient pi-wound r.f. chokes and all power leads are properly bypassed with mica

*48 Campbell Lane, Menlo Park, CA 94025

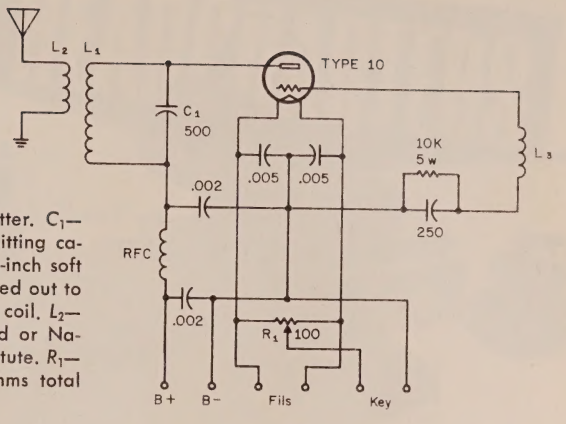


Fig. 2—Circuit of the 1931-style transmitter. C_1—500 mmf Cardwell single spaced transmitting capacitor. L_1—For 80 meters: 12 turns of ¼-inch soft copper tubing, 2⅜" inside diameter spaced out to about 4½" long. See text for 160 meter coil. L_2—Six turns similar to L_1. *RFC*—Hammarlund or National receiving choke. See text for substitute. R_1—Filament center tapped resistor. 100 ohms total resistance.

condensers to keep the r.f. out of the neighbor's broadcast set.

If the commercial r.f. choke cannot be found, a satisfactory substitute can be made by winding a two-inch length of wooden dowel rod (½-inch in diameter) with #34 double silk covered wire.

The filament bypass condensers provide an easy path for r.f. currents flowing to the filament of the tube, otherwise they would have to go through resistor R_1. When the filament of the tube is heated from alternating current the center-tap resistor is necessary to avoid having the a.c. voltages on the filament reach the grid, for this would cause modulation or "ripple" on the signal. The voltage on the leads to the filament is constantly changing at the 60 cycle supply frequency but the voltage at the center point of resistor R_1 is constant.

The antenna is inductively coupled to the transmitter in the modern manner to insure the sharpest possible note and coupling is easily adjusted by swinging the antenna pick-up coil to the proper position. Connection to the far end of this coil is made by means of a copper battery clip and a small piece of flexible wire.

The builder is warned that the oscillator can be adjusted to any frequency within the range of the tuning circuit and particular care must be taken to be certain that operation is within the 80 meter amateur band. A frequency monitor, in fact, is a prime necessity if this transmitter is to be operated properly.

Transmitter Construction

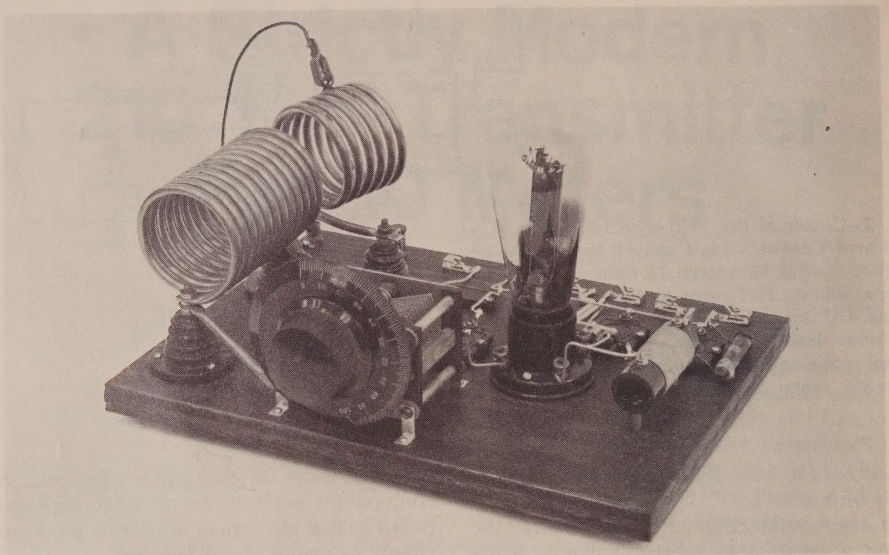
The layout shown in the photographs has been chosen so as to permit the shortest possible r.f. leads for maximum efficiency. All components are firmly mounted to the breadboard so that movement of parts will not contribute to instability of the note.

The plate tank coil is wound of ¼-inch diameter soft copper tubing, and short lengths of tubing are used for the connections between the coil and the plate tuning condenser.

All parts are mounted on a breadboard measuring 12½ inches by 10 inches. Before construction is started, the board is given two coats of clear lacquer or shellac to enhance the natural beauty of the wood. Components are tastefully laid out, somewhat after the circuit diagram, with an eye to short interconnecting leads. Wiring is done with square buss-bar, and spaghetti insulation is slipped over critical leads which may possibly touch one another.

Connections to the various power and key leads are made via a row of Fahnestock clips mounted along the rear portion of the breadboard with wood screws. From left to right in the photograph (rear view) are the key connections, the filament connections, the B-minus connection and the B-plus connection. To the extreme right are the antenna and ground binding posts.

The tank coil is at the left side of the board (front view), mounted on two porcelain standoff insulators which are spaced 4½ inches apart between centers. Immediately to the right is the main tuning condenser firmly mounted to the breadboard by means of four small angle brackets. The 10 tube socket is next, with the grid coil at the far right side of the layout mounted on long wood screws and metal spacers. Behind the tube socket is



The low power single tube transmitter. How many tubes does your transmitter have? How many transistors? Can you draw the schematic of your transmitter on the back of an envelope? The 1931 radio amateur could draw his schematic on a corner of the envelope if he used this one tube breadboard rig! The popular 210 transmitter "ruled the roost" for nearly a decade. In this front view photograph, the tuned circuit (L_1, L_2, C_1) is at the left. The copper tubing coils are mounted on beehive insulators. The main tuning control is at the center, fixed to the chassis by means of four angle brackets. The 210 tube socket is to the right, with the grid coil, grid leak and bypass capacitor at the extreme right-hand edge of the breadboard. The transmitter is wired with genuine square buss-bar wire for best results! Connections to the circuit are made by the Fahnestock clips along the rear of the board.

the filament center-tap resistor and the two filament bypass condensers. These are firmly fixed in position with long wood screws. The grid leak and grid condenser are directly behind the grid coil. The coil is wound of #30 d.c.c. wire on a 2½ inch length of 1-inch diameter bakelite or hard rubber tubing. The coil should be given a coat of collodion or clear Duco cement to maintain its characteristics after it has been properly adjusted.

Winding the Copper Coil

Little need be said about the copper tubing coil as most amateurs are adept at winding coils of this style. The coil is wound around a section of 2⅜" diameter water pipe. The ends of the winding are flattened with a hammer and the tubing is drilled to pass the bolt of the mounting insulator. The turns are spaced out by inserting the shaft of a small screwdriver between the turns and running the screwdriver through the coil, turn by turn. Coil spacing is adjusted so that it fits easily over the insulator bolts and so that no strain is placed upon the coil itself when the nuts are tightened.

The antenna coil is made in the same manner except that it is supported only at one end (as shown in the rear photograph). The other connection is made with a copper battery clip.

The Tube Socket

The socket for the 10 tube is an important element of the transmitter. The best socket is the new isolantite type, if such can be found. The one used in this transmitter is made of bakelite, but it has good spacing between the connections and grasps the base of the 10 tube in such a way that no movement between tube and socket exists. If the tube is permitted to move or vibrate in the socket, or the socket makes intermittent contact to the tube prongs, the good, clean note of the transmitter will be destroyed.

The Tuning Condenser

A transmitting type, 21-plate Cardwell condenser is used for best stability. The model used has heavy aluminum plates and double bearings. The bolts holding the copper leads to the condenser terminals are

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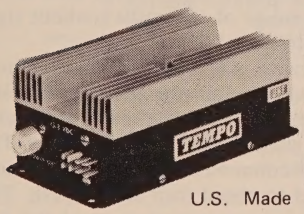
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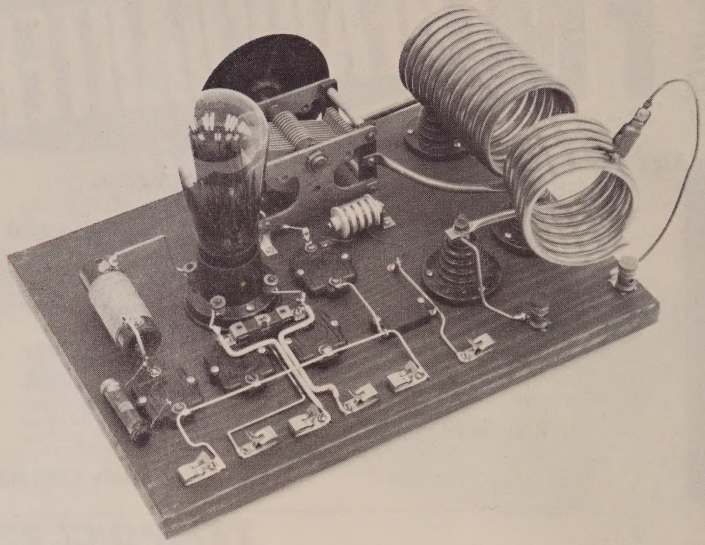
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802B	1-2.5 watts	80-90 watts	$195
502	5-15 watts	35-55 watts	$105
502B	1-2.5 watts	45-50 watts	$130
242-A2	1-2.5 watts	25-30 watts	$ 85

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Read view of one tube transmitter. The layout of all major components is clearly shown. Pilot brand mica condensers are used and all wiring is rigid to achieve crystal-like stability. Plate r.f. choke is immediately behind the variable condenser. 210 tube is genuine RCA but other popular makes such as deForest or Duo-vac may be substituted

brass, not iron, to make sure that these critical connections do not heat up when circulating r.f. current passes through the bolts. The insulation is a good grade of hard rubber. Beware of receiving type variable condensers with thin brass plates, "mud" insulation and mica trimmers. Use a transmitting condenser and be safe!

Transmitter Tuning and Adjustment

The performance of even the best transmitter can be spoiled by the slightest maladjustment, and on the other hand almost any transmitter can be made to perform well by an amateur experienced in the work. The use of some sort of monitor is essential while adjusting and using the transmitter.

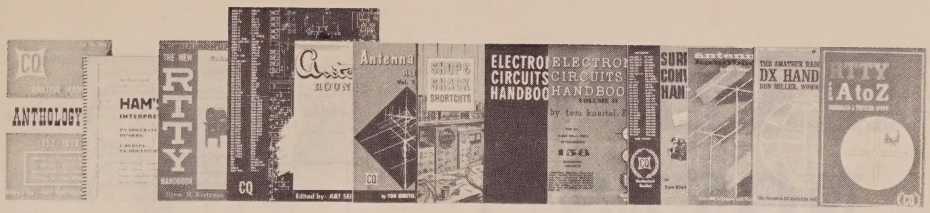
In addition to the monitor, an extremely desirable aid to tuning is a "tuning lamp." This is nothing more than a flash light bulb connected in series with a single turn of wire about two or three inches in diameter. In use, the turn of wire is coupled to the tank coil of the oscillator and induced currents cause the lamp to glow. With practice, it soon becomes possible not only to detect the presence of r.f. current in the tank coil with such a lamp but also to gain a very useful idea of the amount of r.f. energy in the tank circuit.

If a 10 tube is used, the power supply should provide 7.5 volts a.c. at 1.75 amperes for the filament. Up to 500 volts at 60 mills can be run to a good 10. An isolantite based, heavy duty 210 can take as much as 800 volts at 70 mills.

Of greatest importance is a plate current meter in the positive high voltage lead to the oscillator. A range of 100 mills is about right for this transmitter.

The first move is to switch on the filament supply to make certain the tube lights. Filament voltage should be checked at the socket as excessive voltage will ruin any tube. The antenna is disconnected and the plate tuning condenser set to about four-fifths mesh. The high voltage is now turned on, and the key closed. If the tuning lamp is now held near the front end of the plate coil, the bulb will glow, indicating that the set is oscillating. The frequency of operation should now be checked. The plate milliammeter should be checked to make certain that plate current falls to a minimum value as the plate tank condenser is tuned to the desired frequency of operation. Should this minimum point occur at a frequency much lower than that desired, it is an indication that the grid coil has too many turns. If the minimum point occurs

[*Continued on page 91*]



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MATH'S NOTES

BY IRWIN MATH,* WA2NDM

As you will recall, last month we discussed just what BCD was and described some very simple readout methods. This month, we will discuss more complex methods as well as various ways to drive these readouts.

In our final example last month, we described a BCD to decimal converter, utilizing 4-input NAND gates, that operated 10 lamps to indicate the numbers from 0 through 9. Figure 1 shows this same scheme utilizing an existing TTL integrated circuit, the SN7445.

Notice that only the Q outputs are necessary to drive this chip since internal inverters are provided to supply the Q information. Also present in the chip are 80 milliampere 30 volt transistors and hence, the lamp indicators can be connected directly to the chip. Another chip, the SN74145, is also available with the exact same pin configuration (and 80 milliampere capability) but with a maximum rating of only 15 volts. Figure 2 shows the internal logic connection of these chips.

After looking at ten lights for a while it becomes desirable to read actual numbers and this is where the 10 segment gas-filled neon lamp makes its appearance.

This tube, made popular by the famous Burroughs Corporation NIXIE® line, as well as many others, is really nothing more than a special neon lamp version of our 10 lamp readout. In this case, however, one electrode of each lamp is connected to a common lead, and the other ten leads are made available separately. Furthermore, each lamp element is fabricated in the shape of one of the numerals from 0 through 9. By connecting the common lead to a suitable B+ supply and grounding the appropriate remaining lead, any of the lamp sections can be made to glow, thereby indicating the desired number.

As would be expected, there is a TTL integrated circuit especially designed to drive this kind of gas discharge tube. This chip is the SN7441A and its hookup is shown in figure 3. For most 10 segment gas discharge tubes the value of R_L will be about 15K (1/2W) for a B+ of 180 volts. If you are unsure, the readout manufacturers' data sheet should be consulted for typical R_L and B+ values.

In addition to the 10 line information, there is another popular numerical display

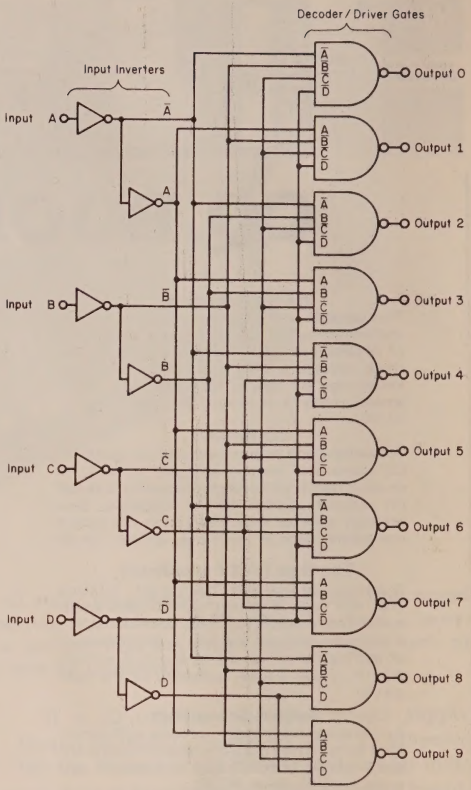


Fig. 2—Logic diagram of the SN7445.

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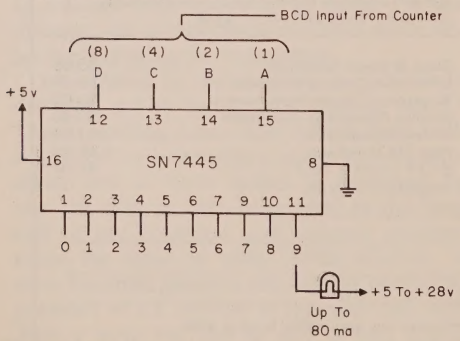


Fig. 1—BCD-Decimal converter chip discussed in text.

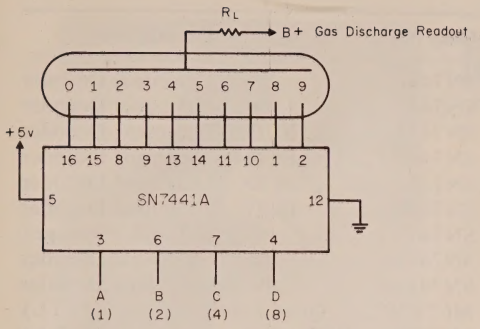


Fig. 3—Hookup of the SN7441A. The values of B+ and R^L are supplied by the readout manufacturer.

known as the 7-segment display. This method indicates the numbers from 0 through 9 by means of seven individual segments as shown in figure 4. This type of display is of interest to the experimenter as the readout devices are usually less expensive. The incandescent versions of these readouts are typified by the RCA Numitron tube (about $5), the Dialco 710 series (about $6-7 each) and a host of others advertised by various surplus houses in the $3-6 range (some quite small). Some amateurs have even made their own because of the simplicity of the device.

The integrated BCD to 7 segment decoders to use with these readouts are the TTL types SN 7446 or SN7447. The SN7446 will handle up to 30 volts at 20 milliamperes per segment while the SN7447 will handle up to 15 volts at 20 milliamperes per segment A simple circuit for use with either of the above chips is shown in figure 5.

Notice that these chips contain special logic circuitry to enable a quick test of the readout by merely pushing the button. This overrides all inputs and causes all seven segments to light up, thereby visually checking the readout. Such a check is important since the failure of a particular segment can

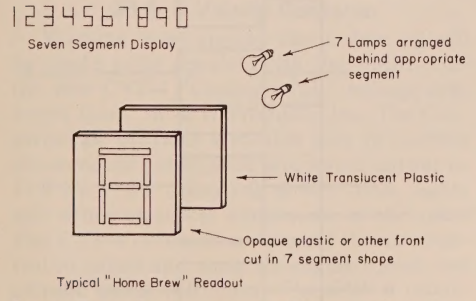


Fig. 4—Typical seven segment display and readout scheme.

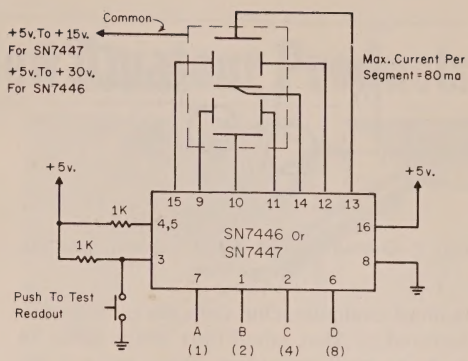


Fig. 5—Hookup of the BCD-7 segment decoder described in text.

easily lead to misinterpreted readings.

This exact same decoder circuitry will operate with most of the seven segment light emitting diode (LED) readouts now becoming available. These devices operate in the same manner as the incandescent variety, but use arrays of light emitting diodes arranged in the shape of the seven segments. Most LED displays at present operate at 5 volts making the need for a separate supply unnecessary.

For seven segment displays requiring more than 20 milliamperes per segment, RCA has the CD2500E, which will handle up to 30 milliamperes (their Numatron) as well as the CD2502E which can handle up to 80 milliamperes per section. Figure 6 shows the hookup of these chips.

To complete our 7 segment discussion, there are also gas discharge versions of this

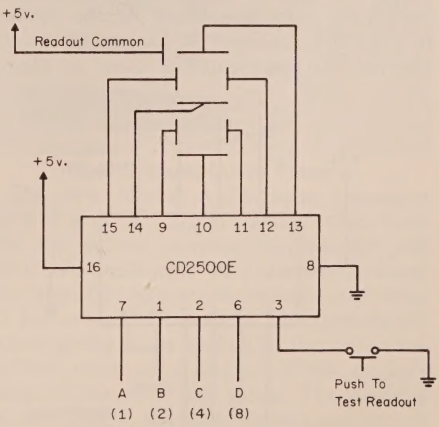


Fig. 6—Typical hookup of RCA chip discussed in text. For specifics see actual manufacturers data sheet.

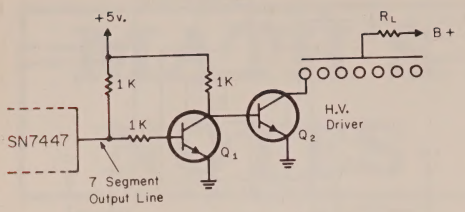


Fig. 7—Driving scheme for 7 segment gas discharge tube.

readout available. One such device is manufactured by Alco, (the Elfin) and is about $4 each in small quantities. Since there is no readily available chip for directly driving these higher voltage 7 segment units, a standard SN7447 can be used together with higher voltage output transistor drivers as shown in figure 7.

For ease in construction, Q_1 can be one section of a hex inverter.

In some types of digital display, particularly where information is constantly being up-dated such as in DVM's or in frequency counters, it is often desirable to display one reading while the next one is being compiled and then "instantly" change the display to the new one. This technique is known as storage and, fortunately for the experimenter, available in another chip.

Our chip, the SN7475 is shown in block form in figure 8. As you will notice, it contains four flip-flops which can only be set or re-set when a command or strobe pulse is present. As a result, BCD information may be present on the input but will not activate the flip-flops (and resulting display) until the strobe pulse is applied. At the moment it is applied, the input BCD is applied to the internal flip-flops causing them to change

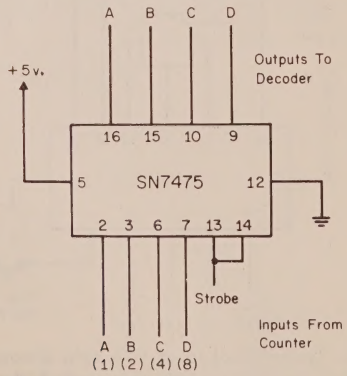


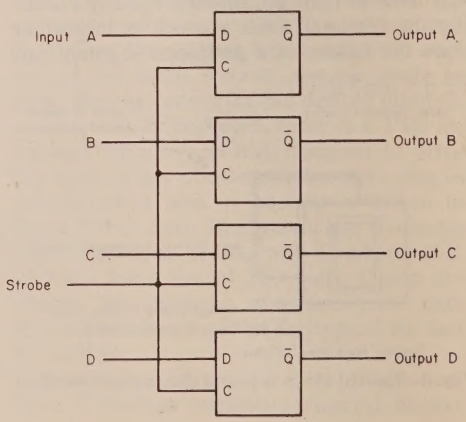
Fig. 8—The hookup of the SN7475 storage chip.

Chip No.	Description
SN7442	BCD—Decimal Decoder
SN7445	BCD—Decimal Decoder
SN7446	BCD—7 Segment Decoder
SN7447	BCD—7 Segment Decoder
SN7448	BCD—7 Segment Decoder
SN7449	BCD—7 Segment Decoder
SN7475	Quad Latch (Storage)
SN74141	BCD—Decimal Decoder
SN74145	BCD—Decimal Decoder
MC767P	Quad Latch (Storage) (RTL)
MC770P	BCD—Decimal Decoder (RTL)
MC9760P	BCD—Decimal Decoder (RTL)

Fig. 9—Some of the more common decoder and storage chips available to the amateur.

to the exact state of the BCD. The decoder now causes the indicator to display the proper number. Once the strobe pulse is released however, the SN7475 flip-flops can no longer change although the input BCD certainly may, and the readout only indicates the last number. When a new number is present, then a new strobe pulse is required and the readout "instantly" changes. This strobe pulse can be derived from the analog/digital conversion section of a DVM, or the timebase controlled gate signal of a frequency counter. In the final analysis however, the use of the storage feature can often vastly improve the readability of a digital display and, since storage is achieved on the BCD line before the decoder, it can be employed with all types of readouts In figure 9 we have indicated several of the more common decoder or storage chips we have seen on the surplus market, both in the TTL variety and RTL

[*Continued on page 86*]

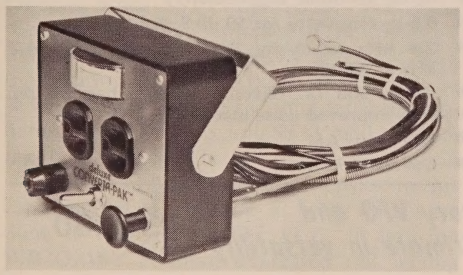


New Amateur Products



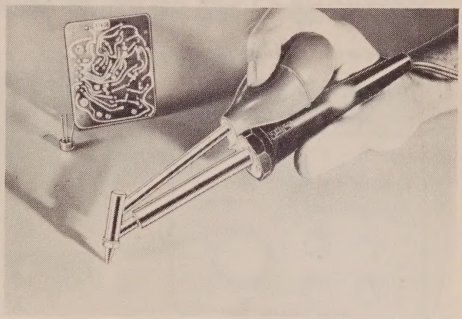
Wahl Cordless Soldering Iron

Any amateur who has ever installed an antenna will immediately appreciate the new Wahl "Iso Tip" Cordless Soldering Iron. The iron is lightweight (6 ozs.) and measures only 8" long, but from a full charge will give about 20 solder joints in No. 12 wire before requiring re-charging! That's five typical dipoles! On small gauge hook-up wire the iron will give a hundred or more solder joints per charge. Heats to 700 degrees in 5 seconds; carries a 50 watt rating. Overnight recharger is included for the price of $24.95. Circle A on page 112 for further information.



3B & D Voltage Converter

Working in or around the mobile rig will be made a lot simpler with the addition of the new CVP-4 "Converta-Pak" voltage converter from 3B & D Products, Inc. The Converta-Pak provides a reliable way to convert the standard automobile alternator output to 110 v.a.c. for operating power tools, lights and other electrical equipment in the auto. The CVP-4 contains an integral throttle control to adjust and maintain engine speed, and a front panel voltmeter. The CVP-4 retails for $28.95 complete. Circle B on page 112 for further information.



Endeco Desoldering Iron

Replacing or salvaging components soldered into PC boards can be a touchy job, with a high probability of damaging board and component. The Endeco Model 510 desoldering iron solves the problem neatly by combining a bulb syringe with a hollow-tip 40 w. soldering iron. Molten solder is cleanly sucked out of the joint. The Model 510 also features an "on-idle-off" switch permitting the iron to maintain its temperature at the 20 w. level. A light indicates which heat is in use. The iron sells for $16.00 at jobbers. Circle C on page 110 for more information.



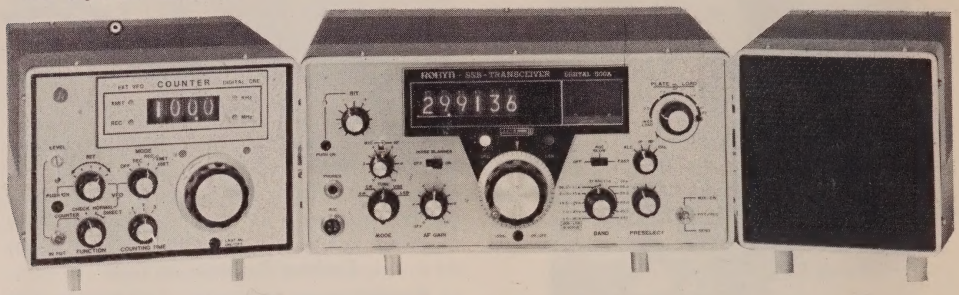
Jud Williams Curve Tracer

The new Model A Dynamic Transistor Curve Tracer from Jud Williams, when used with any general purpose oscilloscope, will enable the technician to examine transistor gain, linearity, saturation, leakage, etc., without removing the transistor from the circuit. A three-prong probe applied to the device under test produces a display of the device's family of curves on the scope. The Model A will test FET's, bi-polars, Zeners and diodes of all types with no danger to the device under test. The price is $135.00. For further information, circle D on page 110.

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Slow Scan TV

BY COPTHORNE MACDONALD,* W1GNQ

Expanded SSTV Band Segments

In an order that became effective on November 22, 1972 the FCC expanded some of the Extra and Advanced class band segments, significantly increasing the h.f. spectrum space available for SSTV. The details are summarized in the table of Fig. 1. The subbands in the 14 and 28 mHz bands remain the same, but Extra class hams can operate SSTV in an additional 25 kHz of the 75 meter band, and 25 kHz on 40 meters. Advanced class operators picked up an additional 15 kHz on 75 meters, 25 kHz on 40, and 5 kHz on 15.

But Where Should the Slow-Scanners Operate?

With the start of a New Year, and some new operating frequencies, it seems a good time to review our operating practices.

Part of the original slow-scan concept was the idea of combining sight and sound to create a communications tool more effective than either mode alone. The FCC saw the wisdom in this when it put voice and SSTV in the same subbands, and authorized simultaneous voice/SSTV operation. The FCC recently reaffirmed its belief in the compatability of voice s.s.b. and SSTV when it denied the petition of Paul Atkins, WB2OZW, to separate s.s.b. and SSTV into separate subbands. So s.s.b. voice, and SSTV will be sharing the same bands for the foreseeable future.

There is, at present, a bit of tension in this arrangement. Let's look at what might be done to alleviate it. The FCC, in denying WB2OZW's petition, expressed the feeling that voluntary planning and coordination give the best results. So, let's do it.

What are the problems and the facts? As I see them:

1. On 20, 40, and 75, the crowding together of all stations is going to get even worse as the sunspot cycle approaches its minimum, and the 15 and 10 meter bands become less useful.

2. There is way too much "non-caring" operation by both s.s.b.ers and SSTVers who just don't give a damn about the other guy. Calling without verifying that the frequency is not in use; SSTV transmissions without the required voice or c.w. station identification; fits of childish temper expressed by one station as he intentionally jams another. These are examples.

3. Most hams seem to feel more comfortable with segregated band activities: DX here, ragchewing there, RTTY elsewhere.

4. SSTV can be either a primary or secondary part of a QSO. The ham who transmits a "CQ SSTV" slide obviously is interested primarily in exchanging pictures. The ham sends a couple of pictures to illustrate something being discussed in an s.s.b. QSO is using SSTV in a supplemental, or secondary way.

Are there any changes in present operating practices that will reduce the tension and increase everyone's fun? Think about it. Talk about it. Pass your ideas along to me, and the DX, operating, and SSTV people connected with the other ham magazines.

I have gotten input from a few DXers and Slow-Scanners and my initial reaction goes like this:

1. We could move primary SSTV operation to the high frequency end of the Advanced class band segments. Calling frequencies could be 5 kHz inside the upper subband edge (3.885, 7.220, 14.270, 21.345), with operation extending down into the band from the high end, as SSTV activity grows.

2. I would make no attempt to frequency-segregate SSTV operation that is incidental or secondary to a basically phone QSO. Why QSY just to send a few frames of SSTV in a QSO already in progress, on a frequency already occupied?

Band	Extra	Advanced	General
3.5	3.775 - 3.890	3.800 - 3.890	None
7.0	7.150 - 1.225	7.150 - 7.225	None
14	14.200 - 14.275	14.200 - 14.275	None
21	21.250 - 21.350	21.270 - 21.350	None
28	28.5 - 29.7	28.5 - 29.7	28.5 - 29.7

Fig. 1—Revised SSTV h.f. frequency assignments now in effect.

*P.O. Box 261, Forest Park Station, Springfield, Mass. 01108.

3. Let all of us—SSTVers and s.s.b.ers—GIVE A DAMN! Let's care more about all the others using the band. Let's listen *every* time, then if we think the frequency is clear, ask: "Is this frequency in use?" Let's identify each SSTV transmission by voice or c.w. per section 97.87 of the FCC rules. (Your call sign in the picture does *not* make you legal.The lack of voice identification could also make accidental interference appear intentional.) Naturally, we'll all use only enough power to carry on our communication.

The present situation reminds me of the s.s.b./a.m. controversy in the early 50's. At first that weird sounding s.s.b. signal was an alien, hostile usurper of frequencies that "rightfully belonged" to the "natural sounding" a.m. fraternity. Twenty years later s.s.b. is the "natural" and SSTV the "foreign" sound. Twenty years from now it is possible that most rigs will have a built-in SSTV camera and monitor. Then it will probably be the strange sounds of automatic thought transference signals that have everyone upset—unless, of course, we've grown out of getting upset at strange sounds by then.

If SSTV does grow anything like s.s.b., there are bound to be growing pains. At this moment the idea of keeping the phone DX in its traditional place at the low edge of each band, moving the primary SSTV activity to the high end of each Advanced class segment, and leaving the in-between area for rag chewing phone operation, and the natural expansion and contraction of DX phone, and SSTV activities makes sense to me. What are your thoughts: SSTVers?, DXers?, Rag Chewers?

Vidicons

On the technical side of things, we'll start this month looking at the mysterious inner workings of those camera tubes that can be used in SSTV cameras. The most commonly available tubes are vidicons and Plumbicons. They use the principle of photoconductivity to convert optical images into electronic images. Figure 2 shows a cross section of a vidicon and its associated coils.

A word about the scanning beam and the tube electron optics first. The most common vidicon and Plumbicon gun structure is of the "immersion optics" type. This simply means that the entire gun is immersed in a magnetic field. This field has components in three directions. The focus field has its lines of force running parallel to the axis of the

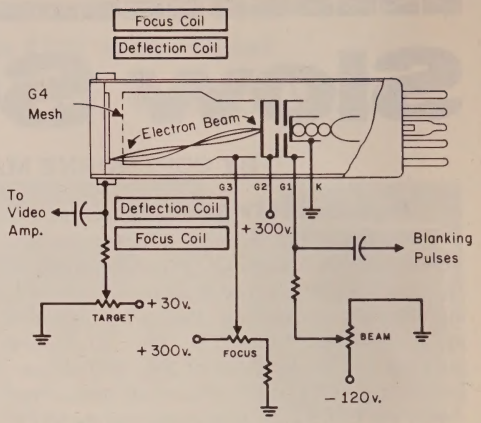


Fig. 2—Cross sectional view of vidicon showing deflection and focus coils.

tube. The vertical deflection coils produce a vertical field and the horizontal coils, a horizontal field. The H and V fields are weaker than the focus field, and in essence they "bend" the magnetic lines of force produced by the focus coil up or down, left or right. The electrons emerge from a pinhole in the G_2 electrode and "spiral" down a magnetic line of force to the target. If the gun is focused properly this spiral makes exactly one turn around the line of force in its travel from G_2 to target. For any given magnetic field strength, the velocity of the electrons must be set so that the transit time of the electrons from G_2 to target gives this one turn. The voltage applied to G_3 controls this velocity; the higher the voltage, the higher the velocity. The focus field for a 1 inch diameter vidicon is normally set at about 40 gauss. Under these conditions a G_3 voltage of 250 to 300 volts produces optimum focus.

For minimum shading effects in the picture it is important that the electrons arrive at the target perpendicular to the target. The G_4 electrode is a fine mesh (750 or 1000 holes per inch) that provides a uniform electric field for the electrons as they slow down for their arrival at the target. A fine adjustment of the shading can be provided by a set of Alignment Coils or Alignment Magnets positioned over the G_2 electrode. Good results can normally be obtained without these magnets or coils. My personal preference would be to include them in a fast-scan or sampling type SSTV camera. Because of the difficulty of adjusting them properly, however, I would leave them out of a camera

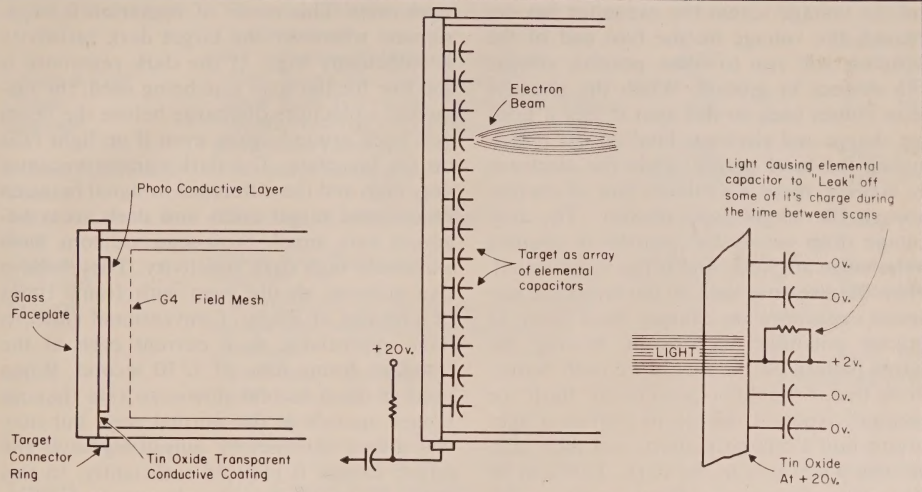


Fig. 3—The vidicon target and what happens as it is exposed and scanned. (A) Conductive transparent layer on inside of faceplate is connected to the target ring. (B) Target represented as an array of elemental capacitors. (C) Light causes photoconductive layer resistance to decrease causing elemental capacitor to leak off some of its charge between scans.

that actually scanned the vidicon at slow-scan rates, unless you have some prior experience setting up vidicons.

The cathode of the vidicon is, naturally, the source of the electrons, and this electrode is normally kept at or near ground potential. The G_1 electrode controls the current reaching G_2 and thus the flow of electrons through that G_2 pinhole. G_1 is normally operated at -20 to -80 volts but should be adjustable down to at least -120 volts to insure that the beam can be completely cut off if desired.

The Vidicon Target

The action at the target is not terribly complex, but is not super simple either. Pay close attention because there will be a test later (when you try to get your own camera going).

The faceplate/target construction is shown in fig. 3. The inside of the glass faceplate is made conductive by coating it with tin oxide which is transparent. Onto this conductive coating a thin layer of photoconductor is evaporated. The exact composition, and details of the evaporation process, are secrets closely guarded by the manufacturers. It is of interest to us that there are differences from type-to-type and even manufacturer-to-manufacturer for the same type. Roughly speaking, conventional vidicons use compounds such as antimony trisulphide or antimony oxysulphide. Slow-scan vidicons use amorphous selenium. Plumbicons use lead oxide. The ideal photoconductor would have low resistivity in the dark, and rapid change between the two states. The real world photoconductors differ from the ideal in various ways, but let us assume the ideal in seeing what happens at the target.

The target can be thought of as an array of tiny capacitors, as in fig. 3(B). One side of each capacitor is connected to the tin oxide conductive layer and from there to the tube's target connection ring. This ring is connected through a resistor to a target voltage source; normally $+10$ to $+40$ volts depending on the tube type. The free ends of the elemental capacitors are scanned by the electron beam which deposits electrons until the free ends are charged down to cathode potential (0 volts). At this point each capacitor has say 20 volts across it. Assume that a spot of light hits one area of the target as shown in fig. 3(C). The resistivity of the photoconductor drops in that one spot; it is no longer a good insulator. This causes a localized *R-C* discharge of that elemental capacitor. This does not give rise to any output current directly. It does gradually change the voltage across the capacitor during the time between scans. Since one side of the elemental capacitor remains connected to $+20$ volts,

and the voltage across the capacitor has decreased, the voltage on the free end of the capacitor will rise to some positive voltage with respect to ground. When the electron beam comes back to this spot it sees a positive charge and electrons land on the target. During the brief period while the electrons are landing, there is a minute flow of current through the target load resistor. The tiny voltage drop across the resistor is coupled to the video amplifier and is the video signal. When the electrons land on the target the elemental capacitors are charged back down to cathode potential once again, erasing the charge pattern on the tube once each frame. (Note that it should be possible to "flash" or "shutter" expose a vidicon to convert a light pattern into a charge pattern, and then scan the tube when it is in the dark. This can be done with slow-scan vidicons such as the 7290.)

This has been a discussion of how vidicon targets normally operate. It is how a standard vidicon operates at standard scan rates, and how a slow-scan vidicon operates at slow-scan rates. This mode of operation is experienced whenever the target dark resistivity is sufficiently high. If the dark resistivity is too low for the scan rate being used, the elemental capacitors discharge before the beam gets back around again, even if no light falls on the faceplate. The dark current becomes very high and the difference in signal between illuminated target areas and dark areas becomes very small. Slow-scan vidicons have extremely high dark resistivity. They behave like vidicons should even with frame times of a minute or longer. Conventional vidicons have appreciable dark current even at the standard frame time of 1/30 second. When used at the 8 second slow-scan rate they no longer operate in the normal way, but may still give a satisfactory output signal if the target voltage is reduced sufficiently. In this mode it appears that the changes in resistivity are being read directly, or the variations in the charge on the line directly above the one being scanned are being read. The quality of the picture using this mode varies con-

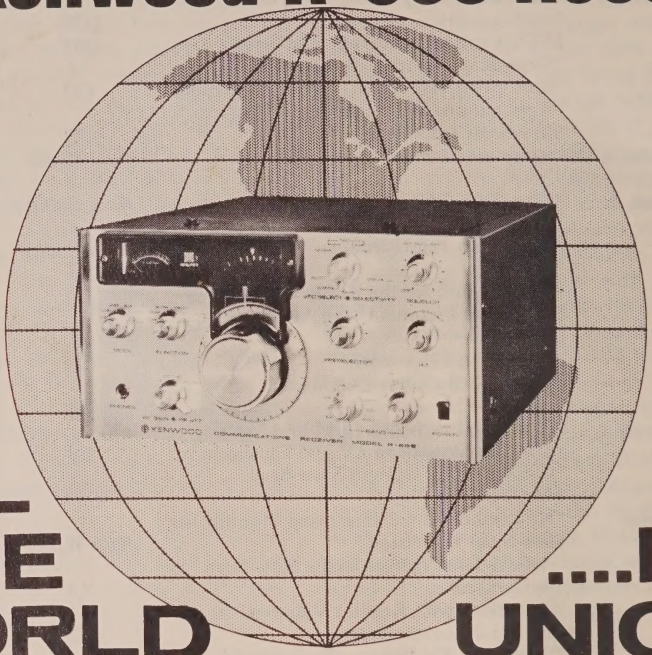
[*Continued on page 91*]

Articles on Amateur Slow-Scan Television

Author	Title	Publication	Date
De Witt	"Slow-Scanning Color"	*CQ*	Sept., 1972
Tschannen	"Questions and Answers on the Solid-State SSTV Monior" in Technical Correspondence	*QST*	Sept., 1972
Miller & Taggart	"Slow-Scan TV: Introduction and Basic Principles"	*73*	Aug., 1972
Macdonald	"Slow-Scan TV" First issue of monthly series	*CQ*	July, 1972
Taggart	" A simple Solid-State Flying-Spot Scanner for Slow-Scan Television"	*73*	July, 1972
Smith	"A Storage Tube Monitor for SSTV"	*QST*	July, 1972
Patterson	"Sync Generator for SSVT"	*Ham Radio*	June, 1972
Jones	"SSTV" First issue of monthly column	*73*	June, 1972
Richarz	"SSTV" Monitor the Easy Way"	*73*	May, 1972
Hutton	"Tuning Indicators for SSTV Monitors"	*73*	Jan., 1972
Hastings	"What You Always Wanted to Know About SSTV"	*QST*	Jan., 1972
	"Slow-Scan Television (SSTV)" in the *Radio Amateur's Handbook*	ARRL	1972
Hall	"Robot Research Model 70 SSTV Monitor and 80 Camera," in Recent Equipment	*QST*	Nov., 1971
Stone & Schechner	"Conversion from Fast-Scan to Slow-Scan Television"	*Ham Radio*	July, 1971
Tschannen	"A Solid-State SSTV Monitor"	*QST*	Mar., 1971
Gorga	"Magnetic Deflection for SSTV"	*73*	Feb., 1971
Cohen	"A Slow-Scan Patch Box"	*73*	Feb., 1971
Cohen, Husted, & Lintz	"Computer Processing of Slow-Scan Television Pictures"	*Ham Radio*	July, 1970
Cohen & Tarr	"An Improved Method for the Transmission of Color Information by Slow-Scan Television"	*73*	July, 1970

Briles & Gervenack	"Slow-Scan TV Viewing Adapter for Oscilloscopes"	*QST*	June, 1970
	SSTV Pictures Sent from Viet Nam	*QST*	April, 1970
Cohen & Tarr	"Slow-Scan Color Transmission"	*73*	Jan,, 1970
Cohen	"Slow-Scan Television," letter to the Editor	*CQ*	Feb., 1970
Ingerson	"Applications of Information Theory to Slow-Scan Television"	*CQ*	Dec., 1969
Cohen, Harmon, & Veazey	"Sampling Techniques"	*Ham Radio*	Dec., 1969
Taggart, Cohen, & Tarr	"Slow-Scan Color Television"	*Ham Radio*	Dec., 1969
Taggart	"Slow-Scan Television"	*Ham Radio*	Dec., 1969
Backman	"SSTV"	*73*	Dec., 1969
Taggart	"A Procedure for the Reception of Slow-Scan Color Pictures Using Additive Synthesis"	*73*	Nov., 1969
Miller	"Slow-Scan Television"	*CQ*	July & Aug., 1969
Hutton	"A Slow-Scan Television Signal Generator"	*73*	July, 1969
Popkin-Clurman	"A Simple Inexpensive FM to AM Converter for Slow-Scan TV and Facsimile"	*73*	June, 1969
Taggart	"U.S.-Europe Two-way Slow-Scan TV QSO"	*QST*	May, 1969
Watson & Horne	"New Solid-State Camera and Monitor for Slow-Scan Television"	*Ham Radio*	April, 1969
Hutton	"A Fast-Scan Vidicon in the Slow-Scan TV Camera"	*73*	Feb., 1969
Taggart	"Slow-Scan with Regular Vidicons" in Technical Correspondence	*QST*	Dec., 1968
Horne	"Slow-Scan TV Pictures Exchanged Between Canada and Sweden"	*QST*	Sept., 1968 Sept., 1968
	FCC Approval of Slow-Scan TV Docket		Sept., 1968
Deutsch & Simpson	"A Continuous Motion Narrow Band Television System"	*CQ*	April, May, & Dec., 1968
	ARRL Comments on FCC Slow-Scan TV Proposal	*QST*	Feb., 1968
	FCC Proposal on Slow-Scan TV	*QST*	Nov., 1967
Hutton	"A Slow-Scan Television Picture Generator"	*73*	Oct., 1967
Cohen	"An Economical Slow-Scan Television Monitor"	*73*	July, 1967
Sulu	Amateur Television Issue, SIRAN, Journal of the Bangalore (India) Amateur Radio Club		Mar., 1967
Macdonald	"Slow-Scan TV Communications with Antarctica"	*QST*	Feb., 1967
Macdonald	"Pseudo-Random Scanning" in Technical Correspondence	*QST*	Jan., 1967
Simpson	"Narrow-Band TV using Pseudo-Random Dot Scan" in Technical Correspondence	*QST*	Oct., 1966
Macdonald	"Twenty-Meter Slow-Scan Tests"	*QST*	Sept., 1966
Macdonald	"A Slow-Scan Vidicon Camera"	*QST*	June, July, & Aug., 1965
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Plowman	*Slow-Scan Picture Transmission,* The British Amateur Television Club, London		1961
Macdonald	"S.C.F.M.—An Improved System for Slow-Scan Image Transmission"	*QST*	Jan. & Feb., 1961
Macdonald	"Slow-Scan Image Transmission Transmission: A Progress Report"	*QST*	April, 1960
Macdonald	"A New Narrow-Band Image Transmission System" (Spanish translation in *Revista Telegrafica Electronica*	*QST*	Aug. & Sept., 1958 Feb. 1959)

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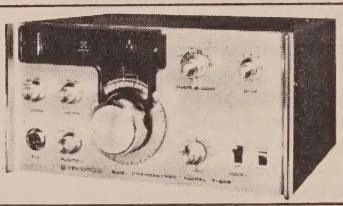
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CQ Reviews: The Pickering kb/2000 Universal Code Generator

BY WILFRED M. SCHERER,* W2AEF

SOME time ago *CQ* reviewed a Pickering electronic keyer,[1] a solid-state job which instead of employing a paddle by which the operator himself forms code characters, automatically produces perfect code characters in response to pressing buttons on a typewriter-like keyboard.

The latest innovation for this type of a device is Pickering's Model kb/2000 Universal Code Generator which is a highly flexible and sophisticated instrument. Its value lies in its ability to permit an operator to handle more traffic and more circuits with greater accuracy. It relieves him of much of the routine burden of message transmission and also frees him completely from timing skill in sending International Morse Code. As a matter of fact, it is not necessary to know the code at all or even to be a good typist. The output of the machine produces perfectly-formed characters, character spaces and word spaces.

More specifically, here is what can be done with the basic unit:

1—With the machine operated as a typewriter, a message can be typed, or loaded, into the device as fast as the operator wishes for immediate transmission. As this is done, the output code speed will be determined only by the setting of the speed control which is calibrated in one-w.p.m. steps from 10 to 69.

2—A message of up to 96 characters[2] may be pre-loaded into the kb/2000, but instead of being immediately transmitted, it may be stored for later use.

3—In the case of a break-in situation, provisions are included to halt any stored data during a transmission and then to be continued as is, or to be cleared for additional information to be typed in.

4—The unit may be supplied with one or two optional memories, each with a capacity of 32, 64 or 96 characters (selected at the time the unit is ordered). Each memory is loadable from the keyboard.

5—Where a message is longer than the available storage space in any one memory, it may be divided between memories which later can be automatically actuated in proper sequence for transmission of the complete message.

The instrument thus can be useful for amateur radio use particularly in relation to contest operation and message handling, and especially valuable for commercial communications services. Its versatility and simplicity of operation will be described shortly in more detail.

Brief Technical Data

A block diagram of the unit indicating the essential lineup is shown at fig. 1. The elements drawn with dashed lines are the optional sections, otherwise the diagram represents the basic setup for the kb/2000.

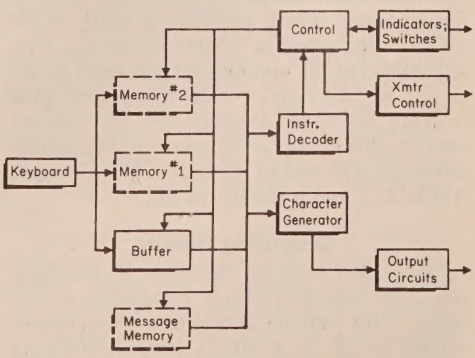


Fig. 1—Block diagram for the kb/2000. Sections outlined with dashed lines are optional ones. Details are given in text.

*Technical Director, *CQ*.

[1] "*CQ* Reviews: The Pickering Model KB-1 Electronic Keyer," *CQ* June 1971, p. 56.

[2] A character is defined as any combination of dots and dashes up to a total of six, with no spaces. Accordingly, other characters, besides the normal ones, can be provided with the machine at any position on the keyboard (except for the control characters at one end).

Data for the messages is fed from the keyboard and is applied to the three storage boxes (the buffer and optional memories 1 & 2). The fourth optional storage section, a message memory, needs no message data from the keyboard, inasmuch as it is set up at the factory with a fixed specific message as ordered by the customer.

The output of the desired storage section is selected by pushbuttons identified as to function and is fed to the character generator which produces code output at the selected speed by means of a mercury-wetted relay. The speed control is a digital switch with the speed indicated numerically. LED's indicate the number of characters loaded into the buffer or the memories.

The instruction decoder monitors the output characters and via the control section tells the machine what to do or how to proceed with the desired functions or sequences. The transmitter control activates the transmitter as may be desired for tuneup or other tests.

Included in the unit is a sidetone monitor and loudspeaker along with volume and pitch controls. The output is a sine wave with at least 1-watt of power available.

The keyboard is an N-key rollover type which means that the machine responds only to the order in which the keys are *struck*, not on how they are released. This is a more desirable feature over conventional systems. The key switches are sealed reeds and may easily be replaced if necessary.

The data storage is handled by MOS shift registers. All logic is TTL and the logic elements are plugged in for easy maintenance. The use of the LED's ensures long life for the indicators. A dual-Pi power-line filter is incorporated which provides at least 50 db of r.f. attenuation at 5 mHz to the a.c. line. Operation of the unit may be had from either a 125 or 250 v.a.c., 50/60 Hz, source with voltage selection obtained by an internal switch. Power consumption is approximately 20 watts. The size of the unit is 6″×13″×14″ (H.W.D.) and it weighs 14 lbs.

Operating Details

We'll first take up operation of the basic kb/2000 which is simply conducted as follows: This version contains a 64-character buffer which is a FIFO (first-in-first-out) type. There are three panel controls to set up the desired procedures. These are BUF CLEAR, BUF LOAD and BUF RUN, the last two of which have indicator lamps to show the existing status. For normal operation (that is, immediate transmissions) you press BUF RUN and begin typing while also watching the digital indicator so as not to exceed 64 characters at any one time. The transmitter will be keyed by the internal relay at the rate for which the speed control is set.

The buffer readout is destructive; that is, after all the characters in the buffer have been transmitted, the buffer will be empty and the indicator will show "00". However, typing may be continued at any time as long as the character count is below 64. Thus, even though the output speed may be set for a slow rate, a message can be burst typed into the buffer, allowing the user to turn to other duties while the machine grinds out the data in perfect code. By typing in more data before the buffer is empty, a steady output stream may be maintained, allowing a complete message of any number of characters.

Pre-Load Message

To pre-load the buffer for a later transmission, you press the BUF LOAD. Now, when a message (limited to 64 characters) is typed in, there will be no output. Subsequently pressing the BUF RUN will then transmit the stored message. In the event of break-in by the receiving station, the output may be halted by pressing BUF CLEAR. This will wipe out all the remaining characters from the buffer. On the other hand, pressing the BUF LOAD will cause the output to stop without destroying the remaining contents of the buffer.

Optional Functions

So much for the basic operation. Now let us see the added versatility provided by the use of the optional memories.

For such operation there are additional buttons on the control panel or the keyboard. The loading procedure of a one-memory system is quite simple. You first press M1 CLEAR, next M1 LOAD and then proceed to type into the memory, making sure not to exceed the number of characters shown by the LED indicators. At the conclusion you tap the EOM (End-Of-Message) key, then press M1 STORE. The message is now in storage and the character counter is connected back to the buffer.

To put the contents on the air you simply press M1, a red key at the left of the keyboard. The message will then be transmitted and at its conclusion the machine will auto-



The Pickering .KB/2000 Universal Code Generator. On the sloping panel are the operating control switches and their associated LED indicators (center), speed control thumb switches and indicators (left), and character count (LED readout at right). One of the large push button switches at the far left is the on-off switch; the others may be wired during manufacture for various functions such as transmitter tune, etc. Included on the keyboard are a variety of common c.w. symbols and the two red keys by which the M1 or M2 memories are called up, and the End of message (EOM) key.

matically switch back to the buffer and wait for new instructions.

In the meanwhile, however, other data may be typed into the buffer and when the memory readout has been completed, the machine will switch back to the buffer and pick up the new characters held therein, making additional message data available.

The whole procedure is quite simple and is quickly accomplished once you've caught on to it. After about an hour's practice, you'll experience additional flexibility that is possible with the kb/2000. For example: had the EOM character[3] not been typed into the memory, the machine will continue to repeat the contents of that memory until it is manually interrupted by pressing the BUF RUN button.

Two-Memory Operation

The unit observed for this review was equipped with two 32-character memories, so we had a chance to experence how much more powerful message control is possible under these conditions.

For example, consider the usual message: It consists of a preamble, a text and a suffix. In general the preambles are nearly identical to each other, as may be the suffixes. Only the texts differ. Thus a preamble can be loaded into Memory 1 and a suffix into Memory 2. These are now available for call at any time.

To send a complete message, the operator begins by striking M1 which starts the preamble. While this is running he loads the buffer with the text, terminating the text with the character M2. The machine will then, at the end of M1, switch to the buffer for the text, switch back to M2, send the suffix and return to the buffer for further information.

[3]The EOM character is a control character that is not transmitted, as its function is only to instruct the machine to switch back to the buffer. However, it is employed like any other character. It can be loaded into any memory, and whenever it is encountered, it will cause the required switch. Similarly, M1 (and M2 in a two-memory machine) is also a control character and whenever it comes up will cause a switch to Memory 1 (or Memory 2).

Where the preambles are not always the same, the kb/2000 can also handle this situation by splitting the memories into several smaller pieces. For example, this is how it may be worked out in a contest:[4] Assume that the first half of the contest exchange is as follows:

NR *233* W2AEF *579* NYCLI K

Only the italicized items here are variable; all the rest are fixed and can go into a memory. If it is desired to give every station a 579, that also can go in storage. For the above example you load Memory 1 with:

NR (EOM) W2AEF (EOM)
NYCLI K (EOM)

where EOM means the END-OF-MESSAGE key. A total of 21 characters, including spaces, is now loaded into the memory (there need be no space between the K and the last EOM). When it is time to put the composite message on the air, it is necessary to type only the following nine keys:

(M1)233(M1)579(M1) with no spaces. The resulting output will be the contest exchange first noted above.

For an exchange with the next station, the typing will be similar, except for the message number and signal report. For even more simplicity, the report could have been put into the memory, in which case it would be necessary to type only (M1)233(M1).

Where a second memory is provided, another contest exchange can be loaded into it and be quickly called upon when required.

If a station is heard calling a contest CQ, you can press the BUF LOAD and type in his call a couple of times, followed by the on-the-air typing noted above. After he signs, pressing the BUF RUN will make the entire calling sequence automatic.

Long Messages

When a message is too long to fit into one memory, it may be split up between the two in a two-memory machine by loading as much as possible into Memory 1, terminating the typing with the M2 key, loading the remainder into Memory 2 and terminating the typing with the EOM key. Striking the M1 key will cause Memory 1 to go on the air and when it empties, it will automatically call M2 to accomplish the splice to Memory 2. There is no delay in the splice, because it takes place in microseconds during the last character in Memory 1. If necessary while this is going on, the buffer still can be loaded for more data and will be called upon after the memories have finished running.

MSG Function

Another optional feature is a so-called "MSG" Function. This incorporates a simple read-only memory, factory-loaded with a specific message of arbitrary length. It cannot be changed in the field. It is placed in operation by striking the MSG key. The message contains its own EOM character to return to the buffer when the message has been completed.

RTTY Applications

A different machine, the Pickering Model kb/2000-10 is a Baudot-output keyer with all the optional memory features of the kb/2000, but is designed for use on 5-level teletype gear. Figure shift and letter shift are automatic.

Conclusion

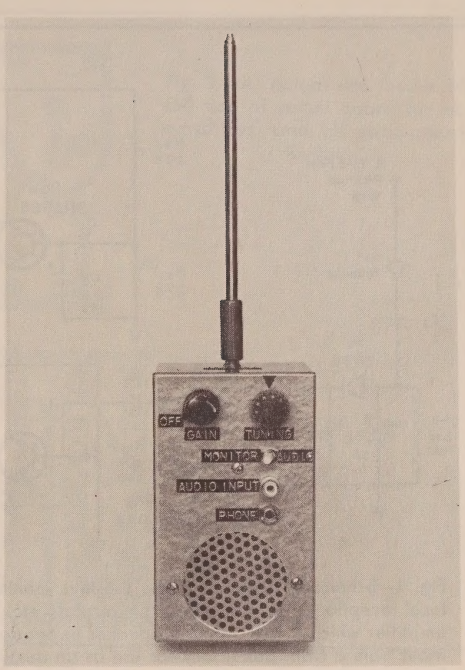
If you can afford it, the kb/2000 Universal Code Generator will be a good adjunct in the amateur shack for convenience and a lot of fun to boot. As for commercial communications services, it can be a worthwhile investment for the efficient handling of traffic.

The basic unit is priced at $1740. Prices on the various options along with additional information may be obtained from the manufacturer: Pickering Radio Company, Professional Plaza, Portsmouth, Rhode Island 02871. —*W2AEF*



"The console here is unusual . . ."

[4] Tom Pickering tells us that at least two of the kb/2000's will be heard in an upcoming contest.



The sensitive modulation monitor is housed in a 5¼ × 3 × 2⅛" aluminum box. Controls at the top are On/Off/Gain and Tuning. Below the Tuning control are the Monitor-Amplifier switch, and jacks for audio input and headphones. A small collapsible whip antenna plugs in at the top.

Sensitive Modulation Monitor

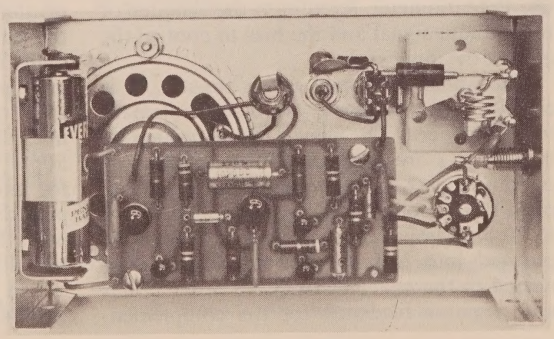
BY WILLIAM F. SPLICHAL, JR.,*
WA6QVQ

A COMPACT combination modulation monitor/audio amplifier was designed to use almost any type high beta silicon NPN and PNP transistors and operate from a single 1.5 volt battery. Because the amplifier requires no critical components, junked transistor radios or surplus transistorized computer boards will supply most of the parts required. The unique high gain audio amplifier features a low noise cascode input stage and an output stage which will drive a speaker or headphone. The amplifier has no tendency to oscillate because of the inherently stable cascode input circuit and generous use of negative feedback in all stages. Passive reception of r.f. signals up to approximately 200 mHz is obtained by rectified detection of a.m. signals and slope detection of f.m. signals. This very sensitive monitor/audio amplifier will have many uses around the ham shack as a modulation monitor, signal tracer, audio amplifier, or hidden transmitter locater.

*1160 Brace Ave., Apt. 8, San Jose, Cal. 95125

Circuit Operation

The parallel resonant circuit L_1C_2 (see fig. 1) is tuned to the desired reception frequency by capacitor C_2 and is fed by a short pick up lead plugged into jack J_1. The s.p.d.t. switch S_1 selects either r.f. signals detected



Interior view of the monitor shows the placement of the tuned circuit at top left and a.f. amplifier circuit board at left. At the far right is a pin jack for connection to an antenna.

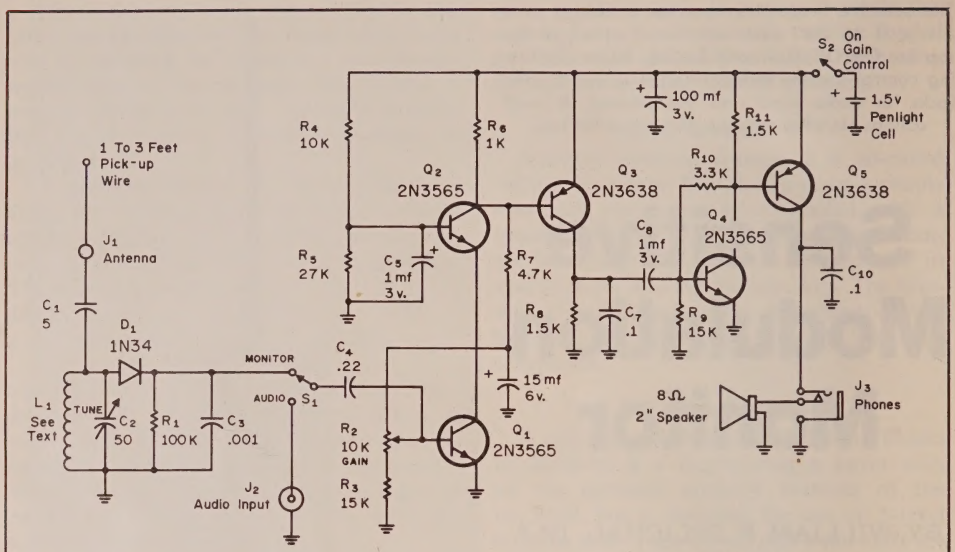


Fig. 1—Schematic diagram of the sensitive monitor for checking a.m. or f.m. modulation, or for local reception of transmissions from aircraft, etc. The diode detector feeds a very high gain audio amplifier which drives a built-in speaker or headphones. A switch selects either detector output or input from a front panel jack for use as an auxilliary a.f. amplifier. All resistors are 1/2 watt or less; capacitors greater than 1 are in pf unless otherwise indicated. Decimal values are in mf.

by diode D_1, or audio signals applied to jack J_2.

Audio signals selected by switch S_1 are coupled into the amplifier input via capacitor C_4 to the base of transistor Q_1 which is the input transistor of the cascode amplifier, Q_1Q_2. Current through transistors Q_1Q_2 is maintained at a low value to enhance the signal to noise ratio. The signal developed across resistor R_6 is coupled directly to the base of Q_3 which is connected in a complementary arrangement with the cascode input stage. Bias and negative d.c. feedback from the collector of transistor Q_2 is fed back to the input of transistor Q_1 via resistor R_7 and the a.c. component is decoupled by capacitor C_6. Potentiometer R_2 adjusts the amount of input audio signal and the bias to control the gain of the input stage.

The signal developed across resistor R_8 is coupled via capacitor C_8 to the complementary amplifier Q_4Q_5. Signals developed across resistor R_{11} are coupled directly to the base of transistor Q_5. The amplified output developed at the collector of Q_5 is applied to a 4 to 50 ohm impedance speaker or headphone plugged into jack J_2. Resistor R_{10} is connected to the collector of Q_4 to provide bias and negative feedback for the complementary amplifier Q_4Q_5. Capacitors C_7 and C_{10} limit the high frequency response of the amplifier. A low battery drain of approximately 10 ma insures long battery life from a single 1.5 volt penlite cell.

Construction

The monitor was constructed in a small metal mini box chassis (2⅛" × 3" × 5¼") as shown in the photos. Although the amplifier is shown fabricated on a printed circuit board, it may also be constructed by wiring the components to terminal strips or Vectorboard if more desirable by the builder. Figure 2(A) is the negative of the amplifier which has been laid out on a 3" × 1½" printed circuit board with fig. 2(B) showing the parts placement. Layout of the components is not critical and is shown in interior view photo. A two inch 8 ohm speaker was mounted at one end of the box and a resonant circuit comprised of capacitor C_2 (5 to 50pf) and L_1 (#18 wire, 4 turns, 1/4" i.d.) for monitoring between 75 to 150 mHz was placed at the other end. Coils for monitoring other frequencies can be wound easily or selected from the "junk box" with the aid of a grid or tunnel dipper. Germanium diodes (1N34, 1N64, 1N66) were found to be more

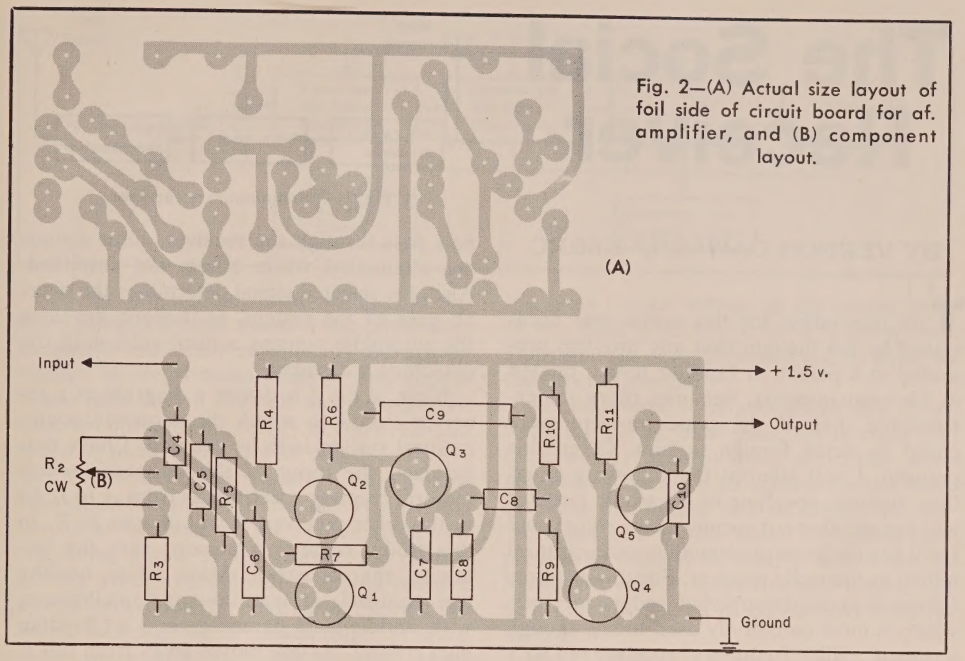


Fig. 2—(A) Actual size layout of foil side of circuit board for af. amplifier, and (B) component layout.

sensitive as v.h.f. detectors than silicon diodes because of the lower forward voltage drop (.2 volt versus .5 volt). The type of high beta NPN and PNP transistors used in the amplifier is not critical but should have a beta of 100 or greater for best results.

Using The Monitor

R.f. signals are monitored by plugging a 1 to 3 foot pick up wire or telescoping antenna into Antenna jack J_1. Replacing jack J_1 with a coaxial connector will enable a loop antenna to be attached to the monitor for finding hidden transmitters. The selector switch S_1 is placed in the MONITOR position and the GAIN control is used to control the volume. Maximum audio gain is obtained with the GAIN control positioned approximately 75% fully clockwise. No output is obtained with the GAIN control positioned at either the fully clockwise or counter-clockwise position. This is because the input stage is cut off with the control set at the fully counter-clockwise position and the audio signal is bypassed to ground by capacitor C_6 when the control is set at the fully clockwise position. A headphone may be plugged into PHONE jack J_3 for monitoring a transmitter to prevent feedback when near the microphone of the transmitter.

Placing the selector switch S_1 in the AUDIO INPUT position enables audio signals to be connected to the amplifier by a shielded cable for signal tracing or amplifying weak audio signals. A voltage doubler type r.f. detector probe, shown in fig. 3, can be easily constructed on the end of a shielded cable for r.f. signal tracing of r.f. circuits.

Another interesting use of the amplifier was to easily monitor v.h.f. transmissions from pilot to ground stations while riding in a commercial aircraft. A 24 inch pick up wire was placed near a window and a hearing aid earphone was driven by a miniaturized version of the amplifier built in a small metal cuff link box. This passive type of receiver is completely safe to operate on aircraft as it contains no oscillators which could radiate and cause interference with communication or navigational equipment. ■

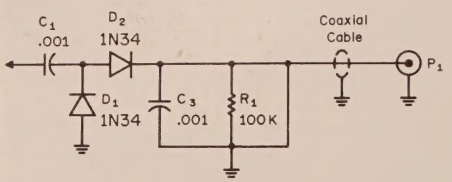


Fig. 3—Circuit of r.f. detector probe permitting use of the a.f. amplifier for signal tracing in r.f. circuits. Probe is of the voltage doubler type.

The Social Receiver

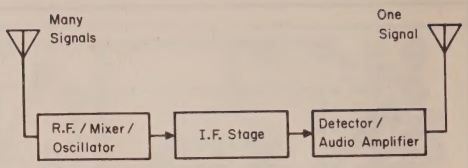


Fig. 1—The elementary receiver.

BY VERNON DAWSON,* K6RRC

THE inspiration for this article was occasioned by the thought that any problem presented to a person in familiar terms, related to his own interests, becomes more understandable than if the same problem were posed in terms foreign to him. Given this premise, I will attempt the following equation: namely, speaking in electronic terms, I will use members of society as the signal, and I will use the present economic-socio-cultural milieu as the radio receiver. For this example I propose to use the superheterodyne receiver, which is most commonly used today, though a tuned radio frequency receiver (TRF) would serve as well. To review our typical receiver see fig. 1.

In the first stage of the receiver (mixer oscillator), by mixing incoming signals with the local oscillator frequency, I obtain many additional products, and this, in turn, I feed to the intermediate frequency (i.f.) stage. The frequency to which the i.f. is tuned determines which signal will pass on to be heard at the speaker. The design of the i.f. stage will determine the band pass and possible gain of the selected frequency to be detected in the next stage.

Looking at fig. 2, you will see an example of the receiver selecting a wanted station from among signals 10 kHz apart. As the signals pass through the receiver, some signals are attenuated while others are amplified. Also, the selected signal determines the overall gain of the system, as it alone develops the automatic volume control voltage in the detector a.v.c. stage.

Now, in fig. 3 is drawn a diagram of a receiver circuit to which the economic-socio-cultural system is to be equated. I have categorized the input of this economic-socio-cultural receiver spectrum as from *A* to *I*. As in the other receiver, it will choose *E*. *E*, in this study, represents persons with the following characteristics: Male, white, healthy and well-fed, at least average intelligence, with middle-class parentage and a Christian background. As one moves away from this *E* pattern toward *A* or *I*, we find all of the groups that are adversely affected by various chauvinistic prejudices—Blacks, Chicanos, Indians, Jews, *et al.* The list is almost endless, from the small minorities of militant radicals, right or left, to the majority-minority of women. The enlightened few who are not in tune to the amplified center are meaningfully removed, as their political and economic influence is of no practical consequence.

As the young approach this selective barrier and try to pass through the first response transformer, it can be readily seen that those who are of, or very near to, the *E* group, advance easily. This group is more easily motivated to achieve since the rewards of upward mobility are more easily grasped.

*7304 Tenth St., Rio Linda, Cal. 95673

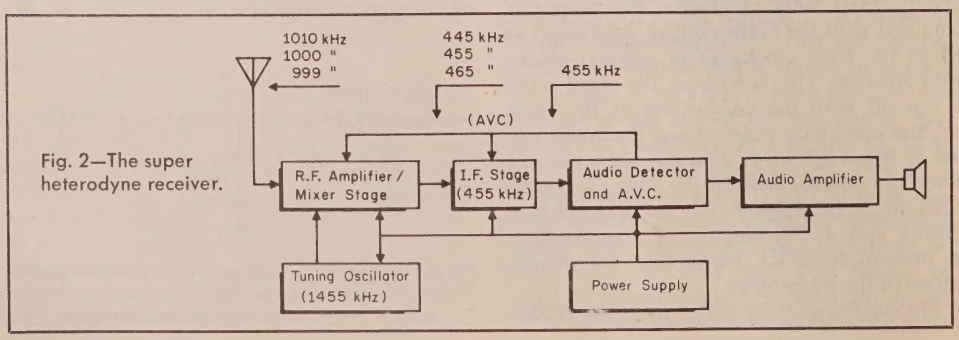


Fig. 2—The super heterodyne receiver.

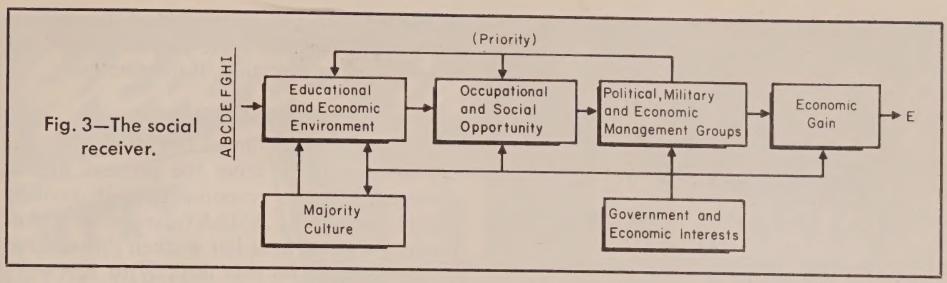


Fig. 3—The social receiver.

On the other hand, those within the underprivileged groups whose lives, physically, mentally, and often emotionally have been stunted by deprivation, hunger, and educational lack, find it difficult and near-impossible to cope with the reality of the stress and strain of social survival with dignity. As a result, the motivational response (output voltage) of such deprived individuals is much less than that of those of the center group, all else being equal. If, by chance, an off-frequency group, or individual should achieve a high motivation, or have talent beyond the norm, such a group or person might produce the same output voltage as the center type. In this case, as shown in fig. 3, it is very obvious that the rewards would not be equal to the effort expended.

In conclusion, it may be stated that if, by widening the i.f. band pass, (as in color TV i.f. systems) each member of society were guaranteed the right to achieve on the basis of native intelligence and/or ability, and not "screened out" by the social repression of a prejudiced society, all persons would benefit by the increased receptivity and interaction of a much wider scope of talented achievements. ■

Late OSCAR-6 News

BY GEORGE JACOBS,* W3ASK

THE OSCAR-6 radio amateur communications satellite is successfully completing its first month in space as this is being written, and is already far and away the most popular of the amateur satellites launched to date.

Hundreds of two-way QSOs have taken place through the satellite's 2-to-10 meter repeater, involving at least three dozen countries, and the count is climbing rapidly. For example, during the three day period Nov. 2-4, DK2ZF in Western Germany worked dozens of stations in a total of *22 different countries*, including the following: DJ4ZCA, DM2BEL, EA4AO, EI6AS, F1UP, G3PWJ, GI3ONF, GW3LEW, HB9IN, HG5AIR, I3LDS, LA8WF, LX1DB, LZ1FO, OE3XUA/3, OH3AZW, OK1MBS, ON4GF, OZ1OF, SM2CFG, UM6MA and VE2BYG. He also heard SP2DX, W1QXX and W2MRX calling CQ but didn't have enough time to work them!

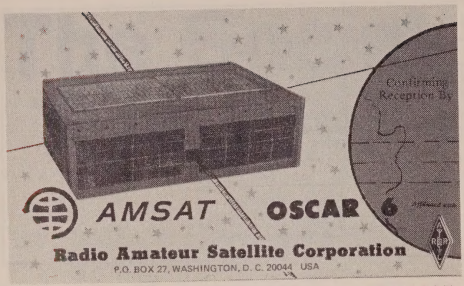
On this side of the Atlantic, after only the first two weeks in orbit, VE2BYG reported working a total of 105 stations through the satellite's repeater, among them 8 countries, 21 states, 4 Canadian Provinces and 9 trans-Atlantics.

Here's one that will make Frank Anzalone's, *CQ*'s Contest Editor, hair stand on



Photo of what was probably the first 2-way SSTV contact through OSCAR-6. It was made between WA9UHV and W9NTP during orbit 30 on Oct. 18.

*11307 Clara St., Silver Spring, Md. 20902



Official OSCAR-6 QSL card now being sent AMSAT to confirm reports of reception through the satellite.

end. During the *CQ* WWDX Phone Contest several stations were heard exchanging contest reports through OSCAR 6's 2-to-10 meter repeater! How will you score those Frank?

On October 18, W9NTP and WA9UHV completed the first reported 2-way SSTV QSO through the satellite (see photo).

OSCAR-6 Operating Schedule May Be Reduced

OSCAR-6 continues to orbit the earth every 115 minutes, crossing the equator about 28.75 degrees progressively to the west for each new orbit. Telemetry reports indicate that all is reasonably well aboard the satellite, except for somewhat lower than expected battery voltage, sudden shut-downs of the repeater, and low output from the 29.45 mHz beacon signal.

To keep battery voltage at a safe level it has become necessary to take the repeater out of service for varying periods of time. This permits the solar cells on the satellite's surface to recharge the batteries. In mid-November AMSAT decided to operate the satellite Friday evenings and all day on Saturdays and Sundays, but to restrict its use on weekdays depending on battery voltage level. Operational schedules will now be included in orbital announcements. Since they are subject to change, be sure to check them from time-to-time.[1]

All-in-all it still looks very much like OSCAR-6 will enjoy a long life, *if it is used wisely*. AMSAT again cautions stations using the repeater to restrict effective radiated power (e.r.p.) towards the satellite to less than 100 watts, or not more than is necessary to conduct successful communications. E.r.p. is equal to the c.w. power fed to the antenna system, multiplied by the power gain of the antenna in the direction of the satellite.

OSCAR-6 QSL Card

A special multi-colored OSCAR-6 QSL card has been received from the printers and is now going out in response to each verified report received by AMSAT (see photo). Reports of stations heard or worked through the satellite should be sent directly to AMSAT, P.O. Box 27, Washington, D.C., 20044, using the reporting format contained in "OSCAR-6; IT'S IN ORBIT!!!," which appeared in the December, 1972 issue of *CQ*. Two-way QSOs conducted through OSCAR-6 should be QSLed between the participating stations in the usual manner.

Frequency Info

Listening to OSCAR passes indicates that many stations are still having difficulty between transmit and receive frequencies. OSCAR-6's repeater accepts transmissions

[*Continued on page 91*]

Transmit Freq. (mHz)	*Corresponding Receive Freq.* (mHz)
145.900	29.450[2]
145.905	29.455
145.910	29.460
145.915	29.465
145.920	29.470
145.925	29.475
145.930	29.480
145.935	29.485
145.940	29.490
145.945	29.495
145.950	29.500
145.955	29.505
145.960	29.510
145.965	29.515
145.970	29.520
145.975	29.525
145.980	29.530
145.985	29.535
145.990	29.540
145.995	29.545
146.000	29.550

Table I—Relationship between transmit and receive frequencies through the OSCAR-6 satellite.

[1]Available 24 hours a day from the AMSAT Hotline: 301 654-1166. See also the latest W1AW transmission schedules appearing in *QST*, Nov. 1972, p. 118.

[2]Do not transmit on 145.90 mHz since 29.45 mHz is reserved for beacon transmissions.

years in the making



RTTY FROM AtoZ

DURWARD J. TUCKER, W5VU

Drawn partly from the pages of **CQ**, and partly from previously unpublished material, this new RTTY classic has been produced to fill the void in RTTY knowledge among amateurs and professionals alike.

Written to round out the amateurs' RTTY bookshelf which up to now has relied solely on another **CQ** classic: "The New RTTY Handbook," the combination of the two is unbeatable. To properly describe the scope of this volume would demand a volume in itself, but the chapter headings below tell the story:

Chapter 1—**RTTY Basics.** Chapter 2—**The Teletypewriter.** Chapter 3—**Teletype and Radio Reception.** Chapter 4—**Converter (Terminal Unit) Basics.** Chapter 5—**Polar Relays and Distortion.** Chapter 6—**Special RTTY Circuits.** Chapter 7—**Test Sets.** Chapter 8—**Machine Adjustments.** Chapter 9—**Tape Printers.** Chapter 10—**Kleinschmidt Machines, Tape Readers, Teletype Models 28 and 32.** Chapter 11—**Codes, Data Processing & Advanced Machines.** Chapter 12—**Distortion Producing Test Sets.** Chapter 13—**Regenerative Repeaters and Frequency Shift Monitors.** Chapter 14—**Terminal Units.** Chapter 15—**The RTTY Station.** Chapter 16—**FCC Rules, Operating Procedures.**

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DX

BY JOHN A. ATTAWAY,* K4IIF

HAPPY NEW YEAR! Feliz Año Nuevo! Gutes Neues Jahr! Bonne Année! Buon Capo d'Anno! Szczesliwego Nowego Roku! Shana Tova! and Gott Nytt Ar! to all our amateur radio friends the world over.

As we start another new year memories of new year's past, and the things happening in the world of DX, seem to flood the mind. Thumbing back through *CQ* for January, '72 we find a picture of the operating crew for the ET3ZU/A DXpedition which made a new country of Jabal At Tair. Remember chasing that one.

Two years ago, Charlie, TJ1AW, was getting set up in Cameroun, and the January issue announced that the new *CQ* C.W. and *CQ* S.S.B. DX awards were off the ground and flying. Both have well-established honor rolls now.

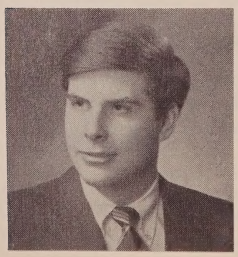
Jumping back 5 years to January, 1968 we announced that the very first WPNX certificate had been awarded to Mary Ann Crider who was then known as WN3HUP. Mary Ann must be about to renew WA3HUP for the first time now and has become one of the world's top DXers and QSL Managers. We're pround that her career started with WPNX.

Another 5 year leap to 1963 finds Urb Le Jeune, W2DEC, the DX EDITOR and reports of the exploits of WØMLY and W4BPD, including DXpeditions to TJ8, TL8, TN8, TR8, TT8, TZ2, TY2, 5V4, 3 VQ9 countries, 9U5 and ZD9. Those were the heydays of the big worldwide DXpedition.

A quantum skip to January, 1958 finds Don Chesser, W4KVX, just taking over the DX EDITOR'S reins from that grandaddy of all DX Editors, Dick Spenceley, KV4AA. Don't seem like its been 15 years, does it Dick?

So much for the past. Jerry and I and all the *CQ* DX Committee wish you the best of skip for '73.

*P.O. Box 205, Winter Haven, FL 33880



Wayne Hudson, VP-2EW/K5JZN, made 437 contacts in 30 countries during his recent DXpedition to Anguilla. His VP-2EW QSL, featuring the Anguillan beaches, is being routed from his home QTH, K5JZN.

The Countries Article

In October *CQ* used my lengthy article on the various countries which make up the amateur radio list. They even featured it on the cover for which I am grateful.

That article represented uncountable hours in the library pouring over maps, charts and encyclopedias and writing letters. Such a thing is a labor of love. Please give me this opportunity to thank all those who have written in with kind remarks on this effort. You made it very worthwhile.

De Extra

The Zone 15, Zone 33 Boundary: An interesting question developed this past autumn regarding the location of this boundary in relation to the Italian islands of Pantelleria (IH9), Linosa (IE9) and Lampedusa (IE9) in the Mediterranean. The question was prompted by an inquiry from the DX Old Timer's Club of Palermo, Sicily who planned a trip to Pantelleria for the *CQ* Worldwide DX Contest in October.

After examining the old maps at our disposal, the DX Department ruled that the above islands were in Zone 33. However, this ruling was challenged by a member of the *CQ* DX Awards' Advisory Committee who felt that islands under Italian jurisdiction should be in Zone 15, the Central European Zone, not Zone 33, the Northwestern Zone of Africa. The point was made that in the contests a station in Zone 15 would get only one point for working other European stations, while a station in Zone 33 was on another continent, Africa, and got 3 points for each European contact. Thus it was a little more involved than simply another Zone multiplier.

As a result of this challenge, the DX Department did an exhaustive study to determine the most logical basis for resolving the question. Letters were written to the National Geographic Society and the Geography Departments of 3 universities. The National

Geographic Society pointed out that the matter was quite complex because "the islands are politically part of Europe, but two of them seem geographically part of Africa." The Society suggested that we consider the geologic history of the islands and referred us to the Woods Hole Oceanographic Institute and the International Oceanographic Foundation.

Information from the Universities also failed to show a clear choice, as 2 schools of thought exist among geographers. Those favoring "human geography,' 'which emphasizes the cultural and political history of the inhabitants, were inclined toward Zone 15 as the island populations are Roman Catholic and Italian. However, those favoring the geological approach were inclined toward Zone 33 as the islands *seemed* geophysically to be a part of Africa.

As a result of this difference of opinion it was decided to await information from Woods Hole and the International Oceanographic Foundation before making a decision. In early September we received a letter from Dr. Cesare Emiliani, Chairman of the Division of Marine Geology and Geophysics, School of Marine and Atmospheric Science, University of Miami, replying for the International Oceanographic Foundation. Dr. Emiliani stated: "The islands of Linosa and Lampedusa definitely belong to the continent of Africa. Pantelleria is a continental fragment that could be assigned to either Europe or Africa. I would favor Africa."

In mid-September a letter was received from Dr. H. K. Wong, Associate Professor of the Department of Geology, Northern Illinois University, replying for the Woods Hole Oceanographic Institute. Dr. Wong stated that: "The boundary between Africa and Eurasia is partially defined by seismically and volcanically active Sicilian-Calabrian arc. According to the plate tectonics theory this implies that the 3 islands under discussion all lie within the African plate." He further indicated that the classification of Pantelleria and Linsoa is questionable because of their volcanic origin, with Africa being the best of a difficult choice. Lampedusa, however, is clearly situated on the African shelf, is not volcanic in origin, and should be classified as part of Africa.

As a consequence of the above information, the DX Department has decided to accept the geophysical method of classification and uphold the earlier ruling that Pantelleria, Linosa and Lampedusa are in Zone 33. This places Italian territory in Africa for amateur radio purposes, but this is certainly not unprecedented as Turkey, for example, lies partly in Europe and partly in Asia, but counts as a single country.



Vern, K1DRN, is a most enthusiastic member of the CQ DX Awards Advisory Committee, but we didn't realize that he would go so far as to get a street named for our Worked All Zones award. WAZ street is the shortest in Ludlow, Mass., but Vern refuses to believe that the road to WAZ is either short or easy. *(Thanks W1DGJ)*

The WAZ Program

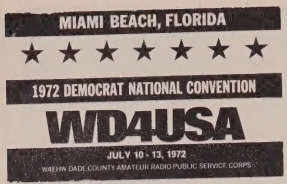
S.S.B. WAZ

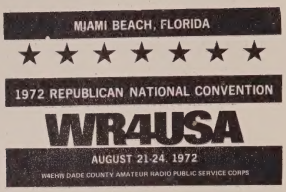
1027.....KZ5FN	1032.....VK2PF
1028.....VK3JF	1033.....JA1RWE
1029.....9Q5QR	1034.....LU5DDM
1030.....DL7NJ	1035.....UL7NW
1031.....DL7PR	1036.....K8CMO

C.W.—Phone WAZ

3422.....W1DXB	3433.....ZL1AOV
3423.....W5LUJ	3434.....UA1CY
3424.....DK2NA	3435.....UR2KAW
3425.....JA1TNV	3436.....UWØAJ
3426.....HS1ADX	3437.....UC2SE
3427.....LU9FAN	3438.....W9FT
3428.....DM2CGH	3439.....W8WOJ
3429.....OK1KYS	3440.....W7YTN
3430.....WAØVBV	3441.....W6BYB
3431.....JA3MXR	3442.....ZL2VN
3432.....ZL2ASM	

Complete WAZ rules are shown on pgs. 64-66 of the June, 1970 issue of *CQ*. Application blanks and reprints of the rules may be obtained by sending a self-addressed, stamped envelope to DX Editor, P.O. Box 205, Winter Haven, FL 33880.





WD4USA and WR4USA were eagerly sought by prefix chasers during the national political conventions in Miami. If you qualify for one of these cards route your QSL to Andy, W4IYT, P.O. Box 501, Miami Springs, Fl. 33166. Enclose a self-addressed, stamped envelope.

New and Rare Prefixes

A4A - A4Z: This callsign block is allocated to the Sultanate of Oman.

A51: A51PN appears regularly on 20 meter c.w. starting around 1200 GMT.

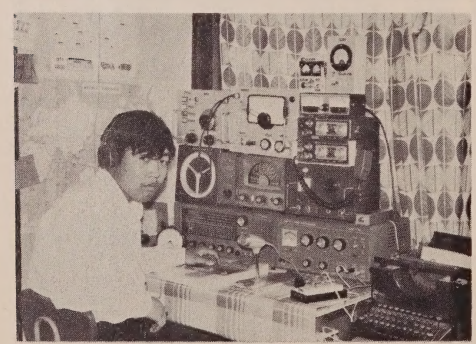
AC3: AC3PT frequents 14250 kHz at irregular intervals. 1400 GMT is a good time to listen for him.

EL∅: EL∅H has been reported on the upper end of the 20 meter phone band.

FC2: FC2CF was heard on 14240 kHz s.s.b.

FC6: FC6ABP has been worked on 28570 kHz.

FH∅: Uli, DK2SI, was QRV from Moroni, Comoro Islands last summer as FH∅DL. QSL to his home QTH.



Nobumasa Wakabayashi, JH3CIQ, is really pouring it on with WPX endorsements this month. Nobu qualified for 350 prefixes on s.s.b., for the 15 meter endorsement, and for the Asia and Africa continental endorsements.

The WPX Program

S.S.B. WPX

714.....ZS2RM
715.....OZ1WL
716.....JH3CIQ

C.W. WPX

1198.....K4FRM
1199.....ZS2RM
1200.....UA3WI
1201.....UD6CN
1202.....UC2AT
1203.....UA4AY
1204.....UA1UP
1205.....DM4XXH
1206.....VK3LV
1207.....W8DSO
1208.....SP2AHD
1209.....SP9AGS
1210.....SP8SR
1211.....W2SZ
1212.....W6NJU

Mixed WPX

354.....WA5ALB
355.....KR6IX
356.....W6NJU
357.....3D6AX

WPNX

50.....WN5YMW

VPX

44.....UA3-27320
45.....UA4-133-21
46.....UA9-154-27
47.....UA3-151-18

WPX Endorsements

S.S.B.: W4NJF—1050, F2MO—750, WB6DXU—650, YU1AG—600, WA2EAH—500, W2EHB—500, WB2FMK—450, K8MMH—400, VK3SM—400, WA5UDH—350, OZ1WL—350 and JH3CIQ—350.

C.W.: DJ7CX—750, K2AAC—700, VO1AW—650, W2EVO—350, W6NJU—350, UB5VK—350, SP2AHD—350, and UA3WI—350.

Mixed: DJ7CX—900, W4WSF—800, K2AAC—750, W4HHN—600, W1EQV—600, W2MB—600, SP9AI—600, W5LPO—550, K∅PMZ—500, HI8LC—500, WA5ALB—450 and W6NJU—450.

40 Meters: W4WSF.*

20 Meters: W4NJF, VK3LV and SP8SR.

15 Meters: 14ZSQ, W4NJF and JH3CIQ.

10 Meters: K8MMH and W4NJF.

Africa: W4WSF.*

Asia: WA5VDH, YU1AG and JH3CIQ.

Europe: K∅PMZ, YV7AV, YU1AG, SP9AGS, SP8SR and WB2FMK.

North America: K∅PMZ.

Oceania: VK3SM and JH3CIQ.

South America: YV7AV.

* W4WSF now has every continental and band endorsement available for his Mixed WPX certificate.

Complete rules for WPX, WPNX and VPX may be found on pg. 67 of the February, 1972 issue. Application blanks and reprints of the rules may be obtained by sending a business size, self-addressed, stamped envelope to Award Manager, P.O. Box 1271, Covina, CA 91722 or to the DX Editor.

CQ DX AWARD HONOR ROLL

The *CQ* DX Award Honor Roll recognizes those DXers who have submitted proof of confirmation with 273 or more countries for the mode indicated. The ARRL DXCC Country List, LESS DELETED COUNTRIES, is used as the country standard. Effective with this listing all scores reflect the deletion of Minerva Reefs and Maria Theresa. These countries were deleted from the DXCC List on 1 Oct. 72. The total number of current countries on the DXCC List is now 320, however further changes are expected in the near future.

C.W.

K6EC 316	WØAUB 303	W6ISQ 293
W6ID 316	DL3RK 302	WA6EPQ 292
W8LY 309	ON4QX 300	WA6MWG 281
K6LEB 307	W6NJU 297	WA8DXA 278
W4IC 306	W4BQY 295	DJ7CX 276
VK3AHQ 305	K1SHN 293	

S.S.B.

TI2HP 319	W6YMV 310	K1SHN 298
W2TP 319	XE1AE 310	YS1O 298
W3NKM 318	IT9JT 309	ZL3NS 298
W9ILW 318	VE3MR 309	ZL1AGO 297
DL9OH 317	F2MO 308	WA6MWG 295
IØAMU 317	VE2WY 306	VE3GMT 294
WA2RAU 317	G3DO 306	YV1LA 293
K2FL 316	I1AA 306	WØYDB 292
W6REH 316	W9QLD 306	XE2YP 292
G3FKM 315	VE3ACD 305	WB2RLK 291
SM5SB 314	F9MS 304	K8GQG 289
W6EUF 314	K6EC 304	K1KNQ 285
W6NJU 314	I1ZV 303	HP1JC 283
W6RKP 314	W6KZS 302	K3GKU 283
ZS6LW 314	W6FW 301	OE2EGL 279
I8KDB 313	WA2HSX 300	WAØKDI 279
W3AZD 313	K4HJE 300	WAØCPX 277
W3DJZ 313	W9KRU 300	W8ZOK 275
W6KTE 313	G3RWQ 299	DL1MD 274
W9JT 313	KH6BB 299	K9LUI 274
W9DWQ 312	WA3IKK 299	G3KYF 274
W4IC 311	K4RTA 299	G3WW 273
WA2EOQ 310	YV1KZ 299	WØSFU 273
	OZ3SK 298	

FOØ: FOØES was heard on 14312 kHz s.s.b. at 0805 GMT.

FPØ: QSL FPØVX to VE3VX.

FYØ: FYØRV was heard on 21294 at 1730 GMT.

HGØ: HGØLJ, a Hungarian v.h.f. station, frequents 28580-90 around 1700 GMT.

HM5: Park, HM5EE, in Taegu, has been quite active on 21040 c.w.

HMØ: HMØB frequents 14185-190 kHz s.s.b.

HR6: This is the new prefix for Swan Island which is now under Honduran administration.

II1: II1FGM was reported on 14200 kHz at 1840 GMT.

KCØ: KCØKCI, on from Oct. 14-23, was a special station used in celebrating the opening of the new Kansas City airport.

KE4: QSLs for KE4FLA go to W4OZF.

PW: This prefix was used by Brazilian operators in September to commemorate the 150th anniversary of Brazilian independence.



Left to right are Mayuree (XYL of HS1WR), "Big John" (HS1AFW/VE7IR/9M2IR), Kam (HS1WR), and Pete (HS1AFI) after a quick planning session prior to the Second Annual Southeast Asia Net Convention in Bangkok. *(Tnx HS1AFI/W8JNM)*



Tom Newberry, WA9HHJ, at the helm of the KG6-ALV bombshell on Guam.

RI8: Soviet v.h.f. station RI8AGX in Uzbek is frequently found near 28015.

S2A - S3Z: This callsign block is now officially allocated to Bangladesh.

TT8: Gus, TT8AC, is active on 15 and 20 meter s.s.b. QSL to DJ1LP.

VA3: VA3HAM was on in September with the first VA3 prefix. The operation was conducted by the Atwood Amateur Radio Club. QSL to VE3GCO.

VA5: VA5WCC will be operated by the Regina Amateur Radio Association this spring to commemorate the World Curling Championships. Meanwhile this call is being used for contest operations.

VA6: VA6NC was operated by VE6LQ and other North Alberta Amateur Radio Club operators.

YB4: YB4WT is often heard on 21280-290 at 1700-1800 GMT.

YBØ: YBØBY and YBØJC are often active between 21250 and 21350 kHz between 1600 and 1700 GMT. QSL to P.O. Box 2761, Djakarta, Indonesia.

3X1: 3X1P in September and October was operated by SMØKV and SMØCBZ. QSL to SMØKV.

4JØ: 4JØBJ operated by UA3BJ and 4JØDI operated by UW3DI were QRV from the Kurile Islands in August. The Kuriles are in U.S.S.R. Oblast No. 153.

5N5: This prefix was used by Nigerian amateurs in October to commemorate the 12th anniversary of Nigerian independence.

9H5: Amateur stations using the 9H5 prefix are operated by British military personnel in Malta.

The CQ DX Award Program

C.W. DX

102.....K2USA
103.....DJ1QQ
104.....DL2WR

S.S.B. DX

233.....YV1LA
234.....W3AZD
235.....K3GKU

C.W.: YU1AG—250.

S.S.B.: WA2RAU — 320, W3AZD — 310, WA3IKK—300, YV1LA—275, K3GKU —275 and G3KYF—275.

Complete rules for the *CQ* DX Award Program may be found on pg. 58 of the January, 1971 issue. Application blanks and reprints of the rules may be obtained by sending a self-addressed, stamped envelope to Award Manager, P.O. Box 1271, Covina, CA 91722, or to the DX Editor.

Here and There

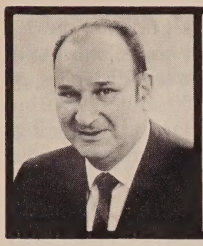
Rare Zones: For those needing Zone 18, UAØTD on 14030 kHz c.w. at 0245 GMT, and UAØTU on 14227 s.s.b. at 0220 GMT have been reported. Some active stations reported recently from Zone 23 include JT1AO, 14031 c.w. at 1148 GMT; JTØAE, 14210 s.s.b. at 0100 GMT and again at 0200 on 14201; JTØKAA on 14025 c.w. at 0115 GMT; JTØKOK on 21085 c.w. at 1000 GMT and 14024 c.w. at 1707 GMT; and JTØXV on 14210 *l*sb at 1220 GMT. JTØXV is said to be *only* on lower sideband. QSLs for JTØAE may be sent via OK1AQW and for JTØKOK via OK1KZD. Zone 34 has been represented on the bands by ST2SA on 14201 at 1445 GMT, on 14243 at 1455 GMT, on 21384 at 2100 GMT, and on 28600 at 1500 GMT. This is good info for the monoband WAZ chasers. Also active from this rare zone are SU1MA on 14196 at 0300 GMT and SU1MI on 14010 at 0300 GMT and 28050 at 1420 GMT.

SY1, Mt. Athos: Mt. Athos is an autonomous region of Greece and has been classified as a new country. QSLs for the October expedition go to WA1HAA, 238 Slater St., Attleboro, Mass. 02703.

KH6, Kure: The W7WOX/Kure operation scheduled for the *CQ* Worldwide Phone contest in October included KH6HLK, K5CIT, KH6COY and others. QSL to KH6BZF, 45-601 Luluku Road, Kaneohe, Hawaii 96744.

9H4: The Gozo Amateur Radio Society of Malta advises that Eric Rogers, 9H4G, is QSL Manager for all 9H4 stations. His QTH is: "Dar Ghall-Kwiet," Ghajn Melel St., Zebbug, Gozo, Malta. (Tnx George Gauci, 9H4H, Secretary)

[*Continued on page 92*]



Propagation

BY GEORGE JACOBS,* W3ASK

THE sunspot cycle continues its unusual behavior! The Swiss Federal Observatory reports a monthly mean sunspot number of 61 for September, 1972. This results in a smoothed sunspot number of 73, centered on March, 1972. There are some indications that this unexpected 12-month rise in solar activity may have ended and that the cycle has begun to decline again. A smoothed sunspot number of 53 is forecast for January 1973.

Typical winter shortwave propagation conditions are expected to continue through January. Maximum usable frequencies should remain high during the daylight hours, with openings to many areas of the world expected on 10, 15 and 20 meters. During the hours of darkness, maximum usable frequencies should drop to seasonally low values, with the 40 and 80 meter bands being optimum for DX propagation. Static levels are expected to be at their lowest values of the year in the northern hemisphere, and signal levels should be exceptionally strong during many DX openings.

The following is an overall picture of shortwave band conditions for January, 1973. For specific times of DX openings refer to the *DX Propagation Charts* which appeared in last month's column. This month's column contains *Short-Skip Propagation Charts* for January and February, as well as Charts centered on Alaska and Hawaii. The *Short-Skip* Charts contain propagation forecasts for paths varying in distances of between 50 and 2300 miles.

10 Meters: Some fairly good DX openings during the daylight hours to most areas of the world, especially southern and tropical regions, Some short-skip openings, between distances of approximately 1300 and 2300 miles, are also forecast for the afternoon hours.

15 Meters: This should be the optimum band for DX propagation during most of the daylight hours. Generally good openings are forecast to most areas of the world from shortly after sunrise to shortly after sunset. Some openings to southern and tropical areas are likely to occur during the early evening hours as well. Fairly consistent short-skip openings, resulting from regular F-layer reflection, are expected during the daylight hours over distances ranging between 1000 and 2300 miles.

20 Meters: While DX openings to one area of the world or another should be possible on this band throughout the daylight and early evening hours, conditions are expected to be optimum during the sunrise period and again during the late afternoon hours. Signals are expected to be especially strong during peak periods. Good short skip openings, over distances between 750 and 2300 miles, should also be possible during the daylight hours. Openings over shorter distances, with the skip often as short as a few hundred miles, are expected during the early afternoon hours. On a few nights during the month, when propagation conditions are above normal, the band may remain open for both DX and short-skip propagation well into the hours of darkness.

40 Meters: The band should open for DX during the late afternoon hours, with con-

*11307 Clara Street, Silver Spring, Md. 20902

LAST MINUTE FORECAST

Day-to-Day Conditions Expected For January, 1973

	Rating & Forecast Quality			
Propagation Index	(4)	(3)	(2)	(1)
Date				
Above Normal: Jan. 6, 11, 14, 18-19	A	A	C	C
Normal: Jan. 1, 5, 7, 10, 12-13, 15-17, 23-24, 26-27, 30	B	C	D	E
Below Normal: Jan. 2, 4, 8-9, 20, 22, 28-29	C	D	E	E
Disturbed: Jan. 3, 21	D	D	E	E

Where *expected signal quality is:*

A—Excellent opening, exceptionally strong, steady signals.

B—Good opening, moderately strong signals with little fading and noise.

C—Fair opening, signals between moderately strong and weak, with some fading and noise.

D—Poor opening, signals weak with considerable fading and noise.

E—No opening expected.

HOW TO USE THIS FORECAST

1. Find *propagation index* associated with particular band opening from Propagation Charts appearing on the following pages.

2. With the *propagation index*, use the above table to find the expected signal quality associated with the particular opening for any day of the month. For example, all openings shown in the Charts with a *propagation index* of (4) will be excellent on Jan. 6, but good on Jan. 1, fair on Jan. 2, poor on Jan. 3, etc.

How To Use The Short-Skip Charts

1. In the Short-Skip Chart, the predicted times of openings can be found under the appropriate distance column of a particular Meter band (10 through 160 Meters), as shown in the left hand column of the Chart. For the Alaska and Hawaii Charts, the predicted times of openings are found under the appropriate Meter band column (10 through 80 Meters) for a particular geographical region of the continental USA, as shown in the left hand column of the Charts. An * indicates 80 Meter openings. Openings on 160 Meters are likely to occur during those times when 80 Meter openings are shown with a *propagation index* of (2), or higher.

2. The *propagation index* is the number that appears in ( ) after the time of each predicted opening. On the Short-Skip Chart, where two numerals are shown within a single set of parenthesis, the first applies to the shorter distance for which the forecast is made, and the second to the greater distance. The index indicates the number of *days* during the month on which the opening is expected to take place, as follows:

(4) Opening should occur on more than 22 days
(3) " " " between 14 and 22 days
(2) " " " between 7 and 13 days
(1) " " " on less than 7 days

Refer to the "Last Minute Forecast" at the beginning of this column for the actual *dates* on which an opening with a specific propagation index is likely to occur, and the signal quality that can be expected.

3. Times shown in the Charts are in the 24-hour system, where 00 is midnight; 12 is noon; 01 is 1 A.M.; 13 is 1 P.M., etc. On the Short-Skip Chart appropriate *standard* time is used at the *path mid-point*. For example, on a circuit between Maine and Florida, the times shown would be EST; on a circuit between NY and Texas, the time would be CST since the path mid-point falls in this time zone. Determine the path mid-point, and use the appropriate standard time. Times shown in the Hawaii Chart are in HST. To convert to standard time in other USA time zones, *add* 2 hours in the PST zone, 3 hours in MST zone; 4 hours in CST zone; and 5 hours in the EST zone. *Add* 10 hours to convert from HST to GMT. For example, when it is 12 noon in Honolulu, it is 14 or 2 P.M. in Los Angeles; 17 or 5 P.M. in Washington, D.C.; and 22 GMT. Time shown in the Alaska Chart are given in GMT. To convert to *standard* time in Alaska and other areas of the USA, subtract 10 hours in the Alaskan Standard zone; 9 hours in the Yukon zone; 8 hours in PST zone, 7 hours in MST zone, 6 hours in CST zone, 5 hours in EST zone. For example, at 20 GMT it is 12 Noon in Juneau and 15 or 3 P.M. in NYC.

4. The Short-Skip Chart is based upon a transmitter power of 75 watts c.w. or 300 watts p.e.p on sideband; The Alaska and Hawaii Charts are based upon a transmitter power of 250 watts cw or 1 kw p.e.p. on sideband. A dipole antenna a quarter-wavelength above ground is assumed for 160 and 80 meters, a half-wave above ground on 40 and 20 meters, and a wavelength above ground on 15 and 10 meters. For each 10 db gain above these reference levels, the *propagation index* will increase by one level; for each 10db loss, it will lower by one level.

5. Propagation data contained in the Charts has been prepared from basic data published by the Institute For Telecommunication Sciences of the U.S. Dept. of Commerce, Boulder, Colorado, 80302.

ditions peaking during the hours of darkness and at sunrise. Static levels should be low during the month, and signals often should be exceptionally strong. During the daylight hours, good short-skip openings should be possible over distances ranging between 150 and 750 miles. During the hours of darkness, the shortskip range is expected to increase to between approximately 1000 and 2300 miles.

80 Meters: Solar absorption and static levels are expected to remain at low seasonal values during January, permitting some fairly good DX openings to many areas of the world during the hours of darkness and the sunrise period. During the daylight hours, short-skip openings are forecast between distances of approximately 50 and 350 miles. During the hours of darkness, short-skip openings should be possible between distances of about 250 and 2300 miles.

160 Meters: Some DX openings should be possible on this band from a few hours after sunset to shortly before sunrise. Short-skip openings up to 2300 miles should also be possible during the hours of darkness. Skywave propagation is not usually possible during the hours of daylight on this band because of high solar absorption.

V.H.F. Ionospheric Openings

January is generually a poor month for v.h.f. ionospheric propagation. Very little sporadic-E propagation or auroral activity is expected, and this is also the month when propagation conditions are at their poorest for trans-equatorial (TE) openings.

On the optimistic side, some fairly good meteor-scatter openings should be possible on the v.h.f. bands during the first week of January as a result of the *Quadrantids* meteor shower. This is a major shower which should peak around January 3 and 4 with about 30 to 40 meteors entering the earth's atmosphere each hour

An occasional TE opening may be possible to South America on 6 meters between 8 and 11 P.M., local time. Some v.h.f. openings may also be possible during periods of ionospheric storminess on the h.f. bands. Check the "Last Minute Forecast" appearing at the beginning of this column for those days that are expected to be "below normal" or "distrubed", since these are the days on which v.h.f. ionospheric openings are most likely to occur.

73, George, W3ASK

CQ Short-Skip Propagation Chart
January & February
Local Standard Time At Path Mid-Point
(24-Hour Time System)

Band (Meters)	*Distance From Transmitter (Miles)*			
	50-250	*250-750*	*750-1300*	*1300-2300*
10	*Nil*	*Nil*	08-10 (0-1) 10-15 (0-2) 15-17 (0-1)	08-09 (1) 09-11 (1-2) 11-15 (2) 15-17 (1-2) 17-19 (0-1)

15	*Nil*	09-11 (0-1) 11-15 (0-2) 15-16 (0-1)	07-08 (0-1) 08-09 (0-2) 09-11 (1-3) 11-15 (2-4) 15-16 (1-3) 16-18 (0-2) 18-19 (0-1)	07-08 (1) 08-09 (2) 09-11 (3) 11-15 (4) 15-16 (3) 16-18 (2-3) 18-19 (1-2) 19-20 (0-1)
20	10-12 (0-1) 12-14 (0-2) 14-15 (0-1)	08-09 (0-2) 09-10 (0-3) 10-12 (1-3) 12-14 (2-4) 14-15 (1-4) 15-18 (0-2) 18-22 (0-1)	06-08 (0-1) 08-09 (2-3) 09-12 (3-4) 12-15 (4) 15-18 (2-4) 18-21 (1-2) 21-22 (1) 22-00 (0-1)	06-08 (1-2) 08-09 (3) 09-14 (4-3) 14-18 (4) 18-21 (2-3) 21-23 (1-2) 23-00 (1) 00-06 (0-1)
40	07-08 (0-1) 08-09 (1-3) 09-16 (3-4) 16-18 (2-3) 18-20 (1) 20-00 (0-1)	07-08 (1-2) 08-09 (3) 09-15 (4-3) 15-16 (4) 16-18 (3-4) 18-20 (1-3) 20-00 (1-2) 00-02 (0-2) 02-07 (0-1)	06-08 (1-3) 07-08 (2-3) 08-09 (3-2) 09-15 (3-1) 15-17 (4-2) 17-18 (4) 18-20 (3-4) 20-23 (2-4) 23-02 (2-3) 02-04 (1-3) 04-06 (1-2)	06-07 (3-2) 07-08 (3-1) 08-09 (2-1) 09-15 (1-0) 15-17 (2-1) 17-19 (4-3) 19-23 (4) 23-04 (3) 04-06 (2)
80	08-10 (3-4) 10-15 (4-3) 15-20 (4) 20-22 (3-4) 22-03 (2-3) 03-07 (1-2) 07-08 (2-3)	08-09 (4-2) 09-16 (4-1) 16-18 (4-2) 18-22 (4) 22-03 (3-4) 03-07 (2-3) 07-08 (3)	08-09 (2-0) 09-16 (1-0) 16-18 (2-1) 18-20 (4-3) 20-03 (4) 03-05 (3) 05-07 (3-2) 07-08 (3-1)	08-16 (0) 16-18 (1-0) 18-20 (3-2) 20-02 (4) 02-03 (4-3) 03-05 (3-2) 05-07 (2-1) 07-08 (1)
160	09-17 (1-0) 17-19 (3-2) 19-05 (4) 05-07 (3) 07-09 (2-1)	17-18 (2-1) 18-19 (2) 19-21 (4-3) 21-05 (4) 05-06 (3) 06-07 (3-1) 07-09 (1-0)	17-18 (1-0) 18-19 (2-1) 19-21 (3-1) 21-03 (4-3) 03-05 (4) 05-06 (3-2) 06-07 (1)	18-19 (1-0) 19-21 (2-1) 21-03 (3) 03-05 (4-2) 05-06 (2) 06-07 (1-0)

ALASKA

Openings Given In GMT*

To:	*10 Meters*	*15 Meters*	*20 Meters*	*40/80 Meters*
Eastern USA	19-22 (1)	17-19 (1) 19-20 (2) 20-22 (3) 22-23 (2) 23-01 (1)	11-16 (1) 16-18 (2) 18-21 (1) 21-22 (2) 22-00 (3) 00-01 (2) 01-03 (1)	04-13 (1) 07-12 (1)*
Central USA	19-23 (1)	16-19 (1) 19-21 (2) 21-00 (3) 00-01 (2) 01-03 (1)	11-17 (1) 17-19 (2) 19-21 (1) 21-23 (2) 23-01 (3) 01-02 (2) 02-04 (1)	03-14 (1) 07-12 (1)*
Western USA	19-21 (1) 21-00 (2) 00-01 (1)	17-19 (1) 19-21 (2) 21-00 (3) 00-02 (2) 02-04 (1)	11-17 (1) 17-20 (2) 20-21 (3) 21-00 (4) 00-01 (3) 01-03 (2) 03-05 (1)	04-05 (1) 05-12 (2) 12-15 (1) 15-16 (2) 16-17 (1) 05-12 (1)* 12-15 (2)* 15-17 (1)*

*See "How To Use Short Skip Charts", in box at beginning of this column.

HAWAII

Openings Given In Hawaiian Standard Time*

To:	*10 Meters*	*15 Meters*	*20 Meters*	*40/80 Meters*
Eastern USA	08-09 (1) 09-12 (2) 12-14 (1)	07-08 (1) 08-12 (2) 12-14 (3) 14-15 (2) 15-17 (1)	12-15 (2) 15-17 (3) 17-20 (2) 20-02 (1) 02-04 (2) 04-12 (1)	17-19 (1) 19-21 (2) 21-00 (3) 00-03 (2) 03-04 (1) 19-21 (1)* 21-01 (2)* 01-03 (1)*

[*Continued on page 96*]

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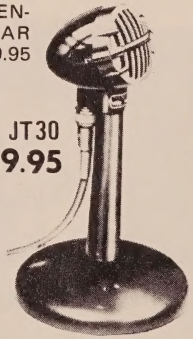
GD104
$25.00



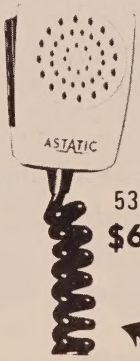
G10 D
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Your salary was cut?

You say the F.C.C. has expressed interest in your four different calls?

You say food is so expensive it's cheaper to eat money?

You say you invited your boss to dinner and during the soup course the finance company repossessed your furniture?



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Contest Calendar

BY FRANK ANZALONE,* W1WY

Calendar of Events

Jan.	6-7	Firebird QSO Party
Jan.	6-7	ARRL VHF Sweepstakes
Jan.	20-21	Louisiana QSO Party
Jan.	20-21	Arkansas QSO Party
Jan.	**26-28**	**CQ WW DX 160 Contest**
Jan.	27-28	French C.W. Contest
Feb.	3-4	Space Net VHF Contest
Feb.	3-4	ARRL DX Phone Contest
Feb.	10-11	QCWA QSO Party
Feb.	10-11	CCHSRC "Operation's Day"
Feb.	17-18	ARRL DX C.W. Contest
Feb.	24-25	French Phone Contest
Feb.	24-25	YL-OM Phone Contest
Mar.	3-4	ARRL DX Phone Contest
Mar.	10-11	YL-OM C.W. Contest
Mar.	10-11	WAB HF Phone Contest
Mar.	17-18	ARRL DX C.W. Contest
Mar.	**24-25**	**CQ WW WPX SBB Contest**
Mar.	24-25	WAB HF C.W. Contest
Mar. 31-Apr. 1		WAB LF Phone Contest
Apr.	7-8	WAB LF C.W. Contest
Apr.	21-22	Bermuda Phone Contest
May	5-6	Bermuda C.W. Contest

Louisiana QSO Party

Starts: 1800 GMT Saturday, January 20
Ends: 2200 GMT Sunday, January 21

This is the eighth annual QSO Party sponsored by the Lafayette ARC. The same station may be worked on each band and mode for QSO points.

Exchange: QSO no., RS(T) and QTH. Parish for La. stations, ARRL section or country for others.

Scoring: One point per QSO, including in-state contacts for La. Multiplier for La. stations is ARRL sections worked, others use La. Parishes. (max of 64.)

Frequencies: C.W. — 3535, 7035, 14035, 21035, 28035, Phone — 3920, 7270, 14290, 21370, 28600 and 50125.

Awards: Certificates to top scorers in each ARRL section and country. And 1st, 2nd and 3rd place winners in La. and portable category. The K5AGI Trophy goes to the Top La. winner, and the W5DDL Trophy to the highest scoring portable in the party. (min. of 50 pts. for US and 25 for DX.)

Mailing deadline February 17th to: Lafayette ARC, c/o K5ARH, 123 Normandy Road, Lafayette, La. 70501. Include a s.a.s.e. for results.

Arkansas QSO Party

Two Periods: (GMT)
1900—0600 Sat/Sun. January 20/21
1200—2300 Sunday, January 21

This is the eighth QSO Party for the North Arkansas ARS. Stations may be worked on each band and mode.

Exchange: QSO no., RS(T) and QTH. County for Ark., ARRL section for others.

Scoring: Ark. stations score one point for each QSO, multiply by ARRL sections worked. Outside stations get 5 points for each Ark. contact and multiply total by Ark. counties worked. (max. of 75)



The QCWA's annual National dinner was held in Washington, D.C. last October. One of the highlights of the meeting was the presentation of certificates to members who have reached 50 years of service as a licensed radio amateur. Forty-four (44) were present and received their award from the Club's President, Senator Barry Goldwater. Your Editor was one of the honored recipients. (Any resemblance to the photo heading this column is purely accidental.)

* 14 Sherwood Road, Stamford, Conn. 06905.

Area	Maximum D.C. Plate Input Power in Watts													
	1800 to 1825 kc		1825 to 1850 kc		1850 to 1875 kc		1875 to 1900 kc		1900 to 1925 kc		1925 to 1950 kc		1950 to 1975 kc		1975 to 2000 kc	
	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night
Alabama	500	100	100	25	0	0	0	0	0	0	0	0	100	25	500	100
Alaska	1000	200	500	100	500	100	100	25	0	0	0	0	0	0	0	0
Arizona	1000	200	500	100	500	100	0	0	0	0	0	0	0	0	0	0
Arkansas	1000	200	500	100	100	25	0	0	0	0	100	25	100	25	500	100
California	1000	200	500	100	100	500	100	25	0	0	0	0	0	0	0	0
Colorado	1000	200	500	100	200	50	0	0	0	0	0	0	0	0	200	50
Connecticut	500	100	100	25	0	0	0	0	0	0	0	0	0	0	0	0
Delaware	500	100	100	25	0	0	0	0	0	0	0	0	0	0	100	25
District of Columbia	500	100	100	25	0	0	0	0	0	0	0	0	0	0	100	25
Florida	500	100	100	25	0	0	0	0	0	0	0	0	100	25	500	100
Georgia	500	100	100	25	0	0	0	0	0	0	0	0	0	0	200	50
Hawaii	0	0	0	0	0	0	0	0	200	50	100	25	100	25	500	100
Idaho	1000	200	500	100	500	100	100	25	100	25	100	25	100	25	500	100
Illinois	1000	200	500	100	100	25	0	0	0	0	0	0	0	0	200	50
Indiana	1000	200	500	100	100	25	0	0	0	0	0	0	0	0	200	50
Iowa	1000	200	500	100	200	50	0	0	0	0	100	25	100	25	500	100
Kansas	1000	200	500	100	100	25	0	0	0	0	100	25	100	25	500	100
Kentucky	1000	200	500	100	100	25	0	0	0	0	0	0	0	0	200	50
Louisiana	500	100	100	25	0	0	0	0	0	0	0	0	100	25	500	100
Maine	500	100	100	25	0	0	0	0	0	0	0	0	0	0	0	0
Maryland	500	100	100	25	0	0	0	0	0	0	0	0	0	0	100	25
Massachusetts	500	100	100	25	0	0	0	0	0	0	0	0	0	0	0	0
Michigan	1000	200	500	100	100	25	0	0	0	0	0	0	0	0	100	25
Minnesota	1000	200	500	100	500	100	100	25	100	25	100	25	100	25	500	100
Mississippi	500	100	100	25	0	0	0	0	0	0	0	0	100	25	500	100
Missouri	1000	200	500	100	100	25	0	0	0	0	100	25	100	25	500	100
Montana	1000	200	500	100	500	100	100	25	100	25	100	25	100	25	500	100
Nebraska	1000	200	500	100	200	50	0	0	0	0	100	25	100	25	500	100
Nevada	1000	200	500	100	500	100	100	25	0	0	0	0	0	0	0	0
New Hampshire	500	100	100	25	0	0	0	0	0	0	0	0	0	0	0	0
New Jersey	500	100	100	25	0	0	0	0	0	0	0	0	0	0	0	0
New Mexico	1000	200	500	100	100	25	0	0	0	0	100	25	500	100	1000	200
New York	500	100	100	25	0	0	0	0	0	0	0	0	0	0	0	0
North Carolina	500	100	100	25	0	0	0	0	0	0	0	0	0	0	100	25
North Dakota	1000	200	500	100	500	100	100	25	100	25	100	25	100	25	500	100
Ohio	1000	200	500	100	100	25	0	0	0	0	0	0	0	0	100	25
Oklahoma	1000	200	500	100	100	25	0	0	0	0	100	25	100	25	500	100
Oregon	1000	200	500	100	500	100	100	25	0	0	0	0	0	0	0	0
Pennsylvania	500	100	100	25	0	0	0	0	0	0	0	0	0	0	0	0
Rhode Island	500	100	100	25	0	0	0	0	0	0	0	0	0	0	200	50
South Carolina	500	100	100	25	0	0	0	0	0	0	0	0	100	25	500	100
South Dakota	1000	500	500	100	500	100	100	25	100	25	100	25	0	0	200	50
Tennessee	1000	200	500	100	100	25	0	0	0	0	0	0	0	0	200	50
Texas	500	100	100	25	0	0	0	0	0	0	0	0	0	0	0	0
Utah	1000	200	500	100	500	100	100	25	100	25	0	0	0	0	100	25
Vermont	500	100	100	25	0	0	0	0	0	0	0	0	0	0	0	0
Virginia	500	100	100	25	0	0	0	0	0	0	0	0	0	0	100	25
Washington	1000	200	500	100	500	100	100	25	0	0	0	0	0	0	0	0
West Virginia	1000	200	500	100	100	25	0	0	0	0	0	0	0	0	100	25
Wisconsin	1000	200	500	100	200	50	0	0	0	0	0	0	0	0	200	50
Wyoming	1000	200	500	100	500	100	100	25	0	0	0	0	0	0	200	50
Puerto Rico	500	100	100	25	0	0	0	0	0	0	0	0	0	0	200	50
Virgin Islands	500	100	100	25	0	0	0	0	0	0	0	0	0	0	200	50
Swan Island	500	100	100	25	0	0	0	0	0	0	0	0	100	25	500	100
Serrana Bank	500	100	100	25	0	0	0	0	0	0	0	0	100	25	500	100
Roncador Key	500	100	100	25	0	0	0	0	0	0	0	0	100	25	500	100
Navassa Island	500	100	100	25	0	0	0	0	0	0	0	0	0	0	200	50
Baker, Canton Enderbury, Howland	100	25	0	0	0	0	100	25	100	25	0	0	0	0	100	25
Guam, Johnston Midway	0	0	0	0	0	0	0	0	100	25	0	0	0	0	100	25
American Samoa	200	50	0	0	0	0	200	50	200	50	0	0	0	0	200	50
Wake	100	25	0	0	0	0	100	25	0	0	0	0	0	0	0	0
Palmyra, Jarvis	0	0	0	0	0	0	0	0	200	50	0	0	0	0	200	50

160 Meter Regulations

Frequencies: C.W. — 3560, 7060, 14060, 21060, 28060. S.S.B. — 3960, 7260, 14320, 21360, 28560. Novice — 3735, 7175, 21110.

Awards: Certificates to the highest scoring station in each ARRL section with 100 points or more.

Mailing deadline is February 15th to: North Arkansas ARS, c/o WA5ZKE, Route 1, Green Forest, Arkansas 72638.

French DX Contest

C.W.—Jan. 27-28 **Phone**—Feb. 24-25

Starts: 1400 GMT Saturday

Ends: 2200 GMT Sunday

You may work French continental stations, French DUF countries and also stations in HB, LX, ON, 9Q, 9U, 9X and 4U1ITU.

Exchange: The RS/RST report plus a progressive QSO number starting with 001. (French stations will indicate their dept. by 2 figures after their call.)

Scoring: Each QSO counts 3 points. You earn a multiplier of 1 for each French department (95), each Swiss canton (22), each Belgium province (9) each DUF country worked. Plus LX, 9Q, 9U, 9X and 4U1ITU.

Final Score: Total QSO points times the sum of the multiplier from each band.

Awards: Certificates to the top scorers in each country and US call areas. Contest contacts may also be applied for the many French awards, DUF, DPF, DDFM, and DTA.

Logs go to the REF Traffic Mgr., Lucien Aubry, F8TM, rue Marceau 53, 91120 Palaiseau, France.

CQ WW DX 160 Contest

Starts: 2200 GMT Friday, January 26

Ends: 1600 GMT Sunday, January 28

No change from last year's rules. This is a c.w. only contest, no c.w. to phone or cross band contacts allowed.

Exchange: RST and a three figure contact number starting with 001, plus your state or VE province. It is not necessary for DX to send their QTH, the prefix will identify them.

Scoring: For W/VE/VO 2 points per QSO with other W/VE/VO stations. Contacts with all DX 10, points for each QSO.

For all other countries: 2 points per QSO with stations in the same country, 5 points with stations in other countries. Except contacts with W/VE/VO which count 10 points.

Multiplier: For all stations, a multiplier of one (1) for each US state, Canadian province and DX country worked.

Final Score: Total QSO points multiplied by the sum of the multiplier.

Disqualification: Violation of the rules and regulations pertaining to amateur radio in the country of the contestant, or the rules of this contest, or unsportsmanship conduct, or taking credit for excessive duplicate contacts will be deemed sufficient cause for disqualification. Decision of the Committee is final.

Awards: Certificates to the top scorers in each state, VE province and DX country. Additional awards if the score or participation warrants.

A Plaque will be awarded by *CQ* to the highest scoring single operator station.

Hawaii and Alaska are considered as DX for QSO and multiplier credit. The District of Columbia counts as Maryland, and keep in mind that VE1 is divided into three provinces, Nova Scotia, New Brunswick and Prince Edward Island.

Log sheets and United States Regulations

for 160 may be obtained from *CQ*, include a large s.a.s.e. with sufficient postage with your request.

Mailing deadline is February 28th to: *CQ* 160 Contest, 14 Vanderventer Ave., Port Washington, L.I., N.Y. 11050.

Space Net VHF Contest

Starts: 6:00 p.m. Saturday, February 3
Ends: 6:00 p.m. Sunday, February 4
(Your Local Time)

This is another in the series of Space Net activities commemorating Apollo moon missions. This one is for Apollo 14, the landing in an exploration of lunar highlands, and golf courses. (Remember Alan Shepard two years ago? Hi!)

Use any of the v.h.f. bands, 50, 144, 220 and 432 mHz. (But no repeaters)

Exchange: RS(T) and Zip Code number. Non-US use P.O. name.

Scoring: Two points per QSO on each band. Multiplier is sum of different Zip Code areas worked. (Counted only once) There is also a bonus of 10 you add to your multiplier.

Final Score: Zip Code + 10 × QSO points. Same station may be worked on each band for QSO points but multiplier is counted only once.

Awards: To 1st and 2nd place winners in three classes based on power used. 1-25, 25-100 and over 100 watts input There are also awards for multi-operator stations, club participation and Novices. All stations submitting a log will receive attractive participating certificates.

Logs and request for additional infromation go to: Space Net VHF Contest, Att: A. W. Slapkowski, WB2MTU, Box 909, Sicklerville, N.J. 08081. Mailing deadline February 28th.

ARRL DX Contest

Phone: February 3-4 and March 3-4
C.W.: February 17-18 and March 17-18
Starts: 0001 GMT Saturday
Ends: 2359 GMT Sunday

The 39th running of this conest will again have the DX stations pointing their beams to the USA and Canada. The idea is to work as many W/Ks and VE/VOs as possible on all bands.

The fellows on this side will send a signal report and their state or province. The DX stations will add three digits to their signal report indicating their power input.

Get all the finer details and new disqualification criteria in the current *QST*.



Happy Trophy winners for Eastern Pennsylvania Pin the Apollo 11 VHF Space Net Contest last July 15-16. L. to R.—WA3JMM, WA3HOW, WA3LKO and WA3LNH. There's another Space Net Contest coming up next month.

It is recommended that you get and use the official ARRL log and summary and especially their excellent check-off list which are available from Headquarters. An s.a.s.e. will get them to you by First Class mail.

Address all requests and your logs to: ARRL Communications Dept., 225 Main Street, Newington, Conn. 06111.

QCWA QSO Party

Starts: 0000 GMT Saturday, February 10
Ends: 2400 GMT Sunday, February 11

This year's party will again be sponsored by the Dallas Chapter. Only contacts between members will count for the QCWA certificate and the National Headquarters Plaque.

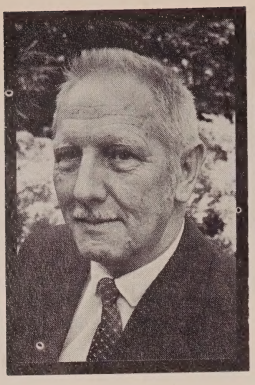
The object of this activity is to renew old acquaintances and to see how many members can be contacted. This year a special effort will be made to contact overseas members. It is suggested that they call 10 kHz plus or minus the listed frequencies, and that stateside stations do not call CQ on these frequencies.

Exchange: QSO no., RS(T), QTH, name and QCWA membership number.

Scoring: One point for each member worked. (A member may be worked only once regardless of band.) Multiply total QSO points by sum of States, VE provinces, Maritime mobiles, DX countries and Officers multiplier for final score.

Contacts with any of the officers or board members are worth extra *multiplier* credit

[*Continued on page 96*]



THE awards PROGRAM

BY ED HOPPER,* W2GT

THE January, "Story of The Month", as told by Ray is:

Ray A. Vigneux, VE3CBY
(All Counties #83, 8-12-72)

"It has been a long but fun road to All USA Counties and may I at once thank *All* who were so cooperative with the needed help.

"But back to the beginning; I was born in Windsor, Ontario in March of 1925. Attended grade school in La Salle, and graduated from Assumption High School in Windsor.

"Patti, my XYL, moved to Canada from Detroit in 1938 and we were married in 1948.

"Moved to Toronto that same year and opened the Steak Pit Dining Lounge and it is still at the same corner.

"We have 4 children, all at home, Tom 23, Bob 19, Jane 12, and Jo-Anne 11 (better known on the air as my wall to wall kids).

"Was a s.w.l. for many years but the amateur radio bug bit me in 1959. With help from my good friend Stayner, VE3CRM, received my Advanced class license in May 1960.

"Chased DX and received DXCC in April 1962. Won *CQ* WW DX Contest for Ontario in 1961-1962-1963 and 1964.

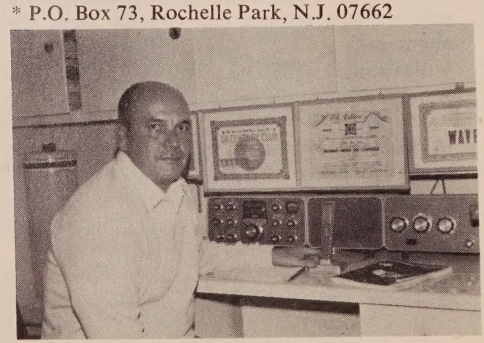
"Came across the 40 meter County Hunters in 1963 and Otts, K8CIR/8 in Montcalm County, Michigan gave me my start and Max, W9SOM/M9 in Mercer County, Illinois gave me #3079. Paul, W4YWX made the longest trip for me, 300 miles, for Doddridge and Tyler in West Virginia.

"I run a Drake TR4 and a Hustler Antenna Mobile, and on my last trip to Florida I gave out over 800 contacts and all on the run at 70 miles per hour, with zero ignition noise, so the weak contacts are a breeze (it pays to listen to those chalk talks by WØSJE). The home station equipment includes a Swan 500C; Heath SB200 and a TH6DX up 60 feet.

"Peoria 1972 has to be mentioned as the greatest ICHN Convention yet. Patti says all wives should come to the ICHN Conventions and join in all the fun. The Ladies had a ball this year as in the past."

(For those who do not realize it, Ray won #1 All Counties for Canada, and it is #3 for a station outside the USA. Roy, ZL1KG being #1, and Jim, TG9UZ being #2. Ed.).

* P.O. Box 73, Rochelle Park, N.J. 07662



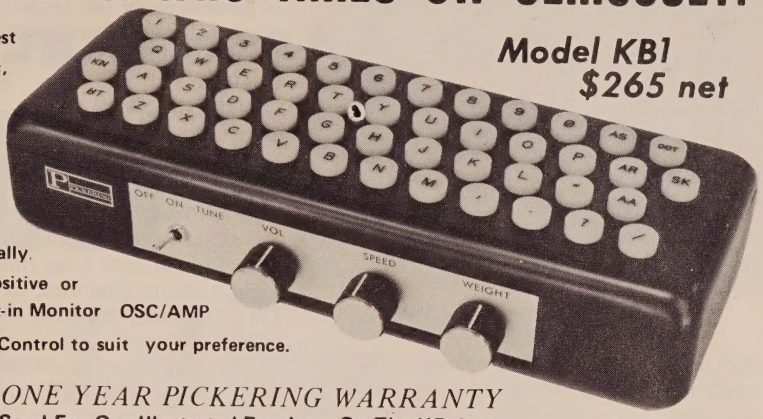
Ray Vigneux, VE3CBY.

Awards

Worked Reciprocal Operations Certificate: Fellow amateurs working under reciprocal agreement, portable in all parts of the world have formed the International Reciprocal Operators Club, which supports the establishment of worldwide reciprocal amateur radio privileges. Membership is open and free to all reciprocal operators. Send a copy of your home and foreign reciprocal license and a QSL with details of your operation/operations abroad with 2 IRCs to: IROC, Box 11, Medway, Maine 02053, USA. The IROC is

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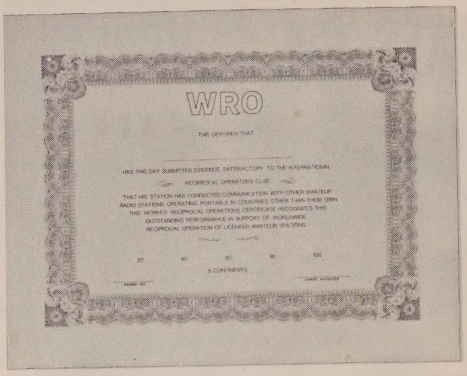
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73, Al

Al McMillan, WØJJK

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Worked Reciprocal Operations Award.

also sponsoring an awards program for all amateurs working with Reciprocal Operating Stations (They need not be IROC members).

The basic W R O, Worked Reciprocal Operations certificate is issued for contacts with 20 different reciprocal operating stations, such as F2BO/W1, W1AA/DL etc. Refer to the DXCC countries list; contacts with stations portable in their own DXCC country do NOT count, such as WIAW/1 or W1AW/6.

However calls issued to foreign nations (so called alien licenses) are valid and do count for W R O, when the home call of the station is noted in the award application; such as G5ABC—home call F3ABC.

Stickers are issued to the W R O award for 40, 60, 80 and 100 contacts and for working reciprocal statons in all six continents.

Send logbook data, certified by two licensed amateurs or club officials with one U.S. Dollar (or 10 IRCs) for basic Award to: I R O C, Box 11, Medway, Maine 02053, U.S.A. Stickers are free but please send s.a.s.e. or s.a.e. and 2 IRCs.

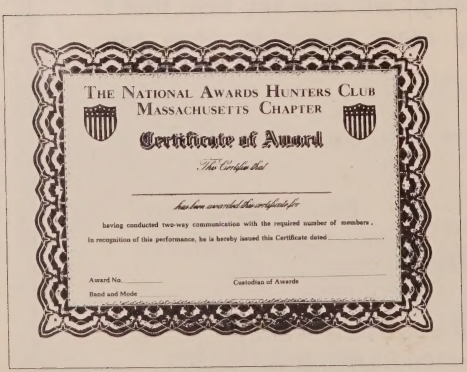
The Award is also issued to s.w.l.s, but in this case, QSLs of logged stations must be in possession of the applicant, GCR applies. Awards for amateurs in countries outside the Universal Postal Union are free and require no IRCs.

Naturally W R O #1 went to Senator Barry Goldwater, K7UGA for his contributions to the reciprocal operating privileges in the USA.

Ten O'Clock Line Award: This Award got the name from an Indian Treaty in Indiana. The Ten O'Clock Line runs through or into eight Indiana Counties, as follows: Brown, Clay, Jackson, Monroe, Owen, Parke, Putnam and Vermillion.

The Award is available by working the required number of Counties in classes as listed, or by working 10 holders of the Award. Class A—8 counties plus 3 Johnson County, Indiana stations. Class B—6 counties plus 2 Johnson County, Indiana stations. Class C—5 counties plus 1 Johnson County, Indiana station. Class D—10 holders of the Award. (Send s.a.s.e. for latest list to K9EMV). GCR log data and $1.00 or 10 IRCs to K9EMV, Win Hardisty 116 Mercantor Drive, Greenwood, Indiana 46142.

Work Members Of Mass. Chapter NAHC: Issued for having worked members of the Massachusetts Chapter National Awards Hunters Club *after* January 1, 1972. Mass. stations must work 25 Chapter members, rest of U. S. Work 10, and DX work 5. Submit full log data only. QSLs not required. Contacts on Chapter Nets do NOT count. NO higher class seals issued, but certificates will be endorsed for band and mode. Fee is 25¢ PLUS a s.a.s.e. (Note—Certificate will be folded to fit the envelope you supply.) Fee for DX is 3 IRCs. AWARDS Custodian is George Hayes, W1DOM, 29 Belmont Street, North Quincy, Mass. 02171.



Work Members Of Mass. Chapter NAHC.

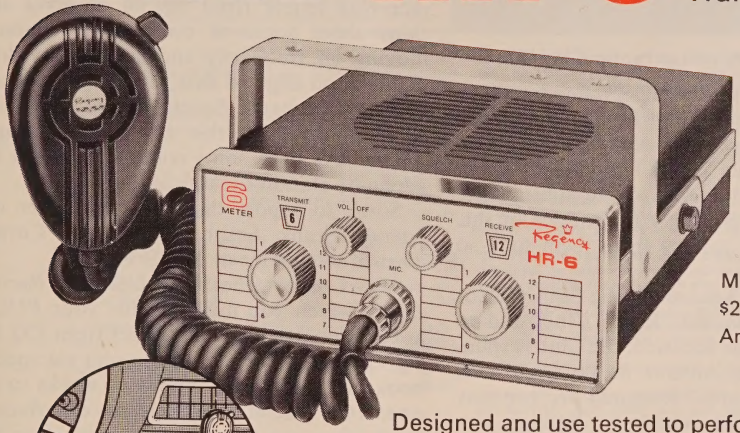
Notes

I am very happy to report on a letter received from Chris Lyons, VE3GUS, President 1972-73 of the Nortown Amateur Radio Club, VE3NAR. In case you do not know, the Nortown ARC, P.O. Box 356, Adelaide Street Postal Station, Toronto, Ontario, Canada issues two of the most popular Canadian Awards, WAVE and WACAN and their rules have been in my column several times, also I have complained of their SLOW service, due to my own experience and many letters of

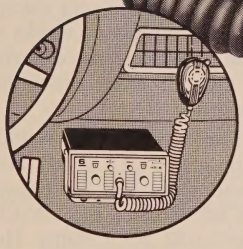
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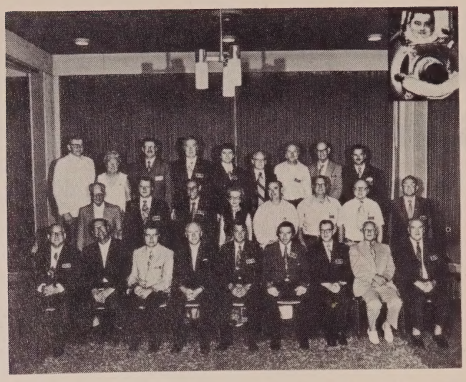
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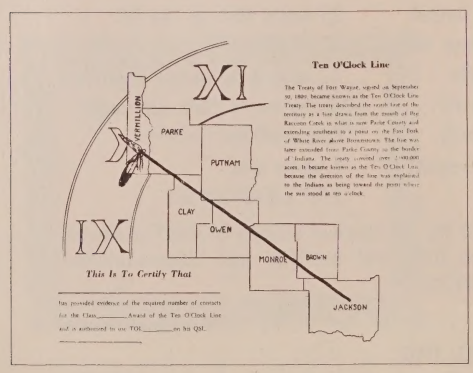
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complaints. Chris, VE3GUS wants to assure me that the troubles that caused the unreasonable delays have been rectified and I have also received other letters from recent applicants for those fine Awards, to substantiate his statement. I am sorry that notice of this new and normal service from them took so long to get to me.

The 1972-1973 season is the 25th year of the Nortown Amateur Radio Club, and to commemorate this occasion, the Club is sponsoring "Nortown Amater Radio Club 25th Anniversary Award." Required are two-way contacts with Club members: Foreign (including USA need 5 contacts; All Canadians (except VE3s) need 7 contacts; VE3s need 10 contacts. All contacts must be made between 0001 GMT September 1, 1972 and 2359 GMT August 31, 1973. Submit log data entries of contacts, including date, time in GMT, signal report, frequency, mode and station worked. Apply to QTH mentioned in the first part of my notes. Oh yes, there are some slight changes in the rules for the WAVE and WACAN Awards, but I do not have space for them now, if you can't wait until next month, send s.a.s.e. or s.a.e. and IRC for the latest rules (remember they can NOT use USA stamps, so get Canadian stamps or be sure to send IRC).



Ten O'Clock Line Award.

By the time you read this, most will have had time to read and digest the new FCC Rules, at this moment the only change that I can see for the average County Hunter is that unless you plan to go mobile or portable for 15 days or longer, it is *not* necessary to notify your district inspector.

Speaking of FCC regulations, I have been receiving letters from official observer stations about some of our County Hunters moving off frequency and getting too close to the band edge so that their sidebands are OUT of the band! Several stations received FCC citations for this about 2 years ago. There have been some complaints about inadequate station identification.

Sorry to report the loss of another old friend, Frank Smith, W5VA of Corpus Christi and owner of KRIS-TV.

May I repeat, the NEW *USA-CA Record Books* which you must use for your *FIRST* application are available direct from CQ for $1.00 postage paid. They are sent via special book rate and take a couple of weeks to arrive. (Oh yes, if you have an old *Record Book*, they are OK for any application for the USA-CA Award).

Through the kindness of Max, W9SOM is the foto of a fine group of County Hunters who have worked them all. First row, left to right are: Cliff Corne, Sr., WA9DCQ father of the deceased #1 County Hunter, K9EAB whose foto is in the right upper corner; Otts, K8CIR; Charles, WØBL (ex-WØJWD); Leo, WB4WDY who has never applied for *CQ* All Counties; Phil, WAØEVO; Paul, W4YWX; Earl, W7KOI; George, W1EQ and Duane, K2PFC.

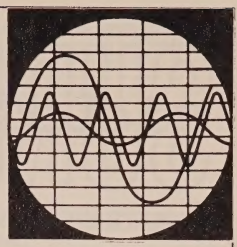
Second row of photograph, left to right: Jack, WØSJE; Dick, WAØDCQ; Marv, WB2SJQ; Cleo, WAØSHE; Steve, K5KDG; Larry, W4GGU; Ed, WAØSBR; and Don, WAØJRS.

Third row, left to right: Dick, W2BLM; Ella, WØAYL; Skip, WAØWOB, Joe, W9DRL; Bob, WA4LMR; Kib, WA4ULL; Father Terry, K6HZI; John, W4HA; and Ben, K5YWX. I hope the foto of K9EAB in the upper right hand corner does reproduce ok.

May I wish you and yours all the best in 1973. Write and tell me—How was your month? 73, Ed., W2GT.

SLEP'S SPECIALS

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electronic distributors

COLLINS R-389/URR VLF RECEIVER, tunes 15KHz to 1500KHz, digital read-out, VLF version of R-390/URR, the best, 19" rack mount. **$450.00**

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MD-129/GRC-27 MODULATOR, goes with T-217/GRC 27. ..... **39.50**

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19" OPEN FRAME 6½ FT. HEAVY DUTY RACK drilled to mount any military 19" equipment. Shipped knocked down with all hardware. Shipping weight 100 lbs..... **37.50**

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SURPLUS sidelights

BY GORDON ELIOT WHITE*

ANOTHER interesting military antenna has come along in surplus. The manufacturer will probably be flabbergasted to hear that these are actually getting into the excess category, since he is selling them briskly to Uncle Sam, but at least one has gone the way of all government goodies. This is the MLA-2/B, designed by Antenna Research Associates, Beltsville, Maryland.

Fig 1 is a drawing of the MLA-2/B, a rather odd-looking loop device which has the interesting capability of handling a kilowatt continuously over the high-frequency band 3-25 mHz.

There is not a great deal of gain in the MLA-2, except above 17 mHz, but the antenna has a beautiful elevation pattern that covers both high-angle and low-angle radiation, with a 4 mHz coverage that is almost perfectly uniform. (fig. 2) The horizontal pattern is the typical figure eight of a loop, and it offers excellent directivity, with an inherent noise-figure improvement over a dipole. The pattern null is rated as sharp as 20 db.

The MLA-2's longest suit is its size, offering the performance of a half-wave antenna with a device no longer than 54 inches.

*1502 Stonewall Rd., Alexandria, Va. 22302

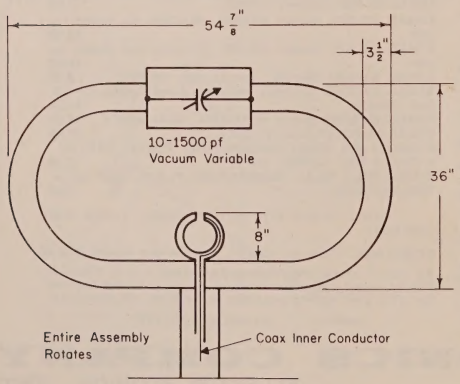


Fig. 1—The MLA-2/B loop antenna.

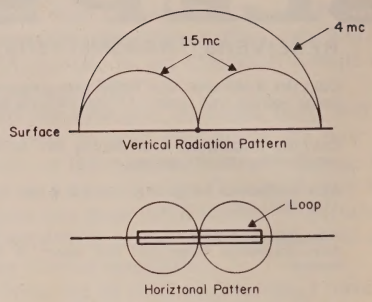


Fig. 2—Radiation patterns for the MLA-2/B.

Now let me say that I doubt the average reader will find a MLA-2 in a surplus store any time soon, but the design of the antenna could be a starting point for some very useful amateur projects. From a commercial standpoint, A.R.I. of course has a patent (no. 3,588,905) but amateurs might use it as a basis for their own experiments.

The theory of the MLA-2 is an impedance transformer from a 50 ohm transmission line to the nominal 377 ohm radiation resistance of free space. The input to the antenna is to a feed loop placed within the primary loop. The signal is inductively coupled to the primary, which is the radiating body. There is no direct connection between the primary (outer) loop, and the feed loop.

Tuning of the primary loop is accomplished by varying a motor-driven, remotely-controlled vacuum variable capacitor inserted in the top of the loop. The value is varied from 10 to 1,500 picofarads.

The loop itself is constructed of three and one-half inch diameter tubing, and the whole assembly is a rugged device, capable of standing up in 100 mile an hour winds.

The feed loop is matched to the trans-

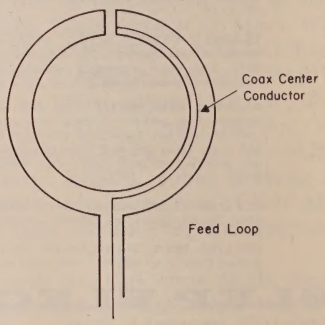
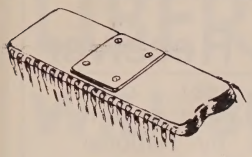


Fig. 3—Matching system for the MLA-2/B.

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74193 up/down binary counter	2.00
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8280 preset decade counter	1.15
8281 preset binary counter	1.15
8520 25 MC divide by "N" 2 to 15	2.00
7495 4 bit SHIFT REGISTER	1.15
8590 8 bit shift register	2.00
8270 4 bit shift register	2.00

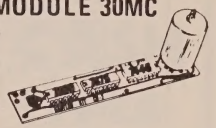
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Op-amp package 10-741's, data sheet and application notes ..... only $5.00

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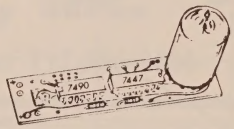
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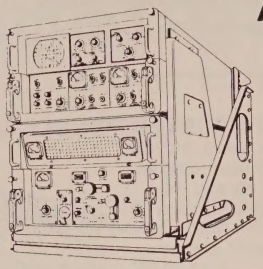
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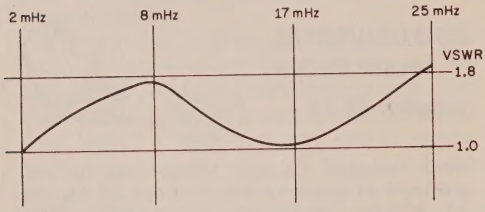


Fig. 4—Rough v.s.w.r. figures over the 2-25 mHz range.

mission line by bringing the coax into one side of the loop, as per the ratio of the diameter of the feed loop to the primary is 1:6. In the actual MLA-2 the feed loop appears to be more or less a standard aircraft loop direction finder about eight inches in diameter. The old MN-26 World War II loop was of the same general size.

The primary loop has an average radius of twenty-two inches, but it is flattened, and the resulting shape is 51⅞ inches across (center of tubing) and 36 inches high (center to center of tubing).

The MLA-2 needs to be operated between

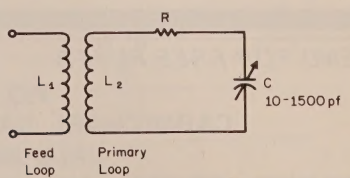


Fig. 5—Schematic representation of the MLA-2/B.

three and five feet above the surface, and requires no ground system. V.s.w.r. with a 50 ohm line is 2:1 or better. Fig. 4 indicates the rough v.s.w.r. figures over the 2-25 mHz range, and Fig. 5 is the schematic representation of the design.

This cost the U.S. about $3,000, by the way.

I have not transmitted with the MLA-2/B, but I have seen it in action with a receiver, and its performance was excellent over a wide range of frequencies, directions and wave angles. ■

Math's Notes [*from page 46*]

should of course obtain applicable data sheets for specific details.

cuits we would like to mention this month

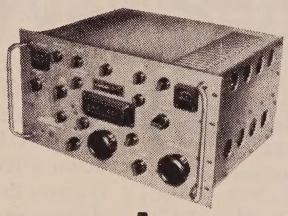
There are two new 7400 series TTL cir- and both are from Texas Instruments. The two chips are the SN74143 and SN74144. Both are fairly complex integrated circuits containing a decade counter, storage capabilities, BCD to 7 segment decoder and LED or lamp driver. With one of these 24 pin plastic DIP packages you have the complete decade counter stage less only the readout. Small quantity price for these is in the area of $5 and for quantities of 100, they drop to $3.60 each. Write to TI for additional data.

At this point I would like to wish all of my readers a very happy, healthy and prosperous New Year, and of course, the very best of DX.

73, Irv, WA2NDM

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F.M. [*from page 36*]

especially when working through a repeater. Sometimes repeaters aren't on the standard 600 kHz low in/high out spacings.

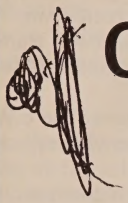
Next, when working through a repeater or on a busy channel, don't hog it. Standby periodically for breakers or to see if someone else would like to use the frequency. Also, don't talk very long, for most repeaters will shutdown after 1 to 3 minutes until you let the receiver drop. Just a bit of enforced courtesy. Always recognize a breaker immediately for he may have emergency traffic. On the other hand don't break into a QSO unless invited or if you have information which is being requested. Its a two way street.

Now for some of the most misued, misunderstood, mis everything differences of f.m.

First of all, S meters are useless for casual operation. This is doubly true when working through a repeater. Since everyone is being retransmitted through the same system and coming out through the same transmitter all signals will have the same signal strength. The main use of the S meter is in a base situation using directional antennae (peak the signal on the meter by turning the antenna) and for alignment of the receiver.

In a.m. or s.s.b. the loudness of a signal is dependent upon the signal strength. In f.m. the loudness is dependent upon the deviation of the transmitter (how far the frequency swings on either side during modulation). When a signal is weak it has varying amounts of noise present. The more noise the weaker the signal. If a signal is relatively free of noise a stronger signal will not sound any louder than the original signal if the deviation is the same. The trend in the United States is to get everyone using "narrowband" or ±5 kHz deviation. In some older receivers designed for "wideband" or ±15 kHz deviation the audio recovery or loudness will be marginal. However, this is a deficiency in the other station's receiver, not in your transmitter. Unfortunately not all off-the-shelf amateur f.m. gear is set by the factory to ±5 kHz, and some of your friends using gear like yours may sound a bit louder than others on the frequency until the deviation is correctly set

Now, you are crystal controlled and therefore must be right on frequency, right? Wrong! At 80 meters a crystal 0.01% tolerance can be at most 400 Hz off, real near frequency. At 2 meters this is 14.6 kHz, half



CQ Survey Shows Ham Market Growth

We're pleased to announce that CQ's marketing staff has just completed a new market survey, and from all outward indications, the amateur radio market has reached its highest peak in the history of the service.

On June 2, 1972, five thousand questionnaires were mailed to randomly selected amateurs. Of these, approximately one hundred seventy were not delivered by the post office because of innacurate addressing, and of the remaining forty eight hundred thirty that did reach addresses, fifteen hundred forty four were completed and returned as of August 3. This is a 32% return, extremely high, and we wish to thank all those amateurs who took the time and effort to aid in this project.

Some of the results were exciting to behold. For example, of the 1,544 amateurs participating, 1,065 spent money during the past year on parts for building and experimenting, and spent a total of $184,493 in this area alone, or an average outlay of almost $180 per person.

The figure for replacement parts was 948 amateurs with a cash outlay of $47,437.

The money spent by hams on equipment was equally impressive. The 1,544 amateurs bought 751 pieces of new major equipment (transceivers, receivers, transmitters and amplifiers) and they spent a total of $295,929 in just twelve months.

For antennas the figures were also substantial: 666 new antennas purchased at a gross cost of $37,278.

It was fascinating to discover that v.h.f.-f.m. equipment and accessories represent almost 25% of all dollars spent, and about 33% of all units purchased. A similar interesting response was noted on questions pertaining to amateur TV. The survey indicates that approximately 5% of all hams are already experimenting with or operating ham TV, and that an additonal 10% will join the ATV ranks within the next twelve months.

A complete thirty-six-page report has been printed and mailed to all major manufacturers and dealers in the amateur market. If by any chance we've missed someone who can use a copy of the report, just get in touch with the CQ marketing staff and we'll be happy to accomodate. However, we must mention that the supply is limited and must be restricted only to companies or individuals who sell products or services to amateurs.

way to the next channel. Most amateur f.m. equipment is designed for crystals with a tolerance of 0.001% or 0.0005%, about 1500 Hz and 750 Hz respectively. This is after the crystal has been set or "warped" to frequency. Almost all f.m. equipment has provisions to bring the crystal onto the correct frequency. These warping circuits can pull a crystal as much as 30 kHz to either side(one whole f.m. channel!) if incorrectly adjusted. Thus, it is real easy to get off frequency even though the rig is crystal controlled. When in doubt, get with someone with an accurate frequency standard (not another receiver) like a counter and check things out.

Enough for now. Next month some more on the technical side for the f.m. newcomer.

Tips and Tidbits

The previous editions of "Tips and Tidbits" have proved popular, so here goes another one!

Tip: Fill those antenna connectors with silicone grease and tape well to keep out water. Sure helps the pocketbook, for water ruins coax quite rapidly.

Tidbit: Dick Ross doesn't have 2 meter f.m. in his Porsche.

Tip: If you're having trouble with alternator whine in your solid-state rig, try running a shielded lead (i.e. old RG8/U) directly to the battery.

Tidbit: A second full blown edition of the Repeater Directory is upcoming shortly. Get your info in ASAP.

Tip: In an emergency wire solder can be used as a mobile rig fuse. Each strand of 0.031" diameter 60/40 blows at about 10 amps. Replace with proper fuse when possible.

Tidbit: F.m.'ers are really not rabid, it only seems that way.

Tip: If your solid-state rig is not controlled by the ignition switch, turn it off when starting the car. Voltage spikes caused by the inductive "kick" of the solenoid cutting out can wipe out transistors. The ignition switch kills accessories during start cycle.

Tidbit: A good way to get local DX low band operators on f.m. is to start a DX alert net. Then, move them over to the repeater.

Tip: Don't use nylon tie wraps to hold up more than one coax line up a tower. They just won't hold much more.

Tidbit: Living on top a high hill sure helps.

Tip: When sharing a site with other commercial or amateur units, don't put the repeater antenna on the very top. Let someone else be the lightning rod!

Tidbit: Dick Cowan doesn't play fair, he uses a v.f.o. and a counter on 2 meter f.m.

Tip: The old "hump" type sideband transceiver mobile mounts do an excellent job with the larger f.m. units.

Tidbit: Who says v.h.f.'ers never use c.W. You have to copy fast just to see what repeater you just hit.

Tip: Be careful when buying a commercial portable unit from an unfamiliar source. Many are being stolen, and the amateur market is a natural.

Tidbit: Remember when an 8 watt f.m. rig took up the entire trunk.

Tip: Put a good ground at the base of a home tower. Concrete is a fair insulator.

Finale'

With Docket 18803 and comments on it, redoing several columns, and the like, there just hasn't been time to get the news items prepared for the January column.

73, Glen, K9STH/5

Ham Clinic [*from page 14*]

HW-101 Sidetone Volume Problem

"My sidetone volume on my HW-101 is maximal. Any way to add a control?"

First see the information in the April 1972 Q&A Column.

Yes. The easy change is to replace R_{326} (1 megohm) to 6.8 megohms. This seems to provide an ideal level not too loud or too weak.

Remember that the a.f. circuit board for the HW-101 and the SB-102 are the same —the only changes you will notice are the markings on top of the board. The SB-102 includes a C.W./Tone/Volume Control circuit. This consists of two additional components on the a.f. circuit board—a .005 mf disc capacitor and a 500K ohm pot (price 60c from Heath—#10-149). Basically, the circuit is the same as presented by WA6HYB in the 1972 April issue of *CQ* except that R_{326} is not used and other different component values *are*. Ordering the pot from Heath directly makes installation simple and consists of removing R_{326}; installing the 500K ohm pot on the foil side of the a.f. circuit board. (Be sure to solder the case to the foil). This is R_{335} on the SB-102 schematic. Then merely install the .005 mf disc pin 1 of $V_{15}B$ (where one lead of R_{326} was

[*Continued on page 94*]

SSTV [*from page 52*]

siderably between vidicons of different manufacturers. Target and beam settings are more critical than normal, but many have gotten good pictures this way.

Q & A

Q. Would you please send me a list of articles on the subject of slow-scan TV?
A. Included in this issue is a rather complete list of slow-scan articles. Many thanks to Ted Cohen, W4UMF, one of the earliest slow-scanners, who has been sending out bibliographies for years, and who got most of this material together. Vy 73, Cop, W1GNQ

Late OSCAR News [*from page 64*]

within a 100 kHz-wide passband in the 2 meter band (between 145.90 and 146.00 mHz) and repeats the transmission within a corresponding 100 kHz-wide passband in the 10 meter band (between 29.45 and 29.55 mHz). The relationship between transmit and receive frequencies is shown in Table I. For example, if you transmit on 145.95 mHz, listen on 29.50 mHz If you hear a signal on 29.480 mHz and you want to call him, transmit on 145.930 mHz, etc. Due to Doppler shift, this relationship will vary slightly in practice. As the satellite approaches, the received signal will appear to be as much as 4 kHz higher in *frequency*. At the point of nearest approach, the Doppler shift should be near zero. As the satellite continues away from the receiving station, the frequency will continue to *decrease* for about another 4 kHz.

TNT Transmitter [*from page 42*]

at too high a frequency, it shows the grid turns should be increased. This trouble is not likely to happen, however, if the construction specifications are followed carefully.

Coupling to the Antenna

With the oscillator operating on the desired frequency, the antenna and ground connections are made and the antenna coil swung near the plate tank coil. As the antenna is tuned it will be found that the plate current of the oscillator rises and the tuning lamp becomes dim as the antenna takes power from the transmitter.

Antenna coupling is critical in this type of transmitter. It should be as loose as possible, and should be decoupled from the position of maximum output until plate current drops about 10 percent from maximum value.

160 Meter Operation

This transmitter may be placed on the 160 meter band if the coils are changed. The new plate coil consists of 25 turns of #14 enamel wire on a 3″ diameter form, with spacing equal to the wire diameter. The grid coil is 150 turns on a 2½″ length of 1″ diameter tubing. Turns should be added or subtracted to the grid coil until the set operates stably over the required frequency range. Operation on frequencies higher than 80 meters is not recommended.

On the Air in 1972?

This little museum piece may be placed on the air and used for contacts provided the signal is *constantly monitored* for frequency and quality in a nearby receiver. It is recommended that a voltage regulated power supply be used and that plate voltage be held to less than 400 volts. With proper antenna adjustment the little transmitter puts out a fine, T9 signal and the unsuspecting listener is often astounded when he finds out the equipment being used!

It is difficult to find a 10 tube these days, but they can be picked up on the surplus market, on occasion. An 801 or a 10Y (VT-25) military type will be a satisfactory substitute. (Don't use the VT-25A. It is for audio service and has an oxide filament!)

A simple antenna is a Marconi type, about 70 feet long, series tuned with a 500 pf capacitor. Since the antenna is directly coupled to the oscillator, any movement of the antenna in the wind will impart a "swing" to the transmitter frequency of a few hundred cycles.

While the little transmitter is a good performer, it is a "maverick" and should be continually monitored while in use. Three or four of these little gems are on the air in the San Francisco area and the operators have a lot of fun with them. The modern ham, unused to operating with a self-excited oscillator may have a nervous time of it, until he gets the hang of things.

Since this equipment is not considered the state of the art, its use should be tempered with caution. If in doubt, enjoy building it and place it in the corner of your operating desk. Watch the eyebrows of the next old timer in your shack. They'll go up the ceiling when he sees this replica of yesterday on your desk! ■

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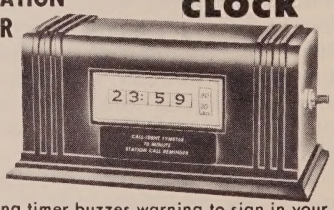
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DX [*from page 70*]

Silent Key: We are saddened to report the death of Roy Alciatore, W5RU, owner of *Antoine's* in New Orleans. Roy died on Sept. 29, 1972 after a long illness. There was always a table for DXers at *Antoine's* no matter how large the crowd. We will always remember Roy's gracious hospitality.

VE Outgoing Bureau: The Canadian DX Association outgoing QSL Bureau has become so popular that it has become necessary to establish a branch in Montreal to handle outgoing cards for VE1, VE2, VO1 and VO2 amateurs. The new branch is operated by Morris, VE2CN, P.O. Box 458, Montreal 101, Quebec.

W2 Area DX Committeeman: Effective Jan. 1, 1973 the *CQ* DX Advisory Committeeman for the 2nd call area is Ed Hopper, W2GT, of the North Jersey DX Association. Thanks to Lew Levitt, WB2NDI, of the Kings County Radio Club for a fine job the past 2 years.

Monoband WAZ

As of midnight, Dec. 31, 1972, the monoband WAZ chase is on. The November issue gives the details regarding rules and trophies.

QSL Information

A2CAY—Via WA1HAA
A35FX—To ZL2AFZ
C31FV—c/o DL2AK
CE3OAF/CE0—Via SM3CXS
CR3AB—To K3RLY
CR9AK—c/o CT1CY
EL2CB—To W3HNK
ET3USA—Via W4NJF
ET3USB—Via WB4UKA
ET3USF—To W3KT
F0WV/FC—c/o ON4TJ
FB8XX—Via F2MO
FB8ZZ—To F8US
FK8AU—c/o I1PQ
FL8HM—Via K4SKI
FO0ES—To K6KRZ
FO0JS—c/o F2KO
FP8DH—Via VE6AYU
FS7DX—To W3HNK
GD3RFK—c/o K4TSJ
GM5ATY—Via W5VNL
HB0AIC—To HB9AIC
HB0NL—c/o HB9NL
HB0XKW—Via WB8AKW
HB0XLG—To VE6AGV
HR1RF—c/o W5ZWX
HS4AGN—Via W5LUJ
HS4AHV—To W6NYG
HV3SJ—For 80 & 40 meter QSO's on Sept. 29 & 30, QSL to W21WC, 644 Rose Blvd., Baldwin, N.Y. 11510
IH9JT—c/o IT9JT
IH9PLT—Via IT9PLT
JD1ADG—To JA2GXQ
JY9EB—c/o W3EMH
JY9YL—Via W3EMH
KG6JBO—To K1JHX
KG6SL—c/o WA6AHF
KS4KZ—Via WA8TDY
KX6MD—To K6CKB
LG5LG—c/o LA4YF
LU1ZC—To K4MZU
MP4TDM—Via K1DRN
MP4TEE—To G3LQP
ST2SA—c/o K3RLY
SV0WJJ—Via WA1HAA
TL8LI—To 9Q5LI
TY1BF—c/o WA4WTG
VK2BCV/VK9—Via Golden Gate QSL Bureau, 71 Surrey St., San Francisco, CA 94131
VK2BQQ/LH—To VK2BQQ
VP2EQ—c/o WB2ZMK
VR1W—Via W6CUF
VU2FBZ—To K6TWT
YB0ABE—c/o K5GUZ
YJ8BL—Via W6NJU
ZD8BR—To W6EJT
ZD8GC—c/o W5ULN
ZD8US—Via K8NSA
ZF1EP—To W4PJG
ZK2BD—c/o Radio Station, Niue Island, via New Zealand
ZL3KK/C—To ZM4CR
ZS2MI—Via ZS6LW
3X1P—To SM0KV
4W1AF—Via G4ATQ
5H1LV—c/o K3RLY
5T5DY—Via CN8CG
5W1AU—To W6KNH
7Z3AB—c/o W5NOP
9G1WW—Via W5EGH
9H3D—To G3PRS
9J2HI—c/o WA2CRD
9L1VW—Via K9QZI
9M6HM—To K6ZIF
9N1MM—c/o W3KVQ
9X5VA—Via W2PPG
73, John, K4IIF

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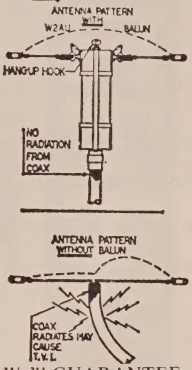
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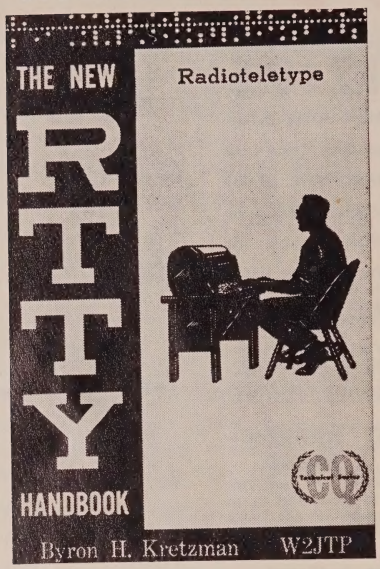
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SIRS: My check (money order) for $_____ is enclosed. Please send _____ copies of the "The New RTTY Handbook.

Name_____

Address_____

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Ham Clinic [*from page 90*]

removed). *to* pin 3 of the 500K pot—a hole is provided for this—C_{319}. Thanks to WA4VQD/4).

NCL-2000 A.L.C. Delay

"I am sure that I am not alone when I say that I retained my NCL-2000 linear after buying a few transceivers having a.l.c. inputs. Some gave no trouble at all (the tranceivers I mean). Others did. Now the current one a (Japanese model) does have an a.l.c. output and the delay is disturbing to say the least. What can I do? I've had my good old NCL-2000 since 1965."

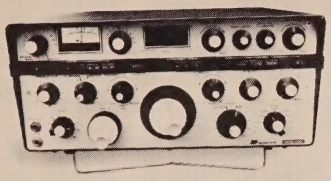
Well, there's a method. Instead of opening the ground return of the grid bias regulator's zener diode and control transistor as was previously done to cut off the final 8122 tubes, the ground return of the screen supply is now opened during standby *A*. disconnect the orange wire at the junction of CR_9 and R_{42}. Connect a jumper between the junction of CR_9 and R_{42} and the adjacent ground lug. *B*. Dissconnect CR_3 and CR_6 rectifiers from the lug nearest the front panel and then reconnect CR_3 and CR_6 to the adjacent empty lug C. Splice a 9 inch length of wire to the orange wire disconnected earlier. *D*. Connect the other end of the wire spliced to the orange wire then to the lug to which CR_3 and CR_6 are connected. *E*. Disconnect the blue wire connected to the ground lug near the relay terminal strip J-6. Then splice a 17 inch length of wire to the blue wire and route the new wire along the harness past the PA load capacitor . . . (C_6) & S_4 point; and then connect this wire to the lug where CR_3 and CR_6 *were* connected before—where the black wire and one end of R_{35} are connected. Make sure all connections are *hot* soldered.

R.F. Saturation

"I'm a new ham and have a ham neighbor behind me. We both use inverted "V's". When I'm on 40 I 'click' him out. I've tried everything. The set I use is a DX-40. Any help?"

Working so close together the r.f. fields are *great*. R.f. saturation is no doubt the problem. Key click filters, high "Q (crystal type) antenna filters etc., will work but not when two antennas are oriented the same and so close together. The best solution to your operating problem is to arrange an operations schedule. 73, Chuck, W6QLV

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by signal/one

SPECIFICATIONS

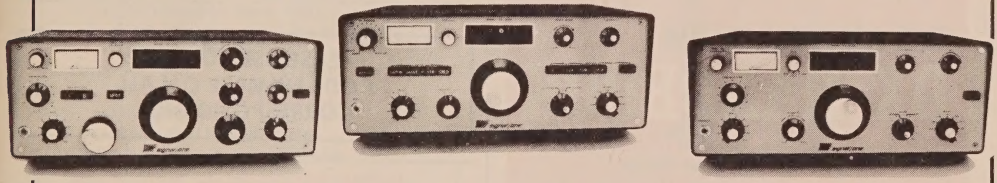
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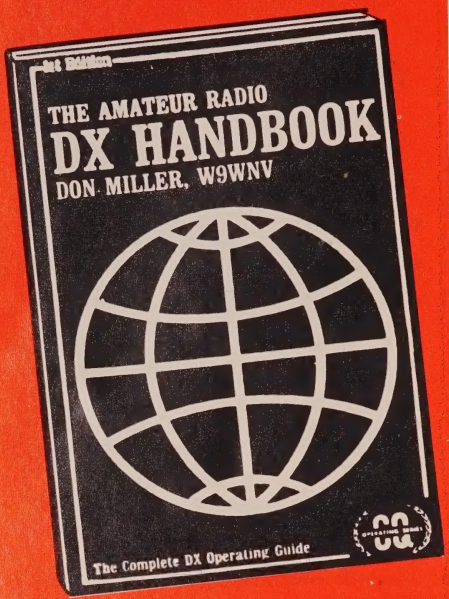
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Propagation [*from page 73*]

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	09-10 (2)	07-09 (2)	14-16 (4)	19-20 (2)
	10-13 (3)	09-13 (3)	16-18 (3)	20-03 (3)
	13-15 (2)	13-15 (4)	18-20 (2)	03-04 (2)
	15-16 (1)	15-16 (3)	20-04 (1)	04-06 (1)
		16-17 (2)	04-06 (2)	19-21 (1)*
		17-18 (1)	06-08 (3)	21-03 (2)*
			08-13 (2)	03-05 (1)*
Western USA	07-08 (1)	06-07 (1)	06-07 (2)	16-18 (1)
	08-10 (2)	07-08 (2)	07-09 (4)	18-19 (2)
	10-13 (3)	08-10 (3)	09-14 (3)	19-22 (4)
	13-15 (2)	10-14 (4)	14-16 (4)	22-02 (3)
	15-17 (1)	14-16 (3)	16-18 (3)	02-04 (2)
		16-18 (2)	18-22 (2)	04-09 (1)
		18-19 (1)	22-06 (1)	19-20 (1)*
				20-22 (2)*
				22-04 (3)*
				04-05 (2)*
				05-07 (1)*

Contest Calendar [*from page 77*]

as follows: With the President K7UGA (or W3USS) 4 points, with Vice President W6ATC 3 points, and the rest of the officers W2HX, W2JE, W2KH, W2KW, W3RE, W4YK and W8KW, 2 points. (Remember these are multiplier points like states, provinces and etc.)

Frequencies: C.W.—3580, 7080, 14080, 21080, 28080. Phone—3980, 7280, 14280, 14345, 21380, 21445, 28580. RTTY—3595, 7095, 14095, 21070, 28070.

[*Continued on page 98*]

PLEASE USE YOUR ZIP CODE NUMBER ON ALL CORRESPONDENCE

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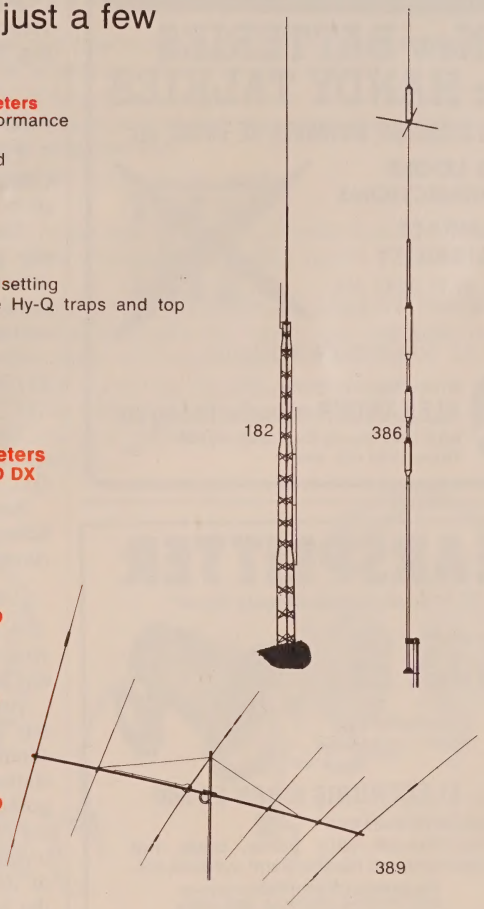
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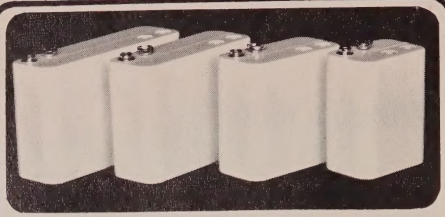
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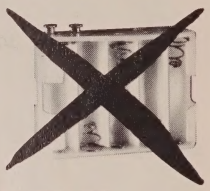
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Contest Calendar [*from page 96*]

Awards: The QCWA Plaque to the "Top Banana" in the party, to be permanently retained by the member winning it three times. (Don McClenon, W3IN has one leg on it.) Also a certificate to all stations working 100 or more members.

Mailing deadline is March 10th: L. F. Heithecker, W5EJ, 1409 Cooper Drive, Irving, Texas, 75060.

CCHSRC "Operation's Day"

8:00 A.M. to 8:00 P.M. EST, Sat., Feb. 10th

This is the 4th year the boys at the Colonie Central High School of Albany, N.Y. have planned an "Operation's Day."

They will have two c.w. and two phone rigs going for the full 12 hour period, with activity alternating between the different bands. On c.w. the emphasis will be on operation in the Novice bands.

Frequencies: C.W.—3725, 7175, 21120, 21150. Phone—3920, 7275, 14280, 21310, 21375, 28550.

The Club station, WA2DNR has had a special card printed for this occasion and all QSL's will be answered.

Send your cards to: Colonie Central High School Radio Club, WA2DNR, 100 Hackett Avenue, Albany, N.Y. 12205.

Editor's Notes

A reminder that the deadline for mailing your c.w. logs for last November's WW Contest is January 15th.

And another reminder, this one regarding our 160 Contest. W/K and VE stations should keep the "DX Window" clear of any stateside contest operation. We are just not going to hear the weak DX signals if they are covered by strong state-side activity. And trying to work DX on frequency is a waste of time. They are listening for you down at the low end of the band. Deliberate contest operation between 1825 and 1830 hardly comes under the definition of "good sportsmanship."

It is also hoped that state-side phone stations and other stations not in the contest will observe this request for the contest weekend.

My apologies for not getting my Christmas greetings in last month's Column. Trust the Holidays were happy ones for you and that you will receive many Blessings during the New Year.

73 for now, Frank, W1WY

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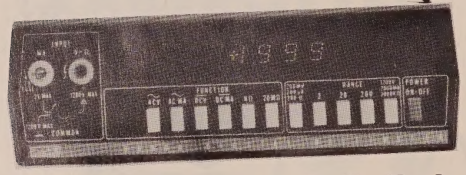


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22nd ANNUAL Dayton Hamvention will be held on April 28, 1973 at Wampler's Dayton Hara Arena. Technical sessions, exhibits, hidden transmitter hunt flea market, and special program for the XYL. For info write Dayton Hamvention, Dept. C, Box 44, Dayton, OH 45401.

HALLICRAFTERS HT-37, mint condx - $194.95. Also, Hallicrafters SX-111 - $145.00. Marine Electronics, 76 New York Ave., Halesite, L.I., N.Y. 11743. Phone 516/427-7199.

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WANTED: Two 50/60W AC power supplies for Motorola base station. C. E. Brown, WB4OOT, Cataula, GA 31804.

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SELL: RME VHF-126 (50, 144, 220 mc) $125. AMECO TX-62 VFO-621 $175. Knight TR-108 $155. TV Camera $200. WA3MEG, 12211 Valerie, Laurel, MD 20810.

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National NCX-200 Transceiver, mint, manual, original carton: $180. Delux AC supply: $60. WB2-GRB, 14 Duryear Place, Lynbrook, NY 11563. (516) LY9-3440.

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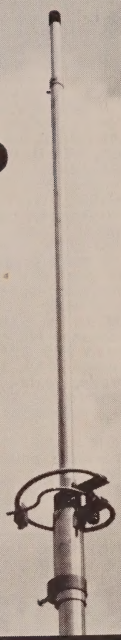
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FOR SALE: Heath SB110-A, HP-23 AC supply manuals, all excellent condition. $250 ship collect. George Wellborn, 406 Mayfiar Dr., Shreveport, LA 71107. (318) 424-5533.

WANTED: Transistorized power supply & modulator for Clegg Thor 6. Ron Ginns, WA3RQP, 55 E. Pleasant Grove Rd., West Chester, PA 19380.

SELL: HQ-16, Mint. $98. WA2FTZ, 211 Barnes St. Ossining, NY 10562. (914) 941-4840.

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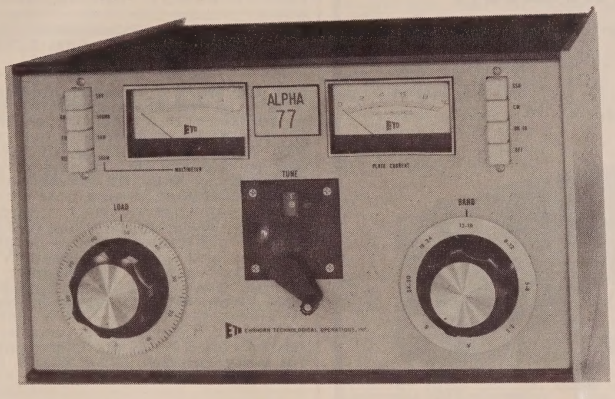
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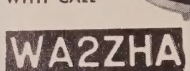
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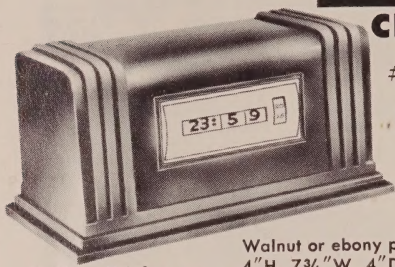
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SWAP: Allied (Kenwood) A-2516 Ham or A-2515 General rx for compact HF linear or SBE xcvr. K9ZAT, 913 S. Carpenter, Chicago, Il. 60607.

HP-525-A $30, HP-525-B 100-220 mc $60, BC-312 Rec $30, LM freq. meter with book $20.-K6KZT, 4434 Josie Ave., Lakewood, CA 90713.

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FOR SALE: Collins Mechanical Filters; F455Q2 7T2 2.1 kHz $15, f455 Q5 4R2 500 kHz $22.50. K3JYZ. Call 301-384-7771 after 001 GMT.

SELL: National SW-3 receiver in good condition, with coils. Best offer over $75. Dick Nebel W2DBQ 31 Whitehall Blvd., Garden City, NY 11530. Tel. 516-741-6603.

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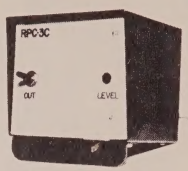
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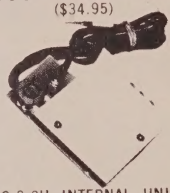


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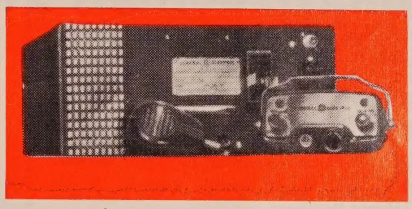
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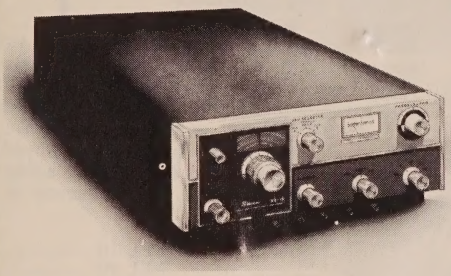
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JUGE

Proudly presents the new SWAN

FULLY SOLID-STATE TRANSCEIVERS

UP TO 200 WATTS



Swan was the first to provide a low cost single sideband transceiver the average ham could afford. Again, Swan leads the field with "state-of-the-art" concepts!

- No Transmitter Tuning
- Infinite VSWR Protection
- Receiver uses FET's, IC's, and Operational Amplifiers
- IF Derived AGC
- Minimized Front-end Overload, Distortion and Cross-modulation
- Selectable Sideband, 80-10 Meters
- Built-in VOX
- Semi-CW Break-in and Monitor
- Noise Blanker, with Threshold Control
- 25 KC Calibrator
- 10 MHz WWV Receive

Mobile is "First Class!" Operates directly from 12 volt DC requiring less than 500 ma on receive. Ideal for net operation. No tune-up necessary, simply dial the station and talk!

Compatible AC power supplies and a host of other accessories available to provide "Top-Of-The-Line" fixed station operation. Operating ease and flexibility makes it a winner for contests or rag-chewing!

CHOICE OF 3 MODELS:

SWAN SS-15, 15 watt P.E.P. **$579.00**
SWAN SS-100, 100 watt P.E.P. **$699.00**
SWAN SS-200, 200 watt P.E.P. **$779.00**

ACCESSORIES INCLUDE:

SWAN PS-10, 115V AC power supply for SS-15 SS-100	$ 89.00
SWAN PS-20, 115V AC power supply for SS-200/SS-100 SS-15	$139.00
SWAN SS-1200, 1200 watt P E P Linear Amplifier (tube type)	$299.00
SWAN SS-208, External VFO	$159.00
SWAN 610X, Crystal Controlled Oscillator	$ 53.95
SWAN SS-16B, Super Selective Filter	$ 79.95

ED JUGE ELECTRONICS, INC.

3850 SOUTH FREEWAY
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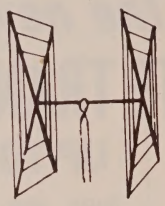
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TELEX 75-8329

Hours: 9:00–5:30 Tues. thru Sat.

WHICH ANTENNA WINS THE CONTEST ?

In open competition against thousands of commercial and home-brew antennas, WA1JFG won the New England championship with a Gotham beam, by a margin of 5,982 points! WB2JAM won the sectional award for the Sweepstake contest in 1969 and 1970 with a Gotham 4-element 15 meter beam! Hundreds of unsolicited testimonials from grateful hams are our proof that Gotham antennas give you the best design, and the best materials. Forget our low prices - rely on the results of open, competitive contests. Ask yourself: Why do Gotham antennas win?

QUADS Worked 42 countries in two weeks with my Gotham Quad and only 75 watts... W3 CUBICAL QUAD ANTENNAS — these two element beams have a full wavelength driven element and a reflector; the gain is equal to that of a three element beam and the directivity appears to us to be exceptional! ALL METAL (except the insulators) — absolutely no bamboo. Complete with boom, aluminum alloy spreaders; sturdy, universal-type beam mount; uses single 52 ohm coaxial feed; no stubs or matching devices needed; full instruction for the simple one-man assembly and installation are included; this is a fool-proof beam that always works with exceptional results. The cubical quad is the antenna used by the DX champs, and it will do a wonderful job for you!



10/15/20 CUBICAL QUAD SPECIFICATIONS

Antenna Designation: 10/15/20 Quad
Number of Elements: Two. A full wavelength driven element and reflector for each band.
Freq. Covered: 14-14.4 Mc. 21-21.45 Mc. 28-29.7 Mc.
Shipping Weight: 28 lbs. Net Weight: 25 lbs.
Dimensions: About 16' square.
Power Rating: 5 KW.
Operation Mode: All
SWR: 1.05:1 at resonance
Gain: 8.1 db. over isotropic
F/B Ratio: A minimum of 17 db. F/B
Boom: 10' long x 1¼" O.D.; 18 gauge steel; double plated; gold color
Beam Mount: Square aluminum alloy plate incorporating four steel U-bolt assemblies. Will easily support 100 lbs. Universal polarization.
Radiating Elements: Steel wire, tempered and plated, .064" diameter.
X Frameworks: Each framework consists of two 12' sections of 1" OD aluminum 'hi-strength' (Revere) tubing, with telescoping ⅞" tubing and short section of dowel. Plated hose clamps tighten down on telescoping sections.
Radiator Terminals: Cinch-Jones two-terminal fittings
Feedline (not furnished); 52 ohm coaxial cable

Now check these startling prices—note that they are *much lower* than even the bamboo-type:

10-15-20 CUBICAL QUAD	$41.00
10-15 CUBICAL QUAD	36.00
15-20 CUBICAL QUAD	38.00
TWENTY METER CUBICAL QUAD	31.00
FIFTEEN METER CUBICAL QUAD	30.00
TEN METER CUBICAL QUAD	29.00

(all use single coax feedline)

GOTHAM
1805 Purdy, Dept. CQ, Miami Beach, Fla. 33139

BEAMS The first morning I put up my 3 element Gotham beam (20 ft) I worked YO4CT, ON5LW, SP9-ADQ, and 4U1ITU THAT ANTENNA WORKS! WN4DYN Compare the performance, value, and price of the following beams and you will see that this offer is unprecedented in radio history!



Each beam is brand new; full size (36' of tubing for *each* 20 meter element, for instance); absolutely complete including a boom and all hardware; uses a single 52 or 72 ohm coaxial feedline; the SWR is 1:1; easily handles 5 KW; ⅞" and 1" alumnium alloy tubing is employed for maximum strength and low wind loading; all beams are adjustable to any frequency in the band.

2 EL 20	$25	4 EL 10	24
3 EL 20	31*	7 EL 10	38*
4 EL 20	38*	4 EL 6	24
2 EL 15	21	8 EL 6	34*
3 EL 15	25	12 EL 2	31*
4 EL 15	31*	*20' Boom	
5 EL 15	34*		

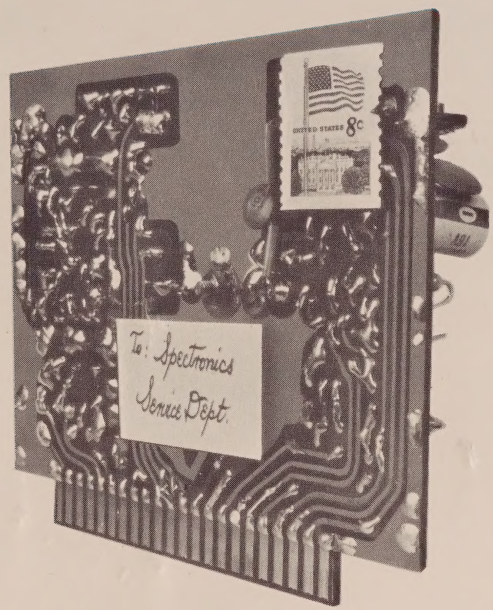
ALL-BAND VERTICALS

"All band vertical!" asked one skeptic. "Twenty meters is murder these days. Let's see you make a contact on twenty meter phone with low power!" So K4KXR switched to twenty, using a V80 antenna and 35 watts AM. Here is a small portion of the stations he worked: VE3FAZ, T12FGS, W5KYJ, W1WOZ, W2ODH, WA3DJT, WB2FCB, W2YHH, VE3FOB, WA8CZE, K1SYB, K2RDJ, K1MVV, K8HGY, K3UTL, W8QJC, WA2LVE, YS1MAM, WA8ATS, K2PGS, W2QJP, W4JWJ, K2PSK, WA8CGA, WB2KWY, W2IWJ, VE3KT. Moral: It's the antenna that counts! *FLASH!* Switched to 15 c.w. and worked KZ5IKN, KZ5OWN, HC1LC, PY5ASN, FG7XT, XE2I, KP4AQL, SM5BGK, G2AOB, YV5CLK. OZ4H. and over a thousand other stations!

V40 vertical for 40, 20, 15, 10, 6 meters	$18.95
V80 vertical for 80, 75, 40, 20, 15, 10, 6 meters	$20.95
V160 vertical for 160, 80, 75, 40, 20, 15, 10, 6 meters	$22.95

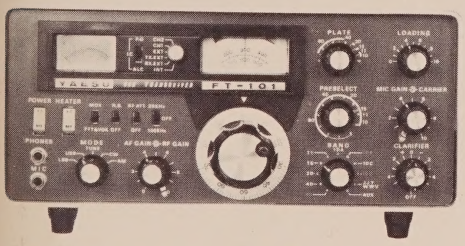
"HOW TO ORDER: Send money order (bank, store, or United States) in full. We ship immediately by best way, charges collect. DEALERS WRITE."

Repair by mail.



Except for driver and finals, the Yaesu FT-101 is all solid state. Ten FET's, 3 IC's, 31 silicon transistors and 38 silicon diodes do the job — solidly. Most of these components are found on computer-type plug-in modules. Should one of them ever give you trouble, just send us the module. We'll send you a factory-new replacement by return mail.

But with the FT-101, you can expect everything but trouble. Like a built-in VOX, 25 KHz and 100 KHz calibrators, the WWV 10 MHz band,



a high Q permeability tuned RF stage and a 5 KHz clarifier. All of that in a portable rig that sounds like it was home base.

The FT-101 is thirty pounds of power. You can work the world on 260 W PEP, 180 W CW or 80 W AM maximum input power. The world between 80 meters and 10 meters. And you'll hear it back with 0.3 microvolts sensitivity — and a 10 db signal-to-noise ratio.

This rig even includes 12 VDC and 117 VAC built-in power supplies right in the package. You supply the 12 or 117 volts plus an antenna and you're air-ready.

For in-motion operation, a noise blanker is essential. We didn't forget to include it in the FT-101. It picks out noise spikes and leaves you with nothing but clean, crisp signal copy.

Though plug-in modules mean quick, convenient repair, we don't really expect to hear from FT-101 owners. Unless it's on the air. Maybe that's why we unconditionally guarantee it for a year. The FT-101 — only $559.95

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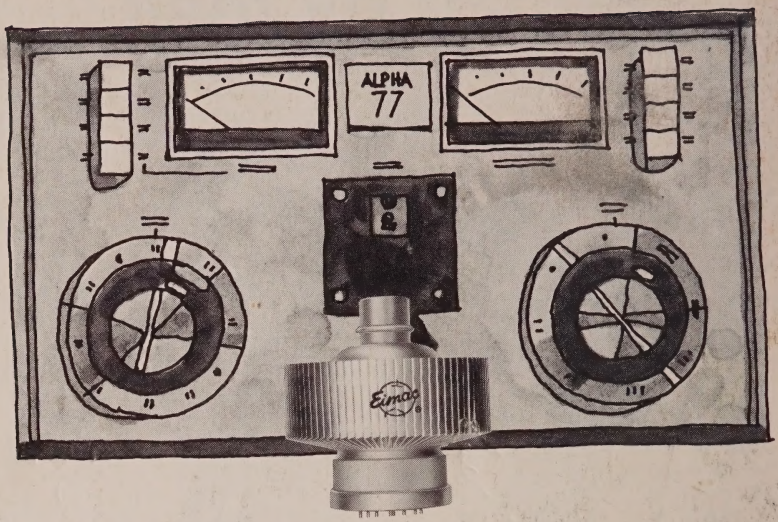
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The no-compromise Alpha 77 is powered by the no-compromise EIMAC 8877.

No corners were cut in designing the rugged Alpha 77 amplifier. Rated for continuous commercial service, it loafs along at the maximum legal amateur power limit.

And, no corners were cut in designing EIMAC's air-cooled 8877 ceramic/metal, high-mu triode, the Alpha 77 power tube. The 8877 is conservatively rated at 1500 watts plate dissipation up to 250 MHz and requires less than 65 watts PEP drive signal for the legal power input limit. This impressive power gain is achieved with 3rd order intermodulation distortion products −38 decibels below one tone of a two equal-tone drive signal.

This compact, rugged, high-mu power triode has a maximum plate voltage rating of 4000 and a maximum plate current rating of one ampere in commercial service. While the 8877 is primarily designed for superlative linear amplifier service demanding low intermodulation distortion, its high efficiency also permits excellent operation as a class C power amplifier, oscillator, or as a plate modulated amplifier. The zero bias characteristic is useful for these services, as plate dissipation is held to a safe level if drive power fails, up to a plate potential of 3 kV.

The Alpha 77 is the ultimate power amplifier for the 70's. That's proven by the choice of the 8877, another example of EIMAC's ability to provide tomorrow's tubes today. For additional information on this tube or other products, contact EIMAC Division of Varian, 301 Industrial Way, San Carlos, California 94070. Phone (415) 592-1221. Or contact any of the more than 30 Varian/EIMAC Electron Tube and Device Group Sales Offices throughout the world.

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