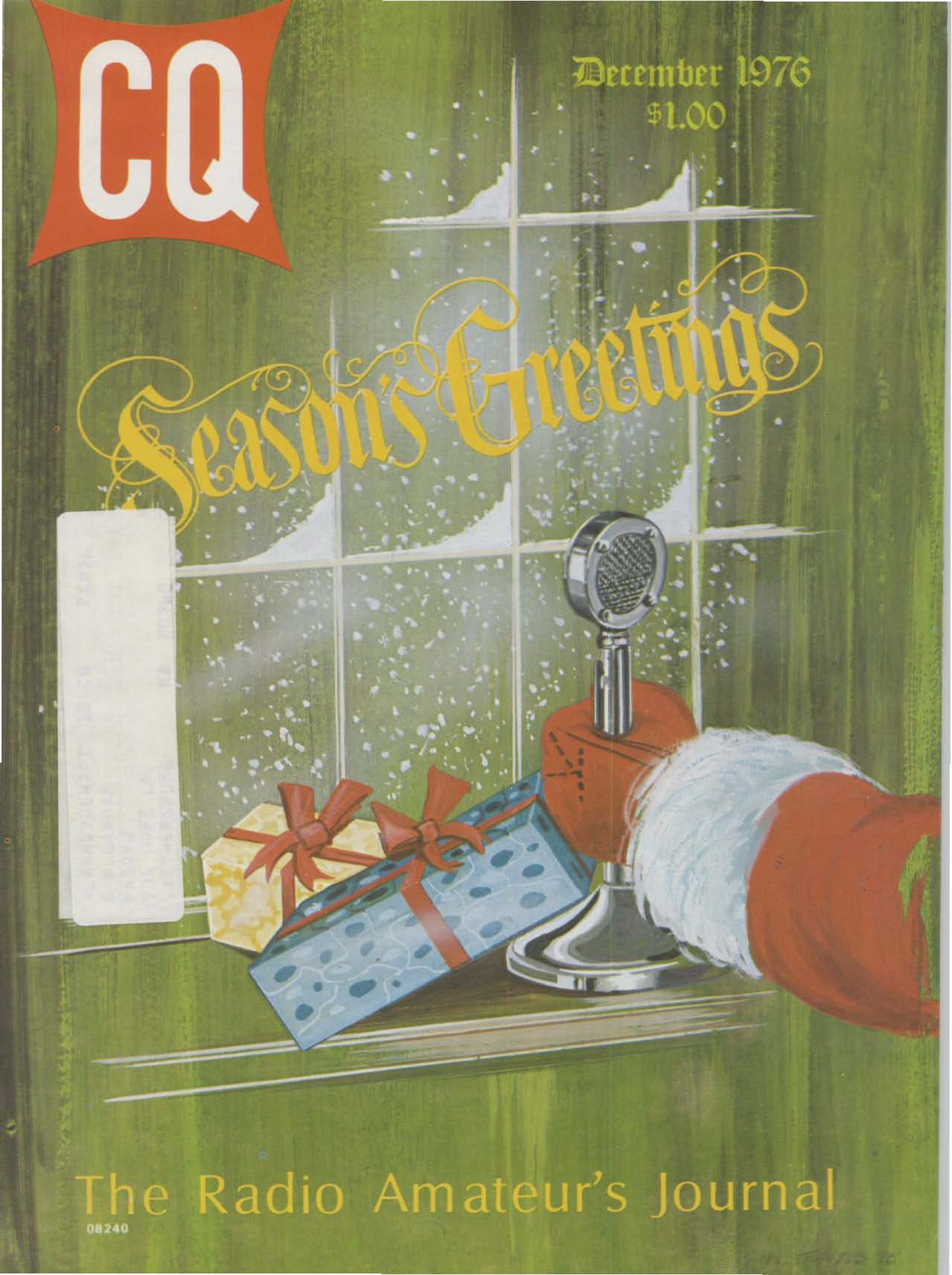
CQ

December 1976

$1.00



The Radio Amateur's Journal

08240

The one You've Been Waiting for!

$269.95 with standard microphone

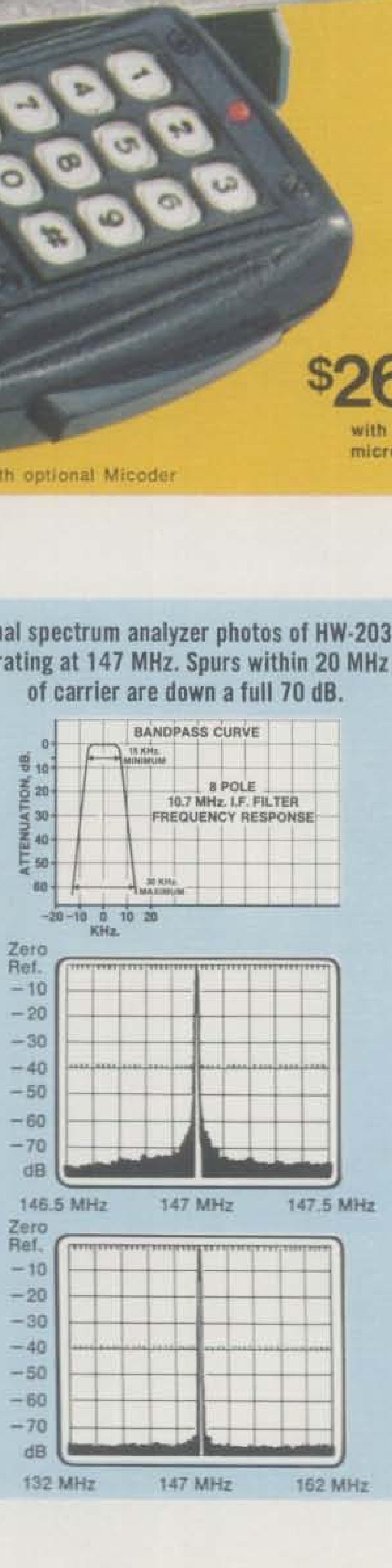
Shown with optional Micoder

Just look at these photos and specifications. The HW-2036 gives you the kind of 2-meter performance you WANT!

HW-2036 SPECIFICATIONS

Receiver: Sensitivity: 0.5 μV for 12 dB SINAD (or 15 dB of Quieting). Squelch Threshold: 0.3 μV or less. Audio Output: 1.5 watts at 10% T.H.D. typically 2 watts. (5 kHz deviation). Image Rejection: −45 dB or greater. Spurious Rejection: −50 dB or greater. IF Rejection: −80 dB or greater. Internally Generated Spurious: Below 1 μV equivalent. Bandwidth: 6 dB at 15 kHz min. and 60 dB at 30 kHz max. Modulation Acceptance: 7.5 kHz, min. Transmitter: Power Output: 10 watts min. at 25°C and 13.8 VDC, into a 50Ω load. Harmonic & Spurious Output: −70 dB within 20 MHz of carrier; −50 dB elsewhere, −40 dB harmonics. Modulation: FM, 0 to 7.5 kHz, adjustable. Duty Cycle: 100% with infinite VSWR. Tone Encoder: 3 tones, 70 to 200 Hz, approx. ±700 kHz deviation. Transmitter Offset: 0 (simplex), −600 kHz, +600 kHz with crystals supplied. Provision for one additional offset crystal. General: Frequency Coverage: Any 2 MHz segment from 143.5 to 148.5 MHz. Both receiver and transmitter must be aligned for the same 2 MHz segment. Frequency Increments: 5 kHz. Frequency Stability: ±.0015%. Operating Temperature Range: 15° to 125° F. (−10° to 50° C). Operating Voltage Range: 12.6 to 16 VDC (13.8 VDC nominal). Current Consumption: RX: 700 mA max. squelched. TX: 2.6 A max. at 13.8 volts. Dimensions: 2¾" high x 8¼" wide x 9⅞" deep. Weight: 6.25 lbs.

Actual spectrum analyzer photos of HW-2036 operating at 147 MHz. Spurs within 20 MHz of carrier are down a full 70 dB.



Heathkit Synthesized 2-meter Transceiver!

The new Heathkit 2-meter frequency-synthesized transceiver combines state-of-the-art technology with operating ease, convenience and versatility in an easy-to-build kit that's about HALF THE COST of comparable synthesized transceivers. It's the one to buy and build for real 2-meter PERFORMANCE!

Operation is easier than ever! The front panel lever switches select any frequency in any 2 MHz segment of the 143.5 to 148.5 operating frequency range. You select the last four digits, three with lever switches which display the frequency directly and the last with a 0/5 kHz toggle switch which makes ALL 2-meter frequencies in the band available. If you inadvertently dial up an out-of-band frequency, the transmitter simply will not key.

And the signal is solid! The HW-2036 puts out a minimum 10 watts at 25° C and 13.8 VDC. And it operates into an infinite VSWR without failure. The transmitter output is extremely clean, with spurious output greater than 70 dB below carrier. True FM circuitry means you transmit and receive with excellent audio quality too.

The receiver is hot! Sensitivity is an outstanding 0.5 μV for 12 dB SINAD. An 8-pole IF crystal filter provides an ideally shaped bandpass for excellent adjacent channel rejection and its superb selectivity makes it the one to have for crowded signal areas.

Complete operating versatility! A built-in continuous tone encoder with three customer-adjusted tones selectable on the front panel accesses most repeaters. The HW-2036 provides all the offset capability you'll ever need — built-in simplex, plus and minus 600 kHz offsets, and an Aux. position that lets you add a crystal for any other frequency. And, if you order the HW-2036 with the Heathkit Micoder microphone/auto patch encoder, you'll be able to make phone calls through repeaters equipped with auto patch input! (And save $19.95 in the bargain!) The HW-2036 operates mobile from your vehicle's 12 VDC battery, or you can use the optional HWA-2036-3 AC power supply for fixed station operation.

The HW-2036 is our best 2-meter transceiver! Check it out for yourself and you'll see it's the one to have for years of reliable 2-meter communications!

Our HW-2021 hand-held 2-meter transceiver is the one to have if you're working portable. It gives you a full 1-watt output plus 5 receive and 5 transmit channels and flexible simplex/offset. It's hand-held, battery-operated, and there's an optional auto patch encoder to add telephone versatility at low cost. Crystal-controlled, with better than 0.05% frequency stability. Sensitivity is 0.5 μV for 12 dB SINAD.

The HW-2036 and HW-2021 are two of the finest 2-meter transceivers around. Use 'em both for complete 2-meter versatility! Read more about them, and all the other superb Heathkit Amateur Radio products in the new Heathkit Catalog. Send coupon below!

Heath Company, Dept. 12-23 Benton Harbor, Michigan 49022

FREE!

New Heathkit Catalog

Nearly 400 fun-to-build, practical and money-saving electronic kits! Send coupon today!

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Heath Company, Dept. 12-23
Benton Harbor, Michigan 49022

Please send me my FREE Heathkit catalog. I am not on your mailing list.

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Address____________________

City____________________

State__________ Zip__________

AM-338

Prices & specifications subject to change without notice.

KENWOOD'S TS-520

...worth waiting for!

Why wait any longer for a rig that offers top performance, dependability and versatility . . . the TS-520 has proven itself in the shacks of thousands of discriminating amateurs, in field day sites, in DX and contest stations, and in countless mobile installations.

Superb craftsmanship is evident throughout . . . in its engineering concepts as well as its construction and styling . . . craftsmanship that is a Kenwood hallmark.

Maybe the Kenwood TS-520 is the one you have been waiting for.

Kenwood offers accessories guaranteed to add to the pleasure of owning the TS-520. The TV-502 transverter puts you on 2-meters the easy way. (It's completely compatibile with the TS-520.) Simply plug it in and you're on the air. Two more units designed to match the TS-520 are the VFO-520 external VFO and the model SP-520 external speaker. All with Kenwood quality built in.

TS-520 Specifications

MODES: USB, LSB, CW
POWER: 200 watts PEP input on SSB, 160 watt DC input on CW
ANTENNA IMPEDANCE: 50-75 Ohms, unbalanced
CARRIER SUPPRESSION: Better than −45 dB
UNWANTED SIDEBAND SUPPRESSION: Better than −40 dB
HARMONIC RADIATION: Better than −40 dB
AF RESPONSE: 400 to 2600 Hz (−6 dB)
AUDIO INPUT SENSITIVITY: 0.25μV for 10 dB (S+N)/N
SELECTIVITY: SSB 2.4 kHz (−6 dB), 4.4 kHz (−60 dB). CW 0.5 kHz (−6 dB), 1.5 kHz (−60 dB) (with accessory filter)
FREQUENCY STABILITY: 100 Hz per 30 minutes after warmup
IMAGE RATIO: Better than 50 dB
IF REJECTION: Better than 50 dB
TUBE & SEMICONDUCTOR COMPLEMENT: 3 tubes (2 x 6146B, 12BY7A), 1 IC, 18 FET, 44 transistors, 84 diodes
DIMENSIONS: 13.1" W x 5.9" H x 13.2" D
WEIGHT: 35.2 lbs.
SUGGESTED PRICE: $629.00

VFO-520

Provides high stability with precision gearing. Function switch provides any combination with the TS-520. Both are equipped with VFO indicators showing at a glance which VFO is being used. Connects with a single cable and obtains its power from the TS-520. Suggested price: $115.00.

SP-520

Although the TS-520 has a built-in speaker, the addition of the SP-520 provides improved tonal quality. A perfect match in both design and performance. Suggested price: $22.95.

TV-502

TRANSMITTING/RECEIVING FREQUENCY: 144-145.7 MHz. 145.0-146.0 MHz (option)
INPUT/OUTPUT IF FREQUENCY: 28.0-29.7 MHz
TYPE OF EMISSION: SSB (A3J), CW (A1)
RATED OUTPUT: 8W (AC operation)
ANTENNA INPUT/OUTPUT IMPEDANCE: 50Ω
UNWANTED RADIATION: Less than −60 dB
RECEIVING SENSITIVITY: More than 1μV at S/N 10 dB
IMAGE RATIO: More than 60 dB
IF REJECTION: More than 60 dB
FREQUENCY STABILITY: Less than ±2.5 kHz during 1-60 min after power switch is ON and within 150 Hz (per 30 min) thereafter
POWER CONSUMPTION: AC 220/120V, Transmission 50W max., Reception 12W max. DC 13.8V, Transmission 2A max., Reception 0.4A max.
POWER REQUIREMENT: AC 220/120V, DC 12-16V (standard voltage 13.8V)
SEMI-CONDUCTOR: FET 5, Transistor 15, Diode 10.
DIMENSIONS: 6⅝" W x 6" H x 13¼" D
WEIGHT: 11.5 lbs.
SUGGESTED PRICE: $249.00

CW-520
500 Hz CW Crystal Filter: $45.00.

Prices subject to change without notice

KENWOOD
...pacesetter in amateur radio

TRIO-KENWOOD COMMUNICATIONS INC. 116 EAST ALONDRA/GARDENA, CA 90248

CQ

DECEMBER, 1976 **VOL. 32, NO. 11**

The Radio Amateur's Journal

FEATURES

DEPARTMENTS

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Now, you can hear better with our KC-3035 KRIKET® mobile speaker. Better than you believed possible.

Because AFS offers the first acoustically designed voice communications speaker. And, that means you get outstanding intelligibility across the entire voice range.

AFS — the only company with the "WORKING WALL"® speaker enclosure. Cross-laminated tubular fiberboard deadens channel noise, eliminates voice distortion by controlling rebounding sound waves. Brings the voice through — clean and clear.

Available at CB dealers everywhere

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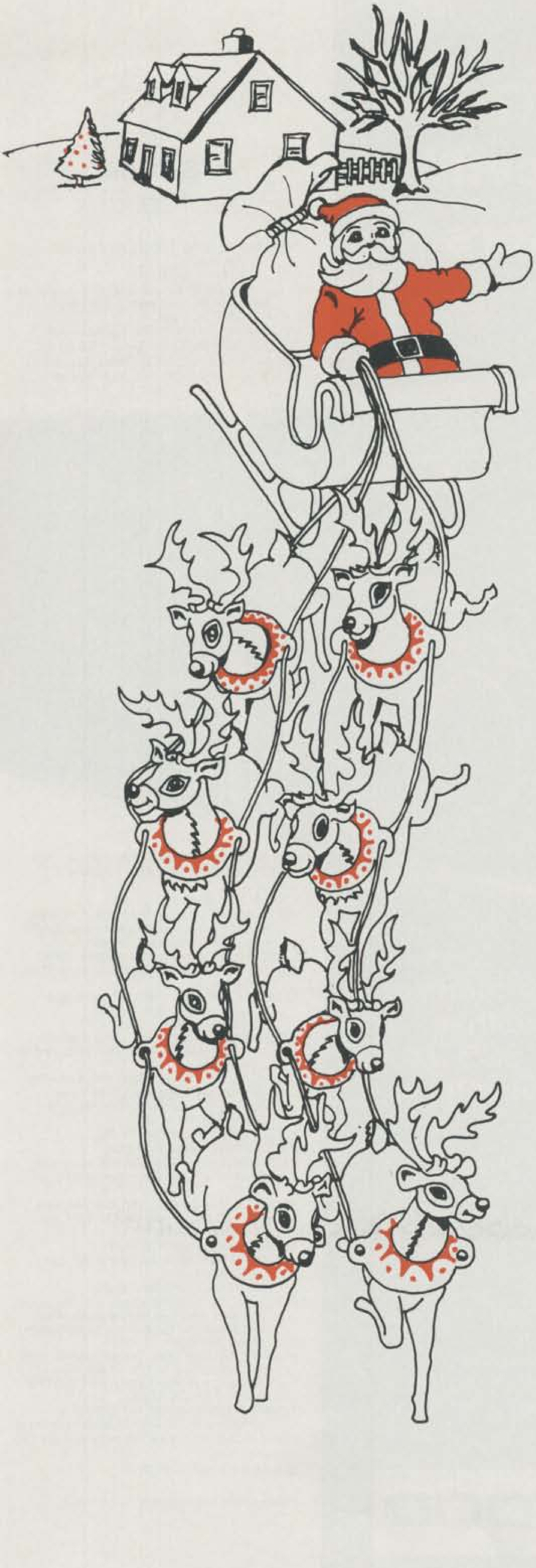
All KRIKET® speakers are manufactured in the U.S.A. using American materials and craftsmen.



Zero Bias

It seems traditional at the close of each year to speak of wonderous things to come or of accomplishments gone by. We speak of resolutions, peace on earth, good will toward men, and the hope for this holiday season to be better in some ways than the last. It's an up season for most of us in a lot of ways. We send cards to those we care about, buy gifts, plan dinners, make last minute phone calls and in general share a mutual warmth and happiness. It's a spirit of giving and receiving. It's something new and exciting. To many of us this season epitomizes our religious beliefs and we celebrate in joyous fashion.

In light of these feelings the following may appear to be a grim interjection into an otherwise festive mood. The fact that some of us may not have as happy a holiday as most of us hope to is often clouded over by our own anticipation. However, an important part of this holiday season is represented in the symbolic act of giving and sharing. One radio club is giving to help one of their own. We, as part of this great fraternity, can and should do no less.

The other day I received a copy of the **News Fuse**, a monthly publication of the Hall of Science Radio Club here in New York. One of the features of this particular issue concerned the untimely and premature passing of one of their members, Sam Weinstein, WB2AMY. It seems that during Sam's stay at N.Y. University Medical Center he had received 64 pints of blood which resulted in an enormous bill. The members of Sam's club have worked out an agreement with the center to have the blood replaced and thereby lessen what must be an astronomical medical bill. Members have already donated blood to the center, in Sam's name but 64 pints is still a lot of blood.

My holiday message this year is quite simple. Let's share some of our good fortune with others. Perhaps some of us who are able can ease the Weinstein family's bereavement and financial hardship through this season by donating a pint of blood in Sam's name. If you can, contact: Ms Judith Kratka, N.Y.U. Medical Center, 560 First Ave., N.Y., N.Y. or call 212-679-3200, Ext. 2837.

On behalf of all the people who make CQ possible, I want to extend our wishes and hopes for a Merrier Christmas and a Happier New Year for all.

73,

Alan, K2EEK

If you haven't tried the TS-700A ...you haven't experienced the excitement of 2-meters

Experience the excitement of 2 meters. There's more than just FM repeaters, you know. SSB DX, OSCAR Satellite, CW...and do it all with a tunable VFO. Do it all with the Kenwood TS-700A.

- Operates all modes: SSB (upper & lower), FM, AM, and CW
- Completely solid state circuitry provides stable, long lasting, trouble-free operation
- AC and DC capability. Can operate from your car, boat, or as a base station through its built-in power supply
- 4 MHz band coverage (144 to 148 MHz) instead of the usual 2
- Automatically switches transmit frequency 600 KHz for repeater operation ... reverses, too
- Outstanding frequency stability provided through the use of FET-VFO
- Zero center discriminator meter
- Transmit/Receive capability on 44 channels with 11 crystals
- Complete with microphone and built-in speaker

The TS-700A is available at select Kenwood dealers throughout the U.S. For the name of your nearest dealer, please write.

KENWOOD
...pacesetter in amateur radio

TRIO-KENWOOD COMMUNICATIONS INC. 116 EAST ALONDRA, GARDENA, CA 90248

TS-700A Specifications

TRANSMIT/RECEIVE FREQUENCY RANGE: 144-148 MHz
MODE: SSB, FM, CW, AM
RF OUTPUT: CW, FM: more than 10W output. AM: more than 3W output. SSB: more than 20W DC input.
ANTENNA IMPEDANCE: 50Ω (unbalanced)
CARRIER SUPPRESSION: Better than 40 dB
SIDE-BAND SUPPRESSION: Better than 40 dB
SPURIOUS RADIATION: Less than -60 db
MAX. FREQUENCY DEVIATION (FM): ±5 kHz
REPEATER FREQUENCY SHIFT WIDTH: 600 kHz
TONE BURST TIME: 0.5-1.0 sec.
MODULATION: Balanced modulation for SSB. Variable reactance frequency shift for FM. Low power modulation for AM.
MICROPHONE: Dynamic microphone, 500Ω
AUDIO FREQUENCY RESPONSE: 400-2600 Hz, within -9 db
RECEIVING SYSTEM: SSB, CW, AM: Single-superheterodyne. FM: Double-superheterodyne.
INTERMEDIATE FREQUENCY: SSB, CW, AM: 10.7 MHz. FM: 1st IF: ... 10.7 MHz. 2nd IF: ... 455 kHz.
RECEIVING SENSITIVITY: SSB, CW: S/N = 10 dB or better at 0.25μV. 20 dB noise quieting = Less than 0.4μV. AM: S/N = 10 dB or better at 1μV.
IMAGE RATIO: Better than 60 dB
IF REJECTION: Better than 60dB
PASS-BANDWIDTH: SSB, CW, AM: More than 2.4 kHz at -6 dB. FM: More than 12 kHz at -6 dB.
RECEIVER SELECTIVITY: SSB, CW, AM: Less than 4.8 kHz at -60 dB. FM: Less than 24 kHz at -60 dB.
SQUELCH SENSITIVITY: 0.25μV
AUDIO OUTPUT: More than 2W at 8Ω load (10% distortion)
RECEIVER LOAD IMPEDANCE: 8Ω
FREQUENCY STABILITY: Within ±2 kHz during one hour after one minute of warm-up, and within 150 Hz during any 30 minute period thereafter.
POWER CONSUMPTION: Transmit mode: 95W (AC 120/220V), 4A (DC 13.8V), max. Receive mode (no signal): 45W (AC 120/220V), 0.8A (DC 13.8V).
POWER REQUIREMENTS: AC 120/220V, 50/60 Hz. DC 12-16V (13.8V as reference).
DIMENSIONS: 278 (W) x 124 (H) x 320 (D) mm
WEIGHT: 11 kg
SUGGESTED PRICE: $700.00

Prices subject to change without notice

Our Readers Say

Editor, CQ:

Suggestion:

When using Black Heat disapating tube shields make sure you sand off the paint on the inside where the shield physically locks onto the base otherwise the shield is "above ground" and can cause all sorts of oscalations etc.

Richard Mollentine, WAØKKC

Editor, CQ:

Here's a handy trick for measuring output. Everyone - or almost everyone - has a relative output meter with a variable resistor adjustment, somewhere in his RF line. Beg or borrow (don't steal) a calibrated wattmeter and place same in line in series with output meter. Set output of rig at 25, 50, 100, 250 etc. watts as measured on calibrated meter. Each time adjust variable resistor on output meter to show full scale and note position of pointer by a scratch on the panel and a mark. If control knob does not have a pointer, replace it with a pointer knob. Remove calibrated wattmeter and return to owner. You now have a wattmeter that is reasonable accurate on full scale. On less than full scale, I have not figured it out, but instinctively, would say you should square the reading, e.g., if 10 on full scale represents 100 watts, 8 would be 64 watts, 5 would be 25 watts, etc.

I am assuming that everybody has nice flat lines terminating in 50 ohms. Varying the load should throw things off somewhat.

Pass this one on for what it's worth. It will not measure that last 10 watts in the linear but will quickly show that one of the two parallel final tubes in the exciter has gone flat when that happens.

Reuben E. Gross

Editor, CQ:

A thought for your Readers:

The wire tables should be a bit more useful if the following relationship is kept in mind.

The "OHMS/KFT" Tabulation may be translated to mean "MV DROP/FT/AMP".

Example:

4 FT no. 20 Carrying 1 Amp given as 10.35 /KFT=

10.35 MV/FT
4
41.40 MV Drop

For 2 amps, double the above drop.

The 700 CM/A Rating (Given in Handbook) indicates no. 20 will handle about 1.5 amp; however if a 300 CM/A rating is used, we find a 3.4 amp capability.

(Continued on page 10)

Now...more than ever---
the TEMPO line means solid value

Tempo VHF/ONE

the "ONE" you've been waiting for

No need to wait any longer — this is it! Whether you are already on 2-meter and want someting better or you're just thinking of getting into it, the VHF/ONE is the way to go.

• Full 2-meter band coverage (144 to 148 MHz for transmit and receive. • Full phase lock synthesized (PLL) so no channel crystals are required. • Compact and lightweight — 9.5" long x 7" wide x 2.25" high. Weight — About 4.5 lbs. • Provisions for an accessory SSB adaptor. • 5-digit LED receive frequency display. • 5 KHz frequency selection for FM operation. • Automatic repeater split — selectable up or down for normal or reverse operation. • Microphone, power cord and mounting bracket included. • Two built-in programmable channels. • All solid state. • 10 watts output. • Super selectivity with a crystal filter at the first IF and E type ceramic filter at the second IF. • 800 Selectable receive frequencies. • Accessory 9-pin socket. • $495.00

TEMPO SSB/ONE

SSB adapter for the Tempo VHF/One

• Selectable upper or lower sideband. • Plugs directly into the VHF/One with no modification. • Noise blanker built-in. • RIT and VXO for full frequency coverage. • $225.00

TEMPO/CL 146A

. . .a VHF/FM mobile transceiver for the 2 meter amateur band. It is compact, ruggedly built and completely solid state. One channel supplied plus two channels of your choice FREE

144 to 148 MHz coverage • Multifrequency spread of 2 MHz • 12 channel possible • Metering of output and receive • Internal speaker, dynamic microphone, mounting bracket and power cord supplied. A Tempo "best buy" at $239.00.

TEMPO POCKET RECEIVERS

MS-2, 4 channel scanning receiver for VHF high band, smallest unit on the market. **MR-2**, same size as MS-2 but has manual selection of 23 channels, VHF high band. **MR-3**, miniature 2-channel VHF high band monitor or paging receiver. **MR-3U**, single channel on the 400 to 512 UHF band. All are low priced, extremely compact and dependable.

TEMPO 100AL10 | SOLID STATE VHF LINEAR AMPLIFIER. 144-148 MHz. Power output of 100 watts (nom) with only 10 watts (nom) in. Reliable and compact.

TEMPO/fmh

So much for so little! 2 watt VHF/FM hand held 6 Channel capability, solid state, 12 VDC. 144-148 MHz (any two MHz), includes 2 pair of crystals, built-in charging terminals for ni-cad cells, S-meter, battery level meter, telescoping whip antenna, internal speaker & microphone. $199.00

FMH-MC for Marine & Commercial service also available.

TEMPO 6N2

The Tempo 6N2 meets the demand for a high power six meter and two meter power amplifier. Using a pair of Eimac 8874 tubes it provides 2000 watts PEP input on SSB and 1000 watts input on CW and FM. Completely self-contained in one small desk mount cabinet with internal solid state power supply, built-in blower and RF relative power indicator. $895.00

The Tempo 2002.. 2 meters only $745.00

The Tempo 2006.. 6 meters only $795.00

TEMPO

VHF/UHF AMPLIFIERS

Solid state power amplifiers for use in most base/mobile applications. Increase the range, clarity, reliability and speed of two- way communications.

Low Band VHF amplifiers available in 100W out with 2, 10 & 30W in. High Band VHF amps available in 30, 50, 80 & 130W out with 2, 10 & 30W in. UHF amps available in 10, 25, 40 & 70W out with 1, 2, 10 & 30W in. Call or write for spec sheet and prices.

Most of the above products are available at dealers throughout the U.S.

Henry Radio

11240 W. Olympic Blvd., Los Angeles, Calif. 90064 213/477-6701
931 N. Euclid, Anaheim, Calif. 92801 714/772-9200
Butler, Missouri 64730 816/679-3127

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INTRODUCING

The TEMPO 2020

A BRILLIANT NEW SSB TRANSCEIVER PROVIDING AN UNBEATABLE COMBINATION OF ADVANCED ENGINEERING AND UNIQUE OPERATING FEATURES.

YOU MAY NEVER HAVE OWNED A TRANSCEIVER THAT OFFERS SO MUCH.

Send for descriptive information on this fine new transceiver, or on the time proven Tempo ONE transceiver which continues to offer reliable, low cost performance.

***Phase lock-loop (PLL) oscillator circuit minimizes unwanted spurious responses.**
***Hybrid Digital Frequency Presentation.**
***Advanced Solid-state design...only 3 tubes.**
***Built-in AC and 12 VDC power supplies.**
***CW filter standard equipment...not an accessory.**
***Rugged 6146-B final amplifier tubes.**
***Cooling fan standard equipment...not an accessory.**
***High performance noise-blanker is standard equipment ...not an accessory.**
***Built-in VOX and semi-break in CW keying.**
***Crystal Calibrator and WWV receiving capability.**

***Microphone provided.**
***Dual RIT control allows both broad and narrow tuning.**
***All band 80 through 10 meter coverage.**
***Multi-mode USB, LSB, CW and AM operation.**
***Extraordinary receiver sensitivy (.3u S/N 10 db) and oscillator stability (100 Hz 30 min. after warm-up)**
***Fixed channel crystal control on two available positions.**
***RF Attenuator.**
***Adjustable ALC action.**
***Phone patch in and out jacks.**
***Separate PTT jack for foot switch.**
***Built-in speaker.**
***The TEMPO 2020 ...$759.00.**
Model 8120 external speaker...$29.95.
Model 8010 remote VFO...$139.00.

Henry Radio

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Our Readers Say (from page 7)

This translates to about 34MV/FT/Amp, which may be adequate in many cases.

Larry Guffer, WA6RNH

Editor, CQ:

About all the country rules, etc. I've wondered for years why someone didn't take a mercator projection of the world and divide it up in zones along latitude and longitude. For instance from 90 to 80 degrees N+S, 2 Zones each. 80 to 70 degrees N+S 4 zones each. 70 to 60 degrees N+S zones 20 degrees width in longitude. Rest of world 10 degrees by 10 degrees.

This would also give the maritime mobiles a shake.

For God's sake, don't mention my name. I don't want to get murdered. Hi.

STOLEN EQUIPMENT

• **San Francisco CA** — Stolen from my car in parking lot One-Tempo V.H.F. One 2 Meter Transceiver No. 5728, a westernelectric touch tone pad. Reward contact: Shel Kurtzman, 19436 Topham St., Tarzana, Cal. 91356. 1-213-344-0878.

• **Chicago, IL** — Stolen from Genave Radio Expo '76 booth. One GTX-1T Handie-Talkie S/N 10-59 with .13T-/.73R, .25T/.85R, .52T/.52R, .72 T/-.12R. Anyone with any info. contact: Genave 4141 Kingman Dr., Indianapolis, Ind. 46226.

• **Colorado Springs CO** — Drake TR-22 2 meter transceiver SN. 640139 Beige trimline TT handset, magnet mount quarter wave antennae, crystals for 52/52, 16/76, 37/97, 87/27, 63/03, 34/94. Contact: Rick Simpson, 2723 Rigel Dr. Colorado Springs, Colo. 80906.

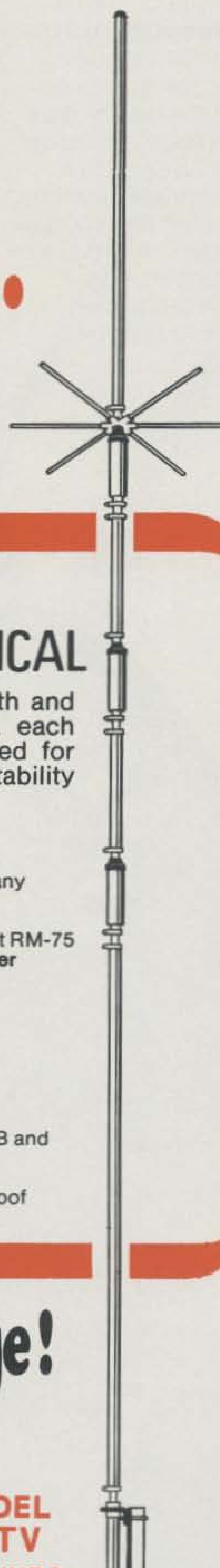
• **Colorado Springs, CO** — Wilson T1402 S/M 2 meter handi-talky SN OR6427. Crystals for 52/52, 22/92, 25/85, 16/76, 34/94, 69/09. Contact: James Hettle, PSC No.1 PO Box 2493, Peterson AFB, 80914.

• **Colorado Springs CO** — Yaesu FR-101 -SD1G HF Digital Receiver SN. 6C31-339, Yaesu FL101 HF Digital Receiver SN. GE3o627. Contact: Associated Electronics Service, 404 Arrawana, Colorado Springs, Colo. 80909.

• **Colorado Springs, CO** — ICOM 22S SN; 0017 Has total of 19 channels. Contact: Ken Keyte, 3812 Windsor Ave., Colo. Spgs., Colo. 80907.

• **Chicago, IL** — Motorosa Metrum II and Motorola HT 220. Anyone with info contact R. L. Scott, 200 W. Chicago Avenue, Oak Park, IL 60302.

if the 4-BTV weighs 39% more... what do others leave out?



HUSTLER FIXED STATION FOUR BAND VERTICAL

The 4-BTV is longer for greater aperature, larger in diameter for strength and bandwidth, heavier traps for precision and safety factor. Individually, each subassembly weighs more to collectively give you an antenna designed for convenience of assembly and installation, a wide margin in mechanical stability and far superior electrical performance.

- **Lowest SWR**—PLUS!
- Bandwidth at its **broadest!** SWR 1.6 to 1 or better at band edges.
- Hustler exclusive trap covers **"Spritz" extruded** to otherwise unattainable close tolerances assuring accurate and permanent trap resonance.
- Solid one inch **fiberglass trap forms** for optimum electrical and mechanical stability.
- Extra heavy duty aluminum mounting bracket with **low loss—high strength** insulators.
- All sections **1¼" heavy wall,** high strength aluminum. Length 21'5".
- **Stainless steel clamps** permitting adjustment without damage to the aluminum tubing.
- Guaranteed to be **easiest assembly** of any multi-band vertical.
- Antenna has ⅜"-24 stud at top to accept RM-75 or RM-75-S Hustler resonator for **75 meter operation** when desired.
- Top loading on 75 meters for broader bandwidth and **higher radiation efficiency!**
- Feed with **any length** 50 ohm coax.
- Power capability—**full legal limit** on SSB and CW.
- Ground mount with or without radials; roof mount with radials.

one setting for total band coverage! 40 THROUGH 10 METERS

HUSTLER ANTENNA PRODUCTS—for sixteen years—original designs—created and manufactured by American ingenuity, labor and materials—used by communicators throughout the world.

Hustler designs are patented under one or more of the following assigned to New-Tronics Corporation: 3287732, 3513472, 3419869, 3873985, 3327311, 3599214, 3582951

HUSTLER®

Available from all distributors who recognize the best!

MODEL 4-BTV
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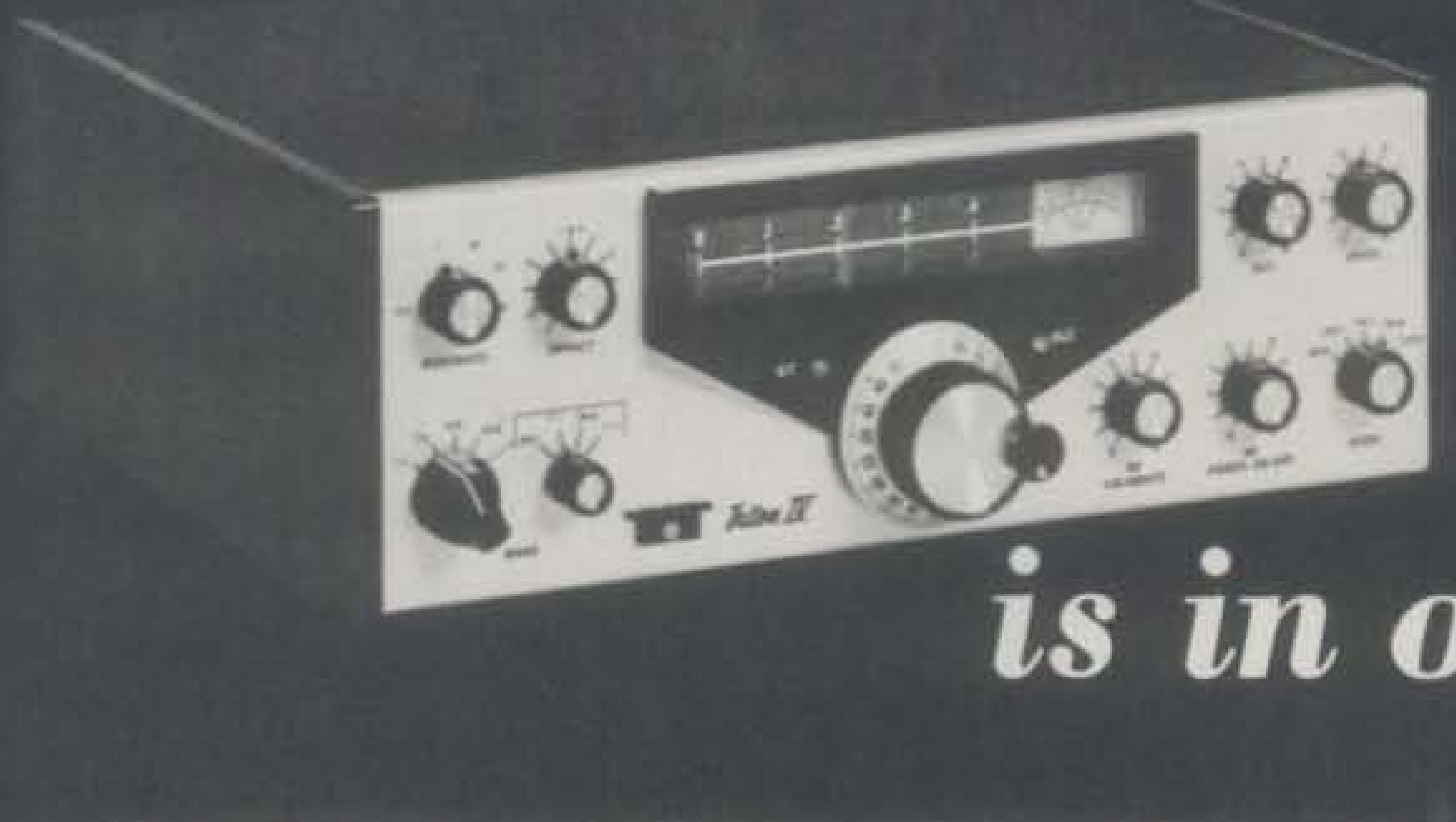
The proof of the pudding is in the eating.



The proof of Triton IV is in owner satisfaction.

Here's some of the proof . . .

K4EME — This is my second TRITON IV. They are excellent xceivers! **WA8ICK** — Luv it. Dynamite! **W9NXU** — I am very thrilled with this unit, it is great. I think you have scooped the field. **WA0AYA** — I like CW and full break-in. (Beautiful) **K3TFU** — I love the unit. **WA3VEZ** — Rig is just great. Combined with your service makes a super transceiver. **WN0SED** — Beautiful radio to use. Magnificent CW filter! Just a pure joy. **W8IIT** — I have had my TRITON IV for two months and am delighted with it. **YN1MBV** — It is a very nice rig. **W3GTX** — New features very welcome. **W0BYC** — Bought one of the first TRITON II, like it so well I updated it with a TRITON IV. **W2TBK** — It is absolutely fantastic. **WB0OPI** — I am pleased with the rig. **WA3GJA** — Very-very-very nice. Good audio quality. **W5ZBC** — The most outstanding rig I have ever used. **K8CJQ** — Excellent rig, Good filters. **W7BKK** — Very happy . . . getting excellent quality reports. **W2CET** — Power-signal reports good. **WB2UEH** — I like the compactness and appearance. **VE3IBK** — An excellent rig with superior receiving quality. **K4IVM** — I think it is tops. **WA4LOG** — I've become so used to dip, peak and adjust, this TRITON is a beautiful new experience. **KL7IHW** — Easy to set up—works great. **K4JXD** — Seems to be very FB rig. **WA7KHE** — Fantastic performance. Thanks for a fine rig. **WB4BPG** — No problems—fine rig. **VEIBZ** — Good work. **W9HQT** — Receiver better than expected, CW break-in is super. **W0AP** — Tremendous transceiver. I appreciate your engineering. **WA2ZRO** — Wonderful. **K0SFV** — Real nice rig. You thought of almost every feature and built it in. **KQ9DQ** — Beautiful. **WB0JIQ** — Beautiful radio; however, your ads do not do justice to the radio. **WN5SOH** — Very sophisticated—Easiest tuning rig ever. Very glad I bought it. **K3OJV** — Very impressed. **W4LZP** — Very good results. Put out 100 watts as good as 300 watt rigs. **WA4DQY** — I think the TRITON IV is great. **W6QXN** — Appreciate full CW break-in. **W0INH** — Enjoy light weight. **VE3CYK** — I am extremely pleased with the clarity of receiver and after putting rig on the air, received unsolicited compliments on the audio quality of the transmitter. **K4PHY** — Was 3rd in USA, first in fourth district in WWCQ contest. **W8RYU** — Own Argonaut. Both fine rigs. **W4CDA** — Compact, light weight, good engineering. **WB2WZG** — TRITON IV is the most versitile CW/SSB radio I have ever used. **WB2FMV** — Outstanding. Highly pleased with performance. **WA8ACZ** — A real nice rig. I have owned about every other make. **W5EGK** — Works nicely. **WB4ECO** — I tried this rig, a pleasure to operate. **WA4YRK** — Excellent reports on audio. **WB8NKB** — Wonderful. **W9QPQ** — An excellent rig. Love it. **W8SOP** — Makes running SSB nets a real breeze. Also good on CW nets. **WL7IRT** — Fantastic rig. **W4MDB** — Has rekindled my interest and enthusiasm in Amateur Radio to an extent I hadn't thought possible. It far out distances any competitive product at **any** price. **W6EYR** — Very nice. Been a ham for 45 years and now solid state perfection. **W2RPH** — Excellent rig. **WN0TDK** — TRITON IV is a fabulous piece of equipment. **W5VIW** — Very nice rig **WB2LQF** — Wow! **W9JCV** — Tnx for giving us a FB piece of equipment made in the USA. **W8GHO** — Very pleased. **K4KXB** — Seems to have everything desired. **W4SZ** — A pleasure to operate. **W2FKF** — Greatest rig I ever had. So far in a month 34 QSO's without one miss. Been a ham since 1922. **W4GVC** — Nothing but complements. **WB9EZE** — Well pleased with performance and simplicity of operation. **K4ETI** — Rig is great. **W8CNV** — Man—! what a rig. I've had this call since 1929. Never saw anything like it and I've seen them all! **WB2MZU** — Seems like everything the S - - - - - O - - was supposed to be at one third the price. **WN0VHE** — I think it is a very good rig. **WB9FTD** — Break-in CW is very impressive. **K0CBA** — I believe it is one of the finest HF transceivers on the market. I can't tell you how pleased I am with the noise blanker. I can get on the air from my home station again for the first time in a few years. Other rigs with noise blankers just didn't hack it. **WA7YHW** — I am very pleased with this equipment. It is certainly of high quality. **W7IIA** — Excellent equipment. **WB0RWA** — Couldn't be more pleased with it. It certainly has performed beautifully and is all I expected and more. **WB4QJT** — Like it very much — keep up the good work. **WN1YVX** — Really impressed with looks and performance. **W0NC** — Very FB rig. Performs up to specifications, an excellent design. **K8PBZ** — Already have TRITON II and IV. **W7KD** — This little "T-4" is smooth as silk . . . I've received some very flattering reports about transmitter voice quality and the CW operation is the greatest. **WN8TTO** — I found that the TRITON IV was the best rig on the market for around $800. I love it! **W2JBK** — It is absolutely fantastic. **W8FEI** — Am amazed at receiver performance. I thought I had a top notch receiver with the H - - - - - - - - -! **W1FYM** — Your guarantee is refreshingly proper. **W8MOK** — Sure makes a guy look twice at his old tube type gear. **W1TFS** — Finest CW ever, CW selectivity very good. **WB6IVR** — Very satisfied with TRITON IV. Just what I was looking for to use on my yacht. Thanks. **WA8ONP** — Also have a TRITON II. I am pleased that Al Kahn and the **good guys** at TEN-TEC thought of the CW operator! **W2EMX** — Excellent Amateur gear meets and exceeds advertised claims. **W0AMJ** — It looks like there is nothing left to be desired. It is beautiful. **W6SE** — The receive function is outstanding. It is superb in transmit. **W1BV** — In love with this fantastic gem. It's so easy and a pleasure to operate. **W6ASH** — Very happy with performance. Particularly impressed with full break-in and light weight. **WA0IMS** — By far the best rig I have ever operated. I am glad I decided on the TRITON IV and not one of the other transceivers on the market. **WA8HQO** — Thank you gentlemen.

Add your name to the growing list. See your TEN-TEC dealer or write for full details.

TEN-TEC, INC.
SEVIERVILLE, TENNESSEE 37862
EXPORT: 5715 LINCOLN AVE., CHICAGO, ILL. 60646

Introducing the 2-meter hand-held that gives you high performance. Without high cost.

It's the new Hy-Gain 3806 2-meter, 6-channel hand-held FM transceiver (144-148 MHz). The 2-meter hand-held that takes the high cost out of performance.

The Hy-Gain 3806 is built to out-perform. Out-last. And out-class every other 2-meter hand-held.

It's built tough. Water, dirt and corrosion are sealed out by specially gasketed shafts and jacks. The speaker/microphone grill is engineered to prevent direct entrance by water. Even changing the power pack in the field won't diminish case integrity. The power section is separately sealed. So you never expose the circuitry.

The high-impact ABS case is extra tough. And ribbed for a sure, non-slip grip. The controls are up front. And easy to operate. There's volume. Squelch. 6-position channel selector. Transmit LED indicator. A meter that indicates battery condition on transmit, signal strength on receive. And a separate power switch for positive on-off.

There's a telescoping antenna that collapses completely into the case. Or you can use our 269 flexible antenna for extra convenience. And there are jacks for use with external antenna. Earphone. And external 12 VDC.

The 3806 has the kind of guts that have made Hy-Gain products famous throughout the world. Its receiver section is superior to everything else for the money. It has 6 poles of tuned, on-frequency selectivity in the RF amplifier circuit. Two dual-gate MOS-FET RF amplifier stages. Plus dual-gate MOS-FET's in the 1st and 2nd mixers. They make the 3806 virtually immune to out-of-band signals. Intermodulation distortion. And cross-modulation. So you get truly incredible dynamic range. For superb adjacent channel rejection, the 1st mixer is followed by a monolithic crystal filter. And the 2nd mixer by an 8-pole ceramic filter.

A frequency multiplication factor of 12 allows you to use thicker, high stability crystals (one set of 146.52 simplex crystals supplied). Audio is enhanced through use of a separate speaker and microphone. And there's an internally adjustable mic preamp. Something you won't find anywhere else.

The Hy-Gain 3806 hand-held is backed by a complete line of superb accessories. Including AC and DC chargers. Carrying case. External antenna adapter cable. And a Nicad power pack that's so over-engineered you won't over-extend it. Even in the most adverse conditions.

The pack is completely sealed in its own tough ABS case. Protected against over-charging. And contact shorting. It has 30-40% more in-use capacity than competitive units. And an average service life of more than 20 hours per charge.

Soon we'll have a Touch-Tone®* pad available for the 3806. It'll fit flush in the back panel. Because we designed it specifically for the 3806.

The Hy-Gain 3806 2-meter, 6-channel FM hand-held. It gives you the performance you want. Without costing a lot. Available locally through your Hy-Gain dealer. See it and our more than 300 other fine products soon.

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Pack up all your cares and woes and stick them in the closet. Ship the kids off to their grandparents. Take the XYL, some radio gear, suntan lotion and head south for a...

CARIBBEAN DX VACATION

Or How I made my wife happy and still got some DXing done

By L.D. "BOB" BURNS*, W5SJS

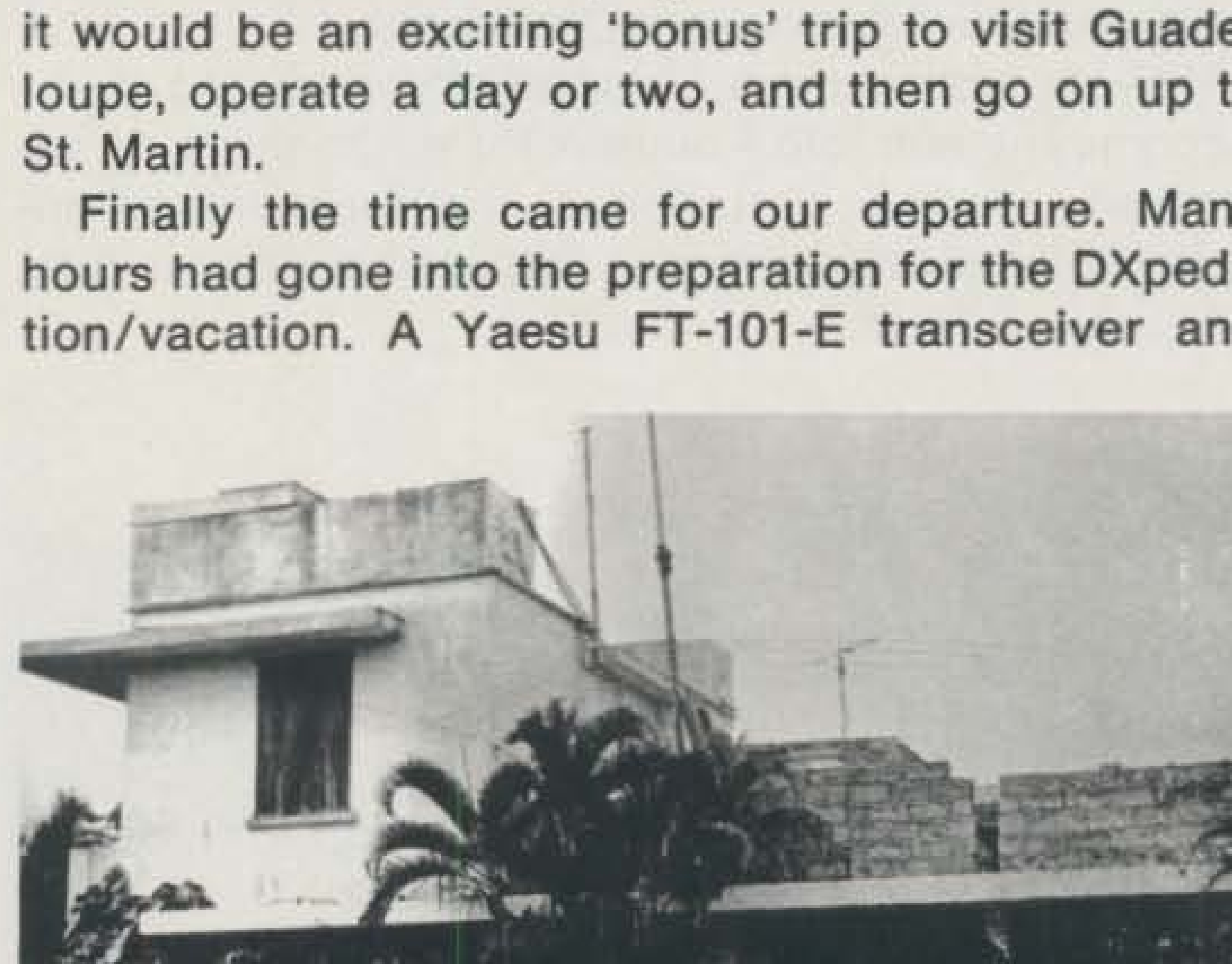
The islands of the Caribbean are ideally suited to tropical vacations as well as some exciting DXing. While the lesser Antilles do not represent the rare DX for stateside amateurs that they do for European amateurs, there are a few islands, such as St. Martin, which are much sought contacts for everyone. This is an account of a vacation/DXpedition from two of the lesser antilles during July of 1976.

After spending 16 days sailing down the leeward and windward islands in a three masted schooner, my wife and I became intrigued with the Caribbean. For our vacation in 1975 we went to the island of Montserrat and I operated as VP2MJS. (Fortunately I was able to get the last two letters of my home call). The experience was great! So much so that we decided to visit another island in 1976. While trying to decide, it occurred to me that St. Martin would be ideal, because of its relative rarity resulting from the scarcity of resident amateurs there. I found it was necessary to apply for a license to operate in Guadeloupe, as St. Martin is governed from there. The Guadeloupe call sign (FG7 for natives of the country and FG0 for non-resident license holders), is then signed portable FS7 when used on the French side of St. Martin.

I first contacted the French Consul General here in Houston, who advised me of the proper department to write in Paris. I then wrote, in French, requesting the proper forms for application. Within 2 months they mailed the forms and a copy of their Amateur Radio Regulations. The forms were filled out and returned with a copy of my U.S. Amateur license. It took about 3 months for the French license to arrive, but I was made aware that it can take as long as 6 months. Just in case the French license had not come in time for our trip, back-up plans had been made for going to Barbados, where obtaining a license is much easier. The P.T.T. Department in Paris issued me the call FG0CRZ.

Having obtained a license to operate on both St. Martin *and* Guadeloupe, my wife and I decided that it would be an exciting 'bonus' trip to visit Guadeloupe, operate a day or two, and then go on up to St. Martin.

Finally the time came for our departure. Many hours had gone into the preparation for the DXpedition/vacation. A Yaesu FT-101-E transceiver and



The Au Grand Corsair Hotel on Guadeloupe. Yvon, FG7AK, is the manager. His TH3 Mk III is atop the hotel.

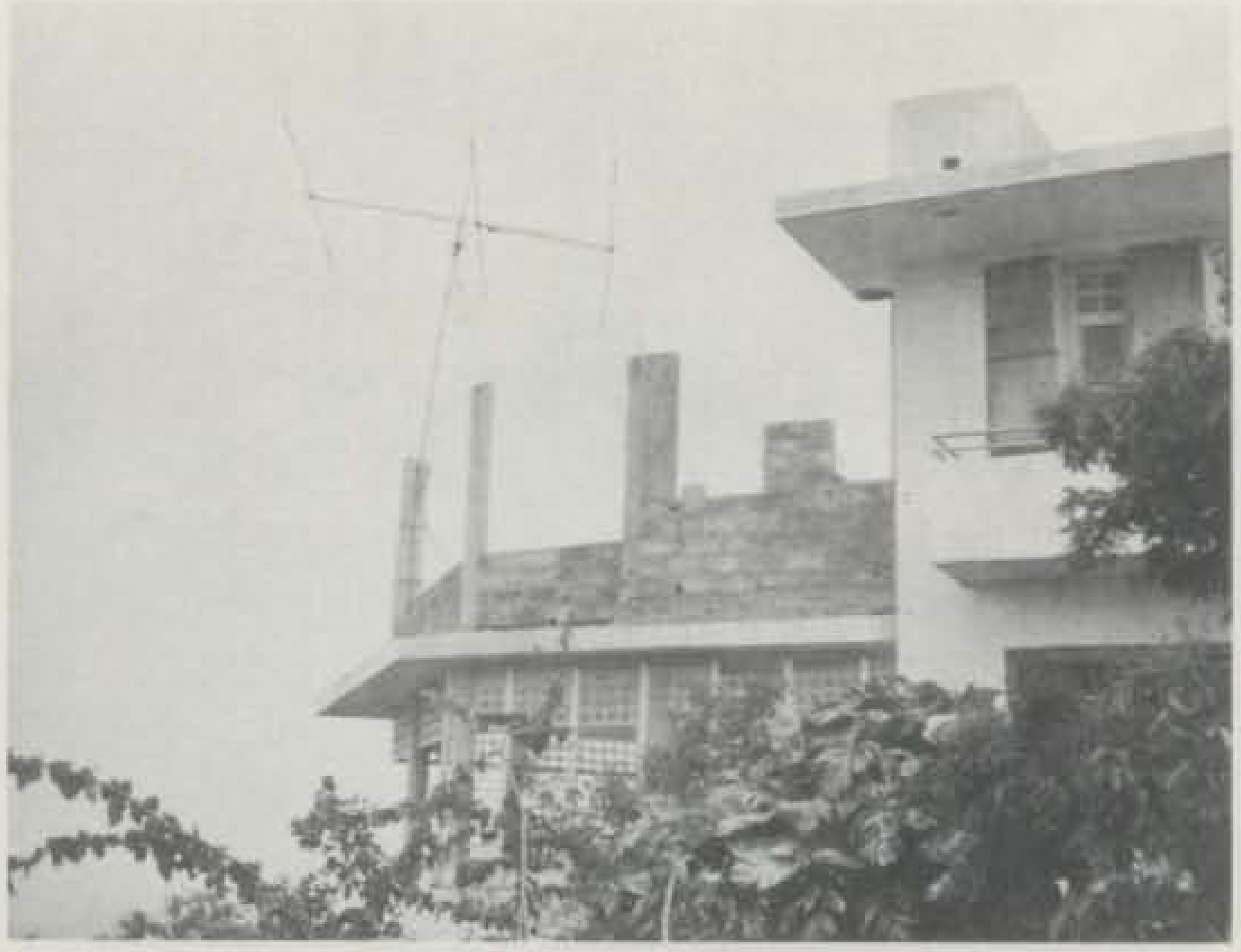
*5125 Tangle Lane, Houston, Texas 77027

The basic equipment for the vacation/DXpedition. The Yaesu and carrying case are in the upper left with the 2-el tri-band quad, coax, portable dipole filling out the picture.

its Haliburton carrying case, a portable stainless steel doublet antenna, a portable 2-el tri-band cubical quad, mast, guy rope, and a lot of other related equipment had to be prepared for boarding the airline. Everything except the FT-101-E was checked through as luggage.

First, we flew into Pointe A Pitre, the capital of Guadeloupe. We had made arrangements to stay with Yvon, FG7AK, at his hotel, Au Grand Corsair, (which is located about 10 miles from Pointe A Pitre in a small town called Gosier). We arrived well after 10:00 p.m. local time, yet Yvon rushed out to greet us and help with the equipment. After several beers and much conversation, we were shown to our cottage which overlooked the Carribean.

The next morning, a Saturday, Yvon invited me to accompany him into Pointe A Pitre. On the way, we worked a number of stations in the Venezuelan Contest, which was just under way. Yvon was running an Atlas transceiver and Hustler antenna in his small automobile.



Yvon's TH3 Mk III tri-bander atop the Au Grand Corsaire Hotel on Guadeloupe.

While in town we met several other resident amateurs, among them Father Jack Delkmyn, (possibly the senior amateur on the island, with over 30 years of operation there). Father Jack's call is FG7XT. He was kind enough to allow me to operate his KWM-2 briefly during our visit. Other amateurs I met were Simon, FG7AE, Jude, FG7XA, Guyan, FG7YE, and Alex, an amateur who owns a very modern drugstore in the town of Gosier.

When we returned to the hotel, Yvon had arranged a luncheon for my wife and I and a number of the local amateurs.

That afternoon Yvon helped me set up the Yaesu FT-101 and put up the dipole antenna on 20 meters. The cottages where we stayed were on a hillside overlooking the water. Just offshore, about a mile, was a small island with a lighthouse on it, making the view very delightful. The antenna was about 160 feet above the Caribbean and sloped at about 30 degrees favoring the West. We had brought the collapseable 2-el cubical quad, and Yvon even had a steel mast for us. However, on the flight down, the shipping tube with the boom and spreaders was damaged beyond repair.

Father Jack Delkmyn, FG7XT, on the right and the author at Father Jack's station on Gosier, on Guadeloupe.

During our 3 day stay on Guadeloupe we enjoyed the excellent food and wine at Au Grand Corsair. Yvon made sure we had all of his special dishes. His hospitality was wonderful. Each time we came through the main lobby he would invite me in to operate the Atlas 210 in his office. He had dipoles on 80 and 40 meters, and a TH3 MK III for 20, 15 and 10. All were mounted atop the hotel at about 60 feet.

While on Guadeloupe, I worked sideband on 80, 40, 20 and 15, and c.w. on 80, 40, and 20 meters. In approximately 2½ days of actual operation, about 100 stations were worked.

On Tuesday, July 6th, we flew up to the island of St. Martin, landing at Juliana Airport on the Dutch side. We stayed at the "Le Pirate" hotel in the town of Marigot on the French side. We were given room #6 which is where most of the visiting amateurs stay when operating FS7. This room is located at the end of the building, with a nice stretch of sand and palm trees next door to it . . . very useful for erecting antennas.

Operations were begun at 1800 Z on 20 meters, using only the sloping dipole. I worked sideband on 80, 20 and 15 and c.w. on 80, 40 and 20 meters. Most of our activity was on 40 and 20, almost equally divided between c.w. and s.s.b.

Probably the greatest problem was the lack of a remote v.f.o. for the Yaesu. With space being such a problem on such a trip, the FV-101 was felt to be a luxury item and was left at home. So, when pile-ups occurred I was right underneath it all with no way to move out of the way. In addition, I had no

The view from the patio at the Hotel Le Pirate on the French side of St. Martin Island.

one stateside to run a list for me. While I definitely do not like the use of a list, it is effective in allowing the DX station to work as many stations as possible under crowded band conditions, (and is particularly helpful in working stations with weak signals). I did have the good fortune to have the help of Mario, YV1MAE, in making a list for me as I worked Europeans. He and IT9LRY did a marvelous job of handling the calling stations. They enabled me to work 3 to 4 times as many stations as we had without the use of the list. Even then we were working under extremely heavy QRM conditions.

During our stay in St. Martin we enjoyed a visit from Alain Rochemont, FG7AR/FS7, the only permanent resident amateur on the French side. At the time Alain was not on the air due to antenna problems. The high winds on this part of the island during July are unbelievable! Alain's station consists of a Swan 350 and an SB-220 linear.

The management of the "Le Pirate" Hotel was most cooperative in allowing me complete freedom

Bebe Burns and Yvon, FG7AK, at Guadeloupe International Airport. Yvon runs an Atlas 210 in his mobile setup.

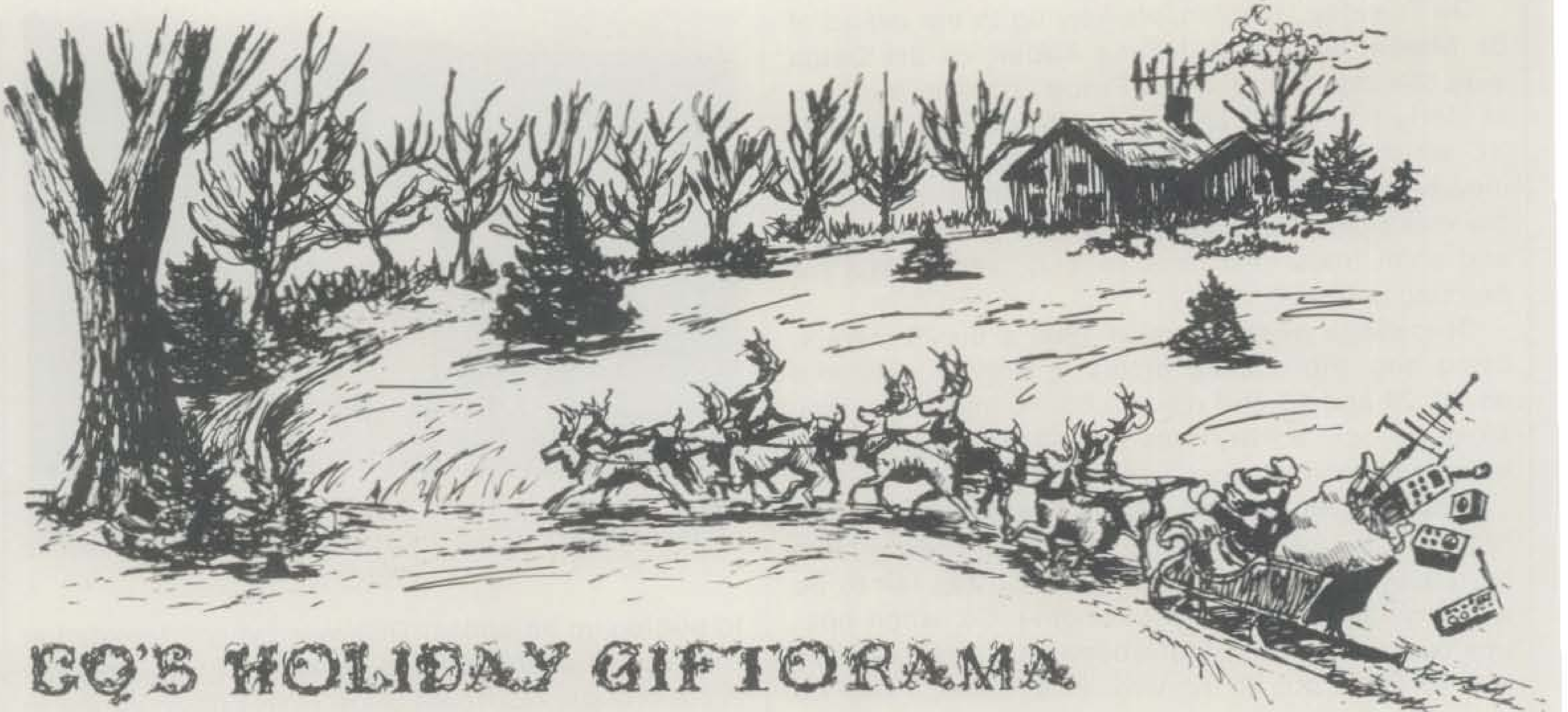
in putting up antennas. They were very interested in the rig and in the various countries I was working. Alain brought his Heath SWR/PWR bridge for me to calibrate and the hotel manager loaned us some tools to do the job. The food, the room, and the service were all quite good and added to our enjoyment of the trip.

Over all I worked 100 stations from Guadeloupe and about 700 from St. Martin and still found time to enjoy the beaches, shopping, and the numerous fascinating visits with local amateurs. The DXpedition/Vacation was not intended to be a DX marathon, but rather a husband-wife vacation combined with as much hamming as such would permit.

I would like to express my appreciation to the French Consul General in Houston, Monsieur Vorms, and to the Department of Postes et Telecommunications in Paris for their cooperation. And most of all to the French people, particularly the amateurs, on Guadeloupe and St. Martin for their courtesy and friendliness.

Station FGØCRZ struck its antennas, ceased operations and closed down at 0300 Z, July 11, 1976. ■

The author in front of the Le Pirate Hotel on St. Martin. Le Pirate is where many visiting amateurs stay while on the island.



CQ'S HOLIDAY GIFTORAMA

gift suggestions for the active amateur . . .

This is the season for exchanging gifts, and while it's usually difficult to know what to buy for anyone, imagine, if you will how difficult it is to know what to give a ham. What with the broad range of gear used by hams, and the general unfamiliarity of most family members and friends with the technical equipment we use, it's no wonder we get the same old windbreakers, ties and sweaters.

CQ wants to help solve this dilemma, and make certain that this year you receive some of the goodies available on the counters at your local radio emporium.

You'll note that the items have been grouped in five categories in ascending order of cost. So look over the next few pages, decide what you really want, then circle it and leave *CQ* on the coffee table or night stand with the pages open to what really grabs you. Other helpful hints such as the picture, write up and source stuck in the corner of the bathroom mirror or slipped under your dinner plate could have a positive effect. We sincerely hope this works for you. In any event, the staff of *CQ* wishes you a merry yuletide season, and a happy and prosperous New Year.

Under $25

Amateur Radio Coffee Cup, with design, $7.95; with call letters, $10.95. **Rustprint,** Box 7575, North Kansas City, MO 64116.

W2AU Balun. Replaces center insulator, improves front-to-back ratio, and features a built-in lightning arrester. $12.95. **Unadilla Radiation Products,** 6743 Kinne St., East Syracuse, NY 13057.

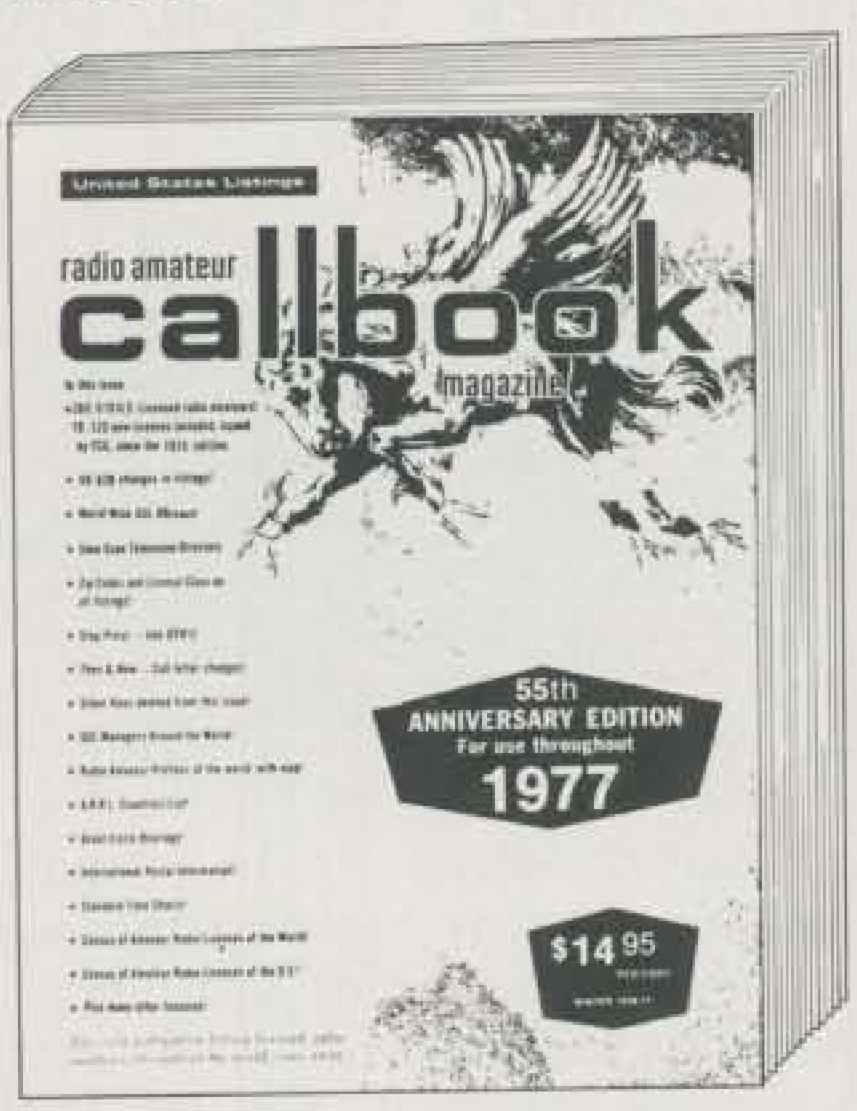
Swan SWR-3 Meter. Measures 1:1 to 3:1 s.w.r. from 1.7 MHz to 55 MHz. Small, but with all the accuracy needed. $10.95. **Swan Electronics,** 305 Airport Road, Oceanside, CA 92054.

Frequency Standard MFJ-200BX. Provides strong precise markers every 100, 50, and 25 kHz well into the VHF region. Gated for positive identification. CMOS. Accurately determines receive and transmit frequency. $24.95 **MFJ Enterprises,** P.O. Box 494, Mississippi State, Mississippi 39762.

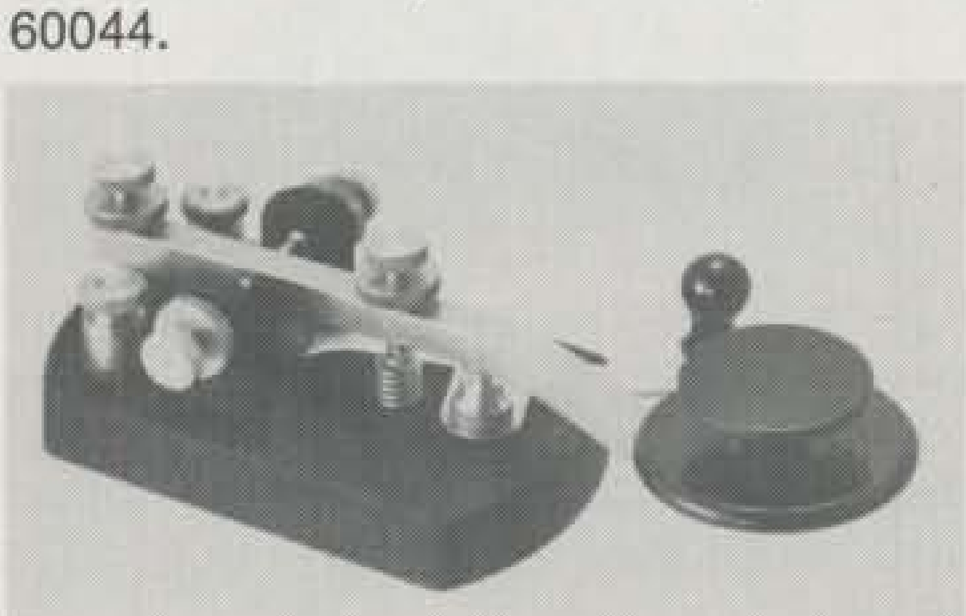
Ham Key Model HK-3. Deluxe straight key. Velvet smooth action. Heavy non-slip base. $16.95. **Ham Radio Center, Inc.,** St. Louis, MO 63132.

QRP VFO MFJ-40V. Plugs directly into MFJ QRP transmitter for stable variable frequency control from 7.0 to 7.2 MHz. Can be used with other transmitters. $24.95. **MFJ Enterprises,** P.O. Box 494, Mississippi State, Mississippi 39762.

Nye Viking Super Squeeze Key SSK-1. Extra long, form-fitting molded paddles for maximum operating flexibility. $23.95. **William M. Nye Company, Inc.,** 1614 130th N.E., Bellevue, WA 98005.



United States Callbook. All W and K listings. $13.95. Foreign Radio Amateur Callbook. DX listings. $12.95. **Radio Amateur Callbooks, Inc.,** 925 Sherwood Ave., Lake Bluff, Illinois 60044.



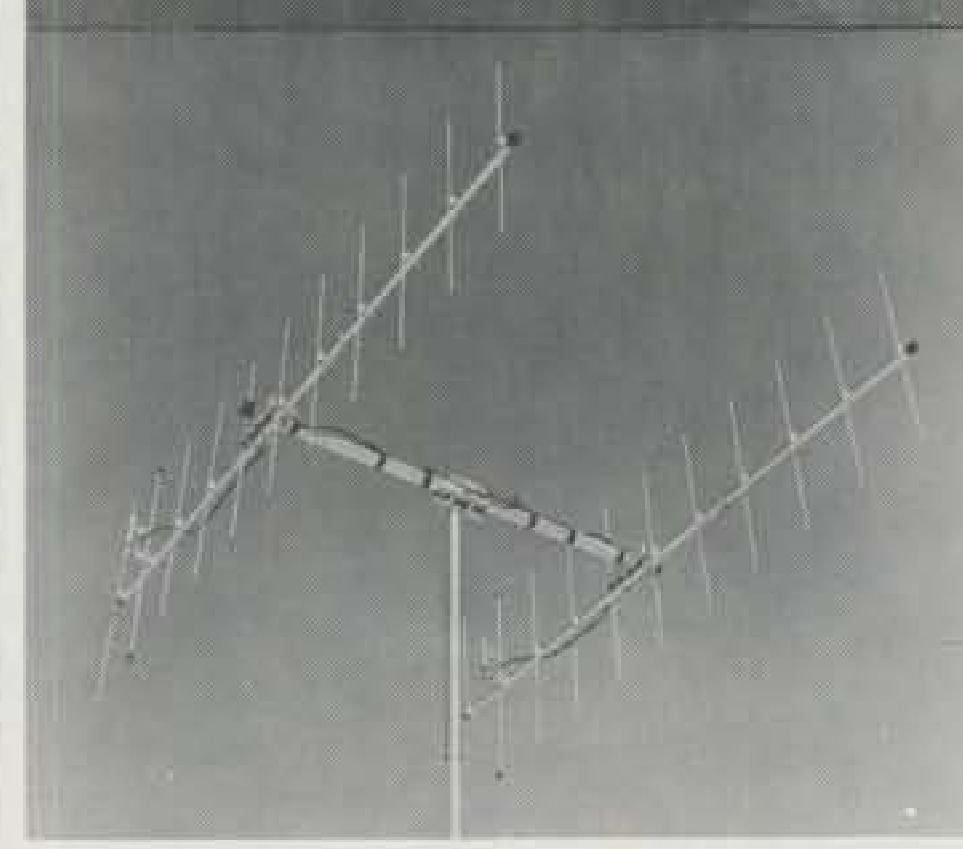
Nye Viking Speed-X Telegraph Keys. Smooth, sure-operating heavy duty keys mounted on a heavy die-cast base with black wrinkle finish, and brass, chrome or nickel-plated hardware, Silver plated contacts. Eight models priced from $6.95. Brass: $9.95. **William M. Nye Company, Inc.,** 1614 130th N.E., Bellevue, WA 98005.

QRP Transmitter MFJ-40T. Work the world on 5 watts with this rig on 40-meter c.w. No tuning required. Short circuit proof. Requires 12 v.d.c. $24.95 **MFJ Enterprises,** P.O. Box 494, Mississippi State, Mississippi 39762.

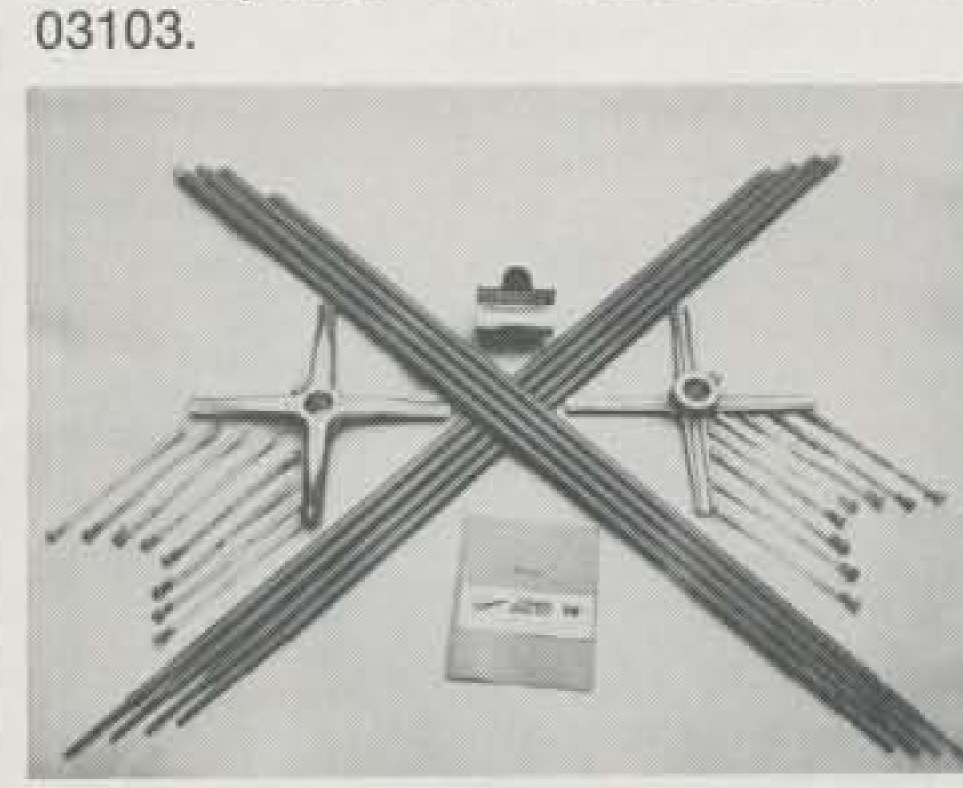
Dust Covers. Covers available for more than 100 types of equipment, and special covers can be made to order. Send for list. Most covers: $2.95 to $4.95. **Cover Craft,** P.O. Box 555, Amherst, NH 03031.

Under $100

MFJ has a number of products in this price category. They include a c.w. Filter, $27.95, CMOS Keyer, $49.95; Super Logarithmic Speech Processor, $59.95; State-Of-The-Art Preselector, $49.95. **MFJ Enterpises,** P.O. Box 494, Mississippi State, Mississippi 39762.



Cushcraft A147-22. Two 11-element yagis for 2 meters on a horizontal mounting boom. For both f.m. and s.s.b./c.w. $69.50. **Cushcraft Corp.,** 621 Hayward St, Manchester, NH 03103.



Skymaster Quad Antenna Kit. 2-Element, 3-band quad. Includes 8 fiberglass arms, 2 end spiders, boom, 16 spreader arm clamps and instruction manual. $99.95. **Cubex Company,** P.O. Box 732, Altadena, CA 91001.

AZ Special Antenna Kit. Described by K3AZ in September 1975 *CQ*. Operates on 75/80, 40, 20 and 15 meters. 88 ft. long, no loading coils. Provides gain on 15 and 40 meters. $38.00. **Tech-Staff Associates,** P.O. Box 136, Glen Cove, NY 11542.

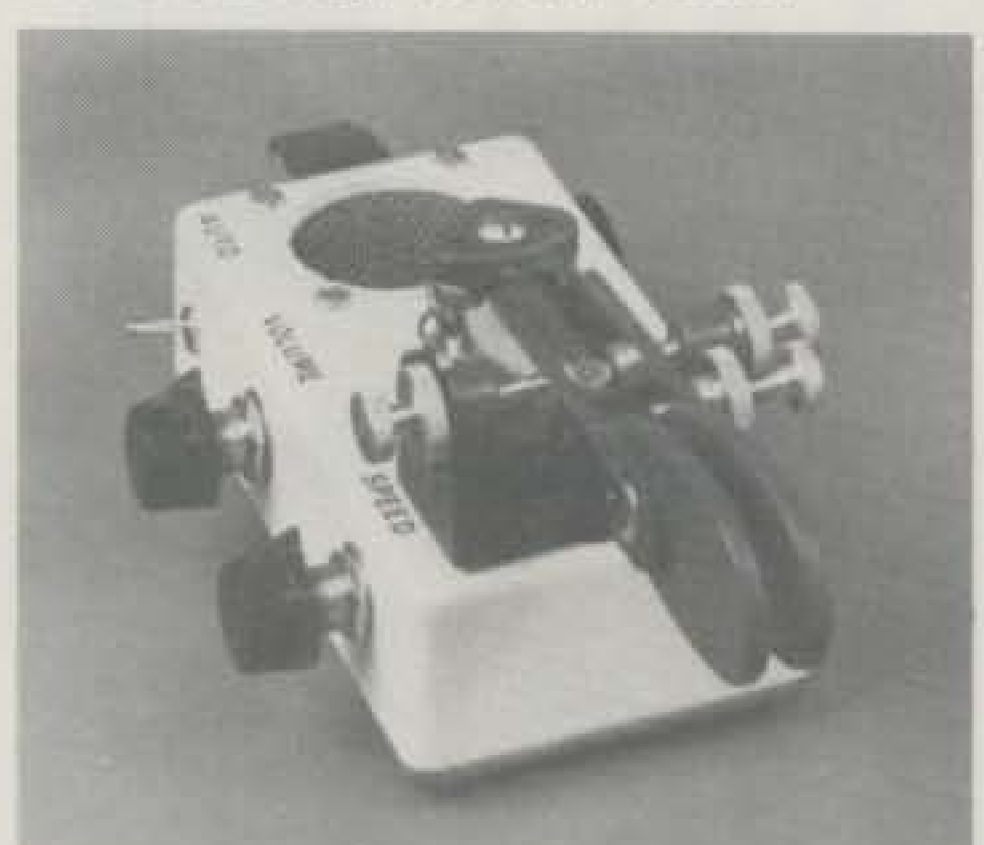
De Forest MM 200 Digital Multimeter, reads a.c. and d.c. volts and current, and ohms to 10 megohms. $99.95. **De Forest Electronics,** 40 Fairfield Pl., West Caldwell, NJ 07006.

Frequency Standard. Precision crystal, battery operated, markers at 100, 50, 25, 10 or 5 kHz selected by front panel control. Zero adjusts to WWV. $37.50. **Palomar Engineers,** Box 455, Escondido, CA 92025.

Antenna Impedance Meter. Adjust antenna for proper match. Battery operation permits adjustment on roof or tower in combination with your dip meter. Measures linear amplifier and receiver input impedance, 1.8 to 150 MHz. $99.95. **Leader Instruments Corp.,** 151 Du Pont Street, Planview, NY 11803.

Automatic Electronic Keyer. All solid state construction. Reliable reed relay switching. Complete with paddles. Sidetone generator. Precise Dot-Dash space timing. Self completing Dots and Dashes. Dot memory. Speed adjustable from front panel. Weighted to stay put. Needs only +5 v.d.c. at 150 m.a. $39.95. **Suntronix Company,** 360 Merrimack Street, Lawrence, MA 01843.

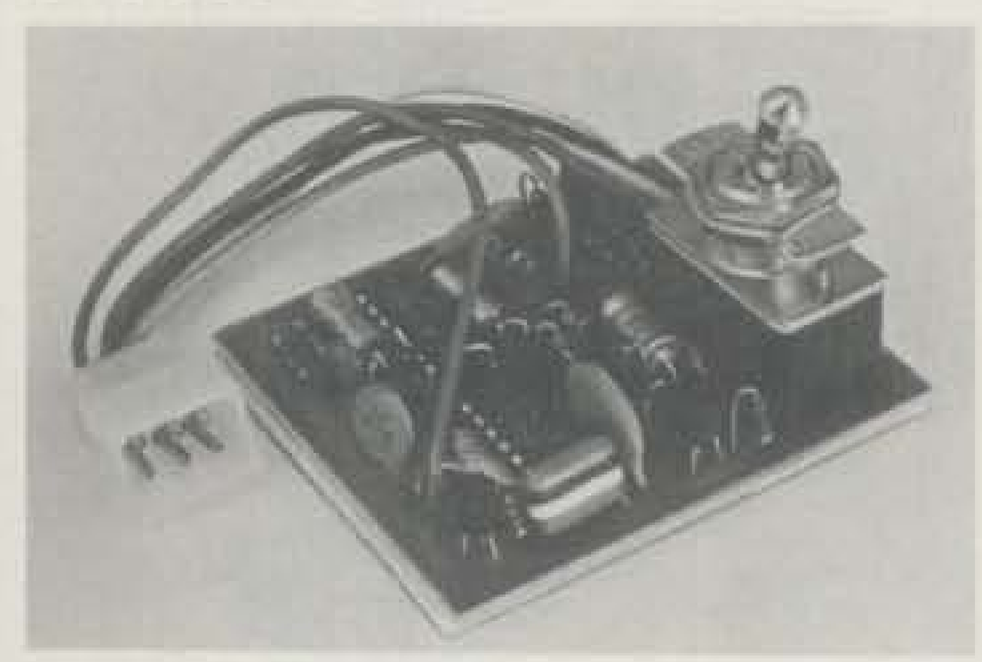
VIBRO-KEYER. Works with any electronic keyer. Weighs 2.75 lbs. Finely polished parts. Size 3.5" x 4.5". Standard model: $33.00; Deluxe model, chromium plated base $43.75. At dealers, or **The Vibroplex Co., Inc.** 833 Broadway, NY, NY 10003.



IC Keyer. Takes less space on operating table than just about any bug. Features full automatic, self-completing, dot memory, iambic operation. May be used as a straight keyer. Built-in sidetone oscillator and speaker, volume and speed controls. Speeds from 5 to 50 w.p.m. Fully adjustable and complete rf shielding. With heavy base. $97.50. **Palomar Engineers,** P.O. Box 455, Escondido, CA 92025.

Autek Audio Filter Model QF-1. Infinitely-variable active audio filter. Continuously adjustable from 250 to 2500 Hz. Peak c.w. and voice. Reject whistles and c.w. 80dB skirts, notch to 70dB. Plugs into phone jack. $52.95. **Autek Research,** Box 5127 E, Sherman Oaks, CA 91403.

Random Wire Antenna Tuner. Continuous coverage 3.0 to 30 MHz, 1:1 s.w.r., compact 5" x 6.5" x 10". Year guarantee. FOB factory: $99.00 **Unique Products Company,** 1003 South Fircroft Street, West Covina, CA 91761



Entry Sentry Model BA-1A. Creates an instant alert by blasting the auto horn (or other sounder) 120 times in 60 seconds, and will repeat if necessary. Easily installed. $34.95. **Theta Labs., Inc.** 10911 Dennis Rd., #405, Dallas, TX 75229.

Ham Key Model HK-4. Combination lever paddle and straight key on common, heavy, non-slip base. $44.95. **Ham Radio Center Inc.,** 8342 Olive Blvd., P.O. Box 28271. St. Louis, MO 63132.

Under $200

CW Sendin' Machine. Iambic memory keyer with dot and dash memories stores up to eight different messages in 2048 bits of memory. $137.00. **H. Alan Harp,** WA4SVH 718 Magnolia Drive, Lake Park, FL 33403.

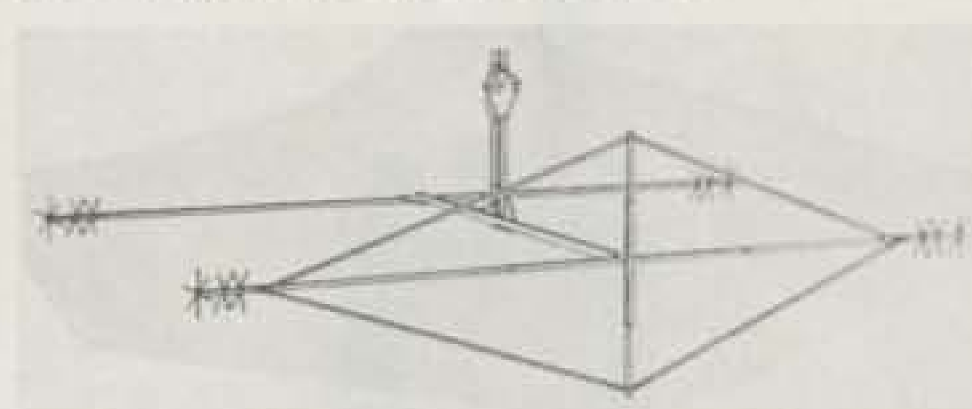
Atronics Visual Code Reader KCR101. Displays decoded morse code signals visually. In kit form. Assembly time is as little as 5 hours. Connects to speaker. Operates at 5 to 50 w.p.m. at selected speed. $149.00. **Atronics,** P.O. Box 77, Escondido, CA 92025.

Ten-Tec Ultramatic Keyer-KR 50. Automatic or manual weighting, dit and dah memories, straight key override, adjustable paddle force. $110.00 **Ten-Tec, Inc.,** Sevierville, Tennessee 37826.

Millen 92200. 2kW Super Heavy Duty Transmatch. With built-in reflectometer. $199.00. **James Millen Mfg. Co.,** 150 Exchange Street, Malden, MA 02148.

Swan TB-3HA Heavy-duty, three-working-element antenna for 10, 15 and 20 meters. $189.95. **Swan Electronics,** 305 Airport Road, Oceanside, CA 92054.

Wilson 1402SM. 144-148 MHz. 6 channel, handheld transceiver. $164.95. Tone encoder TE 1, $34.95. 10 Ni-Cad batteries, $14.95. **Wilson Electronics Corp.,** 4288 S. Polaris Ave., Las Vegas, Nevada 89103.



Hybrid Quad Antenna. Boom length only 54 inches. Weight only 15 pounds. Covers 6, 10, 15, and 20 meters. Handles 1200 watts p.e.p. $109.50. **Mini-Products, Inc.,** 1001 W. 18th St., Erie, PA 16502.

CTR-2-50MHz Kit 50 MHz frequency counter. Measures frequencies of transceivers, transmitters, repeaters and tone pads to an accuracy of ± 2 p.p.m. $199.95. **Davis Electronics,** 636 Sheridan Dr., Tonawanda, NY, 14150.

Clegg FM-76. 220 MHz mobile or fixed, 10 watt 12-channel transceiver $165.00. Clegg Mark-3. 146 MHz mobile or fixed. 15 watt, 12-channel transceiver. $169.50. **Clegg Communications Corp.,** 208 Centerville Rd., Lancaster, PA 17603.

TEMPO 100AL10 VHF Linear Amplifier 144-148 MHz. Power output: 100 watts. $199.00. **Henry Radio,** Butler, Missouri 64730.

Ultimate Transmatch Model UT2000A. Use with any coax-fed antenna or end-fed random wire antenna. 2 kw p.e.p., 1 kw continuous, 1:1 s.w.r. to transmitter. $139.95. **Murch Electronics,** Box 35, Franklin, Maine 04634.

KLM Two-Meter Linear Amplifier. Boost power as much as 28 times with this little box just 6.5 x 10 x 2 inches. Emitter balanced, protected against high VSWR, short and open circuits. Connects between antenna and transceiver. $199.95. At dealers.

Hufco 500 MHz Six Digit Frequency Counter Kit. 100 Hz readout, 1Hz optional. Kit: $169.95; Wired: $199.95. **Hufco,** Box 357, Provo, Utah 84601.

Gary 302 Frequency Counter. Counts 50Hz to over 20 MHz input. Rechargeable Nicad battery. ±0.005% ± 1 count accuracy. $120.00 plus $5 postage and handling. **Gary McClellan and Co.** Box 2085, 1001 West Imperial Hwy., La Habra, CA 90631.

Astatic D104 Silver Eagle Microphone. One of the most famous microphones in amateur radio. Grip-to-talk and push-to-talk. All exterior parts chrome plated. Wired for universal hook-up. Comes with a 5-conductor plus shield coil cord. $119.00. At dealers.

Under $500

Regency HR-312. 35-watt, 12-channel (expandable to 144) 2-meter transceiver. $269.00. **Regency Electronics,** 7707 Records Street, Indianapolis, Indiana 46226.

Heathkit HW-104. 3.5 to 29 MHz broadband transceiver. Built in 100 kHz and 25 kHz calibrator. Less than 100Hz/hr. drift after warmup. Kit: $489.95. **Heath Co.,** Benton Harbor, Michigan 49022.

Kyokuto FM144-10SXR-II. All solid-state PLL digital synthesized, 5kHz steps, 144-148 MHz, LED readout. $439.00. **Amateur-Wholesale Electronics,** 8817 SW 129th Terrace, Miami, Florida 33176.

Genave GTX-1T. Handheld, 6-channel 2-meter transceiver with tone encoder. Hi 3 watts, Lo 1 watt. Receiver sensitivity .2mV for 12db SINAD. $299.95. **Genave,** 4141 Kingman Drive, Indianapolis, Indiana 46226.

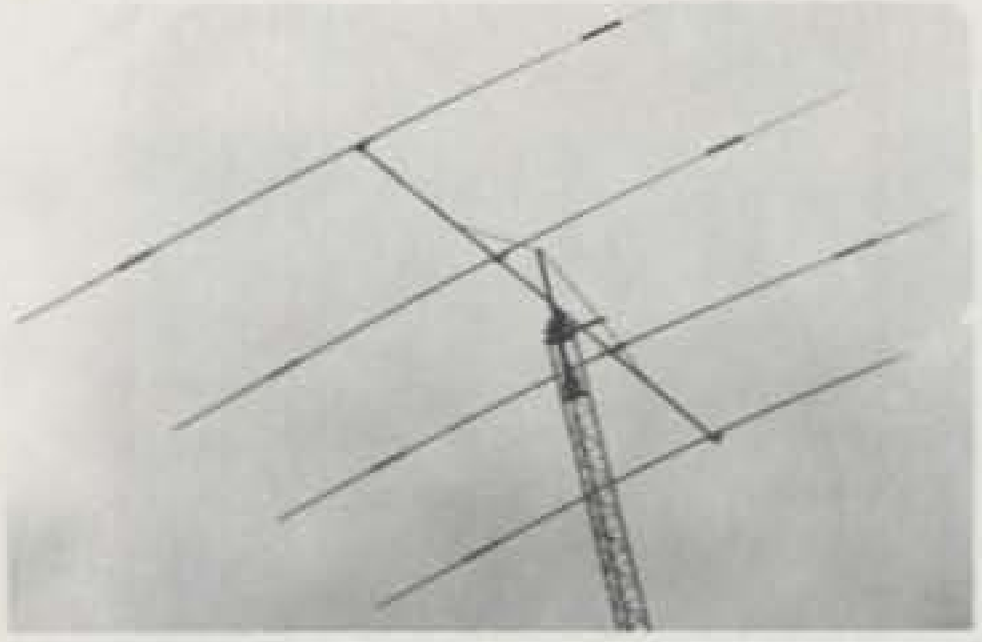
Kenwood TV-502. 2-meter transverter. Puts a TS-520 on 144-145.7 MHz. Just plug it in. $249.00. **Trio-Kenwood Communications, Inc.,** 116 East Alondra, Gardena, CA 90248.

Drake TR-33C. 2 meter f.m. portable transceiver. 12-channel capability, plus single crystal per channel feature. Reduced receiver battery drain. Nicad batteries included. A.c. and d.c. power cords and built-in battery charger. $229.00. **R. L. Drake Co.,** 540 Richard Street, Miamisburg, Ohio 45342.

Heathkit HW-101. 3.5 to 29.7 MHz transceiver features operating ease, convenience and versatility. 180 watts input p.e.p.; 170 watts input c.w. Stable FET v.f.o. Kit: $339.95. **Heath Co.,** Benton Harbor, Michigan 49022.

Tempo CL-146A. Compact 2-meter f.m. transceiver. 12-channel capability, one supplied, plus two of your choice. Internal speaker dynamic mike, mounting bracket and power cord. $239.00. **Henry Radio,** Butler, Missouri 64730.

Genave GTX-202. 30-watt, 22-channel 2 meter f.m. transceiver. Half the price of synthesis. Add crystals as you want or need them. 8-pole crystal filter. $239.95. **Genave,** 4141 Kingman Drive, Indianapolis, Indiana 46226.



Swan TB-4HA. Heavy-duty, four-working-element antenna for 10, 15 and 20 meters. $249.95. **Swan Electronics,** 305 Airport Rd., Oceanside, CA 92054

Argonaut 509. 3.5 to 30 MHz, 5 watt s.s.b./c.w. transceiver. Solid state, permability tuned, instant band change, built-in s.w.r. bridge, S-meter, and internal speaker. WWV, direct frequency readout, and receiver offset tuning. $329.00 **Ten-Tec,** Sevierville, Tennessee, 37862.

Wilson 2202SM. 220 MHz handheld transceiver. $239.95. Wilson 4502SM. 450 MHz handheld transceiver. $279.-95. Each device: 6-channels, plug-in crystals, complete with rubber duckie antenna. **Wilson Electronics Corp.,** 4288 S. Polaris, Las Vegas, Nevada 89103.

Dentron Super Amplifier. 2kw p.e.p. input on s.s.b., 1 kW on c.w., RTTY and SSTV, 160-10 meters. $499.50. **Dentron Radio Co., Inc.,** 2100 Enterprise Parkway, Twinsburg, Ohio 44087.

Yaesu FL2100B. 80 to 10-meter linear amplifier. Conservative 1200 watts p.e.p. input on all bands. 117 to 234 v.a.c. operation. Built-in s.w.r. meter. Tubes biased to cutoff during receive to maximize tube life and minimize heat. Individual input coils for each band. $399.00. At dealers.

Wilson M520 5-element 20-meter beam antenna. Boom length, 40 feet. Turning radius, 27 feet. Weight, 90 lbs. $269.00. **Wilson Electronics Corp.,** 4288 S. Polaris Avenue, Las Vegas, Nevada 89103.

Yaesu 200R. 200 channel synthesized f.m. transceiver. 144-146 MHz or 146-148 MHz. Power output 1 or 10 watts. Built-in tone burst oscillator. Priority channel. Automatic VSWR protection. Selectable ± 600 kHz transmitter offset. $449.00. At dealers.

Exotic Gifts

4K ULTRA general coverage linear amplifier. Features two Eimac 8877 grounded grid triodes in the ultimate of conservatism. 100 watts drive can produce 4000 watts p.e.p. input on s.s.b., c.w. and f.s.k., 3.0 to 30 MHz. $2950.00. **Henry Radio,** Butler, Missouri 64730.

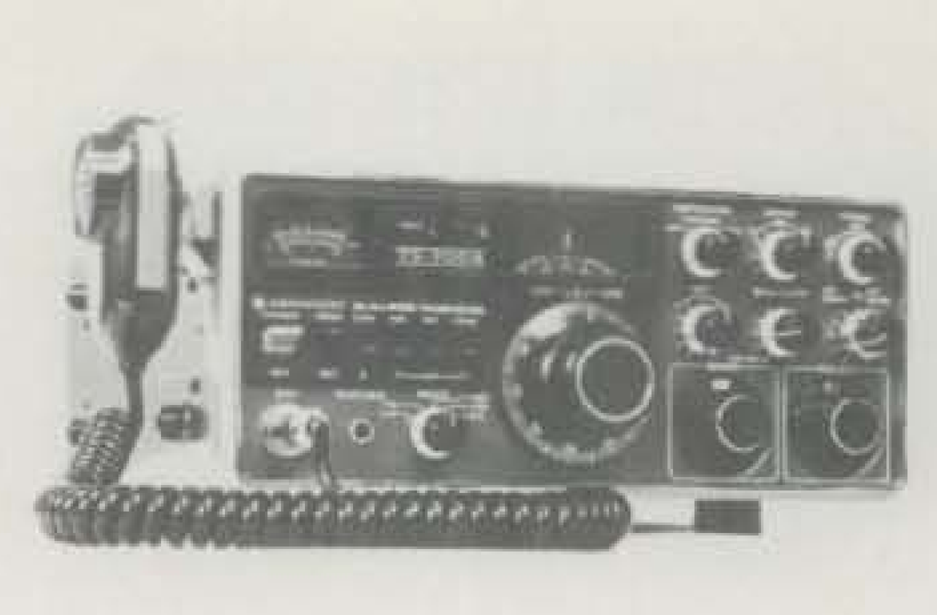
Clegg FM DX. Fully synthesized, digital display f.m. 2-meter transceiver. Covers 143.5 to 148.5 MHz in 5 kHz steps. 35 watts output. $599.99. **Clegg Communications Corp.,** 208 Centerville Rd., Lancaster, PA 17603.

Compact h.f. s.s.b. Transceiver and Digital v.f.o. The **Atlas** 210X and 215X transceivers have earned enviable reputations. Provide 5-band coverage in very small size. 200 watts p.e.p. in a seven pound package. Transceiver: $649; a.c. console: $139; Model 206 v.f.o.: $299. At dealers.

ETO Alpha 77D. Full legal limit linear amplifier. Full break-in 1.8 to 30 MHz. $2,995. **Ehrhorn Technological Operations, Inc.,** Brooksville, Florida 33512.

Yaesu FT-301D. All solid state 200 watt p.e.p. digital dial transceiver. All modes. 160-10 meters. 3-position a.g.c. R.f. speech processor. Weight: 22 lbs. $935.00. At dealers.

Robot Model 400. All solid-state, digital, random access memory SSTV scan converter. Put your present rig on TV. Need only a TV camera and a monitor. $695.00. **Robot Research, Inc.,** 7591 Convoy Court, San Diego, CA 92111.



Kenwood TS700A. Two Meter Transceiver. 144 MHz to 148 MHz with tunable v.f.o., s.s.b., c.w., f.m. and a.m. Completely solid state. a.c. and d.c. capability. Automatic repeater offset. Complete with mic and built-in speaker. $700.00. At dealers.

Kenwood TS-820 Pacesetter Transceiver. So many features they can't all be listed. Some of the more desirable ones include: noise blanker, r.f. monitor, digital readout and hold, speech processor, i.f. shift, r.f. attenuator, VOX, PLL circuitry, heater switch, built-in 25 kHz calibrator, built-in speaker, c.w. sidetone, etc., etc. $1,000.00. At dealers.

Hy-Gain 3750 transceiver. Covers 1.8 to 30 MHz. PLL circuitry with dual gate MOS Fet's. Rotating dial, and a frequency counter with digital readout and a memory display. $1,895.00. **HY-Gain Electronics Corporation.** 8601 Northeast Highway Six, Lincoln, NE 68505.

Yaesu FR101D. 160 to 2-meter digital solid-state receiver. Plug-in circuit boards for easy service. Fast or slow AGC. Betttr than 1 kHz readout on all bands. ± 5 kHz clarifier. Built-in a.c. power supply and 12 v.d.c. operation. All mode reception. $629.00. At dealers.

The devices described above represent only a fraction of the gear available to radio amateurs. Future issues of *CQ* will discuss products by category, and in much greater detail.

Results of the 1976 CQ World Wide WPX SSB Contest

BY BERNIE WELCH,* W8IMZ/AC8IMZ

DK2BI — **First station to ever acquire over 500 multipliers.**

4J3A — **First official USSR Multi-Operator, Multi Transmitter entry.**

VR8D — **First to receive the new WPX-DX-pedition Plaque.**

AA9BWY — **First to break the so-called "USA Midwest Jinx" — wins Trophy.**

CE6EZ — **A 6-digit score on the 10 meter band!**

Just how much poor DX propagation can a world-wide contest tolerate and still continue to grow? George Jacobs' (W3ASK) early propagation forecasts had left me very pessimistic. Many log comments indicated the '76 weekend must have occurred at or near the bottom of the sun spot cycle. And how about that severe solar disturbance that took place at approximately 1925Z on the final day of the contest? The 20 meter band went almost completely dead in less than a minute, followed by a very high noise level. Short skip signals were back in about a half hour with the band returning to only semi-normal later. Keeping in mind these handicaps, how do we explain this 19th annual event with so many high scores and the 16 percent increase in logs received? This year's activity surpassed all previous years, and was the greatest, when you consider a single operator station can only record, for contest purposes, 30 of the 48 hours of *one* weekend annually. Could it have been that the conditions presented a greater challenge to a good number of superior contestants? Now, can you imagine what it will be like in future years as the conditions improve?

The super high scoring station was UK9AAN at Chelyabinsk, Asiatic USSR. Sam, UA9AN and his multi-operator single transmitter group totaled over 4 million points and will receive a special CQ Award for their accomplishment. In '75 they won a World Trophy as UK9ADT as the same QTH.

*7735 Redbank Lane, Dayton, OH 45424

WORLD TROPHY WINNER Station VP2G was a single-op all band accomplishment by Mike, W5MYA.

The USA Top Scores were achieved by stations using the special Bicentennial prefixes, with the exception of W8LRL on 160 meters. However, AD2BQO was second on that band.

Mike, AA9BWY took advantage of some extra good DX openings at his Indiana QTH to become the first mid-west station to win the Joe Miller, W4OPM Memorial Trophy. The "AA9" prefix could have been a contributing factor.

TOP AWARD WINNERS: WPX Contest trophies and plaque awards for 1975 were presented by CQ Contest Chairman Frank Anzalone, W1WY and CQ Editor Al Dorhoffer, K2EEK at the '76 Dayton Hamvention-Contest Forum. (L to R) Yuri Blanarovich, VE3BMV (VE7KB Trophy), Don Search, W3AZD (CQ Plaque) accepting for PJØJR, the VP5B Group- Al, VP5AH, Ron, VP5B, George VP5CW and Bill, VP5WW (K7LMU Memorial Plaque by W9WNV), Jim Lawson, W2PV (W4OPM Memorial Trophy by WA6GLD) and John Kanode, W4WSF (Virginia Century Club W4OPM Memorial) accepting for K4VX.

USA's Bicentennial "A" prefixes were in great demand, as were the Canadian "XJ"s and Romanian special "YR"s,—adding an extra spark.

There can never be too many different prefixes in the WPX contest. The rare and unique are always welcome and invited to participate, along with all regular prefix stations throughout the world. That's the name of the game.

In magnifying this point, we were also extremely happy to have the participation of these goodies: OG1, IV3, HD5, YY4, LG5, RP2, RB5, CT4, PA5, 4J3, CP6, 4J6, IA5, ZK2, ZV6, ZW6, YQ4, PA9, RAØ, HD2, II4, PI1, UX3, RA3, RA4, CT6, ZY2, ZX2 and AK8.

If you were looking for the new hard to find "WB3" and didn't contact WB3BAT, operated by W3AZD, your luck probably ran out. Don won the

The UCLA Amateur Radio Club Station AC6YRA, team of WA7DAC and WA6DPQ, had Murphy in reverse, i.e., a two day power outage in the ham shack ended just one hour before the contest. With this good omen, plus a 120 ft. high station location and antenna farm, they went on to rack up the USA High Multi-Single Score.

first all-band certificate award for a "WB3" station. Wonder if we will have an award winning "WD" in '77?

The all-band activity by four individual stations on Madeira Island caused extensive pile-ups and should have provided many a WPXer with the prefix CT3 and probably a new country for the *CQ* DX Awards. Tony, CT3BK is ex CR6OY and he promises to take part in all *CQ* contests as he had done from his previous location. Other much sought after prefixes from semi-rare DX locations were: CR9, OJØ, 9H4, JW5, VU7, ZK2, VR8, JB0, 5W1, GC3, GD4, 5B4, and CEØ. They sure kept the pile-ups perking.

An all time high prefix multiplier mark of 517 by the DK2BI group was an excellent accomplishment and will probably remain a record for years. Missing the magic 500-mark by only 16 was CT4AT with 484, followed by 4J3A with 473; UK9AAN, 437; and IV3VLS, 401. Reaching the 400-plus mark is something of which to be extra proud.

Some of the competitors for the first WPX-DXpedition Plaque were: VP2G at Grenada; IA5WKS on Giglio Island, Tuscan Arcipelago with IØWKS at the mike; The Bahama Islands excursion by

This is the operating position and antennas at the Western Samoa QTH of 5W1AU and 5W1AZ. That's Phil 5W1AU indicating "V" for victory. Using Peter's call 5W1AZ (he's also WB6OOL) the twosome placed 3rd world high and 1st Oceania, multi-single.

W4BRB/C6A, W4EPO/C6A and C6ABC operated by WB4PQB — all of the West Palm Beach, Florida ARC; Niue Island's ZK2AQ by WB7ABK; G3UKS and G4ALG journeyed to LG5LG at Morokulien on the Norwegian-Swedish Border; PA5GIG/A, the GIGA group special call portable from a sandbank on the Dutch coast; members of the Chelsea College ARC went to the Isle of Man as GD4CCL/p; 4J6A was an "UA" endeavor from Armenia's UG6 land; VE2AQS/TG9 from Guatemala; WB9AJF was portable 6Y5 at Jamaica. The Tuvalu, VR8D group from Japan was acclaimed the winner. The competition was so very good in this category that I regret we can have only one winner.

How's this for winning a certificate award the hard way? . . . AA6PDE won his for a mobile operation on 80 meters. OA8V's QRPp effort was with 5 watts PEP input. Paul said that this was his last opportunity to operate this contest as an OA8. CE6EZ worked all continents on both days of the contest on 10 meters accumulating an almost unbelievable 6-digit score. FB.

As an item of special interest for those who have repeatedly requested that we compile and publish annually an "All Time WPX Contest Records" listing, we would like to report its in the planning stage. However, you will have to consider the fact that the method of scoring has changed several times over the years.

Two items took precedence in numbers over other log comments. First, a very impressive 232 stations indicated club affiliation and/or requested we credit their score for club competition, with a total of 62 different clubs indicated. If this enthusiasm continues in the '77 contest, and we hope it will, a club competition award should be implemented for 1978. Second, why is there no c.w. part of the WPX Contest? Or, can we have a WPX-CW Contest also? This has been bounced around for a number of years and is presently in limbo. I, for one,

The DK2BI, multi-multi group (l. to r.) DK5WL, DK6WL, DK2BI, DK5WM along with DK5WN, DK9WB and DK5WK (not in photo) attained the all time high multiplier record for a single contest. Their computerized log is a masterpiece.

would also like it, — preferably one weekend in May or June. Maybe if all you c.w. contest addicts would overwhelm the *CQ* Editor with an abundant flow of letters indicating your desires, it just might happen.

Many have qualified for the special Bicentennial *CQ* "USA-WPX-76" Award as a result of their participation in the contest. VP9GE, HI8MOG, HD5EE, UK9AAN, YU1BCD, W4BRB/C6A, F6BFH and I4ZSQ are among those who have already applied for and received the award. AJ3AA, the all-band certificate award winner for the Virgin Islands, was also the recipient of the DX #1 Award issued on 2 Jan. '76. Dick has made over 24,000 Bicentennial contacts as of this writing. There is still plenty of time to qualify and apply for your award. A large s.a.s.e. or IRCs to W8IMZ will get you the rules and an application form. January 1, 1977 is the deadline.

That's Gene, W4BRB and Manny, W4EPO arriving in the Bahamas with part of the gear that was necessary for each to contest operate as portable C6A. Bill, WB4PQB also made the trip and saw action as C6ABC. (Photo by WB4PQB)

The attendance at the '76 Dayton Hamvention — Contest Forum was far above our expectations and I must apologize to those who encountered standing room only. I appreciate your many fine comments regarding the program. Thank you for making it a big success through your attendance and participation. Hope to see many of you there in '77.

The next WPX — SSB Contest is on the weekend of the 26th and 27th of March 1977. The rules are basically the same as we had for 1975. However, up-dated rules should be in the January 1977 issue of CQ. Log forms and summary sheets are available from the *CQ* office and should be requested at an early date to insure your receipt prior to the contest. Please send a large s.a.s.e. or IRCs. Why not give it a go in next year's event, — try all bands or maybe you'd prefer to go solo as an added challenge on 10 or 160 meters. Whatever you decide,

World High 3.8 MHz score belongs to Benito, YY4YC. The Venezuelan "YY4" prefix surely enhanced his efforts. FB.

Station IV3VLS with I3PRK at the controls won an all band single operator certificate award.

remember your participation is appreciated, so do send in your log to *CQ*, regardless of the score.

I have reason to believe that some logs may have been lost in transit this year. If you sent a log and it is not listed anywhere in these results, please advise me.

I am pleased to announce that the North Florida DX Association is donating the Trophy for the Top World Single Operator, All Band score. (This is the category vacated by K4FMA.)

In wrapping this up for another year, I want you to know how much I have enjoyed being involved as the Contest Manager/Director for the past five years and cherish the experience. I have been fortunate in that I have received so much help from Club Contest Managers, QSL Managers and contestants from around the globe. Mr. CQ Contest, Frank W1WY, has certainly been a guiding light. My XYL, Ellie, who understands and clerically

Seppo, OH1VR/OH2BA operating as OG1VR provided many with another new prefix.

assists me with these results, should certainly be a part of this group. I sincerely thank all of you.

Hope to work ya in the next one.

73, Bernie, W8IMZ

Random Contest Comments

"Biggest thrill was working A6XP and not realizing it until after contest . . . *AA1EUO*. The point rule for Bicentennial calls was a great idea and helped us 10 meter single band contestants . . . *AB2CST*. I was surprised and happy to hear A35AF and ZK2AQ came back to my CQ's on 15 meters . . . *AC2HBT*. New antennas all around helped compensate for erratic conditions . . . *AA4FCT*. I do not like the rest period that is required. I think the length is too long . . . *AC4WJJ*. Conditions screwy, the 4's in Florida were getting Europe openings on 15 that we up North never heard . . . *AC4WSF*. Allowing stations to use both commemorative and regular calls was a mistake . . . *W5UOJ*. Finished working all South American countries . . . *K5DEC*. Had over 600 contacts on 20 meters and not one "JA" . . . *AA5VDH*. I think one of the Japanese I worked thought I was a new country since he requested QSL information . . . *AC6KYA*. The worst

Tan, SV1IG (above), Rich, SVØWX, Len, SVØWSS, and Les, SVØWEE made the "SV" prefixes plentiful throughout the contest. Their all-out individual efforts won each a certificate award for their respective categories.

radio conditions I've seen in over 50 years . . . *AC6CLM*. W1's were more rare than DX out here . . . *WA7PEZ*. Broke gear in rotor — fortunately it was at 2305Z of the final day! A club award would be of interest . . . *AD8HLR*. Why is there always a W6 running JA's? I have yet to hear one on 75 SSB . . . *AB8UKX*. A great contest . . . *AA9BWY*. Where were the Africans? . . . *WA9PBK*. Thunderstorms 1st night made conditions impossible. Had a FB time Saturday night . . . *ACØTDR*. In future I wish all contests could avoid giving numbers. I think that is a waste of time . . . *ACØIUB*. The hardest work I've ever put into a contest under the worst possible conditions. Without the Bicentennial prefixes it would have been a total disaster . . . *VE3NCT*. I did manage 150 new prefixes and USA-WPX-76 Award . . . *VP9GE*. Contest was much easier with the new call. QSL via DK5AD . . . *OE2BZL*. How come so few W's use their special prefix?? Only about 10% in ARRL contest. This way its impossible for us to obtain those special awards for 1976 . . . *ON4XG*. I took part for the first time and I like this contest . . . *OK2SPS*. First DX on 10 meters for sometime ... *G3XHK*. Good USSR support with 4J3, 4J6, UX3, another very enjoyable event. CU next year ... *G4BBA*. It's strange to give FY0BHI a bigger serial number than I receive ... *G3TXF*. FB contest ... *OH7NW*. During 1976 I am looking for Bicentennial prefixes for awards, especially during the contest ... *F6BFH*. I should have stuck with my regular callsign (DA2DX) instead of this oddball ... *AA5VKJ/DL*. I need more time and an antenna system which works for a good score ... *DK4OO*. Biggest thrill was QSO #157 with CT3AF on 21 MHz band ... *I4DLS*. Sure like to work this test I'm looking forward to a c.w. part as I'll work a lot more on c.w. ... *LA7TT*. Very interesting contest. 10 meter band not open ... *SP9AI*. No funny story, —it was my best contest in about four years of amateur radio ... *CT6DW*. No linear! A QRP Tx- 90 watt d.c. input in such a contest ... *YR3QK*. It seems to be one of the top of 3 contests of big interest ... *YO7NA*. My license is dated 26 March 1976 ... *EA1PT*. Anxious to see the Top Ten list of this nice contest ... *YU1NZW*. My 10th WPX-SSB since 1967. Enjoyed participating as always ... *VU2DK*. Stripped rotor gears week before contest, had to use remote break switch and 25 ft. pole on roof to turn the TH-6 ... *EP2SN*. A solar flare occurred during the contest and had almost no propagation to North America, —barely exceeded last year's score from PT2ZBS ... *K2IZN/4X*. VR8, CR9, and ZK2 are my new ones so I feel very glad ... *JAØVHI*. Operator is 14 years old and worked about 100 stations and 4 new countries in the intervals of study; Very FB Contest ... *JE3COZ*. Not as many special Bicentennial calls as I expected ... *PY1FI*. Best greetings in the Bicentennial anniversary of USA. Very nice prefix contest ... *CE3AOX*. All QSO's have been 100 percent QSLed. My QSL Mgr. is WA8TDY. A W4 with a 2 letter call sign refused to believe that he could also use the AC4 prefix ... *HD5EE*. There was so much wind that I couldn't control the rotor ... *YV5EED*. Darn it, just missed the magic million again 3 more prefixes or about a dozen 3 pt. QSO's would have done it. My sincere thanks to *CQ* for running the contest and particularly to Bernie and helpers ... *VK4VU*. 5W1AZ must be close to top score ... *VK2OW*. Enjoyed having worked VR8, VU7, BV2, HS1 and UO5 in a 15 minute period ... *AG6JFY*. Solar disturbance just about finished me off ... *AH6IJA*. No WPX logs available, so have modified the WWDX forms ... *YBØABV*. I am holidaying in New Zealand from VK4 and mainly obtained the call sign to enter the contest ... *ZL1BPI*. The entire station was installed in 2 hours and operated from the Niue Hotel on the island of Niue ... *ZK2AQ*."

TOP SCORES

SINGLE OPERATOR

ALL BANDS

VP2G	2,654,308	DKØTU	953,250
UA9BE	1,593,408	VU2DK	951,400
XJ3BMV	**1,103,106**	UA9AJ	902,811
IV3VLS	1,083,101	EP2SN	900,150
UL7OAO	1,069,884	DK1HA	885,894
ZK2AQ	1,020,605	DK8FZ	856,615
VK4VU	989,976	**AA9BWY**	**711,480**
K2IZN/4X	1,292,130	YV5CVE	671,160
VP9GE	1,164,120	HD2TV	377,580
HD5EE	943,448	YU3EYZ	333,318
AC3CRE	**802,113**	I5FCK	314,640

SINGLE BAND

28 MHz		21 MHz	
CE6EZ	383,114	YV2AMM	1,084,512
JH2LQS	7,245	YU2RBY	640,080
YBØABV	7,215	DM2DGO	261,120
UL7PBY	6,210	VK2XT	251,136
JA2DYI	5,800	UY5HV	208,086

14 MHz		7 MHz	
YV4AGP	1,698,390	W4BRB/C6A	911,302

3.8 MHz		1.8 MHz	
YY4YC	739,468	XJ3FFA	31,416
DM2DUK	526,750	W8LRL	2,080
I3MAU	422,334	AD2BQO	1,536
YU3DBC	365,924		
W4EPO/C6A	325,200		

MULTI-OPERATOR

Single Transmitter

UK9AAN	4,158,929	PY3AHS	1,826,250
CT4AT	**3,250,544**	OA4AHA	1,678,260
5W1AZ	3,114,315	UK5MAF	1,676,048
4J6A	2,931,577	UK5IAZ	1,658,690
YV1AVO	2,133,120	**VR8D**	**1,576,179**

Multi Transmitter

4J3A	3,971,781	DLØKI	429,454
DK2BI	3,038,409	VE5NN	383,075

Number groups after call letter denotes: Band, Score, QSO's and Prefixes. Bold listings are certificate winners.

PHONE RESULTS
SINGLE OPERATOR
NORTH AMERICA

United States				
AC1HFB	A	154,350	280	225
AC1DYH	"	65,685	198	151
AC1WY	"	35,763	158	131
AA1FBX	"	28,980	109	105
W1GYE	"	836	19	22
W1MDO	21	1,368	26	24
AA1EUO	14	442,540	650	290
K1IIK	"	1,240	22	20
KH6IAC/AC1	"	168	12	8
WA1FBX	7	3,344	36	44
AC1CF	3.8	232,630	511	215
		(Opr. K1OME)		
AC2PV	A	674.900	892	340
		(Opr. AB2AXY)		
AC2MB	"	55.998	168	122
AC2FGY	"	45,760	152	143
AA2ZWH	"	42,042	163	143
AA2LJM	"	19.314	122	111
AB2LOF	"	2.070	34	46
AA2AUB	"	1.890	35	45
AB2CST	28	2,209	40	47
AC2KDI	"	1,715	43	49
WB2FUN	21	21.090	152	114
AB2ZGI	"	16,008	105	92
AC2HBT	"	10,650	75	71
W2HPF	3.8	121,270	316	181
		(Opr W2IIJ)		
AD2BQO	1.8	1,536	60	64
AB3BAT	A	90,395	259	179
		(Opr. W3AZD)		
AC3CRE	14	802,113	842	393
W3GCQ/3	"	280	10	10
AC3USS	7	59,452	248	178
		(Opr. WA1FFO)		
AD3GJD	3.8	108,446	300	194
K3IXD	1.8	656	48	41
AD4YFQ	A	684,114	807	353
AA4LZR	A	612,402	905	294
		(Opr. AA4FCT)		
AC4LBP	"	440,249	562	323
AC4YWX	"	309,354	556	282
AC4WRY	"	136,875	299	219
AC4CRW	"	88,102	235	203
AD4RZK	"	73,248	211	168
AC4WJJ	"	64,428	186	177
AC4UYC	"	52,540	187	148
AD4BAI	"	26,986	136	131
AC4TMN	"	19,796	101	98
W4KMS	"	16,465	102	89
W4UW	"	8,607	61	57
W4HYY	"	6,120	48	45
AB4VOO	"	5,280	71	80
AC4LGM	"	1,302	26	31
AC4UW	"	32	4	4
AC4WSF	21	170,340	354	255
AA4OSM	21	156,005	316	205
AC4EFO	"	44,304	163	142
AB4JUH	"	15,192	103	72
AC4EEO	14	1,060	19	20
AB4WHE	"	80	14	20
K4KZP	7	40,386	158	159
AA4DRU	3.8	9,120	108	95
W5UOJ	A	52,808	267	161
AC5OB	"	38,955	145	147
K5DEC	"	11,220	80	85
WB5QWX	21	50,256	164	144
AA5VDH	14	261,900	615	270
AA5JMK	"	100,997	331	221
		(Opr. AB5KVM)		
AB5DDI	7	52,940	233	165
W6OKK	A	182,756	391	214
AC6BJB	A	109,220	300	172
AA6TKT	"	37,728	208	131
AC6YVK	"	33,098	153	134
AA6UFY	"	32,450	141	118
AC6KYA	"	21,284	116	68
AC6CLM	"	11,128	120	104
AC6VPZ	"	8,470	67	70
WB6GFJ	"	576	15	18
AD6SVL	21	114,308	335	164
AA9UCE/6	14	364,968	662	274
AC6OJW	"	273	19	13
W6MAR	"	27	4	3
AA6PDE/6	3.8	26,026	93	91
W7AYY	A	161,568	339	216
AC7HAD	"	25,676	126	98
AD7RSB	"	4,899	69	71
WA7OBL	21	53,475	228	93
WA7PEZ	14	237,354	477	221
AA7GOO	"	63,826	273	194
AD7LAY	"	7,125	99	95
K7RSC	7	53,088	181	158
K8YRV	A	212,076	344	258
AC8IMZ	"	40,089	179	159
AC8GLC	"	1,620	25	27
K8PYD	"	160	9	8
AC8KOD	21	26,136	112	108
W8BI	"	14,688	107	96
		(Opr. WB8IAY)		
AB8NZM	"	275	12	11
AD8HLR	14	307,207	510	289
AC8BDO/8	"	74,480	221	196
WA8LXJ	7	27,948	120	137
K8LUU	"	24,384	116	127
AC8TJQ	"	15,180	91	110
W8IMZ	"	1,152	28	24
W8TJQ	"	340	12	17
AB8UKX	3.8	139,082	315	197
AC8LT	3.8	103,270	370	165
		(Opr. AB8JXS)		
AC8FJS	"	18,240	101	114
WB8AYC	"	3,750	79	75
AC8BI	"	2,394	56	63
		(Opr. AB8IAY)		
WB8UKX	"	276	17	23
W8LRL	1.8	2,080	78	80
AA9BWY	A	711,480	781	363
AA9NPM	"	243,312	431	274
AB9CEP	"	67,338	258	174
AC9OHH	"	11,098	70	62
WA9BWY	"	1,972	37	34
WB9HAD	21	144,270	305	210
W9LKI	"	8,694	59	63
WA9PBK	14	340,070	633	310
AC9YRA	"	89,890	298	202
AA9UEK	"	24,605	100	95
AC9LUH	"	3,441	40	31
AA9HEU	7	35,816	151	148
WAØPAO	A	136,240	380	208
AAØUFS	"	98,271	301	183
ACØIUB	"	16,799	196	107
ACØGNX	14	41,055	319	161
ACØTDR	3.8	18,796	128	127
Alaska				
AL7HDX	14	19,899	117	67
Bahama Is.				
C6ABC	14	520,671	1281	197
		(Opr. WB4PQB)		
W4BRB/C6A	7	991,302	1122	213
W4EPO/C6A	3.8	325,200	530	150
Bermuda Is.				
VP9GE	14	1,164,120	1470	327
YN1MAB/VP9	"	104,720	276	170
Canada				
VE1ANH	A	39,330	141	114
VE1AIH	3.8	3,264	25	34
XJ3BMV	A	1,103,106	1075	339
XJ3EJK	"	22,022	103	91
VE3NCT	14	403,275	655	285
VE3ENM	7	68,306	144	119
VE3KZ	3.8	283,240	394	194
XJ3FFA	1.8	31,416	106	77
VE4PO	A	7,242	79	51
XJ4PO	14	117	6	9
XJ5RA	14	61,750	232	130
XJ6AGV	A	151.902	316	174
VE6WX	14	265,420	502	230
XJ6LB	7	35,096	117	82
XJ7AZG	A	4,747	37	47
XJ7AJ	"	4,700	43	50
VE7BC	14	632,552	929	296
		(Opr. VE7LB)		
Costa Rica				
TI2WX	A	48,178	215	109
Dominican Republic				
HI8MOG	A	573,362	787	226
HI8EVA	7	1,344	17	21
Grenada				
VP2G	A	2,654,308	2493	388
		(Opr. W5MYA)		
Guatemala				
VE2AQS/TG9	A	248,640	593	168
Jamaica				
WB9AJF/6Y5	A	643,314	755	289
Mexico				
XE1LLS	A	502,656	1233	176
XE1HR	"	245,979	551	181
Panama				
HP1SH	21	14,544	100	72
Virgin Is. (U.S.)				
AJ3AA	A	160,650	476	153
KV4FZ	1.8	110	5	5

TROPHY WINNERS

WORLD—Single Operator, Single Band. Jack Reichert, W3ZKH Trophy. Won by: **Marcos Avellan, YV4AGP** (14 MHz).

WORLD — Single Operator, All Band. North Florida DX Association Trophy. Won by: **Mike Badolato, Jr., VP2G.**

WORLD — Multi-Operator, Single Xmtr. Ted Thorpe, ZL2AWJ Memorial, Awarded by Don Miller, W9MNV. Won by: **Station CT4AT. (Oprs. K7CBZ, WA3HRV, CT1OY, CR6XX).**

WORLD—Multi-Operator, Multi Xmtr. Chuck Swain, K7LMU Memorial, Awarded by Don Miller, W9WNV. Won by: **Club Station 4J3A. (Oprs. UA3AFO, UA3AGW, UA3EAI, UV3CC, UA3ADM, UV3CO, UW3BO, UW3FI, UW3IB, RA3AKQ).**

CANADA—Single Operator, Single Band. Gene Krehbiel, VE7KB Trophy. Won by: **Station VE7-BC, Opr. Ron Kaye, VE7LB (14 MHz).**

CANADA—Single Operator, All Band. Garth Hamilton, VE3EUP Trophy. Won by: **Yuri Blanarovich, XJ3BMV.**

U.S.A.—Single Operator, Single Band. Joe Johnson, W5QBM Memorial, Awarded by The Richardson Wireless Klub. Won by: **Burt C. Cohen, AC3CRE** (14 MHz).

U.S.A.—Single Operator, All Band. Charles "Joe" Hiller, W4OPM Memorial, Awarded by Jerry Hagen, WA6GLD. Won by: **Michael J. Wetzel, AA9BWY.**

WORLD — DX-pedition. Awarded by Bernie Welch, W8IMZ. Won by: **Station VR8D. (Oprs. JAØCUV, JA2PJC, JA3KWJ).**

SPECIAL CQ AWARD—Station UK9AAN.

AFRICA

Madeira Is.

CT3BK	A	623,300	856	230
CT3BD	A	258,672	421	204
CT3AB	"	144,000	283	150
CT3AR	"	3,874	27	26

ASIA

Cyprus

5B4YK	14	32,800	142	82
		(Opr. OH2BCA)		

India

VU2DK	A	951,400	1097	335
VU2OO	14	93,111	462	123

Iran

EP2SN	A	900,150	1293	255

Israel

K2IZN/4X	14	1,292,130	1444	315

Japan

JA6CNL	A	80,580	248	158
JA3DGC	A	59,182	194	127
JA0URR	"	24,386	129	89
JA1LDJ	"	16,717	116	73
JAØMTY	"	16,215	108	69
JA5FMT	"	14,214	86	69
JAØVHI	"	9,960	94	60
JA3ELU	"	9,620	82	52
JR2BDG	"	6,670	64	46
JH7CZQ	"	3,132	47	36
JH4DVV	"	900	19	18
JA3BCT	"	507	22	13
JH4MVB	"	496	15	16
JA5VOB	"	345	15	15
JA4UDP	"	319	14	11
JR3STC	"	40	5	5
JH2LQS	28	7,245	130	115
JA2DYI	"	5,800	102	58
JR1IJV	"	3,450	80	69
JF1XDM	"	255	14	15
JA6UBK	21	98,189	228	169
JH6QPD	21	79,430	234	130
JR2LPA	"	76,796	251	146
JH2MYN	"	62,152	246	136
JA5PUL	"	55,937	175	131
JH1XYB	"	49,000	184	125
JH1AHU	"	41,200	167	100
JR2JFC	"	38,306	156	107
JA1GSK	"	24,360	121	84
JR2OEI	"	11,480	89	70
JAØWAM	"	9,020	77	55
JA3BUB	"	7,995	76	41
JA5BYF	"	4,860	50	45
JE1WIH	"	3,913	45	43
JH4ARN	"	1,998	28	27
JH4KEB	"	1,365	26	21
JHØBFS	"	860	25	20
JHØBQJ	"	774	17	18
JA5UYE	"	612	17	18
JH4LBE	"	544	14	16
JH4MVA	"	119	7	7
JA3YJQ	"	112	8	7
JE3EVC	"	12	2	2
JE1LSD	14	139,158	338	162
JA8SW	14	90,270	261	153
JA1CG	"	61,695	206	114
JAØAIE	"	22,610	119	85
JA9SV	"	19,575	111	75
JA2EIV	"	18,876	111	78
JE3COZ	"	12,998	97	67
JA1AAT	"	12,586	85	62
JA1MZM/7	"	11,520	89	60
JA4GXS	"	11,224	81	61
JA3XGZ/2	"	8,400	73	56
JA1EMX	"	7,830	64	58
JA3KGF	"	7,384	72	52
JH7BRG	"	7,020	52	52
JA9EBA	"	6,681	58	51
JA6KAK	"	6,552	69	42
JR2BDF	"	5,895	58	45
JA6UYF	"	5,891	66	43
JA1PUK	"	5,192	49	44
JA1QID	"	4,995	53	45
JA1COT	"	4,368	56	48
JH7DPU	"	3,666	56	39
JH2BFU	"	3,515	48	37
JA4DZ	"	3,366	50	33
JA2TKO	"	2,912	35	32
JA7ARW	"	1,888	39	32
JA4AQZ	"	1,664	52	32
JAØAGA	"	1,254	19	22
JA3INN/6	"	817	21	19
JA2RFG	"	816	23	17
JA4AOR/3	"	442	18	13
JA6AHT	"	416	21	13
JAØVHK	"	312	16	12
JA7KM	"	152	10	8
JA1ZSX	"	15	3	3
JA2BAY	7	69,972	205	102
JA4BKL	"	8,064	67	48
JA7KAC	3.5	6,900	52	50

Macao

CR9AJ	14	265,920	1120	160

Thailand

HS1AKT	A	31,200	152	96
HS1ALA	"	30,840	266	82
HS1BG	14	32,040	203	89

U.S.S.R.

Asiatic

UA9BE	A	1,593,408	1296	386
UA9AJ	"	902,811	1155	273
UA9YE	"	620,136	1031	261
UA9TS	"	246,080	467	160
UA9AED	"	990	19	15
RA9ODC	28	756	38	18
RA9CAS	"	70	7	7
UW9CL	21	184,800	541	165
UV9WF	"	115,155	411	135
UA9EU	"	65,268	305	111
UA9MQ	"	35,112	265	84
UA9MS	14	590,568	1048	264
UA9HD	"	193,318	642	163
UA9AAP	"	169,520	369	163
UA9HAX	"	100,678	328	142
UA9UDR	"	72,657	316	117
UA9ADF	"	41,172	169	94
UA9MT	"	6,909	57	47
UV9DO	"	5,670	55	42
RAØSCQ	28	1,863	62	27
UAØSFN	"	1,508	53	26
UAØUBG	"	12	5	4
UVØEX	14	65,472	515	96
UAØPJ	"	52,536	405	88
UAØFBZ	"	630	46	14
UAØBAC	"	288	10	12
UAØUBA	7	5,104	85	23
UAØACJ	3.5	56	9	7

Armenia

UG6GAF	21	115,773	316	149

Azerbaijan

UD6CN	A	54,200	215	100
UD6CC	"	396	12	11
UD6DFD	21	8,771	16	49
UD6DHW	14	16,185	89	65

Georgia

UF6HS	A	133	7	7
UF6DG	14	367,632	620	222

Kazakh

UL7OAO	A	1,069,884	1495	264
UL7PAT	"	25,752	117	74
UL7TA	"	6,532	82	47
UL7MG	"	5,754	52	42
UL7PBY	28	6,210	122	45
UL7PCK	"	3,444	80	41
UL7EAM	14	196,064	512	176
UL7NAA	"	390	15	10
UL7IBC	3.5	79,132	198	73

Tadjik

UJ8JGJ	A	243,610	546	170
UJ8BQ	14	2,268	30	27

Turkoman

UH8BZ	A	21,846	132	66

Uzbek

UI8LAK	28	1,078	36	22
UI8LAF	3.5	17,056	79	41

EUROPE

Austria

OE2BZL	A	542,619	909	297
		(Opr. DK5AD)		
OE5CWL	"	156,672	462	192
OE1SBA	14	1,924	48	37

Belgium

ON4XG	A	96,075	300	183

Bulgaria

LZ1QO	A	336,720	671	230
LZ1QR	"	158,776	580	178
LZ2KKK	"	63,623	221	149
LZ1FJ	"	11,147	104	71
LZ1CN	"	5,096	60	49

Channel Is.-Guernsey

GC3YIZ	14	71,142	300	167

Czechoslovakia

OK2SIR	A	527,620	841	310
OK1AGQ	A	348,743	618	277
OK2BLG	"	167,676	544	178
OK1AGN	"	136,497	438	173
OK2BIH	"	132,606	457	159
OK2BJU	"	98,739	367	159
OK1DVK	"	67,262	218	169
OK1KZ	"	52,555	256	115
OK3YCA	"	36,963	221	111
OK2BEF	"	36,153	199	103
OK2ZU	"	31,850	170	98
OK1WT	"	31,610	158	109
OK2PBG	"	16,072	112	82
OK1IBL	"	16,093	120	77
OK3TAH	"	11,900	93	68
OK3EA	"	10,395	86	63
OK2SPS	"	9,880	121	65
OK2PCT	"	6,840	84	60
OK3CEE	"	6,100	58	61
OK2BOL	"	3,444	52	42
OK2CIJ	"	2,346	42	34
OK2CAW	"	1,188	22	22
OK1MPP/P	21	83,352	234	151
OK1ASQ	"	21,840	135	91
OK1JVT	"	2,862	53	27
OK1FV	14	188,139	502	217
OK3LU	14	80,327	351	167
OK1FAR	"	60,098	245	151
OK1ADP	"	38,625	153	125
OK1ATE	"	6,534	50	54
OK1PCL	"	3,872	55	44
OK1ATZ	"	2,356	46	38
OK1FBH	"	512	12	16
OK1AMB	"	96	8	8
OK1DWA	7	150,416	438	158
OK1AHV	7	142,600	442	155
OK1AWZ	"	92,664	301	132
OK2BNK	"	24,236	162	83
OK2BIQ	3.5	103,494	376	141
OK3YCL	3.5	60,138	277	117
OK1AVU	"	46,816	213	112
OK1KIR	"	44,100	212	105
OK2HI	"	23,040	171	72
OK1HCH	"	15,504	121	68
OK1DDS	"	14,420	111	70
OK1EP	"	7,236	67	54
OK1DIT	"	6,072	71	46
OK1JST	"	5,698	70	41
OK1ARH	"	2,220	37	30
OK1DNM	"	968	25	22

Denmark

OZ4HW	A	34,299	184	103
OZ2NU	"	26,500	167	100
OZ3KE	"	25,474	163	94
OZ7BW	"	1,769	29	29
OZ6XR	14	16,160	181	80
OZ5EV	3.5	100,340	354	145

England

G3XHK	A	131,906	449	202
G4BBA	"	64,224	291	144
G3YBH	"	55,421	230	157
G2AJB	"	47,864	242	124
G3ZLQ	"	35,456	176	128
G4DBW	"	12,160	121	76
G4ETK	"	11,466	115	78
G3XYP	14	405,805	774	293
G3TOE	14	385,472	716	304
G4DKT	"	127,161	411	213
G4DMN	"	114,072	396	194
G3TXF	"	92,752	346	187
G4CVZ	"	74,983	391	167
G3TJW	3.5	184,300	471	190

Finland

OH1IG	A	323,640	734	261
OH1MA	A	282,698	677	262
OH6IW	"	74,798	276	146
OH3OF	"	50,085	283	135
OH7NW	"	11,346	92	62
OH2BJY	"	10,579	118	71
OH2VZ	"	6,897	89	57
OH7TO	"	3,800	70	40
OH2DN	"	351	13	13
OH1IW	21	64,904	271	152
OH2BH	14	702,708	1152	372
		(Opr. OH2SB)		
OG1VR	14	643,023	1315	333
		(Opr. OH1VR/OH2BA)		
OH2LU	"	327,155	756	295
OH1LW	"	210,798	707	239
OH3TA	"	17,952	186	88
OH2KP	"	15,345	138	93
OH6MM	"	12,852	113	84
OH3XZ	"	665	19	19
OH6VV	"	336	15	14
OH1JW	"	240	12	12
OH6JR	"	231	13	11
OH2BDA	"	204	13	12
OH6MO	"	4	2	2
OH5TS	7	57,536	243	116
OH2KI	"	33,060	164	87
OH2BCD	"	3,840	52	40
OH1XX	3.5	1,664	28	26

France

F6BFH	A	222,758	452	254
F6DIM	A	97,216	321	196
F0BYR	"	79,459	250	181
F5RC	"	47,275	220	155
F2OO	14	231,673	530	251
F0KH	"	5,040	83	45
		(Opr. OH2BH)		

Germany (DDR)

DM2BJJ	A	270,126	540	258
DM5UUL	A	169,026	461	197
DM5YJL	"	127,140	489	156
DM4SDA	"	109,836	433	162
DM2DEO	"	64,554	258	159
DM6TAH	"	63,106	240	139
DM2CDL	"	59,040	244	144
DM4OEE	"	51,537	231	123
DM2CMF	"	51,362	204	122
DM3WMJ	"	49,920	204	130
DM2BTO	"	26,224	138	88
DM2FBN	"	18,873	146	81
DM4SOG	"	18,656	114	88
DM2DND	"	11,390	102	67
DM5RDL	"	10,206	99	63
DM2AXC	"	9,794	87	59
DM2BKH	"	9,513	88	63
DM3CF	"	8,928	83	62
DM3ZC/P	"	6,720	88	56
DM3XMJ	"	5,576	74	41
DM2AUF	"	5,014	43	46
DM2CBB	"	2,800	45	35
DM2FQN	"	2,765	40	35
DM3XD	"	2,130	38	30
DM2COJ	"	1,500	33	30
DM2DRN	"	1,134	29	27
DM4BK	"	1,100	30	25
DM4WJG	"	792	23	22
DM2CWJ	"	792	19	18
DM47FM	"	220	11	11
DM2DGO	21	261,120	556	204
DM3BGO	"	5,763	69	51
DM3UE	"	1,083	24	19
DM2FGN	14	47,215	256	133
DM3BE	"	6,174	72	63
DM2CRO	"	5,000	90	50
DM2ATL	"	3,397	64	43
DM2EXH	"	560	23	20
DM4JA	"	384	18	16
DM3SB	7	42,570	222	99
DM4UEE	"	26,488	150	86
DM2BOO	"	24,272	154	82
DM2BPB	"	12,928	110	64
DM2BLE	"	11,160	106	60
DM2AJH	"	2,706	40	33
DM2DUK	3.5	526,750	1014	245
DM5UFD	3.5	93,960	341	145
DM3PFF	"	81,328	320	136
DM3WDJ	"	47,952	234	108
DM3XRF	"	39,600	233	99
DM2AZB	"	32,384	203	92
DM4SL	"	26,928	166	88
DM2CDH	"	24,934	143	91
DM5YVL	"	20,540	140	79
DM3YBF	"	20,482	139	77
DM3SIC	"	17,856	138	72
DM4XIG	"	15,732	120	69
DM4YXD	"	3,024	48	36
DM2CJF	"	2,838	50	33

Germany (FRG)

DKØTU	A	953,250	1239	375
		(OPR. DK6QI)		
DK1HA	A	885,894	1132	361
DK8FZ	A	856,615	1199	355
DK5AJ	"	218,025	561	225
DL7EN	"	65,747	271	139
DK4IO	"	49,784	250	127
DL7PD	"	45,537	252	129
DK6PY	"	41,600	219	104
DL2HQ	"	38,150	200	109
DL1IP	"	34,093	222	103
DK5GX	"	25,761	157	93
DL7SP	"	21,931	123	91
DJØUP	"	21,087	111	99
DL1YA	"	7,704	92	72
DL1ED	21	47,495	192	115
DJØXT	"	44,409	181	113
DK1FW	14	373,876	590	302
DLØJK	14	259,618	571	271
		(OPR. DK6FT)		
DJØBA	"	203,320	426	230
DLØCM	"	64,200	286	150
DK5WQ	"	30,849	214	113
DL1AMA	"	12,848	95	88
DL1RB	"	8,064	64	63
DF5SF	7	72,800	337	130
DK4OO	"	20,636	126	77
DL2JO	"	15,408	110	72
DL8PC	3.5	264,620	713	202
DK3SN	"	164,032	503	176
DK4RQ	"	96,924	218	102
AA5VKJ/DL	"	35,640	211	108
DK4FP	"	3,780	62	45
DL2RM	"	1,680	40	28
DA1IE	A	106,505	386	180
DA2BA	14	82,476	303	174
DA2KD	"	56,160	312	135

Greece

SVØWX	A	94,764	492	159
SVØWSS	21	20,640	166	96
SV1IG	14	41,244	287	128
SVØWEE	7	28,836	158	81

Hungary

HA5KKO	A	159,120	568	170
HA1ZD	"	63,048	271	142
HA5KAS	"	23,406	171	94
		(Opr. HA5CE)		
HA4KYB	14	81,375	406	155
HA5LZ	"	20,700	160	90
HA4KXG	7	9,880	95	52
		(Opr. HA4XG)		
HA4KYN	3.5	164,920	585	155

Italy

IV3VLS	A	1,083,101	1297	401
		(Opr. I3PRK)		
I4BNR	"	157,584	390	196
I2MQP	"	35,991	191	129
I3VOA	"	32,760	186	105
I5WCN	21	155,880	398	180
IA5WKS	21	121,212	356	182
I2LPA	"	20,060	110	85
I8ZLW	"	5,304	64	52
I4JBJ	14	104,493	373	183
I5PLS	"	84,303	314	171
I5FCK	7	314,640	530	228
I4DLS	"	187,680	411	184
I5ZUF	"	119,504	343	154
I3MAU	3.5	422,334	747	237

Malta

9H4G	A	88,176	387	167

Market Reef

OJØMA	A	66,025	369	139

Netherlands

PA9TOM	A	488,761	901	287
PAØATY	"	92,016	283	162
PAØTAU	"	4,788	44	42
PAØGBY	"	2,967	42	43
PAØBAB	"	1,296	21	16
PAØLEG	"	1,290	22	21
PAØNMH	"	465	16	15
PAØZH	14	174,304	512	226
PAØPFW	"	18,334	159	89
PAØLVK	"	3,773	66	49
PAØDIN	7	10,912	92	62
PAØJMO	"	221	17	13

Norway

LA2GN	A	36,297	251	109
LA5QK	"	25,095	190	105
LA2AD	"	6,588	100	61
LA7TT	"	4,455	62	55
LA1RN	"	4,416	77	48
LA3WU	"	1,584	40	33
LA3UQ	21	5,626	77	58
LA3RP	14	26,103	196	113
LA4AT	"	2,714	63	46

Poland

SP9AI	A	527,616	1015	288
SP5BB	A	127,040	441	160
SP9AAJ	"	66,550	293	121
SP9AVZ	"	45,500	228	125
SP6DB	"	44,770	203	121
SP9BLF	"	44,132	227	118
SP9HWT	"	39,558	210	114
SP1EHI	"	37,788	204	94
SP9IGY	"	25,203	185	93
SP7FQI	"	21,294	151	91
SP9EWM	"	16,929	129	81
SP9ZU	"	14,678	127	82
SP9BBH	"	14,559	128	69
SP3AUZ	"	10,496	102	64
SP7CDH	"	5,850	66	50
SP2FWC	"	2,211	42	33
SP5AMX	"	1,240	24	20
SP1II	"	70	5	5
SP3GEM	21	20,169	147	83
SP4AS	"	17,100	117	75
SP9ERC	"	9,499	94	59
SP8AWL	"	6,474	67	46
SP9PT	"	2,128	30	28
SP4CLX	14	100,200	427	167
SP9FLY	14	61,194	316	141
SP5EAQ	"	50,180	305	130
SP5ENA	"	41,503	246	121
SP9NH	"	35,100	240	108
SP8HXN	"	9,660	120	69
SP9BPF	"	8,442	109	63
SP9AEG	"	3,285	48	45
SP7BCA	"	1,171	44	23
SP3CB	"	1,100	27	20
SP6ECA	"	434	16	14
SPØKGT	7	32,930	187	89
		(Opr. SP5ELW)		
SP6AGD	"	10,824	87	66
SP3BQD	3.5	143,220	457	165
SP5XM	3.5	114,480	364	159
SP3BLG	"	67,440	312	120
SP8RJ	"	13,338	122	57
SP9IEK	"	9,010	98	53
SP6HFI	"	8,976	77	66
SP9AKD	"	7,420	77	53
SP1PBW	"	5,494	72	41
SP9FTM	"	4,400	56	44

Portugal

CT6DW	A	336,384	852	256

Romania

YR3AC	A	461,988	996	246
YR6EX	A	444,030	935	285
YR5AFJ	"	234,357	710	191
YR5BQ	"	159,588	506	186
YO6MD	"	59,653	317	121
YR3QK	"	59,184	259	144
YR8AKA	"	56,511	307	117
YR8RL	"	19,344	185	93
YO7APM	"	13,528	105	76
YO6LV	"	8,478	88	54
YO7NA	"	7,502	70	62
YO3ABL	"	3,434	47	34
YR3RF	"	1,311	32	23
YO3ZR	"	576	21	18
YO4AYE	14	42,912	307	144
YO3QO	"	1,300	34	26
YO3BEJ	7	25,760	165	80
YR3JW	3.5	211,914	561	183
YR2II	"	72,774	300	117
YR2SB	"	51,744	280	98
YO6AJI	"	11,468	112	61

Scotland

GM3MZV	A	77,112	384	168
GM3CFS	A	76,347	299	153

Spain

EA4LH	A	668,287	1088	323
EA1PT	A	362,210	783	290
EA3RP	"	41,715	256	103
EA3AIT	"	28,056	164	84
EA2LY	14	22,042	216	103

Svalbard Is.

JW5NM	A	51,888	291	138

Sweden

SM5AOE	A	539,585	1022	311
SM5CSS	A	412,776	900	273
SM4DQE	"	209,508	692	221
SM7TV	"	26,125	185	95
SM7AAQ	"	22,590	154	90
SM5GRG	"	18,250	132	73
SM5RE	"	16,632	161	84
SM4AZD	"	14,875	114	85
SM5CAK	"	4,120	45	40
SMØBDS	"	3,952	69	52
SMØDJZ	"	3,652	70	44
SMØCGO	"	1,749	37	33
SM7FSV	"	855	21	19
SM7AIL	"	666	23	18
SM7EFI	"	403	13	13
SM7ABL	21	14,325	87	75
SM5ERK	"	6,555	83	57
SM5AD	14	254,012	595	253
SM5BNZ	14	235,144	493	266
SM2DHG	"	16,800	165	96
SM5GA	"	11,644	94	82
SM5CVC	"	660	17	20
SM4CAN	7	65,702	221	133

Switzerland

HB9UD	A	24,308	132	103

Wales

GW3SLA	14	28,441	200	119

Yugoslavia

YU1NZW	A	82,080	296	152
YU5FGF	"	62,348	310	143
YU1GMN	"	47,520	183	110
YU2CDO	"	7,506	65	54
YU3ER	28	3,348	46	36
YU2RBY	21	640,080	973	252
YU2CBV	"	24,780	137	84
		(Opr. YU2RKE)		
YU1BCD	14	709,852	1095	374
		(Opr. YU1ODS)		
YU3EY	14	694,025	986	355
YUØSRJ	"	310,612	750	268
		(Opr. YU1PCF)		
YU2HDE	"	249,614	584	274
YU3EYZ	7	333,318	630	219
YU3DBC	3.5	365,924	712	227
YU1SF	"	680	21	17

U.S.S.R.

European

UA4RZ	A	528,250	1025	250
UA3QAQ	A	228,058	703	202
UV3DN	"	102,754	405	166
UA3FT	"	96,096	401	154
UA4UAZ	"	86,460	330	132
UA3DFK	"	84,056	353	152
UW6NU	"	71,260	292	140
UA6AJG	"	69,678	265	126
UV3FD	"	50,295	246	105
UW6LC	"	36,499	219	113
UA1SE	"	34,037	220	101
UA6JWW	"	33,669	181	102
UA1JM	"	28,222	199	103
UA3XP	"	27,141	167	109
UV3CS	"	17,835	151	87
UA3SAG	"	14,820	100	76
UA6HYL	"	14,640	115	48
UA4CO	"	7,320	83	61
UA3TCH	"	7,260	72	55
UA6HCZ	"	3,792	55	48
UA3XAN	"	2,277	35	33
UA6LBQ	28	2,233	35	29
RA3ALQ	"	200	11	10
RA4HDE	"	112	8	7
UA6LED	"	77	7	7
UW6DR	21	149,703	511	139
UA6LBC	21	95,432	344	158
UA6HBU	"	86,991	360	107
UW3EQ	"	51,282	240	111
UW1AE	"	37,791	210	117
UA6JAD	"	33,454	197	86
UA6BV	"	28,222	182	103
UA3ZP	"	25,389	193	91
UA1QBE	"	16,848	135	78
UV3CE	"	16,650	157	39
UA3QBU	"	15,498	128	82
UW3RR	14	74,412	377	156
UA4CZ	14	69,713	350	161
UA3DCY	"	65,858	352	149
UA1MU	"	41,574	239	123
UA3GM	"	34,510	200	119
UA4ZA	"	26,040	190	105
UV3TQ	"	23,520	200	96
UA3ERD	"	11,778	126	78
UA3AH	"	10,880	100	64
UV6AF	"	8,294	113	58
UA1AET	"	7,500	120	60
UA4FAR	"	4,346	69	53
UW3DZ	"	3,198	52	41
UA3AAK	"	897	28	23
UA4HAN	"	759	28	23
UA3IAM	"	570	20	19
UK3AAY	"	132	11	11
UW4AK	"	72	6	4
UA4FAU	3.5	8,800	101	44
UA3DJS	"	8,796	80	53
UA3QDC	"	7,310	85	43

Estonia

UR2RJ	A	75,306	316	154
UR2AW	"	4,747	60	47
UR2REN	21	24,600	168	100
UR2QD	14	295,392	822	272
UR2QI	14	250,344	859	244
UR2JI	"	22,200	205	100
UR2RCN	3.5	20,586	141	73
UR2REO	"	17,556	129	66
UR2RER	"	8,112	75	52
UR2CW	"	504	15	14
UR2RCU	"	162	10	9

Kaliningrad

UA2DM	A	151,184	482	176
UA2EC	"	48,763	202	121
UA2WJ	"	27,048	161	98

Latvia

UQ2DV	A	97,650	365	155
UQ2GW	"	704	20	16
UQ2MU	21	33,048	203	108
UQ2HO	14	27,432	182	108
UQ2CR	"	16,188	160	76
UQ2GDQ	"	4,218	60	37
UQ2GCN	3.5	85,854	340	123
UQ2NU	"	4,914	63	39

Lithuania

UP2OU	A	415,672	966	233
UP2CY	A	152,048	524	172
UP2OM	"	93,636	400	153
UP2BAT	"	46,256	264	98
UP2BAO	"	4,770	55	45
RP2PEC	28	9	3	3
UP2BAR	21	21,845	137	85
UP2FA	"	2,380	43	34
UP2PX	14	275,500	834	250
UP2PBW	3.5	49,104	240	99
UP2BAE	"	1,344	32	21

Moldavia

UO5BZ	A	15,296	101	64
UO5OGE	28	378	15	14
UO5AP	21	8,526	83	58
UO5OWK	14	17,952	121	88

Ukraine

UB5TK	A	146,672	480	178
UB5MCS	A	100,344	363	111
UB5JK	"	26,505	194	93
UB5LAY	"	22,764	156	84
UB5LU	"	17,745	162	91
UB5IDL	"	9,400	76	47
UY5DJ	"	7,020	78	65
UY5YY	"	5,044	74	53
UT5HP	"	1,600	31	25
UB5VBY	28	1,008	20	18
UB5HBT	"	225	9	9
RB5IOV	"	200	12	10
UB5LCV	"	144	8	8
UB5LBP	"	114	7	6
UY5HV	21	208,086	571	158
UB5OD	14	71,883	347	163
UB5ABJ	"	21,243	161	97
UB5MBY	"	21,024	176	96
UB5MDI	7	14,400	95	60
UB5UBJ	3.5	80,400	320	120
UB5FBO	3.5	61,344	285	108
UB5GBD	"	59,360	259	106
UB5ZBP	"	27,054	170	81
UB5VCK	"	336	16	12

White Russia

UC2BF	A	45,150	199	129
UC2BA	"	32,175	163	99
UK2OAA	14	132	12	11
		(Opr. UC2OBI)		
UC2ABT	3.5	56,280	261	105
UC2ABF	3.5	47,040	218	98
UC2WAN	"	8,190	89	45

OCEANIA

Australia

VK4VU	A	989,976	1209	247
VK5MF	A	181,800	610	101
VK4UA	"	151,320	514	104
VK3SM	A	66,470	211	115
VK2XT	21	251,136	660	128
VK2OW	14	2,464	27	32

Guam

WA6EVX/KG6	A	663,432	1291	168
AG6JFY	A	456,224	1340	106
KG6JAR	14	123,836	515	83

Hawaii

KH6IJ	A	629,698	1180	146
AH6IJA	14	70,490	244	106

Indonesia

YB0ACG	A	379,432	750	172
YB0ACH	A	170,576	502	112
YB0ABV	28	7,215	67	37

New Zealand

ZL1BKX	A	647,802	769	261
ZL2HE	A	289,575	437	195
ZL2ACP	14	369,155	583	215
ZL1RE	14	326,304	624	176
ZL1AAS	"	191,625	380	175
ZL2AH	"	58,116	175	116
ZL1BPI	"	2,436	33	28
		(Opr. VK4PJ)		

Niue Is.

ZK2AQ	A	1,020,605	1583	215
		(Opr. WB7ABK)		

SOUTH AMERICA

Bolivia

CP1AT	A	118,690	247	166
CP1EU/CP6	A	45,046	138	101

Brazil

ZW6AHU	A	458,745	627	257
PY4KL	A	371,070	472	266
PY8JO	"	277,576	423	221
ZV6AM	"	266,282	458	211
ZY2FOS	"	54,859	461	119
PY3CKL	"	8,848	54	56
PY1FI	21	99,470	235	145
PY1CHP	"	26,000	114	80
PY2ELZ	7	62,510	120	95
ZX2FUP	"	33,200	86	83

Chile

CE3AOX	A	20,944	103	77
CE6EZ	28	383,114	607	223

Ecuador

HD5EE	14	943,448	1148	302
HC1BI	"	36,188	116	109
HD2TV	7	377,580	341	210

Paraguay

ZP5RS	A	5,625	47	45

Peru

OA8V	14	6,552	51	52

Venezuela

YV2AMM	21	1,084,512	1169	316
YV4AEL	"	132,682	281	163
YV5EED/1	"	115,479	281	141
YV4AGP	14	1,698,390	1704	339
YV5CVE	7	671,160	464	255
YY4YC	3.5	739,468	586	223

Single Operator U.S.A. TOP SCORES

All Band	AA9BWY	711,480
28 MHz	AB2CST	2,209
21 MHz	AC4WSF	170,340
14 MHz	AC3CRE	802,113
7 MHz	AC3USS	59,452
3.8 MHz	AC1CF	232,630
1.8 MHz	W8LRL	2,080

Multi Operator

Single Xmtr.	AC6YRA	911,180
Multi Xmtr.	AA4IVL	209,689

MULTI-OPERATOR SINGLE TRANSMITTER

United States

AC6YRA	911,180	1141	290
AC6HX	824,064	1060	256
AC5NOP	745,714	956	358
K8YZW	483,923	645	319
AA4EYR	447,066	773	306
AB6GFJ	435,760	726	260
ADØIET	289,710	718	270
WB4LOK	245,490	561	245
W9NLS	230,400	386	256
AA4UFW	199,576	533	247
LU1BAR/AC3	184,682	348	214
W6AB	79,518	241	174
AK8VDN/WA8UUY	22,260	121	105
W5YR	11,615	144	115
AC5YR	7,828	103	103

ASIA

KA6RI	497,000	738	250
KA6JC	164,472	380	168
JA1YYB	8,712	82	66
JA3YEJ	4,756	63	41

EUROPE

CT4AT	3,250,544	2636	484
SP5PWK	1,113,738	1383	366
I4ZSQ	977,886	1276	378
IØOU	936,225	1312	365
G4DAA	850,580	1252	355
LZ2KKZ	835,989	1494	329
LG5LG	813,936	1276	372
SP6PZB	804,220	1318	316
G3RUV	725,340	1130	330
I1GJC	719,776	1004	332
G3RCV	704,220	1046	330
G8JC	648,507	1046	339
YR3KAA	618,528	1190	272
OH4RH	541,171	1040	293
HA7KLG	496,382	895	283
YO4KCA	491,288	1211	283
DLØUE	477,605	756	295
YU2CBM	469,362	973	274
HA5KKB	414,464	873	256
HA9KOV	412,852	847	242
YU2CTF	390,094	745	262
YR6KEI	387,252	901	186
HA5KKP/3	385,295	767	263
LA1K	383,116	868	284
DLØRCA	360,858	639	274
PAØSMK	332,514	613	273
HA7KLF	307,131	739	227
G6CW	298,592	741	248
HA6KVB	287,793	843	187
DM3CK	277,680	763	195
OK3KAP	270,048	577	232
HA6KNI	252,120	719	191
G2FNK	242,608	585	236
DM4HJ	234,421	643	211
OK1KCI	207,557	577	199
GD4CCL/P	191,672	627	194
HA4KYH	179,895	535	179
SP9PDF	171,808	452	208
OH2AA/3	166,320	446	198
I14FGM	157,878	459	179
HA5KFN	148,410	531	170
PI1GOE	141,760	489	160
PA5GIG/A	130,644	473	171
YR6KBM	130,050	494	153
OK3KWK	110,094	380	177
DM4DE	107,074	385	157
YR6KAF	102,076	481	169
SP6KGJ	98,728	354	164
SP9KMQ	97,382	338	146
LA1R	82,170	472	99
OK1KYS	80,352	270	162
HA5KJX	79,560	397	130
OK1KUR	70,560	292	147
SP5KOH	68,094	381	117
SP9KDA	66,402	288	126
DM4NJ	48,025	256	113
LZ1KDP	29,046	170	103
OH2TI	22,776	147	78
YO3KBC	19,646	159	94
OK1KOK	17,910	140	90
OH6AH	15,744	140	82
SP9KCB	10,385	109	67
PI1KMA	10,143	93	69
OK3KJJ	8,568	92	51
SP9KOT	8,164	83	52
OK3KFO	7,540	85	58
F5KG	5,650	82	50
SP9PEY	2,100	35	28

OCEANIA

5W1AZ	3,114,315	3307	295
VR8D	1,576,179	2643	183

SOUTH AMERICA

YV1AVO	2,133,120	1898	320
PY3AHS	1,826,250	1659	375
OA4AHA	1,678,260	1565	337
PY1EMM	1,421,931	1335	357

U.S.S.R. CLUB STATIONS

ASIA

UK9AAN	4,158,929	2927	437
4J6A	2,931,577	2559	341
UKØAAB	929,355	1916	265
UK9FER	723,580	969	220
UKØSAA	457,878	1343	201
UKØLAB	360,165	1068	195
UKØAAC	286,528	928	176
UKØSAJ	260,944	750	188
UK7AAF	223,234	475	146
UK9OBI	216,151	573	169
UK8JAA	211,904	659	154
UK9OAD	146,438	520	146
UK7LAH	135,682	262	179
UK6FAC	126,360	320	120
UKØOOO	43,608	487	79
UK7LAF	35,280	166	98
UK9CAM	23,328	170	81

EUROPE

UK5MAF	1,676,048	2083	356
UK5IAZ	1,658,690	2092	374
UK3SAB	1,203,300	1780	315
UK2GKW	1,079,974	1531	389
UK2BBB	1,009,225	1473	365
UX3R	759,724	1500	301
UK2BAS	734,448	1207	321
UK4HBB	682,122	1224	218
UK5IAA	595,866	1058	282
UK4WAB	560,807	1264	241
UK3AAI	533,065	1119	295
UK3QAA	504,654	1149	241
UK3DBG	438,309	1012	279
UK2AAA	376,425	878	239
UK2PAF	345,790	812	229
UK3WAC	337,180	847	230
UK5WAZ	332,748	773	234
UK4LAC	294,380	859	205
UK5AAO	287,300	739	221
UK6LAI	269,816	705	232
UK6LTE	258,312	693	229
UK3DBA	242,130	716	210
UK4WAC	231,990	747	185
UK3UAA	227,256	602	204
UK2PAT	165,725	612	175
UK4HAC	163,496	509	191
UK2GCF	135,982	492	154
UK3ABX	128,860	432	170
UK6LKP	104,576	419	152
UK3IBA	102,850	409	170
UK2FAA	99,144	364	153
UK6AAF	95,992	480	169
UK3TBF	92,568	372	152
UK2RIL	91,728	351	168
UK4FAD	49,800	279	120
UK4FAV	39,941	200	91

UK2PRC	35,532	250	108
UK3DAU	35,175	222	105
UK4YAN	26,040	169	93
UK2WAR	19,564	145	73
UK3DBE	12,684	136	84
UK2GCL	10,692	93	54
UK3XAM	8,694	107	46
UK5QAV	4,144	54	28
UK5WAA	713	31	22

MULTI-OPERATOR MULTI-TRANSMITTER

4J3A	**3,971,781**	**3861**	**473**
DK2BI	**3,038,409**	**2688**	**517**
DLØKI	429,454	912	288
VE5NN	**383,075**	**787**	**199**
SP9KRT	**374,750**	**899**	**250**
JA1YFL	**252,970**	**618**	**205**
JH1YDT	232,932	611	188
AA4IVL	**209,689**	**328**	**277**
SP1KIZ	156,890	559	145
SK1AQ	**73,950**	**305**	**145**
JA1YFG	18,035	103	65

Our thanks to the following stations who submitted their logs for checking purposes: AB4KPU, AH6IAC/AC1, AC2HL, AC3GCO, AC4HYY, AC6OKK, AD5-DEC, CE0AE, DM2YLO, DM3GG, DM3YZG/P, DM4YEL, DM5YVL, DM6AJ/DM3WBJ/DM3PBJ, DM6-TAF, JR1YYO, JR1ZSG, LA2IJ, LA-2XT, OH2KI/3, OH5YX OK3CGI, OK3KFF, SP1CQN, SP3CDQ, SP3-IGB, SP9DFH, UK2GAB, UK3AAC, UK3MAA, UK3QBF, UK4PAE, UK5-CAO, UK5MAG, UK6LAZ, UK6LEZ, UW3WZ, W1CF, W1WY, WA2AUB, WA2ZWH, W4UYC, WB4VQO, K4-YFQ, W6CLM, W6OJW, W8GLC, WA9HEU, WA9UEK, KH6IJA, KL-7HDX, XJ6WX.

Rules for 1977 CQ World Wide WPX-SSB Contest Next Month

STATION OPERATORS

Multi-Operator, Single-Transmitter

AA4EYR & AB4EYX, AA4SGF, AD4UTE. **AA4UFW** & AB4IAI, AK4MFK. **AC5NOP** & AC5KKZ, AD5FVA, AD5YMY, AA5KND, AC5WQI. **AC5YR** & AK5SBH. **AB6GFJ** & AC6OAT, AA6BVY, AD6CQF. **AC6HX** & AB6OLD, JA1FZO. **AC6YRA:** AA6DPQ, AA7DAC. **AK8VDN/WA8UUY:** AA8HMU, AA8UUY. **ADØIET** & ABØOED. **CT4AT:** CT1OY, CR6XX, K7CBZ, WA3HRV. **DL0UE:** DL3LU, DL8RL, DJ4GO. **DL0RCA:** DJ4EI, DL2QB, DF2KO. **DM3CK:** DM3PCK, DM3WCG, HA9RX. **DM4DE:** DM4XDE, DM2BVE. **DM4HJ:** DM2AUJ, DM3ZCK, DM4ZHJ. **DM4NJ:** DM4JNJ, DM4QNJ, DM4VNJ. **F5KG:** CLUB. **G2FNK** & G3NTM. **G3RVC:** G3RZP, G3VLX, G3XMD, G3ZAY, G4BAH, G8KNW. **G3RUV** & G3HTA. **G4DAA:** G3FXB, G3MXJ, G3XBN, G3ZQW, G4BUE, G4BVH. **G6CW:** G3SJJ, G3TVY, G3WFV, G3YUT, G3ZMU, G4AFJ, G4ANS, G4CKG, G4DJJ G4DLR, G4EKW, G8IMC. **G8JC:** G3RMF, G3TQD, G3TQZ, G4BXS, G4CZE, G4DXD G4DXE, G4ETH, G8ASO, G8IXQ. **GD4-CCL/P:** G3YYN, G8FQM, G8GSH, GD3HQR. **HA4KYH:** HA4YO, HA4YQ, HA4YX. **HA5KFN:** 2 OPRS. **HA5KKB:** 4 OPRS. **HA5KKP/3:** 3 OPRS. **HA6KNI:** HA6NN, HA6NI, HA6OH. **HA6KVB:** 2 OPRS. **HA7KLF:** HA7MI, HA7LR, HA7LW. **HA7KLG:** HA7MC, H-7015, H-7031, H-7032, H-7033. **HA9KOV:** 3 OPRS. **HA5KJX:** CLUB. **I1GJC** & I1ANF, I1GUB, I1DSG, I1PCT, I1RBP, I1VVZ, I1UW. **I4ZSQ** & I4VEQ, I4USC. **IØOU** & IØAMU. **II4FGM:** I4ADS, I4BJN, I4BMJ, I4LEC. **JA1YYB:** JE1NYS, JG1AOU, JI1MJN, JI1OBZ. **JA3YEJ:** JE3EVC, JH3BJN, JR3STD, JR3STC. **K8YZW** & K8DVV, WA8WWM. **KA6JC** & KA6DD, KA6DX. **KA6RI** & KA6BN, KA6WG, KA6YL, KA6ZZ. **LA1K:** LA2UO, LA3BO, LA4AU, LA4CQ, LA5KO, LA6MP, LA8TO. **LA1R:** LA2YT, LA4EO, LA9RT. **LG5LG:** G3UKS, G4ALG. **LZ1KDP:** 3 OPRS. **LZ2KKZ:** 5 OPRS. **LU1BAR/AC3** & LU2DX. **OA4AHA** & OA4AHZ, OA4ANR. **OH2AA/3:** OH2BKH, OH2BNP, OH2EC, OH2HR. **OH2TI:** OH5TM, OH6IJ. **OH4RH** & OH4RF. **OH6AH:** OH6IZ, OH6UM. **OK1KCI:** OK1IDK & Group. **OK1KOK:** Club. **OK1KUR:** Club. **OK1KYS:** 2 Oprs. **OK3KAP:** OK3CGI & Group. **OK3KFO:** Club. **OK3KJJ:** OK3CKY, OK3TA. **OK3KWK:** OK3TEI & Group. **PA5GIG/A:** PAØHTR & PI1ARS Group. **PAØSMK** & PAØSPD, PA9WRR. **PI1GOE:** Club. **PI1KMA:** Club. **PY1EMM:** PY1TC, PY1ZBJ, PY2AFM. **PY3AHS** & PY3AIT, PY3APH. **SP5KOH:** SP5GNG, SP5GNI. **SP5PWK:** SP5BSV, SP5CIC, SP5DZI, SP5DZJ. **SP6KGJ:** 2 Oprs. **SP6PZB:** SP6FAF, SP6FIH. **SP9KCB:** SP9CUA, SP9FZX. **SP9KDA:** Club. **SP9KMO:** Club. **SP9PDF:** SP4FUY, SP9-2706. **SP9PEY:** SP9HMF, SP3RYI. **SP9KOT:** SP9FKO, SP9HPP. **UK2AAA:** 3 Oprs. **UK2BBB:** UP2BAS, UP2BBB, UP2BC, UP2-038517. **UK2FAA:** 3 Oprs. **UK2GKW:** UO2ON, UQ2-03783. **UK2RIL:** UR2ED, UR2-08375, UR2-08378. **UK3SAB:** UA3SAO, UA3SCR, UA3SF, UA3VDE, UA9SDL, UA3-15125. **UX3R:** UA3AED, UA3FG, UA3HK, UV3EA, UV3FR, UW3AX, UA3-170320. **UK5IAZ:** UB5IDV, UB5IDZ, RB5IRZ, UB5-073202, UB5-073342, UB5-0731151, UB5-0731277. **UK5MAF:** UY5LK, UB5MAK, UB5MDC, UB5-05922. **UK6FAC:** UF6AP, UF6FCR. **UK7AAF:** 3 Oprs. **UK8JAA:** UJ8JCC, UJ8JCL, RJ8JBJ. **UK9AAN:** UA9AN, UA9ACZ, UA9AFN, RA9AIL, UA9-165516, UA9-165686, UA9-165965, UL7-02671. **UKØAAB:** UAØABY, UAØAEE, UAØ-10340, UAØ-103190, UAØ-103259, UAØ-103344. **VRSD:** JA2PJC, JA3KWJ, JAØCUV. **WB4LOK:** W4GTS, WB4BCL, WB4TVU, WB4VAF. **W5YR** & WN5SBH. **W6AB:** Club. **W9NLS** & AD9HDF, AB9IWN, AB9IWO, AB9KLW. **YO3KBC:** YO3JE, YO3YZ. **YO4KCA:** YO4ASP, YO4HW, YO9APJ. **YR3KAA:** YO3AOJ, YO3FU. **YR6KAF:** YO6AW, YO6GB. **YR6KBM:** YO6AFP, YO6DB, YO6OO. **YR6KEI:** YO6AWR, YO6UX. **YU2CBM:** YU2RTW & Club. **YU2CTF:** YU2RLD, YU2RTI, YU2RUX, YU2RUZ, YU2RXZ, YU2RZE. **YV1AVO** & YV1TO. **4J6A:** UA6HZ, UK6GAE, UW6FZ, UW3HV. **5W1AZ** & 5W1AZ, WB6OOL.

Multi-Operator, Multi-Transmitter

AA4IVL & AA4SHL. **DK2BI** & DK5WL, DK5WM, DK5WN, DK6WL, DK9WB. **DL0KI: DJ3UM** & Club. **JA1YFG:** JA2WIQ, JA5GJI, JE1XZL, JG1ILP, JR1CKM. **JA1YFL:** JAØJCJ, JE1TSD, JH2KKW, JR1GVZ. **JH1YDT:** JH1AGH, JH1BBT, JH1GNU, JH1SBE, JR1BSM, JR1EYB, JR1FNR, JR1LYT. **SK1AQ:** SM1CJV, SM1CXE. **SP1KIZ:** 3 Oprs. **SP9KRT:** SP9FYQ, SP9HMF. **VE5NN:** VE5NW, VE5UA. **4J3A:** UA3AFO, UA3AGW, UA3EAI, UV3CC, UA3ADM, UV3CO, UW3BO, UW3FI, UW3IB, RA3AKQ, UA3-142303, UA3-170885, UA3-170888.

Harry Leeming describes the whys and wherefores of audio and r.f. clipping.

Why Radio Frequency Clipping?

BY HARRY LEEMING*, G3LLL

There cannot be many amateurs who at some time or another have not experimented with audio processing and clipping. In the past, on a.m., results were quite encouraging, but for some reason the things just don't seem to work in many cases with s.s.b.—why?

A typical block diagram of an audio processor which includes clipping and compression is shown in fig. 1. This kind of unit looks quite impressive, but let us examine it stage by stage and see what we have to gain if we connect it into a good quality single side band transmitter.

Preamplifier And Pre-Emphasis Stage. This stage does just about everything that a decent microphone (plus, perhaps, a bass-cut capacitor) should do. If you are short of audio gain or if you use a microphone with a bass-y response, it may help, but if you use something with plenty of output and a controlled response such as, say, a Shure 444 you will gain little or nothing.

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The Compressor Stage. The a.l.c. circuit in any correctly operating amateur s.s.b. transmitter makes a very good audio compressor; why add another in series?

Clipping Stage. Most a.l.c. circuits derive their output from the PA tubes grid. Before this type of circuit can work the PA tube has to be over-driven, and in this condition the cathode and grid form a clipping diode limiting the audio peaks and giving, whether you want it or not, several db's of radio frequency clipping. The small amount of clipping obtained may not increase the **loudness** of the signal as much as 20 db's of audio clipping, but as it will not produce any audio harmonic distortion, in many cases it will do just as good a job of improving the intelligibility.

The High Frequency Filter. While a separate audio high frequency filter may be needed to prevent square wave effects after audio clipping, it is certainly not needed to clean up any signal which is going to be passed through a s.s.b. filter. A s.s.b. filter has a very clearly defined response and this

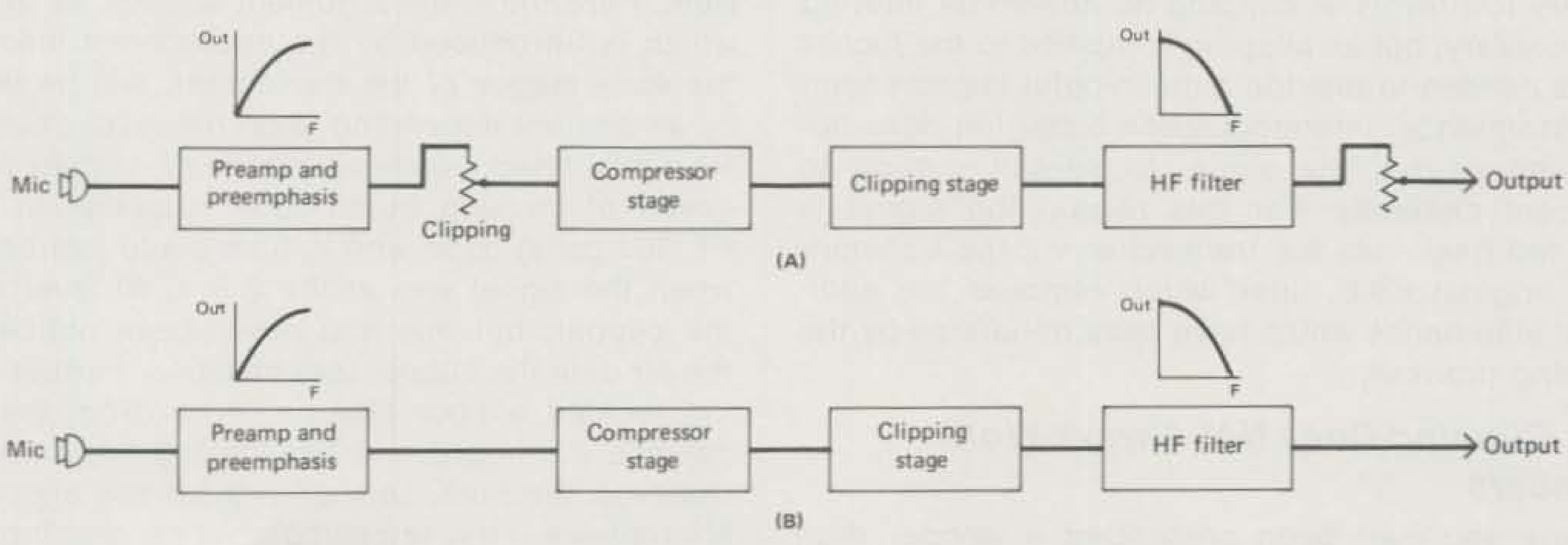

Fig. 1—A block diagram of an audio processor which includes clipping and compression.

ensures that any high frequency distortion products are 'chopped off'.

While doubtless, an audio clipper will help some sometimes, I doubt if it has much to offer when used with single side band equipment if the following conditions are already met:

1. A good communications type microphone with a rising response and adequate audio output is used.
2. The transmitter has an efficient a.l.c. circuit which is derived from the PA grid.
3. Adequate drive with some clipping at the grid of the PA tube is available on all bands.

Although many would argue otherwise, my own experience is that under these conditions the only clipper giving any real hope of more than a db or two improvement is a radio frequency clipper.

Radio Frequency Clipping

To refresh your memory, the general layout needed for an "add-on" radio frequency clipper is shown in fig. 2. The double side band signal is taken from the transmitter and first of all converted to single side band by the clipper's filter FL 1. The *then* single side band signal is amplified by an amount necessary to ensure adequate clipping and is then clipped and fed via the output control back to the associated transmitter.

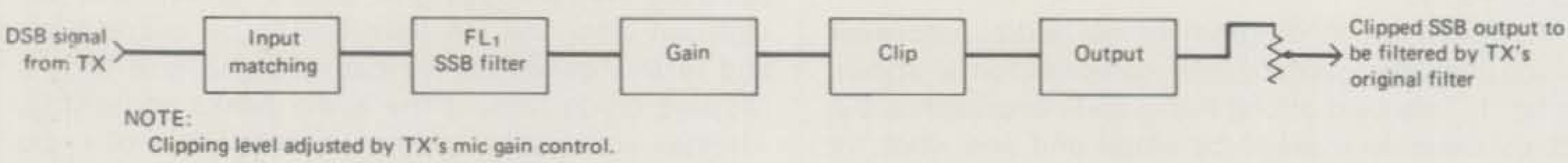

Fig. 2—Block diagram for an add-on r.f. clipper.

If things are working correctly it is impossible for a radio frequency clipper to *generate* audio harmonic distortion, as the s.s.b. signal fed to the clipper diodes consists only of a bunch of radio frequencies. Harmonic distortion products in this case are at twice or more times the *radio frequency*, and so are filtered out by the simplest of tuned circuits. At very low levels of clipping no additional filtering is necessary, but as clipping is pushed to the higher levels needed to provide a meaningful improvement in performance, intermodulation distortion does occur and causes the signal to spread out on to adjacent channels. For this reason the signal is then fed back into the transmitter via the transmitter's original s.s.b. filter which removes the additional side bands which have been generated by the clipping process.

R.F. Clipping Does Not Always Work Wonders

Have you ever been prescribed a wonder drug for hay fever? I was, and it certainly worked; that is, I think it did; but the trouble was I hardly ever woke up sufficiently to sneeze! R.f. clipping can also have its problems.

Heat. Most single side bands rigs are rated for a 50% duty cycle on c.w., and for less than this at higher power on s.s.b. When using any form of clipping, the speech duty cycle becomes considerably extended and if the extreme of infinite clipping was to be applied the duty cycle would become 100%. At the more realistic levels commonly used, of around 15-20 db's of clipping, you should be safe if you keep within the *c.w. ratings,* and if your equipment is not equipped with a blower, you install one.

Distortion. R.f. clipping properly applied does not *cause* objectionable harmonic or intermodulation distortion, and speech can sound excellent even at 30 db's of clipping. How then do the distorted signals which we all hear on the air on occasions, occur? The purpose of clipping the peaks is to boost up the low level signals, and r.f. clipping boosts up all low level signals. Distortion is, however, a low level signal, and suppose for a moment that before the application of clipping your rig has an inbuilt distortion level of 5%. This level of distortion is quite acceptable in amateur practice, frankly no one is likely ever to have commented. If you do go ahead and add a radio frequency clipper after the stages which have produced the distortion, you will boost up the distortion. If you go as far as to add clipping in the region of 20-30 db's the distortion will become boosted until it is nearer to 50%, and then you will be told that your clipper is causing distortion. It is not causing distortion; it is simply amplifying the distortion which already exists.

Hum. Here the same argument applies, as any hum which is introduced by the microphone lead, or in the early stages of the transmitter, will be boosted by an amount depending upon the level of clipping. Recently, I had a case where my r.f. clipper was accused of causing hum. Upon examination of the FT. 101 being used with it, hum could just be heard when the signal was at the S.9 + 40 level without the clipper, but this had never been noticed over the air until the clipper was installed. Further checking located a poor chassis return from the transceiver's a.f. board and resoldering this completely removed the hum, with or without the clipper.

Microphone. First remember that r.f. clipping shows up everything, and microphone distortion will be just as mercilessly amplified as any other kind of distortion. Frankly, if you do not wish to invest in a good quality microphone, you will be wasting your money on a radio frequency clipper.

The frequencies which carry most information in speech are in the octave and a half above 1 kHz, and whether you use clipping or not, a microphone which has a peak response in this range will give maximum talk power. If you want to get the best possible from *any* type of clipping you must use a microphone with a rising response, and even if you use a good mic it is still worthwhile adding extra low frequency cut.

I use a Shure 444 microphone, and I have modified the VOX/PTT switch so that it adds a 2000 pf capacitor in series with the audio lead in one position. Under poor conditions switching in this capacitor is at least as good as doubling the power but somewhat cheaper!

Clipping Circuits: I could be wrong, but I am not personally very keen on using arrangements where clipping diodes are associated with tuned circuits. Under these conditions it is very difficult to measure just what is happening, and I cannot help feeling that it might just be possible for phase modulation to occur at some signal levels as the diodes change capacity with signal voltage. The very simplest arrangement is resistance capacity coupling; it only being essential to ensure that there is adequate dynamic range so that clipping definitely occurs in the diodes and not in the transistors. In this connection it is helpful if two stages of clipping are used as shown in fig. 3 the gain of Q2 being adjusted so that at the maximum level of clipping desired, say, 20 db, clipping is shared equally by each stage.

Does R.F. Clipping Really Work?

With a generously rated transmitter having an inherent level of distortion in the high fidelity class, it should be possible to run 40 or 50 db's of r.f. clipping and gain anything up to fifty times effective increase in power. Under these conditions perhaps it would be necessary to operate under ground in a padded cell to keep blower and room noise down to a reasonable level, but in any case the consideration is purely academic.

In more practical terms I use radio frequency clipping with my Yeasu FT. 101 mainly in a static mobile condition. Without the engine running I get only 12 volts out from the battery, and so the FT.101 runs at reduced power. Under these conditions I can really "push" the FT. 101 without worrying about overloading the power supply or PA tubes, and I often use 20 db's or more of clipping. Even at these levels of clipping I often get unasked for comments of "excellent speech quality," and some stations have told me that apart from being much louder and easier to read with the clipper, the speech quality is actually better! This may be due

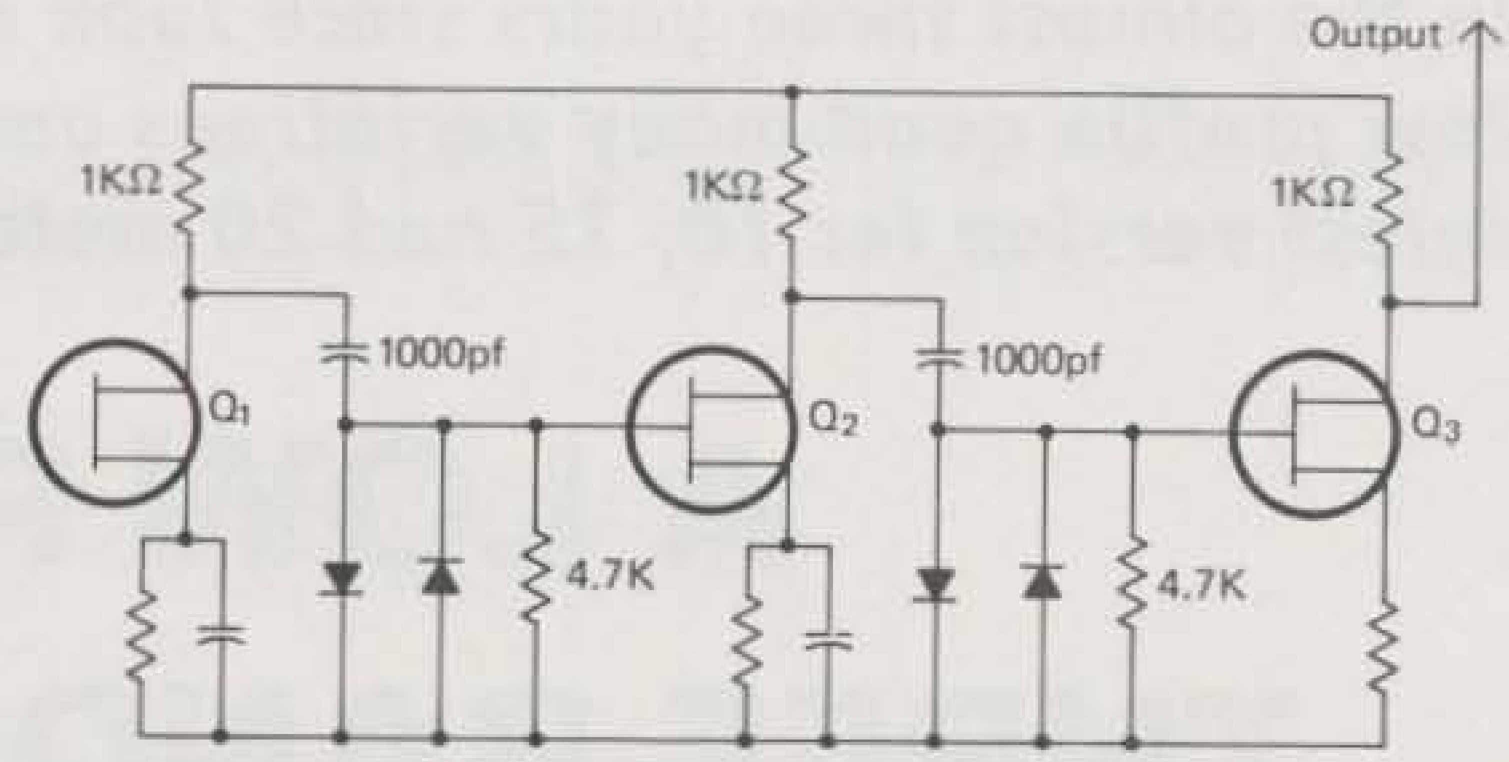

Fig. 3—Clipping circuit described in the text.

to over-enthusiasm, but certainly the sound quality at any level of clipping which is within the capabilities of the FT. 101 is of a kind that will not upset the most critical listener.

Reception

As explained previously, before you can incorporate r.f. clipping it is necessary to purchase an extra s.s.b. filter which usually is quite an expensive item. With quite a few transceivers it is possible to design the clipper so that the extra s.s.b. filter is in circuit on reception as well as on transmit. The extra filter gives quite a notable improvement in skirt selectivity which is well worth having as it is "thrown in free of charge." This approach is not possible with all transceivers, but if you are home brewing a radio frequency clipper the possibility should certainly not be overlooked.

Conclusion

Radio frequency clipping is not cheap, but pound for pound or dollar for dollar it seems a much better proposition than a linear amplifier. If you really want to flatten the opposition there is no reason why it should not be used in addition to a linear, in which case you will have talk power in the broadcasting station class! R.f. clipping will make an excellent rig, even better, but as it amplifies everything including any hum or distortion, one should not try and incorporate it in any equipment which is the slightest amount under par in audio quality or else the results will be disastrous. ■

In the almost three years since John introduced his low profile quad many variations ensued. This is the latest version for 10, 15 and 20 meters.

A LOW PROFILE, THREE-BAND QUAD, MK IV

BY JOHN P. TYSKEWICZ*, W1HXU

The diamond quad has many features that make it preferable over the square or cubical kind. Structurally the vertical spreader is nicely guyed by the wire loops and supports the horizontal spreaders. Performance is said to be better, particularly with a low tower installation, for at the same boom elevation the upper current loop is higher, and in all cases the high current loops are stacked further apart. Also in a square quad the effective quarter wave long horizontal sections and the vertical components are well defined whereas in the diamond version it's conceivable that the radiator sections exceed a quarter wavelength; after all the diamond quad element and a stretched folded dipole are very similar.

For many reasons the trend is towards smaller antenna structures utilizing some form of loading. The Low Profile Quad was introduced in the February 1974 issue of *CQ* and this Mk IV is another variation.

The dimensions in fig. 1 reveal that the outer 20 meter quad has been reduced to half size while it's peripheral wire length is 73 per cent of a full quad; and the 15-10 meter loops are 84 per cent of a full

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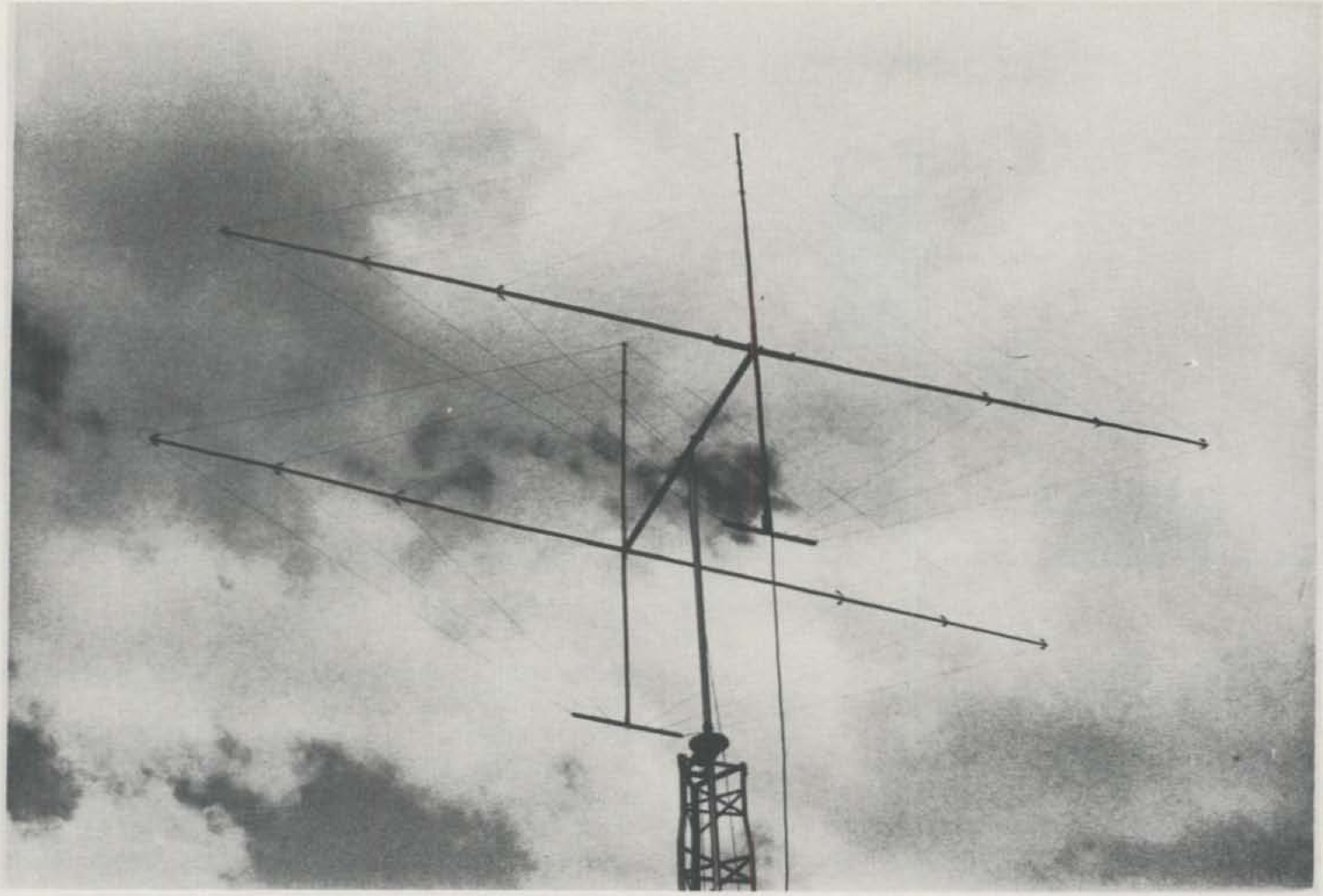
Fig. 1—Construction of the tri-band elements and wire loop anchors.



This is how the whole thing will look after you finish it and mount it high atop your tower.

wave. The latter two can be further expanded since space is available but I prefer the dimensions given for it provides better support and looks better.

Construction

The spiders were made as shown in fig. 4 and should offer no difficulty except for the welding part to some constructors. The 24 inch (60.8 cm) long horizontal angle iron is notched with a hacksaw and the cut out section used as the filler piece insert between the lower half of the pipe stub and vertical angle iron. The spreader clamps are made from 20 gauge (1 mm) thick stainless or galvanized iron stock formed to a snug fit. A less elegant method is to wrap the spreader and spider arm with friction tape and bind with wire. The tips of the bamboo poles should be reinforced with wood inserts approximately 3 inches (7cm) long using epoxy glue. Seal tips with masking tape and position poles to insure epoxy flows and sets at tip. Bamboo spreaders are now spiral wrapped with ¾ inch (19mm) wide paper masking tape and given two coats of

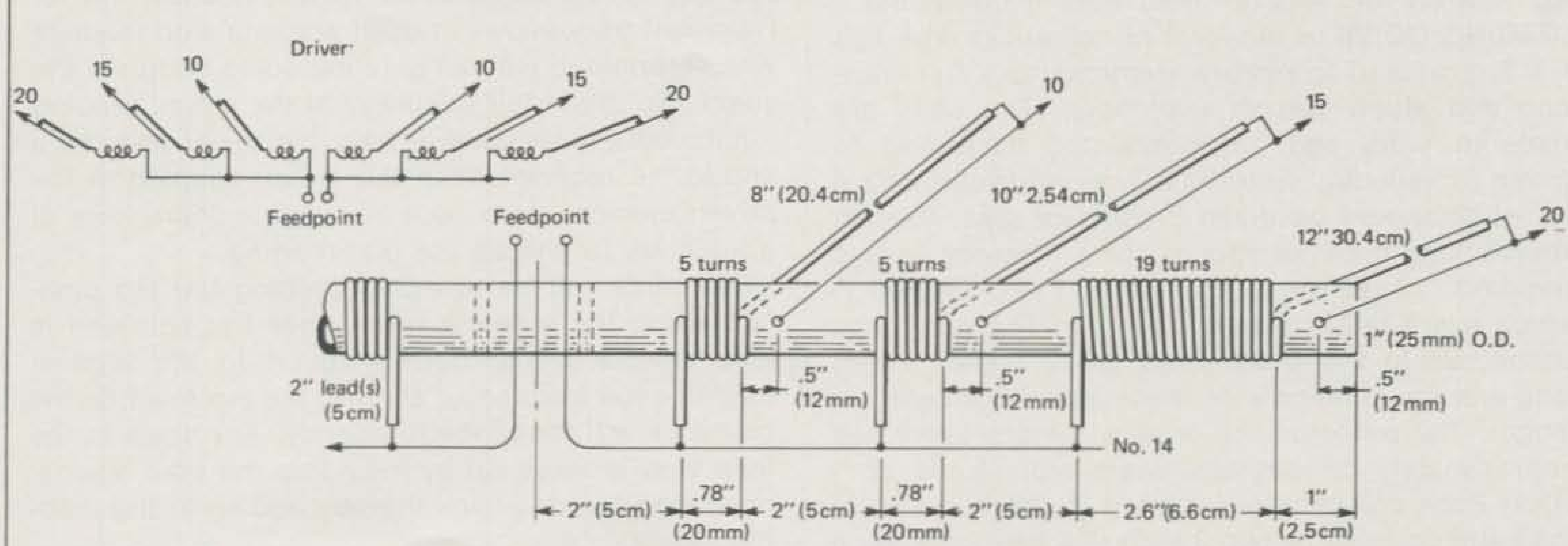


Fig. 2—Mechanical diagram of driver element, and coil sticks.

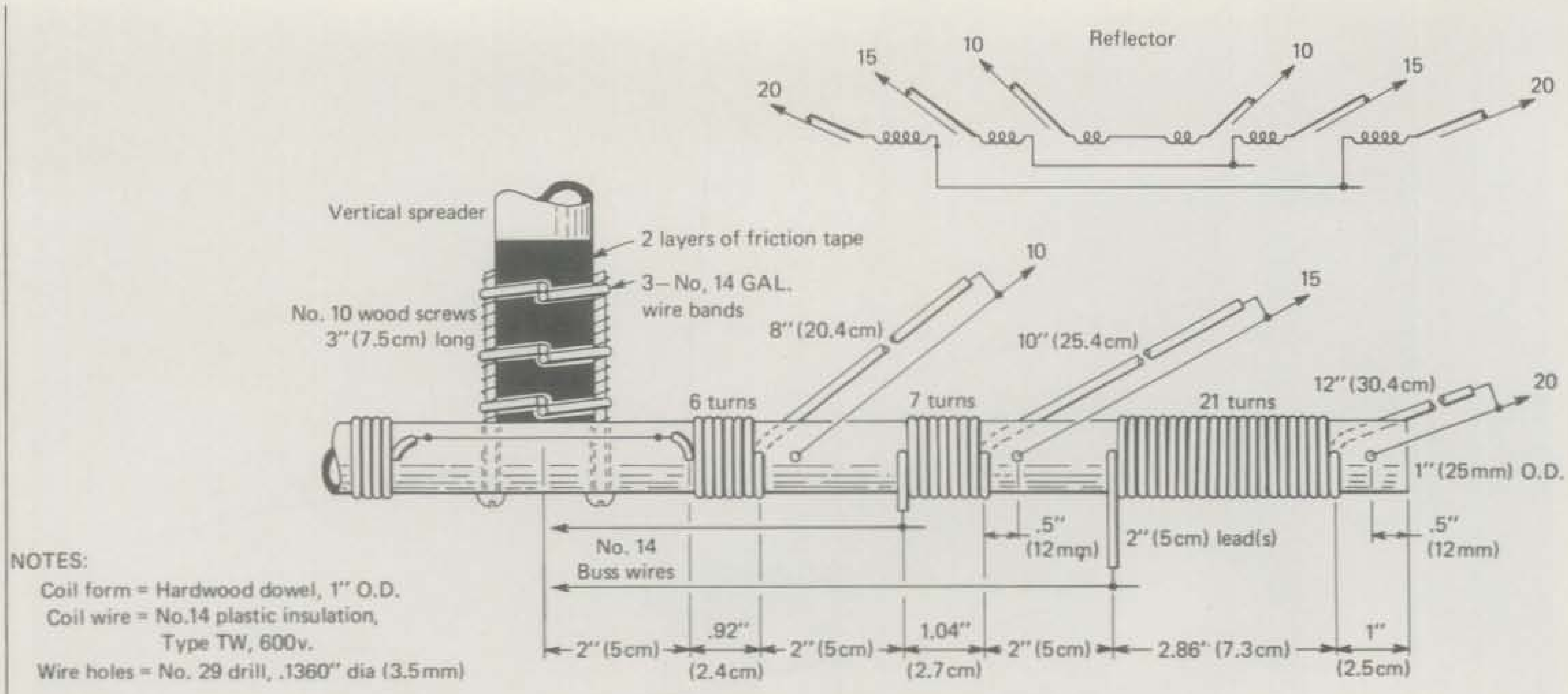


Fig. 3—Mechanical diagram of reflector element, and coil sticks.

latex paint.

ELEMENTS Fig. 1 shows the tri-bander's driven and reflector elements which are identical except for the loading coil-sticks. The wire-loop anchors were attached to the spreaders prior to spider-spreader assembly therefore make allowance for spider fit when locating anchor points which are wrapped with 2 layers of friction tape.

The wire-loop anchor forming sequence begins by bending the wire around a nail held in a bench vise; formed piece is then fitted to spreader and longest lead wrapped about for 2 turns, drawn up tightly with pliers and leads twisted. Excess wire is cut off and a nail inserted into the 2 turn eyelet and given another twist. Adjacent to each pair of anchors (towards the spider) drill a small pilot hole for a number 6 panhead screw. Along the horizontal spreaders attach small egg insulators for the wire at these points will be "hot." Previous experiments with the LPQ MkII & III indicated that a metal central spreader can be used and quad effectively grounded, however this was not tried with this antenna.

LOADING COILS in the form of coil-sticks, see figs 2 & 3, are used to restore elements to a full wave loop and attain correct resonance. The coils are made in pairs and are connected according to driven or reflector operation. The hardwood dowel coil-stick should be given 2 coats of clear varnish after drilling required sets of holes. The coil wire is standard "house wire," Number 14 TYPE TW 600 V. which has a heavy plastic covering. The coil leads connected to the buss wires are 2 inches (5cm) long and the antenna side leads are as indicated or longer. The reflector coil buss wires are separated approximately 80 degrees apart around the coil-stick. Each coil-stick is fastened to the butt end of the bamboo mast by two 3 inch (7.5 cm) long wood or sheet metal screws straddling the tape covered spreader-mast and banded with three galvanized iron wire loops.

Wire Stringing is done with the assembled element on the ground, pipe stub up, and spider propped on a block 6 inches (15 cm) high. The spreaders will sag a bit to retain correct wire tension after completion of wire loops. The antenna wires radiating from the coil-stick are attached ½ inch (12.5 mm) away from the coils and left "floating," see wiring diagrams figs. 2 & 3.

Adjustment and Feeding

The completed array can be tuned near ground level using a grid dip meter. Temporarily bridge the driven element buss wires with an insulated wire one turn link but without the feedline or balun. Because of the ground effect, body capacity, power leads etc. the resonant frequency of elevated antenna will shift; in my case final results indicate the gdm must show a higher frequency in the order of 200 kHz. on 20, 600 kHz. on 15, and 300 kHz. on 10. Resonant frequency of raised antenna with feedline was determined with an antenna noise bridge in the shack. To attain fair accuracy of the g.d.m. reading I installed a loud-speaker near the tower and ran a line to the receiver. With the g.d.m. coupled to the driven element, zero beat and adjust some form of a fiduciary to line up the dial reading.

Elements will be tuned by shifting the tap position along the antenna wire. When the coil lead is fully extended the loop is tuned to it's highest fundamental frequency; shifting the tap towards the coil-stick will lower the frequency. Any slack in the lead wire is taken up by moulding the lead against or around the coil-stick thereby adding to the loading inductance.

Proceed by setting calibrated receiver to 28 MHz

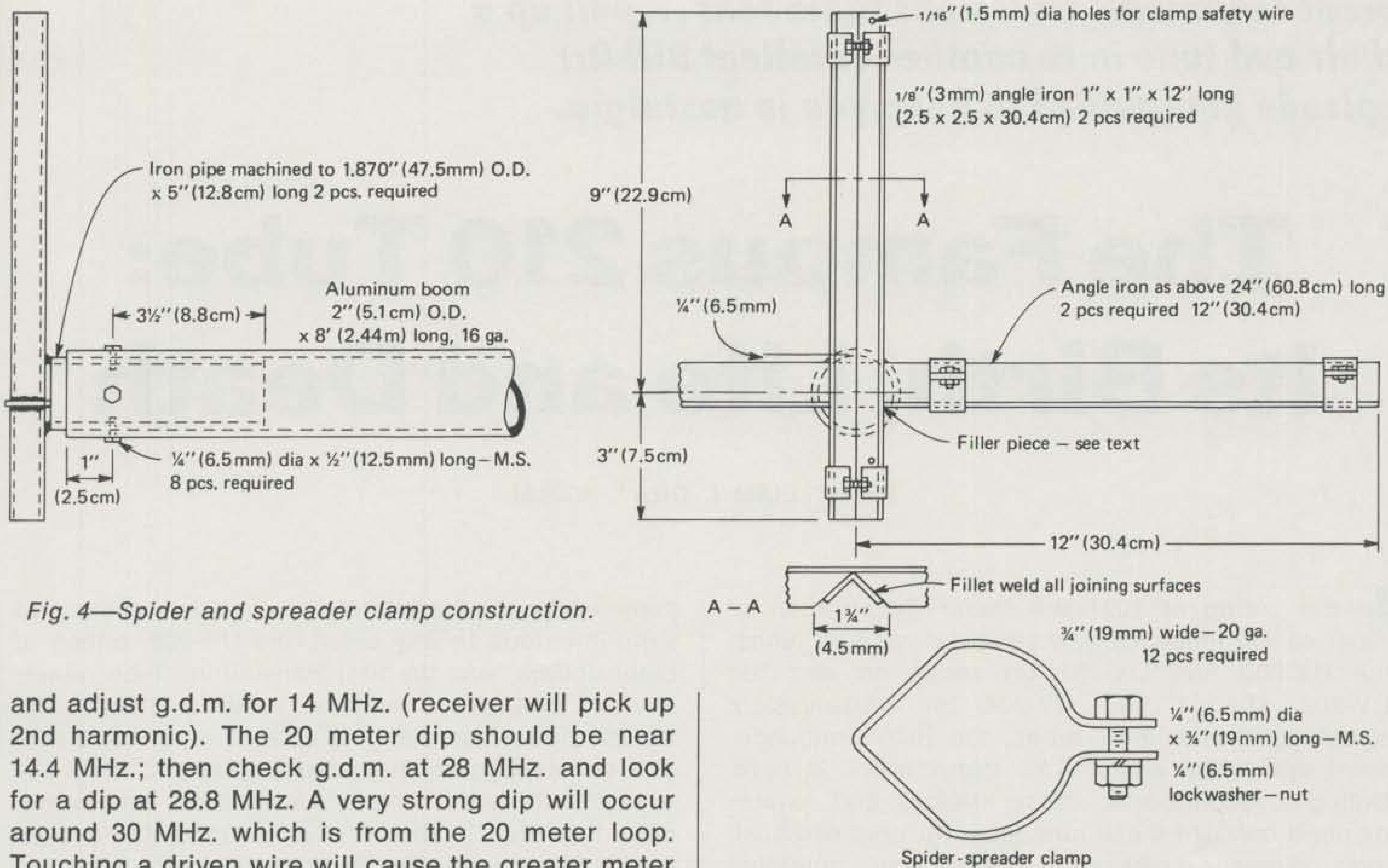


Fig. 4—Spider and spreader clamp construction.

and adjust g.d.m. for 14 MHz. (receiver will pick up 2nd harmonic). The 20 meter dip should be near 14.4 MHz.; then check g.d.m. at 28 MHz. and look for a dip at 28.8 MHz. A very strong dip will occur around 30 MHz. which is from the 20 meter loop. Touching a driven wire will cause the greater meter deflection and verify a reading. Follow by setting receiver to 21 MHz., adjust g.d.m. dial and look for a dip at 21.8 MHz. The g.d.m. coupling loop is removed and a homemade 1:1 air core balun and RG-8 50 ohm cable was connected. Finally the reflector's coil lead connections checked and Mk IV raised to firing position.

Tests were made at low power to determine s.w.r., relative field strength and front to back performance. The most useful data can be obtained from the field strength readings taken by a remote and simple receiver consisting of a short (non resonant to 10-15-20) horizontal dipole, IN34 diode detector and transmission line leading to a 0-1 ma meter in the shack.

Using direct feed to a 3 band array of varied impedances will result in some mismatch which can be reduced to acceptable levels when the elements are tuned to the most desired part of a band and the co-axial line trimmed to length.

Lacking sufficient data to offer a design formula or a simple co-ax "line stretcher" one must resort to the cut and try method. The pronounced effect of a few random lengths of insertable co-ax will show up on the s.w.r. meter but to a lesser degree on the field strength meter. The inconvenience of handling extra lengths of cable when changing bands can be solved with co-ax switches; which turns out to be easier and safer than peaking up three gammas while perched on a shaky tower during a blizzard at midnight. ■

Great thermionic emissions radio fans... pull up a chair and tune in to another excellent Bill Orr episode guaranteed to keep you in nostalgia.

The Famous 210 Tube: Its Birth, Life and Death

BY WILLIAM I. ORR*, W6SAI

In the spring of 1921 the *Radio Corporation of America* introduced a new series of vacuum tubes: the UX-200 and UX-201 for reception and the UV-202, UV-203 and UV-204 for transmission. Speaking of the latter tubes, the RCA announcement said, "The era of C.W. transmission is here. Colleges, Laboratories, relay stations and experimenters can use these new tubes to help establish long distance records". Presumably amateurs came under the classifications of relay stations and experimenters. In any event, the UV-202, priced at eight dollars, was the first transmitting tube generally available to the amateur. Rated at 5 watts, the UV-202 had a "normal" life of 250 hours (hopefully) and boasted a pure tungsten filament. It lit up like a lamp bulb and in reality had a short, and unreliable life. But it was the only transmitting tube available at a reasonable price to amateurs and it had to do (Figure 1). Some amateurs operated as many as eight UV-202s in parallel to achieve high

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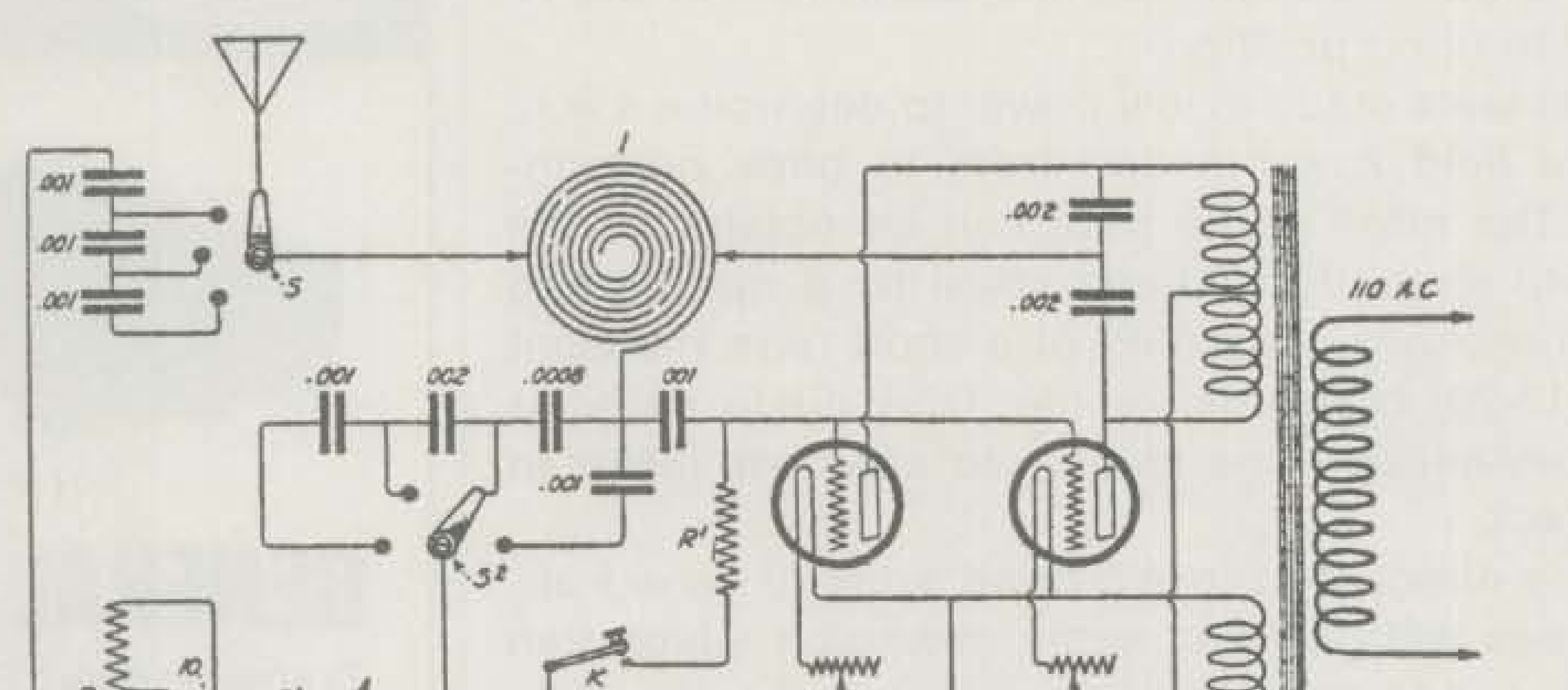

Fig. 1—The UV-202, introduced in 1921 was the "grandfather" of the famous UX-210 transmitting tube. The UV-202, manufactured by the General Electric Co. and sold through the Radio Corporation of America, cost eight dollars and was famous for its short life and unpredictable operation. A representative circuit for a shortwave transmitter using two of these tubes is shown above. (Illustrations from "Radio News" Magazine, May, 1921).

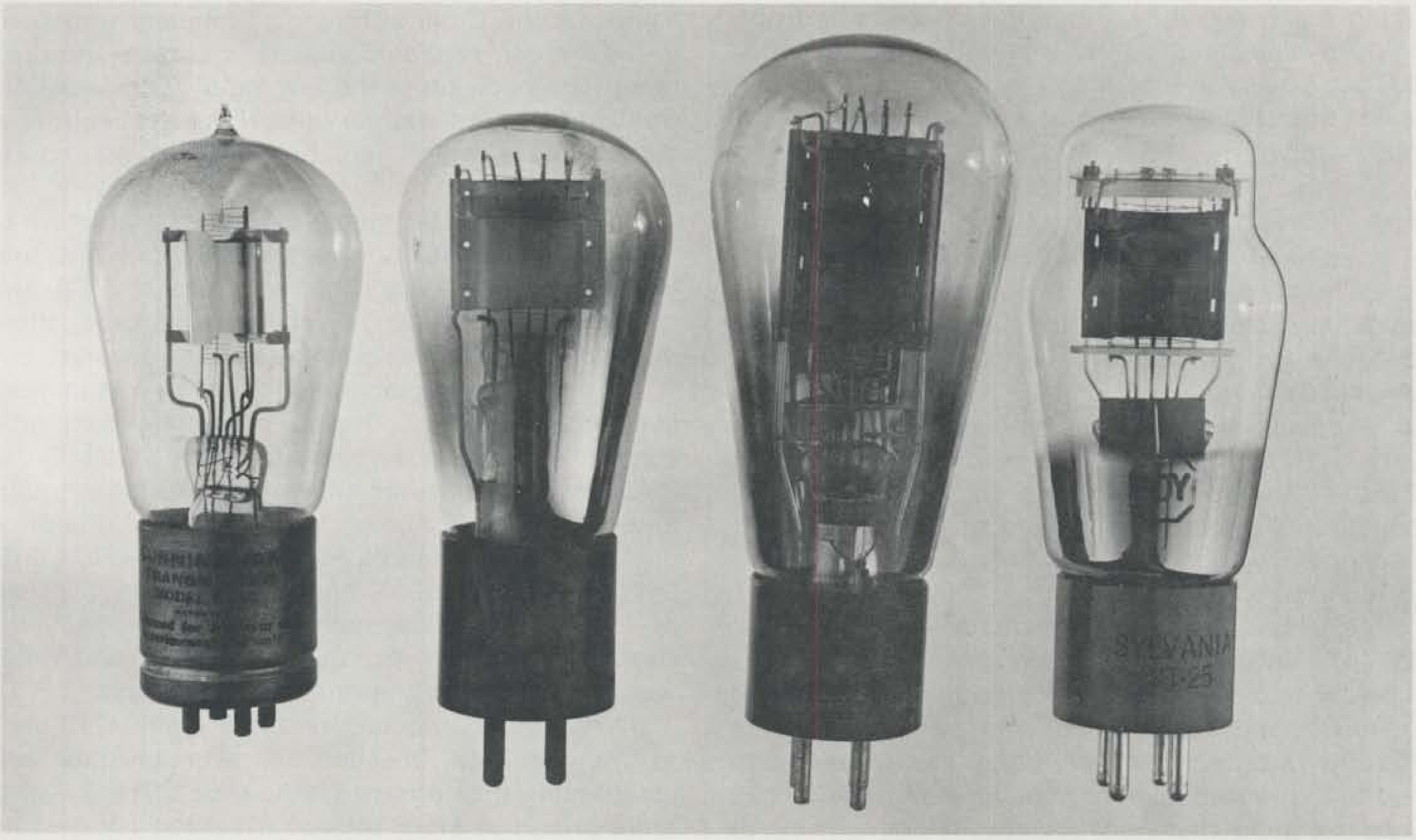

Fig. 2—The birth and growth of the 210 tube. At left is the old UV-202 a valued collector's item today. Plate dissipation was rated at 5 watts. Next, is the UX-210 as manufactured in 1926. The anode, rated at 7.5 watts dissipation was supported from the bottom glass stem of the tube. The filament and grid were supported and strengthened by a glass bar placed across the top of the element structure. Second from right is the "perfect" 210. The extra-large anode structure raised the hope among amateurs that this tube would perform better as an oscillator. Alas! designed only for audio service the big 210 proved to be a poor oscillator and gave the 210 family a bad name among many radio amateurs. At right is the ruggedized 210 used during World War II. Ceramic headers at top and bottom of the elements, plus an indented glass envelope made the tube suitable for use in aircraft transmitters of the 1938-1942 period. A low-loss micanol base took the place of the old "mud" base. An improved version of the 210 (with the military designation VT-25A) was introduced in 1943 but by then the military equipment using this old tube was obsolete. VT-25 and VT-25A tubes are still available today on the surplus market for those nostalgic amateurs interested in building up old-time gear.

power. The bigger UV-203 and UV-204 tubes were very expensive, fragile and hard to obtain. So the UV-202 it was, for a few years at least, until the U.S. Navy demanded a more reliable transmitting tube. This is the story of the replacement for the venerable UV-202; the UX-210, and how it influenced the history of radio transmission and the future of amateur radio.

Broadcasting! The word was on everyone's lips! Stations were coming on the air by the hundreds and the craze had started. Build-it-yourself broadcast receiver kits were snapped up and the modern receivers even had a horn, or loudspeaker, whereby several members of the family could listen to music, news and sports.

By 1924, it became apparent to the *Radio Corporation of America* that a more powerful audio amplifier tube was required to supplant the popular 201A in the new family of receivers to be marketed in 1925. The timing was propitious, as the new X-L (Thoriated tungsten) filament was generally available and the U.S. Navy was anxious to have a replacement transmitting tube having a longer life than the old UV-202. These specifications coincided in the design of a radically new tube, designated as the UX-210.

The 210, as *QST* described it in October, 1925, was "designed to handle an enormous amount of power for receiving purposes" and "should be the berries in the so-called 5-watt transmitting set". Little practical information was given, but it was noted that the new tube had a filament capable of operating from a 6-volt storage battery. When used for transmitting however, it was recommended that filament voltage be raised to 7.5 volts for increased emission.

Undoubtedly the UX-210 was a great improvement over the UV-202. It had a quartz rod across the top of the elements which braced everything together. That should make the Navy happy. And it had copious emission from the thoriated tungsten filament. That should make amateurs happy. And best of all, it could be made on a mass production basis, on the regular equipment used for manufacturing receiving tubes. Since the UX-210 was to be sold for nine dollars (and it is estimated that production costs ran less than fifty cents), *that* should make the stockholders and management of RCA *very* happy!

The "Perfect" Tube

In spite of the exorbitant price, the 210 proved to be a very popular transmitting tube. True, as amateur radio expanded into the higher frequencies, the 210 proved to have some problems. The biggest problem was the "mud" base. At 20 meters, for example, the dielectric losses in the base were very high. Continued operation of the 210 caused the base to overheat and the "mud" bubbled and boiled until the base was grotesquely distorted out of shape. Needless to say, power output and stability suffered.

The 210 received its first major revision about 1927. While it was still produced as a replacement tube for audio equipment, it had been superseded by newer and better tubes, such as the 171A and the 250. In order to make a better replacement 210 —one that would give more audio—a "perfect" 210 was designed that had a larger anode and more filament emission (Figure 2). The new 210 was quite a bit larger physically than the standard one, and ham's eyes bugged out when they saw the new tube. No doubt it would be a real giant when used in the transmitter!

Alas, the "perfect" 210 proved to be a transmitting flop. Worse, it confused everybody as its operation as an oscillator was erratic and most amateurs couldn't tell whether the transmitter was at fault, or the tube. Some 210s worked OK, others had characteristics that seemed to wander off the data sheet. What had happened?

Viewing those days from these days, the story is simple. The "perfect" 210, while bigger and more robust, incorporated an oxide coated filament for improved emission characteristics. This was satisfactory for class A audio operation wherein the grid was never driven positive. But when the tube was used in class C service, where the grid was driven positive, serious grid emission problems developed. These were brought about by a slow and steady migration of oxide from the filament to the grid. After a few hours of use, the "perfect" 210 just would not perform in class C service, grid and plate current "running away" to the eventual destruction of the tube.

May 25, 1931

An action of the Supreme Court of the United States on this date was of tremendous significance to the radio world, to the amateur, and to the 210 tube. A decision, written by Associate Justice Stone held that the famous Langmuir high vacuum patent No. 1,558,436 was invalid. This patent was controlled by the *General Electric Company* who sued the *deForest Radio Company* claiming infringement. The decision of the Supreme Court was final from which there was no appeal, and brought to a close a case which had been before the courts since 1926.

Stated simply, this meant that the manufacture of radio tubes was free of patent limitations and that the strangle-hold that *General Electric, RCA* and *Western Electric* had on vacuum tube production, distribution and sales was broken for all time.

The effect of this landmark decision was immediate and impressive. Dozens of independent tube companies sprung up and by early 1933 *Gross Radio* in New York was advertising 210 tubes (guaranteed) for $1.40. And by fall of that year, the price of the 210 had dropped to 99 cents. The *RCA* 210, still priced at about $7, had literally been "shot out of the saddle". Transmitting tubes by *Sylvania, Raytheon, Duo-vac, Gordos* (Gordos??), and *V.T.E.* were advertised in the amateur magazines.

Sylvania, in particular, tried to bring the 210 back to life. It offered "the first 210 ever designed and manufactured as a transmitting tube". The *Sylvania* tube, priced at $4.75 offered a carbon anode conservatively rated at 15 watts dissipation. Maximum plate potential was raised to 600 volts, and the tube boasted an isolantite base for high frequency operation.

The Tube "Explosion"

RCA, caught off-base by the Supreme Court decision, was determined to get back into the amateur game, regardless of the fierce competition. In April, 1934, *RCA* commenced a series of full-page advertisements in *QST*, aimed directly at the radio amateur. In the first rear-cover ad, the president of *RCA*, E. T. Cunningham, spoke directly to all radio amateurs,

> "It has long been a special wish of mine that the *RCA Radiotron Company* might be better equipped to handle the particular requirements of radio amateurs. That wish has been fulfilled in the *RCA-deForest Amateur Radio Division*, which was recently reorganized to handle both the engineering and sales of amateur types exclusively".

RCA was back in the game again and new tube types designed exclusively for shortwave transmission poured forth during the next few years. Of particular interest to the amateur was the newly announced version of the 210, designed at 801, and specifically aimed to take the market away from the *Sylvania* graphite-anode tube. The 801 boasted a graphite anode, too, and with the tremendous push of *RCA* marketing behind it soon eclipsed the *Sylvania* product. *Sylvania* couldn't stand the intense competition and soon faded from the amateur scene. By 1935, *RCA* had the lion's share of

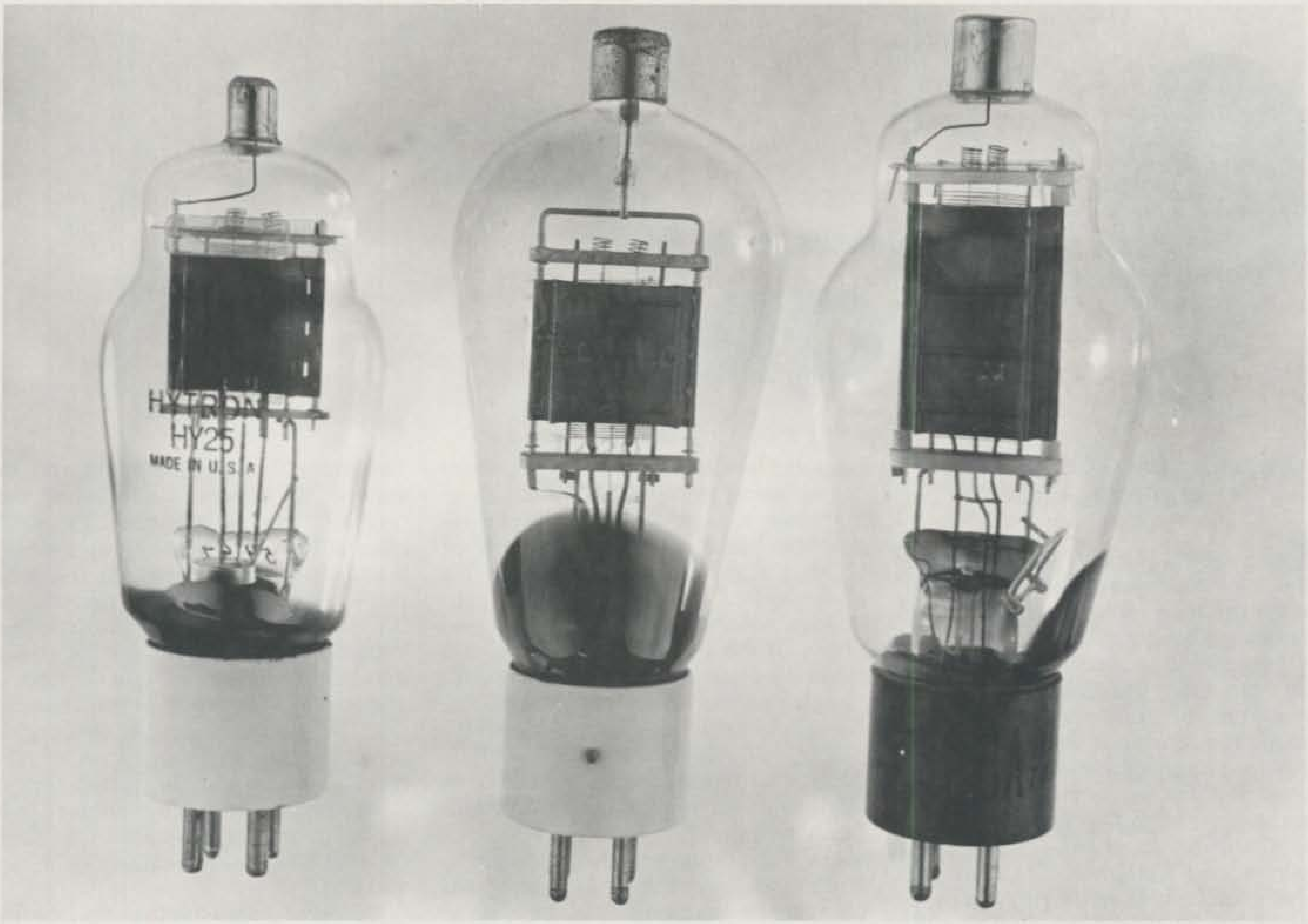

Fig. 3—The final flowering of the famous 210. At left is the Hy-tron HY-25, a 210 with the plate lead out the top of the envelope and an isolantite base. At center is the Taylor T-20, a comparable design to the HY-25. When this tube went into large production, the price was less than two dollars. The HY-25 eventually dropped in price to $1.45. At right is the RCA type 809 which signalled the end of the 210 dynasty. The 809 had an oversize 6.3 volt filament and a husky anode rated at 25 watts dissipation. Early 809s had a ceramic base, but large production tubes had a micanol base. The 809 design was later upgraded into the popular and famous 811A, the final offspring of the old 210.

the amateur transmitting tube market back again and the 801 quietly became the 801A. The carbon anode was replaced by a cheaper metal anode and the "new" tube looked suspiciously like the old *RCA* 210 brought up to date and sold at a slightly higher price.

Wartime

While all this jockeying-around was going on, the military was quietly pressing for an improved 210 for aircraft service. Military specifications were set up and to meet them the 210 was again revised. Tolerances were tightened, the structure was ruggedized and tighter quality controls were introduced. A *micanol* base was substituted for the ceramic base and the military designation of the improved 210 was VT-25. Thousands of these tubes were built between 1938 and 1945 and many of them surfaced in the surplus market immediately after the war. A little-known version of the 210 was the VT-25A, an interesting tube having a 25 watt plate dissipation rating and an oxide coated filament suitable for very high peak emission. The problems inherent with the old "perfect" 210 were avoided by giving the VT-25A a control grid wound with *gold* wire; gold having very low emission characteristics.

The Last Hurrah!

The 210 was very nearly on the way out. In mid-1937 RCA dropped the 801A from its full-page advertisements. On the other hand, a brash, young tube company had completely modernized the 210. The *Taylor* T-20 was the new tube! This was a ceramic-based 210 design, with the plate lead out the top of the envelope (Figure 3). Selling for only $2.45, the T-20 was an inexpensive bottle, rated at 55 watts input up to 5 meters! (What do you think of those numbers, *RCA?*). *Hy-tron* made a competitive tube at the same price and what amateur could resist these fine tubes, selling at such a low, low price?

(Continued on page 84)

ADRIAN WEISS, K8EEG, ON

QRP

Operating The DX Contest With QRPP (Part II)

To continue last month's discussion of DX contesting with QRPp, let's turn to a consideration of the many variables that can be operative in the contest situation and how they can influence the QRPp operator's technique. In the "passive analysis" mode, the operator must be aware of a multitude of factors that determine departures from conventional on-the-air methods of making contacts and he must make oftentimes split-second judgments as to the active response with the highest probability of successfully establishing contact with a DX station. The following discussion is intended to provide a sampling of the factors that are operative and important in the DX contest situation, and examples of how the passive-active modes function in tandem in that situation.

Conventional Responses

In the contest situation, the major objective of most DX stations is to contact as many other stations as possible, and consequently, an impersonal, business-like, competitive approach predominates which leaves no time for cordialities or other unnecessary data. Even when a DX station is merely putting in an hour or two into a contest with no concern for a high score, the fact that numerous stations are feverishly calling him tends to motivate him to answer as many as possible in an economic and efficient manner. The conventional response in a contest situation, then, is brief and to the point, consisting of station call letters and the required exchange report data. A general rule of thumb is to imitate the DX station's exchange format. If he is hurrying along with a 1×1 exchange, *i.e.* "K8EEG 59926 BK," respond in kind, unless some aspect of his report or behavior indicates or suggests a need for a lengthier report because of signal strength or QRM. Do not attempt to match his code speed if it is beyond your ability; otherwise, go ahead at his speed. If the DX sation operates at a leisurely pace with no apparent concern for abbreviation, *i.e.* "K8EEG DE G4XXX 599100 599100 73 ES GL K8EEG DE G4XXX BK," no rush is desired or necessary. In a word, it is adviseable to play it by the DX station's rules.

On s.s.b., repress the impulse to chat and tell him of your great pleasure at meeting him, hoping to see him further down the log etc and etc. He probably doesn't want to hear it, and neither do the rest of us who are waiting in line. Likewise, judge from his transmission whether or not repetition or the use of phonetics is necessary. If he has copied your call correctly, there is no need to continue using phonetics. If he gets your call incorrectly, by all means repeat with phonetics, but do not go into a lengthly repetitious explanation that he copied your call incorrectly. When he hears the proper phonetics, he will automatically make the correction. Likewise, avoid exotic phonetics that are mind-bogglers in themselves, *i.e.*, "WASHINGTON EIGHT TANGANYIKA AFGANHISTAN BHUTAN," or sublimely witty combinations, *i.e.*, "WILLY SIX LOVES OLD NELLY," (save it for the CB'ers!). Use the standard phonetic list—monosyllabic words which emphasize the specific letter which they represent.

Modifying Circumstances

Circumstances, however, can call for a modification of the basic response format for any number of reasons, including the fact that you are QRPp with under five watts. Some factors that should be judged in the passive mode are: (1) a large "wolfpack" may be calling the DX station; (2) several "tailenders" may be QRM'ing exchanges; (3) QRM from adjacent channels may be overlapping the frequency; (4) the wolfpack may be tightly zeroed on the DX station's frequency, rather than "spread out" a bit; (5) the DX station may be quite weak and buried in stateside QRM much of the time; (6) the DX station may be responding only to areas other than your own; (7) the DX station may be giving reports that indicate that all stateside stations are weak or QRM'd at his QTH, or that he is only hearing a few stations.

Some of these factors can be deduced by listening to the stateside stations, others by observing and analyzing the DX station's "behavior." For example, it will be obvious at a glance that a wolfpack is obliterating the frequency. If the DX station replies irregularly in picking up stateside stations, the two facts suggest that the pack is so heavy that it is making copy difficult at his end, or it may indicate very poor propagation to his location for everyone. If he replies instantly, but has obvious difficulty getting call signs correct, this can indicate that signal strengths are good, but QRM heavy. Or again, if you hear many strong signals replying to the DX station's QRZ, and he comes back with another QRZ or several in a row, short skip, or one-way skip may be indicated. On the other hand, if the DX station is strong, and running wolfpack stations with instant responses, brief exchanges, *i.e.*, "BK W7CUF 589100 BK", and stations are being worked from all areas, conditions should be very good.

Objectives of Analysis

Our observation and analysis of factors such as the above have the following objectives. We are attempting to determine: (1) propagation conditions between our area and the

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DX QTH, whether widespread favorable/unfavorable, or whether favorable only to a limited area of the US; (2) the intensity of QRM and competition from responding stations; (3) the frequency distribution of responding stations. Analysis of these conditions enables us to decide whether or not to call the DX station, how, when, and where to call him, and how long to continue calling without success. In any given situation, it may be necessary to try several different answers to the "how, when, and where" questions. Let me explore this subject further in terms of example situations, but first, consider the following system of analysis.

DX Profile Analysis

The following set of categories and characteristics is helpful in the passive analysis procedure mentioned earlier. The categories are ranked inversely according to the degree of difficulty that the ranked characteristics presents to a successful contact, *i.e.,* a "1" rank indicates the most difficult degree.

1.) **Distance Factor** (DX). DX1 — over 7000 miles; DX 2 — 4-7000 miles; DX 3 — under 4000 miles. The effect of direction of the path varies with bands and QTH (transpolar, trans-equatorial etc).

2.) **Demand Rating** (DR). DX stations can be grouped into four ranks relative to the demand that their appearance in a contest occasions. These are as follows. DRI — DX-pedition, a once-in-a-lifetime to work exotic places like San Andres, St. Peter and Paul Rocks, Deception Is., Aland Is. and the like; DR2 — rare country with only a couple active stations, very infrequent appearances; DR3 — fairly uncommon country, infrequent appearances, but could be worked in routine operation, and most hams get it before hitting DXCC; DR4 — many active stations, frequent appearances, easily worked in routine operations.

3.) **Availability** (AV). AV1 — only station from that country to appear during the contest; AV2 — several on from that country; AV3 — many on.

4.) **Station Type.** TYPE 1 — In it for the fun. Slow QSO rate — perhaps a QSO every couple minutes; pauses between exchanges; may be silent for minutes between QSO's; irrelevant data in exchange; seems inexperienced. TYPE 2 — Smooth operator, moderate-to-strong signal; obviously experienced and can control the frequency; quick exchanges but no irrelevant data; no hesitation; relaxed. TYPE 3 — Big gun veteran, crack operator; rapid 3 QSO's per minute or more, 1×1 exchanges; usually strong signal; can copy anything.

5.) **Density Factor** (DF). Based upon observation of stateside responding stations. DF1 — wolfpack obliterates 3 kHz wide segment; DF2 — wolfpack strong, but several individual stations easily distinguished in the general bedlam; DF3 — normal, with half-dozen and more stations responding and spread out over a kHz or so; DF4 — prime, with one or two responding stations and relatively clear frequency.

6.) **Propagation Factor** (PF). The ranking of conditions is primarily in reference to the path between the DX station and the stateside station's area. PF3 — DX station is working many stations from your area; PF2 — he is working mostly stations closer or farther than you, but intermittently calling a few from your area; PF1 — he is showing a definite tendency to another area with few or no responses to your area. In addition to these rankings, see last month's column concerning the "pipeline" phenomenon as a corollary to the above. Since most contesters "program" a single signal report either mechanically or thru habit ("599KW" to all comers, weak or strong), signal strength reports are usually undependable as an index to propagation conditions.

DX Profile System Applied

Bear in mind that the above DX Profile Analysis system is merely this operator's attempt to consciously define the important components that have been functional in his own passive mode. Other operators undoubtedly will share some of these components, while incorporating others gotten from their own experience. Further, the fact that we are discussing QRPp operation rather than QRO in part explains the emphasis and approach. Also, the system functions as an *aid* in determining how, where, when, and if, to call a DX station, and in selecting the proper response to that station and the circumstances that are evident. Lady Luck can overrule the conclusions suggested by the system analysis of the operating situation — I've had several experiences where a look at the situation suggested that even *making* a call was foolhardy, and yet the DX station was contacted in three calls or less. But there is little sense in bucking the odds if you don't succeed right off with Lady Luck! A PF1 ranking is perhaps the only unbeatable factor in the whole list! But let's move on to some hypothetical situations and responses.

Situation A. Profile: DX2 (4-7000 miles), DR3 (Demand Rating), AV2 (Availability), TYPE 2, DF3 (Density Factor), PF3 (Propagation Factor). This station will attract a continuous series of callers, and hence, there will be stiff competition for the QRPp station which may require several 15 minute calling periods. But a PF3 indicates that the chance to make contact is good from a propagation standpoint. Likewise, the distance is such that five watts will still deliver a healthy signal that can be heard among the big guns. The station Type indicates that the QRPp station can count on eventually being heard and worked if his signal is getting through. The DF3 permits a careful selection of the response frequency, either in between other respondents, or off to one side. A check of the frequencies to which the DX station is responding indicates the bandwidth which he is scanning, *i.e.*, whether his transceiver is left stationary, or whether he is using incremental tuning to dig out stations. A Type 2 that answers signals over a wide bandwidth (2kHz) is a good opportunity for the QRPp'er because he is tuning across gaps in the wolfpack frequency distribution. The Profile, then, suggests that Situation A is very good for the QRPp chances of success. Patience and persistence should pay off in a successful contact. What remains is to select a proper response that enhances the probability that contact will be completed with the DX station.

The DX station's QSO-rate and exchange speed will indicate whether the QRPp'er has to limit himself to brief 1×1 or 1×2 calls, or can "string out" his call sign several times. The major objective is to make one's call distinguishable at the DX end, and hence, it is unnecessary to include the DX station's call, *i.e.*, "ZD2X DE K8EEG BK." It is more effective to simply use the time period for nothing but one's own call letters, since the DX station will assume that anyone on frequency is probably calling him rather than another DX station. Break-in capability is a great asset because it allows one to stop a response as soon as the DX station recognises another caller. Likewise, overlapping can be avoided, and the QRPp operator can also tell when no one has been recognised and the DX station is still listening — the pack will finally all end their calls, and then start calling again until the whole bunch is on. That gap which occurs when the pack for the most part has signed "BK" is a good QRPp opening.

If the DX station recognises you, an instantaneous response from him, *i.e.*, your "BK" immediately followed by his "BK", indicates that he is copying you solidly and a 1×1 or 1×2 exchange will suffice. However, if there is any indication of difficulty, *i.e.*, mistake in call sign, a "QRZ K8E? BK", take time to repeat corrections to your call sign and your report several times, clearly and without rushing. Perhaps even a QRS is in order, and certainly in the event that he has to ask for a second repeat of call sign or report. Putting a little extra time into repeats during the first exchange transmission will save time otherwise lost in an extra transmission. Needless to say, once the DX station recognizes you, do not change frequency in the attempt to get out in the clear — he's listening for you where he first heard you. Some crack stations will request a standby ("QRM AS") if QRM is momentarily heavy, and then give the go-ahead to repeat the exchange with a "BK". In this case, be ready and listening.

Situation B. Profile: DX3, DR1, AV1, TYPE 3, DF1, PF1/PF3. The HKØ expedition to San Andres or Galapagoes has been announced far in advance in all magazines. A PF1 condition suggests that there is no sense in joining the bedlam, but try

Lady Luck for several minutes — just in case. PF3 is a go-ahead, but settle in for a couple hours of frustrating calls and the possibility of no QSO after all the calls. With a DF1, frequency selection won't influence the outcome. The decision to call depends on whether you value a contact with this country above all else. If you are aiming at QRPp DXCC and are at the 40 country level, one extremely rare one weighs in the balance against 5-8 new, less exotic countries that could possibly be worked in the time spent calling the HKO. If you are nearing DXCC, ,at least give an hour or so to calling him. It may pay off! My Galapagos QSO on 15 meter SSB came on my third call in DF1 conditions! Have had others like it too.

Situation C. Profile: DX2, DR4, AV3, TYPE 1, DF4, PF2. If you've already worked this country (DL, G, F, LA etc), chances are that going after him would waste time because of the TYPE 1 operator, especially if his responses are erratic. His weak-to-moderate signal may indicate a 100w transmitter and unsophisticated antenna, and perhaps poor receiver, rather than poor propagation. I'd pass him up.

Situation D. Profile: DX1, DR3, AV1, TYPE 2, DF4, PF2 (perhaps VK1). The distance and propagation are the chief concerns here. He will probably be weak because of the distance, which means that your signal will also be weak. However, the DF4 and PF2 suggest a decent chance. If you need this one, or want it, it is worth the effort.

Situation E. Profile-Group: DX1, DR3 (opening to UAØ), AV3, TYPES 2/3, DF3/4, PF3. The case covers numerous stations from a given area during an opening. Conditions are good. Don't sit on one station for more than several minutes, but skip around trying different stations.

Summary

The foregoing situations were selected to include most of the factors and judgments that I've found to be important in working DX Contests with QRPp. Several re-readings and some thought should help the newcomer to this elite sport to familiarize himself with what he is looking for while operating the DX contest. After a while, one learns to recognize familiar Profiles and recall former successes or failures, and response techniques that have succeeded in similar situations.

In scanning the *CQ WW DX Contest* announcement in the August issue, I find no indication that the special QRPp section has become a reality, contrary to my comments in an earlier column when plans were still underway to initiate that section this year. I'm disappointed if my reading is correct. If QRPp logs in sufficient number show up at headquarters, I'm sure the section will have to be included next year, so get into the contest and submit your entries anyway, specifying QRPp in bold letters. But this "ground roots" approach usually is insignificant — if the category is there, the logs will be entered, if it isn't there, the logs won't be entered. At any rate, I hope that our discussion in these past two columns helps you all enjoy DX contesting. In the meantime

73, Ade, K8EEG

In Focus

BY BILL DEWITT, W2DD

Season's Greetings From W2DD!

It's that time of year again. My best wishes for Happy Holidays and a rewarding 1977 to "In Focus" readers. Time to say, "Thanks again!" for the letters and photographs received during the past year. Please keep them coming!

Slow Scanner Of The Month

Bob King's call, WB5IXK, is one of the best known SSTV signatures around the world. From what must be a terrific location in Houston, Texas, Bob seems to work just about everything that comes along. His WAS is SSTV Number 13. He also holds a WAC certificate and has worked 92 countries on SSTV.

Bob's antenna is a two element quad at 55 feet. As you can see in the accompanying photos, Bob is not short on equipment! Gear in the pictures includes a TS-820, TS-520, Henry 2K4, Drake L4B, Robot 300, Robot 400, W0LMD keyboard, and 9 and 17 inch monitors. That object in Bob's hands is one of those famous coconut QSLs sent to Bob by Peter Kuehn, WB6TOC during the latter's recent trip to Hawaii.

Although Bob spent ten years in the U.S. Army doing communications work, it wasn't until fourteen years later that he got into amateur radio with an Advanced Class ticket. That was five years ago. Bob has been active in SSTV for four years. He's 46 years old.

*2112 Turk Hill Road, Fairport, N.Y. 11450

Fig. 1—Bob King, WB5IXK displays the most unusual "QSL" he ever received. It's a coconut, sent to him by Peter Kuehn, WB6TOC, while Peter was in Hawaii!

Fig. 2—As mentioned in the text, Bob is not short on equipment! Through some oversight, Bob has only ONE keyer and ONE telephone. Perhaps this can be corrected by the time we publish another photo of WB5IXK's station!

Bob is well-known for the outstanding job of Public Relations he has done for amateur radio in general and SSTV in particular. Oh yes, I might add a P.S.—Don't be surprized if this tall Texan turns out to be the winner of the Albatross SSTV Contest.

What's New Department— Sales Of Robot's Model 400 Going Strong

According to Dave Smith, WB6ZFT, Sales Manager of Robot Research Inc., sales of the new Model 400 are going great guns. The number of 400 owners checking in on various SSTV nets confirms Dave's understandable enthusiasm. Ease of operation seems to be a prime factor in the acceptance of the 400.

I received my Robot 400 (S.N. 55) last September. It works just fine. It is a neat, compact package. As a matter of fact I was a little "shook" when I took it out of the shipping carton—it was So Small! It's only a little bigger than one of those keyers with a memory feature and weighs in at a mere 15 pounds.

The 400 produces a very satisfactory display on a conventional TV monitor. It's an easy-to-operate, well designed, reasonably priced piece of gear. There'll be photographs of the 400 itself and off-the-screen pix too in an early issue.

I had hoped to have some comparisons of scan converted displays from BOTH the 300 and 400 units in this issue but the strike of a delivery service has deprived me of the use of the Model 300 until nobody knows when! A most frustrating experience, to say the least.

A Comment On SSTV Images Viewed Via Scan Conversion

There is a predictable difference between digitally scan converted images and analog scan converted images (Storage Tube versus the 65K Memory digital methods without image processing). In my opinion, the discrete dot pattern of a digital system (65K) is easily discernible by the eye at viewing distances that are

Fig. 3 — Jordan Makower, WA2BRV, checks the performance of the Robot 400 scan converter at his home station prior to its installation at the Pearl River H.S. ARC station, WB2YCR. That pretty girl picture on the screen originated at WA4LZZ's station.

acceptable (same size image) for analog converted images. If the dot pattern is distracting, the viewing distance should be increased until the pattern is no longer resolvable. However, I would advise anyone contemplating the purchase of ANY scan converter to stick with the smaller screens, say, nine inches or less, for desk top viewing. After all, the line pattern of US/525 line broadcast TV can be distracting too if you're sitting too close to a 17 inch set.

Through The Looking Glass With SSTV

Slow scan television is many things to many people. To some, it is a "window to the world". It provides them with a means of seeing their amateur counterparts and equipment arrays around the world. To others, it is an escape from the older forms of communication, or a new toy to play with. Cop MacDonald, the inventor of SSTV, sees it as a medium for the exchange of ideas. As mentioned here last month, he is interested in exploring and developing the human side of SSTV.

Two school teachers in separate small towns in New York state see SSTV as an educational tool with great potential. I hope that you'll agree that their ideas and how they've put them into practice makes an interesting story.

A Tale Of Two Teachers And SSTV—Background

Last Summer I received letters from two high school science teachers who are trustees for school club stations.

Jordan Makower, WA2BRV, is trustee for WA2ABJ the Pearl River High School ARC station at Pearl River, N.Y. John Kienzle, WA2UON, is trustee for WB2YCR, the Maple Hill High School ARC station at Castleton, N.Y. Both of these teacher-amateurs are convinced that SSTV has great educational value. However, the means chosen by the two men to establish slow scan capabilities in their respective club stations just happen to be vastly different!

Fig. 4—WB2WBO, Barry Kantrowitz, and fellow club member, WA2KYW, Paul Mowat, are seen here checking out the reception from YV5FBL with WA2BRV "MC-ing" the proceedings, using Jordan's station.

A Tale Of Two Teachers— The Educational Grant Approach To SSTV

Let's take a look at what Jordan, WA2BRV, did.

It was Jordan's feeling that there are a number of ways in which SSTV can be shown to have significant educational value. He decided to convince the New York State Department of Education that an SSTV system would indeed be a worthwhile educational tool. He applied to the Dept. of Education for a "Mini-Grant" of $810 to purchase SSTV equipment for the club station.

The text of Jordan's justification for the grant is a bit too long to include in this article, but in summary, it presents SSTV as: A means of making what is learned in several disciplines more relevant to each other; A way to communicate with people of different cultures; A source of experience with natural phenomena such as skip effects, sun spots, etc. All this was tied in with a license training program.

Fig. 6—When VK3LM goes "on holidays", the gear goes with him! This collection of HF, VHF, and SSTV equipment went along when John and his family visited an Aussie ranch last Fall, or was it last Spring? (It was HIS Fall, MY Spring, I think, W2DD.)

Grantsmanship Can Be Rewarding!

Jordan's request for funds was granted early this summer. As you can see in the accompanying photo, the Pearl River High School ARC elected to purchase a Robot Model 400 scan converter as the keystone of their slow scan set-up. (See accompanying photos.) That "chewed up" a good share of the grant! However, careful scrounging and surplus searching made it possible to acquire a monitor, tape recorder, and an Hitachi CCTV camera to round out the SSTV gear.

Fig. 5—John Kienzle, WA2UON, and student Tim Sanger are shown here demonstrating the flying spot scanner and converted "scope" monitor built by the hams of Maple Hills H.S. ARC a few months ago. WB2YCR is the club's station call sign.

One should not look at this project from just the standpoint of the hardware acquired by means of a grant. The objectives are excellent, and it is a certainty that much will be learned by the students under Jordan's guidance.

Jordan Makower should be congratulated for thinking-through and organizing a well coordinated approach to a combination of academic and "hands-on" learning. How often do we find someone capable of putting it all together? Well done, WA2BRV!

A Tale Of Two Teachers And SSTV—The Club Project Approach

Now let's take a look at a very different approach to "going slow scan" as organized by John, WA2UON, and his club members.

The student members of the Maple Hill High School ARC are part of a group called "Media Men". (Maybe that name should become "Media Persons".) Participants are 14-18 year old boys and girls who have been trained by John to run all of the school's PA systems, lighting

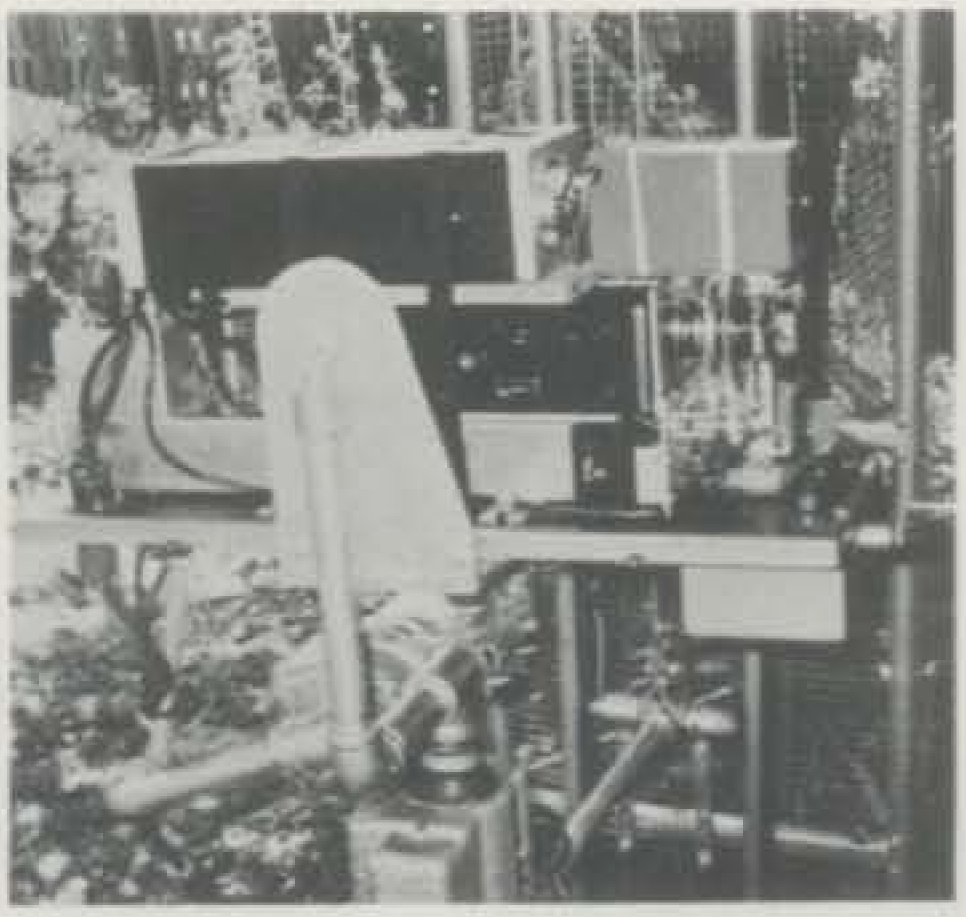

Fig. 7—Warren Weldon, W5DFU, had his "lofty-lookie camera" down for a check-up when this photo was made. See Text for details.

systems, as well as video tape and CCTV units. Their technical experiences and interests extend beyond the limits of amateur radio alone. They are familiar with the needs and practices of the press, radio, and television media. In addition, they are VERY project-minded.

Nearly 50 percent of the club members are licensed amateurs. All members are encouraged to study for FCC examinations. OK, but what about the club's SSTV activities?

The Maple Hill High School amateurs started out with a home-brewed flying spot scanner and a converted scope monitor as seen in the accompanying photo. Then came the decision to upgrade their gear as mentioned in these excerpts from letters to yours truly:

"During the summer, we meet to work on radio projects, experiment, take trips, and plan. Recently we got a home-brew flying spot scanner working and enjoyed an SSTV QSO with Lee, W0DO. But the equipment is very primitive and we'd like to improve our SSTV station."

"We do build some gear and raise money by selling hot dogs, putting on dances, etc."

In a later letter, John and his Maple Hill amateurs stated that they had decided to buy a scan converter, but lacked the money. Yes, you guessed it, another bunch of projects are in the wind! They said:

"To raise the money, we are putting on a Rock and Roll Revival show in September. This will Kick-off the new school year with a bang and beats any competing school group to the punch with fund raising! Who says amateurs don't hustle? In October, a Halloween night with Frankenstein and Wolfman movies, Basketball tournaments (we sell hot dogs, soda, etc.). For next Winter and Spring, a record hop. It will take a while, BUT WE'LL GET THERE!"

Projects Can Be Work— But They're Rewarding!

For the Maple Hill High School ARC, one project leads to another. You can be sure that they'll stick with this one until they get that new gear in operation. After that? Well, I'll bet they will be off and away, building a "keyboard", a video mixer, or what have you? John and his club members seem to have a strong emphasis on action as a group. The group makes the decisions, and the group does the work. John has obviously inspired a great *esprit de corps* in the club. He has extended his teaching task well beyond its boundaries into the realm of everyday practicality by making sure that club members know how to build and repair the equipment they use.

Summing It Up— Grants And Projects

I hope that I have not created the impression that the Pearl River High School youngsters don't have any projects, they do, and they have worked hard to secure their equipment (other than SSTV). The club members in BOTH schools have shown great initiative and willingness to WORK to get a job done. My personal congratulations to both club groups WA2BRV, and WA2UON, for what they have accomplished. For their willingness to share it with readers of "In Focus", many, many thanks!

From Far Away Places With Strange Sounding Names— Australia, Oklahoma

From "down under", John Wilson, VK3LM, of Melbourne, Australia checks in with a picture of his gear all set up for "portable" operation. John and his family vacationed at the ranch home of a friend recently. Judging by the grand collection of h.f., v.h.f., and SSTV equipment showing in the accompanying photo, they must have left all of their luggage at home! First things first!

In Tulsa, Oklahoma, Warren Weldon, W5DFU, is still transmitting fast scan video of local thunderstorms to the U.S. Weather Service office on 430 MHz. Be sure to take a good look at the photo submitted by W5DFU. It shows his "lofty-lookie camera" at ground level for servicing. A pair of tracks running up the side of Warren's tower make it possible for him to raise and lower the whole assembly with a motor drive. Needless to say, there is a neat enclosure over "the works" when it's in use

Final-Final

The enormous lead time necessary for any magazine publication makes it difficult to be "current" in a column like this. However, what is perhaps more important is the general content of "In Focus".

If you have ideas about what you would like to see in this column, be sure to drop me a line stating your views. I will do my best to bring slow scanners everywhere the items that they find of greatest interest.

In a little over a year's time, "In Focus" has brought you over a hundred pictures of slow scanners and SSTV related equipment. This has been possible through the generous response of readers to my repeated pleas for letters and photos. Above all else, readers indicate that they are interested in seeing pictures of other slow scanners and their stations. So, if YOU have some pictures of yourself, your home, your station, and your pet projects, BE SURE to send them in!

Thanks again for the warm response to "In Focus". Same old address for your letters, 2112 Turk Hill Road, Fairport, N.Y. 14450.

73, Bill DeWitt, W2DD

Novice

BY HERBERT S. BRIER*, W9AD

Power Input And Output: Amplifier Efficiency

The FCC rule permitting any U.S. amateur to run a maximum d.c. transmitter power input of 250 watts in the Novice bands is easy to understand. This input is calculated by multiplying the applied d.c. plate voltage by the plate current in amperes drawn by the amplifier tubes feeding the antenna. Thus: $\text{Power}_{\text{watts}} = E_{\text{volts}} \times I_{\text{amperes}}$. In transistor amplifiers, substitute the word "collector" for the word "plate." If the key-down plate voltage is 650 volts and the plate milliameter reads 400 milliameters (0.4 amperes), the indicated d.c. power input is 260 watts. We say "indicated" input because the plate milliameters of most modern amateur transmitters and transceivers actually are in the amplifier cathode circuit as a safety measure. Putting the meter in the cathode lead gets the high voltage off the meter and meter switch terminals. But, as a result, the meter reads screen current and control-grid current in addition to the plate current of the amplifier tubes.

Some manufacturers simply discount the screen and control-grid currents when rating the power input of their transmitters and transceivers, which may be why their figures and your calculations may not always agree. Other manufacturers simply ignore the problem or label the meter switch position "cathode," and let the user figure out the plate current for himself. The direct way to check for this ambiguity is to temporarily connect a milliameter in the B+ lead between the amplifier power supply and the amplifier. If the internal meter is only reading plate current, the two meters should read the same. In making this test, be careful not to get tangled up with the high voltage. Also, do not operate the amplifier without plate voltage but with screen voltage, or you will probably damage the amplifier tubes.

*409 So. 14th St., Chesterton, Ind. 46304.

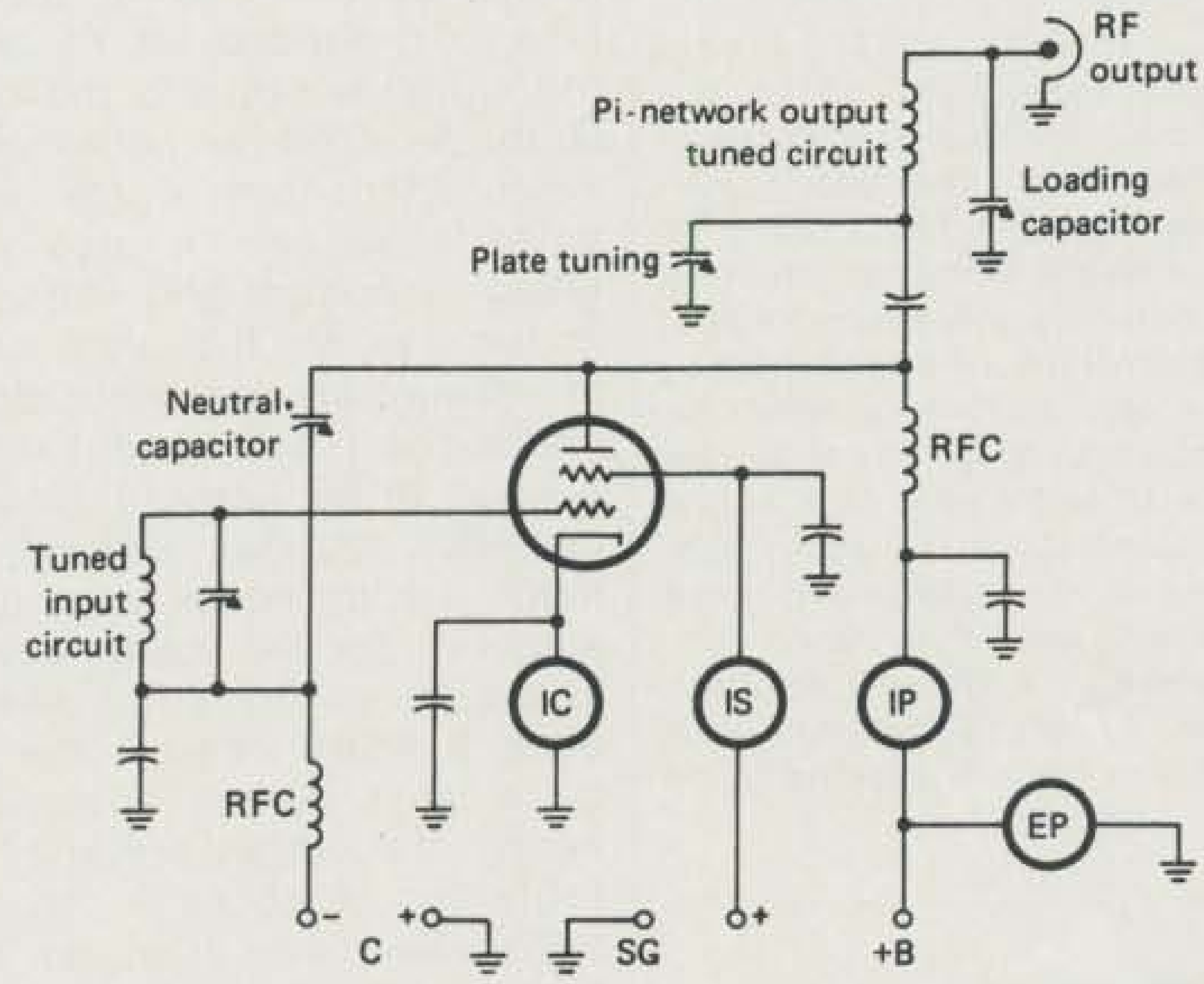

Fig. 1—The basic diagram of a tetrode, radio-frequency amplifier. Whether it operates as a Class A, Class-AB, Class-B, or Class-C amplifier depends largely on its fixed, negative grid-bias voltage and the amplitude of its input signal.

Although the d.c. power input of c.w. transmitter is quite easy to measure accurately, measuring its radio-frequency output with equal accuracy is quite difficult with the instruments available to the average amateur. Fortunately, a reasonably accurate estimate of the output power can be made when the input power is known, because the efficiency of r.f. power amplifiers is well known.

Class-A Amplifiers. By adjusting the grid bias and signal input of an amplifier tube so that its plate current does not change with signal, a class-A amplifier is formed. As usually operated, a class-A amplifier does not extract any power from its exciting source, and it amplifies with low distortion. Its overall power efficiency is low, however—usually less than 25 per cent; so it is seldom used when more than a few watts of output power are required.

Class-B and Class-AB Amplifiers. A class-B amplifier is adjusted or designed so that its no-signal plate current is low. But the plate current increases linearly with an increase of grid voltage. When a radio-frequency or other a.c. signal is applied to the grid, its positive half cycles cause corresponding pulse of current to flow in the plate circuit and to couple energy in the output tank circuit. But the negative half cycles of the input signal reduces the already-low plate current to zero. However, the "flywheel" effect of the tank circuit stores excess energy during the positive plate current pulses and releases it gradually during the entire excitation cycle. Consequently, the antenna does not know that the signal was torn in half and reassembled in passing through the amplifier.

Class-B amplifiers. By reducing the negative fixed bias voltage of a class-B amplifier somewhat, the amplifier acts like a class-A amplifier on weak signals and like a class-B amplifier on strong signals. The

Dave Hanson, WNØSHI, 3921 Effrem Road, White Bear Lake, Minn. 55110, operating his Heathkit HW-16 c.w. transceiver and Heathkit electronic keyer. Many Novices and former Novices felt a pang of regret when the Heath Company dropped the HW-16 from its line a few months ago. We are sending WNØSHI a 1-year subscription to CQ for this picture of what the HW-16 did best—making an eager Novice happy. If you wish to try your luck in our Monthly Photo Contest, send a sharp photograph of you and your station and some details of your radio career to: Photo Contest, CQ Magazine, c/o Herbert S. Brier, W9AD, 409 So. 14 St., Chesterton, Ind. 46304. Non-winners are published as space permits.

class-AB amplifier is easier to drive and—with modern tubes—is almost as efficient as a class-B amplifier. It is the universal choice as the output amplifier in modern, self-contained c.w./s.s.b. transmitters and transceivers.

Practical class-AB r.f. amplifiers have an overall power efficiency of approximately 60 per cent. Therefore a 250-watt transceiver or transmitter can be expected to have an r.f. power output of approximately 150 watts—possibly a few watts more on the 3.5-MHz band, and a few less on the 28-MHz band.

Grounded-Grid, Class-B Amplifiers. If the control grid of an amplifier tube is grounded for r.f. and its input signal is fed into the cathode, a Grounded-Grid amplifier is formed. When the input signal varies the cathode voltage, it also varies the effective control-grid voltage, which, in turn, varies the plate current. At the same time, the input signal modulates the plate current directly. As a result of the latter, a grounded-grid amplifier requires several times as much driving power as a grid-driven amplifier for the same power input. The extra power is not wasted, however; it flows through the tube and is radiated by the antenna. Coincidently, the output power of a typical table-top s.s.b./c.w. transmitter/transceiver will drive an accessory 1,000-watt, grounded-grid, triode class-B amplifier to full power. The overall efficiency of the driver-amplifier combination is approximately 60 per cent.

The often-ignored FCC regulation 97.197 requires that the d.c. input power of a grounded-grid amplifier exciting the antenna must be added to the final amplifier input power to comply with the FCC rules governing maximum permissible power input.

Class-C Amplifiers. By operating an amplifier tube with a fixed negative voltage two or more times as high as necessary to reduce its plate current to zero and increasing the amplitude of the input signal until plate current flows, a class-C amplifier is formed. Although its plate current flows in spurts during the positive peaks of the exciting signal, the flywheel effect of the output tank circuit results in a continuous sine wave of power being delivered to the load. Class-C amplifiers can be used to amplify c.w. signals with an overall efficiency of over 70 per cent. But, because their output waveforms are not linear reproductions of their input signals, class-C amplifiers cannot be used to amplify s.s.b. or other amplitude-modulated signals without extreme distortion.

No More Novice Call Signs!

In mid-August, the FCC announced that, effective October 1, 1976, all new Novices will be issued permanent call signs with prefixes beginning with WA, WB, WD, etc., instead of temporary call signs beginning with "WN," etc., that are changed as the licensee upgrades his license class. Also, the FCC will mail notices as quickly as possible to Novices whose licenses expire after October 1 what their new call letters are. Continue to use your present Novice call sign until you receive the official notice telling you what your new call is: then start using it. Some Novices take a very dim view of the elimination of Novice calls. The FCC's explanation for their elimination that the FCC computer has trouble translating some Novice call signs to unassigned higher-class call signs when the Novices upgrade their license class. This difficulty has resulted in problems of the same call sign being assigned to more than one licensee.

Technical Note

One sought-after piece of used equipment is the Johnson "Matchbox," a 3.5-30 MHz antenna coupler designed to match single- and two-wire antennas and transmission lines to the 50-ohm output impedance of amateur transmitters and transceivers, but it balks at matching some antenna and feeder lengths, especially on the 3.5-MHz band. In the July, 1976, Central Oklahoma Radio Amateurs *Collector And Emitter*, W7KFV/W6MUG recommends connecting a two- or 3-gang broadcast-band variable capacitor (750-1100-pf total) with its stator terminals strapped together in series between the center terminal of the Match-strapped together in series between the center terminal of the Matchbox input coaxial connector and the coupling coil. Mount the new capacitor on a piece of insulation, and connect its shaft to the adjusting knob through an insulated coupling. Adjust the Matchbox original controls and the new capacitor to achieve minimum s.w.r. in the 50-ohm coaxial line coupling the transmitter to the Matchbox. W7KFV says that after the change, the Matchbox works as well as his home-built antenna coupler!

Will Roberts, WN4PSL, P.O. Box 907, Roseboro, N.C. 28382, was a Novice for only three weeks before

(Continued on page 90)

Math's Notes

BY IRWIN MATH, WA2NDM

Experimenters that do much audio, low frequency a.c., video, or other analog circuit work are well aware of the use and problems associated with mechanical switches. Contact bounce, poor or noisy contacts and hard-to-get contact configurations are but a few of the problems one has to put up with.

There is another technique to switch analog signals however and that is to use semiconductor devices as the actual switching elements. This technique is becoming more and more prevalent today, so much so in fact that a new group of devices called "analog switches" is now available — and in integrated circuit form. To acquaint the experimenter with this technique we have presented a brief discussion of analog switching as the first of this months topics.

In fig. 1, we have one of the simplest configurations of an analog switch. When the base of the transistor is at ground level, it is cut off and the input signal has only the resistance of Rd in series with it. If Rd is 10K and the output drives a FET or other high impedance load, the signal passes virtually unattenuated. When the base of the trans:stor is positive however, the transistor conducts effectively short circuiting the signal at its collector. The purpose of R1 and R2 is to introduce an average positive d.c. level to the analog signal to allow the transistor to operate properly. The output coupling capacitor effectively removes the d.c. level after switching. One requirement here is that the peak excursions of the input signal do not exceed the bias voltage. If the bias point is 5 volts for example, the maximum signal that can be properly switched will be approximately 10 volts peak-to-peak. Also, when the signal is blocked, the collector is not exactly at zero but at some higher point. Therefore, there is some feed through with this circuit.

*5 Melville Lane, Great Neck, NY 11020.

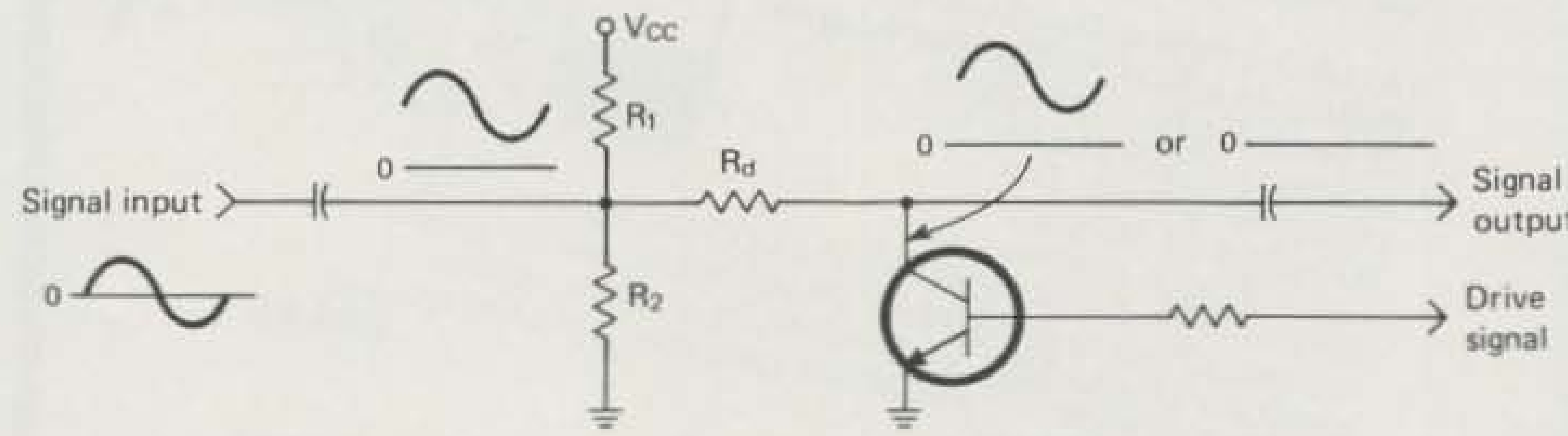

Fig. 1—A simple transistor switch that is discussed in the text.

Fig. 2 shows the use of a diode as an analog switch. This circuit acts in a similar manner to that of fig. 1. When the diode is forward biased (+ on the control line) it conducts blocking the signal. When the diode is reverse biased, it is cut off and the signal passes. As in the first case, care must be taken to not attempt to switch levels that are much above the control voltage levels or the diode will not work properly. Again, there is a small residual voltage across the diode when it conducts, so isolation is not perfect. The circuit of fig. 2 can be used up into the u.h.f. region however, with appropriate high frequency diodes.

In fig. 3 we have employed a junction FET as a switch. When the gate of the FET is negative, it is cut off and, unlike the first two circuits, no appreciable signal passes. With the gate grounded however, the 100K resistor forward biases the FET and it conducts. Because of the high impedancy of this circuit, the gate-to-source capacitance unfortunately limits operation to a few kHz.

Most of the shortcomings of these methods is solved by the new so-called "analog switch". These devices employ bipolar and/or FET elements to achieve a switch that comes very close to its mechanical counterpart. One example of this is the National Semiconductor LF16500 quad analog switch shown in fig. 4. Note how the schematic as given by National is virtually a relay type hookup.

Hookup is the same as you would hook up an equivalent relay except that a ± 15 volt supply (V_{cc} and V_{ee}) is necessary. Also present is a "disable" input which will turn all switches in the package off regardless of their individual input signals. The control voltage is fully TTL compatible and will operate the switch from as little as + 2 volts up to the V_{cc} supply—2.5 volts.

On resistance of the switch is 150 ohms typically while the isolations of the switch in the OFF position is about −50 db at 1 MHz and −90 db at 10 kHz. Crosstalk between switches is

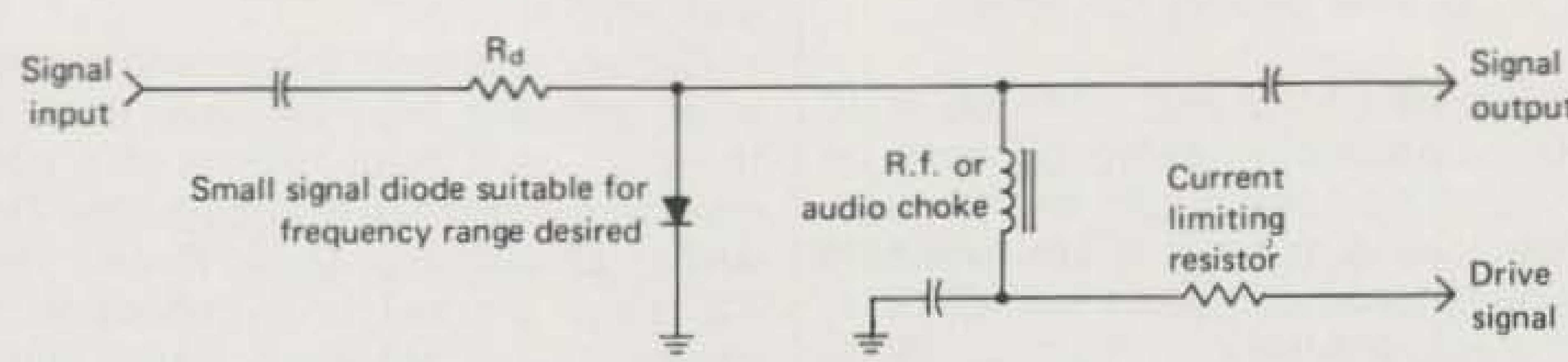

Fig. 2—A diode switch for analog or r.f. signals. The choke should be selected for the frequency range to be used with the circuit.

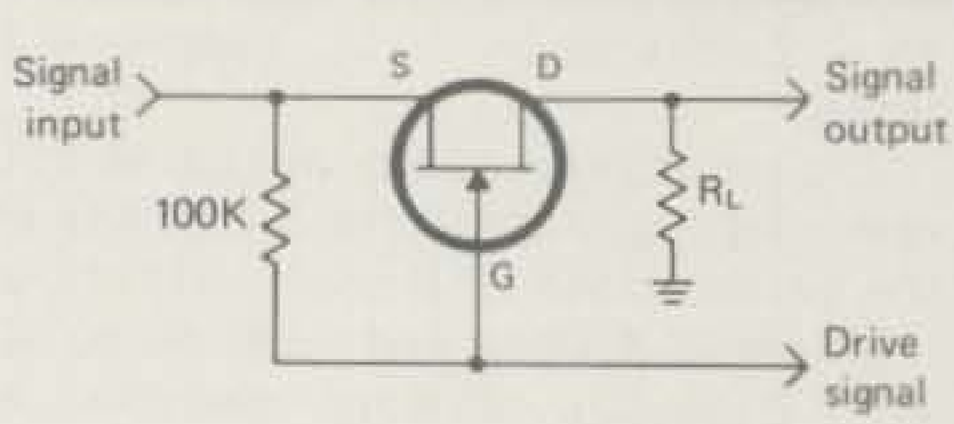

Fig. 3—A junction FET switch.

−65 db at 1 MHz and −110 db at 10 kHz. In addition, analog currents up to 20 milliamperes can be handled.

Devices such as this are available from National and other semiconductor manufacturers in configurations ranging from the simple s.p.s.t. switch to d.p.d.t. varieties and multiple switch elements in one package for use as multiplexers, choppers and commutators. If you have an interest in this type of device, write to National Semiconductor, 2900 Semiconductor Dr., Santa Clara, California 95051 and ask for analog switch data sheets as well as application notes AN-33, AN-38 and AN-53.

Our second topic this month, somewhat different than we have done in the past, is a brief review of a new well-advertised ARRL publication, *The ARRL Electronics Data Book.* This 125 page manual is a collection of charts, tables standard Radio Amateur's Handbook type circuits and design notes and manufacturers data

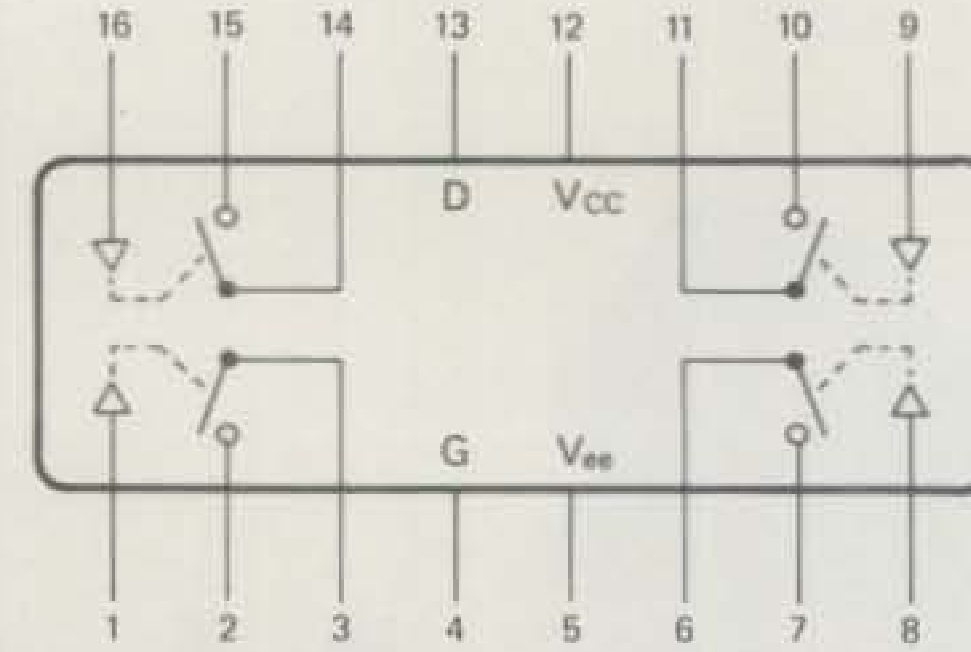

Fig. 4—Schematic of the National LF1650 analog switch.

sheets all slated toward the radio amateur. There is something in this book for just about every amateur and no doubt the answer to many homebrewer's problems will be found here.

Included also are mathematical formula, LC and R network calculations, coilwinding data, antenna calculations, filter design, transformer data and a host of communications oriented circuits.

Other than the fact that the data seems to be literally "packed in" this publication, at $4.00, is a handy book to have around if you do any significant amount of "homebrewing". Copies can be obtained from the ARRL at Newington, Connecticut 06111.

See you next month, Irwin, WA2NDM.

Read how WB6JKW modified his LMD keyboard so he can program a single line he wants to correct or to update the next line.

WØLMD SSTV KEYBOARD MODIFICATION

BY ROLPH VAN JINDELT*, WB6JKW

This article describes a modification to the SSTV Keyboard, originally designed by WØLMD. Refer to: *CQ* Magazine September 1974 "An SSTV Keyboard" by Dr. Robert Suding, WØLMD.

Quite a few amateurs have constructed the WØLMD keyboard. The distinct sound of keyboard generated characters became very familiar on the air. As the precise characters are displayed on the screen, so are the mistakes in key punching. How often does it happen you find a mistake in key punching, after you have completed one or several lines, or, maybe you have filled the total screen with 30 characters? So you either have to erase the total information and start from the beginning, or, if you had punched the total format of 30 characters, start from the top and update the information til you get past the wrong character(s). This is very time consuming and frustrating.

With this design modification to the WRITE CLOCK of the SSTV keyboard, you have the capability of programming a single line, you want to correct or update next. Instead of making both, character and line counter, programmable, I have the character counter fixed to BCD "5" (when the program is loaded into memory). That orients the next character, you punch, to the beginning of a line. This line counter is completely programmable though. Thus, you can select any line from 1-5, to be edited or undapted next and DO NOT have to erase and re-punch the total information.

Circuit Description

IC-numbers: IC-16, IC-18, IC-19, and IC-20 refer to the above mentioned article. IC-45, 46, and 47 are added.

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In the original WRITE CLOCK design by WØLMD, IC-19, a ¾ 7493 (divide by 6) accomplishes the WRITE HORIZONTAL CHARACTER ADDRESS, and IC-20, a ¾ 7493 (divide by 5) the VERTICAL CHARACTER ADDRESS. These 2 IC's are replaced by 74193's.

Horizontal Counter

Since the output of the 74122—IC-16—(30μs clock), pin 6, sends a negative going pulse and the 74193 counts on a positive going pulse, an input inverter IC-46—(¼ 7400) is needed, which connects to pin 5 of the 74193 (divided by 6)—IC-19. Pin 4 is connected to +5V. The program lines of the horizontal counter, pins 15, 1, and 10, are preset to BCD "5" (BCD "5" = 1+4). Thus, pins 15 and 10 got to +5V for a "1" and pin 1 goes to ground for a "Ø" programming. Since the 74193 can count up to 16, special gating has to be incorporated to reset the counter AFTER BCD "5". The first gate—IC-47—(¼ 7400), connected to pin 2 and 6 of the horizontal counter, detects BCD "6", when lines 2 and 4 are high, and outputs a "0". The second gate—IC-47—(¼ 7400) inverts this signal and resets the counter. Pin 14 has to be "high" for reset operation. The 3 input lines of the 7430—IC-18—go to pins 3 and 6 of IC-19 and pin 6 of IC-20. The output line of the 7430 remains the same as per original design.

Vertical Counter

Again, an inverter—IC-46—(¼ 7400) is needed to change to a positive going input pulse to the verti-

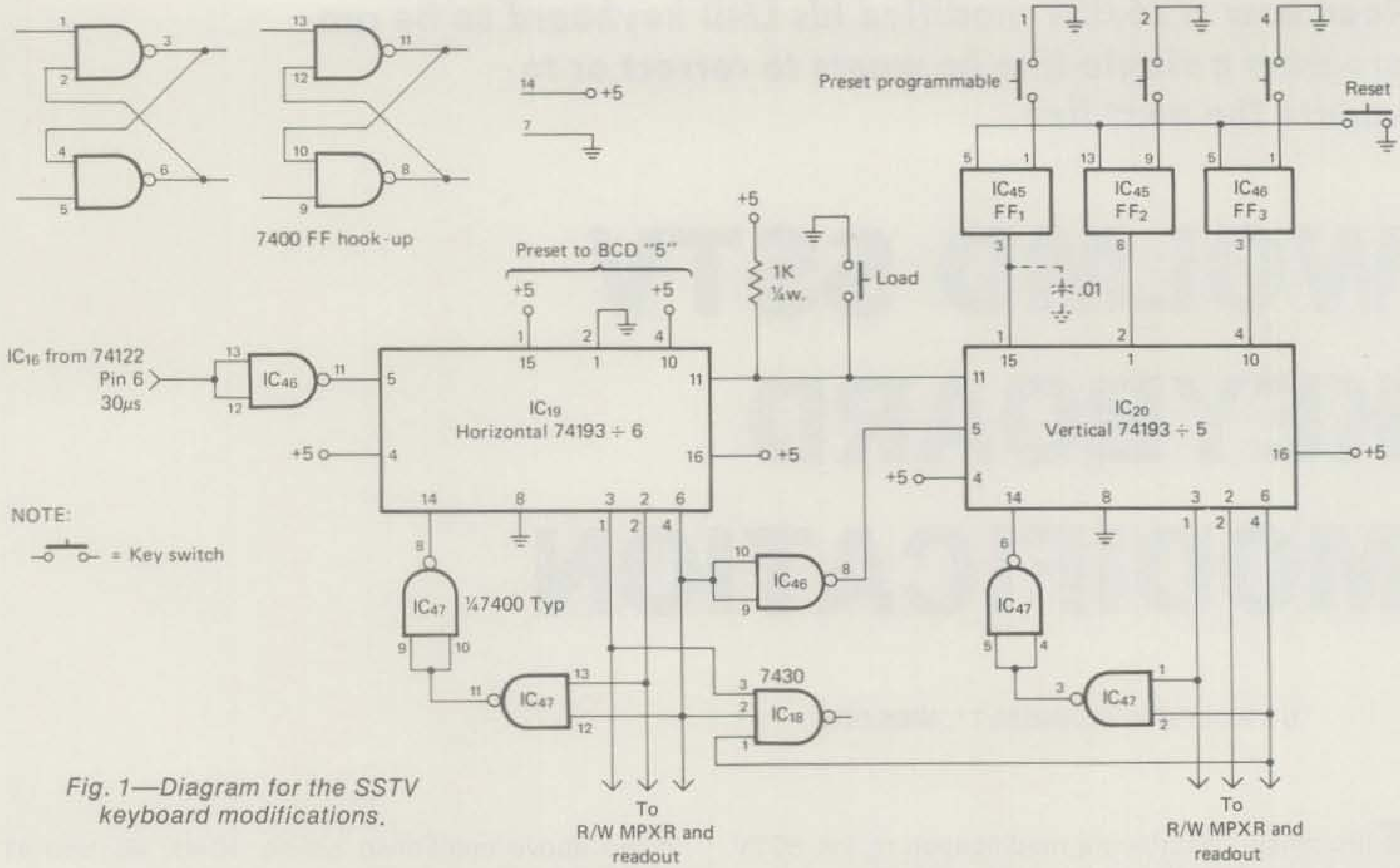


Fig. 1—Diagram for the SSTV keyboard modifications.

cal counter—IC-20—. This 74193 has to be reset AFTER BCD "4". The first gate—IC-47—(¼ 7400), connected to pin 3 and 6 of the 74193 (divide by 5) —IC-20—, detects BCD "5" and outputs of "Ø". The second gate—IC-47—(¼ 7400) inverts this signal and resets the counter. The 3 program lines, pins 15, 1, and 10, are connected to the output of 3 FLIP-FLOPS. See Sub-Schematic of FLIP-FLOP connections. One FF input line each goes to the common RESET KEY SWITCH, pins 5, 13, and 5. The other FF input lines, pins 1, 9, and 1 each go to a separate PROGRAM KEY SWITCH. FF-1—IC-45—represents BCD "1", FF-2—IC-45—represents BCD "2", and FF-3—IC-46—represents BCD "4". The load lines of both counters, pins 11, are connected together through a 1 K pull-up resistor to +5V and to a common LOAD KEY SWITCH. The BCD 1-2-4 output lines of both counters go to the READ/WRITE MULTIPLEXER, IC-12 and IC-13, and optional DIGITAL READ-OUT, as per original design.

The .01 µf capacitor from pin 15 to ground eliminates loading spikes on line 1 of IC-20.

Programming

SEQUENCE

1) Punch RESET KEY to clear the 3 memories.

2) Punch and hold down LOAD KEY, and punch PROGRAM KEY for a specific line. Keep in mind, when programming for a specific line, to be updated, the line counter has to be set to the previous line. The character counter automatically is set to the last character of the programmed line. Then, the next character punched in, will appear as the first character of the following line. Thus, if you want to update the information of line 2, you program the line counter for line 1. Since output "0" of the counters is used as address "I", the programming is as follows:

To Update Line	Program Line	Program BCD
1	5	4
2	1	Ø
3	2	1
4	3	2
5	4	3

EXAMPLE 1

The full format of 30 characters is punched in and displayed on the SSTV Monitor. Now you discover a mistake on line 4. You then punch the RESET KEY, punch and hold down the LOAD KEY and punch the PROGRAM KEY, BCD "2", and update the information for line 4 only, thus correcting the mistake(s).

EXAMPLE 2

Let us say you have the following information punched in and displayed on the SSTV Monitor:

HELLO
CALL SIGN
DE
CALL SIGN
NAME

(Continued on page 84)

Everybody knows that when your transmitter is talking 50 ohms and your antenna only wants to listen to 30 ohms, nothing much gets through.

Least of all you.

But now you can get your antenna and your transmitter speaking the same language and keep it that way with the flip of a switch with our new Model MMBX impedance matcher.

Just mount the MMBX with four No. 6 screws near the antenna, connect the coax and you're ready to match transmitter impedance to antenna impedance at ratios from 1:1 to 1:.06 in seven switch-selected increments of 50, 38, 28, 19, 12, 7 or 3 ohms.

And if your antenna impedance is higher than your transmitter impedance, just reverse the coax connections and you've got a step-up matcher with the same capability.

The new MMBX will handle up to 500 watts of RF power with ease on frequencies from 3 to 30 MHz. And it works great on either fixed or mobile rigs.

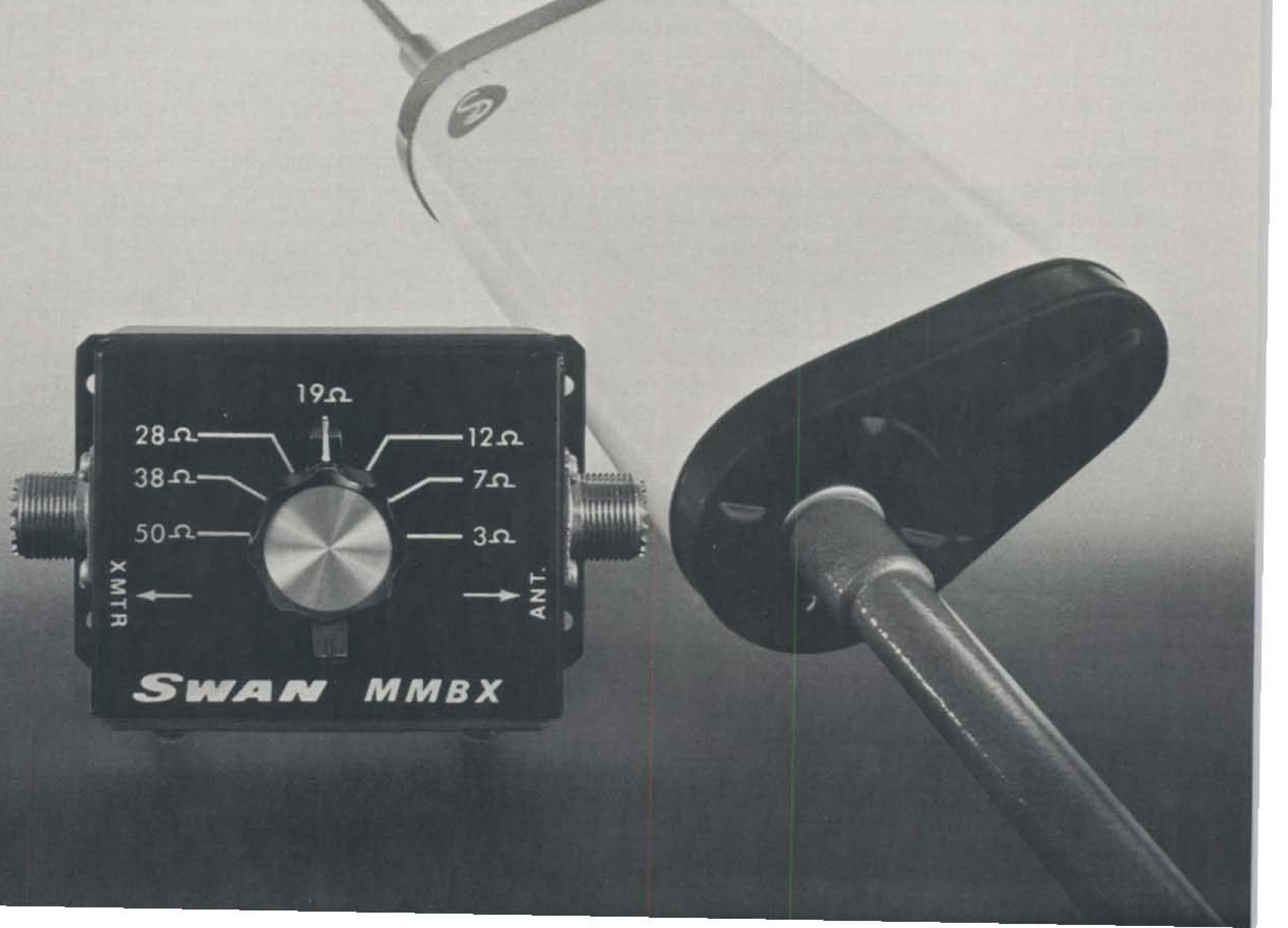
If your transmitter doesn't come across to your antenna, how are you going to get through to anybody? Solve the problem with an MMBX today. Here's a message that's loud and clear: Only $23.95. Use your Swan credit card. Applications at your dealer or write:

SWAN® ELECTRONICS
A subsidiary of Cubic Corporation
305 Airport Road, Oceanside, CA 92054
(714) 757-7525

(Price FOB Oceanside, CA)

NEW SWAN MMBX IMPEDANCE MATCHER.

It keeps your transmitter and your antenna on speaking terms for a song.



In Part I of this two part series Gary Price explains the whys and wherefores of those fascinating metal parts we've seen and pondered.

WAVEGUIDES—Part I

BY GARY H. PRICE,* W6IRA

Introduction

An electromagnetic wave launched into space tends to spread in all directions if it is not confined. For some purposes, such as broadcast transmission, this tendency is useful. It is as often detrimental; the signal amplitude is necessarily reduced as the wave energy is spread through a larger and larger volume. In the transmission of a signal between specific points, such as from transmitter to antenna, we attempt to guide the wave along some structure and thereby minimize the loss of power delivered to the load. This guidance is normally provided at low frequencies by some form of transmission line, the operation of which is not necessarily obvious. At higher frequencies our approach is less subtle; we simply enclose the wave in a **waveguide.**

Waveguide construction is familiar to most of us, but their electromagnetic characteristics are often much less so. Why do their dimensions have to be the order of the wavelength for them to work? Or do they? Perhaps surprisingly to some, they do not, at least not in all cases; transmission lines are really no more than a special type of waveguide. Understanding why a transmission line can be small compared to a wavelength and work, but a hollow pipe cannot, is not especially difficult. However the governing principles are rarely discussed in non-specialized publications. This neglect is unfortunate. Waveguides are not that complex; indeed, they demonstrate many properties of electromagnetic waves with fewer complications than are met in most situations. The concepts naturally used to describe fields in waveguides also have wider application than is generally appreciated. We shall see below just how far a few simple concepts can go toward explaining their behavior.

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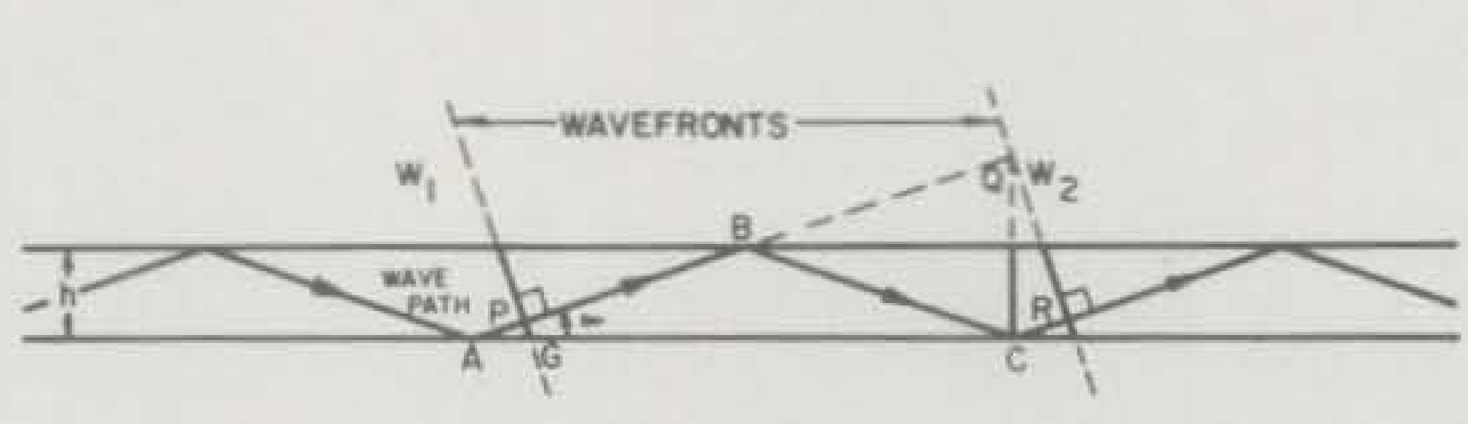

Fig. 1—Wave path in parallel-plate waveguide.

A Simple Example

First, consider a very simple waveguide, two parallel metal plates. An electromagnetic wave can propagate along between these plates by reflecting from each of them alternately in turn, as is shown in fig. 1. Consider the wave propagating along the path shown in fig. 1 after reflection at A. Following one further reflection from each wall, at B and at C, the wave is again going in its initial direction. The resultant field between the plates can be thought of as being built up by the sum of the initial wave, that produced by its reflection from the first wall, that produced by the reflection of this wave from the opposite wall, and so on.

Of course, in adding these waves attention must be paid to their phases. At a given instant in time, the amplitude of the field along the wave path varies sinusoidally with a period equal to the wavelength. This variation is normally measured as a phase angle, one complete revolution, or 360°, equalling one wavelength. We can define a wavefront as those points at which the wave has the same phase at some instant in time. Thus, the wavefronts are planes perpendicular to the wave path, as illustrated by W_1 and W_2 in fig. 1.

If the difference between the direct (PQ) and the reflected (PBCR) path lengths to the wavefront W_2 in fig. 1 is an integral number (0, 1, 2, and so on) of wavelengths, all the different multiply reflected waves add in phase, and the wave can propagate along the guide indefinitely without self-cancellation. This condition defines a waveguide 'mode.' The different modes can be characterized by the number of extra wavelengths in the reflected path.

When this condition is not satisfied, on the other hand, the phase of the wave arriving at wavefront W_2 along the direct path segment PQ is not the same as that arriving along the reflected path segment $\overline{PBCR}$, and the two waves will not add completely constructively. When all the different multiply-reflected waves are considered, the net result is that they cancel each other. Thus, the wave cannot propagate effectively along the waveguide under these circumstances.

The wave path also reflects at a distinct angle to the walls for each mode. This angle, denoted α in fig. 1, can be found with the aid of some simple geometry. If the wavefront W_2 is drawn as shown in fig. 1, so that it intersects the extended path segment $\overline{PQ}$ directly above the reflection point C, then the segment $\overline{BQ}$ of the extended path has the same length as the segment $\overline{BC}$ of the reflected path. Thus, the difference in lengths of the two paths is just the length of segment $\overline{CR}$ of the reflected path in fig. 1. Now the angle α of the wave path relative to the walls is also the angle of wavefront W_2 relative to the vertical line $\overline{CQ}$, and the sine of this angle is just the ratio $\overline{CR}/\overline{CQ}$. But $\overline{CQ}$ is twice the distance $\underline{a}$ between the walls of the waveguide, and we have required $\overline{CR}$ to be an integral number of wavelengths for a mode to exist. Thus, if we denote the wavelength by λ, we have

$$\frac{\overline{CR}}{\overline{CQ}} = \frac{n\lambda}{2\underline{a}} = \sin\alpha, \qquad n = 0, 1, 2, \ldots \quad (1)$$

Since the sine of an angle cannot exceed one, we can see from Eq. (1) that, except for n = O, there is a maximum wavelength that can propagate along the guide. As this maximum is approached, the angle α approaches 90°, and the wave reflects back and forth across the guide more and more frequently in its progress along it until, at the maximum wavelength, the wave simply reflects back and forth without making any progress at all. This behavior is called the waveguide 'cutoff.' As we shall see below, it is just whether or not such a cutoff exists for *all* modes of a guide that distinguishes the conventional waveguide used at high frequencies from the transmission line used at lower frequencies.

It α is set equal to 90° in Eq. (1), we find that the cutoff wavelength λ_c is given by

$$\frac{n\lambda_c}{2\underline{a}} = 1, \qquad (2A)$$

or

$$\lambda_c = \frac{2\underline{a}}{\underline{n}}. \qquad (2B)$$

Thus, the higher the mode number $\underline{n}$, the shorter

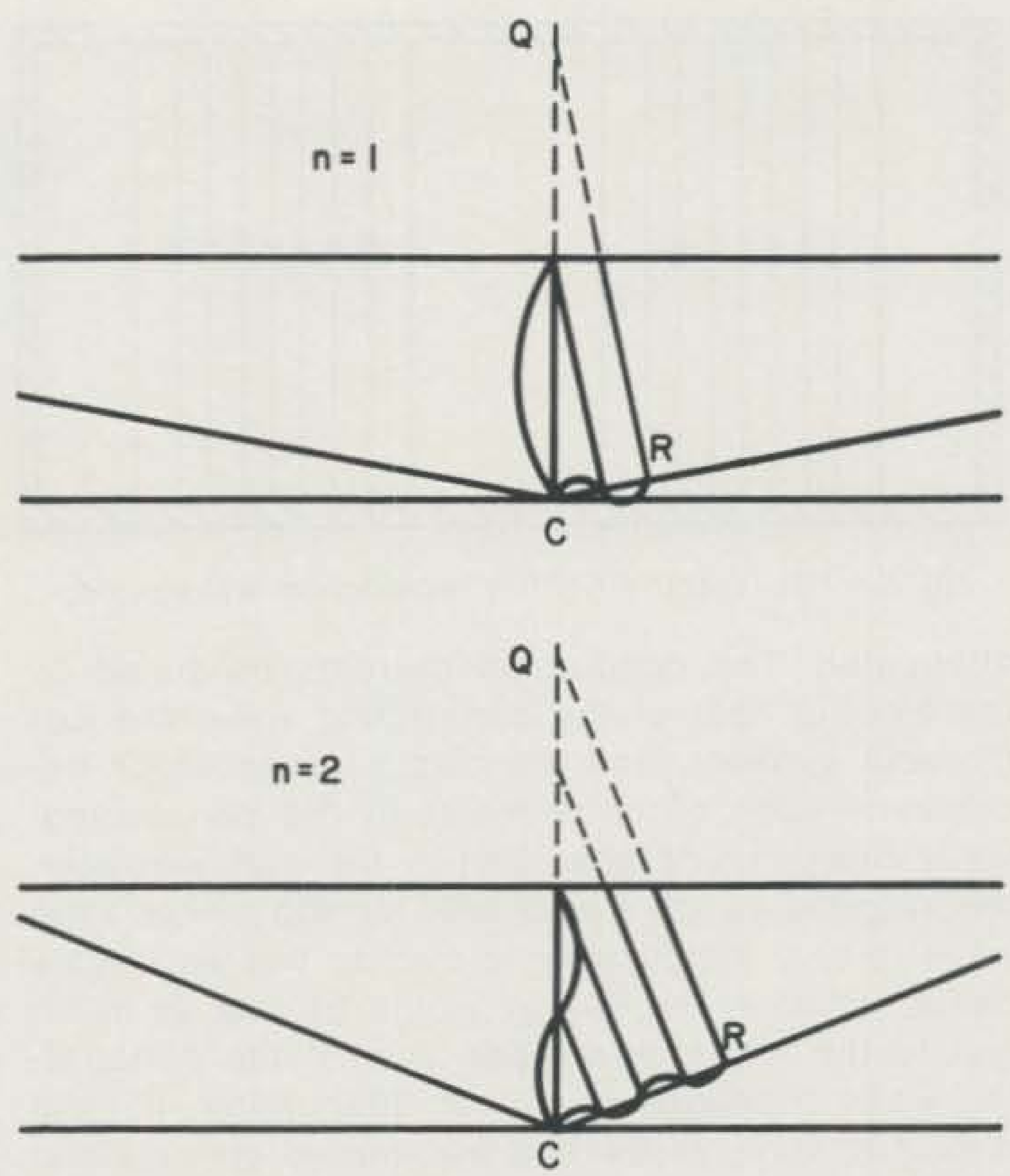

Fig. 2—Field pattern across guide.

the cutoff wave length λ_c, or, equivalently, the higher the cutoff frequency. More than one mode in a waveguide normally is an undesirable complication, and practical waveguides are usually, although not always, constructed with dimensions such that all modes except the lowest are cutoff in the frequency range for which the waveguide is designed.

If the waveguide walls are perfectly conducting, the wave propagates along the guide without attenuation so long as the frequency is above the cutoff value. However, if the walls have only finite conductivity (as is always the case practically), the wave is gradually attenuated as it progresses. The waveguide attenuation characteristics are often discussed in terms of the currents that flow in the walls. A finite conductivity implies ohmic losses that can be directly calculated in terms of these currents, which are confined near the reflecting surfaces of the wall for metallic walls at typical waveguide frequencies.

The losses in a parallel-plate waveguide can be more simply described in terms of the repeated reflection of the wave from the walls. If the walls are not perfectly reflecting, the amplitude of the reflected wave is slightly less than that of the incident wave, and the attenuation rate is just the product of the amplitude loss in each reflection and the number of reflections made in going a unit distance along the guide. The energy lost from the wave in each reflection propagates into the wall as a 'penetrating' wave; in a metallic wall this wave is rapidly

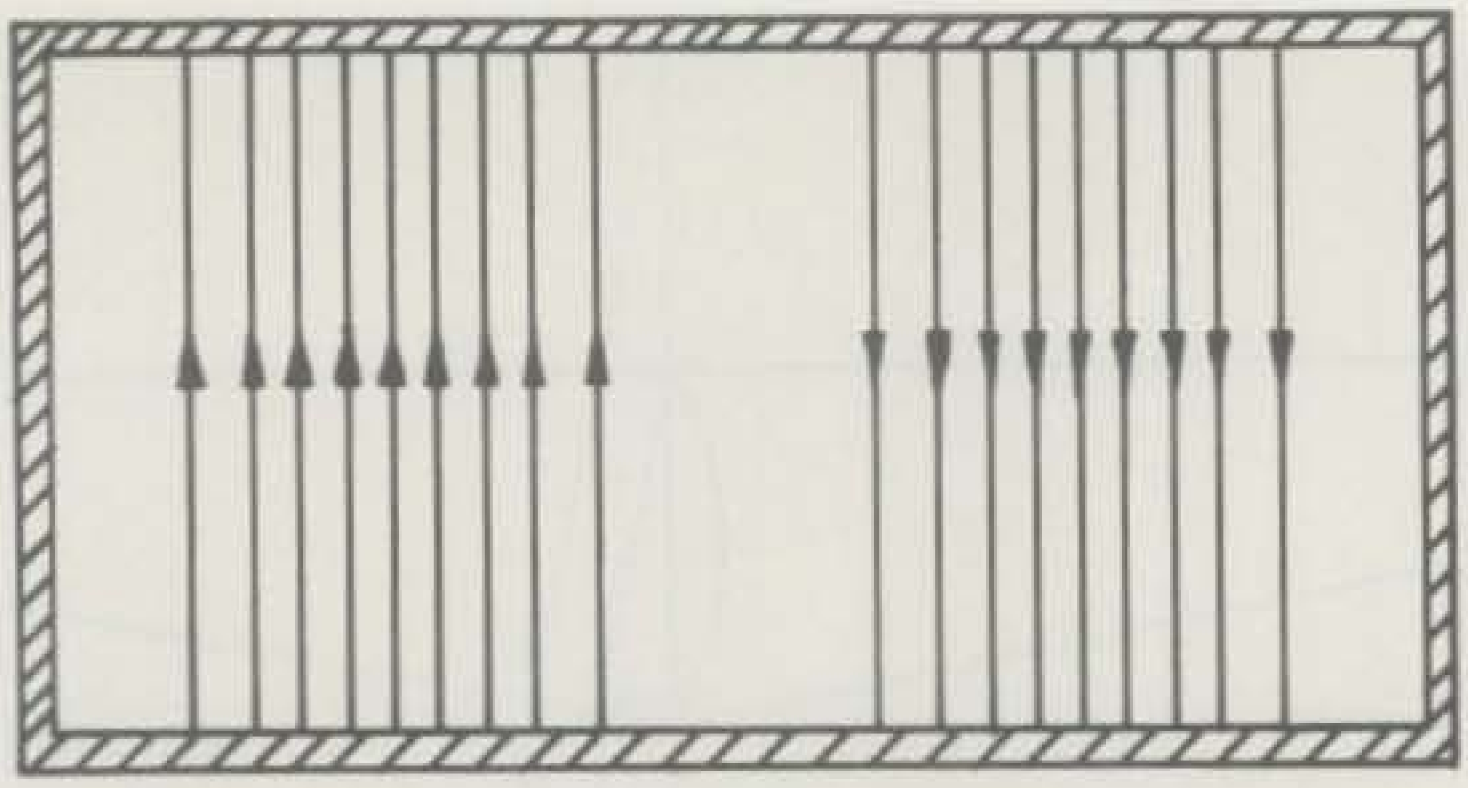

Fig. 3—$TE_{0,2}$ electric field in rectangular waveguide.

attenuated. The conduction currents produced by the electric field of the penetrating wave are just the wall currents, and the ohmic losses which accompany such currents result in the penetrating-wave energy being absorbed by the wall. However, the disposition of the energy of the penetrating wave is only incidentally related to the waveguide characteristics; the energy would be just as much lost to the waveguide mode even if the penetrating wave propagated without attenuation. Optical dielectric waveguides and microwave atmospheric ducts are examples of guided-wave structures, for which there can be modal attenuation with little absorption of the penetrating wave.

Another property of a waveguide field which is of practical interest is its pattern in the guide. The variation of field strength across the guide determines the nature of probes that will couple into it effectively, while the phase variation of the field along the guide determines the wavelength in the guide, and thus the proper length of matching stubs and the like.

The wavelength along the guide is just the distance between the intersections with one of the guide walls of two wavefronts that are one cycle apart. If we look at fig. 1, we see that as the angle α at which the wave path reflects from the guide walls increases for a wave approaching cutoff, the wavefronts tend to become parallel to the walls, and the guide wavelength must increase. The ratio of the wavelength along the wave path to that along the guide is just the cosine of the wave-path angle α. Thus, the wavelength along the guide, λg, is longer than the free-space wavelength along the wave path by just the factor $1/\cos\alpha$:

$$\lambda_g = \frac{\lambda}{\cos\alpha}.$$

If we refer back to Eq. (1), we see that α also depends on the free-space wavelength λ, so that λ_g is not simply proportional to λ. When this dependence of α upon λ is made explicit in Eq. (3), we find

$$\lambda_g = \frac{\lambda}{\left| 1 - \left(\frac{n}{2a} \right)^2 \right|^{1/2}}. \qquad (3)$$

Eq. (4) shows that λ_g becomes infinite as λ approaches $2a/n = \lambda_c$, the cutoff wavelength.

Across the guide, the wave forms an integral number of half cycles between the guide walls. To show this, we recall that the segment of the wave path $\overline{CR}$ in fig. 1 between the reflection point C and the wavefront W_2 contains an integral number of wavelengths. But the wavefront W_2 crosses the perpendicular to the guide wall that passes through C, $\overline{CQ}$, exactly two guide widths above C, at Q. Thus, $\overline{CQ}$ must also contain an integral number of full cycles, and the guide an integral number of half cycles, as shown in fig. 2. We can determine the mode order, n, by counting the number of half cycles between the walls.

This result is scarcely a coincidence. We assumed that the guide walls were perfectly conducting; a consequence of this assumption is that any component of the electric field parallel to the walls must be zero at the walls. If this condition is satisfied at one wall, it can be satisfied at the other one as well only if the two walls are an exact number of half cycles apart. A similar condition holds for the magnetic field; for perfectly conducting walls, the component of this field perpendicular to the walls must be zero at their surfaces.

Rectangular Guide

A parallel-plate waveguide is not a realistic model for most actual waveguides (an exception is discussed in the last section), but it demonstrates the principles that govern propagation in all waveguides. Consider, for example, the conventional rectangular waveguide. The wave path, bouncing as it does off both pairs of walls, is a bit hard to visualize, but the field pattern across the guide is readily determined. As before, for perfectly conducting walls the electric field parallel to any wall must be zero at that wall, and this condition can be satisfied only if the field pattern across the guide from one wall to the other contains exactly an integral number of half cycles. Each mode in the rectangular waveguide is therefore characterized by a pair of numbers, which give the number of half cycles in the field pattern across the guide between the two pairs of walls, rather than by the single number that suffices for the parallel-plate guide. This number pair forms the basis of the standard notation for identifying the modes.

To describe a mode uniquely, it is also necessary to define the wave polarization. Waves propagating in free space are conventionally referred to as vertically or horizontally polarized, as determined by the antenna used to radiate them. This terminology describes the orientation of the electric field in the wave relative to the ground. An analogous pair of polarizations exists in a waveguide, but the names used to describe them are somewhat different. The horizontally polarized free-space wave would be called a transverse-electric (abbreviated TE) wave in waveguide terminology because its electric field is perpendicular to the direction of propagation of the wave. The vertically polarized wave would be called a transverse-magnetic (abbreviated TM) wave because its magnetic field is perpendicular to the direction of propagation.

The term transverse-magnetic is more accurate than is the term vertically-polarized even for a free-space wave; the electric field is strictly vertical for this wave only if it is traveling exactly parallel to the ground. Otherwise the electric field has a horizontal component pointing along the direction of propagation. The magnetic field of this wave, on the other hand, is oriented just as is the electric field of a horizontally polarized wave, that is, horizontal and perpendicular to the direction of propagation.

In a rectangular waveguide, the terms horizontal and vertical are not very helpful in any event since turning the guide on its side would change one into the other. The terms transverse-electric and transverse-magnetic, on the other hand, retain their meaning. In a transverse-electric mode the electric field is perpendicular to the guide direction, while the magnetic field has a component along it. Conversely, in a transverse-magnetic mode the magnetic field is perpendicular to the guide direction, while the electric field has a component along it.

Each polarization has a full set of modes, characterized by the number of half cycles in the wave pattern in each direction across the guide. We can uniquely identify each mode by giving its polarization and the half-cycle indices, which are conventionally written as a pair of subscripts to the polarization initials. Thus, a $TM_{1,1}$ mode has transverse-magnetic polarization and a one-half-cycle field pattern between both pairs of walls, while a $TE_{0,2}$ mode has a transverse-electric polarization, a constant field pattern between one pair of guide walls and a two-half-cycle pattern between the other pair of walls. Since any electric-field component parallel to the walls must vanish, the two-half-cycle pattern must occur between the walls to which the electric field is parallel. This field pattern is illustrated in fig. 3. The intensity of the electric field is indicated by the spacing of the electric-field lines—the closer the lines, the stronger the field.

A transverse-magnetic mode of the form $TM_{0,\underline{n}}$ cannot exist in a rectangular waveguide with conducting walls. Our knowledge of the field patterns implied by the mode indices can quickly show us why. The fields of such a mode would be constant across the guide between one pair of walls. As we noted earlier, the boundary condition for the electric field at a conducting wall is that its component parallel to the wall must be zero. But the TM mode has an electric-field component along the guide, and this component must be zero everywhere in order for it to be zero at the walls between which it does not vary. Thus, any such mode necessarily has zero amplitude.

A similar argument applied to the TE modes indicates that one of the indices must be different from zero, but both need not be. We now know why conventional waveguides must have at least one dimension similar in size to the wavelength of the field they confine—the field must vary across the guide in at least one direction, which it can do only as rapidly as its wavelength allows, for it to satisfy the boundary conditions at the guide walls.

The cutoff characteristics of the rectangular waveguide can be determined from the condition that the wave path reflected from the walls be an integral number of wavelengths longer than the direct path to a wavefront, just as was done for the parallel-plate waveguide. Although the course of the wave path is more difficult to visualize in three dimensions than it is in two, the cutoff condition is readily determined with the help of a little algebra and our knowledge of the field behavior at cutoff. Namely, we can find the cutoff wavelength by noting when the wavelength along the guide become infinite. In part two we shall see just how this is done and examine a number of other interesting properties of waveguides.

(to be Continued)

Take a look at something you cannot see, may not be there, or be something else entirely.

A PROBE INTO RADIATION

BY IRVING M. GOTTLIEB,* W6HDM

A cordial invitation is extended to the interested reader to accompany the author as he ponders the mysteries of *radiation* and *propagation* of electromagnetic waves. At the outset, let it be understood that the usual descriptions of new antenna-configurations purported to exhibit umpteen db gain over a real, or ficticious, reference radiator, will be conspicious by their absence. Nor will the world be any poorer for it—as with women's hats, antennas evolve with a relentless momentum, suggestive of an intrinsic law of nature. In both instances, a "new model" seemingly qualifies as fashionable if it comprises a hitherto untried permutation of old elements. It is easy enough to anticipate that tomorrow's antennas will involve novel arrangements of dipoles, directors, reflectors, loops, groundplanes, and feed techniques. Whatever will be the appearance of those sophisticated clothes-lines, the underlying essence will be a strong dependency on geometrical dimensions. (Momentary intermission for under-the-breath mutterings of "naturally!") A possible (?) conglomeration is depicted in fig. 1. In any event, such is likely to be the general trend, *unless,* this article stimulates fruitful investigation into other domains of radiation phenomena.

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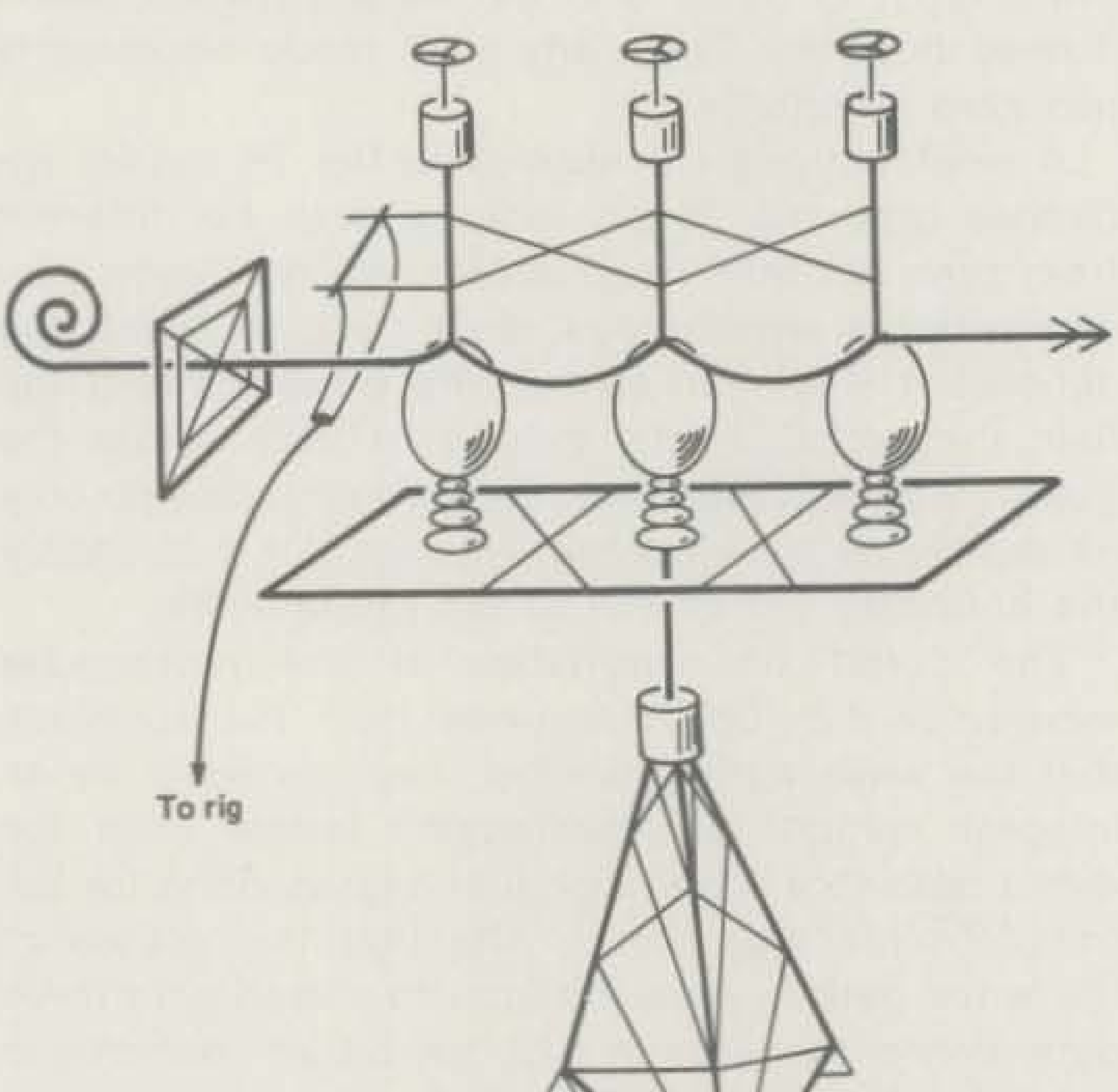


Fig. 1—The "Pointing Vector"—tomorrow's fad in antenna styles? This technological lampoonery drives home the fact that antenna progress predicted upon present radiation and propagation theory will primarily comprise differing arrangements of familiar geometric elements.

It should also be understood that there will be no concerted attempt to diminish the integrity of present antenna theory. For, it is obvious that we *do* have a "handle" on the subject. Most theorists are reasonably happy with extant concepts. And, the needs of both engineers and hobbyists are served in a practical way. The only drawback is that much of what we identify as science tends to *describe,* rather than *explain.* This being the case, a different way of viewing things can lead to profitable insights without toppling the basic framework of prevailing notions. We might even stumble upon a better way of skinning that proverbial cat. If, in the process, we find ourselves impelled to revise our previous ideas about what makes the cat tick—well, so be it!

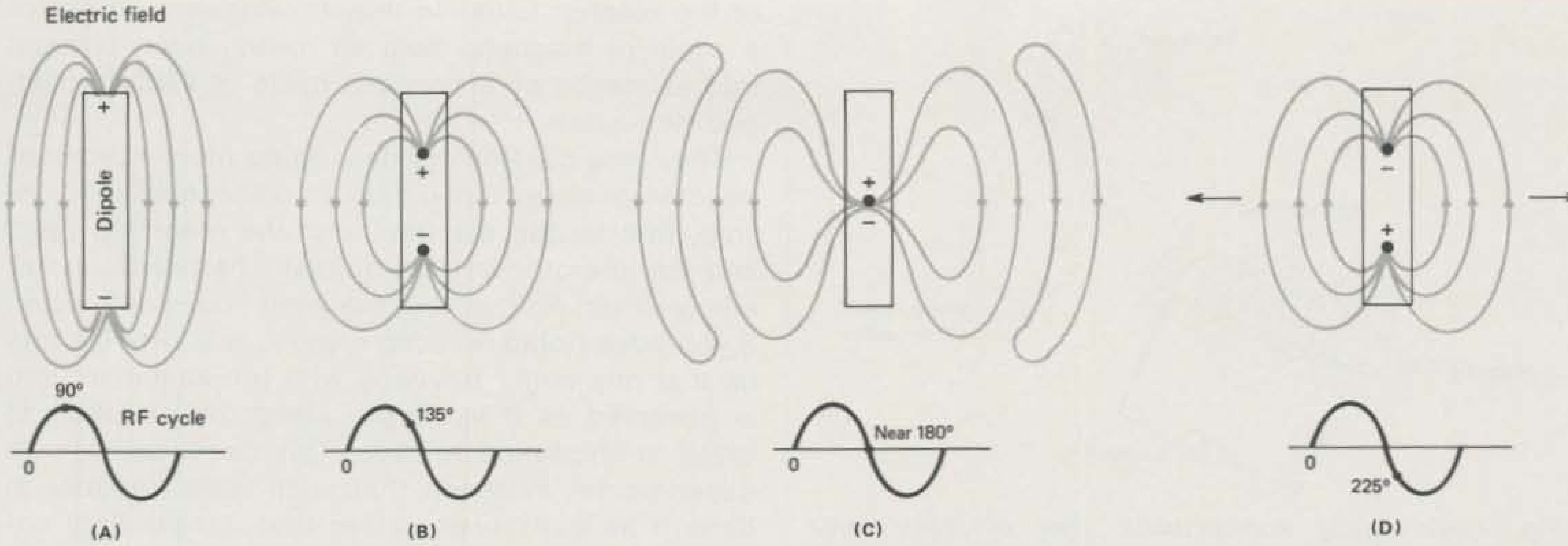


Fig. 2—The prevailing concept of the radiation mechanism. Electric lines of force are seen to peel off much like the outer skin of an onion. (A) The peak of a cycle —the ends of the dipole bear opposite charges (90°) (B) An eighth-period later in the cycle (135°). (C) Very close to polarity reversal (near 180°). (D) Approximately another eighth of a period later (approx. 225°). In another eighth of a period, the condition depicted in (A) will occur again, but with the polarity of the charges reversed. (270° not shown.) And, a quarter of a cycle later, radiation will "peel" off as in (C), but with the direction of the electric field reversed. (360° not shown.)

A more relevant analogy to our objectives than the cat, is the *wheel.* We all have heard cliches about re-inventing, or improving the shape, of the wheel. As wonderful as the wheel must have appeared to its original implementer, he surely realized that nature had conspicuously by-passed this technique when she endowed her creatures with the power of locomotion. Today, much developmental effort is being expended on the air-blast vehicle, which supports itself on a cushion of air. Such vehicles skip nimbly over the terrain with no need for roads or freeways. Although next year's marvels from Detroit may not sport such a mode of locomotion, it does not dim one's awareness of *alternatives* to the wheel when the objective is locomotion. When the objective is *radiation,* do we dare contemplate *antenna* alternatives? (Remember, mere re-arrangement of elements will not qualify your prophetic or speculative efforts.)

It is probably easier to imagine alternatives for the wheel than for the basic antennas that we are more-or-less familiar with. It is tantalizing that, despite an extensive arsenal of mathematical "tools," and much know-how about roof-top applications, the actual mechanism of radiation retains an elusive aspect. A popular description of this strange phenomenon is approximately as shown in fig. 2. The radiating source is a center-fed vertical conductor, which we recognize as a dipole. It is not necessary to assume that its length comprises two quarter-wave elements, as is often the case in practice. (Analytical procedures usually deal with a "short" dipole—one often implied to be of infinitessimal length.) Lines of electric force are, by mutual repulsion, crowded *away* from the antenna. The outermost lines then experience increasing difficulty in maintaining their terminations on the oscillating charges on the dipole. According to this "model," a portion of the electric field surrounding the antenna becomes forcibly detached from it because of its inability to remain in step with the oscillating charges. Once detached, the electric lines of force representing the freed field close upon themselves, and sally forth as a propagating wave with a free-space velocity of nearly 3×10^8 meters per second.

For the sake of simplicity, only the electric field has been considered in the act. The *magnetic field* is involved in an analagous way—the "peeling-off" behaviour also pertains to it. It is, indeed, axiomic, that the electric and magnetic fields always have *interdependent* existences. Not only are their existences mutual, but the very propagation of the electromagnetic wave is predicated upon the supposition that one type of field *begets* the other.

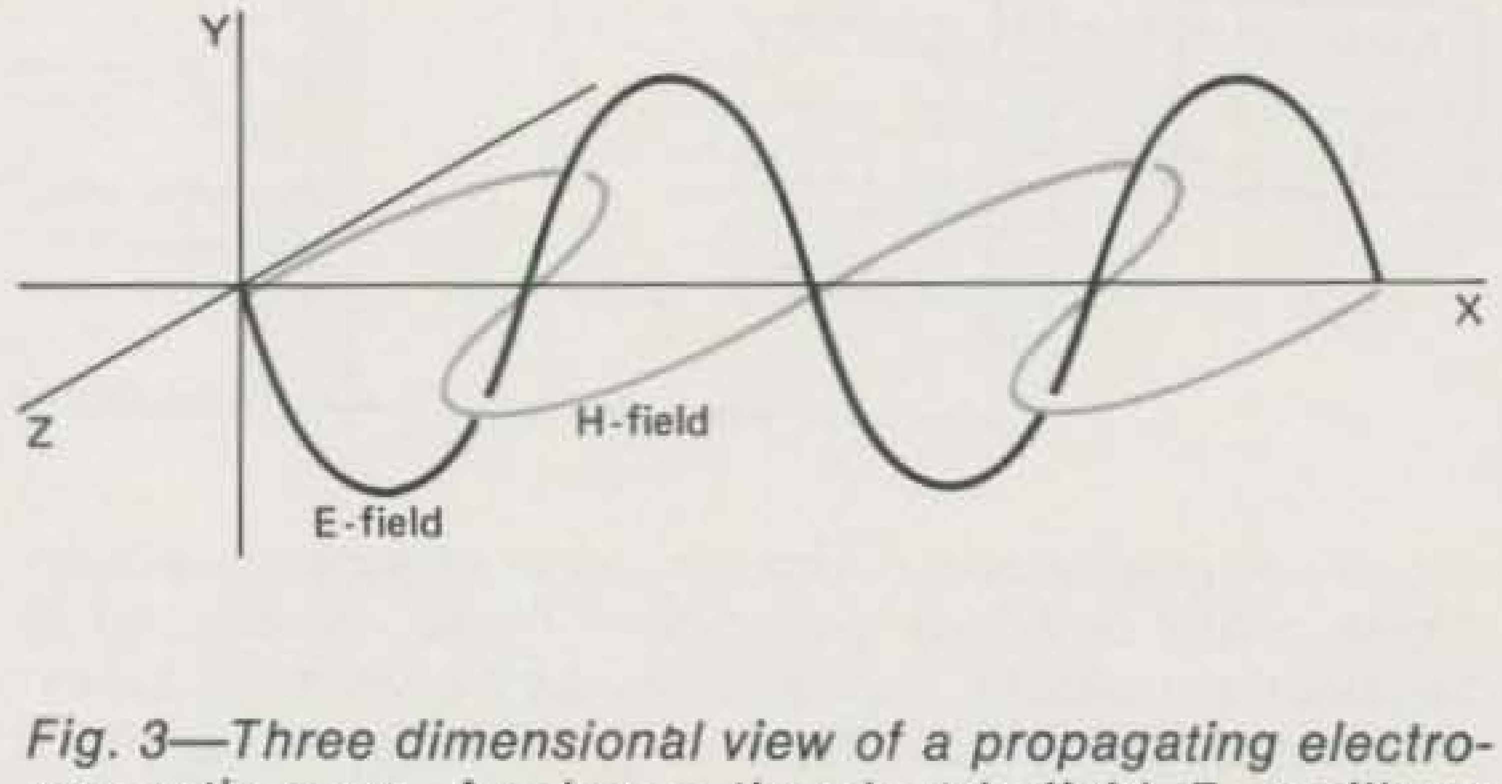


Fig. 3—Three dimensional view of a propagating electromagnetic wave. As shown, the electric field, E, oscillates along the Y axis; the magnetic field, H, oscillates along the Z axis. (This is ordinarily called vertical polarization.) As propagation occurs, there is repetitive generation of one type of field by the other. Speed of propagation in free space is approximately 3×10^8 meters per second, or 180,000 miles per second. As shown, propagation is to the right, along the X axis.

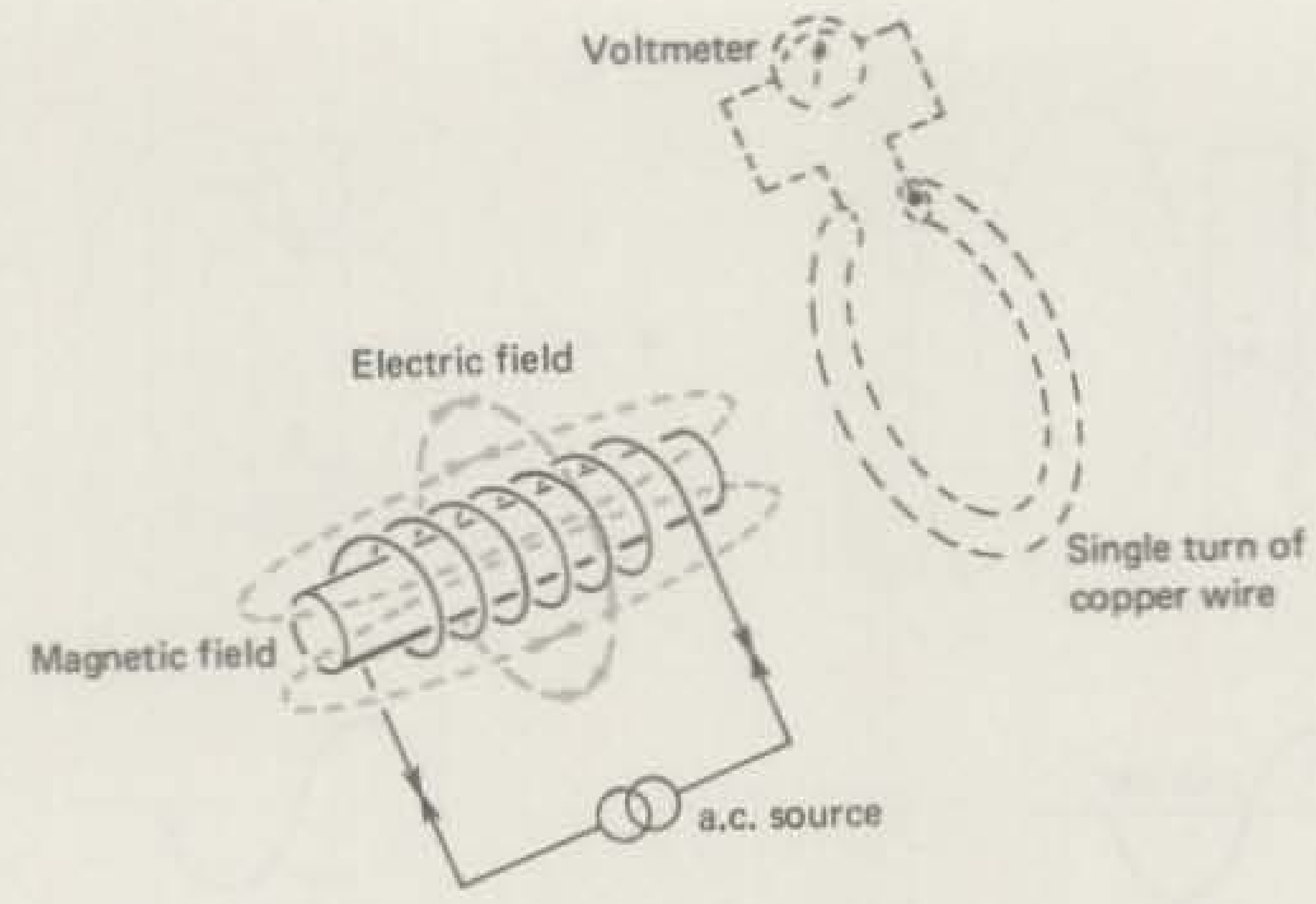


Fig. 4—A strictly non-textbook view of transformer action. The time-varying electric field accompanies, or is "generated by" the time varying magnetic field of the solenoid. This electric field has a spatial existence whether or not the secondary "winding" (shown in dotted lines) is in close physical proximity to the solenoid. The secondary can be thought of as a monitor or detector of the electric field. (current is available from the secondary because the free electrons within the copper respond to the gradient, or pressure along the electric-field lines of force.) Thus an emf is developed across the ends of the secondary turn.

Thus, a time-varying electric field "generates" a time-varying magnetic field. Then the time-varying magnetic field generates, or begets, a new time-varying electric field. The process repeats itself over and over. Each generated, or "begotten" field is positionally advanced in the direction of propagation because time is required for the generation process. Fig. 3 shows a three-dimensional view of a vertically-polarized electromagnetic wave. (The polarization corresponds to the spatial orientation of

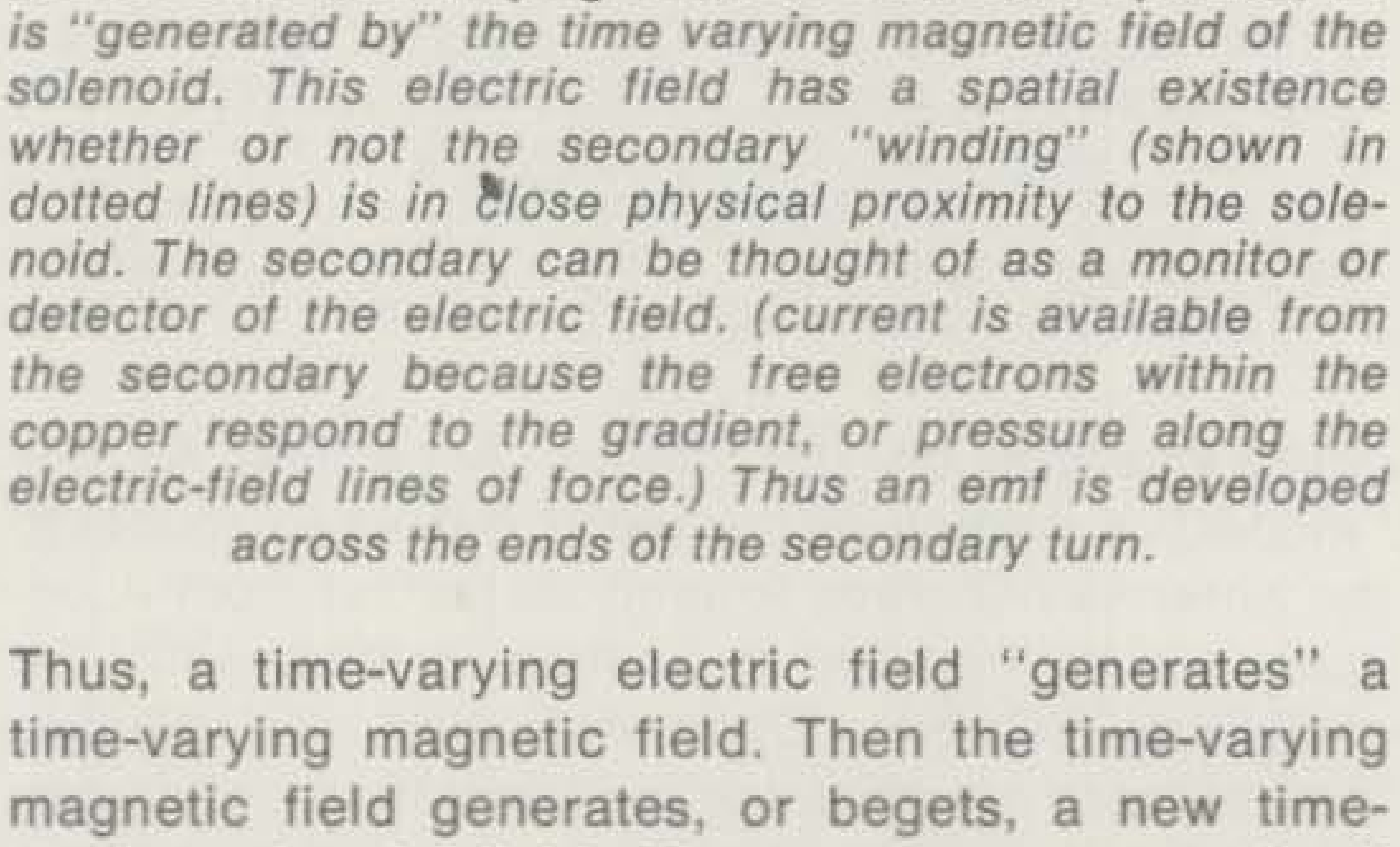


Fig. 5—A strictly non-classroom view of antenna action. Three zones of action are shown. These correspond to behavior defined by mathematics and confirmed by experimental evidence. What is lacking is a satisfying explanation of why and how the energy invested in the oscillating charges which go up and down the dipole elements, ultimately propagate into space. The dual arrows in the near region symbolize electromagnetic energy which is cyclically stored in the space close to the antenna, and returned to the antenna. For simplicity of presentation, the identical situation, prevailing to the left of the antenna, is not shown.

of the electric field.) In this drawing, one thinks of a cycle of magnetic field as having been brought into existence by a previous cycle of electric field, and vice-versa.

The three parameters describing the electromagnetic wave of fig. 3 maintain an orthogonal relationship, that is, the electric field, the magnetic field, and the line of travel are mutually perpendicular to one another. And, regardless what you would report if you were riding on such a wave, *relativity* informs us that any entity traveling with the speed of light is observed as if its length along the direction of travel is shortened to zero. This complies with all experimental evidence that such waves appear to behave as *transverse,* rather than longitudinal undulations, such as sound waves.

Encyclopedic volumes have been written on the behaviour of electromagnetic waves; the subject turns out to be a "natural" for mathematicians. In our effort to acquire insights into radiation and propagation of these waves, we will make use of the homely simile, the analogy, and the "model". Let us, for example, contemplate the basic action in a simple *transformer*. It often serves our practical needs to refer to a current induced in the secondary winding. More accurately, we should, of course, think of the current as being available as a *consequence* of an emf developed in the secondary. If this seems nitpickingly trite, it will vindicatively serve as a bridge to the next idea, (See Fig. 4)—one which is not commonly found in texts on transformers. Whether or not the secondary winding is physically present, there is a time-varying electric field in the space surrounding the primary winding, or the core. This electric field is generated in space by the time-varying magnetic field, which in turn, owes its existence to accelerated charges, that is, the sinusoidally-changing primary current. Therefore, the secondary winding may be thought of as an electric-field *detector*. It merely "reports" the existence of the aforementioned electric-field. Of course, if the secondary winding has "n" number of turns, we get this report cumutatively-added n times. Current is available because of the tremendous number of *free electrons* contained within copper wire. Summing up, a time-varying magnetic field generates a time-varying electric field in "space". The charges within the copper-wire secondary continually *redistribute themselves* under compulsion of this "electrified space", or field. We see that the electromagnetic field for a transformer bears *some* resemblance to the electromagnetic wave. In the transformer, however, the spatial fields grow and collapse in the *vicinity of the transformer only*—there is virtually no radiation. (at least in low-frequency transformers.)

Yet another view of the secondary winding would be as a *receiving antenna*. Even though propagation of fields does not come from a remotely-located source, this concept is not at all far-fetched. For, as pointed out, an electric field is there to be monitored *whether or not the secondary winding is in place.* And, whether you call the monitoring provision a winding, or an antenna, derives from traditional usage. In our quest for the *different* viewpoint, it will do us no harm to consider the semantics of tradition as purely arbitrary. This digression from the r.f. scene has been for the purpose of emphasizing that electrical effects commonly associated with conductive materials can actually be manifestations of fields in space. This does not bother the mathematician—to him, neither the electric nor the magnetic field require any "material" support. The concept does, however, prove bothersome to a school of theorists who find the ordinary notion of space, as an *idealized vacuum,* suspect.

Long before we qualified as amateurs, some of us experienced mental-reservations with regard to the concept of spatial energy-storage. For example, a *vacuum capacitor* stores electric energy, as does a capacitor with some material, say mylar, as the dielectric. Now, mylar has a relative dielectric-constant of approximately two. This implies that a vacuum capacitor would have its capacitance doubled if its interplate material were mylar, rather than "nothingness." In other words, the relative dielectric-constant of vacuum is unity—it provides capacitance and stores energy *as if* it were a "substance" with a relative dielectric-constant of one. This bothers the mathematician, with his "field" concepts, not one bit, but we find ourselves prompted to make the hypothetical wager that if it were *not* otherwise known, many a deep-thinking theoretician would "intuitively" guess that a vacuum should behave *as if* its dielectric constant were *zero* —this would harmonize with the very definition of empty space. The fact that vacuum functions as a dielectric in capacitors, stores electric energy, and serves as a "medium" for the propagation of electromagnetic waves cannot be ascribed to the imperfectness of man-made vacuums. For then, we should expect to see the capacitance of a vacuum capacitor *decrease* as the vacuum is made better. There is no evidence of this. Yet, life would have one less imponderable if vacuum capacitors could *not* be!

Admittedly, the quandary exists only in the minds of those, who, like your author, require some kind of imagery to lend viability to those cold and lifeless equations. For those of us cursed with such mental apparatus, the conjecture that *true emptiness* somehow differs from even a perfect vacuum, or from "free" space, is not easy to put aside. Adding to our torment, we can only flounder in response to such a "childish" question as "what, then, is "true emptiness," and where does one find it?

A similar situation prevails for the storage of magnetic energy. In a simple solenoid with an air

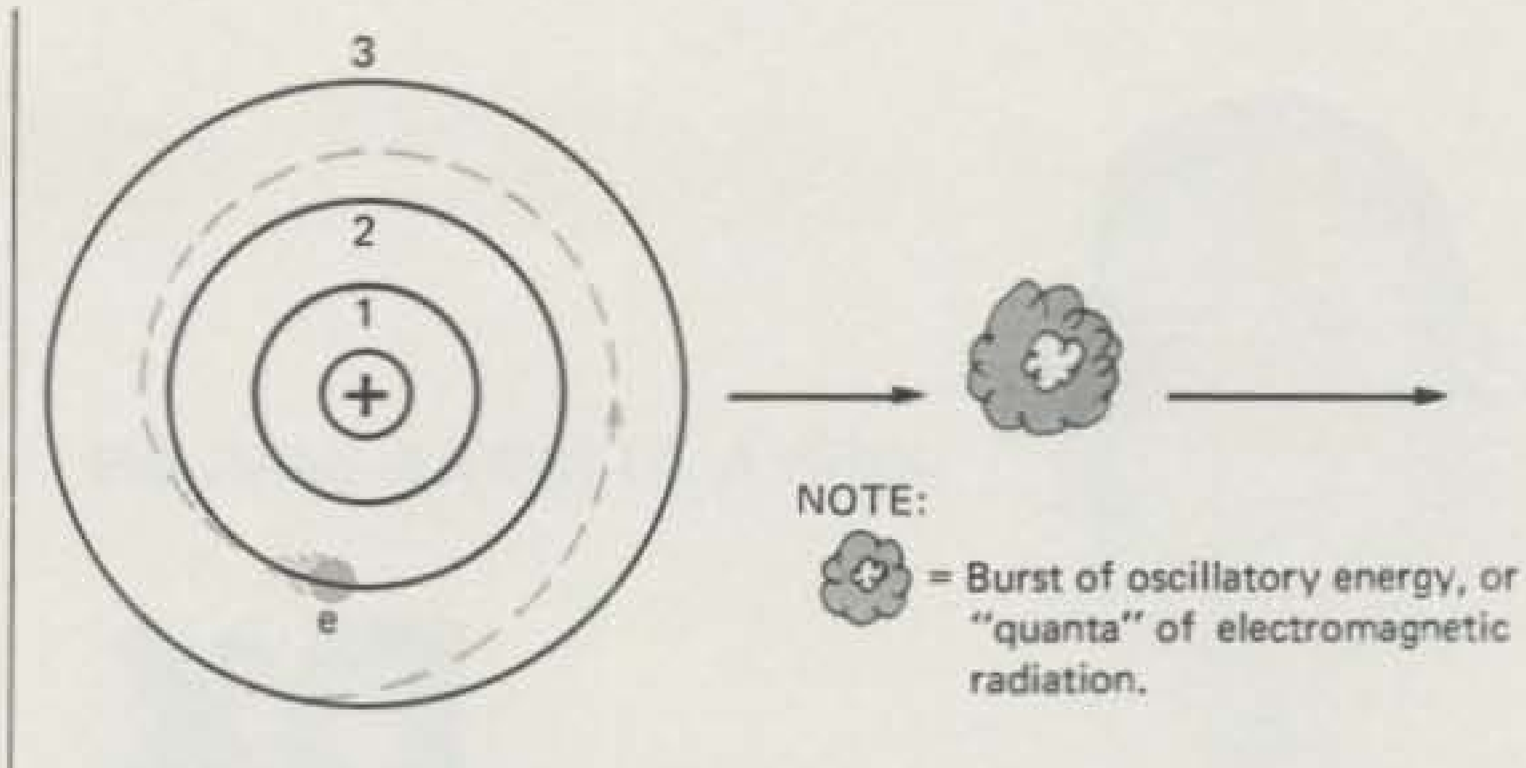


Fig. 6—The atom—nature's transmitter-antenna system. In the simple hydrogen atom shown, the solitary electron can occupy any of several orbits, such as those designated as 1, 2, 3. More energy is associated with large electronic orbits than with small ones. If, say because of electric fields introduced from the external environment of the atom, the electron "jumps" to a smaller orbit, it releases its surplus energy. This released energy is conveniently represented as being carried by photons.

"core," the relative permeability is very, very close to unity, which actually is prescribed for a vacuum. Various materials, particularly those displaying ferromagnetic properties, have relative permeabilities many times that of the "reference material"—*vacuum.* Summing up, free space behaves as "matter" possessing a relative magnetic-permeability of one, as well as a relative dielectric-constant of one. The fact that space, or something associated with it, can store electric and magnetic energy leads to interesting *models* for accommodating the propagation of electromagnetic waves. There is, of course, no denying that these models often reflect the biases and insecurities of those who derive displeasure from the ability of "nothingness" to manifest itself as energetic "somethingness."

Those who harbor such mental reservations about the alleged "emptiness" of space and about self-sustaining qualities of force fields may be said to be throwbacks to previous generations of thinkers, especially, those who contended with the problems

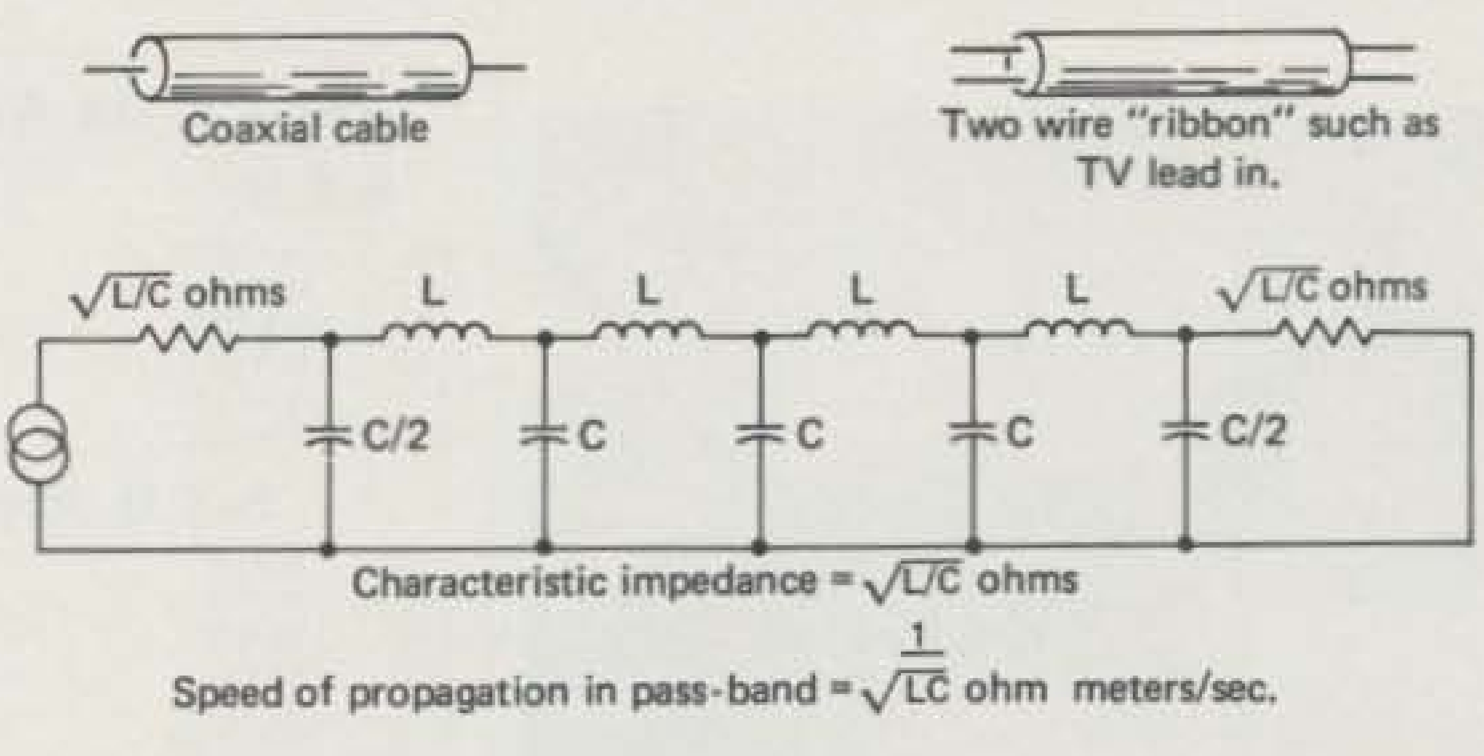


Fig. 7—Basic low-pass networks. The coaxial cable, the TV lead-in, and the "lumped" circuit of inductors and capacitors can all be made to yield similar behavior. An objection to the use of the low-pass transmission line as a "model" for space propagation of radio waves is that this network will transmit a steady d.c. signal.

(Continued on page 81)

JOHN A. ATTAWAY, K4IIF, ON

DX

The CQ Worldwide C.W. Contest on November 27 and 28 made that the biggest month of the year for the c.w. DXer, as this contest attracts a truly worldwide following of c.w. DX enthusiasts. The greatest concentration of rare, semi-rare and just plain DX stations of 1976 were operating from 0000 GMT Saturday night the 27th until 2400 GMT Sunday night, the 28th and their QSL Managers will be prepared to see that your contact is confirmed. For complete contest rules see page 47 of the August, 1976 issue of *CQ*.

An important feature of the *CQ* contests each year are the special, weekend DXpeditions to rare and semi-rare countries. These have become so prevalent in recent years that a new term, "Contestpedition," has been coined to describe them. At our early presstime it is too soon to give you a complete roster of all Contestpeditions proposed for the 1977 contests. Therefore, it is important that you consult one of the regular DX bulletins which publish the latest information on a short term basis. Many of these bulletins appear weekly and are invaluable to the DXer building up his score. Names and addresses for the bulletins we receive are as follows: *West Coast DX Bulletin*, 77 Coleman Drive, San Rafael, CA 94901; the *Long Island DX Association Bulletin*, P.O. Box 222, Levittown, NY 11756; *DXer's Magazine*, P.O. Drawer DX, Cordova, SC 29039; *DX'-Press*, Jan van Gelderdreff 11, Voorschoten 2260, Netherlands; *DX News-Sheet*, 62 Belmore Road, Norwich NR7 OPU, England; and *Long Skip*, P.O. Box 717, Station Q, Toronto, Ontario M4T 2N7.

Also very helpful are the DX-oriented club newsletters such as the Department of State Amateur Radio Club letter, the *Totem Tabloid* published by the Western Washington DX Club, *The DXer* published by the Northern California DX Club, and the *North Florida DX Association News*.

Another important aid to the DX and Contest operator is *Mail-A-Prop*, a detailed, up-to-the-minute forecast of propagation conditions for each band for each time period. This service is published by *CQ's* internationally famous Propagation Editor, Mr. George Jacobs, W3ASK. For subscription information write to George c/o P.O. Box 86, Northport, NY 11768.

Getting Those Rare Zones During The Contest

Zones 18, 19 and 23 are very hard to work from North America, but there will be several stations active from these zones during the contest and if propagation conditions are reasonable you should get a chance to add them to your already worked list for regular WAZ or the Single

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

The WAZ Program

S.S.B. WAZ

1338....F5RV
1339....SM3DSP

C.W.—Phone WAZ

4000....W5RTX
4001....W8BDO
4002....K5FKD
4003....WB8ABN
4004....JA2BUR
4005....K7INE
4006....G3JTO
4007....HA5KKN
4008....YO3QK
4009....I1SBU
4010....I3OBO

Phone WAZ

521....JA1WTI

The complete rules for all WAZ awards are found in the May, 1976 issue of *CQ*. Application blanks and reprints of the rules may be obtained by sending a business-size, self-addressed, stamped envelope to the DX Editor, P.O. Box 205, Winter Haven, FL 33880.

Bill Braithwaite, W4NML, earned C.W.-Phone WAZ #3989 as WA3SWI. Bill's new QTH is in Falls Church, Virginia.

The CQ DX Awards Program

S.S.B.

450....WA6FZI
451....I6FLD
452....HA7PQ
453....WA4DZZ
454....G3TJW
455....WA2GEZ

C.W.

225....WA3SWI
226....ZD8TM
227....K2GI

S.S.B. Endorsements

320....W2TP
310....F9RM
310....I6FLD
310....K6EC
310....K9WEH
310....W6YMV
300....G3TJW
300....I6FLD
275....G3TJW
275....I6FLD
275....WB4SIJ
250....G3TJW
250....I6FLD
200....G3TJW
200....I6FLD
200....IØMBX
200....W6MFC
150....G3TJW
150....I6FLD

C.W. Endorsement

ON4QX....310

Complete rules and application forms for the *CQ* DX Awards program can be obtained by sending a business size, No. 10, envelope, self-addressed and stamped to: "CQ DX Awards", 5632 47th Avenue S.W., Seattle, Washington 98136.

Peter Berger, DL3RQ, of Seubersdorf, Bavaria, 75 miles north of Munich, made WAZ in 1½ years with his Drake line barefoot to a 2-element quad. His 15 year old son holds the call DF2RQ. The above photo was taken in Hohenfels, Bavaria at the U.S. training area during friendship week 1976. The rig was set up behind a big beer tent in the meadow.

The WPX HONOR ROLL

The WPX Honor Roll is based on confirmed *current* prefixes, which are submitted by separate application in strict conformance with the CQ Master Prefix List. Scores are based on the current prefix total, regardless of an operators all-time prefix count.

Mixed

W4LRN	1625	YU1BCD	1182	K4KQB	960	WA6JVD	875	K2ZRO	782
WA6MWG	1453	W8ROC	1181	K2AAC	963	DL1CF	872	YU4EBL	782
F9RM	1363	WB4KZG	1180	K6ZDL	957	W4BYU	859	JA1AG	765
W2NUT	1333	WA2EAH	1150	W4IC	950	WA1JMP	857	K8UDJ	750
VE3GCO	1300	PAØSNG	1146	I6SF	946	G3DO	849	CT1LN	749
ON4QX	1268	WA6GLD	1125	DL1MD	940	WAØCPX	844	WA5LOB	749
W3PVZ	1275	WA5VDH	1085	WØAUB	929	WAØKDI	824	PY4AP	735
W9DWQ	1253	W3GJY	1052	WB4SIJ	1020	W6NJU	811	KØBLT	733
W4CRW	1251	K6SDR	1037	WØSFU	908	W9WHM	811	K7NHG	719
WB2FMK	1240	W9FD	1035	SM7TV	905	W9ZTD	807	WA6EPQ	713
W4WSF	1235	W6ISQ	1028	WA6TAX	899	IØJX	803	PAØVB	706
W4BQY	1230	YU1AG	1016	W3YHR	882	SM6DHU	803		
DJ7CX	1202	YU2DX	995	YU20B	882	IT9AGA	791		

SSB

W4UG	1405	I4ZSQ	1021	F2MO	904	WA5VDH	840	OK1MP	763
F9RM	1299	I8YRK	1008	WB4SIJ	904	W6RKP	822	W2EHB	750
IØAMU	1257	DK2BI	1003	WA2EAH	900	W3DJZ	818	WA5LOB	747
WA6MWG	1164	HP1JC	954	WØYDB	884	PY3BXW	808	W6YMV	720
I8KDB	1106	WB2NYM	941	K2POA	883	DJ7CX	800	WB6DXU	708
W4WSF	1098	YU1BCD	940	ZL3NS	874	W4IC	800	CX2CN	702
W9DWQ	1083	WA6TAX	925	WB4KZG	860	OE2EGL	780	WB2FMK	700
IØZV	1067	CT1PK	923	DL1MD	858	G3DO	765	CR7IK	613
PAØSNG	1034	IT9JT	916	W3YHR	857	YU1AG	764	I4LCK	608
DL9QH	1033								

C.W.

W8LY	1256	YU1BCD	962	K6ZDL	833	WA6JVD	803	WB4KZG	650
W8KPL	1256	G2GM	911	K2AAC	826	W4BYU	768	K2ZRO	649
WA6MWG	1109	W3ARK	910	IT9AGA	825	W4IC	754	K1LWI	629
WB2FMK	1085	DJ7CX	887	W6ISQ	824	VO1KE	750	OK2QX	600
ON4QX	1081	W2HO	885	WA5VDH	817	WA2EAH	750	VE4OX	600
W9FD	1056	VO1AW	873	YU1AG	814	I6SF	726		
DL1QT	1030	WA2HZR	853	K7ABV	812	SM5BNX	706		
W2AIW	972	W4WSF	850	VK3AHQ	809	OK2DB	693		

Band WAZ Awards. Even if you aren't interested in running up a big contest score it will be a good opportunity to log the zones and countries you need for award purposes.

Stations with UA9, UV9, UW9 and UK9 prefixes may be in Zones 16, 17, or 18, while UA0, UV0, UW0 and UK0 stations may be in either Zone 18 or Zone 19, both of which are quite rare. The key to picking out the UA9 or UA0 in the zone you need lies in the first letter of the suffix, or described another way the first letter after the numeral of the prefix. The zone 18 UA9's have the letters O, P, U, V and Y immediately following the number 9, Ø and P being used for stations in the Novosibirsk area, U and V for stations in Kemerov, and Y for stations in Altai or Barnaul. Other UA9 stations are probably in zone 16 or zone 17. An example of a zone 18 station in Novosibirsk is UA9OA.

UAØ, UKØ, UVØ, and UWØ stations having A, B, O, P, S, T, U and V as the first letter of the suffix are in zone 18, while those with C, E, F, G, I, J, L, M Q, and R as the first letter of the suffix are in zone 19. The zone 18 UA0 stations with A or B are in Krasnoyarsk, Nobilsk, Cape Chelyuskin or Dickson Island. The O and P, UAØ suffixes represent Buryat-Mongolia, Ulan-Ude and Yakutsk, while S and T indicate Irkutsk and U and V are in Chita.

The UAØ stations in zone 19 having C, E, F and G as the beginning letter of the suffix are in Khabarovsk or on Sakhalin Island, while -I— suffixes represent Cape Schmidt, Bering Magdan, Perek and Wrangel Island, -J— suffixes represent Blagoveshchensk (Amur), -L— indicates Vladivostok, -M— means Ussuriisk and -O— and -R— are in Olenck. If you are lucky enough to snare a UA0Y— station, it is in Tannu-Tuva, *Zone 23,* the most difficult of all zones to work from North America.

U.S. amateurs active in the 1975 c.w. contest were rewarded with contacts with zone 18 stations UA9OO, UA9UDR, UA9OS, UA9UGA, UA9VK, UA9ODY, UAØAG, UAØKAN, UAØVF, UAØBBC and UAØUBA, plus zone 19 stations UAØJAY, UVØEX, UAØFBF, UAØCBH, UWØFB and UAØFCK. In recent months the following stations have been heard on c.w. from zone 18: UA9OO, UK9OAD, UAØAAK, UAØAU, UAØBAP, UAØBBI, UAØKAP, UAØKAW, UAØOAZ, UKØAAB, UKØSAJ, UKØSAL and UWØAJB. Zone 19 stations recently worked on c.w. include UAØFCK, UAØQBF, UKØIAK, UKØZAD, and UWØFM, while UKØYAA has been quite active from zone 23 along with JT1AM, JT1AO, JT1AU and JT1BF.

Another real prize in a *CQ* contest is the Northeastern Zone of Africa, zone 34, as activity from Libya has been virtually non-existent for several years and stations in Egypt and the Sudan are quite scarce. However, in recent months there have been several stations, SM4ATE for example, operating /4U. These are United Nations troops in the Sinai peninsula of Egypt and they count as zone 34 contacts. According to the

Our new WPX Manager, Bob Huntington, W6TCQ. Bob started in radio as a military operator during World War II, and subsequently applied for an amateur license in 1952. He operates c.w., s.s.b. and s.s.t.v. on the high frequency bands. His chief interests are DX and WPX and he is a member of the Pacific DX Net and YL-ISSB. For WPX info, contact Bob at 5014 Mindora Drive, Torrance, CA 90505.

West Coast DX Bulletin there is also a Sinai Field Mission from the U.S. monitoring the Giddi and Mitla passes. W7LXE is reported to be among this group.

Good hunting in the next contest!

Here and There In The World of DX

Contestpedition to GC4 — G3FXB, G3MXJ and G4BUE of the Channel Contest Group (G4DAA) plan to activate GC4DAA from Guernsey during the *CQ* Worldwide C.W. Contest in November. Operation will be in cooperation with the Guernsey Radio and Electronics Society using the frequencies 3535, 7035, 14035, 21035 and 28035. There are rumors of a new prefix for Guernsey, GU, as well as a new GJ prefix for Jersey. These could be fact by the time of this operation. QSL via G3ZQW. *(Tnx G3FXB)*

In last month's column we reported that Stig Roskvist, SM5AYY, had earned the first single band WAZ on 40 meter c.w. after a delay induced by the arrival of triplets in the family. To show that we weren't kidding, here is Stig's beautiful XYL Gunnel posing in the shack with left to right, triplets Bjorn, Anders and Lars, age 1½, and their older brother Tobias, age 2½. Stig says "look for us in the multi-operator class in a few years."

CQ DX Honor Roll

The *CQ* DX Honor Roll recognizes those DXers who have submitted proof of confirmation with 275 or more countries for the mode indicated. The ARRL DXCC Country List, less deleted countries, is used as the country standard. Total number of current countries on the DXCC as of this listing is 322. Honor Roll submissions must clearly state that the submission is for the Honor Roll. Those wishing to be placed on the *CQ* DX Award Honor Roll should request the Honor Roll Check List.

C.W.

W6PT 322	W4YWX 312	WA6GLD 306	VK3AHQ 301	W6NJU 294
K6EC 317	W8LY 310	W9DWQ 305	WØAUB 301	WA6MWG ...293
ON4QX 316	W4IC 309	K6LEB 302	DL3RK 298	WA6EPQ 288
W8KPL 316	W6ISQ 306	W4BQY 302	WA8DXA 296	DJ7CX 281
W6ID 315				

S.S.B.

W2TP 321	W6YMV 313	ZL3NS 308	WB6DXU ...300	XE2YP 289
WA2RAU 320	F9RM 312	ZS6LW 308	K6AQV 299	YV1LA 289
DL9OH 319	K4MQG 312	I8YRK 307	W4WSF 299	WAØKDI 288
IØAMU 318	I6FLD 311	K3GKU 307	W6TCQ 299	DJ7CX 287
K2FL 318	K6WR 311	VE3GMT 307	WA6GLD ...299	K1KNQ 287
W9ILW 318	W2QK 311	F9MS 306	HP1JC 298	OE3WWS ...287
W3AZD 317	W6EUF 311	KH6BB 306	WØYDB 298	SP5BSV 287
TI2HP 316	W6KTE 311	W9QLD 306	K4HJE 297	DL1MD 286
G3FKM 315	W6RKP 311	XE1AE 306	W6FW 297	K8GQG 286
VE3MR 315	W9DWQ 311	YV1KZ 306	DK2BI 296	VE7WJ 284
W3CWG 315	WA2EOQ 311	OE2EGL 305	G3RWQ 295	W3CRE 284
W4SSU 315	K6EC 310	OZ3SK 305	W9OHH 295	WB4SIJ 283
W6EL 315	K9WEH 310	W6NJU 305	YS1O 295	DK1FW 282
W6REH 315	K4RTA 309	VE2WY 304	VE7CE 294	K8PYD 282
IT9JT 314	W3DJZ 309	W2CNQ 304	W8ZOK 293	OK1MP 282
SM5SB 314	WA6MWG ...309	G3DO 303	WAØCPX ...293	WB6PNB ...282
SM6CKS ...314	ZL1AGO 309	W6KZS 303	DL6KG 292	WA2VEG 280
W3NKM 314	F2MO 308	WA6AHF ...303	W6FET 292	W6HUR 279
W4NJF 314	IØZV 308	VE3MJ 302	WØSFU 291	W7YBX 278
I8AA 313	W9JT 308	G3TJW 301	G3KYF 290	W9YRA 277
I8KDB 313	W9KRU 308	WA2HSX 301	OE1FF 290	I1WT 275
W4EEE 313	WA3IKK 308	K8DYZ 300	WB2RLK 290	VE7HP 275
W4IC 313				

Seychelles Prefix — The new prefix for the Seychelles Republic embrace the series S7A - S7Z. The old prefix, VQ9, will probably not be used again in the future as the islands are now an independent republic. It is assumed that VQ9/A Aldabra, VQ9/D Desroches and VQ9/F Farquhar will join the ranks of deleted countries. *(Tnx DX'Press)*

Geyser Reef — After Bill Rindone's operation it was discovered that many DXers are uncertain regarding the location of this exceedingly rare "country." Reference to a standard world atlas doesn't cast much light on the situation as it isn't usually listed. For your info the exact location is 12°21′ south and 46°26′ east, or about half way between Mayotte Island in the Comoros and Glorioso Island to the east. Hydrographic Office Publication 65 says: ". . . the formation consists of a group of rocks and sandbanks that lie around an ellipse-shaped, central lagoon-like interior. . . . the British Naval vessel that first examined the reef was not taken across the formation because such action was considered dangerous. . . . a vessel wrecked on Geyser Reef described it as a dangerous reef extending east north-eastward and west southwestward with numerous rocks and dry sandbanks. The largest rocks appeared about the size of boats under sail. The area of Geyser Reef is considered to be the most dangerous part of the Mozambique Channel. *(Tnx West Coast DX Bulletin).*

Kaoru Iwamitsu, JA6AGS, earned C.W.-Phone WAZ #3966 from his QTH in Miyazaki, Japan.

Sunrise and Sunset Times — When making schedules for low frequency DX contacts it is important to know the exact sunrise and sunset times for each station. The general rule is that there are 2 short path peaks, one around sunrise time with the station at the eastern end of the path and the second one around sunset with the station at the western end of the path. A long path means a peak at sunrise with the station at the western end of the path or at sunset with the station at the eastern end of the path. A long path contact is possible only if the sunrise at the western end of the path is later than the sunset time at the eastern end of the path.

John A. Devoldere, ON4UN, has made a computer program which resulted in 96 pages of printout giving sunrise and sunset times for all DXCC countries, all 48 states of the continental U.S., all Canadian provinces, and the 7, VK call areas, in intervals of 5 days. There are 24 sunset and 24 sunrise times per area or country resulting in 18,528 computed times, all in GMT. You can get copies of the computer runs plus 2 pages of explanation and examples, totaling 99 pages, by placing a direct order to John. He will accompany each order with a personal printout for your particular QTH. Prices are $10. for one set, $25. for 3 sets, $40. for 5 sets or $75. for 10 sets. Payment may be made by check to John at Poelstraat 215, 9220 Merelbeke, Belgium. *(Tnx ON4UN)*

Prefix List—The DX News-Sheet is offering a 15 page prefix list with country, continent, *CQ* zone, ITU zone and DXCC notes for the very nominal sum of $1.00, which includes mailing by air, and a self-addressed envelope. This is a very useful operating aid for DX and Contest operators. Orders go to Mr. Geoff Watts, *DX News-Sheet,* 62 Belmore Rd., Norwich, NR7 OPU, England.

Icelandic Radioamateur Award, IRAA—To celebrate the 30th anniversary of the Icelandic Radioamateur Society, a new diploma is being issued. Complete rules and requirements may be obtained from the Award Manager, I.R.A., P.O. Box 1058, *101 Reykjavik,* Iceland. *(Tnx TF3JA)*

160 Meter DX—For those of you just becoming interested in DX on Top Band, most European DX operates in the "DX Window" at 1825-1830 kHz and listens for U.S. and Cana-

The WPX Program

Mixed

537....UT5RT
538....UB5ES
539....YU1SJ
540....K4CKA
541....HAØHW

S.S.B.

924....UK5QAV
925....JA3WBK
926....ZP5RS
927....WBØNHG

C.W.

1506....UK9LAA
1507....UB5XY
1508....UB5FAL
1509....UV3WT
1510....UI8AX
1511....UB5CAY
1512....UQ2PQ
1513....UA3GBI
1514....UAØLL
1515....VE3HLC
1516....DM2FNN
1517....DM2FIL
1518....G3MZE
1519....SP2IW
1520....LZ1MH
1521....F6DBX
1522....ZL2AH

Endorsements

MIXED: 1279 W4QBY, 1260 W4WSF, 1180 WB4KZG, 1150 WA2EAH, 1039 K2AAC, 850 K5DB, 848 W2MB, 757 OK3EE, 655 W2FVS, 601 WA9UEK, 600 W9OYZ, 425 W4DZZ.
SSB: 1100 W4WSF, 900 VE7WJ, WA2EAH, 860 WB-4KZG, 550 K2AAC, 450 JH1VRQ.
CW: 850 W4WSF, K2AAC, 750 VO1KE, WA2EAH, 670 OK2BLG, 650 WB4KZG, 615 W2FVS, 500 WA5TPO, 451 W0MHK, 406 JA1VE, 400 W6YMH, 351 VE3HLC, 350 WA8TDY, 300 ZL2AH.
40 Meters: OK3EE
20 Meters: ZL2AH, LZ1XL
Africa: OK3EE
No. America: VE3HLC
Oceania: K4RDU

Complete rules for WPX may be found in the May, 1976 issue of *CQ* Magazine. Application forms may be obtained by sending a business size envelope, self-adressed and stamped, to "CQ WPX AWARDS", R. F. Huntington, 5014 Mindora Dr., Torrance, CA 90505.

dian stations on 1800-1808 kHz. Australians are found in the 1800-1808 band segment while most New Zealand stations will be 1803-1813 kHz. KH6 and stations on other U.S. islands in the Pacific will be from 1995-2000 kHz and the Japanese top-banders are limited to a very narrow band from 1907.5-1912.5 kHz. Other DX stations can generally be found in the "DX Window." *(Tnx DX'ers Magazine)*

Potomac Valley Radio Club Officers—Newly elected officers are John C. Kanode, W4WSF, President; Steve Jarrett, K4CFB, Vice President; Dick Klein, K4GKD, Secretary; and Don Search, W3AZD, Treasurer. Tom, W4BVV, and Gene, W3BQV, were elected to the Executive Committee. John, W4WSF, is also the club's representative on the *CQ* DX Award's Advisory Committee.

Contestpedition to Saipan — Assistant DX Editor, Rod Linkous, W7YBX, plans to operate the *CQ* Worldwide C.W. Contest from KG6S-land. Go get 'em Rod!

Rules for the CQ Slow Scan TV DX Award

As announced in the October issue, the *CQ* DX Award's Advisory Committee has approved the addition of a Slow Scan TV DX Award as a companion to our C.W. DX Award and S.S.B. DX Award. This new award, requiring 100 countries confirmed by S.S.T.V., will be available beginning Jan. 1, 1977 and will be handled by Assistant DX Editor Rod Linkous, W7YBX. Complete rules are as follows:

Applications:

1. The *CQ* SSTV DX Award will be issued to any amateur station submitting proof of contact with 100 or more countries on SSTV. Applications should be submitted on the official CQ DX Award Application Form. (CQ Form 1067)
2. All QSO's must be two-way SSTV —cross mode or one-way QSO's are not valid. QSL's must be listed in alphabetical order by prefix and all QSO's must be dated after Nov. 15, 1945 and must be from the same call area.
3. QSL cards must be verified by one of the authorized checkpoints for CQ DX Awards, or must be included with the application. Postage for their return by first class mail must be included. If Certified or Registered Mail return is desired, the proper additional postage should be included.
4. Country endorsements for 150, 200, 250, 275, 300, 310 and 320 countries will be issued.
5. To promote multi-band usage and special operating skills, special endorsements are available as follows:
   A. A 28 MHz endorsement for 100 or more countries confirmed on the 28 MHz band.
   B. A 3.5/7 MHz endorsement for 100 or more countries confirmed using any combination of the 3.5 and 7 MHz bands.
6. Any altered or forged confirmations will result in permanent disqualification of the applicant.
7. Fair play and good sportsmanship in operating are required of all amateurs working toward CQ DX Awards. Continued use of poor ethics will result in disqualification of the applicant.
8. A fee of $1.00 or 8 IRC's to defray cost of the certificate and handling is required for each award. An s.a.s.e. or s.a.e. and one IRC is required for each endorsement.

Country Status:

1. The ARRL DXCC country list constitutes the basis for *CQ* DX Award country status. Deleted countries will not be valid for the *CQ* SSTV DX Award.
2. All contacts must be with licensed, land-based amateur stations working in authorized amateur bands. Contacts with ships and aircraft cannot be counted.
3. Decisions of the *CQ* DX Awards Advisory Committee on any matter pertaining to the administration of the *CQ* SSTV DX Award will be final.

We do not plan to have a SSTV DX Award Honor Roll in the immediate future. However, as soon as there are enough applicants to make an Honor Roll meaningful, one will be initiated.

QSL Information

A6XR—Via G4CHP
A35AF—To WA4RNE
C5AJ—Via D.A.R.C.
C31JT—c/o SM7FQX
C31JV—Via P.O. Box 280, C-11009 Pully, Switzerland
CE0AE—To WA3HUP
CT3BM—c/o P.O. Box 490, Funechal, Madeira Islands
CT4AT—Via W1YRC
CP1AT—c/o W0GX
DU6BG—To WA7RFH
EP2VW—c/o K4DAS, 6321 Northwest 1st. Court, Miami, FL 33150
FG0CRZ/FS7—Via W5SJS
FGØAD/FS7—To W9MR
FK8CK—Via P.O. Box 1966, Noumea, New Caledonia
FPØBB—c/o VE3ECP
FR7BE—To P.O. Box 137, Tampon, Reunion Island, Indian Ocean
GD3RFK—Via W5MYH
HL9TO—To WB6GYS
JY9CS—c/o K5OEA
KP8USC—Via W8KAJ
K4ITU—To W4LVM

Dieter, DJ3NK, worked WAZ with a home-brew receiver and a 500 watt linear to a 14 AVQ vertical. He is 38 years old and was first licensed in 1956.

N6RPV—c/o WA6HXM
NC4M—Via W4CQ
NSØDAK—To K0CXL
OD5HH—c/o P.O. Box 3637, Beirut, Lebanon
OHØAC—Via OH2NM
OHØNJ—To OH Bureau, P.O. Box 10306, Helsinki 10, Finland
P29BN—c/o W3LPF
P29CD—Via ZL2FA
P29UC—To WA7ILC
PY3APH—Via Caixa Postal 20, 97670 Sao Borja (RS), Brazil
SV0WZ—c/o OE3NH
SV0WSS (Crete)—Via P.O. Box 201, FPO, New York, N.Y. 09525
TA1MB—To DK3GL
TU2FH—c/o R.E.F., 2 Square Trudaine, 75009 Paris, France
UM8FM—Via W3HNK
VK2FT/LH—To K1TZQ
VKØLB—c/o VK2RS
VP2AG—Via WB2TSL
VR1AF—To W7OK
VR1AH—c/o VK5JW
VR3AK—Via KH6AHZ
VR4BT—Via G4CRY
VR8A—c/o ZL2BJU
VS6DO—Via K4CIA
VS6GG—To PO. Box 521, Hong Kong
WF4WBC—c/o WB0OYX
WM3PEN—Via WA3RCA
YB9ABX—To SM6CVE
YBØAAG—c/o DJ2JB
YJ8DE—Via P.O. Box 56, Vila, New Hebrides
ZD8EW—To G4EHJ, or to B.B.C., Ascension Island, South Atlantic
ZF1MA—c/o VE3BWY
ZK1DA—Via WA5OCN, or to P.O. Box 269, Raratonga, Cook Islands
ZK1CV—To P.O. Box 23, Raratonga, Cook Islands
ZS3KC—c/o P.O. Box 1235, Swakopmund, Namibia (Southwest Africa)
3D2AJ—Via W6SC
4X4JS—To WA2KWP
4Z4BG, 4Z4EV and **4Z4PX**—
Via WB4FSV, 1951 Thunderbird Trail
Maitland, FL 32751
5B4NK—c/o OE2SJL
5U7AG—Via W3HNK
5W1AB—To Percy J. Rivers, P.O. Box 112, Apia, Western Samoa
7X2EPM—c/o Bureau, P.O. Box 2, Algiers, R.P., Algeria
7Z1AB—Via W3ACE
9K2DT—c/o P.O. Box 13220, Kuwait
9K2EH—To OZ8EH
9M8HB—c/o HB9XJ
9V1SH—To W7PHO
9V1SQ—c/o VE3FFA
9X5VF—Via ON4LM

73, John, K4IIF

Heinz, DL8YS, used this fine station to earn WAZ. DL8YS and K4IIF had their first QSO in April, 1967 back when K4IIF was just beginning as DX Editor.

GEORGE JACOBS, W3ASK, ON

Propagation

Letter writing has paid off, and propagation information is again being carried hourly on WWV!

The institute for Telecommunication Sciences (ITS) of the U.S. Dept. of Commerce did in fact *discontinue* its fourteen minute past each hour propagation announcement on October 1. However, in response to a very large volume of mail received from radio amateurs and other users of the h.f. radio spectrum, thanks in very large measure to *CQ*'s August editorial, another government agency picked up the sponsorship of new propagation announcements.

Prepared and sponsored by the Space Environment Laboratory (SEL) of the National Oceanic and Atmospheric Administration, these new announcements began on October 1, and are given at *eighteen* minutes past each hour on all WWV frequencies. At present they consist of the latest available value of 2800 MHz (10 cm) solar flux and the A-index for geomagnetic activity. When pertinent, the announcement will also include solar flare data.

The present SEL announcements do not contain hf propagation forecasts but the solar flux and geomagnetic data are adequate for do-it-yourself type forecasts.[1] SEL does intend to make these new announcements more responsive to the needs of h.f. users in the future.

If you find the new announcements helpful but would like to see additional propagation data included, send your ideas and suggestions to:

Mr. Glenn Jean
Space Environment Services Center
SEL-NOAA
Boulder, Colorado
80302

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

[1] "A Breakthrough In Simplifying Ionospheric Propagation Forecasts," Jacobs, G. and Cohen, T.J., *CQ*, March 1975, p. 16.

LAST MINUTE FORECAST

Day-to-Day Conditions Expected For Dec., 1976

	Expected Signal Quality			
Propagation Index............	(4)	(3)	(2)	(1)
Date				
Above Normal: 28	A	A	B	C
High Normal: 1, 3, 5, 18-19, 24, 27, 30	A	B	C	C-D
Low Normal: 2, 4, 6-7, 12-14, 17, 20-21, 23, 26, 29, 31	B	C	D	D-E
Below Normal: 8, 11, 15-16, 22, 25	C	D	D-E	E
Disturbed: 9-10	C-E	D-E	E	E

Where *expected signal quality is:*

A—Excellent opening, exceptionally strong, steady signals greater than S9+30 dB.

B—Good opening, moderately strong signals varying between S9 and S9+30 dB, with little fading or noise.

C—Fair opening, signals between moderately strong and weak, varying between S3 and S9, with some fading and noise.

D—Poor opening, with weak signals varying between S1 and S3, and 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 band opening for any day of the month. For example, a path shown in the Charts with a *propagation index* of (3) will be *good* (B) on Dec. 1, *fair* (C) on the 2nd, and *good* (B) again on the 3rd, etc.

For updated information dial Area Code 516-883-6223 for DIAL-A-PROP, subscribe to bi-weekly MAIL-A-PROP, P.O. Box 86, Northport, NY 11768, or check WWV at 14 minutes past each hour.

Solar Cycle Progress

Daily solar activity rose slightly during August and September, but the sunspot cycle continues to decrease at a slow rate.

The Swiss Federal Solar Observatory at Zurich reports a monthly mean sunspot number of 17 for August and 13 for September, 1976. This results in 12-month running smoothed sunspot numbers of 13 and 12 centered on February and March, 1976, respectively. The sunspot cycle is measured by these smoothed sunspot numbers. A smoothed sunspot number of 6 is forecast for December, 1976 as the present cycle gets closer and closer to its minimum value.

December Conditions

Twenty meters should continue to be the best band for worldwide DX during December. The band should open on most days just after sunrise, and remain open until an hour or two after sunset. Signals should peak toward Europe and the east about Noon; toward Africa during the early afternoon; towards South America during the late afternoon; towards the Pacific area and Australasia during the early evening and towards Antarctica a bit later in the evening. When conditions are HIGH or ABOVE NORMAL, the band may remain open for DX until as late as Midnight.

Even though we're near the bottom of the present sunspot cycle, look for some fairly good DX openings on *15* meters when conditions are HIGH or ABOVE NORMAL. Check for openings towards Europe, Africa and the east before Noon; towards South America during the early afternoon and towards the Pacific and Australasia during the late afternoon. Although not likely to happen very often, look for some *10* meter DX openings when conditions are HIGH or ABOVE NORMAL. Best bet is for openings towards South America during the early afternoon, although the band may also open briefly towards Africa from the eastern half of the country and towards the Pacific and Australasia from the western half.

With the hours of darkness at a maximum in the northern hemisphere, and static levels at seasonally low values, a considerable improvement is expected in DX propagation during the hours of darkness on the *40, 80* and *160* meter bands. *Forty* should open for DX during the early afternoon, with the first signals coming from Europe. After sundown the band should open to Africa and to South America. Signals from the Pacific area, the Far East and Australasia should peak just before sunrise, but the band may remain open for an hour or two later. Fairly good DX is also expected on *80* meters between sundown and sunrise. Signals from Europe, Africa and the east should peak before Midnight; signals from South America should be in for most of the hours of darkness; signals from Australasia and the Pacific area should peak just before sunrise. There will be many nights during December when *80* meters will be the best band for DX propagation. Check both *40* and *80* meters for long-path openings during sunrise and sunset periods.

December should be an active month for *160* meter DXers. Check the *Contest Calendar* in this issue of *CQ* for the dates of the *ARRL 160 Meter DX Test* and the annual *Trans-Atlantic DX Tests*. Expect fairly good conditions on this band, probably better than they have been during the past eleven years. Conditions on *160 meters* are generally at their best during periods of very low solar activity. Look for openings towards Europe and the east as early as 8 p.m. in the EST time zone, with the band remaining open until 2 a.m. Check for European openings in the CST time zone between 8 p.m. and 1 a.m.; from 8 p.m. to Midnight in the MST zone and to 11 p.m. in PST zone. Some openings towards the south, especially to the Caribbean area, should be possible from about 10 p.m. to 2 a.m. in all time zones, and possibly right up until local sunrise. Openings towards the Pacific and Australasia favor west coast stations, but it will be worth looking for these openings in all time zones between 4 a.m. and sunrise. A good rule to remember about *160* meter DX openings is that conditions tend to peak about the time that the sun *rises* at the *easternmost* terminal of a DX path, or during the night-to-day "greyline" period.

V.h.f. Ionospheric Openings

Quite a bit of meteor shower activity is expected during December. *Germinids,* one of the year's major meteor showers should begin on December 12 and last for about three days. Maximum intensity should take place around 4 p.m. EST on December 13, with a meteor rate of about *one a minute*. This should permit fairly good meteor-type openings on *10, 6* and 2 meters. A second, but considerably less intense shower period is expected later in the month, called *Ursids*. This shower should take place on December 21 and 22, peaking about 6 am. EST on the 22nd, with a meteor rate of about 15 an hour.

A secondary seasonal peak in sporadic-E propagation usually takes place during December (the major peak is during the summer months). This should result in occasional short-skip openings on *10* and *6* meters as short as a few hundred miles, and as long as 1400 miles. Some auroral-type v.h.f. ionospheric openings are also likely to occur during December, especially when ionospheric conditions on the h.f. bands are BELOW NORMAL or DISTURBED Be sure to check the "Last Minute Forecast" at the beginning of this column for those days that are forecast to be in these categories during the month.

HOW TO USE THE DX PROPAGATION CHARTS

1. Use Chart appropriate to your transmitter location. The Eastern USA Chart can be used in the 1, 2, 3, 4, 8, KP4, KG4 and KV4 areas in the USA and adjacent call areas in Canada; the Central USA Chart in the 5, 9 and 0 areas; the Western USA Chart in the 6 and 7 areas, and with somewhat less accuracy in the KH6 and KL7 areas.

2. The predicted times of openings are found under the appropriate meter band column (15 through 80 Meters) for a particular DX region, as shown in the left hand column of the Charts. A ** indicates the best time to listen for 10 meter openings; * best times for 160 meter openings.

3. The *propagation index* is the number that appears in ( ) after the time of each predicted opening. 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) Opening should occur between 14 and 22 days
(2) Opening should occur between 7 and 13 days
(1) Opening should occur on less than 7 days

Refer to the "Last Minute Forecast" at the beginning of this Propagation 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.

4. Time 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. Appropriate *standard* time is used, *not* GMT. To convert to GMT, add to the times shown in the appropriate Chart 8 hours in PST Zone, 7 hours in MST Zone, 6 hours in CST Zone, and 5 hours in EST Zone. For example, 14 in Washington, D.C. is 19 GMT. When it is 20 in Los Angeles it is 04 GMT, etc.

5. The charts are based upon a transmitter power of 250 watts c.w., or 1 kw, p.e.p. on sideband, into a dipole antenna a quarter-wavelength above ground on 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 10 db loss, it will lower by one level.

6. 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.

This month's column contains DX Propagation Charts valid through February 15, 1977. Short-Skip Propagation Charts for use during December appeared in last month's column.

The Editor of this column would like to take this opportunity to extend his warmest wishes to everyone, everywhere during this holiday season, and to herald the good news that solar activity is almost certain to rise again during the New Year.

73, George, W3ASK

December 15, 1976-February 15, 1977
Time Zone: EST (24-Hour Time)
EASTERN USA TO:

	15 Meters	*20 Meters*	*40 Meters*	*80 Meters*
Western & Central Europe & North Africa	09-11 (1)** 08-09 (1) 09-11 (2) 11-12 (1)	06-07 (1) 07-08 (2) 08-10 (3) 10-12 (4) 12-13 (3) 13-14 (2) 14-15 (1)	15-16 (1) 16-17 (2) 17-19 (3) 19-01 (2) 01-03 (3) 03-04 (2) 04-05 (1)	17-19 (1) 19-20 (2) 20-02 (3) 02-03 (2) 03-04 (1) 20-00 (1)* 00-02 (2)* 02-03 (1)*
Northern Europe & European USSR	08-10 (1)	06-07 (1) 07-11 (2) 11-12 (1)	15-17 (1) 17-19 (2) 19-01 (1) 01-02 (2) 02-03 (1)	17-19 (1) 19-01 (2) 01-03 (1) 21-00 (1)*
Eastern Mediterranean & Middle East	08-09 (1) 09-10 (2) 10-11 (1)	07-08 (1) 08-10 (2) 10-12 (3) 12-14 (2) 14-15 (1)	17-19 (1) 19-21 (2) 21-00 (1) 00-01 (2) 01-02 (1)	18-20 (1) 20-22 (2) 22-00 (1) 20-22 (1)*
Western Africa	10-12 (1)** 08-09 (1) 09-11 (2) 11-13 (3) 13-14 (2) 14-15 (1)	06-07 (1) 07-09 (2) 09-12 (1) 12-14 (2) 14-16 (3) 16-17 (2) 17-18 (1)	18-20 (1) 20-23 (2) 23-02 (1) 02-03 (2) 03-04 (1)	19-22 (1) 22-01 (2) 01-03 (1) 22-01 (1)*
Eastern & Central Africa	08-11 (1) 11-13 (2) 13-14 (1)	07-13 (1) 13-16 (2) 16-18 (1)	18-20 (1) 20-23 (2) 23-01 (1)	19-00 (1)
Southern Africa	10-13 (1)** 08-09 (1) 09-11 (2) 11-13 (3) 13-14 (2) 14-15 (1)	07-09 (1) 12-14 (1) 14-15 (2) 15-16 (3) 16-17 (2) 17-19 (1)	18-20 (1) 20-22 (1) 22-00 (1) 22-00 (1)	19-22 (1)
Central & South Asia	16-18 (1)	07-10 (1) 19-21 (1)	06-08 (1) 18-22 (1)	06-07 (1) 18-20 (1)
Southeast Asia	16-18 (1)	07-10 (1) 17-20 (1)	06-08 (1) 18-21 (1)	06-07 (1) 18-20 (1)
Far East	16-18 (1)	06-07 (1) 07-09 (2) 09-11 (1) 15-17 (1) 17-19 (2) 19-21 (1)	05-08 (1) 17-18 (1)	05-08 (1) 17-18 (1)
South Pacific & New Zealand	13-15 (1)** 12-14 (1) 14-17 (2) 17-18 (1)	05-07 (1) 07-10 (2) 10-18 (1) 18-20 (2) 20-22 (1)	01-02 (1) 02-04 (2) 04-07 (3) 07-08 (2) 08-09 (1)	04-05 (1) 05-07 (2) 07-08 (1) 04-07 (1)*
Australasia	14-16 (1)** 12-15 (1) 15-17 (2) 17-18 (1)	06-07 (1) 07-10 (2) 10-12 (1) 15-16 (1) 16-19 (2) 19-21 (1)	03-05 (1) 05-08 (2) 08-09 (1) 17-19 (1)	05-06 (1) 06-07 (2) 07-08 (1) 17-18 (1) 05-07 (1)*
Caribbean, Central America & Northern Countries of South America	10-15 (1)** 08-09 (1) 09-12 (2) 12-16 (3) 16-17 (2) 17-18 (1)	06-07 (1) 07-08 (3) 08-09 (4) 09-11 (3) 11-15 (2) 15-17 (3) 17-18 (4) 18-19 (2) 19-20 (1) 01-03 (1)	17-18 (1) 18-19 (2) 19-21 (3) 21-03 (2) 03-06 (3) 06-07 (2) 07-08 (1)	18-20 (1) 20-21 (2) 21-04 (3) 04-06 (2) 06-07 (1) 21-03 (1)* 03-05 (2)* 05-06 (1)*
Peru, Bolivia, Paraguay, Brazil, Chile, Argentina and Uruguay	11-15 (1)** 08-09 (1) 09-11 (2) 11-13 (1) 13-14 (2) 14-15 (3) 15-16 (2) 16-17 (1)	06-07 (1) 07-09 (2) 09-10 (1) 12-14 (1) 14-15 (2) 15-16 (3) 16-17 (4) 17-18 (3) 18-19 (2) 19-20 (1) 22-00 (1)	19-21 (1) 21-02 (2) 02-05 (1) 05-06 (2) 06-07 (1)	21-03 (1) 03-05 (2) 05-06 (1) 03-05 (1)*
McMurdo Sound, Antarctica	15-17 (1)	07-09 (1) 17-18 (1) 18-20 (2) 20-22 (1) 22-00 (2) 00-02 (1)	22-00 (1) 00-02 (2) 02-06 (1)	*Nil*

Time Zones: CST & MST
(24-Hour Time)
CENTRAL USA TO:

	15 Meters	*20 Meters*	*40 Meters*	*80 Meters*
Western and Southern Europe & North Africa	09-11 (1)	06-08 (1) 08-10 (2) 10-12 (3) 12-13 (2) 13-15 (1)	15-17 (1) 17-19 (2) 19-12 (3) 23-01 (2) 01-02 (1)	17-19 (1) 19-00 (2) 00-01 (1) 20-01 (1)*
Northern & Central Europe & European USSR	08-11 (1)	07-08 (1) 08-11 (2) 11-12 (1)	16-18 (1) 18-19 (2) 19-22 (1) 22-00 (2) 00-01 (1)	18-00 (1) 20-00 (1)*

*Indicates Best Time For 160 Meter Openings.
**Indicates Best Time For 10 Meter Openings.

Eastern Mediter-ranean & Middle East	08-11 (1)	07-09 (1) 09-12 (2) 12-14 (1) 22-00 (1)	17-19 (1) 19-22 (2) 22-23 (1)	19-22 (1)
Western Africa	09-12 (1)** 08-09 (1) 09-11 (2) 11-13 (3) 13-14 (2) 14-15 (1)	06-07 (1) 07-09 (2) 09-11 (1) 11-13 (2) 13-15 (3) 15-16 (2) 16-18 (1)	17-20 (1) 20-23 (2) 23-01 (1)	19-22 (1) 22-23 (2) 23-00 (1) 21-23 (1)*
Eastern & Central Africa	09-12 (1)	07-12 (1) 12-14 (2) 14-16 (3) 16-17 (1)	18-19 (1) 19-21 (2) 21-23 (1)	19-22 (1)
Southern Africa	10-12 (1)** 08-10 (1) 10-13 (2) 13-14 (1)	07-13 (1) 13-15 (2) 15-16 (3) 16-17 (2) 17-18 (1) 22-00 (1)	18-19 (1) 19-21 (2) 21-23 (1)	19-22 (1)
Central & South Asia	17-19 (1)	07-10 (1) 19-21 (1)	06-08 (1) 18-21 (1)	06-07 (1) 18-20 (1)
South-east Asia	17-19 (1)	06-07 (1) 07-09 (2) 09-12 (1) 17-20 (1)	06-08 (1) 17-19 (1)	06-07 (1) 17-19 (1)
Far East	17-19 (1)	06-07 (1) 07-09 (2) 09-11 (1) 15-17 (1) 17-19 (2) 19-20 (1)	01-03 (1) 03-07 (2) 07-08 (1)	02-04 (1) 04-06 (2) 06-07 (1) 04-06 (1)*
South Pacific & New Zealand	12-16 (1)** 11-13 (1) 13-15 (2) 15-17 (3) 17-18 (2) 18-19 (1)	06-07 (1) 07-11 (2) 11-16 (1) 16-17 (2) 17-19 (3) 19-20 (2) 20-21 (1)	23-01 (1) 01-02 (2) 02-06 (3) 06-07 (2) 07-09 (1)	00-01 (1) 01-06 (2) 06-08 (1) 03-07 (1)*
Austral-asia	14-17 (1)** 11-15 (1) 15-17 (2) 17-18 (1)	07-08 (1) 08-11 (2) 11-18 (1) 18-20 (2) 20-21 (1)	01-03 (1) 03-07 (3) 07-08 (2) 08-09 (1)	03-05 (1) 05-07 (2) 07-08 (1) 04-07 (1)*
Carib-bean, Central America and Northern Countries of South America	10-15 (1)** 08-09 (1) 09-10 (2) 10-13 (3) 13-15 (4) 15-16 (3) 16-17 (1)	06-07 (1) 07-10 (3) 10-14 (2) 14-16 (3) 16-17 (4) 17-18 (3) 18-19 (2) 19-21 (1) 23-01 (1)	18-20 (1) 20-22 (2) 22-00 (3) 00-04 (2) 04-06 (3) 06-07 (1)	19-21 (1) 21-05 (2) 05-06 (1) 23-05 (1)*
Peru, Bolivia, Paraguay, Brazil, Chile, Argentina and Uruguay	11-15 (1)* 08-09 (1) 09-11 (2) 11-13 (1) 13-14 (2) 14-15 (3) 15-16 (2) 16-17 (1)	06-07 (1) 07-09 (2) 09-13 (1) 13-14 (2) 14-15 (3) 15-17 (4) 17-18 (3) 18-19 (2) 19-20 (1) 22-00 (1)	19-21 (1) 21-02 (2) 02-04 (1) 04-06 (2) 06-07 (1)	21-05 (1) 00-04 (1)*
McMurdo Sound, Antarc-tica	15-17 (1)	07-08 (1) 08-09 (2) 09-11 (1) 17-18 (1) 18-20 (2) 20-22 (1) 22-00 (2) 00-01 (1)	22-00 (1) 00-02 (2) 02-06 (1)	*Nil*

Time Zone: PST
(24-Hour Time)
WESTERN USA TO:

	15 Meters	*20 Meters*	*40 Meters*	*80 Meters*
Western & South-ern Europe & North Africa	08-10 (1)	06-07 (1) 07-11 (2) 11-13 (1) 23-01 (1)	17-21 (1) 21-23 (2) 23-01 (1)	18-20 (1) 20-22 (2) 22-23 (1) 19-22 (1)*
Northern & Central Europe & European USSR	08-10 (1)	06-07 (1) 07-10 (2) 10-12 (1) 23-01 (1)	17-00 (1)	19-22 (1) 19-21 (1)*
Eastern Mediter-ranean & Middle East	08-10 (1)	07-10 (1) 10-12 (2) 12-13 (1) 21-23 (1)	06-08 (1) 18-22 (1)	06-08 (1) 18-21 (1)
Western Africa	09-11 (1)** 08-09 (1) 09-12 (2) 12-13 (1)	07-10 (1) 10-13 (2) 13-16 (3) 16-17 (2) 17-18 (1)	18-23 (1)	19-22 (1)
Eastern & Central Africa	09-11 (1)	08-10 (1) 13-16 (1) 21-23 (1)	06-08 (1) 18-22 (1)	06-08 (1) 18-21 (1)
Southern Africa	08-10 (1) 10-12 (2) 12-14 (1)	09-13 (1) 13-16 (2) 16-18 (1) 23-01 (1)	18-21 (1)	18-20 (1)
Central & South Asia	17-19 (1)	08-10 (1) 17-18 (1) 18-19 (2) 19-20 (1)	05-08 (1) 17-19 (1)	05-07 (1)
South-east Asia	14-15 (1) 15-17 (2) 17-18 (1)	08-10 (1) 13-16 (1) 16-18 (2) 18-20 (1)	01-04 (1) 04-07 (2) 07-09 (1)	04-07 (1)
Far East	14-15 (1) 15-17 (2) 17-18 (1)	08-10 (1) 13-14 (1) 14-15 (2) 15-17 (3) 17-18 (2) 18-19 (1)	22-00 (1) 00-02 (2) 02-06 (3) 06-08 (2) 08-10 (1)	23-01 (1) 01-06 (2) 06-08 (1) 01-06 (1)*
South Pacific & New Zealand	14-16 (1)** 11-13 (1) 13-14 (2) 14-16 (3) 16-18 (2) 18-19 (1)	07-08 (1) 08-13 (2) 13-15 (1) 15-16 (2) 16-18 (4) 18-19 (2) 19-21 (1)	20-22 (1) 22-00 (2) 00-07 (3) 07-08 (2) 08-09 (1)	00-03 (1) 03-06 (2) 06-08 (1) 03-06 (1)*
Austral-asia	14-16 (1)** 12-13 (1) 13-15 (2) 15-17 (3) 17-18 (1)	07-08 (1) 08-11 (2) 11-17 (1) 17-18 (2) 18-19 (3) 19-20 (2) 20-21 (1)	01-03 (1) 03-05 (2) 05-07 (3) 07-08 (2) 08-09 (1)	03-05 (1) 05-06 (2) 06-08 (1) 04-07 (1)*
Carib-bean, Central America & North-ern Countries of South America	11-14 (1)** 08-09 (1) 09-10 (2) 10-12 (3) 12-14 (4) 14-15 (3) 15-16 (2) 16-17 (1)	06-07 (1) 07-09 (3) 09-13 (2) 13-15 (3) 15-16 (4) 16-17 (3) 17-18 (2) 18-00 (1) 00-02 (2) 02-03 (1)	18-20 (1) 20-21 (2) 21-23 (3) 23-01 (2) 01-03 (3) 03-04 (2) 04-05 (1)	19-21 (1) 21-03 (2) 03-04 (1) 21-03 (1)*
Peru, Bolivia, Paraguay, Brazil, Chile, Argentina & Uruguay	11-14 (1)** 08-10 (1) 10-12 (2) 12-14 (3) 14-15 (2) 15-16 (1)	06-07 (1) 07-09 (2) 09-13 (1) 13-15 (2) 15-16 (3) 16-17 (4) 17-18 (2) 18-21 (1)	19-21 (1) 21-00 (2) 00-02 (1) 02-04 (2) 04-06 (1)	22-05 (1) 00-04 (1)*
McMurdo Sound, Antarc-tica	14-16 (1)	07-08 (1) 08-09 (2) 09-11 (1) 15-17 (1) 17-19 (2) 19-21 (1) 21-23 (2) 23-01 (1)	21-00 (1) 00-02 (2) 02-05 (1)	*Nil*

A. EDWARD HOPPER, W2GT, ON

Awards

Special Honor Roll (All Counties)

#154—Francis H. Heller, W2CUC 7-21-76.

The December, "Story of The Month" as told by Al, is:

Alfred L. Pedneau, K5HKG All Counties #117, 6-29-74

"Born in New Orleans, Louisiana, where I lived until I enlisted in the Navy.

"My first interest in amateur radio came about 1953 when my Father, W5EKL (now a silent key) was first licensed.

"I was first licensed in September 1956 as KN5HKG, but did not do much operating as a Novice.

"I graduated from high school and trade school in New Orleans, I majored in Electronic Communications. Got a Technician license in 1957 and my present license in 1960.

"I enlisted in the Navy and worked as an aviation electrician/instrument technician. Was an airborne communication operator plus a few other airborne duties from time to time. Spent 18½ years in the Navy. Was licensed as KR6JP in 1963-1964 in Okinawa.

"Got transferred to Corpus Christi, Texas, the first time, in July 1964. I soon ran across the County Hunters on 40 and 20. It was not long before I became mobile and started giving out counties. I have given out counties either mobile or aeronautical mobile in 32 states and operated portable in 2 other states.

"I am happily married and we have 3 children. Have started working the counties over again, but will take it a lot easier this time. Am a member of MARAC.

As this is being written, I am attending college in Louisiana". Signed, "The Hong Kong Gorilla".

*P.O. Box 73, Rochell Park, NJ 07662.

Awards Issued

Frank Heller, W2CUC waited until he had them *all* and then was issued USA-CA-500 through 2000 endorsed All S.S.B., All 14, All Mobiles. USA-CA-2500 endorsed All S.S.B.; and Mixed USA-CA-3000 and All Counties.

Ray Teeter, W2NCI, qualified for USA-CA-500, 1000, and 1500 endorsed All A-1.

Bob Fuss, W2HIH won USA-CA-500 and 1000 endorsed All S.S.B. and All Mobiles.

Hank Kahrs, K2UVG/6 acquired USA-CA-500.

Dr. John Reasoner, WN4QMQ received USA-CA-500 endorsed All 2 Way-C.W. and became the first U.S. amateur to receive USA-CA-500 as an S.W.L. (W0-10646 #370 issued 4-26-64) and then as a Novice. (Garry Hammond, VE3GCO had received USA-CA-500-#384 5-23-64 as VE3-7554 and then as VE3GCO #731 8-6-69).

Lewis Zell, WA2PCF gained USA-CA-500 endorsed All S.S.B.

Awards

AWARDS sponsored by *CQ:* NOTE some new Custodians:

WAZ: Complete rules for regular *WAZ* and single band *WAZ* pages 54, 55 and 56 May 1976 *CQ* or send s.a.s.e. for rules and necessary forms to: John Attaway, K4IIF, P.O. Box 205, Winter Haven, Florida 33880.

CQ DX/WPX Awards: Complete rules pages 57 and 72 May 1976 *CQ* or send s.a.s.e. to *New Custodian:* Rod Linkous, W7YBX, 5632 47th Avenue SW, Seattle, Washington 98136.

WPX: Rules pages 56 and 57 May 1976 *CQ* or s.a.s.e. to *New Custodian:* Bob Huntington, W6TCQ, 5014 Mindora, Torrance, California 90505.

VPX: Rules page 57 May 1976 *CQ* or s.a.s.e. to *New Custodian:* W6TCQ.

WPNX: Rules page 57 May 1976 *CQ* or s.a.s.e. to *New Custodian:* W6TCQ.

USA-CA Honor Roll

3000		**1500**		**500**	
W2CUC	173	W2NCI	305	K2UVG/6	1118
2500		W2CUC	306	W2NCI	1119
W2CUC	221	**1000**		W2CUC	1120
2000		W2NCI	405	WN4QMQ	1121
W2CUC	260	W2CUC	406	WA2PCF	1122
		W2HIH	407	W2HIH	1123

USA-WPX-76: Rules page 27 of October 1975 *CQ* and page 42 of April 1976 *CQ* or send s.a.s.e. to Bernie Welch, W8IMZ/AC8IMZ, 7735 Redbank Lane, Dayton, Ohio 45424. (This Award is *FREE*).

USA-CA AWARD: Rules August 1976 *CQ* or send s.a.s.e. to W2GT, P.O. Box 73, Rochelle Park, N.J. 07662

SJRA VHF Award: The South Jersey Radio Association (SJRA formed on 12 June 1916) is offering a special award for any amateur who QSOs the 13 original states on v.h.f. during 1976. Apply to: SJRA, P.O. Box 293, Cherry Hill, N.J. 08002—send s.a.s.e. for rules

Worked Frankford Radio Club Award: This free Award offered by the Frankford Radio Club. USA and VE stations need to work 25 members, other stations need to work 15 club members. Send log data (no QSLs) to: Jack Heisey, K2FL/W3MDE, 616 Chestnut Street, Palmyra, N.J. 08065.

World Wide DX Association Award: Here is the DX Award of the future, a brain child of Gus Browning, W4BPD and Frank Jerome, K5CM. This free

Ed., W2GT, Roy, ZL1KG & Bob, W2OST. Roy #1 Non-USA to get All Counties. Bob got All Counties #38, 8-23-70.

awards purpose is to see who the really big DXer is, and to encourage "newcomers" to really get their feet wet and seek endorsements. Satellite DXers and Novices are also encouraged. This Award is somewhat different than what you may have become accustomed to. You need not send in QSL cards, but have them verified in your neighborhood. No money is required to change hands for the award. You may work off of other awards issued by "national" organizations. Yes, this is the International award of the future. Here are the rules:

1. This award recognizes the total accumulative country count confirmations received by an individual DXer during the DXers operating lifetime. This award is available to ALL radio amateurs of the world.

2. Countries are as established by internationally recognized lists.

3. To apply for this award, the applicant must supply a verified list of confirmations in his possession, or a list of other awards acknowledging confirmations.

4. Confirmations and list, or other awards and list, may be verified by submitting to:
   a. any radio club officer.
   b. any notary public certifying officer.
   c. any two licensed amateurs.
   d. any WWDXA member.
   e. appointed representatives.

5. Total accumulative confirmations can be in any quantity from any call sign or operating location of a DXer.
   example:
   110 QSLs as W6XXX
   80 QSLs as W1XXX
   42 QSLs as DL4XX
   232 QSLs for total accumulative of WWDXA AWARD.

6. All confirmations (QSLs) must be for contacts with government licensed amateur radio land stations only.

7. DO NOT send confirmations (QSLs) outside of your local call area. (Follow rule 4).

8. This award is issued for all one mode, all one band, or mixed modes and bands.

Utah All-County Award.

9. This award is *FREE!* WWDXA award standings will be published annually in *DXers Magazine*.

10. Apply by mailing verified confirmation list to the Award Manager of WWDXA: Frank Jerome, K5CM, 908 Holoway, Midwest City, Oklahoma 73110, U.S.A. NOTE: There is no "minimum" amount of QSL cards needed for this Award. Satellite DXers with 10 QSLs and Novices with 25 QSLs are encouraged to apply. YOU determine where you will be on the annually published list.

Utah-All-County Award: Issued for working all 29 Utah Counties. Although there have been reports of this Award cost as being 50¢ or free, the latest data is that the cost is $1.00. Send GCR and $1.00 to: "Mid" Middleton, W7ZC, P.O. Box 303, Springdale, Utah 84767. Award is free to handicapped.

Mobile Century Award and **Worked All Continents Mobile Award:** The committee of The Amateur Radio Mobile Society have now decided that their M.C.A. and W.A.C./M Awards are available to non-members of The Society. The Awards cater especially for the mobile amateur and qualification is as follows: **M.C.A.:** Confirmed QSOs with 100 countries taken from the A.R.R.L. Countries list whilst operating mobile. Stickers are available for each 20 countries confirmed.

W.A.C./M: One confirmed QSO with Europe, Africa, Asia, North and South America and Australasia whilst operating mobile.

The Awards are issued free to members of The Society (except for the return postage of the QSL cards), but for non-members the charges are as follows (which includes the return of QSL cards by surface mail):

M.C.A.: Within the United Kingdom —3.50p

Outside the United Kingdom—5 p or 8 U.S. Dollars

Endorsement stickers—1 p or 2 U.S. Dollars

W.A.C./M: All applicants—1 p or 2 U.S. Dollars

Receipt of M.C.A. automatically places members of The Society in the Honor Roll. Top three places in May 1976 were: W6KZL/M6—260; F3DJ/M—221; G3BID/M—214.

The Awards Manager is Christopher J. Page, G4BUE, "Tatworth", Station Road, North Chailey, Lewes, Sussex, England.

Notes

Conditions have been real crazy, but hope you are getting your needed Counties and QSLs. Write and tell me, How was your month?

73, Ed., W2GT

Contest Calendar

BY FRANK ANZALONE, W1WY

By the time many of you will be reading this it will be all over but the "wait until next year" alibies for *CQ* WW contesters.

Writing a Column so far in advance (mid-September at this writing) makes it impossible to report current happenings. We do know that several Contest Expeditions are being planned, especially to the Caribbean and a few isolated areas.

The weekly bulletins, Geoff Watts' *News Sheet,* Gus Browning's *DXers Mag.* and others will have informed you about them. (I always forward last minute announcements to them.)

A reminder, the African (W6RR) and Carib./C.A. (W6AM & KP4AST) Trophies are only available to residents of those areas. We define a resident as someone who has lived there for a reasonable length of time, not necessarily a native of the country.

Therefore if you are in that category it would be very helpful if you gave your status. We usually have to write to find out. You have no idea of some of the problems we run into trying to get awards to some of you guys.

Your phone entries should be in the mail by this time, hope you used Air Mail. If you didn't, make sure you do so for your C.W. entry. Need I say more about our present day mail service?

73 for now, Frank, W1WY

Calendar of Events

*	Nov.	5-8	CHC/FHC/HTH Party
**	Nov.	6-7	RSGB 7 MHz Phone
*	Nov.	6-8	ARRL CW Sweepstakes
**	Nov.	9-10	YLRL Anniv. Phone
*	Nov.	13-14	Delaware QSO Party
*	Nov.	13-14	Missouri QSO Party
*	Nov.	13-14	European RTTY Contest
*	Nov.	14	Czech. DX Contest
*	Nov.	20-21	Austrian 160 Contest
*	Nov.	20-22	ARRL Phone SS
**	**Nov.**	**27-28**	**CQ WW DX CW Contest**
	Dec.	3-5	ARRL 160 Contest
	Dec.	4-5	TOPS 3.5 MHz Contest
	Dec.	4-5	Tel. Pioneers Party
	Dec.	11-12	ARRL 10 Meter Contest
	Dec.	11-12	Hungarian DX Contest
	Dec.	11-12	Spanish CW Contest
	Dec.	18-19	S.O.W.P. QSO Party
	Jan.	8-9	YU 80 Meter Contest
	Jan.	15	"Hunting Lions" Party
	Jan.	15-16	DL QRP Contest
	Jan.	**28-30**	**CQ WW 160 Contest**
	Jan.	29-30	French CW Contest

* Covered last month.
** Covered in Sept. issue.

ARRL 160 C.W. Contest

Starts: 2200 GMT Friday, December 3
Ends: 1600 GMT Sunday, December 5

This will be the 7th annual Top Band contest organized by the ARRL. Activity will be between state-side stations, and VE's and also DX. (No DX to DX however).

Exchange: RST and ARRL section, country if its a DX station.

Scoring: Contacts between stations in ARRL sections 2 points, with other areas 5 points. The multiplier is determined by the number of ARRL sections worked, (74 possible) plus VE8 and DX countries. (see section list in *QST*)

Awards: Certificates to top scorers in each section and each DX country.

Keep the DX-window (1825-1830) clear of stateside operation, that's where the DX stations will be calling. They will be listening 1800-1805 or on frequencies they specify for your answer. Look for KH6's and etc. at the top end of the band, 1995-2000. They also will be listening down at the low end. There is a lot of unused space between 1830-1850 so don't crowd your operation below 1825. (The above of course applies mostly to East Coast and Mid-West stations.)

The usual grounds for disqualification, violation of rules, excessive duplicate contacts and etc. will prevail. A large s.a.s.e. to ARRL will get you the necesary forms to make log keeping easier.

All entries should be postmarked no later than Jan. 10th to ARRL Communications Dept., 160 Contest, 225 Main Street, Newington, Conn. 06111

TOPS 3.5 MHz C.W. Contest

Starts: 1800 GMT Saturday, December 4
Ends: 1800 GMT Sunday, December 5

This is the Tops C.W. Club's annual contest in which as the title indicates the activity is concentrated on 80 meters. For the contest it will be between 3.5 and 3.6 MHz, with DX on the low end.

Exchange: RST plus a contact number starting with 001.

Scoring: Contacts with own country 1 point. With stations on the same continent 2 points. With stations on other continents 5 points. Contacts with HQ sation GW8WJ or GW6AQ 25 points. (Each call area in W/K, VE/VO, UA, and VK count as separate countries.)

Final Score: Total QSO points multiplied by number of prefixes worked. (Same as WPX)

Entries may be single or multi-operator.

Mailing deadline is January 31st to: Peter Lumb, G3IRM, 14 Linton Gardens, Bury Saint Edmunds, Suffolk IP33 2DZ, England.

Telephone Pioneers QSO Party

Starts: 1900 GMT Saturday, December 4
Ends: 0500 GMT Monday, December 6

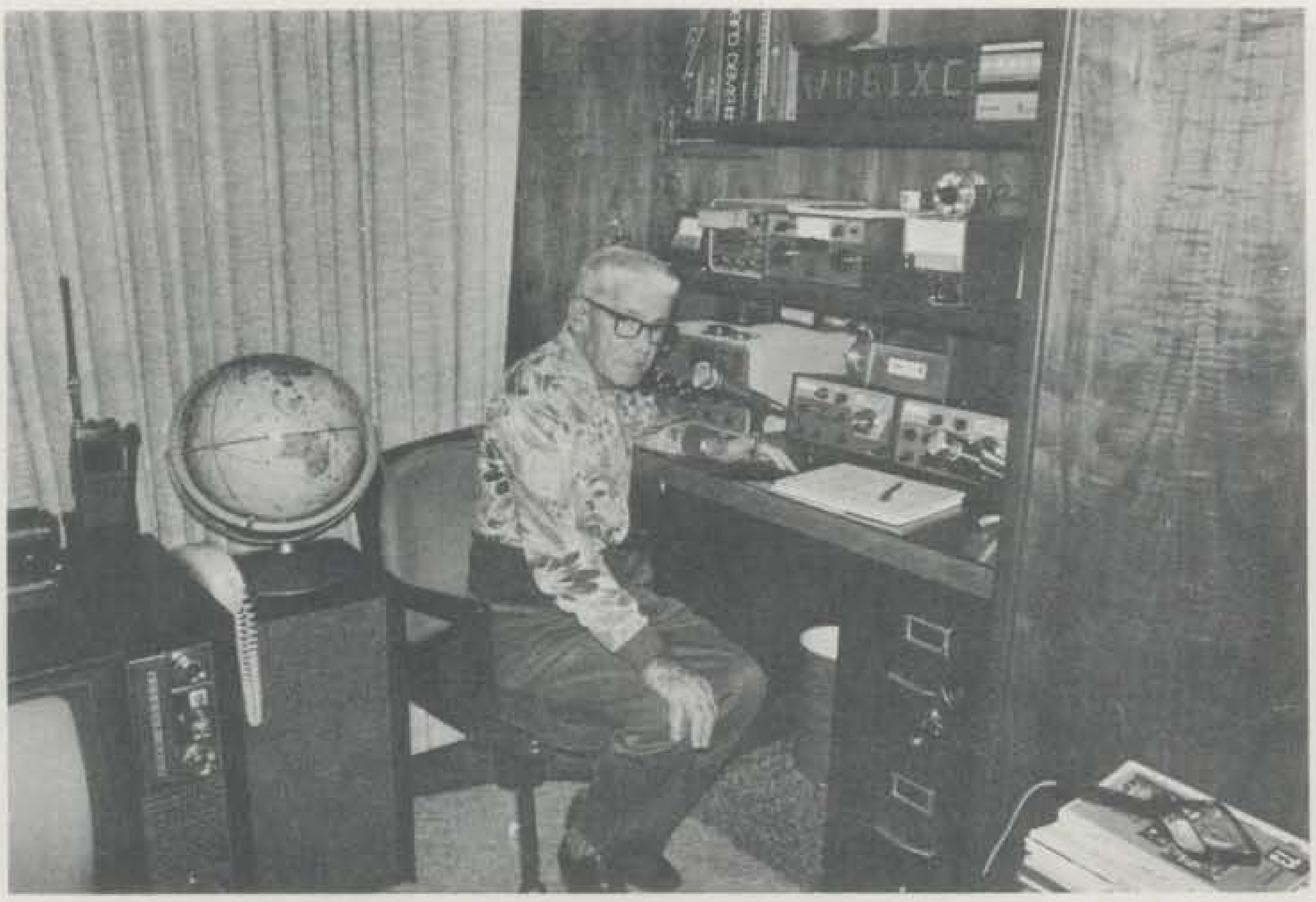
This is the 12th annual party sponsored by the Stanley S. Holmes Chapter in which telephone pioneer ham operators will be able to contact other members in the United States, Canada and in foreign countries. (F2CA will be looking for stateside QSOs.)

Exchange: Signal report, contact number, chapter name and number.

Scoring: One point for each exchange with a Pioneer in any chapter. And one point for each different chapter worked.

The same station may be worked on more than one band, but only one

*14 Sherwood Rd., Stamford, Conn. 06905



The DX fraternity was saddened to hear of the passing away of John Martin, VK3JW on August 22nd. John will be remembered for his DX-pedition to Mellish Reef as VK9JW, putting that spot on the air for the first time. The Pacific DX Net which John ran efficiently for many years is donating the "VK3JW Memorial Trophy" to the CQ WW Contest, which will be awarded in perpetuity to the highest scoring single-op 14 MHz phone station in Oceania. John is shown here at WB6IXC when he visited Dennis in 1974.

mode per band.

Frequencies: Phone — 3969, 7275, 14295, 21365, 28675, 50.100 to 50.250, 144.275 to 145.500. C.W. — 3565, 7065, 14065, 21065. Also any frequency permited by FCC regulations for RTTY, ATV, 160 and etc.

Be sure to indicate your chapter name on your log and mail no later than January 10th to Gene Przebieglec, WB2ZMU, Stanley S. Holmes Chapter #55, Telephone Pioneers of America, 100 Central Avenue, Kearney, N.J. 07032

ARRL 10 Meter Contest

Starts: 1200 GMT Saturday, December 11
Ends: 2359 GMT Sunday, December 12

This is the 4th annual contest on 10 meters and has gained popularity even in this period of the low sunspot cycle.

This is a worldwide activity in which DX stations are permitted to work other DX. You are not limited to working W/K and VE's only. The same station may be worked on both phone and c.w.

Exchange: Stations in the 50 U.S. states and Canada send RS(T) and their state or province. Others send RS(T) and a consecutive contact number starting with 001. (KP4, KV4, KZ5, KC6 and etc. also use a contact number.) Stations not landbased given their ITU region.

Scoring: Each completed QSO is worth 2 points, 4 points if its with a Novice. The multiplier is determined by the U.S. states, VE call areas, DXCC countries and ITU regions worked. (U.S. and Canada not counted)

Frequencies: C.W. — 28000-28050, Novice — 28100-28150, S.S.B. — 28500-28600, A.M. — 28800-29000. Oscar contacts permitted.

Awards: Certificates to the highest scoring single operator entry in each ARRL section, VE call area and DX country. Multi-operator and Novice awards will be given if three or more entries in a section are received.

Here again it is recommended you send a large s.a.s.e. to ARRL for appropriate log forms.

Mailing deadline for entries is Jan. 21st to: ARRL Communications Dept., 10 Meter Contest, 225 Main Street, Newington, Conn. 06111

1976 Results

French Contest

C.W.

ACIPL	27,115
W1FJJ	18,666
AC1OPJ	1,122
AC3ARK	10,512
K4IEX	20,136
WB4OGW	10,974
WB4EDD	768
K5ETA	3,780
W8VSK	15,200
AC8DSO	1,080
W9OHH	8,756
VE3DMC	3,304

Phone

F2YS/W2	17,004
AC4WSF	714
AD8CFU	1,710
VE3BS	38,290

Bermuda Contest

C.W.		Phone	
K2BT	11,253	W1HFB	37,170
VE1CD	10,668	W4UPJ	21,942
G3FXB	32,637	G4GI	46,494
G4BUE	22,176	G3VPW	24,420

Winners and runner-ups. The winners received their awards at a banquet in Hamilton, Bermuda last month. G4BKI/VP9 (CW) and VP9IB (Ph) were the top Bermudians.

Hungarian C.W. Contest

Starts: 1600 GMT Saturday, December 11
Ends: 1600 GMT Sunday, December 12

Its the HA's working the world on all bands 3.5 thru 28 MHz on c.w. only.

Operation will be in three classes: Single operator, single band; single operator, all band; and multi-operator all band. (Club stations enter the latter.)

Exchange: RST plus a contact number starting with 001. In addition the HA stations will send 2 letters to identify their county.

Scoring: One point for each HA contact. And a multiplier of one for each different HA county worked on each band. (Same station may be worked once on each band.)

HA counties: BA, BP, BE, BN, BO, CS, FE, GY, HA, HE, KO, NO, PE, SA, SO, SZ, TO, VA, VE, ZA.

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

Awards: Certificates to the first place winner in each country, and each class.

Logs must be made out in the usual form plus a summary sheet and a signed declaration. Send within six weeks after the end of contest to: Radio Amateur League of Budapest, P.O. Box 2, H-1553 Budapest, Hungary.

Spanish C.W. Contest

Starts: 2000 GMT Saturday, December 11
Ends: 2000 GMT Sunday, December 12

Its the world working the Espanoles on c.w. in this one. Use all bands, 3.5 thru 28 MHz.

Exchange: RST plus a three figure QSO number starting with 001.

Scoring: Contacts between EA stations and the Phillipines or Hispanoamerican countries are worth 3 points. Following prefixes will be considered as three pointers: DU, CE, CM/CO, CP, CX, HC, HI, HK, HP, HR, KP4, LU, OA, PY, TG, TI, XE/XF, YN, YS, YV, ZP or equivalent prefixes.

Between EA and all other non-Hispano and non-European countries, 2 points.

Between EA and Europeans, 1 point.

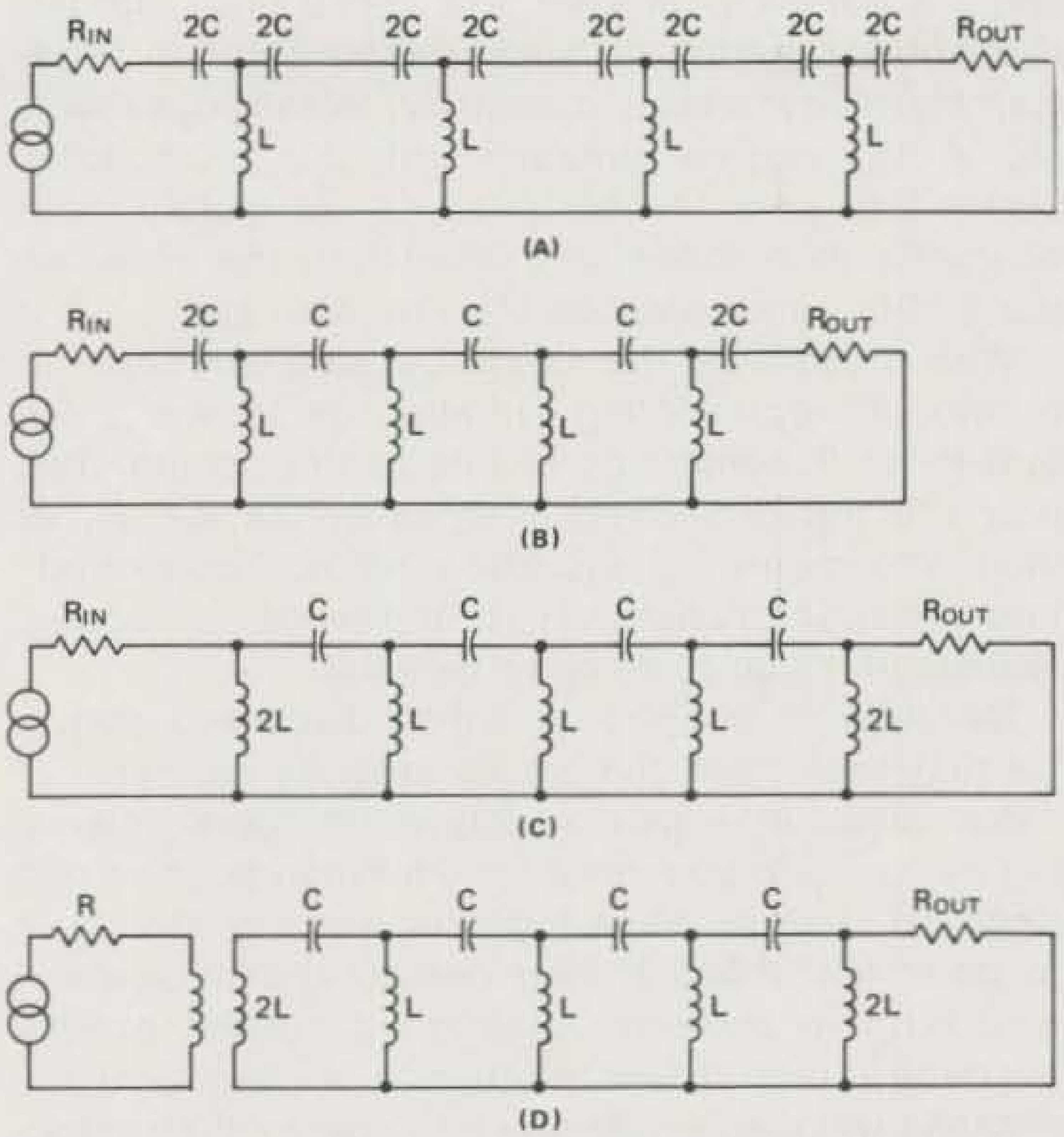
Multiplier: For EA, each DXCC country worked on each band. All others use EA call districts worked on each band.

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

(Continued on page 90)

of light propagation during the latter portion of the last century. Once the wave nature of light was postulated, it seemed necessary to provide a *medium* in which such waves could perform their undulations. Of course, the analogies to water waves, and to acoustic waves in air, are quite obvious. To serve this purpose, the so-called "ether," "or aether" was concocted. In order for ether to harmonize with observable nature and with experiment, it had to be endowed with some wonderfully-magic properties. Its density and viscosity were *zero,* and it was completely transparent. It permeated everything. The very science which objected to theological assertations regarding things pertaining to spiritual and material domains, now fabricated its own invisible, unfathomable, but nevertheless omnipotent state-of-being. Ultimately, the idea of an ether lost favor after experimental investigation failed to disclose an "ether wind" resulting from the earth's rotational and orbital motions through it. In retrospect, one ponders the validity of the search for ether motion, considering the teneous nature predicated for this medium. Interestingly, we now know that liquid helium at near-zero temperature actually displays weird properties which are attributed to its zero viscosity!

It is difficult to conclude that the ether has *really* been abandoned. Although the mathematician abides in peace with his law-obeying fields, the physicist has identified an almost embarrassingly number of "particles", all possessing the requisite properties to bridge the mathematics with "reality," or at least with "something" the mind can relate to, in the same sense that relationships are perceived in everyday life. When one investigates these particles, the never-never world of the ether almost assumes tangible properties. At the very least, it appears that the ether concept remains alive, but in more sophisticated form, and with a change in the style of the descriptive semantics. Let's consider, for example, the *photon.* This beautiful particle is the "carrier" of electromagnetic radiation through empty space. In this role, it would be awkward to attribute to it only corpuscular properties; it simultaneously possesses wave-characteristics. Although, it reminds us of a golf ball in some of its gyrations, it appears very much as a burst of oscillatory energy in other interactions. Obligingly, the photon *disappears* when not "needed," that is, when its free-space velocity cannot be that of light. Most wonderfully, although such "disappearances" extinguish the existence of the photon, the energy invested in it always re-appears in different form—often in the excited states of other "game-playing" particles, such as the ubiquitous *electron.* (which also can behave as a wave-packet when golf balls don't fit the required scenario.)



NOTE:
With proper choice of input winding and R, filter will "see" $R_{IN} = R_{OUT} = \sqrt{L/C} = Z_O$

Fig. 8—Equivalency between high-pass filter configurations. In most important respects, the above arrangements display the same behavior. (A) Three full "T" sections . . . matched condition. (B) Electrically identical circuit, but with paired capacitors replaced by single units. (C) Three full "pi" sections . . . matched conditions. (D) Same as (C), but with inductively-coupled input.

Even though one does not mention *ether* in polite society these days, it is an open secret that Einstein found it convenient to allude to "ghost-fields". Another Nobel-prize laureate, Paul Dirac, postulated space to be "filled" with *undetectable electrons.* Whether physicists, mathematicians, vacuum technologists, and amateurs all refer to the same thing when they speak about space is, indeed, a moot question. Much like Omar Khayyam's wine-grape, "that can with Logic absolute, the Two-and-Seventy jarring Sects confute". the wonderful photon divests the diverse arguments about space of their potency.

One of the games that charged-particles play reminds us of the opossum, which feigns death when exposed to danger. When unlike charges are rapidly brought together, a mutual annihilation takes place, or so you would be led to believe from the evidence of a charge-detecting device, such as an electroscope. Actually, the energy invested in the charges just prior to their demise, now resides in the space-propagating *photons.* From Kent to Superman, as it were! The frequency of the electromagnetic waves associated with the photon is neatly given by E/h, where E is the energy that "disappeared" with the neutralization of the charges, and h is Planck's constant, that cement-like number that bonds together so many relationships in physics, thermodynamics, chemistry, electrodynamics, etc. A little experimentation with this relationship shows that your 14 MHz photons are inately more energetic than those you inject into the ether on the 7 MHz band. (Pardon the Freudian slip)

With photons on the mind now, one can cook up a "model" representing radiation as shown in fig. 5. It is, *as if*, something of this nature occurs. Just how are the oscillating charges in the dipole, or their accompanying induction fields, "converted" into radiation photons? Here, the model is, indeed, realistic, for that is an open question!

Because of the photon antics discussed above, we may look upon the dipole antenna as a sort of "atom-smasher"—as a variety of charge-accelerating devices are popularly called. When positive and negative charges come together, as they are about to do in (C) of fig. 2, their mutual annihilation will give birth to photons. Although it doesn't explain anything (being the consequence of definition) the photons will then propagate into space at the velocity of light. (Velocity through the atmosphere is just a bit less) Now, our antenna takes on the appearance of some kind of a "converter"—does it not convert *electrons* into *photons!*

Anytime charged particles accelerate, collide with other particles, or make transitions between various states, there is the possibility of *excess energy* to

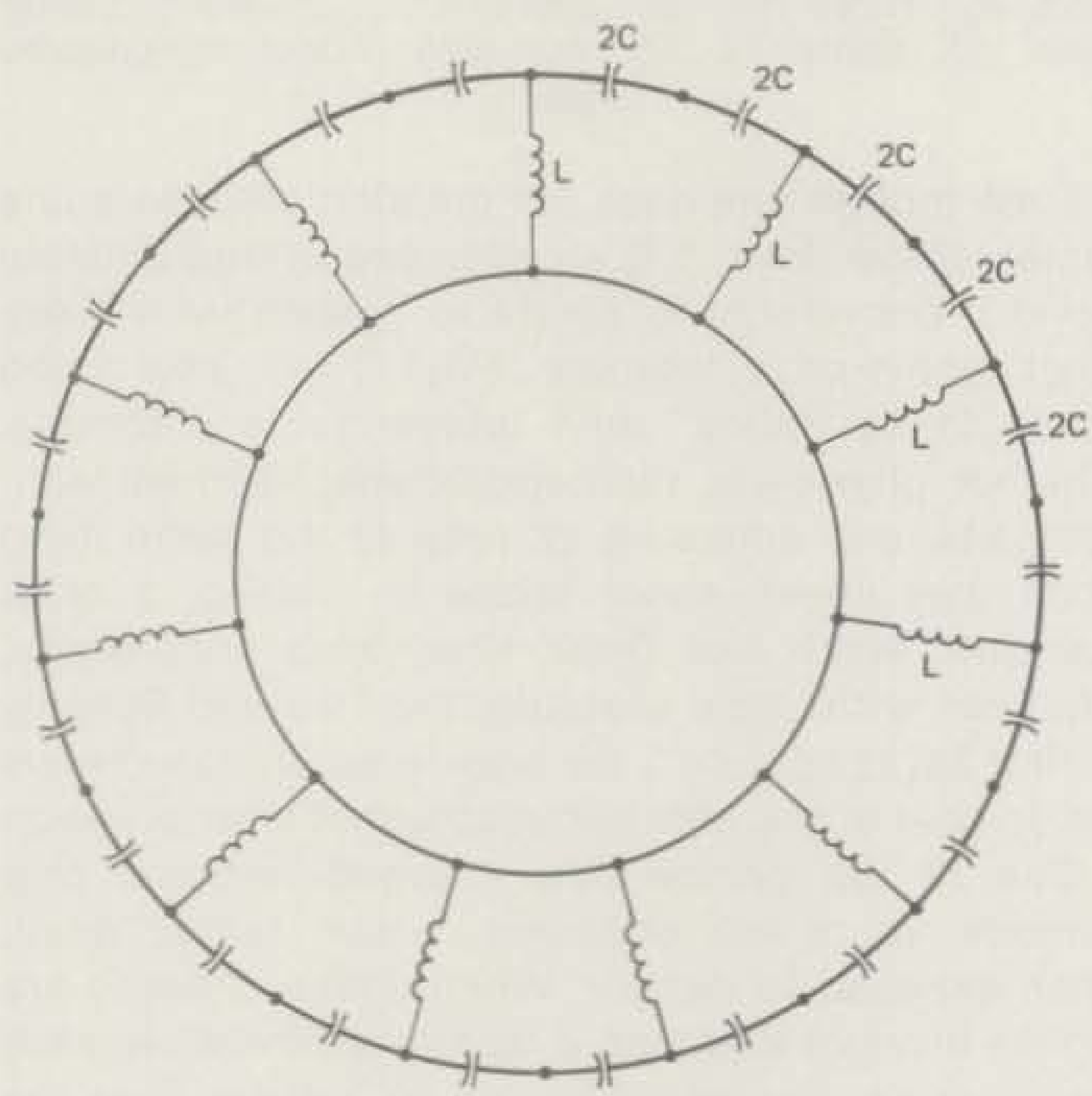


Fig. 9—Transmission line representing the entire universe of space. The important feature of this symbolism is that one cannot grasp hold of either a "beginning" or an "end" to the network. Because of the closed nature of the line, it is not possible to achieve an impedance match when coupling to it. It is further postuated that a dipole antenna can only couple to such junctions as indicated by a dot. A loop antenna, on the other hand, couples inductively to the inductors on the line.

be relinquished. The odds are often favorable that the obliging *photon* will carry away this energy. In fig. 6 an orbital electron in an atom "falls" into a smaller orbit. It now requires less energy to be a satellite of the atomic nucleus than was the case in the larger orbit. As stated, this no-longer needed energy radiates away via photonic "emission." Isn't nature beautiful?

And now—a brief hiatus for the sake of inventory. We have touched upon such concepts and entities as space, ether, photons, fields, electromagnetic waves, and the dielectric constant and permeability of space and materials. The objective has been to try to converge upon a picture of radiation and propagation which would harmoniously embrace these ideas. It may very well be that this endeavor has been attended at least by *partial* success. For example, the expressed dissatisfaction with empty space possessing characteristics of a dielectric material and of a permeable material is suggestively supported by another line of attack: Inasmuch as the velocity of wave propagation, other than the electromagnetic variety, depends upon the nature of the *medium* being traversed, it would appear axiomatic that the very definite free-space velocity of radio waves stems from the very definite properties of space. This statement—as it is worded—may not bring the antagonists out of the woodwork. Quite frankly, however, the *implication* is intended that something more "meaty" than an ideal vacuum inhabits the realms of the universe we blithely call "space."

Also, we have monkeyed a bit with "models." Let it be conceded that most such representations of natural phenomena fall short of a one-to-one analogy of the actual happenings. Some are best described as being childish, or downright crude. At the same time, those hydraulic counterparts of electric circuits *did* prove helpful when we were first groping our way through elementary electrical-theory. We may tend to conceal it at times, but our path to higher, and more intricate thought patterns is usually illumined by mental associations with more familiar things. Thus, a text slanted to graduate students in nuclear physics contains not only those frightening integral symbols, but a good sprinkling of simple drawings of *water drops* to implant the root-thinking of the way in which atomic nuclei get together and separate.

As a consequence of such meditations, we will now proceed with a "model" of space in which electromagnetic waves can propagate at their proper speed, and which, hopefully, helps explain what happens when we insert those "probes" we call antennas into the wild blue yonder. It is, frankly, not likely that anyone will be induced to run down to the nearest hardware store. But, it may well happen that some measure of enhanced insight will

(Continued on page 91)

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Keyboard Modification *(from page 60)*

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Parts List

2 each 74193
3 each 7400
5 each unused Key Switches or SPST Push-Buttons
1 each IK ¼ W Resistor
1 each .01 capacitor Ceramic Disc

210 Tube *(from page 47)*

RCA, meanwhile, had reorganized the transmitting tube facility into the *RCA Manufacturing Company* and was not about to let these upstarts steal the lucrative tube business away from them. So in December, 1937 *RCA* announced the astonishing 809, the grand-child of the 210 and son of the 801A. The 809 had a maximum input rating of 75 watts up to 60 MHz, a rugged 25 watt anode and sold for $2.50. Best of all, RCA shrewdly dropped the old 7.5 volt filament and substituted a heavy-duty 6.3 volt filament in the new tube, to better match the popular 6.3 volt receiving tubes that many amateurs used in the driver stages of their transmitters.

And so the 210, the standard of comparison since 1925, was dead. Killed finally by the company that originally marketed it, it was superseded by a new family of transmitting tubes. The 809 was quickly followed by the larger 811 and 812, which provided 50 watts of plate dissipation for only $3.50. The 812 gradually faded into obscurity, but the 811, revised as the 811A, is still a popular tube for linear amplifier service today.

So the 811A stands as the final version of the old 210, a far cry from the original concept of a tube designed to deliver "enormous amounts of power". While the old 210 sold for $9 (equivalent to about $45 in today's money), the 811A today still sells in the same price bracket.

And that brings up an interesting question. Either today's tube manufacturers are more efficient and can build better products for less, or the tube companies of the early "twenties" mercilessly "screwed" their customers. Undoubtedly the Supreme Court decision of 1931 had something to do with this. What's *your* verdict? ■

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ADVERTISER'S INDEX

Contest Calendar *(from page 80)*

The same station may be worked on each band for QSO and multiplier credit.

Awards: Gold, silver and bronze medals to first 3 place winners, both in Spain and overseas stations.

Include a summary sheet with your log showing the scoring and other pertinent information, the usual signed decalartion, and your name and address in BLOCK LETTERS.

Your entry must be postmarked no later than one month after the end of the contest to: U. R. E. Concurso Internacional C.W. 1976, P.O. Box 220, Madrid, Spain.

S.O.W.P. QSO Party

Starts: 0000 GMT Saturday, December 18
Ends: 2400 GMT Sunday, December 19

The Society of Wireless Pioneers will be holding a QSO party for the first time using *voice only*. Traditionally it has always been on c.w.

There will be no set exchange or scoring, just a social "get-together" to exchange greetings.

Activity will be found in the General portions of each phone band, about 25 kHz above the low edge.

Since no awards are being made no logs are requested.

Listen for the S.O.W.P. Net on 14125 MHz c.w. each Thursday at 1500 GMT. W5QKU will give you all the details.

Novice *(from page 56)*

passing his General exam. But a month later, he was still waiting for the new license to arrive. His record is 30 states and three countries using a Tempo-1 transceiver feeding a Hy-Gain 5-BDQ, five-band trap dipole, 20 feet high. Will's most-rewarding experience of his still-young amateur career has been traffic (3rd-party message) handling on the Novice traffic nets. "I encourage all Novices to join one and advance Amateurs' Public Service image and the hobby itself."

We are at the bottom of the page again. We invite you to contribute to your column with pictures, suggestions for technical discussions, and accounts of your own experiences. What are the impressions of the Novice bands of today compared to how they were years ago when many of the Technicians now active on them were last active on any frequency below 30 MHz. Address your mail to: Herbert S. Brier, W9AD, Novice Editor, CQ Magazine, 409 So. 14th St., Chesterton, Indiana 46304.

73, Herb, W9AD

Radiation *(Continued from page 82)*

ensue. (The author finds himself in a favorable position—whether these notions are "bought" or refuted, the thought-provoking motivation of the article will have been realized!)

Antenna buffs are acquainted with the representation of space by a *transmission line*—space is "modeled" by a line which is accorded an appropriate characteristic impedance, and is comprised of suitable elements to allow radio waves to propagate at the speed of light. These transmission-line models are patterned in the technical literature after *low-pass filters,* such as you have with coaxial cable or TV lead-in. See fig. 7. An objection to this kind of modeling is that it infers the possibility of transmitting a *sustained d.c. signal* through space. Inasmuch as such is not the case, it appears that something might be gained by devising a more realistic model—one that complies more with the facts of life of radiation and propagation.

To this end, *a high-pass filter network* is proposed. Fig. 8 depicts some of the relevant features of the high-pass network. In (A), four cascaded "T" sections are shown. Now, it might appear silly to show the series capacitors-pairs involving capacitors of size 2C. For, it is obvious that these are equivalent to single units of size C. It does happen, however, that the filter designer ordinarily goes through stage (A) before he gets to stage (B). But even more important, we have a reason for illustrating the configuration of (A). This will shortly be revealed. In the meantime, let's jump to the network shown in fig. 8C. This consists of four "pi" sections. For most practical purposes, it can be said to be equivalent to the four "T" section arrangement of (B). This being the case, the modification shown in (D) can be readily understood. Here, we have, again, four cascaded "pi" sections, but the input signal is now inductively coupled. Summing up, the filter, or transmission line networks of fig. 8ABCD can all provide essentially the same behaviour.

Even though the high-pass filter configuration is not commonly used as a "transmission line," it, nonetheless, has some characteristics which are identical to those of the low-pass line. In particular, it is true of both types of networks that the characteristic impedance is given by $\sqrt{L/C}$. And, it is also true that radio-waves propagate along both, the high-pass, and the low-pass network, at a speed of $1/\sqrt{LC}$ meters per second. We must, of course, deal with the units in which L and C are expressed in order that we can obtain some meaningful numbers. Recapitulating our path of progress—we have conjured a model of space which will do everything that the "conventional" model, the low pass network, will do. Unlike the low-pass network, our high-pass arrangement will not "propagate" a steady d.c. signal through space. Hopefully, it may also simulate space in a more analogous fashion in other respects.

The dielectric constant of space is 8.85×10^{-12} farads per meter. In actuality, the dielectric constant of various materials is also expressed in this manner. Thus, when it is stated that the dielectric constant of mylar is 2, what is *really* implied is that this material has a dielectric constant *twice* that of space. The dielectric constant of mylar is therefore, $2 \times 8.85 \times 10^{-12}$, or 17.7×10^{-12} farads per meter. Confusion often arises because the dielectric constant of all substances other than space (vacuum) should be termed *relative* dielectric constant. (Also, if you see the statement that space has a dielectric constant of unity, what is really meant is that it is unity *relative* to all other substances.)

A similar situation pertains to the magnetic permeability of space. The permeability of space is $4\pi \times 10^{-7}$ henries per meter. Again, the permeability of all other substances is expressed in the same manner, that is in henries per meter. When it is stated that the permeability of a substance is 100, what is *really* implied is that the permeability is one-hundred times that of space (vacuum). The permeability of such a substance is therefore, $100 \times 4\pi \times 10^{-7}$, or 400×3.14159 henries per meter. Confusion often arises because the permeability of all substances other than space (vacuum) should be termed *relative* permeability. (Also, if you see the statement that space has a permeability of unity, what is really meant is that it is unity *relative* to all other substances.)

From the above, it is seen that the dimensional description of space as a dielectric "substance" is *so much capacitance per unit length*. And, the dimensional description of space as a magnetically-permeable substance is *so-much inductance per unit length*. So, what can be more natural than depicting space as an LC network? As mentioned, we have decided to view space as a high-pass "transmission line." Let us now see what happens when we plug numbers into the simple equations which describe the behaviour of such a network. For *velocity of propagation,* we have $1/\sqrt{LC}$ meters per second. Substituting the permeability of space for L, and the dielectric constant of space for C, we have,

$$\frac{1}{\sqrt{4 \times \pi \times 10^{-7} \times 8.85 \times 10^{-12}}} = \frac{1}{1 \times 10^{-10}\sqrt{1112}} = \frac{1 \times 10^{10}}{33.485} = 2.99863 \times 10^{8} \text{ meters}$$

per second, or 299,863 kilometers per second, which is within a small fraction of a percent of the value found listed in various physics and engineering handbooks. So far, so good—perhaps our model is beginning to simulate space!

It is well known that fun inspires more fun. So let's investigate our "model" further. Its characteristic impedance is given by $\sqrt{L/C}$. Substituting the same values as we did for L and C in the velocity of propagation calculation, we have
$\sqrt{4 \times \pi \times 10^{7}/8.85 \times 10^{-12}} = \sqrt{14.1993 \times 10^{4}} =$
376.8 ohms, which is the value cited in references for the "impedance of space".

So far our model complies with the nature of space in that d.c. cannot be propagated, in its speed of light-propagation feature, and in its characteristic impedance. What else can we glean from this high-pass transmission line? Referring now to fig. 9, we see the complete transmission line "once around the universe." (Of course there are a near-infinite number of sections.) We now suppose that a dipole antenna can *only* couple into the line at the dotted junctions—where the 2C capacitors join. This is the reason for the paired capacitor representation of fig. 8A. Remember that the line still functions as if it were shown with single capacitors of value C. The essential difference between the line encircling the universe and others we have contemplated, is that the universe line has *no beginning or end*. And that implies that nature is going to frustrate us in any attempt to match impedances, either with a transmitting or a receiving antenna. Consider, for example, an antenna designed to have a radiation resistance of 376.8 ohms. This antenna will *not* make a "reflectionless" coupling into space because at any point where we "connect," the line will see our antenna in *parallel* with its own characteristic impedance. It is suggested that this inescapable mismatch corresponds to the existence of the induction field—a region characterized by energy going to and fro, or in other words, a region of high s.w.r.! (Refer back to fig. 5).

A loop antenna couples electro-magnetically to the *inductors* of fig. 9. The same hypothesis with respect to impedance-matching prevails because of the closed configuration of the system. Otherwise, the loop antenna is postulated to couple to the line as suggested in fig. 8D.

We will not concern ourselves with the cut-off frequency of the line. This is because cut-off is the consequence of *internal reflections* in any filter-type network. Inasmuch, for our lifetime at least, our r.f. is on a *one way* journey into space, the line will *not* exhibit its high frequency cut-off. (which, to appease the curious would be close to 24 MHz

from $f_c = \dfrac{1}{4\pi\sqrt{LC}}$

The inherent impedance-mismatch between *any* antenna, and space, can provide us with some down-to-earth insights regarding the length, or extensiveness, of our radiating systems. A prime reason for getting lots of wire into our "sky hooks" is to couple more tightly to the spatial "load". Or, in terms of our transmission-line model, a closer *approach* to impedance match is attained, thereby allowing for greater transfer of power. In actual practice, increasing the antenna dimensions beyond several wavelengths in the case of dipoles leads to diminishing returns with regard to performance. This is especially true in amateur installations where that old demon, *economics,* rears its ugly head at the slightest provocation. The problem centers about the increase in *dissipative losses* which tends to accompany larger antennas. Thus, it does not necessarily follow that if "a little is good, a lot is much better". Generally speaking, it is not worthwhile to seek increased radiation-efficiency by enlargening dipoles beyond a half wave-length. Of course, longer, antennas may be used for *other* reasons, such as manipulation of directivity or of the angle of radiation, or for resonating purposes, or as a means of securing multi-band operation.

Fortunately, even "too short" dipoles—those with radiating elements appreciably less than a quarter wavelength—can radiate efficiently, *provided* that the dissipative losses of the antenna system (which includes feeders, loading coils, "top-hats", traps, matching networks, grounds or ground planes, etc.) can be kept low. This is readily borne out by the relationship, Radiating Efficiency =

$$\frac{\text{Radiation Resistance}}{\text{Dissipative Losses} + \text{Radiation Resistance}}$$

$\times$ 100. Thus, a tiny antenna with low radiation resistance can radiate efficiently if the dissipative losses of the overall antenna system are low.

Practically, we can only go so far with shortened radiators, for the dissipative losses tend to mount up rapidly in the loading coil and feeder system. This, indeed, had been the situation with the now out-moded low-frequency marine transmitters. The extremely low radiation-resistance presented by the necessarily-short antennas on small boats made even fractional—ohm losses assume great significance in the above equation. To the extent that such losses could be kept low, these short antennas were "willing" to give a good account of themselves. To paraphrase an astrological precept, a low radiation-resistance *inclines*, but does *not compel* poor radiating-efficiency!

The inevitable termination of all things now hastens our probe to its own end. It is hoped some fuel has been provided for the furnaces of creative imagination. The time appears ripe for a genuinely *new* radiative process, some really different antenna-structures, or an *explanatory theory* telling us how the r.f. gets out there. If none of these are immediately forthcoming, let's at least originate some new particles, as do to-day's scientists with almost clockwork regularity. What are your notions of a *radiatron*, or a *propagatron*? ■

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