CQ Amateur Radio

ICD 08240

March 1977
$1.25

Amateur Radio is People...

The Radio Amateur's Journal

ANNOUNCING AN EXCITING NEW 2-METER TRANSCEIVER FROM KENWOOD

the

TR-7400A

Featuring Kenwood's New and Unique CONTINUOUS TONE CODED SQUELCH SYSTEM

4 MHz BAND COVERAGE

25 WATT OUTPUT

FULLY SYNTHESIZED

UNIQUE SQUELCH SYSTEM

The TR-7400A may be used on your favorite repeater, no matter what type of squelch system is used. The continuous tone coded squelch (CTCS) may be used for both transmit and receive or for transmit only. Tone burst operation may also be used.

SYNTHESIZED, 800 CHANNELS

The phase-locked loop (PLL) frequency synthesizer in the TR-7400A divides the 4 MHz bandwidth into 400 channels at intervals of 10 KHz. The frequency may be offset 5 KHz higher with the push of a button, thus providing 800 discrete channels.

REPEATER OFFSET

A convenient front panel switch offsets the transmit frequency of the TR-7400A up OR down 600 KHz for standard repeater operation. This offset circuit uses digital technology to provide a highly stable offset frequency without spurious response. A dual color LED indicates the direction of offset from the displayed receive frequency.

OUTSTANDING RECEIVER PERFORMANCE

Large-sized helical resonators with high Q minimize undesirable interference from outside the 2-meter band. The large helical resonators, 2-pole 10.7 MHz monolithic crystal filter, and MOSFET front-end circuitry combine to give outstanding receiver performance.

TONE PAD CAPABILITY

A jack is provided to allow convenient connection of a tone pad to the TR-7400A.

FINAL PROTECTION CIRCUIT

The final transistor in the TR-7400A is protected from antenna impedance mismatch. Excessive reflected power reduces the amount of drive to the final transistor rather than turning off the final stage. This practical feature allows continued safe operation at a reduced power level whether the antenna system becomes opened or shorted.

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

KENWOOD

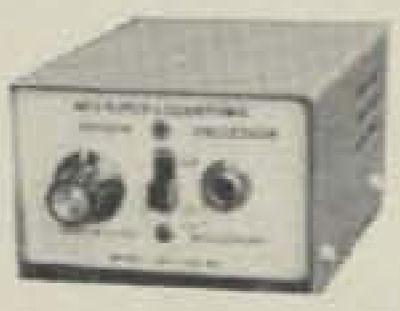
...pacesetter in amateur radio

TR-7400A Specifications

- Range: 144.00 MHz to 147.995 MHz
- Mode: FM
- 800 Channels: 5 KHz spaced
- Sensitivity: Better than 0.4 uV for 20 dB quieting; Better than 1 uV for 30 dB S/N
- Squelch Sensitivity: Better than 0.25 uV
- Selectivity: 12 KHz at −6 dB down; 40 KHz at −70 dB down
- Image Rejection: Better than −70 dB
- Spurious Interference: Better than −60 dB
- Intermodulation: Better than 66 dB
- Receive System: Double conversion
- First IF: 10.7 MHz
- Second IF: 455 KHz
- Audio Output: More than 1.5 Watts (8 ohm load)
- RF Output Power: 25 Watts (High); 5-15 Watts (Low-adjustable)
- Antenna Impedance: 50 ohms
- Frequency Deviation: ±5 KHz
- Spurious Response: Better than −60 dB
- Tone Pad Input Impedance: 600 ohms
- Tone Burst Duration: 0.5 to 1.0 sec.
- CTCS Range: 88.5 Hz to 156.7 Hz
- Microphone: Dynamic, with PTT switch, 500 ohms
- Voltage: 11.5 to 16.0V DC (13.8V DC nominal)
- Current Drain: Less than 1A in receive (no input signal)
- Current Drain: Less than 8A in transmit
- Polarity: Negative ground
- Temperature Range: −20 to +50 degrees C
- Dimensions: 182 mm (7-3/16") wide; 270 mm (10-5/8") deep; 74 mm (2-7/8") high
- Net Weight: Approximately 2.8 kg (6.2 lbs.)

Call toll-free 800-647-8660 for products by MFJ ENTERPRISES

400% MORE RF POWER
PLUGS BETWEEN YOUR MICROPHONE AND TRANSMITTER



$49.95

LSP-520BX. 30 db dynamic range IC log amp and 3 active filters give clean audio. RF protected. 9 V battery. 3 conductor, ¼" phone jacks for input and output. 2-3/16 x 3-1/4 x 4 inches.

$59.95

LSP-520BX II. Same as LSP-520BX but in a beautiful 2-1/8 x 3-5/8 x 5-9/16 inch Ten-Tec enclosure with uncommitted 4 pin Mic jack, output cable, rotary function switch.

SUPER LOGARITHMIC SPEECH PROCESSOR

Up To 400% More RF Power is yours with this plug-in unit. Simply plug the MFJ Super Logarithmic Speech Processor between your microphone and transmitter and your voice is suddenly transformed from a whisper to a **Dynamic Output.**

Your signal is full of punch with power to slice through QRM and you go from barely readable to "solid copy OM".

$27.95

CWF-2BX Super CW Filter

By far the leader. Over 5000 in use. Razor sharp selectivity. 80 Hz bandwidth, extremely steep skirts. No ringing. Plugs between receiver and phones or connect between audio stage for speaker operation.

• Selectable BW: 80, 110, 180 Hz • 60 dB down one octave from center freq. of 750 Hz for 80 Hz BW • Reduces noise 15 dB • 9 V battery • 2-3/16 x 3-1/4 x 4 in. • CWF-2PC, wired PC board, $18.95 • CWF-2PCK, kit PC board $15.95

$49.95

CMOS-8043 Electronic Keyer

State of the art design uses CURTIS-8043 Keyer-on-a-chip.

• Built-in Key • Dot memory • Iambic operation with external squeeze key • 8 to 50 WPM • Sidetone and speaker • Speed, volume, tone, weight controls • Ultra reliable solid state keying ±300 volts max. • 4 position switch for TUNE, OFF, ON, SIDETONE OFF • Uses 4 penlight cells • 2-3/16 x 3-1/4 x 4 inches

$39.95 **NEW**

MFJ-16010 Antenna Tuner

Now you can operate all band — 160 thru 10 Meters — with a single random wire and run your full transceiver power output — up to 200 watts RF power OUTPUT.

• Small enough to carry in your hip pocket, 2-3/16 x 3-1/4 x 4 inches • Matches low and high impedances by interchanging input and output • SO-239 coaxial connectors • Unique wide range, high performance, 12 position tapped inductor. Uses two stacked toroid cores

$29.95

SBF-2BX SSB Filter

Dramatically improves readability.

• Optimizes your audio to reduce sideband splatter, remove low and high pitched QRM, hiss, static crashes, background noise, 60 and 120 Hz hum • Reduces fatique during contest, DX, and ragchewing • Plugs between phones and receiver or connect between audio stage for speaker operation • Selectable bandwidth IC active audio filter • Uses 9 volt battery • 2-3/16 x 3-1/4 x 4 inches

$27.95

MFJ-200BX Frequency Standard

Provides strong, precise markers every 100, 50, or 25 KHz well into VHF region.

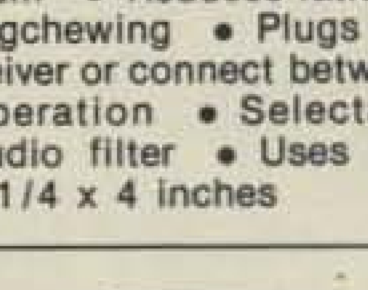
• Exclusive circuitry suppresses all unwanted markers • Markers are **gated** for positive identification. CMOS IC's with transistor output. • No direct connection necessary • Uses 9 volt battery • Adjustable trimmer for zero beating to WWV • Switch selects 100, 50, 25 KHz or OFF • 2-3/16 x 3-1/4 x 4 inches

$49.95

MFJ-1030BX Receiver Preselector

Clearly copy weak unreadable signals (increases signal 3 to 5 "S" units).

• More than 20 dB low noise gain • Separate input and output tuning controls give maximum gain and RF selectivity to significantly reject out-of-band signals and reduce image responses • Dual gate MOS FET for low noise, strong signal handling abilities • Completely stable • Optimized for 10 thru 30 MHz • 9 V battery • 2-1/8 x 3-5/8 x 5-9/16 inches



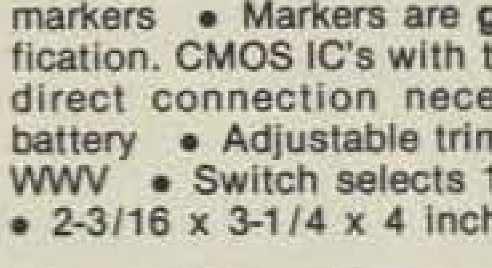
$27.95

MFJ-40T QRP Transmitter

Work the world with 5 watts on 40 Meter CW.

• No tuning • Matches 50 ohm load • Clean output with low harmonic content • Power amplifier transistor protected against burnout • Switch selects 3 crystals or VFO input • 12 VDC • 2-3/16 x 3-1/4 x 4 inches

MFJ-40V, Companion VFO $27.95
MFJ-12DC, IC Regulated Power Supply, 1 amp, 12 VDC $27.95



$15.95 **NEW**

CPO-555 Code Oscillator

For the Newcomer to learn the Morse code.
For the Old Timer to polish his fist.
For the Code Instructor to teach his classes.

• Send crisp clear code with plenty of volume for classroom use • Self contained speaker, volume, tone controls, aluminum cabinet • 9 V battery • Top quality U.S. construction • Uses 555 IC timer • 2-3/16 x 3-1/4 x 4 inches

TK-555, Optional Telegraph Key $1.95

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Try any MFJ products and if you are not completely satisfied, return it within 30 days for a full prompt refund (less shipping). Call us today **toll free 800-647-8660** and charge your BankAmericard or Master Charge, or mail your order in today with your check or money order (or use your BAC or MC). Please add $2.00 for shipping and handling.

73, Martin F. Jue, K5FLU

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CQ

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The Radio Amateur's Journal

FEATURES

DEPARTMENTS

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For the SERIOUS CW/SSB OPERATOR...

500 Hz crystal filter now included
for extra fine cw reception – it's not an option

While operating cw, you may receive with either the 2.1 kHz or the 500 Hz crystal filter —
they are front panel selectable!

Full rated at 250 watts cw input
Ideal for the upgraded Novice/Technician class licenses

the TR-4Cw is a great pile-up puncher for DX chasing and contesting —
it runs more power output *than most transceivers* run input!

TR-4Cw with RV-4C Remote VFO

the New Drake TR-4Cw
sideband/cw transceiver

The serious DX chaser, contester, and traffic handler knows the value of power when the going gets rough in heavy QRM. He also knows the value of sharp receiving selectivity to pull the other guy through the roar.

The NEW Drake TR-4Cw is a great combination of transmit power and receive selectivity. It runs 300 watts PEP input on ssb, and 260 watts input on cw. It is very conservatively rated at these power levels.

When transmitting cw, you're not "locked" into the cw receiving filter as in some rigs. You have your choice of either filter—they're front panel selectable. The cw filter is standard—not an option.

Drake TR-4Cw, Ssb/Cw Transceiver	**$649.00**
Drake AC-4, Ac Supply	**120.00**
Drake DC-4, Dc Supply	**135.00**
Drake RV-4C, Remote VFO	**120.00**
Drake 34PNB, Noise Blanker	**100.00**

To receive a FREE Drake Full Line Catalog, please send name and date of this publication to

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thoughts to consider about the
New Drake TR-4Cw

Of the many questions and comments we receive, we feel the following are very significant. Please spend a moment, and consider these points with us:

The TR-4Cw still uses tubes.

True. While using a combination of transistors and tubes, the TR-4 system makes greater use of tubes. Tubes are easy to change, and with the use of a spares kit, they can be readily replaced from the jungles of the Amazon to the arctic tundra—anytime, anyplace.

Also, the TR-4 system uses a *triple* tube power amplifier. It runs more power *output* than most transceivers run *input*. Serious DX-ers and contesters know the value of power when the going gets rough in heavy QRM. The system is also ideal to drive the various grounded grid linears that require higher drive levels.

The TR-4 system has been around a long time— what does it offer me today?

True again. The system has been around, and improved, over a 13 year period. It is one of the most "bug-free" systems we know.

Interestingly, the TR-4Cw offers some features still not found on most "new" rigs today. For example, frequency tuning in the TR-4 system is accomplished by the use of a precision permeability tuned oscillator (PTO). This makes use of a slug traveling through a coil instead of the older variable capacitor technique. The PTO gives us extra good frequency stability and dial linearity. Speaking of something old, the variable capacitor technique dates back over 50 years!

The cw filter in the TR-4Cw can be independently switched from the front panel. You're not "locked" in to the cw filter when in cw mode as in most transceivers. Many operators prefer to tune randomly with the wider filter. You can do it with the TR-4Cw.

The optional 34PNB noise blanker works so well, you'll have to try it to believe it! It's a miniature 17 transistor receiver with full noise gating functions. Try it in a side by side test at your dealer's.

And what about service on the TR-4Cw?

We service what we sell, and parts are always available. After nearly 20 years, we are still able to service Drake 1-A receivers, so we know there are many in use today. We've been around since 1943, and we fully intend to serve radio amateurs for the long haul. Does the other company you may be considering have the same intentions?

We do—and we have the track record to prove it!

To receive a FREE Drake Full Line Catalog, please send name and date of this publication to:

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for the experimenter!

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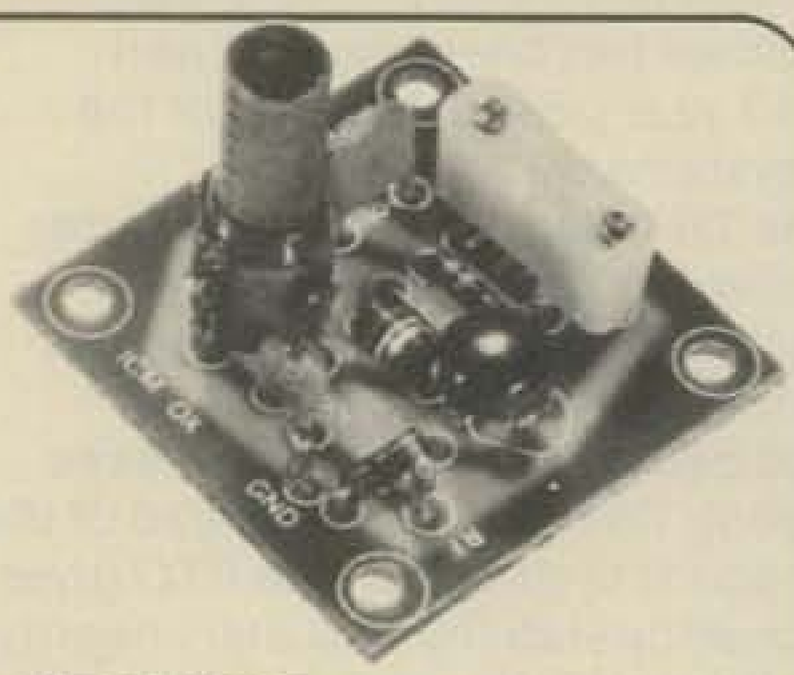
OSCILLATORS • RF MIXER • RF AMPLIFIER • POWER AMPLIFIER



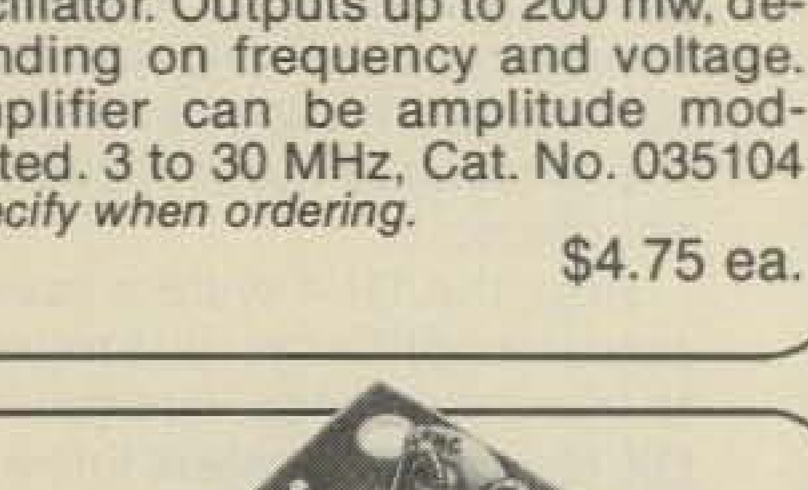
OX OSCILLATOR
Crystal controlled transistor type. 3 to 20 MHz, OX-Lo, Cat. No. 035100. 20 to 60 MHz, OX-Hi, Cat. No. 035101
Specify when ordering.
$3.95 ea.

MXX-1 TRANSISTOR RF MIXER
A single tuned circuit intended for signal conversion in the 30 to 170 MHz range. Harmonics of the OX or OF-1 oscillator are used for injection in the 60 to 179 MHz range. 3 to 20 MHz, Lo Kit, Cat. No. 035105. 20 to 170 MHz, Hi Kit, Cat. No. 035106
Specify when ordering.
$4.50 ea.

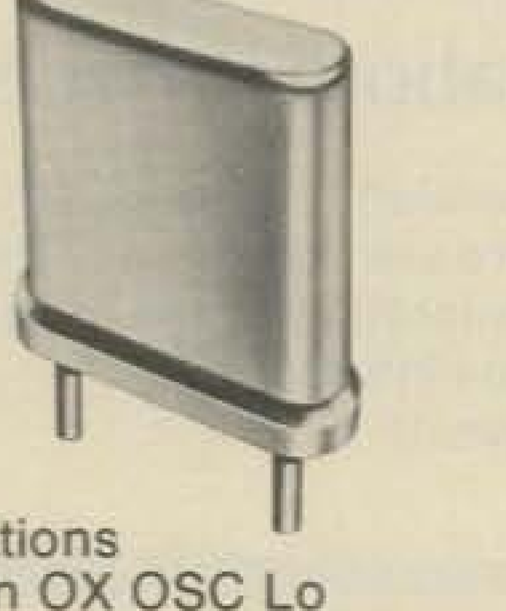
PAX-1 TRANSISTOR RF POWER AMP
A single tuned output amplifier designed to follow the OX or OF-1 oscillator. Outputs up to 200 mw, depending on frequency and voltage. Amplifier can be amplitude modulated. 3 to 30 MHz, Cat. No. 035104
Specify when ordering.
$4.75 ea.

OF-1 OSCILLATOR
Resistor/capacitor circuit provides osc over a range of freq with the desired crystal. 2 to 22 MHz, OF-1 LO, Cat. No. 035108. 18 to 60 MHz, OF-1 HI, Cat. No. 035109
Specify when ordering.
$3.25 ea.

SAX-1 TRANSISTOR RF AMP
A small signal amplifier to drive the MXX-1 Mixer. Single tuned input and link output. 3 to 20 MHz, Lo Kit, Cat. No. 035102. 20 to 170 MHz, Hi Kit, Cat. No. 035103.
Specify when ordering.
$4.50 ea.



BAX-1 BROADBAND AMP
General purpose amplifier which may be used as a tuned or untuned unit in RF and audio applications. 20 Hz to 150 MHz with 6 to 30 db gain. Cat No. 035107
Specify when ordering
$4.75 ea.



.02% Calibration Tolerance
EXPERIMENTER CRYSTALS
(HC 6/U Holder)

Cat. No.	Specifications	
031080	3 to 20 MHz — for use in OX OSC Lo *Specify when ordering*	$4.95 ea.
031081	20 to 60 MHz — For use in OX OSC Hi *Specify when ordering*	$4.95 ea.
031300	3 to 20 MHz — For use in OF-1L OSC *Specify when ordering*	$4.25 ea.
031310	20 to 60 MHz — For use in OF-1H OSC *Specify when ordering.*	$4.25 ea.

Shipping and postage (inside U.S., Canada and Mexico only) will be prepaid by International. Prices quoted for U.S., Canada and Mexico orders only. Orders for shipment to other countries will be quoted on request. Address orders to:
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Oklahoma City, Oklahoma 73132.

ICM

International Crystal Mfg. Co., Inc.
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Oklahoma City, Oklahoma 73102

Announcing

• **Amboy, IL** – The Rock River Radio Club Hamfest will be held on April 24, at the 4H Center in Amboy on Routes 30 and 52. Same place as last year. Tickets $1.00 in advance. $2.00 at gate. Camper parking available at a nominal fee. For more information Write: Carl Karlson, W9ECF, Nachusa, Illinois 61057.

• **Grand Rapids, MI** – The Grand Rapids React is holding their third annual Swap and Shop to be held at the Northeast Jr. High School, 1400 Fuller Ave., N.E. in Grand Rapids on April 2nd from 9 am to 5 pm. Featured will be Ham Equipment, Monitors, CB's and Electronic Parts also door prizes. For further information contact the Grand Rapids React Inc., P.O. Box 2402, Grand Rapids, MI 49509.

• **West Trenton, N.J.** – The annual Delaware Valley Radio Association (W2ZQ/WR2ADE) flea market and auction will be held on Sunday, May 1, 9 am, rain or shine at the Villa Victoria Academy in West Trenton. The school is located adjacent to Rt. 29 near the junction of Rt. 29 and I-95.) Talk in on 07/67 and 146.52. Refreshments are available. Advance registration $1.00; $1.50 at the gate. For additional information or tickets write: DVRA, P.O. Box 7024, West Trenton, N.J. 08628, s.a.s.e. please.

• **Milwaukee, WI** – The 6 Mic Club of Milwaukee, WB9WWP, will be giving a certificate for working 48 states with endorsement for 49th and 50th State on 6 meters on all modes on single-mode endorsement. For more information write: Jim Herriges, WB9RSK, 542 East Van Beck Ave., Milwaukee, WI 53207.

• **Sullivan, IL** – The Moultrie Amateur Radio Klub will have its 16th annual Hamfest the Last Sunday of April at Wyman Park, Sullivan, IL. Heated indoor area and large outdoor parking area. No Charge to vendors. For information Write Mark Radio Klub, P.O. Box 327, Mattoon, IL 61938. Talk In 146.94. For more information write: Joseph W. Wiandt, Moultrie Amateur Radio Klub, P.O. Box 327, Mattoon, IL 61938.

DIGITAL PERFECTION NOW

ICOM recently introduced the revolutionary new **IC-211** 4 MEG All Mode transceiver with dual tracking, optically coupled VFO's: just the first of a great new wave of ICOM LSI synthesized radios. And now the **IC-211** is joined by the amazing **IC-245** mobile transceiver. Together they herald the beginning of the ICOM VFO Revolution.

ICOM DEVELOPED PHASE LOCKED LOOP CMOS LSI

To facilitate the advancement of the phase locked loop concept which has been nurtured by ICOM's forward looking engineers, ICOM has designed an IC to provide these functions in a single LSI integrated circuit.

The circuitry of this chip contains all of the command registers and up down counters and the divide-by-n counter needed to make the ICOM "digital perfection" a reality.

This chip also contains the phase detector and memory system which provides the dual VFO function. In addition, there are provisions to cause the step rate to increase to 5KHz or 10KHz from 100 Hz and another which causes the reading to "freeze" and not change with the dial setting. And yet another provides pulses to both sets of counters to allow them to track while staying offset by the set amount.

Also, included is the circuitry which makes the 100 Hz steps possible with a 10 KHz reference. This circuitry is so unique ICOM has a Japanese patent pending.

THE BEGINNING OF THE ICOM VFO REVOLUTION!

The IC-245 . . . . $499.00
The IC-211 . . . . $749.00

Available at Henry Radio. Please call, write or come in.

Henry Radio

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Prices subject to change without notice.

Zero Bias

an editorial

Amateur Radio is people. Our cover this month shows some of the group who attended the 1976 Mobile Amateur Radio Awards Club (MARAC) Convention in Louisville, Kentucky. This group also represents some very active County Hunters, amateurs who vigorously work for CQ's USA-CA Awards as well as other Awards offered in amateur radio. If you check Ed Hopper's Awards Column on page 64 you can get some first hand information on some of the newer awards being offered and a run-down on who's who in our cover photo.

The crux of Amateur Radio is people and the forte of CQ magazine over the years has been movement and activity. Our readers represent the most "doingest" bunch of people anywhere. Our Contests, Award Programs, Propagation Column, In Focus Column are all about people doing things and getting involved. Just read our DX, QRP, Antenna, Novice, Contest Calendar, and Math's Notes columns each month and you'll find some of the busiest people in amateur radio thinking and doing more things to keep themselves busier whether building, traveling, operating, improving and the simple joys of sharing some expertise and experiences, right on down to creative wool gathering and brainstorming some new idea or concepts.

What's it all about . . . it's about people. It's the people who are important, not just the ideas. It's those of us who can get an idea, go down to the basement workshop and transform that idea into reality then share it with others. It's the reader who looks at each new piece of equipment reviewed in CQ and dreams of all the wonderous things he or she can accomplish with it. It's the special ability to take what you have and think of ways of improving it. It's doing. It's answering questions, lending a piece of test equipment or even a whole rig to that new Novice down the block. Amateur Radio is about people helping people in times of trouble. It's offering to provide communications and following through during rough times and the happy times of parades and other civic functions. It's providing a phone-patch so that someone somewhere can get to hear the voice of a loved one far away.

One of the best expressions of amateur radio is the annual Dayton Hamvention coming up next month. About 15,000 very vocal and very active amateurs decend on Dayton to have one heck of a weekend. Every conceivable aspect of amateur radio is displayed, talked about, bought and sold and just plain enjoyed. It's the one time and the one place where you can get to see an unbelievable assortment of amateur equipment assembled literally under one roof just for you to poke, look at, ask questions about and perhaps buy. It's a huge flea market where you can walk for hours and check out all the goodies and perhaps find an elusive bargain. It's antique radio equipment next to space age technology along side some clunkers from the fabulous fifties. There are forums and talks on just what is happening in every area of amateur radio plus the chance to learn from experts. It's being part of what's happening.

Amateur radio by definition means communication, an involvement with other people and ideas. Remember the next time you flip on that switch you're sharing part of yourself with someone else and getting part of someone else in return. Amateur Radio is people.

It's Finally Happened

CQ is on schedule! The February issue was completed and distributed the first week in January. Those of you who attended the SAROC show at Las Vegas got a chance to see first hand the February issue. As I stated in an earlier Editorial it seemed that the February issue would get out before January and by now most of you realize that this is exactly what occured. January trailed February. Now I don't want to start getting letters and phone calls telling me that CQ is arriving too early and why can't we be a little later like the other magazines.

It was a very hectic and exciting challenge to get February out on time and even more exciting to follow the material down to our new printers in Glasgow Kentucky to oversee the first issue on Christmas week. I got one of my long sought after Christmas gifts after almost fourteen years in journalism, I got to say "Stop The Press" about three a.m. when an error cropped up during the running of CQ. It was all worth the effort and I hope you enjoy it as much as I do.

Whatcha Makin'

I am reminded of the old days when I worked for Hudson Radio in New York and on Fridays Bob Gunderson, W2JIO would work there and greet us and the customers alike with "Whatcha makin". Bob was curious and interested in whatever you were doing. I'm also interested in what you've been tinkering with this winter or a DXpedition you've taken, and I know our readers would be too. We are always looking for new articles to publish. Why not take the time to write up that project or trip and send it in. Who knows, you might just make enough money to pay for your next project.

73, Alan, K2EEK

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.

hy-gain®
We keep people talking.

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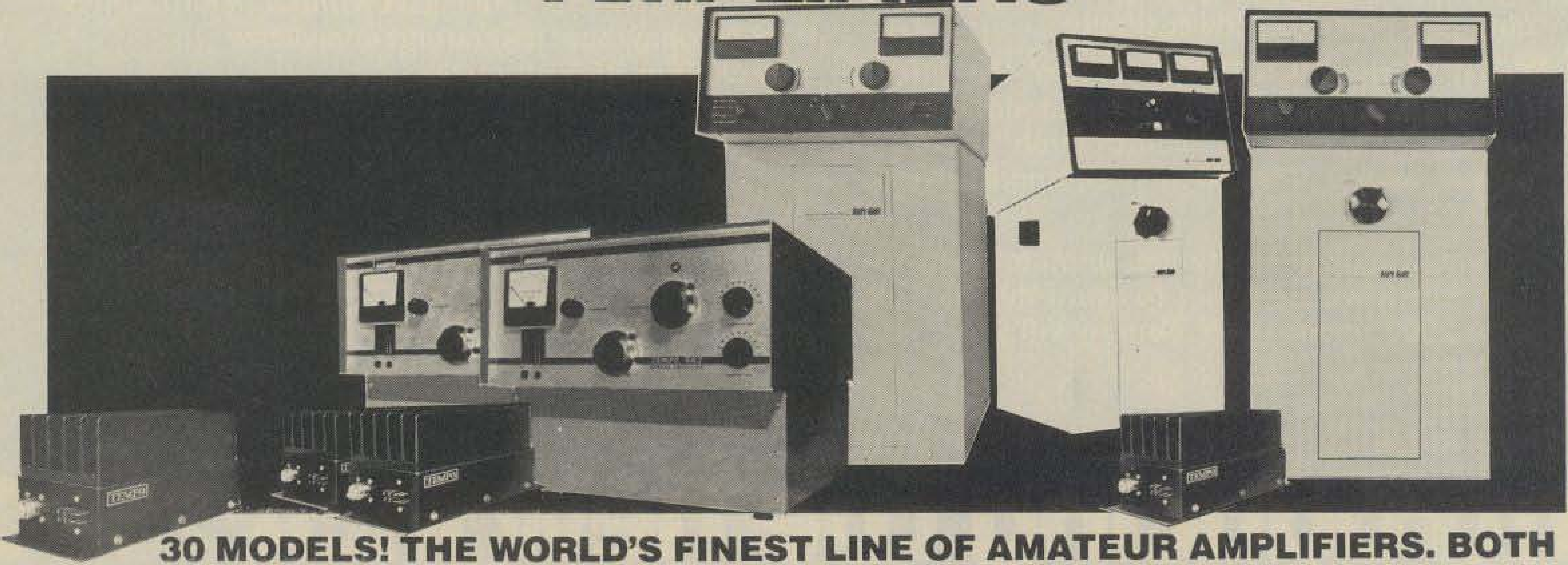

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While stationed on Okinawa Chaplain, Lt. Col. James M. DeMott, USAF, KA6DE, set a new KA6 DXCC record of 218 countries worked and earned CQ's twenty meter 2 x SSB WAZ Award number 12. Jim offers us a helpful prescription and treatment for DXosis.

DXosis Okinawa Style

BY JAMES M. DEMOTT*, KA6DE/6

When I was a senior in college years ago, one of my roommates who was a premedical student told me he planned to become a dermatologist. When I asked him why he had chosen this branch of medicine he replied: "because none of my patients will die from their affliction and their disease will probably never be cured." "This interests you," I replied. He said: "It sure does because they will come back to me again and again." I saw his point.

DXosis is a disease much like diseases of the skin. DXosis patients have never been known to die from it, but it is a disease, that once contracted, will never go completely away. DXosis is a rare and unusual disease, and if you have never suffered from it, it is difficult to describe. DXosis is defined as that rare disease suffered by thousands of amateur radio operators in all countries of the world who attempt to work as many other DX amateurs as they can. DXosis may generate an ulcer or two, precipitate a heart attack, eat into your savings account, create hostilities toward your mailman, increase your tobacco and alcohol intake, lead to family problems and even divorce . . . but it has never been known to be fatal!

DXosis symptoms are: a general rundown physical condition caused from staying up all night looking for a new country, or, if finding him, failing to break through the pile-up; extremely red eyes, loss of communication with family and friends, loss of weight from denying yourself food in order to spend more money to buy a bigger and better kilowatt or the latest, most advertized, wide spaced beam. The DXosis sufferer will also experience some secondary symptoms of his disease such as spending vast sums of money on QSL cards, International Reply Coupons (IRCs) and air mail postage to seldom heard of countries which even the Post Office clerk questions the location of.

These are some of the negative symptoms of classical DXosis. However, the prognosis of most DXosis sufferers is excellent and there are some really worthwhile reasons for not fearing this disease. How else can one experience so great a thrill as that which comes from nailing a new country? I know of few experiences in life that are as exciting as turning across the band, finding a 20 kHz wide pileup, calling the DX station while hundreds of other stations join in the confusion, and hear him come back to your call. Few things are as rewarding as looking at the station you have assembled, after many weeks of hard work, and to know that it is heard around the world. What is as exciting as going to the mail box, or if you have a box at the city Post Office, you will go there several times a day, to find that QSL from the rare DX station you worked recently? Too, there is little to compare

Jim DeMott, KA6DE, at the ready to work that rare new one.

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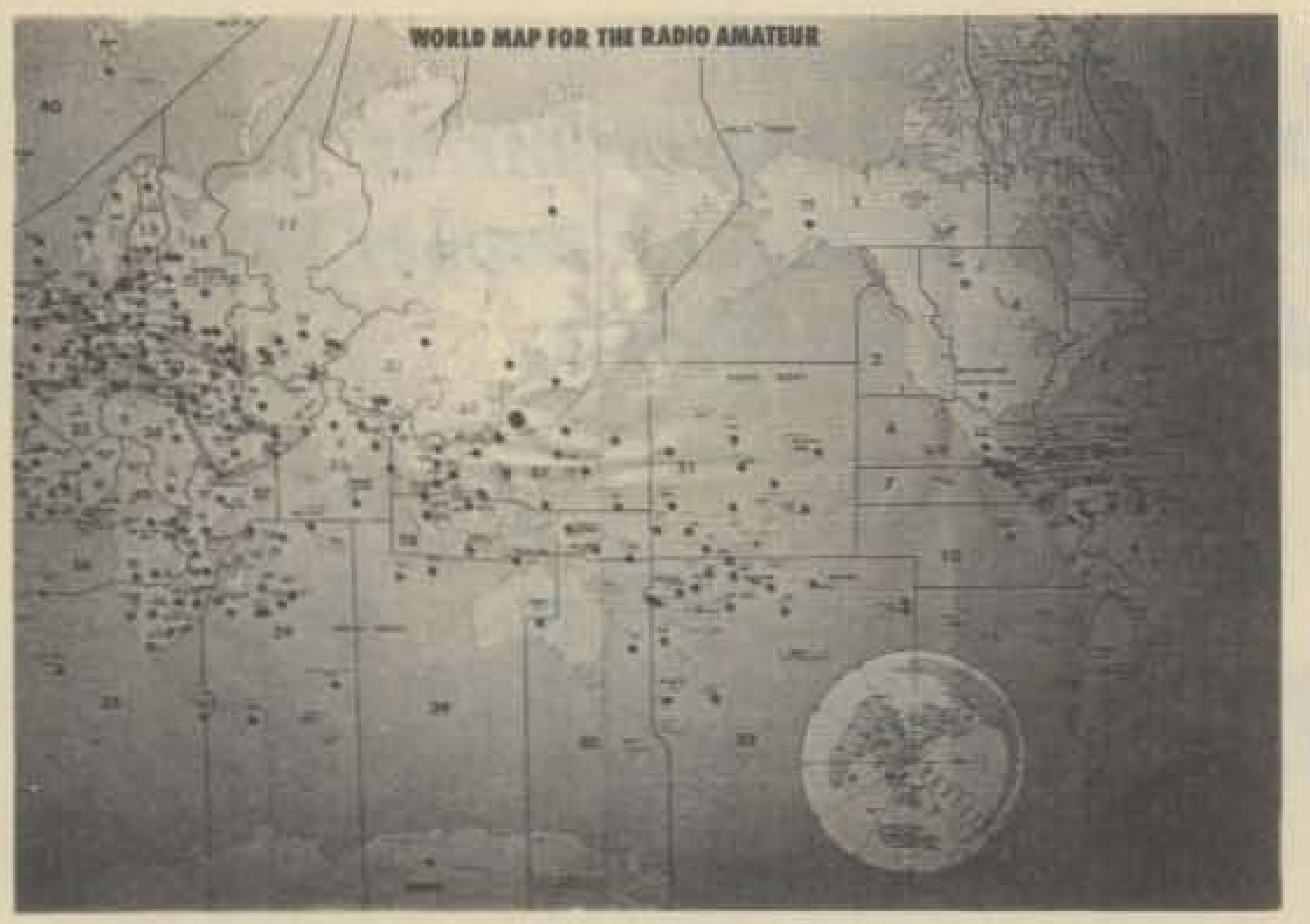


KA6DE's World Map dotted with countries he has talked to.

with receiving your one hundredth DXCC QSL card so you can send in for your DXCC Award. Other thrills experienced with DXosis are related to making friends all over the world, building a bridge of understanding between amateurs from countries with different political or philosophical concepts than yours, or, learning about a piece of geography that before you worked a station on it, you did not even know it existed. Yes, DXosis "ain't" all that bad! As a matter of fact, I'm glad I've got it!

Though I do have DXosis, I do not pretend to be one of the big DXers in the world. I wish I were. However, my profession as a chaplain in the United States Air Force simply will not permit me to reach the top. My frequent moves and the nature of my job requires that I start over again and again. However, this does not dampen my enthusiasm, and I am not afraid to admit that I have DXosis. As a matter of fact, I have suffered from DXosis for over eighteen years now and have enjoyed every minute of it.

DXosis-Okinawa Style is my attempt to share some of the things I have learned about DX. How does one go about working DX? What are the tools of the trade? Who should I get to know to build my country total? How can I increase my QSL return? DXCC Honor Roll members will probably skim over this article because it is too elementary and of little interest to them, and this is probably true. However, it is my wish that some neophytes to DX, who are not afraid of contracting DXosis, will read it and perhaps glean from it some little bits and pieces of information that will assist them to better live with their disease. The techniques and experiences I share with you I have learned from others. I trust they will be of some benefit to you, too.

What are the tools of the DX trade?

It would be inappropriate to discuss DX techniques without first saying something about a DXer's station. Suffice it to say, that equipment wise, one should have the best and most convenient equipment one can afford. In my opinion, split operation is a must. When a rare DX station operator tells the world he is listening ten up or ten down, he means it! Thousands of amateur radio operators miss contacts with DX stations every year because they do not heed this advice. What could cause a DXosis patient to suffer more than to hear a pileup on the DX station's frequency, causing confusion and keeping return signal reports from being heard?

I could write on and on about the importance of big linears, high towers, etc. However, to me the most important piece of a DXer's station is his antenna. I firmly believe that you can do without a linear (most non-US amateurs do) and still hang in there with the best of the DXers, if . . . you have a good rotatable antenna. I will not debate the pros and cons of beams versus quads, but will from here on use the term "beam" for brevity. Certainly a wide spaced, single band beam is better than the tribanders. With your good beam you can work the world with just a 100 watt exciter. Along with your beam you will want a rotator control head that can be recalibrated every time you use it. Why? Not only so that you can see where your beam is headed, but because a.c. line voltage variance can cause your beam heading indicator to be off as much as 30°.

A few other tools that will complete your station and help you work the rare ones, are not pieces of equipment, but tools made of paper.

The most important paper tool, I believe, is a good DX newsletter that you receive on a weekly basis. There are many such newsletters on the market today. I have subscribed to them all, and, in my opinion, there is only one that is worth its subscription price and that is the *West Coast DX Bulletin.* This bulletin has all the latest DX news, is accurate and written in a manner that makes it highly appealing to its readers. The bulletin lists DX station's operating habits, which includes their frequencies and times. It furnishes current QSL information from the DXpeditions and rare DX stations. It is very simple, though time consuming, to study the bulletin and gain insight into the when and how to work the rare ones. I shall never forget the Tuesday some time ago that I received my *WCDX Bulletin.* I devoured it as soon as I arrived home, ate a hurried dinner and went into the shack to tune for the rarest station on at that time, which was 3B9DL on Rodriguez Island. I turned on the rig and tuned to the exact frequency the *WCDX Bulletin* had announced for 3B9DL, and . . . there he was calling "QRZ", on c.w. I sent his call once, and mine twice and back he came! What a thrill! Not only to know you just worked a new one, but later to find out you were just one of 400 stations to work this DXpedition. So, do send off for a yearly subscription to the *West Coast DX Bulletin,* 77 Coleman Drive, San Rafael, CA 94901. A $13.00 check brings it by First

Class or it will zoom in via Air Mail for $15.00 a year. Tell them Dead Eye sent you!

Another paper tool I find indispensable is the QSL Manager's Directory. I think all DXers share the feeling that QSL returns are higher through QSL managers, and there are some great amateurs providing this service. The publication lists over 6000 DX stations along with their QSL managers and address. Subscription price is $5.95 to US/VE amateurs and this includes three quarterly supplements. The address is: DX Publications, 7632 Woodland Lane, Fair Oaks, CA 95628.

One of the most helpful paper tools I have is a computer readout which gives beam headings for all countries on the ARRL DXCC Listing. It lists all the countries of the world by prefix, giving long path and short path bearings from my location here on Okinawa. In addition, it gives the distance, in miles, from Okinawa to all major cities in the world. The list I have was prepared by a company now out of business, unfortunately. However, you can order a Customized DX Bearing Chart from the 73 Gift Gallery, 73 Publications, Peterborough, New Hampshire 03458, for just $4.00. Though I have never seen this chart it appears to be the same type of a paper tool I have used here. An amateur who works for a big computer company has a program which permits him to plug in your location and have it print out the bearings of all the countries of the world from your shack. Send for it!

Another paper tool I will mention that helps me chase DX is my three by five card file. I make out a three by five index card on every station I work and have followed this practice for over eighteen years. It really helps me snag new ones and increases my QSL returns. It gives me a big thrill to be able to hear a station I had worked six months ago calling CQ. I check my card file and see he has not QSLed and so I give him a call when he signs and say, ". . . how copy Erik?" Erik is flustered and dumbfounded because he cannot remember my name but I have taken him on an ego trip by "remembering" his. (The greatest word in any language is one's own name) After his short transmission, Erik turns it back to me after apologizing for not being able to remember my name. Sometime during my third transmission I just happen to mention that I wonder if he has received my QSL. He comes back to say he has and that he has just now filled out a QSL for me which he will mail on the way to work in the morning. The three by five file can be used to enter many items of importance such as station equipment, profession and family information and items of interest about the country of the station. This file is also used to keep track of QSLs sent and received, and is the best tool I have for checking on my DXCC total.

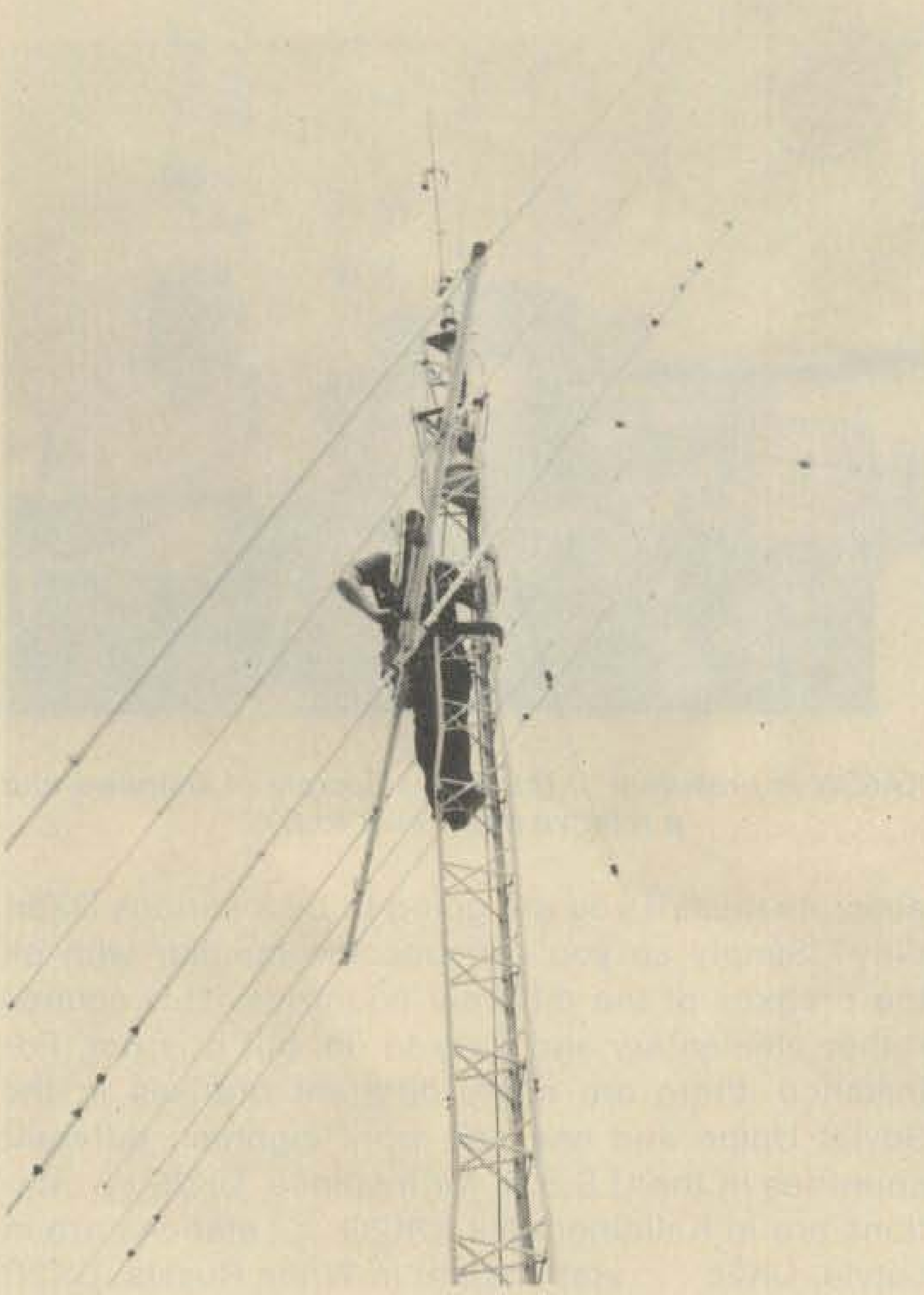
The last paper tool I will mention is the DXCC Country List that is published by the ARRL. It is an

KA6BN is president of the Radio Society of Okinawa and a relative newcomer to DX.

absolute must if you are going to be a serious DXer. Why? Simply so you can become familiar with all the prefixes of the different countries. This sounds rather elementary and easy to do, but it is not. For instance, there are many different prefixes in the Soviet Union and one can work eighteen different countries in the U.S.S.R. for instance, UK2F . . . stations are in Kaliningradsk, UK2G . . . stations are in Latvia, UK2L . . . stations are in White Russia, UK2R . . . stations are in Estonia, and UK2B . . . stations are in Lithuania. There are four different country prefixes beginning with "J"; there are six countries in VP8 land and nine in VP2 land. Many newcomers pass over a new country because they are not familiar with the DXCC Country List and they fail to go after a new one because they think they have already worked it. I shall never forget the night KA6SR, whom all KA6s affectionately refer to as the "Weak Squeak of the Makiminato Housing Area," tried to drive what he thought was a JA station from his frequency. Someone finally broke in and told Wil that the breaking station was a JW4, very rare for the Fareast, and Wil worked him for a new one. Memorize the DXCC Country List and build your total. This is some of the best medicine I can prescribe for DXosis patients.

And now, last, and perhaps more important, what techniques does a DXosis sufferer use to increase his country total? As I said before, I do not consider myself a DX expert and I certainly do not have all the answers to this question. In addition, space does not permit to list all the techniques that are available. However, I hope the following will be of some interest.

First, I would master c.w., not only so you can work countries that are on c.w. only, and there are some, but so that you can break through the s.s.b. pileups by breaking the DX station on c.w. I did not keep track of the number of new countries I racked



"The End of An Age". KA6DE's TH6DXX comes down for the last time. The operator and author of this article, Jim DeMott, a Chaplain in the USAF, worked 218 countries in 15 months to set a new KA6 DXCC record.

up using this technique while operating as KA6DE, but I know it was a goodly number. Just about all non-US DX operators are excellent c.w. operators. They do not mind, regardless of popular belief, if you break them on c.w. while they are working s.s.b. Too, c.w. will often get through when s.s.b. will not. After breaking a s.s.b. station on c.w., it is simple to change over to s.s.b., if that is what you desire.

Next, learn to LISTEN, LISTEN, LISTEN, LISTEN, LISTEN! I cannot emphasize too much how important it is to become a good listener if you have DXosis. I have a philosophy that says "he who ragchews misses much DX." In my opinion it is impossible to be a ragchewer and a DXer. He who talks much hears little. He who listens much works much. You will be surprised, as you develop your listening techniques, how many new countries you will work by some rare and momentary band opening.

Another technique that will help you is used when you run across a pileup and you can't figure out what all the fuss is about. Don't just sit there waiting for the DX station to give his call, because on many occasions, he never will. He is too busy reeling off the stations calling that he doesn't have time. What do you do? Jump in and join the fun! But . . . don't waste your time, and that of the DX station, by giving long calls. Give just the last two or three letters of your call, or your location, if it is rare. We were fortunate to have the magic of "Okinawa Island". The W's in Vermont, Utah, Delaware and Wyoming have a lot going for them, too.

One of the most helpful techniques I have had to develop during this low sunspot cycle is to turn my beam away from the DX station I want to work and turn it toward a station he is working that has better propagation with him than with me. Three months ago I called a Canal Zone station for over an hour. He was the first, and to this date, the only Canal Zone station I had heard on Okinawa. He was coming in R 5-S 7 but working the Ws and giving all of them 10 to 20 over S 9 reports. There was no way I could break through except to turn my beam on the W6s, break with one of them, which I did, to rack up a new one.

You will also build your country total if you become known in the DX world by a nickname. In the pileups from Okinawa it was simple to say: "Dead Eye" and one of my DX buddies on the frequency would advise the DX station that KA6DE wanted to work him. Other DXers have used this technique for years. In this regard, it is also very good to develop the friendship of an active DXer in at least one country on all continents of the world. You can make regular skeds with them to find out the latest DX activity in their area.

I have also found it most beneficial to enter all the world-wide DX contests. You may not have a desire to become a winner, but you will be surprised how many new countries you will work in a contest, simply because the whole world is on the air during these contests.

You will also want to be on the lookout for band openings on the long path. The bands can be dead on short path and wide open on long path. As you gain experience on certain bands at certain times of the year you will know when to use this technique.

It will also help if you will learn about, and try to check into, the DX nets. I will not try to list them here because net schedules change. However, I would keep a current list of nets, with meeting times and frequencies, on my operating desk. I wish all of you could have the privilege of checking into the "C" net, which meets every day at 1200 GMT on 14320. Paddy, 4S7PB, is the net control station and is the finest NCS in the entire world. If you could check into this net, you could, if you had time and propagation was right, work DXCC in just one evening. Stations from Africa, The Indian Ocean, the Middle East, East Asia, South Pacific, Western Pacific and Oceania, all check into this net on a regular basis. If you are looking strictly for Pacific

(Continued on page 72)

In which a look back at some old devices provides insight into some useful new concepts.

Electromagnetics Made Interesting or Cores Need Not Bore

BY IRVING M. GOTTLIEB,* W6HDM

A sure-fire way to turn off a ham's intellectual appetite is to serve him an entree of *electromagnetics* prepared in the ordinary way. Who, after all, wants to regurgitate the hors d'oeuvres gobbled down (and hopefully digested) so much earlier on the menu? At the outset, the yearning for soul food a la technicania was kindled by transformers, reactors, solenoids, and morsels of kindred kind. But now, the satiated patron needs a change in cuisine. A chef's good reputation stems in large part from his ability to evoke culinary miracles—he must deliver tasty tid-bits from blaze raw-material, such as even the egg plant! And, it is respectfully submitted that an author worthy of his salt, should likewise cultivate the skill of transforming the ordinary into the desirable. (Such as even the hum-drum and excessively-recycled theme of electromagnetics.) As the chef has graciously informed us, the clue to such an accomplishment is to prepare it in an extraordinary way.

So, rather than rehash the conventional stuff found in any good technical cook book, the endeavor will be to whet the appetite with a few devices, concepts, and behaviourisms which have not been easy to swallow, or which have been tempting, but not taken because of controversial reports from previous partakers. It may well be that some long overdue clarifications will emerge. In any event, our discussions should lead to some profitable transactions — wherein some wrong answers can be horsetraded for some right questions.

*931 Olive, Menlo Park, CA 94025

A well-known electromagnetic function block is the d.c. to a.c. inverter shown in fig. 1. In the technical literature, one finds that this circuitry is also referred to as a saturable-core oscillator, and as a magnetic multivibrator. The predecessor of the modern solid-state inverter was the erstwhile vibrator power-supply, which provided the requisite translation of dc voltage level for auto radios. A typical vibrator supply is shown in fig. 2a. The vibrator was, in essence, a doorbell buzzer designed to enhance current chopping, but to de-emphasize sound production. A contact-carrying armature was set in vibration by the competitive

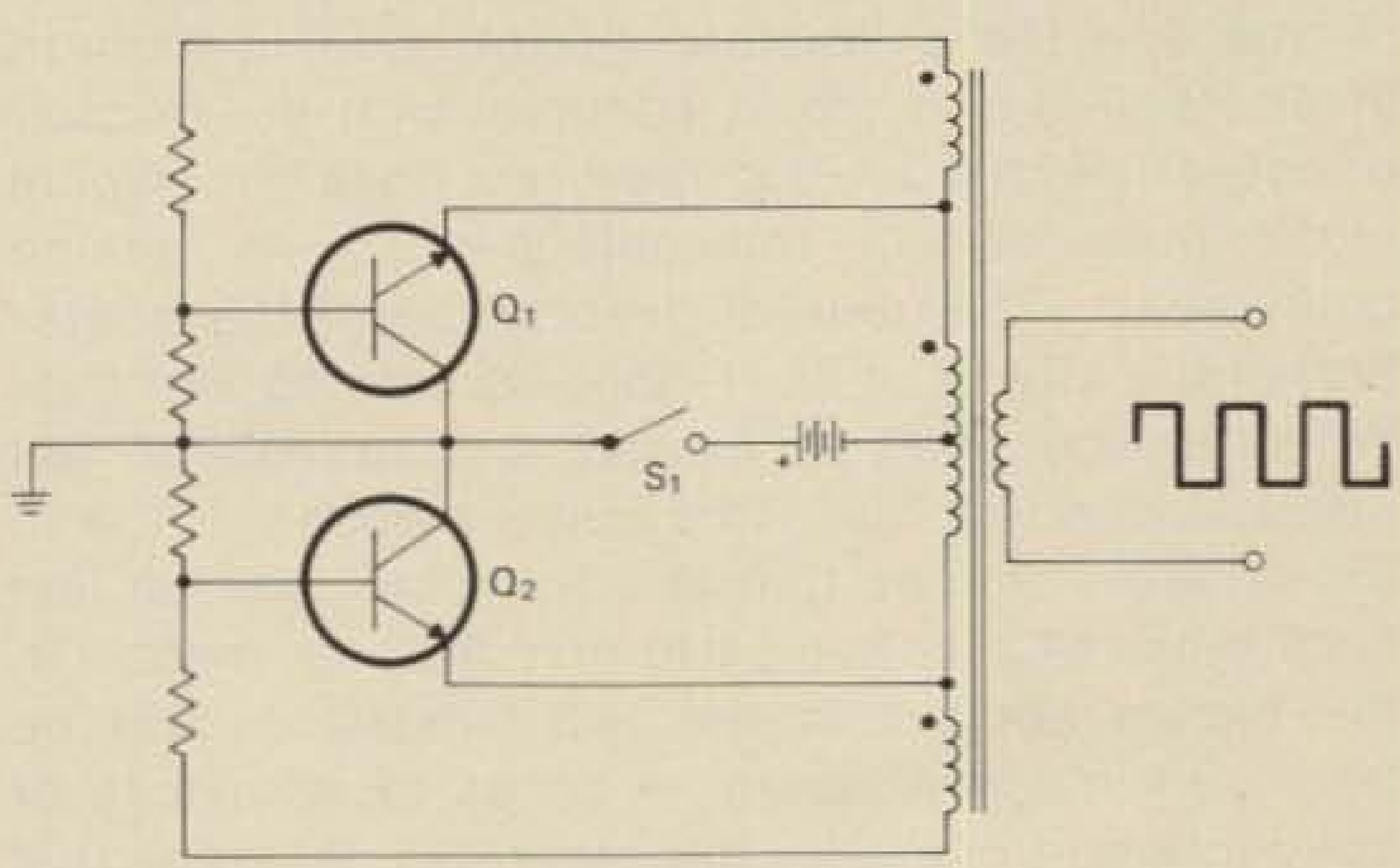


Fig. 1—THE d.c. TO a.c. INVERTER—AN ELECTROMAGNETIC ENIGMA
Most descriptions of the operating theory tell us why oscillation commences when Switch Sw-1 is closed. But suppose the circuit is in operation, and a short is placed across the output winding, then removed—why should this restore the circuit to its oscillatory condition?

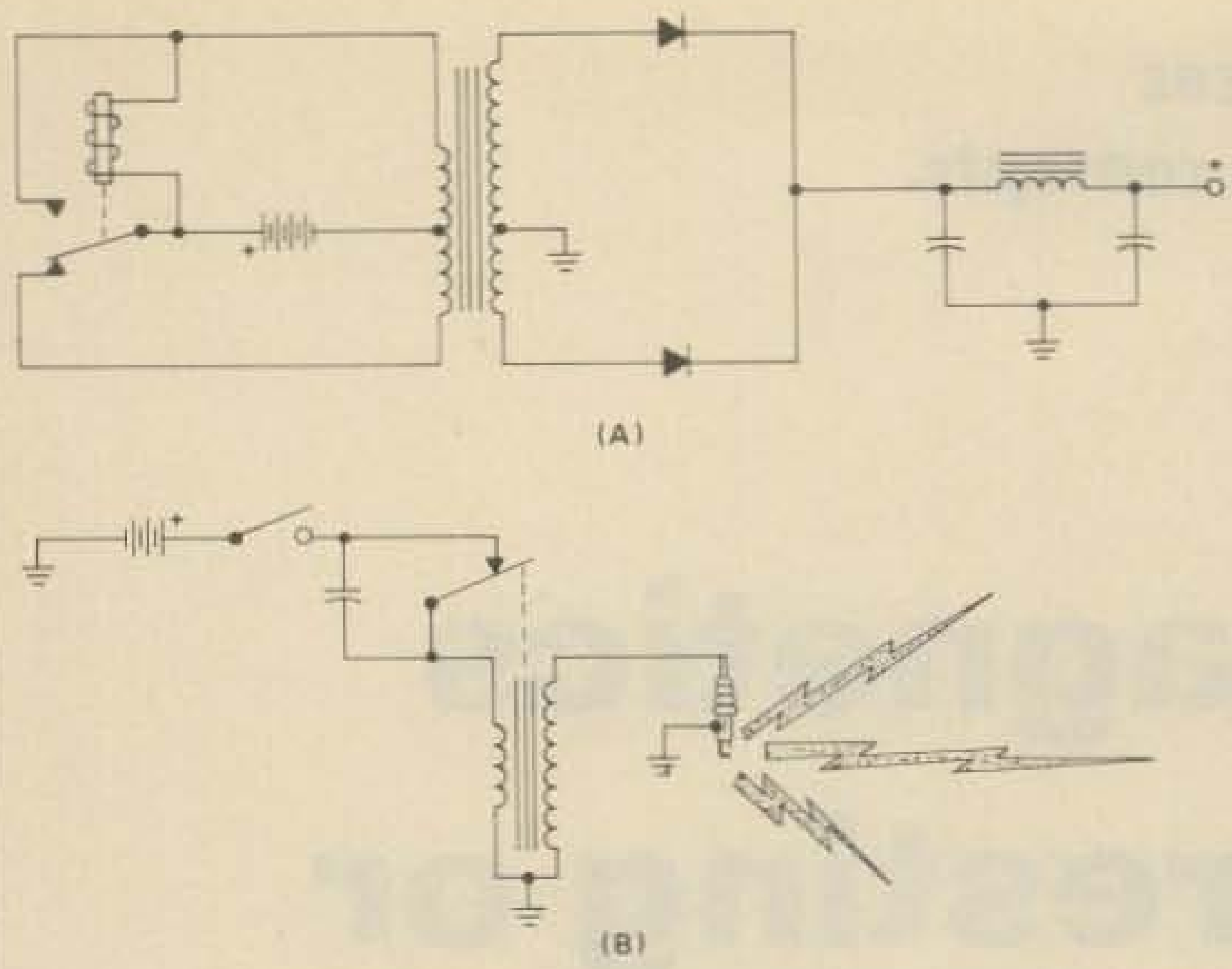


Fig. 2—STONE-AGE PROGENITORS OF THE SOLID STATE d.c. TO a.c. INVERTER

(a) The vibrator power supply sometimes used selenium rectifiers, but more often employed a cold-cathode tube. In this scheme, the vibrator and the step-up transformer are separate units.

(b) The Model "T" spark coil—here the vibrator and the transformer are a single integral unit.

forces of spring tension and magnetism. The chopped current was suitable for subsequent operation of a voltage step-up transformer. Also relevant to the modern inverter, was the Model "T" ignition coil of fig. 2b. Here, the pulsating magnetic force in the transformer core, itself, was utilized to produce the buzzer, or current-chop action. These references are not made for the sake of pleasant nostalgia. (The author is not even sure that "days of auld lang syne" were, as commonly reputed, the "good old days.") Rather, this backward thrust into the stream of time is intended to serve more pragmatic purposes.

In concocting the modus operandi of the modern saturable-core oscillator, the theory boys have borrowed heavily from the ancient vibrator devices. It is true that the solid-state circuit used in modern inverters shares much in common with the buzzer-oriented devices — but then, so does the digital clock bear certain resemblences to its analog counterpart. The general description of the operation of the circuit of fig. 1 goes something like this: When switch Sw-1 is closed, one transistor will begin to conduct first. This may be because it is in the nature of things that one transistor will be just a bit more of a hotter performer than its mate. Or, the biases applied to the two transistors will be purposely made different — so as to always favor conduction in one over the other. So, let's say that the pecking order is skewed in favor of Q1; it always beats Q2 to the current when switch Sw-1 is closed. As the emitter-collector circuit of Q1 begins to consume current through its half of the transformer winding, current is induced in its feedback winding, and in such a direction that the base of Q1 is driven deeper into its forward-conduction region. The effect is regenerative and proceeds vigorously. We might suppose that the closure of the switch started things going from a point such as "X" on the core hysteresis loop illustrated in fig. 3. And, if all goes well, we can anticipate landing at point "A" very soon.

It should be borne in mind that, not only is Q1 indulging in a regenerative turn-on, but Q2 is being progressively driven further into its cut-off region. This action is brought about by the current induced in the feedback winding associated with Q2. A study of the phasing dots pertaining to the transformer windings of fig. 1 will reveal that a given direction of current in the center-tapped winding will always reinforce conduction in one transistor, and simultaneously cut the other one off. Inasmuch as we suspected that the transistors *alternate* their conductive states, so far, so good.

When point A on the hysteresis curve is closely approached, the rate of increase of flux density in the core abruptly slows down, this being accompanied by a drastic reduction in the magnitude of currents induced in the feedback windings. If we suppose that Q1 was driven into collector current saturation by the time point "A" was reached, it now begins to come out of saturation (for lack of strong base drive). This enables the tracing of path "A" to "B" on the hysteresis curve. In the vicinity of point "B" the changing core flux reverses the polarity of the feedback circuits and we suddenly find Q2 being driven into conduction and Q1 being turned off. Again, the process is regenerative and

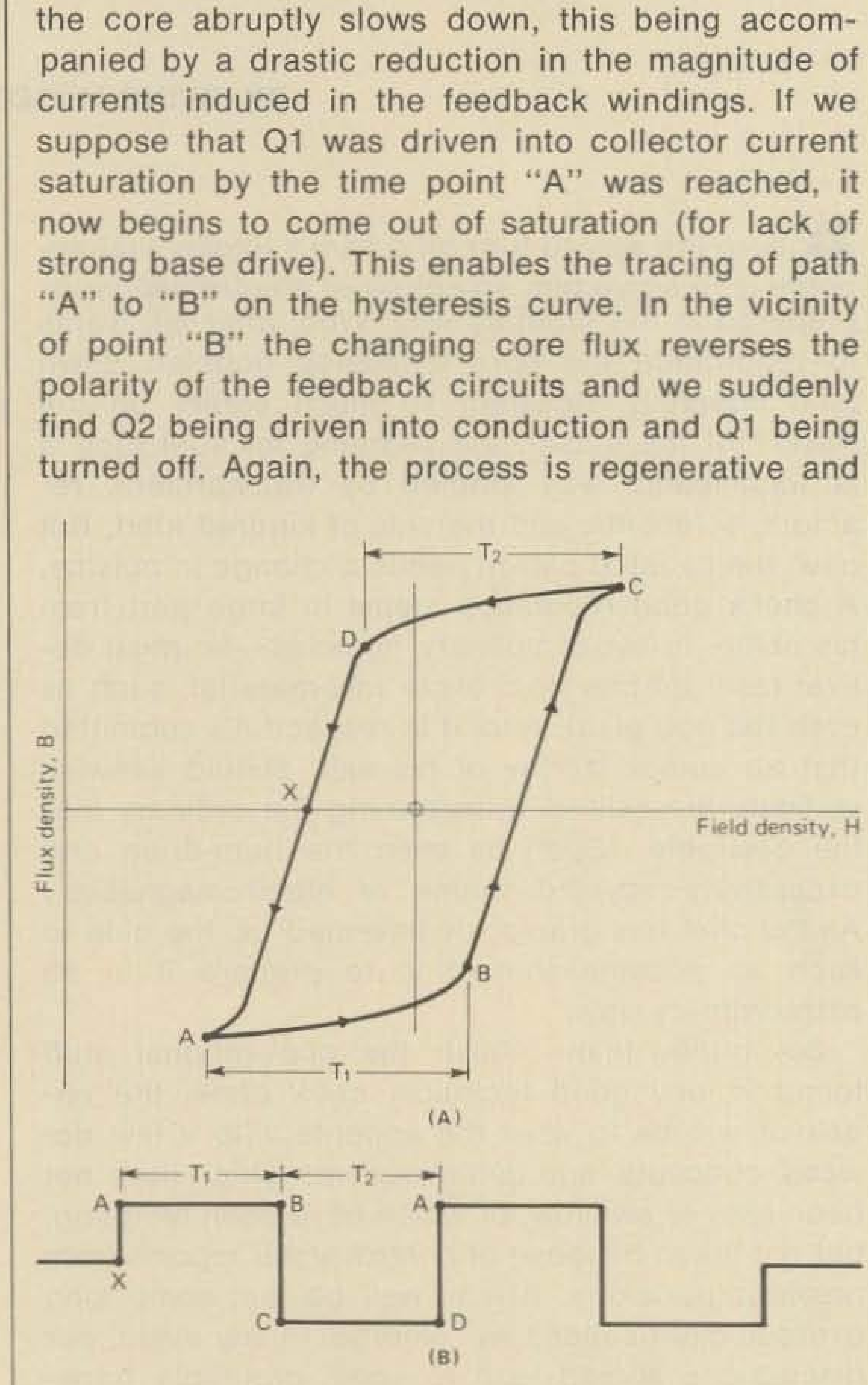


Fig. 3—HYSTERESIS LOOP OF CORE AND THE OUTPUT VOLTAGE WAVE OF THE d.c.-a.c. INVERTER
The roll played by magnetic hysteresis in the operation of the inverter is generally not clearly delineated.

we wind up at point "C". The journey from point "C" to point "D" is analagous to that described between "A" and "B". So, to make a long story short, the process is repetitive, *once started.* For practical purposes, the transistors are caused to behave as knife switches and a rectangular voltage wave results.

The foregoing theory of operation is skeletal — there is much room for detailed mathematical analysis. Admittedly, such analysis can readily be shown to be valid, for we can establish the relationships between such engineering parameters as the applied voltage, oscillation frequency, and core characteristics. Not only is this fine and dandy, it is essential, for otherwise we would tend to avoid the phenomenon as an interesting, but unpredictable occurrence. But, the author has found something missing in even the most detailed treatment of this electromagnetic device. Suppose that the inverter of fig. 1 *was* in operation and the output winding was short-circuited. It is a tribute to the compliant nature of this circuit that such a short need not be destructive at all. In well-designed inverters, oscillation simply ceases and the transistors are returned to their quiescent states of conduction (because one transistor is generaly slightly forward-biased in order to promote starting, that transistor will draw a moderate current when oscillation is inhibited).

Not only can such a short be safely endured for many minutes, or even hours, but normal operation immediately ensues when the short is removed! *Why?* The removal of the short from the output winding cannot be construed to be the equivalent of closing the battery switch, Sw-1. The latter event produces a *transient current* in the center-tapped winding, and this current is regeneratively acted upon by the "turned-on" transistor. But, *lifting the short circuit* cannot produce such a transient current in the center-tapped winding. And it would be quite far-fetched to assume that a winding associated with an active device must necessarily develop cyclical currents under the "guidance" of a core's hystersis loop. We can clearly see why the vibrator supply, or the Model "T" ignition coil can come alive after removal of an output short, but the starting mechanism in the solid-state inverter under similar conditions is more elusive.

It is all too easy to think of the inverter as a *magnetic multivibrator,* that is, as the inductive counterpart of the RC multivibrator. Such circuits do indeed exist and assume the general configuration shown in fig. 4. (Simple inductors, rather than transformers may also be used, but it is then necessary to involve capacitors in the base circuit. To keep the idea being pursued simple, the transformer circuit of fig. 4 will best suit our needs.) The frequency of this relaxation oscillator is a function of L/R in an analagous way to which the frequency of a conventional RC multivibrator is governed by the

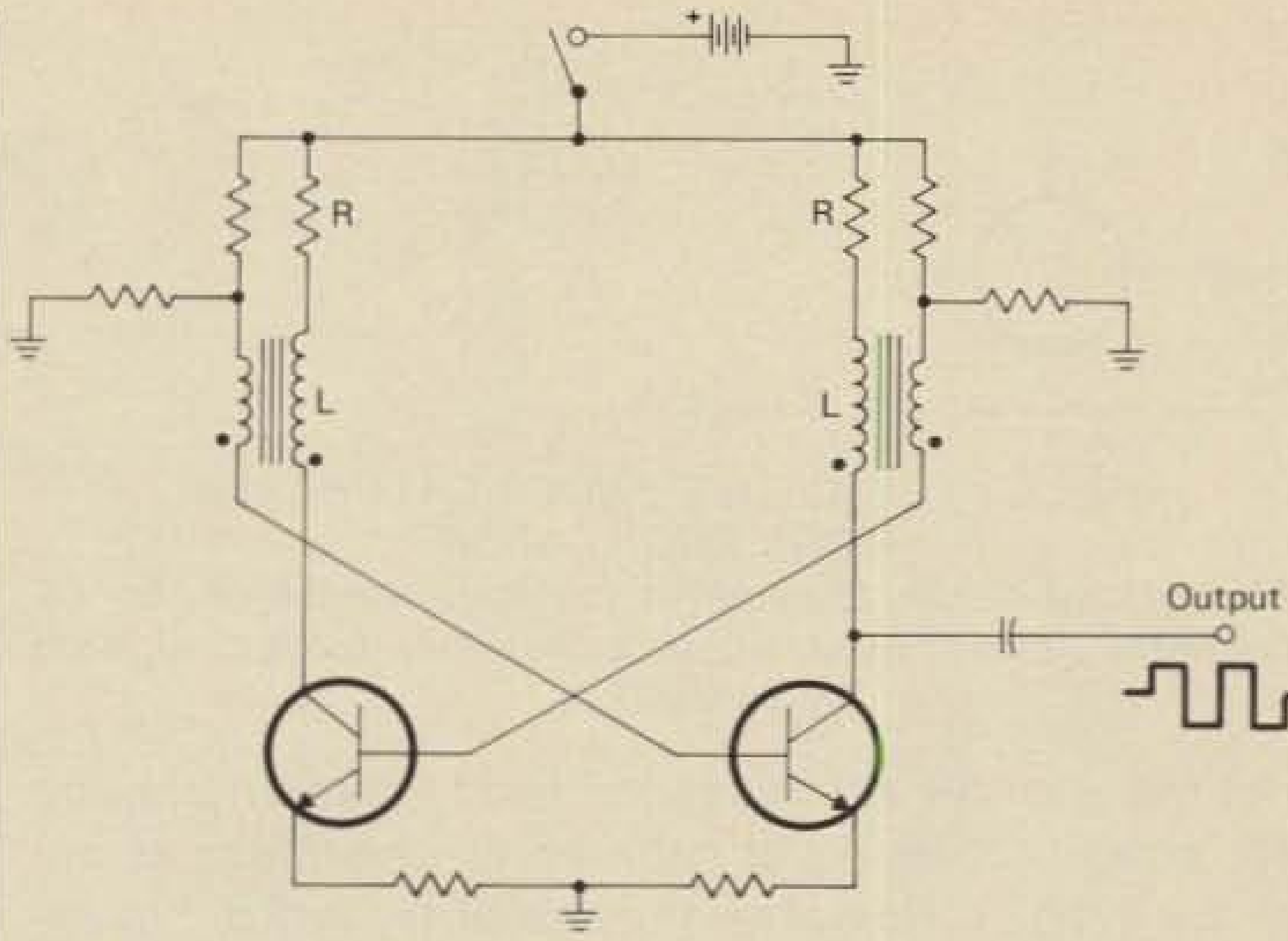


Fig. 4—A TRUE MAGNETIC MULTIVIBRATOR
In this circuit, oscillation frequency is governed by the L/R time constants of the two non-saturating *transformers. "R" can either by physically discrete resistances, or can be the inherent resistance of the collector windings themselves. This circuit is the inductive counterpart of the common RC multivibrator. The operational mode is decidedly* different *from that prevailing in the d.c. to a.c. inverter of fig. 1.*

RC time-constant. *If* this circuit simulated our inverter, it would be found that the L/R influence on repetition rate would prevail. This is decidedly *not* the case. The oscillation transformer or fig. 1 can, in principle, be wound with a wide range of wire sizes with little effect on frequency. (What effect there is, may be shown to be related to the ohmic drop of voltage applied to the transistors, and not to an L/R time constant.) Clearly, our inverter is *not* such a magnetic multivibrator, technical literature notwithstanding!

We may, of course, have allowed ourselves to become ensnared in a gray area of semantics. Perhaps

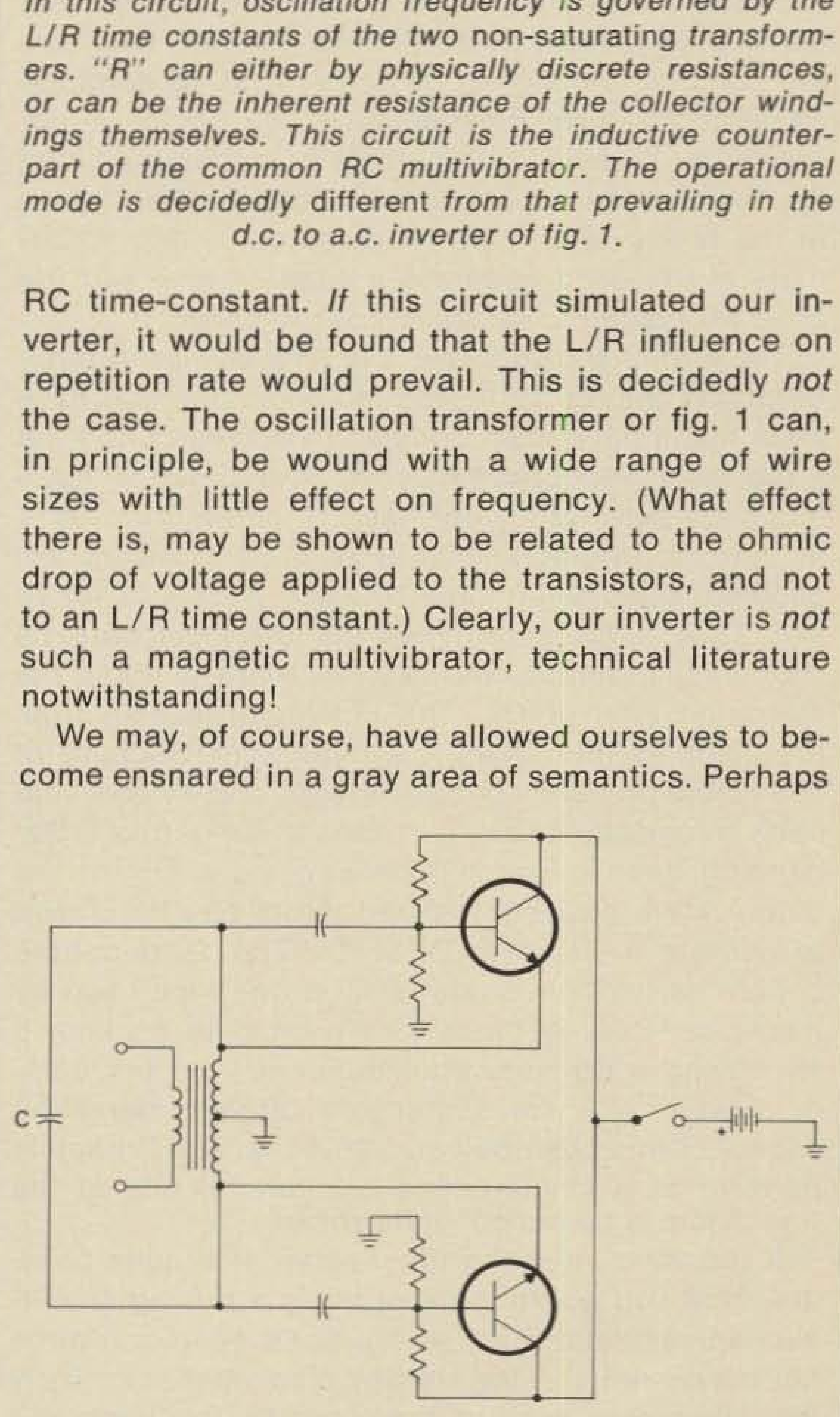


Fig. 5—A PUSH-PULL HARTLEY OSCILLATOR
This circuit resembles that of the d.c.-a.c. inverter of fig. 1. However, a "visible" tank-circuit is provided, and oscillation does not *depend upon saturation of the core, if one is used. Also, the bias circuits are such that one transistor does not turn the other one off during the oscillation cycle.*

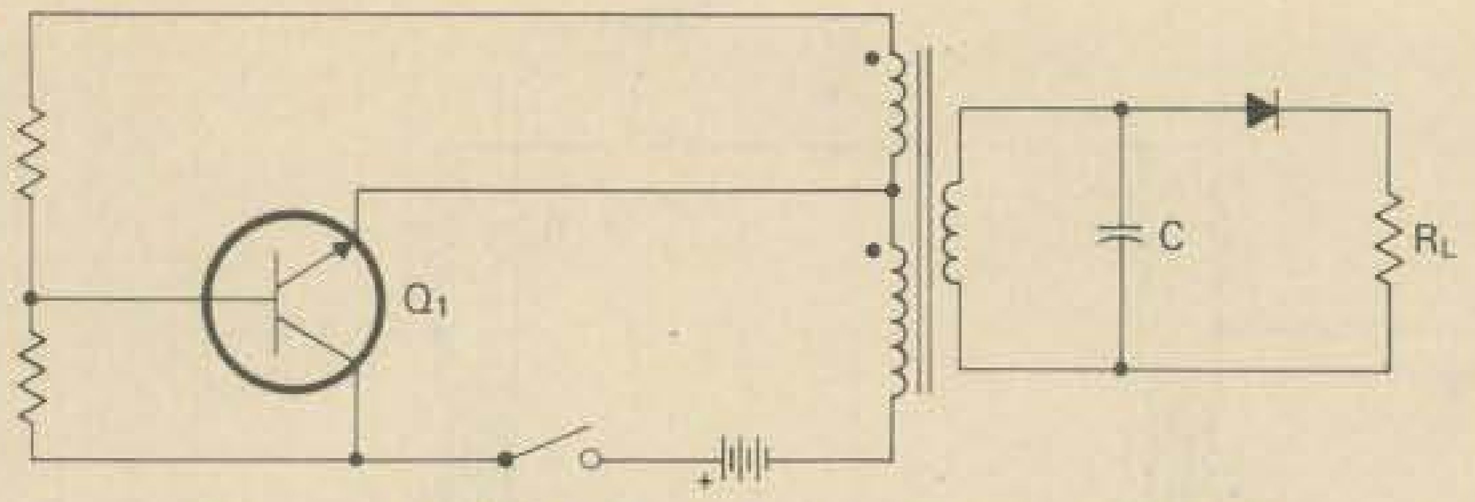


Fig. 6—THE SINGLE-ENDED SATURABLE CORE OSCILLATOR

This circuit tends to confirm the importance of the LC resonant "tank" as a contributing mechanism to core saturation.

not every writer who uses the term "magnetic multivibrator" is thinking of such an arrangement as appears in fig. 4. However, the use of the word, "multivibrator" does tend to conjure up notions of an L/R relaxation oscillator. It might even be argued that the overall performance of the inverter suggests the internal behaviour of some kind of a multivibrator. Whatever nomenclature you decide is appropriate, it remains important to understand that oscillation does *not* occur in the manner that it does in the family of circuits represented by fig. 4. Circuits of this kind generate a square wave with *no need for magnetic saturation* of the cores.

The circuit shown in fig. 5 is very similar in topography to that of fig. 1. The modifications that have been made have been done so in order to bring out a hidden aspect of the inverter. The circuit of fig. 5 is a push-pull Hartley oscillator. It differs from fig. 1 in that the operating biases of the transistors are allowed to be determined by each transistor for itself. That is, Q1 determines (for the most part) its own bias, and does not have much to say about the operating bias of Q2. The converse, is also true, inasmuch as the circuit is symmetrical. Because of the visible presence of capacitor C, it is evident that each transistor "sees" a *resonant tank-circuit*. Depending upon the amplitude and the purity of the output wave desired, the transistors can be biased to operate in class A, B, or C. (The vacuum-tube counterpart of this circuit was at one time used by hams, particularly those who wanted to be known for having a rig somewhat different from the commonplace "TNT" transmitting circuit.) An interesting aspect of this push-pull circuit is that it will happily perform as a single-ended oscillator if *one* of the transistors is pulled out of its socket.

If you were inventing the inverter, it is quite probable that you would think of using a push-pull self-excited oscillator such as fig. 5. Of course, it need not necessarily be the Hartley type. And, it is likely that you would think of arranging its feedback and its "grid-leak" bias so as to attain an over-driven condition. In this way, you would get a non-sinusoidal output — maybe a trapazoidal wave. But, you would never coax a nice square wave out of it. In the course of your experimentation, it is conceivable you might stumble upon the unique operational mode of the inverter. Supposing that such serendipity prevailed, it would be well to remember how you got to the final result, for the cyclic generation of the hysteresis loop in no way obscures the fact that the basic configuration of the circuit remains that of a push-pull Hartley oscillator. This remains so even though the frequency of the new mode of operation is not determined at all by the resonant tank-circuit — it is assumed that a tank exists in the inverter of fig. 1 by virtue of the distributed capacitance in the windings.

Having now covered topics which may appear divergent, or of questionable relevance to our probe into the operating theory of the saturable-core oscillator, it is probably timely to tie things together. What has been inferred, and what is now stated in so many words is that one of the ways in which this circuit can *start* is by attempting to oscillate as an LC oscillator. This attempt quickly gets the core into saturation, whereupon other mechanisms assert themselves and maintain operation in which the hysteresis loop of the core is repetitively traced. The resonant frequency of the LC tank is very high. This is generally true because the tuning capacitance derives mainly from *stray capacitance* in the windings themselves. However, the resonant frequency is still much higher than the switching rate of the transistors even when a physical capacitor is connected across the "tank". Such a capacitor appears in many circuits as a means of attenuating switching spikes. Because of the tendency of the LC oscillation to be high in frequency, the switching transitions can be very fast — as the 'scope display of the output wave from these circuits reveals.

Thus, when the secondary short is removed, the circuit will commence an LC oscillation. It is true that the "tank" Q presented may be quite low, because of the low C/L ratio for parallel resonance. But, at the same time, it is to be remembered that power transistors have exceedingly-high transconductances. The mere *start* of an LC oscillation suffices to speedily bring the core to point "A" in on the hysteresis loop of fig. 3. Thereafter, the oscillation mode is governed by the hysteresis loop in accordance with the explanation previously given.

Suggestive evidence that such reasoning is valid is provided by the circuit of fig. 6. Here, we have essentially a single-ended version of fig. 1. Operation is similar, but efficiency is lower, and the action is not so sure-fire. This circuit often appears in d.c. supplies for Geiger tubes, or for other low-power loads. The capacitor, C, is generally given credit for "resetting" the core in lieu of an alternate switching transistor. From our point of view, however, this is a *resonating* capacitor for the "tank". Such a physical capacitor provides the LC circuit with a higher Q, that is, with greater energy storage than would obtain from stray-capacitance alone.

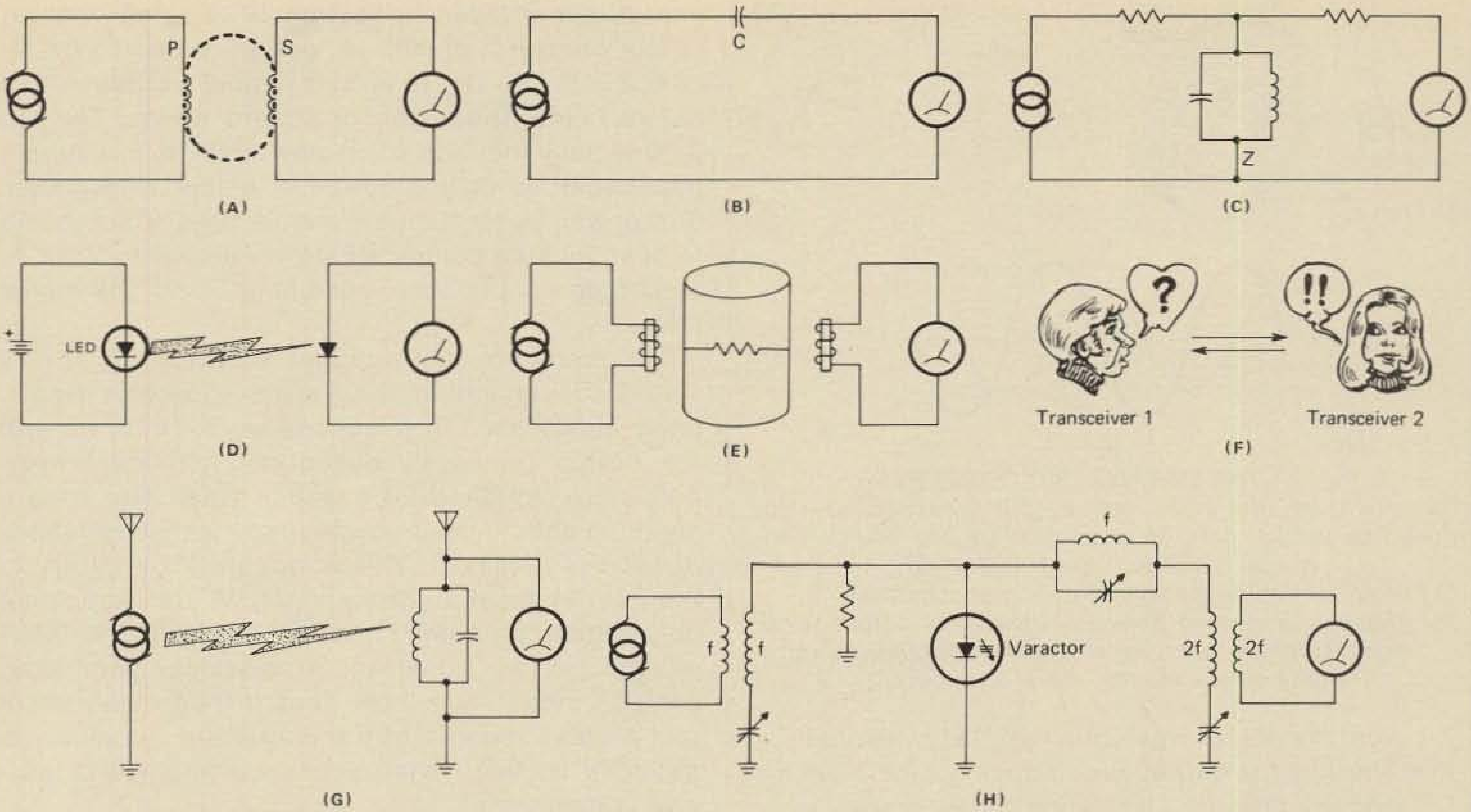


Fig. 7—A FEW OF THE WAYS IN WHICH ELECTRICAL ENERGY CAN BE TRANSFERRED

(A) Transformer action—input and output windings are linked by mutual magnetic flux.
(B) Capacitor "displacement" current.
(C) Common circuit impedance, Z.
(D) Opto-coupler
(E) Nuclear magnetic-resonance. (Exciting coil and pick-up coil are arranged at right—angles to one another to prevent ordinary transformer-coupling.)
(F) Extra Sensory Perception. Often alleged to be instantaneous and independent of distance.
(G) Radiation at radio frequencies
(H) Parametric frequency doubler.

Interestingly, this circuit also takes the form of a free-running blocking oscillator. Virtually all literature dealing with the principle of operation of the blocking oscillator associate the *rise* and *fall* of the pulses to the constants of the LC "tank".

Hopefully, we are now convinced that a hysteresis loop does not, of its own intrinsic nature, supply negative-resistance, amplify, or produce dynamic switching. We may next investigate a very interesting mode of electrical energy transfer based on a novel electromagnetic-device. How many ways can you think of for transferring electrical energy? There are, of course, electromagnetic coupling (transformer action), capacitive coupling via the so-called "displacement current", couplings brought about by mutual impedance between circuits, and electromagnetic radiation. A few of these energy transfer mechanisms are illustrated in fig. 7.

There is, however, yet *another* arrangement for coupling electrical-energy from one circuit to another; one that has been somewhat overlooked theoretically, and neglected in practice. Consider the crazy device shown in fig. 8a. A goofy transformer if ever there was one! But, hold on a moment —*this is not a transformer,* for the magnetic flux of the "primary" winding certainly does not link the turns which comprise the output, or "secondary" winding. Every transformer is, first, and foremost, dependent upon a magnetic flux which is *mutual* to both windings. What goes on here?

For want of a better name, we may call the contraption of fig. 8a a *parametric converter*. The inductance of the output circuit is *modulated* by the magnetic flux of the input circuit. This occurs because of the generally non-linear relationship that exists between the magnetic permeability of ferromagnetic material and the magnetizing force. It happens to be a fact of life that energy can be "pumped" into a circuit if its inductance is varied. But, the "pumping" must occur in such a way that more energy is transferred into, than out of, the circuit by the pumping action. This requirement is satisfied when the input frequency coincides with the resonant frequency of the output winding. Under such conditions, the phase conditions shown in fig. 8b prevail. Note that, unlike the conventional transformer, where the induced secondary voltage is either in phase, or 180 degrees out of phase with the primary voltage, this phase relationship is *ninety degrees* for the parametric converter. Other interesting features of this device are as follows:

- Off-resonance, the output falls to zero. (Except that it will also operate as a frequency multiplier when the source supplies a sub-multiple of the resonant frequency.)
- No matter what the wave shape of the excita-

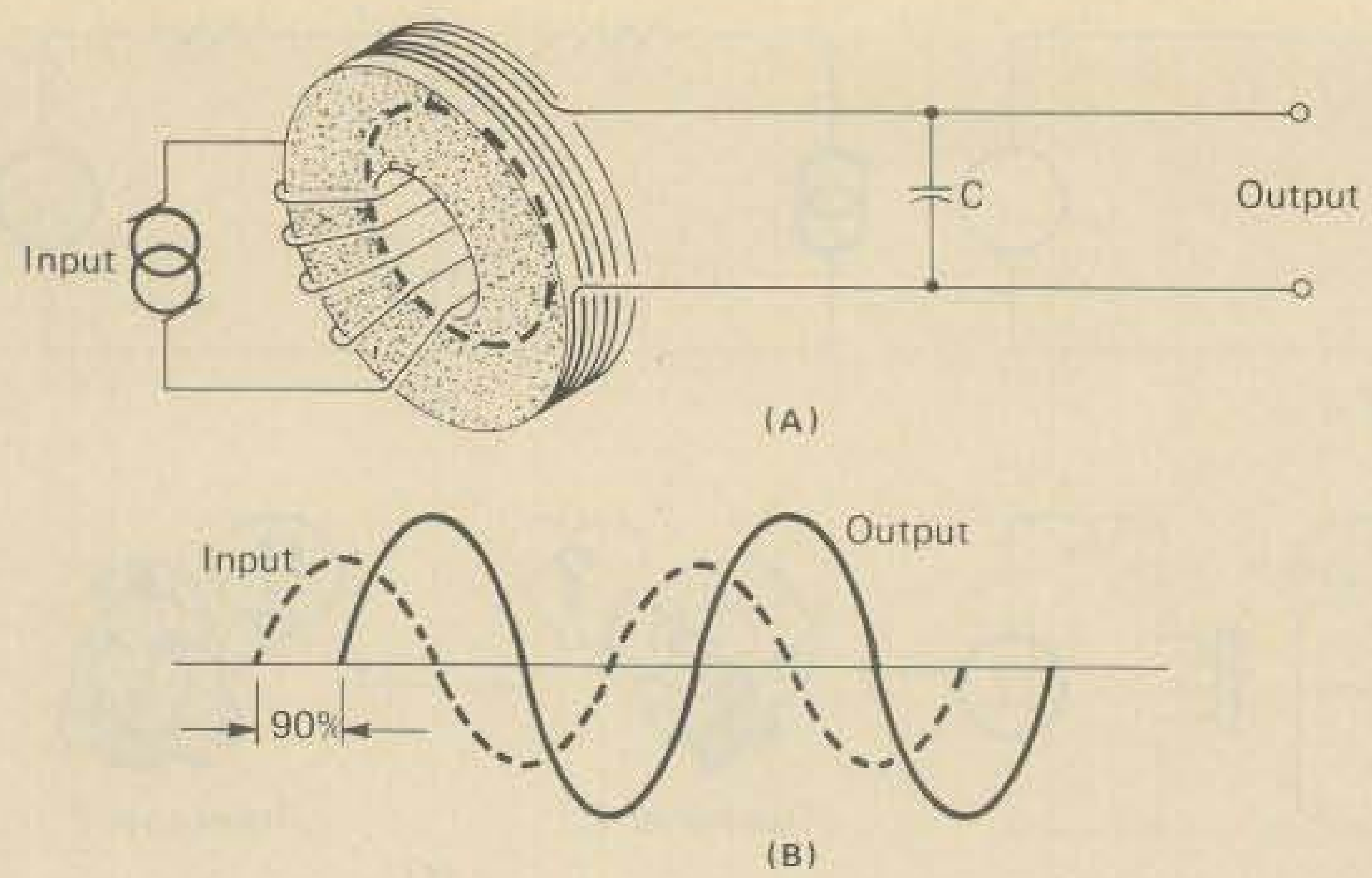


Fig. 8—THE PARAMETRIC CONVERTER
Inasmuch as the input and output windings are not linked by mutual path of magnetic flux, the device cannot be classified as a transformer.
(a) Physical details for an experimental converter.
(b) Phase relationship between input and output windings. This pertains to resonant operation. Appreciably off-resonance, there is no output.

tion, the output waveform remains *sinusoidal.*

- *Shorting* the output circuit does not increase the primary current. Oscillation then ceases.
- The device is not bi-lateral; if the excitation is applied to the output winding, no energy is transfered to the input winding.
- As a corrolary of the above described behavior, the device provides very high rejection of transients produced by either source or load.

The author made the experimental parametric converter of fig. 7 by placing the two windings on a 2" OD powdered-iron core of the type commonly used for antenna baluns, r.f. tanks, etc. These have cross sectional area of ½", and are convenient to work with. Approximately fifty turns of #26 enamel wire used on both the input and output windings. The toroidal (input) winding should be placed on the core first, and it can occupy sixty to ninety degrees of the core circumference. Both windings

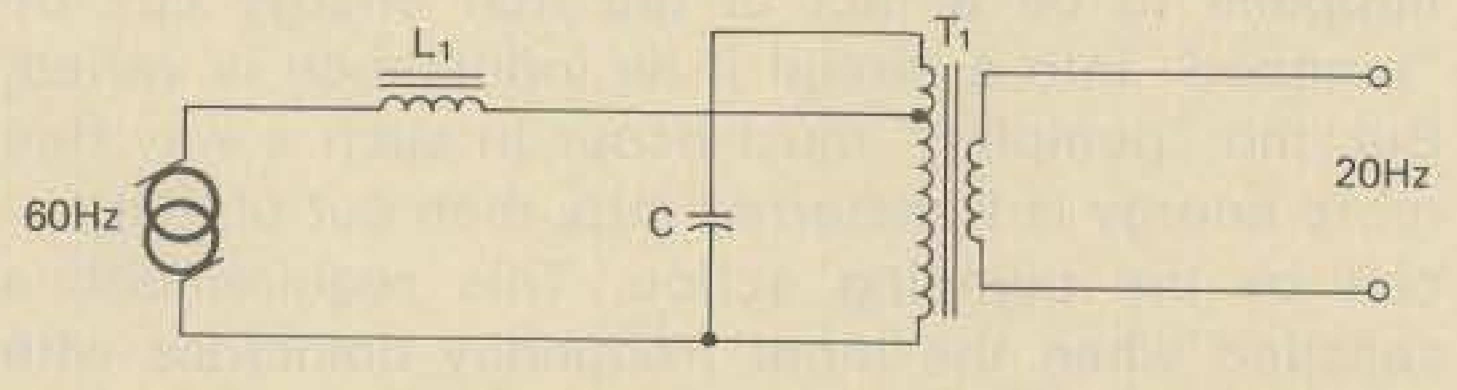


Fig. 9—THE LORAIN SUB-CYCLE RINGER
The production of a subharmonic as a direct consequence of circuit non-linearity is theoretically impossible. Yet, this electromagnetic arrangement appears to accomplish such a result. Actually, the 20 Hz is the difference frequency between the 60 Hz input and an "internal" 40 Hz signal which is the 2nd harmonic of 20 Hz. The 40 Hz signal may be construed to be generated by the non-linear inductance of L1. By assuming the circuit to already be in operation, the interaction between the three frequencies maintains he operation—the 20 Hz is doubled to 40 Hz and the "mixing" of the 40 Hz and 60 Hz frequencies, in turn, yields the difference frequency, 20 Hz. L1 behaves as both "mixer" and "frequency multiplier".

can be either layer, or "scramble" wound. With an output capacitor of 0.05 μF, operation should be attained in the 40 kHz to 60 kHz region. Excitation can be with sine, triangular, or square waves. The experimentally-inclined ham may wish to investigate the properties of this device at higher frequencies and power levels. Some possible uses which come to mind include baluns, RF power amplifier "tank"s, interstage impedance matching, and harmonic filters.

The electromagnetic circuit shown in fig. 9 is a simplified version of the Lorain sub-cycle ringer, once widely used in telephone work. Here, as with the device previously described, non-linear magnetics are exploited for a useful result. The intriguing thing about the sub-cycle ringer is that *frequency division* is achieved. This is apparantly contrary to the Fourier theorem, from which we can anticipate only higher harmonic frequencies from the interaction of an ac signal and a non-linear parameter, such as inductance. How does it then come about that a *sub-harmonic* of the impressed frequency is provided by this rather simple assemblage of passive components?

It happens that there is no way in which the mere condition of non-linearity can cause a fraction of an applied frequency to generated. Something special and unique must be done to bring about such "impossible" operation. Much insight into the true nature of the sub-cycle ringer can be attained by contemplating a somewhat analagous frequency-divider known as a *regenerative modulator.* In the regenerative modulator the essential function blocks, and the signals needed to produce frequency division are clearly delineated. In the sub-cycle ringer, they are concealed. Fig. 10 shows a transistor regenerative modulator which, like the sub-cycle ringer, divides incoming 60 Hz down to 20 Hz. Our procedure in describing the theory of operation will be to assume that the circuit is *already* in operation, then to show why it continues to operate.

The input stage, Q1, has two inputs — 60 Hz is applied to its base, and 40 Hz is impressed on its emitter. Because this stage operates in a non-linear mode, the difference frequency, 20 Hz, is developed across its tuned output circuit. (Non-linearity is achieved by having the forward bias derive from the input signals, primarily the 60 Hz input, rather than from a dc source as is commonly done in ordinary class A amplification.) Some of the 20 Hz energy is available for the output, and some is capacitively coupled to the base of stage Q2. This stage is also operated as a non-linear amplifier. The tuned tank in its collector circuit selects the second harmonic (40 Hz) from the large number of harmonics of 20 Hz caused by the non-linear response of Q2. And, because this 40 Hz signal is "re-cycled" through stage Q1, the mixing and harmonic generating-action continue, thereby keeping the circuit in operation. Note that, despite the non-linearity of the two stages, no actual frequency-division is (nor can be) accomplished within the circuit. Rather, the sub-input frequency delivered at the output terminals is the consequence of *heterodyne action.*

Returning now to the magnetic sub-cycle generator of fig. 9, an analagous reasoning applies to its operation. Although, L1 is not tuned, a 40 Hz signal is developed across is because of the non-linear inductance it offers to the 20 Hz signal produced in the tuned winding of T1. At the same time, L1 "mixes" the incoming 60 Hz signal with the 40 Hz component, and thereby provides 20 Hz pulses to T1, constantly replenishes its energy so that a constant 20 Hz output signal is available. As with the transistor circuit of fig. 10, no output exists without the 60 Hz input. Both circuits operate as "stimulated oscillators". But, because the magnetic sub-cycle generator has no internal amplification, it is not so readily made self-starting . A momentary short-circuit across L1 produces a large transient which provokes the circuit into operation. (Although not shown in the simplified schematic of fig. 9 the actual Lorain sub-cycle ringer used a relay to perform this shorting action during start-up.) For the experimentally inclined, there might be some interesting possibilities for an audio-frequency version of this system for c.w. signal processing at the output of a receiver. Permanent magnets and extra windings for d.c. will be found useful for attaining the requisite non-linearity of the cores.

A situation apparantly contrary to "common sense" exists in many electrical machines. In the d.c. generator, such as shown in the semi-schematic illustration of fig. 11, the rotating armature could produce no current in the load if the field flux were absent. By the same token, the stronger the field flux, the higher is the voltage developed across the load, and the greater is the current forced through it. Indeed, a rheostat, R_f, is commonly used to control the voltage and current delivered to the load. This is not less than reasonable considering the electromagnetic coupling which must exist between the field and armature windings. In view of the fact that a.c. is actually induced in the armature (and is subsequently rectifield by the commutator), it might appear that this electromagnetic coupling is similar to that in an ordinary transformer. But, how does one account for the fact that a change in load demand, say by varying R_l, does *not* cause any change in the field current, I_f? Here, as with the parametric converter, we find a strange departure from conventional transformer-action. In this case, however, we cannot attribute the behaviour to parametric phenomena.

The resolution of this dilemma stems from the recognition that the field and armature fluxes are spatially in a *quadradture* relationship — no mutual

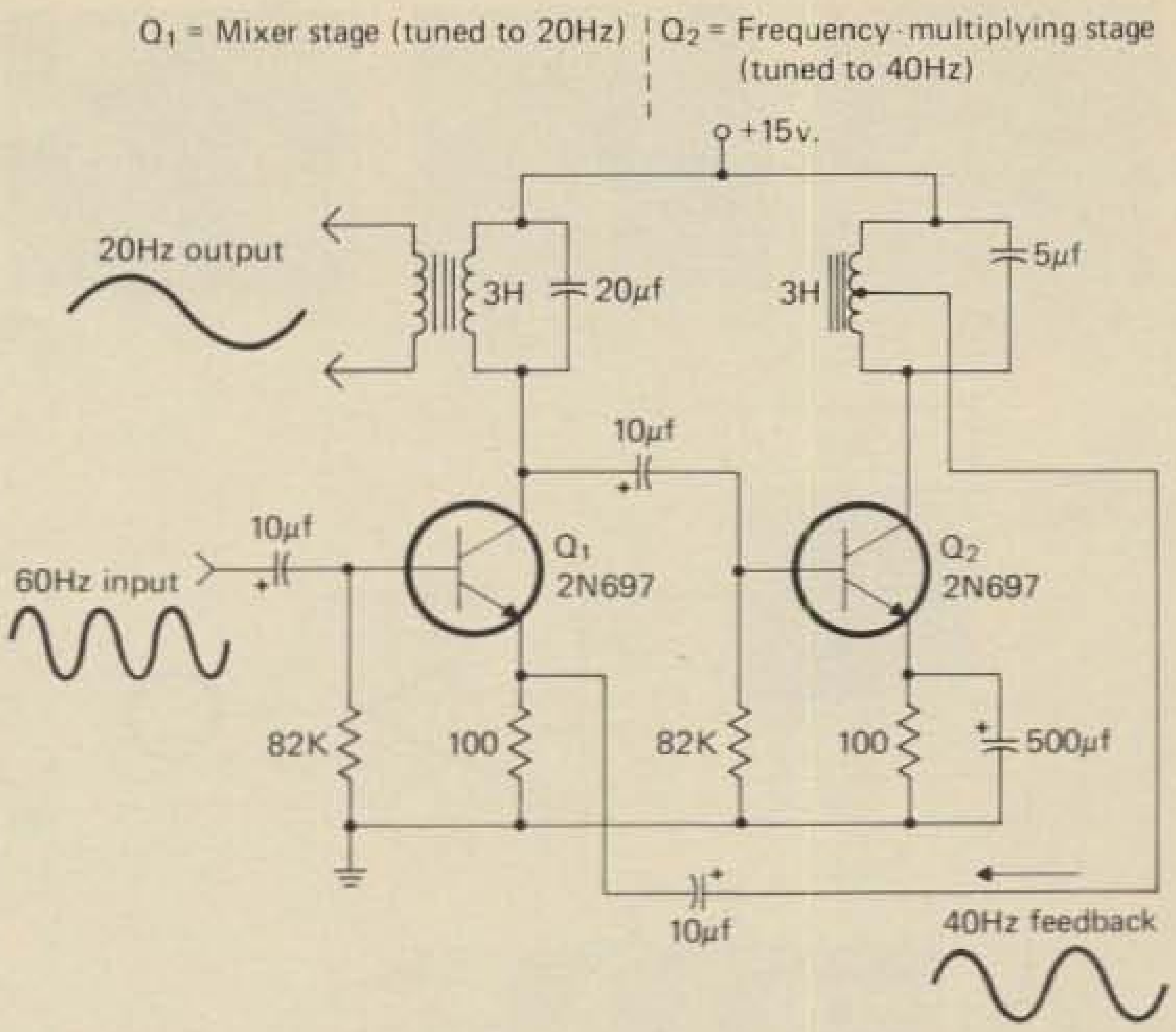


Fig. 10—AN ELECTRONIC CIRCUIT WHICH PRODUCES THE SAME RESULTS AS THE SUB-CYCLE RINGER
This circuit, known as a regenerative modulator, provides instructive insight because of the ease with which its functional blocks can be identified. Note that the 20 Hz output is not *actually generated as a "subharmonic" of 60 Hz. Rather, the 20 Hz is a* difference frequency, *being the heterodyne between 60 Hz and 40 Hz. The 40 Hz signal is the 2nd harmonic of this 20 Hz heterodyne product. The operational sequence of this circuit is most easy to follow by assuming that it is* already *performing as described—then, it is readily seen that the three frequencies continue to interact to mainain operation.*

flux "links" the field and armature windings. So, contrary to a popular misconception, the electrical energy dissipated in the load is *not* derived from the energy stored in the magnetic field. This is fortunate, for otherwise it would not be practical to construct tachometers and other d.c. generators using permanent magnets, for the magnets would quickly "run down" — in analagous fashion to a battery. The true function of the field flux is merely to *deflect* the free electrons in the armature conductors so as to cause piling up of electrons at one end and a deficit at the other end. In more commonplace language, an EMF is induced in the rotating

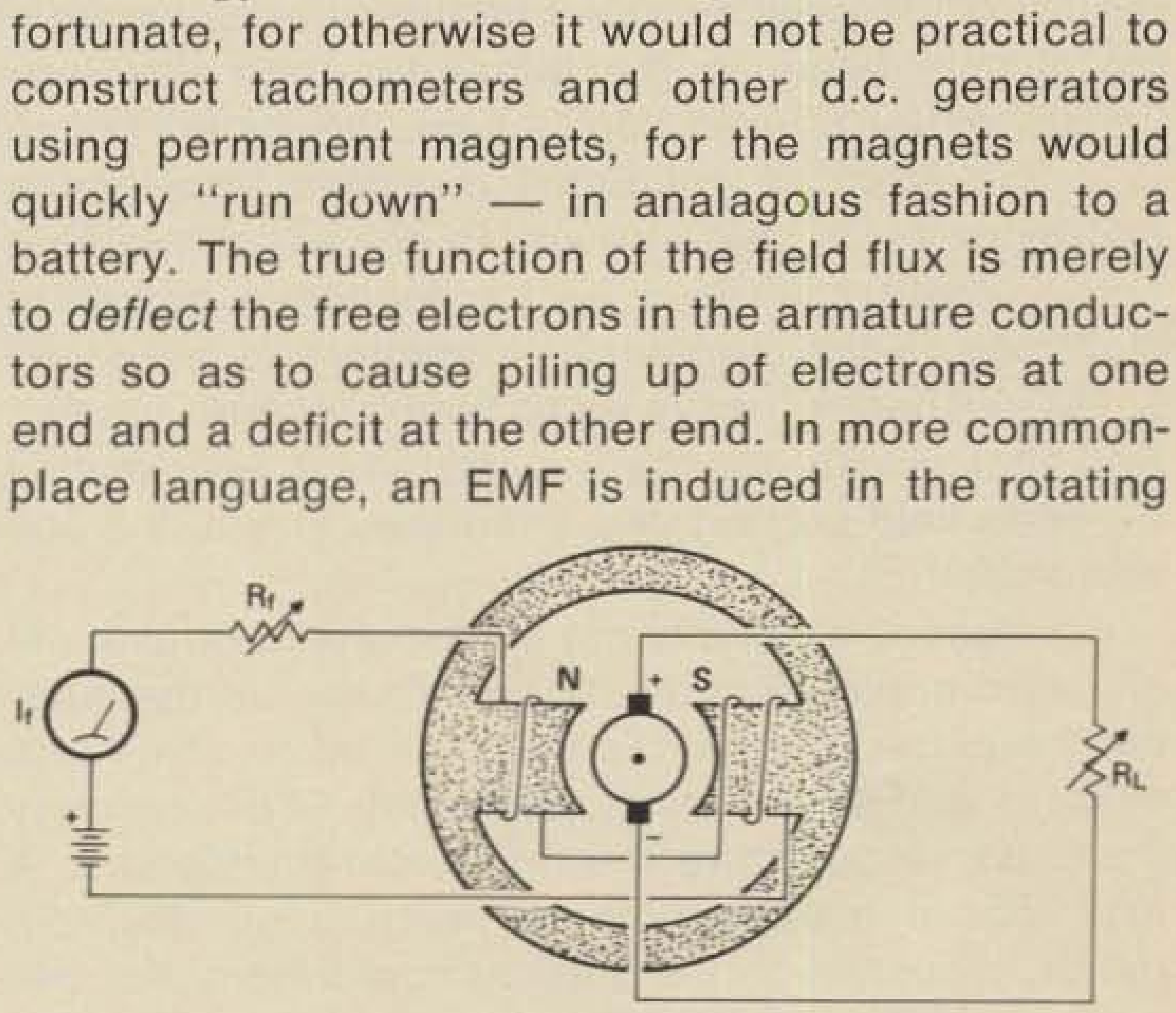


Fig. 11—THE DC GENERATOR— AN ELECTROMAGNETIC ENIGMA
The electromagnetic "coupling" between the field and armature windings is such that load current can be controlled by varying the field current but field current is not *responsive to variations of load current.*

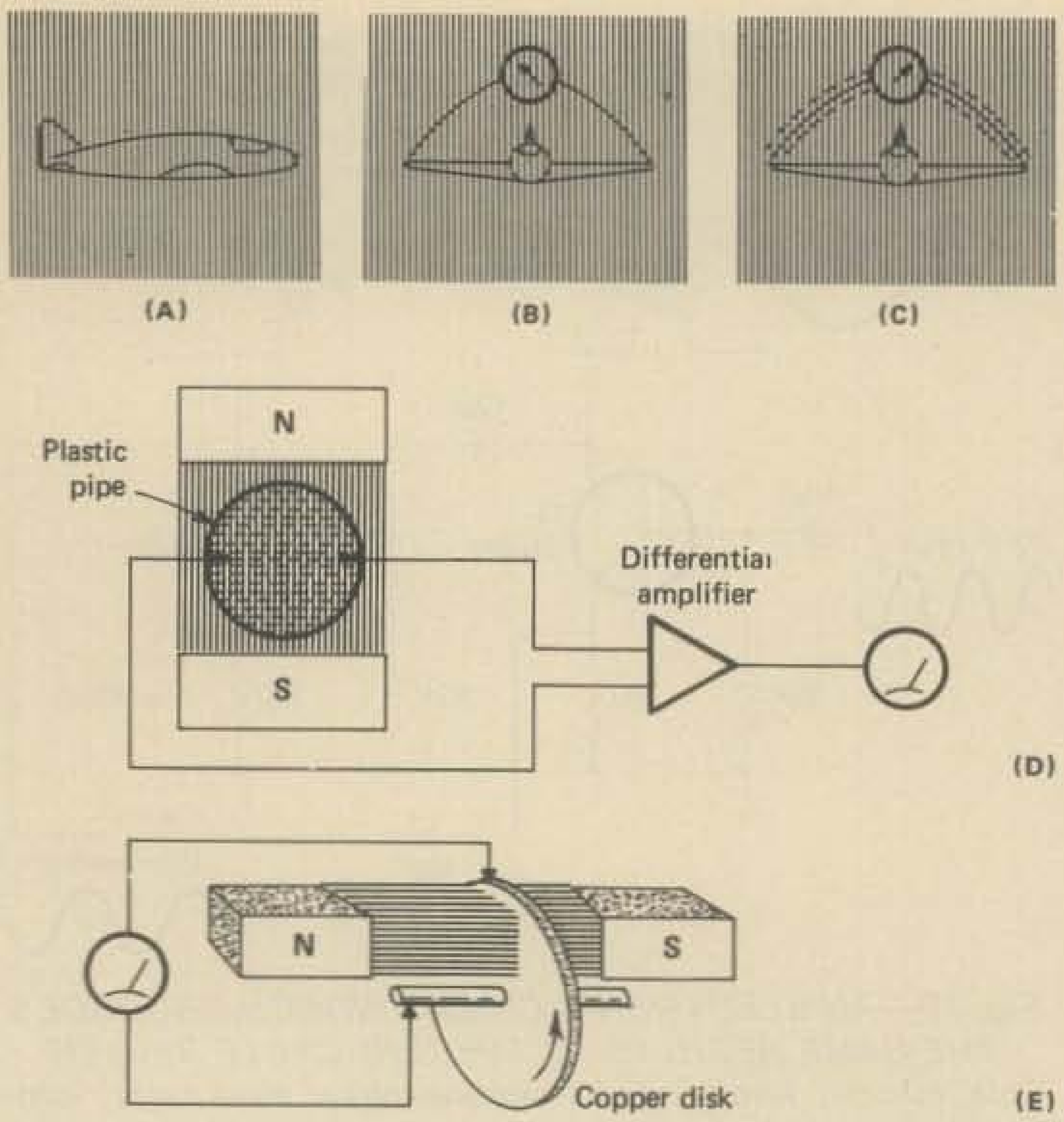


Fig. 12—ELECTROMAGNETIC FOOD FOR THOUGHT
Cutting the flux may not be "cut and dried."
(a) Side view of an aluminum-clad aircraft flying through the vertical component of the earth's field.
(b) Head-on view of craft flying through vertical component of earth's field. A detection device is deployed in order to measure the EMF generated in the wings.
(c) Same as (b), but the leads to the detector are magnetically shielded.
(d) Liquid-flow measuring system.
(e) The Faraday disk generator.

armature. This requires virtually no energy from the field. When current is demanded by a load, the requisite energy is supplied by the *mechanical driving system* because the generator then develops "motor action". From Lenz's Law, this motor action is in the opposite rotational direction from which the generator is being driven. In any event, the field circuit could care less — its deflective action of electrons in the armature conductors is as easily accomplished at heavy as at light armature loads.* And that is why the cause and effect relationship between field current and armature current is a one way street!

For *desert*, we finally are served the controversial situation depicted in fig. 12 abc. Except at the magnetic equator, the earth's field can be resolved into vertical and horizontal components. The ordinary compass responds to the horizontal component. A less commonly-encountered instrument, the dip meter, responds to the vertical component. We will concern ourselves only with the vertical component, and imagine it to comprise lines of force arrayed perpendicular to the surface of the earth. For the purpose at hand, it is not of any consequence whether the magnitude of this vertical flux is the same in a and b of fig. 12. We simply wish to ascertain whether the detector connected to the metallic wings will record a current or voltage proportional to the speed of the aircraft. Apparantly, this will not be the case in b because the leads associated with the detector would have the same EMF's induced in them as have the wings. So, no *net* voltage would be developed across the terminals of the detecting device. This suggests the technique shown in c wherein the detector leads are *magnetically shielded*. Will this strategem work?

In order to evade the barrage of letters which are surely destined to innundiate the author if either conclusion is cited, no direct answer will be given. However, some very suggestive clues may be ferreted from somewhat-similar electromagnetic situations:

In d of fig. 12, we see a practical arrangement for monitoring liquid flow in a pipe. If the amplifier has a high impedance, the fluid may even be a moderately good insulator. On the other hand, a fluid with good conductivity will generally make the task easier. (provided, there is no electro-chemical reaction at the probes) Here, we have a conductor "cutting" magnetic flux, even though the "conductor" is continuously replenished with the passage of time. The faster the flow, the greater is the induced EMF developed across the probes. Similarly, the Faraday disk generator of fig. 12e continuously supplies new conductor material so that the "cutting" of magnetic flux occurs without interruption. Consequently direct current is generated with no need for the rectifying action of a commutator. Can one meaningfully relate the situations depicted in (d) and (e) to that of (c)? In (d) and (e) we enjoy the luxury of a *confined* magnetic-field so that the detector leads have no EMF induced in them. Of course, we hope to accomplish the same result with the aircraft by *shielding* the detector leads. Also, in (d) and (e), the detector is in the same reference frame as the field. In the aircraft, the detector is in the same reference frame as the conductor. (the wings). Without splitting hairs, or bringing the principle of relativity into the picture, can we decide, in a qualitative may, whether the idea portrayed in (c) is feasable?

Whatever your evaluation, it is hoped you will decide you have been served a tantalizingly good meal and will be of a disposition to return for repeat orders! ■

*Second order effects, such as armature reaction, are not considered here. For greater insight into the behaviour of electrical machines see the author's Howard W. Sam's book, "Electric Motors & Electronic Motor Control Techniques" No. 21340.

a monthly feature by

ADRIAN WEISS, K8EEG

QRP

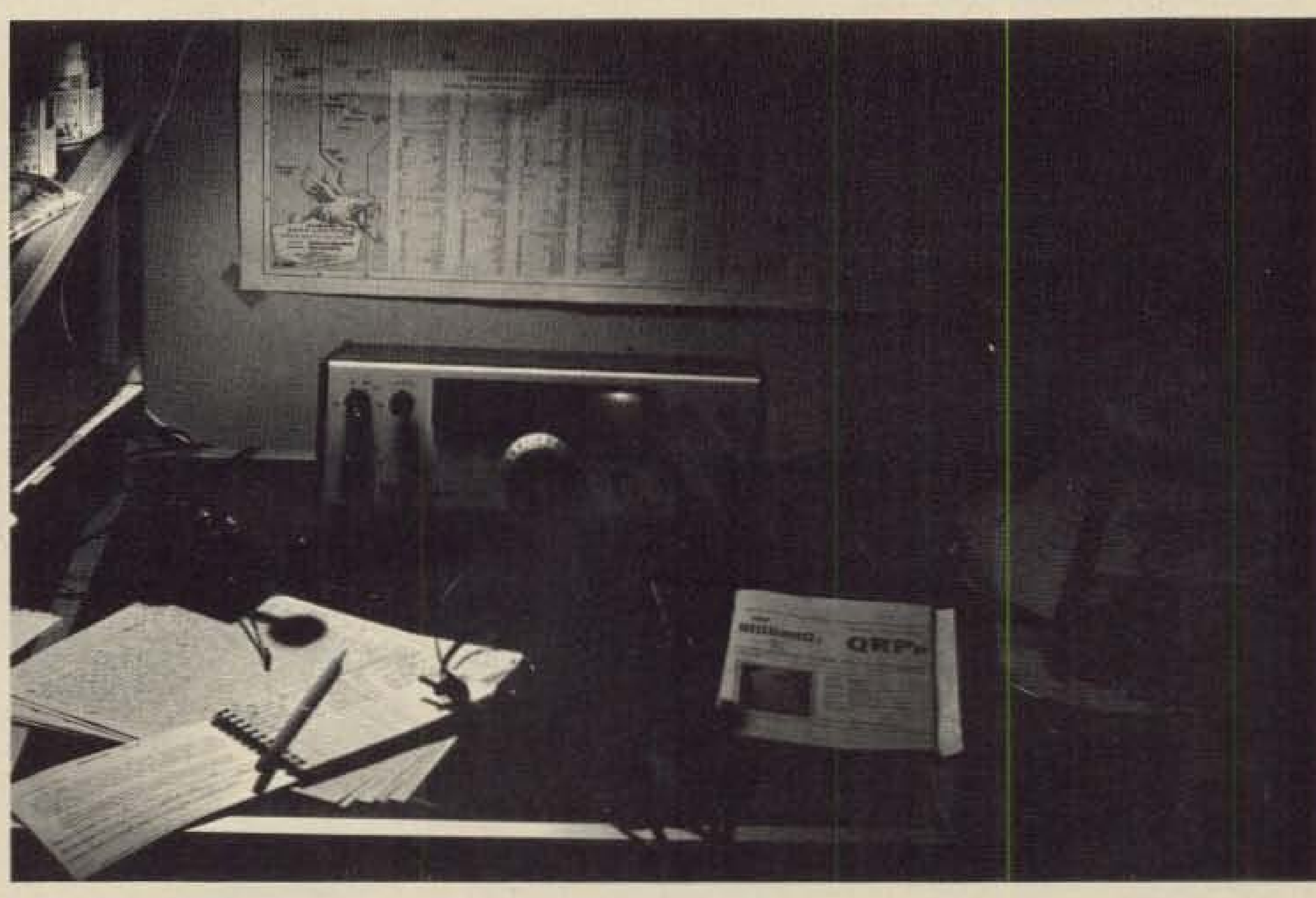
The art of very low power operating

The Old Tube-Hound Goes Solid State

Back in the spring of '71 or thereabouts, at the time that my efforts with *The Milliwatt* and QRPp began to bear some fruits, I had a surprise visit from a fellow that I heretofore had known only from his delightful manner of writing about mundane electronics subjects for the magazine. In fact, I'd invited C.F. Rockey, W9SCH, to join the staff as a contributing editor with no responsibility other than a continual flow of informative technical articles written from a perspective that had been vitalized through some four decades of hamming and teaching electronics to snot-nosed high school kids. Rockey knew his stuff and could get it across, 'cause he'd turn out a couple First Class Commercials each year from his electronics program at New Trier High School. That's a high school, by the way. He was especially pleased when one of his kids, "Schlitzy" Schillereff, WB9CXN, first broke into print in *The Milliwatt* and then in *ham radio.* Pretty good teaching job for an old fogey like Rockey (that's what I always call him, as I never have managed to find out what the "C.F." stands for!). Rockey is one of those guys who doesn't like the limelight and prefers to pass on his electronics wizardry on an individual basis.

Well, as I was saying, he popped up one morning in the wilds of South Dakota and we had a very pleasant visit with him and his charming wife Fran, who is also a teacher. Delightful, cultured couple, to say the least. Amateur radio will always be healthy as long as there are guys like Rockey around to instill the old idealism into the younger generation of hams. But I keep getting off the subject. We BS'd about general matters and quickly set the world straight (those were the Nixon days) and without missing a stride we tidied up the world of Amateur radio. We philosophical types are blessed with the knack of cutting through all the balderdash and getting to the essence of matters expeditiously. With serious concerns out of the way, I showed Rockey some of the "pride 'n' joy" products of my creative electronics genius—all of which were p.c. board solid-state types. That kind of flustered the Rock and got 'im ranting about the virtues of tubes and the evils of solid-state. Now, don't get the wrong picture. Not that he didn't know anything about solid-state. Why, back in '55, or was it '57, I don't remember which, he cajoled his boss into using some leverage to acquire a couple of those newfangled "transeestors" from a friend at Bell Labs, and Rockey had his fun with 'em. Even got one to oscillate up around 1300 KHz. His boss wasn't impressed. Told him that nothing would ever come of those little gadgets, clinching his case by proclaiming that vacuum tube state-of-art had reached such a height of sophistication that vacuum tubes would never be replaced, nor was there any need to try. Well, there's no need to identify his boss in print, not now, at any rate.

To get back to my story, I reminded the Rock of that episode in his life, and he ended up admitting for all his earlier bluster, that transistors are wonderful little gimmicks and he'd really like to tinker with 'em, but by garsh, they were just too danged little for his clumsy paws to work with. Well, I forget all that I said to motivate him into trying solid-state anyway, but I do recall telling him that he could do point-to-point wiring rather p.c. board stuff as long as he didn't show it to anyone, and other stuff like that about maintaining the



The tidy QRPp station of Art Pahlke, K9KXE, (4207 N. Monitor, Chicago, Ill. 60634). Art is a member of the QRP fraternity, having decided to give it a try after reading some back issues of The Milliwatt. The antenna system is a trap vertical, ground mounted, with no radials, and surrounded by bushes and buildings, a very poor situation. Nonetheless, he's had the thrill of working CA on 40 c.w. as well as other areas of the country. He re-entered amateur radio via QRPp after a long layoff, and says he thinks he'll stay now! Great!

*83 Suburban Estates, Vermillion, SD 57069

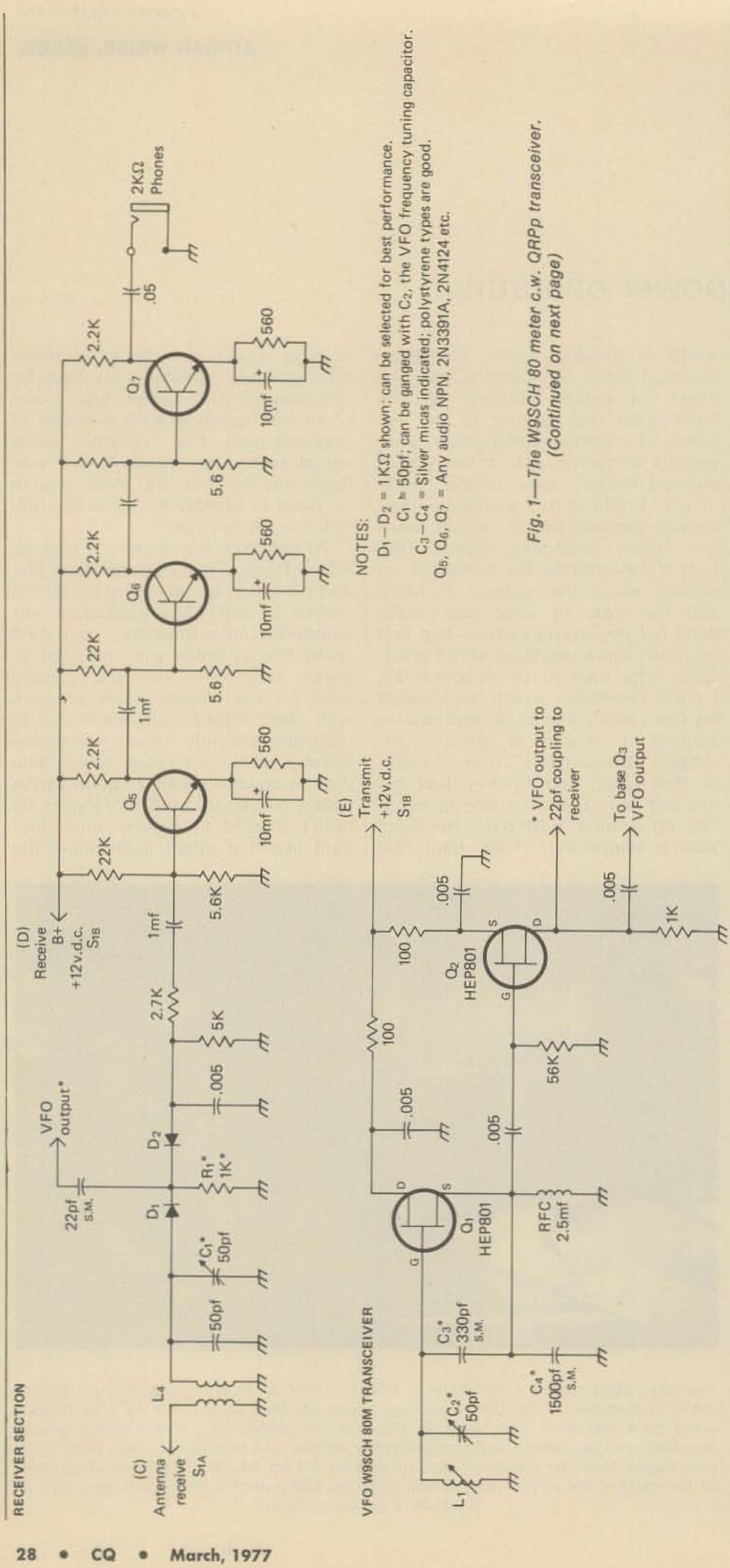


Fig. 1—The W9SCH 80 meter c.w. QRPp transceiver.
(Continued on next page)

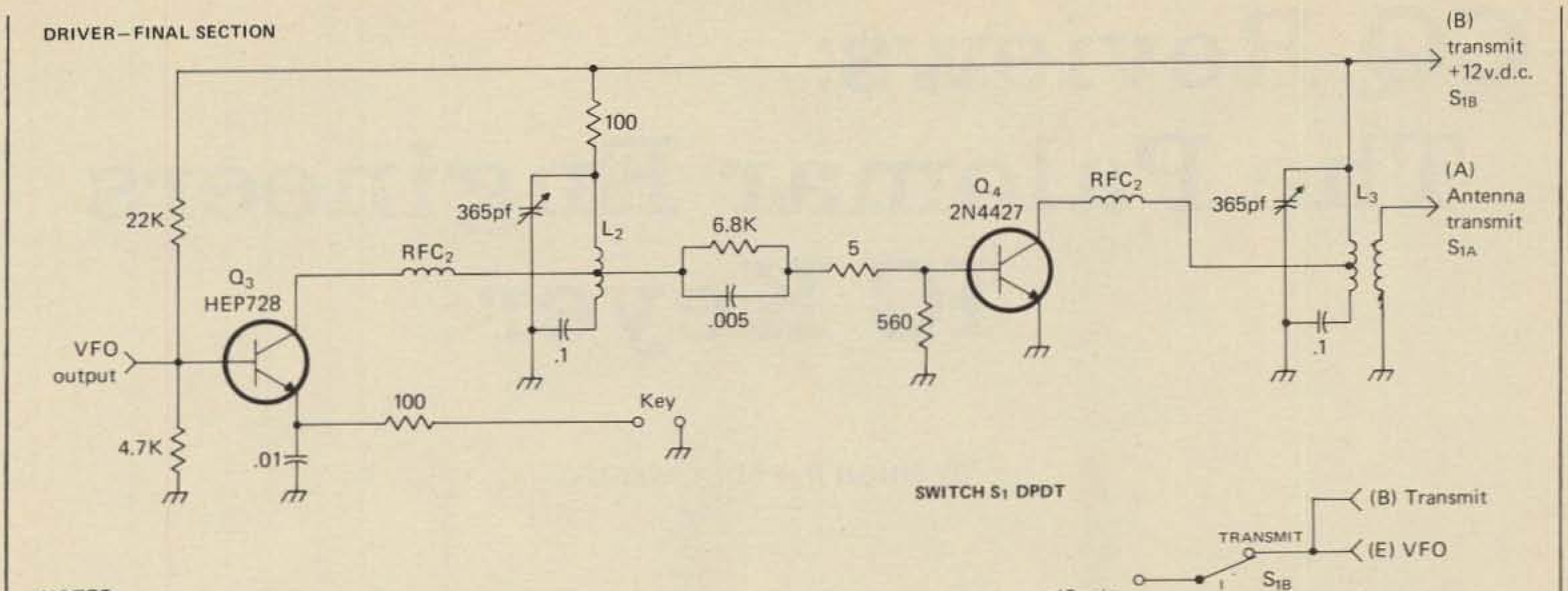
image of QRPp'ers as being right at the front of the modern wave of developments in all respects. While, this whole incident took place quite a while back and several W9SCH "tube" designs ago, but the Rock finally could no longer resist. He went solid-state. Yep. And without any prompting on my part, he sent me the following testimonal with the appropriate moral in its conclusion. Without further ceremony, I pass it on for the reader's edification and emulation.

W9SCH 80M Solid-State Transceiver

After 37 years of using, and misusing the good old fire-bottle, I have finally gotten up the nerve to try an all-solid-state job. This wasn't easy, after absorbing the gloom and doom that fills the literature in this field. One *ham radio* article recently was filled with Faustian foreboding, almost. It's enough to scare a poor boy half to death, it is. But, after all, Ten-Tec has been building these things on quite a scale now, and they're not necromancers—or are they?

Upon reviewing the junkbox stock, the meager cash supply, and my few viable brain cells, I decided to tackle a little 80 meter c.w. transceiver in the TenTec-esque manner. Fig. 1 shows the resulting circuit. It took a while to get it into that form. To paraphrase an old U.S. Navy proverb: "Transistors, like the sea, are not inherently troublesome, but they are horribly unforgiving of human error." That's about the sum and substance of my experience in this project. You can slap a vacuum tube in the face, time and time again, and it will come back for more of the same. Not so a transistor; one little boo-boo will kill an expensive transistor in a millisecond or so. With transistors, there is no second chance to err. . . . So, being the inherently sloppy type, my first adventure with h.f. solid-state power was something of a *lachrymae rerum*.

Low-level, low frequency transistor circuitry is no problem, really. In fact, it seems less fuss and bother than the analogous tube layout. For instance, our FET v.f.o. and source-follower worked just deliciously, right off the bat. In fact, this is probably the cleanest, most stable, and least fussy v.f.o. that I've ever built. Gone are the microphonics and those esoteric little hums that plague the tube v.f.o. The audio amplifier for the receiver also amazed me by its lack of fussiness. A tube amplifier with four stages and this degree of gain would probably "motorboat" its fool head off, unless it were carefully de-



NOTES:

RFC2 = 5t, ¼" dia close space.

Coil data: Bell wire (No. 20), 1.25" dia form

Coil	Primary	Link	Tap
L_2	25t		8t from ground end
L_3	25t	6t	5t from ground end
L_4	51t (40µH)	5–8t	
L_1	8µH slug tuned (Miller 21A68RBI		

coupled etc. The transistors are as well-behaved as they can be, with no special precautions taken whatever. Indeed, everything went so well with the receiver that I began to think that I had this solid-state stuff "made in the shade with lemonade," as they say. But ah, *hubris!* Little did I know the agony ahead. . .

So, I went blithely on to the final amplifier. It completed, I coupled up a 15V "series" type Christmas-tree bulb (my favorite r.f. indicator) to the tank circuit. Flipping on the battery, I fully expected to warm my soul in the effulgent glow of the bulb. But, alas, not so. What did I get? *Gar nichts*, as we say in German—plenty of good ol' nothing!

For gawsh sakes, how could a simple thing like this fail to work? But, there it was—the 2N4427 was as dead as a week-old baloney sandwich, shot right through the collector junction. Another, more-thorough check of the wiring with a v.o.m. exposed no faults. So, I put in another transistor . . . foolish, foolish old man, this one, too, bit the dust quicker 'n a hoss-opera Indian. This was too cotton-pickin' much. I decided to quit and think things over a bit. Two Excedrin headaches and another transistor later, I decided to try it with only six instead of twelve volts. Now we were gettin' somewhere, as plenty of "soup" was lighting up the r.f. bulb. But, behold, the thing was oscillating like a drunken cowpoke in a hoedown contest! Apparently, what was happening seemed to be that the transistor threw itself into oscillation with twelve volts and the excessive current perforated the junction. With six volts, however, there was not enough energy present to wreak such havoc.

I finally shunted the thing down with a 27 ohm resistor in the base lead. That cooled things off sufficiently to risk another twelve volt run. This time the transistor survived. Now that I was getting a goodly gob of "soup" into the r.f. bulb, about a watt with two watts input, I decided to try the thing with a live antenna. Yes, it put the stuff into the antenna all right, but on all kinds of frequencies where it shouldn't have.

More diddling followed. I found out that when the books say that the output impedance of a power transistor is low, they mean low! This amounts to one-half of the d.c. collector resistance. In my case this is, ballpark, about 80 ohms. Assuming a minimum loaded Q of 10 for the tank, a bit of stick-slipping (Ed. Note: the slide-rule, which consisted of a fixed set of scales, and a sliding stick with another set of scales, was formerly used as a mathematical calculator before the time of minicalculators) revealed that the collector should be tapped about one-fifth of the coil turns up from the cold end. And mine presently was tapped about two-thirds of the way up. Any loaded Q the tank exhibited under such conditions was purely coincidental! Moving the tap down to where it belonged cleaned up the signal immensely.

Of course, I was favored with parasitics, the whole doggone collection, including TVI, and that sick-sounding hiss that sounds just like an old quenched-spark signal as received on an oscillating detector, and is spread out all over the band. A little five-turn, ¼ inch diameter "choke" in each collector lead of the driver and final, and a five ohm resistor in series with the final base, seemed to lick these parasitics fairly well. When the ferrite-beads that I ordered from California come, I expect them to do the job even better.

Now the output and efficiency were reasonable—about one watt output for 1.5 watts input. The tank circuit tuned as a tank circuit should, and there was no detectable spurious signals lurking about that I have been able to find. There was a smirch of cross-hatching on Channel 2 on a rabbit-eared boob tube ten feet away, but all other channels were clear. After a week of operating, I had no complaints from the neighbors. The receiver works satisfyingly well despite its simplicity; it compares favorably with that in my PM-3 (allowing for band differences) and there's not much I can hear on my faithful old HRO that I can't hear with this job. The phones are full of workable signals every night, and I'm sure there's little I could work with two watts that I can't hear with

(Continued on page 73)

CQ Reviews: The Palomar Engineers IC Keyer

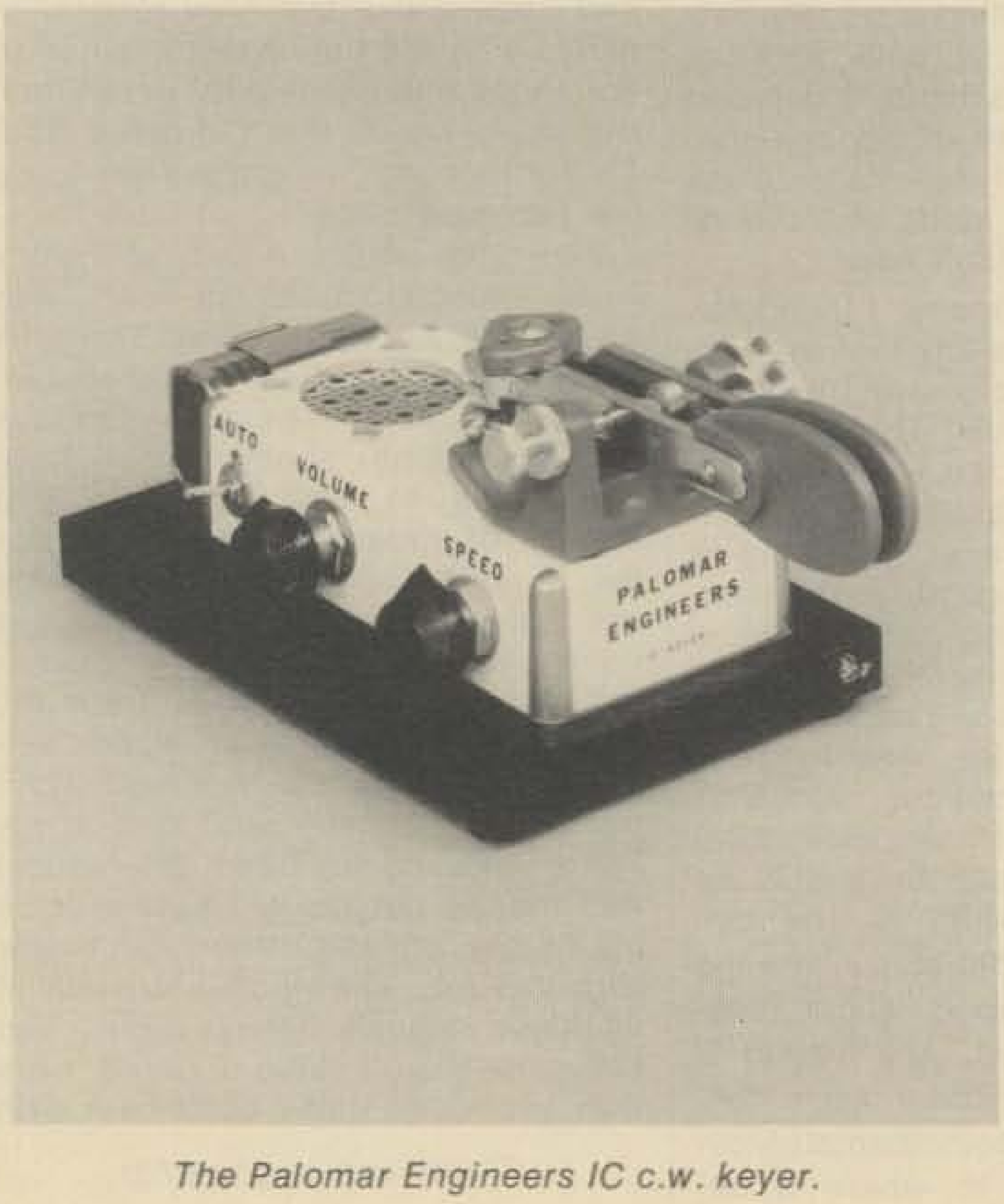
BY HUGH R. PAUL*, W6POK

Contrary to rumors currently in vogue, c.w. is not dead. In fact c.w. is more fun than ever once you have mastered the use of a good electronic keyer, such as the one pictured here, manufactured by Palomar Engineers of Escondido, California.

Powered by an externally mounted 9 volt transistor radio type battery, the Palomar keyer employs CMOS (complimentary metal oxide semiconductor) circuits. The key up current is so low that an on-off switch is not required.

Modes of operation include Automatic for both dots and dashes or Semi-automatic for dots only with dashes being made manually. Iambic operation provides alternating dots and dashes when both paddles are squeezed. The series can be started with either a dot or a dash depending on which paddle is squeezed first. This latter mode contributes greatly to keying ease and speed, once the operator has learned the technique.

*291 Macalester Drive, Walnut, California 91789



The Palomar Engineers IC c.w. keyer.

Keying speed is continuously variable from 5-50 w.p.m. The built in keying monitor has a volume control that can completely silence the monitor if the keyer is being used with a transceiver with its own c.w. monitor.

You need not worry about damage to the integrated circuit and associated components when using this keyer with transmitters employing cathode keying. A heavy duty Signet relay with ungrounded contacts actually does the keying. This relay is not a "reed" type, thus is not subject to sticking when keying high voltages and currents. Neither was any contact "bounce" exhibited, regardless of the keying speed.

All circuitry is housed in a die cast aluminum box, which provides good r.f. shielding. Add to this feature, good internal filtering of keying and power leads and you have a package that will perform reliably in high r.f. fields.

The standard keyer package includes the heavy duty squeeze paddle and sells for $87.50. The heavy base is an option as a cost of $10. If you already have a good paddle, you can purchase the electronics for $67.50. Provision has been made for plugging in a straight key, should you desire.

I have used the Polomar IC keyer for about three months and have found the performance to be top notch. I did find that when using the optional heavy base, the paddles were just a bit too high for maximum keying comfort. When the base was removed, the keyer had a tendency to creep. This was solved by using double backed tape to secure the keyer to the desk. If you have large hands you will probably find the added height provided by the heavy base to be an asset. ■

a monthly feature by

HERBERT S. BRIER, W9EGQ

Novice

"How to" for the newcomer to Amateur radio

Television Interference

Do your neighbors blame you and your transmitter for every defect in their television reception? Does your family run into your radio room to see what you are doing every time a black bar or a colored herring-bone flits across the family TV screen? Even when you are slouched on the couch staring at the big tube with the rest of them? Does your TV picture dance and jerk and change color with every dot and dash or syllable into the microphone? If you answer such questions in the affirmative, you are one of a big family—radio amateurs who automatically get blamed for all television interference (TVI) in a neighborhood, no matter what the actual cause.

One of the causes of the rising number of TVI complaints is the great increase in the number of 27 MHz CB operators. Their second harmonics fall in the portion of channel 2 that is most susceptable to interference. Significantly, the FCC has found that TVI from this source is tied to the use of illegal, high-power amplifiers. Unfortunately, the public sees no difference between amateurs and CB operators. Consequently, when their town councils pass anti-tower and other restrictive laws to control the nuisance, they penalize law abiding amateur and CB operators more than the scoff-laws who can ruin TV reception with an attic antenna as well as with one 50 to 100 feet high.

Two things you can do about the problem is to make sure that your own signals are not on more local TV screens than ABC, CBS, and NBC, networks combined in your neighborhood; and cooperate with other operators, no matter what type of license they have, in working on their TVI problems. The logical place to start is at your own television receiver. It is not absolutely necessary that your receiver be completely clean of TVI before neighboring sets can be clean. At extremely close ranges, an additional few feet of separation between a transmitting antenna and a TV receiving antenna can make a big difference in TVI. Nevertheless, it is a psychological plus if you can demonstrate that your transmitter does not interfere with your own TV reception.

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

Tune up and operate your transmitter in the normal manner and observe the effects on your TV reception on all locally-active TV channels. Replace and tighten any pieces of shielding and screws on and in the transmitter cabinet. If you have more than one antenna, make the test with all of them. Eliminate all loose and corroded connections in all the antennas—including the TV antenna, itself—whether they are being used or not. Also, tighten up all guy wires, ground wires, metal clothes lines, rain gutters, pieces of metal siding on buildings. Corroded or loose connections in any conductors in a strong r.f. field become non-linear conductors that generate harmonics and mixing products from the r.f. field and radiate the new signals into the atmosphere to be picked up by the TV antenna. All cabinets should be connected to the best earth ground available through short, heavy conductors.

Theoretically, with equal separation between the horizontal TV antenna and the transmitting antenna, a vertical transmitting antenna should pump less undesired radio frequency power into the TV antenna, than a horizontal antenna would, because of the cross polarization of the antennas. On the other hand, the radiating portion of the vertical antenna is often closer than a horizontal antenna to the TV antenna and its feed line subjecting them to a more intense interference field.

If your TV reception survives these tests, you can be sure that your transmitter is not radiating a great amount of harmonic and spurious signals in the local TV channels and that your TV receiver has sufficient selectivity to resist overloading by the strong fundamental signal from the transmitter. But suppose you discover that your television set tells anyone interested when you are on the air, how do you decide whether it is a transmitter fault or a receiver fault? And what do you do about it? Reserve judgement, but install a 300-ohm high-pass filter on the receiver and a 50-ohm low-pass filter on the transmitter[1].

Television High-Pass Filters

The strong fundamental signals

[1] Low-pass and High-pass filters are manufactured by R. L. Drake Co., Miamisburg, Ohio 45342; and Barker & Williamson, Canal St., Bristol, Pa. 19007, and others.

Harold W. Case, WN7DHE, 2191 Michigan St., Raymond, Wash. 98577, has his Kenwood TS-520 transceiver tucked into a corner of his mobile home. It is connected to a home-brew, 2 element, 15 meter Quad antenna. He says the antenna is a real DX worker, but he did not present any evidence. We are sending Casey a one-year subscription to CQ for submitting this picture to our monthly Photo Contest. If you wish to enter, send a clear picture of you at the controls of your amateur station with a few facts about your radio career to: CQ Photo Contest, c/o Herbert S. Brier, W9AD, Novice Editor, 409 South 14th St., Chesterton, Ind. 46304. Non prize winners will also be published as space permits.

from a transmitting antenna near a television antenna may overload the TV receiver circuits and deteriorate the received picture and sound. This overloading type of interference most frequently involves channel 2 and the 50, 28, 21, and 28 MHz amateur bands but can involve other channels and bands. The standard cure for television receiver overloading from strong, out of channel signals is to install a 300-ohm television receiver high-pass filter between the TV antenna feedline and the TV receiver tuner antenna input terminals. Disconnect the 300-ohm antenna feedline from the tuner and connect it to the filter input terminals. Then connect the output terminals of the high-pass filter to the input terminals of TV tuner with short leads.

Several manufacturers of television receivers will supply high-pass filters for use with their television receivers, if it is shown that one is necessary to reduce interference to their receivers. The usual procedure is for a technician to install a high-pass filter temporarily: If the filter helps, get one from the manufacturer or his representative and install it permanently. Some high-quality TV receivers come equipped with high-pass filters.

Transmitter Low-Pass Filters

After installing a high-pass filter in your television receiver, the next round in the TVI battle is to install a 50-ohm low-pass filter at the output terminal of your transmitter. Bolt the filter to the transmitter so that its input coaxial fitting can be connected to the output terminal via a short length of coaxial cable and appropriate connectors. After the low-pass filter is permanently installed, treat its output terminal as the new output terminal of the transmitter; so that only filtered r.f. energy is fed to the antenna from your transmitter.

TVI Primer

The composite television signal is six MHz wide. The video carrier is 1.25 MHz above the low frequency limit, the color subcarrier is 4.58 MHz above the limit, and the sound carrier is 5.75 MHz above the low-frequency limit. Any extraneous signal falling in the passband can interfere with a TV signal, if it is strong enough, but signals falling near the carrier frequencies are most troublesome. As electronic circuits are not perfect, all radio-frequency amplifiers generate harmonics of the frequencies they are amplifying. In addition, they may generate weak spurious signals. The aim in modern amateur transmitters is reduce the strength of their second and third harmonics and "spurs" at least 30 db below the fundamental power (1%), with the average strength of the higher harmonics getting progressively weaker. Assuming a fundamental power of 100 watts on 21 and 28 MHz, a second or third harmonic 30 db down will contain 0.1 watts in TV Channel 2 or 3. A 100-milliwatt harmonic might not sound like much until you remember that the power in the incoming TV signals are measured in micromicrowatts.

Because of their harmonic relationships, Channel 2 (54 to 60 MHz) is most susceptable to 27 MHz (CB), 28 MHz, and 14 MHz harmonic signals. Channel 3 (60 to 66 MHz) to 21 MHz. Channel 4 (66-72 MHz) to 14 MHz. Channel 5 to 27 MHz (CB), especially in the sound channel. Channel 6 (82 and 88 MHz), 28, 21, and 14 MHz. Harmonics from the 1.8, 3.5, and 7 MHz bands also fall in TV channels 2 to 6; and harmonics from all amateur bands up to 29.7 MHz fall in the Channel 7 to 13 block of TV channels, but do not cause as much trouble as in the lower segment.

The output signal of a well-shielded, 1.8 to 30 MHz transmitter equipped with a good, properly-installed low-pass filter should have no components stronger than 80 to 100 db weaker than its fundamental signal in the TV channels—provided that the undesired components do not escape the transmitter/transceiver enclosure via voids in the shielding, the power line, control circuits, or key line. A high-pass filter at the receiver, in turn, will prevent fundamental signals overloading the receiver front end—again provided that the undesired signals do not get into the receiver via the power line. The net result is that, provided the incoming TV signals are strong enough to be useful, they can be received on standard TV receivers without interference from amateur transmitters operating on frequencies below 30 MHz[2].

Once you achieve the happy state of no TVI in weak-signal areas, it becomes a constant battle against loose, broken, and corroded connections in the transmitting and television receiving antennas, and in guy wires, metal towers, and metal clothes lines.

News And Views

In the event that somebody has not learned the news: Any Novice who has lost his distinctive Novice suffix may add "/N" after his call sign to identify himself as a Novice, if he wishes. The privilege might be worth something in contests where being or working a Novice licensee earns extra points. As of mid-October, over 26,000 prospective Novices were enrolled in volunteer Novice courses sponsored by amateur radio clubs across the country. Considered especially significant is that—contrary to usual experience—the sizes of the classes have not been decreasing after a few lessons. On the contrary, it is estimated that there will be over 40,000 students in the classes by January, 1977!

Canadian Novice licenses on the way? In a recent survey of the Department of Communication's proposal for a Novice type license, 83 percent voted in favor. A no-code v.h.f. license was approved by a very slight majority.

You are invited to send your comments, news and pictures for the "Novice" column to: Herbert S. Brier, W9AD, Novice Editor, CQ, 409 So. 14th St., Chesterton, Ind. 46404.

73, Herb, W9AD

[2] We do not imply that things are hopeless above 30 MHz; just that we are talking specifically about the lower amateur frequencies.

This article describes a simple technique for the use of adjustable slug tuned coils for the home constructor.

Front Panel Adjustment For Slug Tuned Coils

BY KEN CORNELL*, W2IMB

Most radio amateurs are familiar with the common slug tuned coil as they are extensively used in the r.f. portions of most amateur gear. The coils are normally used with a fixed capacitor of proper value to achieve the desired L/C ratio and fine tuning is accomplished by adjusting the position of the slug within the coil field. If these coils are used in r.f. stages that are "fixed frequency," there is no problem as they can be peaked-up on the desired frequency. There are however, many cases where these coils are used in circuitry that are not necessarily "fixed frequency," such as coils used in an r.f. amplifier or mixer input for a receiver or converter, or low power stages in a transmitter. In this case, the setting of the coil is normally optimized and for maximum efficiency, it has to be re-peaked if there is any wide excursion made in the operating frequency. This can be a nuisance, as many amateurs have probably experienced. Of course, a variable capacitor across the coil can solve this problem, but unfortunately they take up space and with the growing popularity of solid-state and compact construction, there must be a simpler way.

Modifying the Coils

The obvious approach would be to place the coils in a position where they can be adjusted from the front panel. Unfortunately, the normal construction of these coils provide for chassis mounting and are not easily adapted for panel mounting. Also, the small diameter threaded rod will not accept the standard ¼" panel knob. The problem was solved as explained below.

The press-fit threaded cap at the end of the coil is removed along with the slug. The threaded cap is no longer required. A block of wood (or a strip, if more than one coil is to be mounted) is drilled through with a 5/16" diameter drill. One side of the block is then counter-bored with a drill the same diameter as the outside diameter of the coil form to a depth of ¼". The other side of the block is counter-bored at a suitable diameter and depth to accept a standard ¼" hexagon nut. I suggest that the diameter of this counter-bore be slightly less than the nut diameter across the points of the hexagon. Cement is applied to the inner nut face and sides and the nut is press-fit or hammered into its socket. Be sure not to get cement on the nut threads.

A suitable length of ¼" threaded rod (about 2¼" long) is now screwed into the nut, through the block. The threaded rod is a standard hardware store item.

The next step is to cement the slug to the threaded rod. I have had excellent results with Goodyear "Pliobond" cement. The slug should be centered on the threaded rod and be straight on the extended centerline of the rod. . . . The coil is now slid over the slug and is cemented into its respective socket in the block. . . . The assembly is now finished and can be mounted behind the panel by screws, bolts or cement. ■

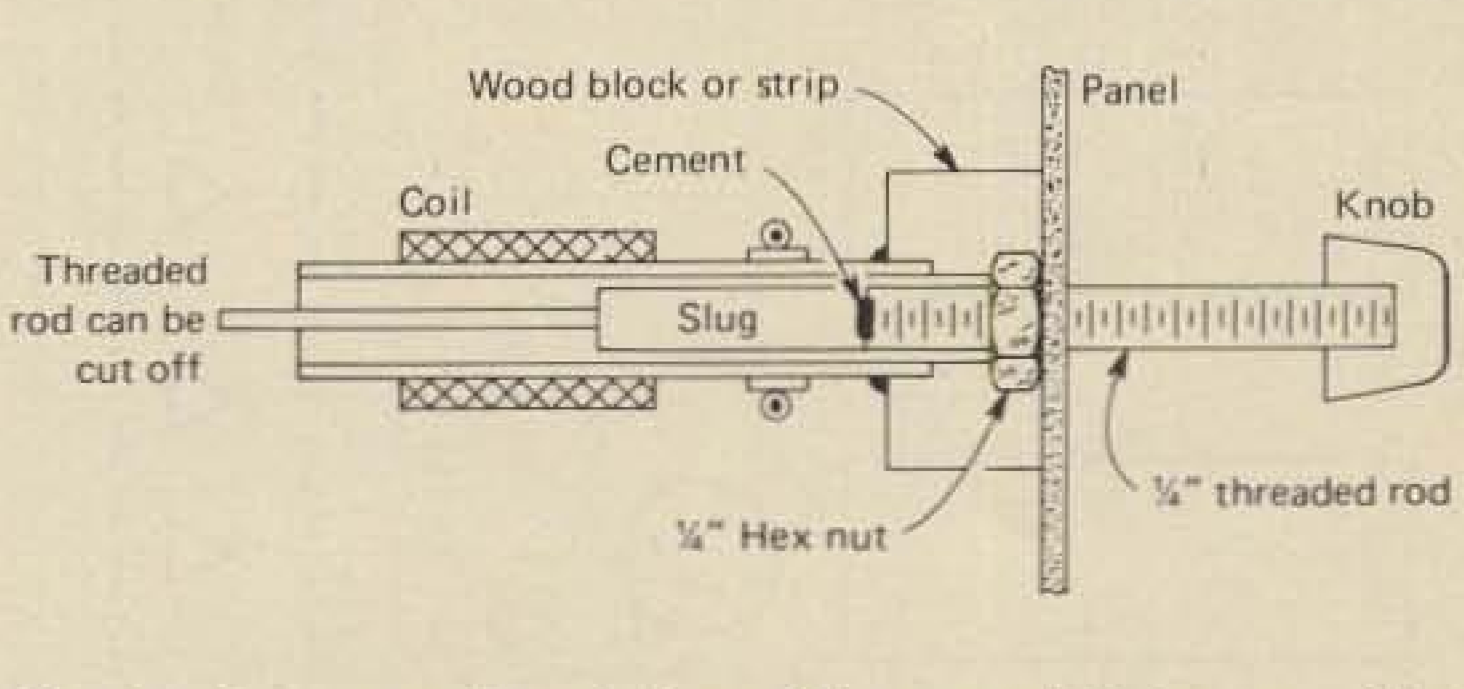


Fig. 1—Cross-sectional view of the completely assembled adjustable slug tuned coil. Care must be taken in the alignment of the slug and rod when gluing.

*225 Baltimore Ave., Point Pleasant Beach, NJ 08742

a monthly feature by
IRWIN MATH, WA2NDM

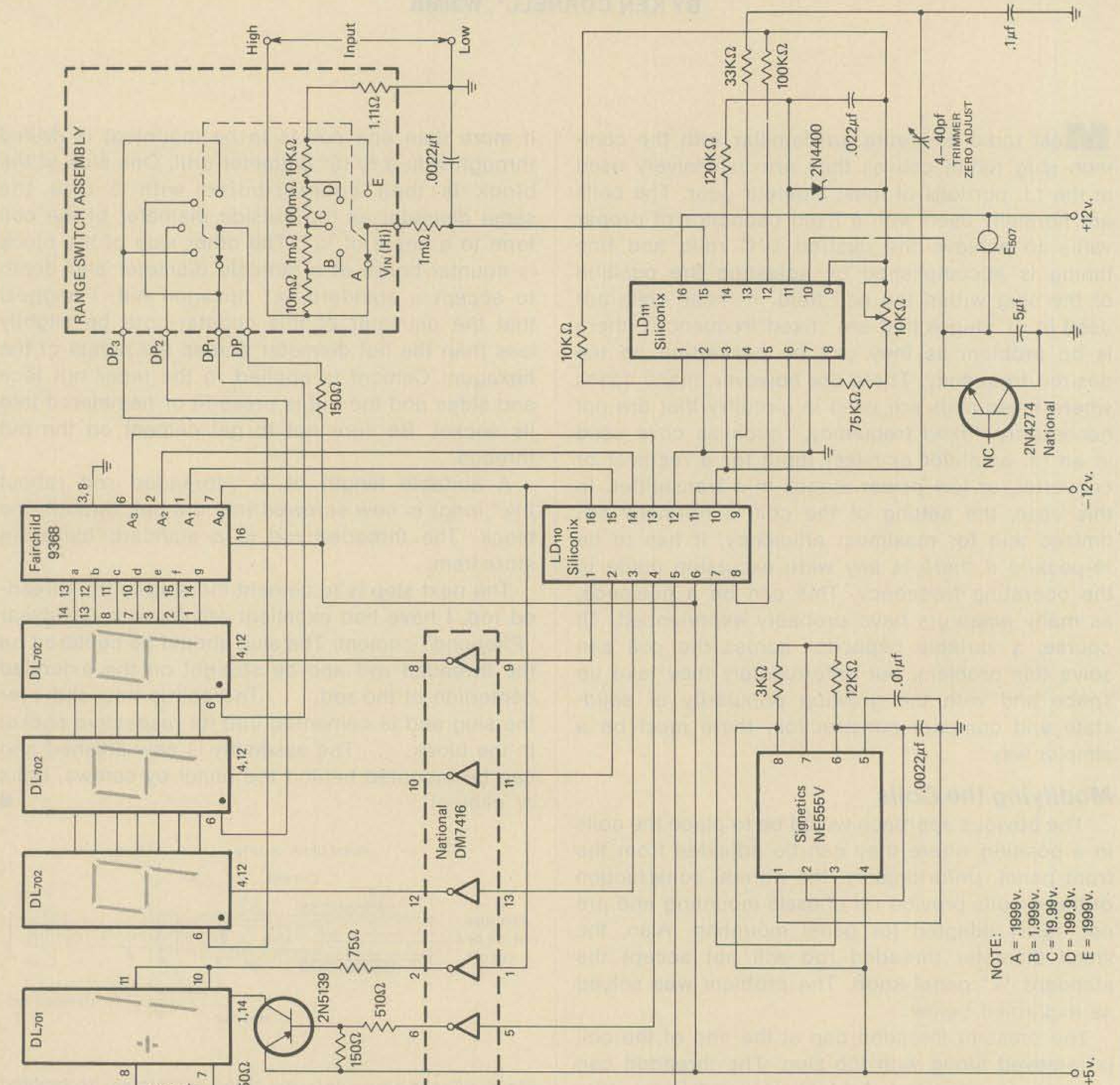
Math's Notes

A look at the technical side of things

Our topic this month is one that should finally make digital instrumentation available to all experimenters—an inexpensive DVM.

Siliconix and other semiconductor manufacturers have produced low-cost analog-to-digital converter integrated circuit sets in an attempt to

*5 Melville Lane, Great Neck, NY 11020.



break into the analog meter market with competitive digital versions. We can take advantage of these new I.C.'s by building relatively simple DVM's in accordance with their instructions.

The circuit to be described here has been described by Siliconix in their application note DA-74-1, "3½ Digit DVM Demonstration Board". Other manufacturers no doubt have similar notes but since the DA-74-1 is the one we are most familiar with we are presenting this version here. Anyone wishing to duplicate this circuitry is advised to write to Siliconix at 2201 Laurelwood Road, Santa Clara, California 95054 for a copy of the note as it will greatly simplify the entire task.

Fig. 1 is a schematic of the complete 3½ digit DVM. It offers a full scale ± display of 1999 units (3½ digits) and covers the range of ± 199.9 millivolts to ± 1999 volts with an accuracy of ± .05% of the reading ± 1 count. Additional circuitry, not described at this time, will allow the measurement of amperes, ohms, etc.

Referring to fig. 1, we see that an input analog signal is applied to a 5 stage divider that reduces it to the basic 199.9 mv required by the circuit. This input voltage is then applied to a Siliconix LD-111 Analog/Digital Processor.

This chip compares the input signal to a stable, accurate, reference voltage developed by the E507 and 2N4274 transistor. It then produces an output and control signal which drive a Siliconix LD-110 Digital Processor. This chip performs all of the operations necessary and develops all of the necessary signals to drive the LED readouts (through a 7416 driver and 9368 BCD to 7 segment decoder) and display the input voltage directly. A 555 timer chip is also included to provide a reference "clock" frequency for proper operation of the analog to digital conversion.

The internal logic of these two chips is quite complex for a person not familiar with this type of circuitry and if you are really interested, you should also request the LD-110 and LD-111 data sheets from Siliconix. They will give detailed timing diagrams, waveshapes, and a complete explanation.

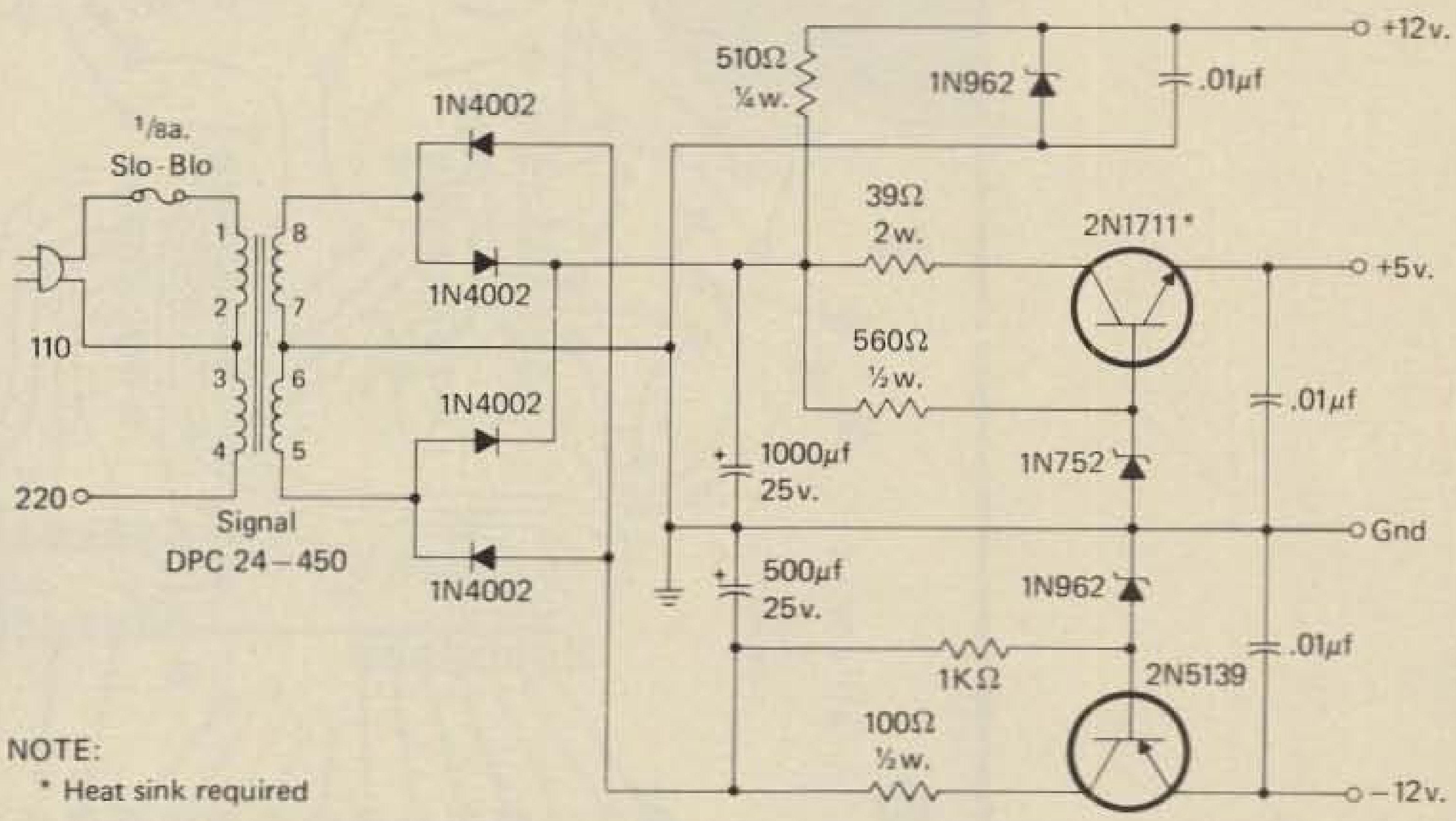


Fig. 2—Schematic diagram of a recommended a.c. power supply for the DVM. All components are mounted on the PC board given in fig. 3. The power transformer is available from Signal Transformer Co., 1 Julius St., Brooklyn, N.Y. 11212.

Fig. 2 is a schematic of an a.c. line operated power supply for those that wish to build a complete DVM.

Fig. 3 is a ½ size artwork layout (including power supply) for a printed circuit board which must be cut as shown, after fabrication, to produce a separate LED readout board. The DA-74-1 sheet from Siliconix gives full scale (1:1) layout artwork as well as a component placement layout and complete parts list.

Two other points that we would like to mention at this time is that the display is multiplexed (see MATH'S NOTES August 1976 for an explanation of multiplexing) to conserve power, and BCD is available for other applications. Since the 9368 is a BCD to 7 segment counter, the input to this chip, pins 1, 2, 6 and 7, is conventional (multiplexed) BCD and may be used with the common readout lines to drive additional equipment or circuitry.

Fig. 1—Schematic of the DVM. Typical manufacturers are given for the IC's, however any equivalents may be used. The readouts are manufactured by Litronix and many other manufacturers.

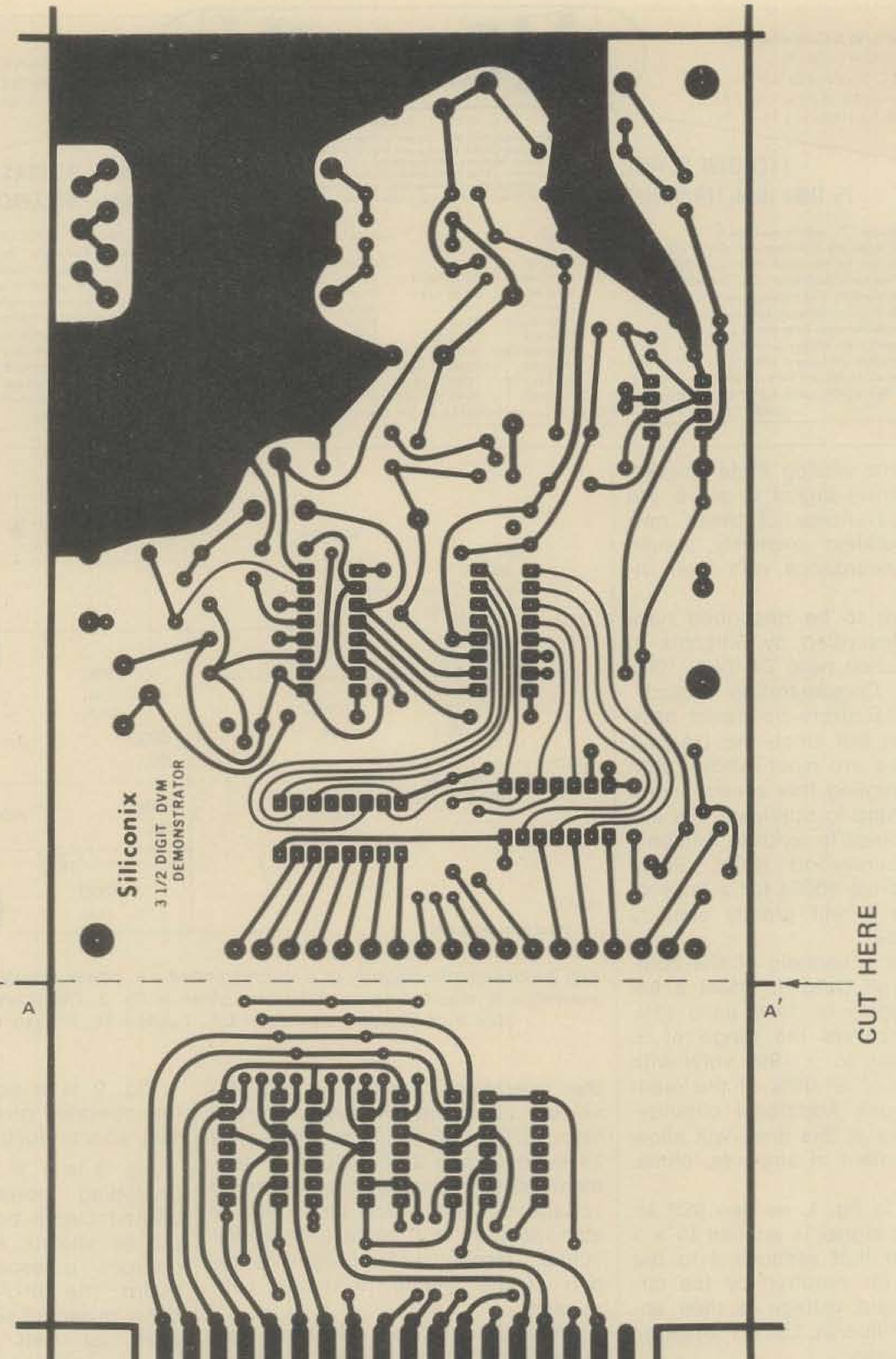


Fig. 3—1:1 Artwork won the DVM. The board should be cut after fabrication and a copy of DA-74-1 should be obtained for parts placement and further details.

CQ's Ham Shop is a good source of antique and hard to get items. It's a free service for CQ subscribers. Why not start collecting now?

Cost for the LD-110 and LD-111 in small quantities is $7 and $10 respectively, while the 9368, 7416 and 555 together will run less than $5 from standard industrial sources and much less from the various surplus houses.

73, Irwin, WA2NDM

a monthly feature by

WILLIAM I. ORR, W6SAI

Antennas

Design, construction, fact, and even some fiction

"You look like *The Great Waldo Pepper*", I remarked as Pendergast leaned his *Moped* cycle against the wall of his shack and removed his World War I aviator goggles. He had a brown ring of dust around his eyes and mouth.

"How do you recognize a happy motorcyclist?", he asked.

"I don't know. How?", I replied.

"By the bugs on his teeth", replied my friend, with a roar. "Come on into the shack and see what the mailman brought me today".

I followed the World War I aviator into the radio room and he picked up a fat envelope and handed it to me, removing his jacket at the same time.

"It's from Tommy White, the last of the Red Hot Antenna men!", I exclaimed. What is this rascal up to now?"

Pendergast bent over the desk and examined the letter closely.

*48 Campbell Lane, Menlo Park, CA 94025

"Well", he exclaimed, "It looks as if K3WBH has come up with a two-band log periodic beam for 144 MHz and 432 MHz. Wasn't he the inventor of the *Whirling Bedspring Beam*, commonly known as *18 dB and a cloud of chicken wire?*"

"The same", I replied. "Let me see his sketch (fig.1)." I looked at the drawing, and said, "Well, it is well known that certain antenna types operate well on the third harmonic of the design frequency. Since a three-to-one relationship exists between the 2-meter band and the so-called-¾ meter band, Tommy took advantage of this and built up a two-band array. Many amateurs are interested in both bands, but have neither the time nor the inclination to festoon their QTH with beams for every band. So this looks like the ideal solution for the two meter operator who occasionally works 432 MHz.

"The basic design is a 2-meter log-periodic beam which has an auxiliary set of directors for the 432 MHz band. Tommy estimates the gain on 2-meters to be about 11.5 dB over a dipole, and about 15.5 dB over a dipole on 432 MHz. Most important, however, the bandwidth without significant deterioration in either gain or s.w.r. is 3 MHz on the 2-meter band and 9 MHz on the 432 MHz band.

"Very clever", said Pendergast, as he examined the drawing.

"Tommy says that the four directors for the 2-meter beam acts as 3/2-wavelength directors on 432 MHz. And to maintain proper director-to-director coupling on the 432 MHz band, additional half-wavelength directors are mounted in between the larger directors", I said.

Pendergast read from the letter, "The beam is built on a ¾-inch square aluminum boom, nine feet long. The parasitic elements for 2-meters are made of ⅜-inch diameter aluminum tubing and the parasites for 432 MHz

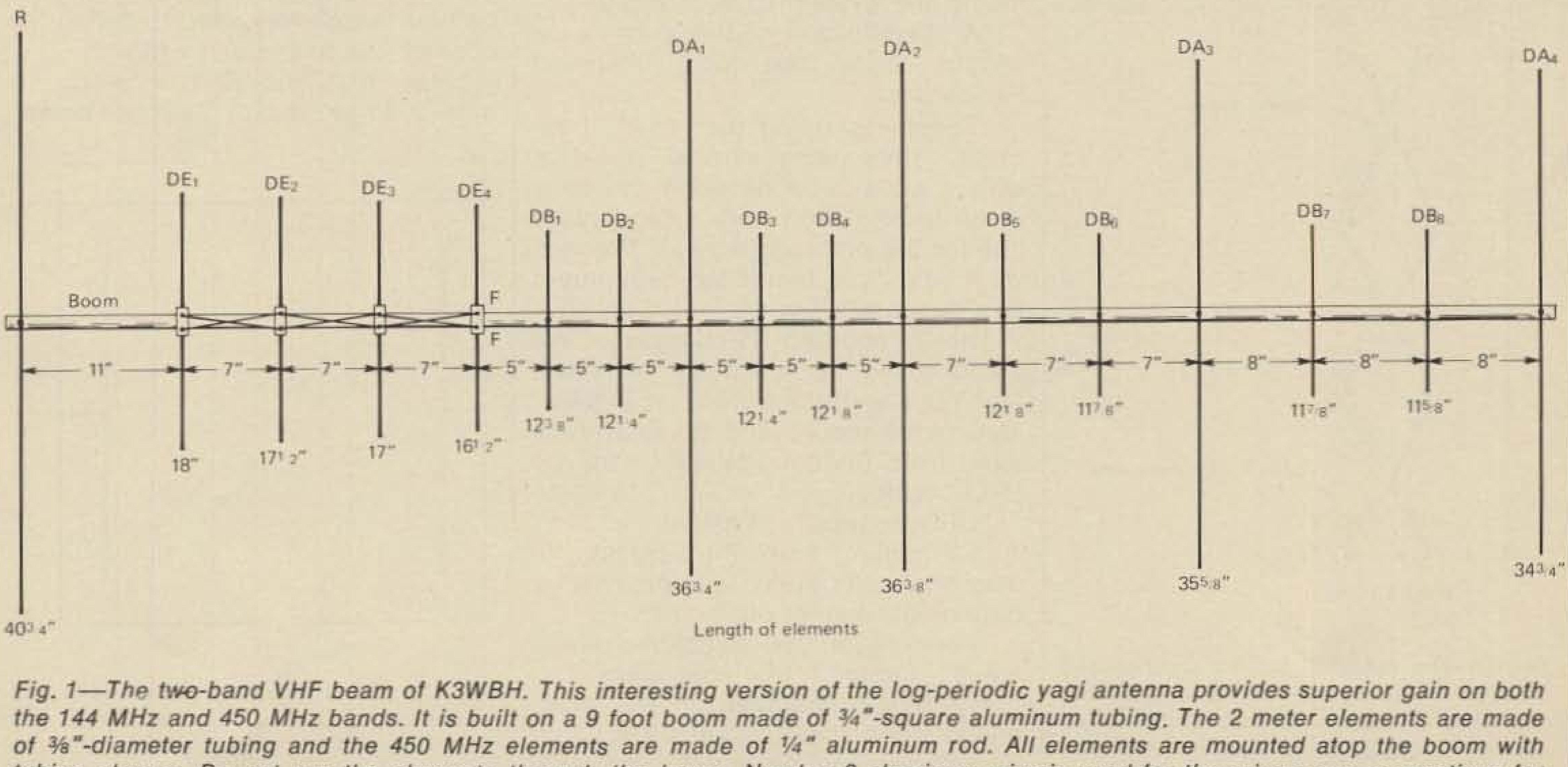


Fig. 1—The two-band VHF beam of K3WBH. This interesting version of the log-periodic yagi antenna provides superior gain on both the 144 MHz and 450 MHz bands. It is built on a 9 foot boom made of ¾"-square aluminum tubing. The 2 meter elements are made of ⅜"-diameter tubing and the 450 MHz elements are made of ¼" aluminum rod. All elements are mounted atop the boom with tubing clamps. Do not run the elements through the boom. Number 8 aluminum wire is used for the criss-cross connections for the driven elements (DE-1 through DE-4). Spacing between the inner tips is 2 inches. The antenna is fed with TV "ribbon" line at points F-F.

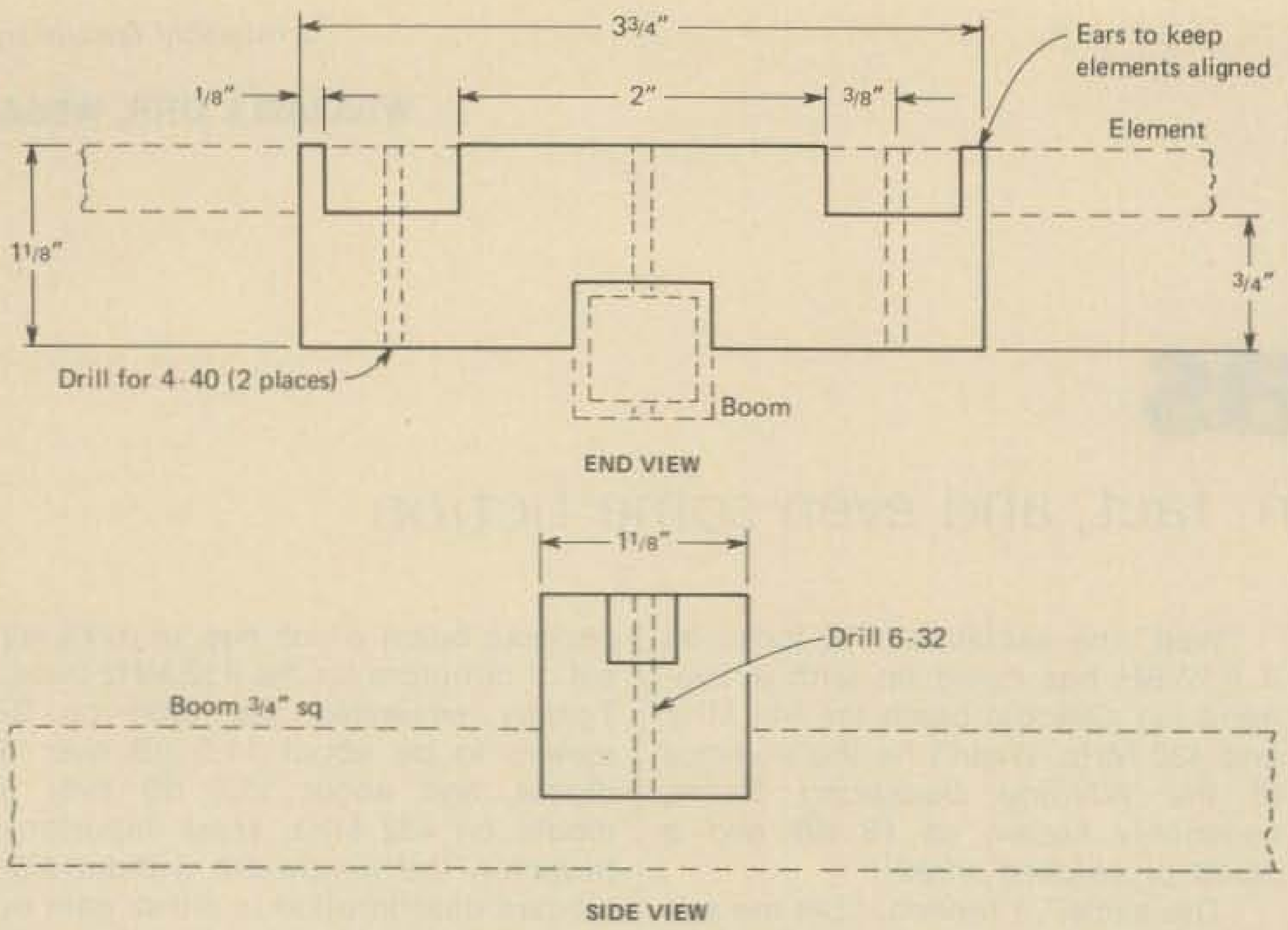


Fig. 2—The log-periodic elements (DE-1 through DE-4) are mounted on insulating blocks (four required). The blocks can be cut from cycolac, phenolic or other good v.h.f. insulating material. They are drilled so they may be attached to the boom with a 6-32 bolt. The element is held to the block with additional 4-40 bolts.

are cut from ¼-inch aluminum rod. The elements are mounted atop the beam with tubing clamps. The log-periodic elements are mounted on saddle blocks made of *cycolac®* or other insulating material (fig. 2). Number eight aluminum wire is used for the criss-cross feedline for the log-periodic section. Short lengths of plastic tubing are slid on the phasing line at the cross-over points before

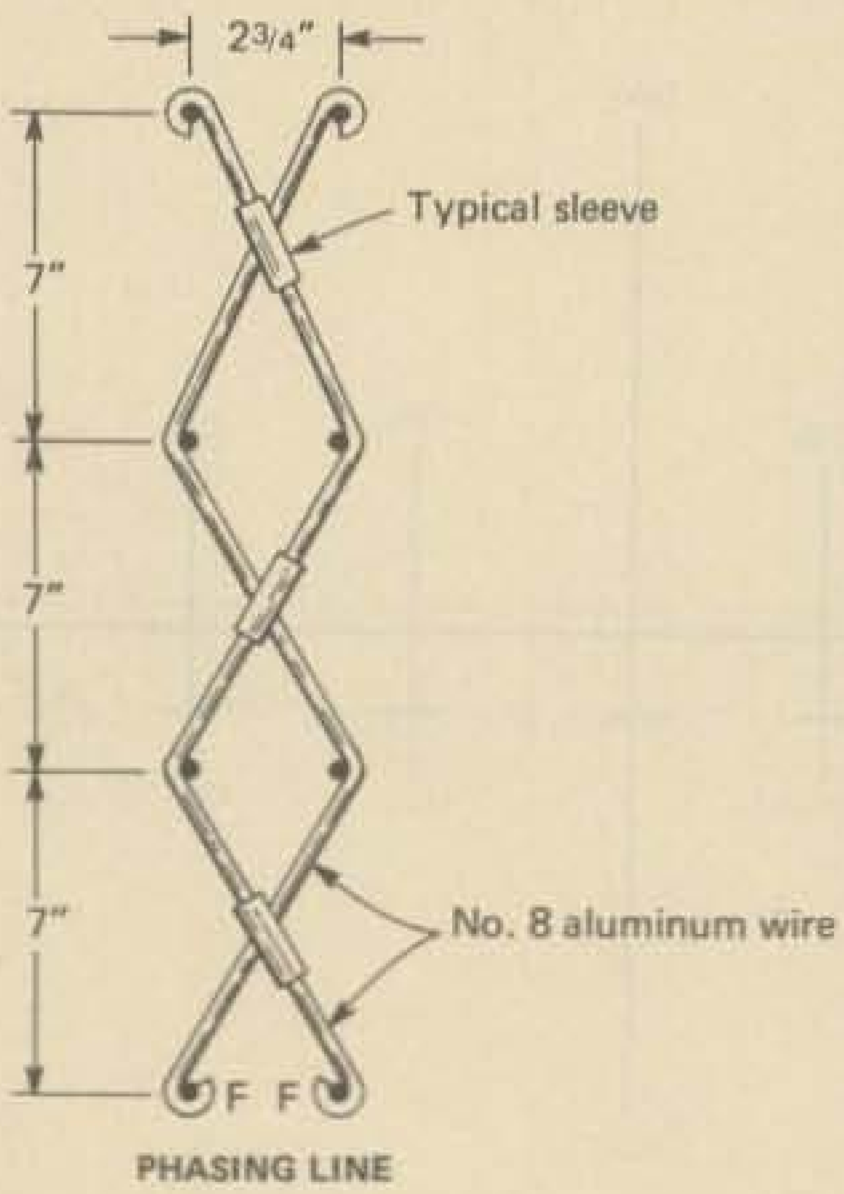


Fig. 3—The feedline for the log-periodic array is made up of #8 aluminum wire. The inner tips of the driven elements are drilled for 6-32 bolts. Spacing between the bolts is 2¾". Insulated sleeving is passed over the line to prevent shorts at the crossover points.

assembly to prevent contact between the wires (fig. 3)".

"What about feeding the antenna?", asked my friend.

"Well, the antenna can be fed with 300 ohm TV-type line. But Tommy recommends open-wire "ladder line" if much 432 MHz operation is contemplated. A four-to-one balun, of the type shown in the various v.h.f. handbooks, can be placed at the station end of the transmission line to match the system to 50 ohms".

"A stacked pair of these antennas should do a nice job", observed Pendergast.

"Tommy is trying that now", I replied. "He's using vertical stacking, with a separation between the bays of 80 inches. And he's using ladder line for the phasing harness. Perhaps we'll hear from him if the experiment is a success".

"Hey", shouted Pendergast. "We could make up an array of these, four high and eight wide on a steerable az/el mount and go after two-band EME (moonbounce)! Or maybe UFO bounce!"

"UFO bounce?", I asked.

"Certainly", said Pendergast. "If they are really there, let's prove it by bouncing a signal off them!"

"Pendergast, you amaze me sometimes", I said. "I like your class".

My friend squirmed in his chair and blushed slightly. "Let's talk about high frequency antennas", he said abruptly. "What do you have of interest?"

"Once again the RSGB magazine, "*Radio Communication*", has come through with some original thinking about high frequency antennas. In the October, 1976 issue there's an interesting article by G3YDX on the design of a capacity loaded mini-quad element for 14 MHz. He didn't have the space to erect a full size 14 MHz Quad, so a capacity-hat loading technique was applied to the Quad loop so that the overall size could be reduced to something less than 12 feet on a side (fig. 4)."

"How did G3YDX adjust the resonant frequency of the loop?", inquired Pendergast, as he produced his notebook from a pocket of his motorcycle jacket.

"He coupled a grid-dip meter to the drive point with a single turn loop and then adjusted the tips of the inner wires", I replied.

"Four bamboo spreaders, each eight feet long, were used to make up the framework," I continued. "The first arrangement, shown in fig. 4, showed resonance at too high a frequency. The final configuration—shown in fig. 5—hit resonance in the 20 meter band.

"When tested close to the ground, the loop compared with a ground plane antenna in many respects, except that it possessed a deep null in the plane of the elements.

"The next step was to build a parasitic reflector element. It was the same size as the driven element, but with a small, shorted stub added at the center of the bottom wire of the loop. The boom G3YDX used was an aluminum pipe about 8'6" long. A gamma match was used to match the coaxial line to the array (fig. 6).

"How high did G3YDX place his mini-quad in the air?", asked Pender-

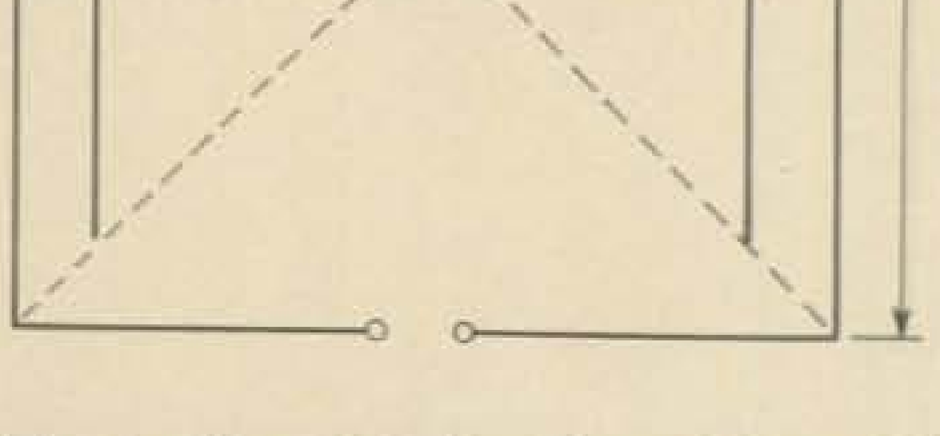


Fig. 4—The original mini-quad loop. Addition of the small "top hat" wires lowered the resonant frequency, but not enough to reach the 14 MHz. band. Loading wires were attached to the crossarms of the Quad assembly.

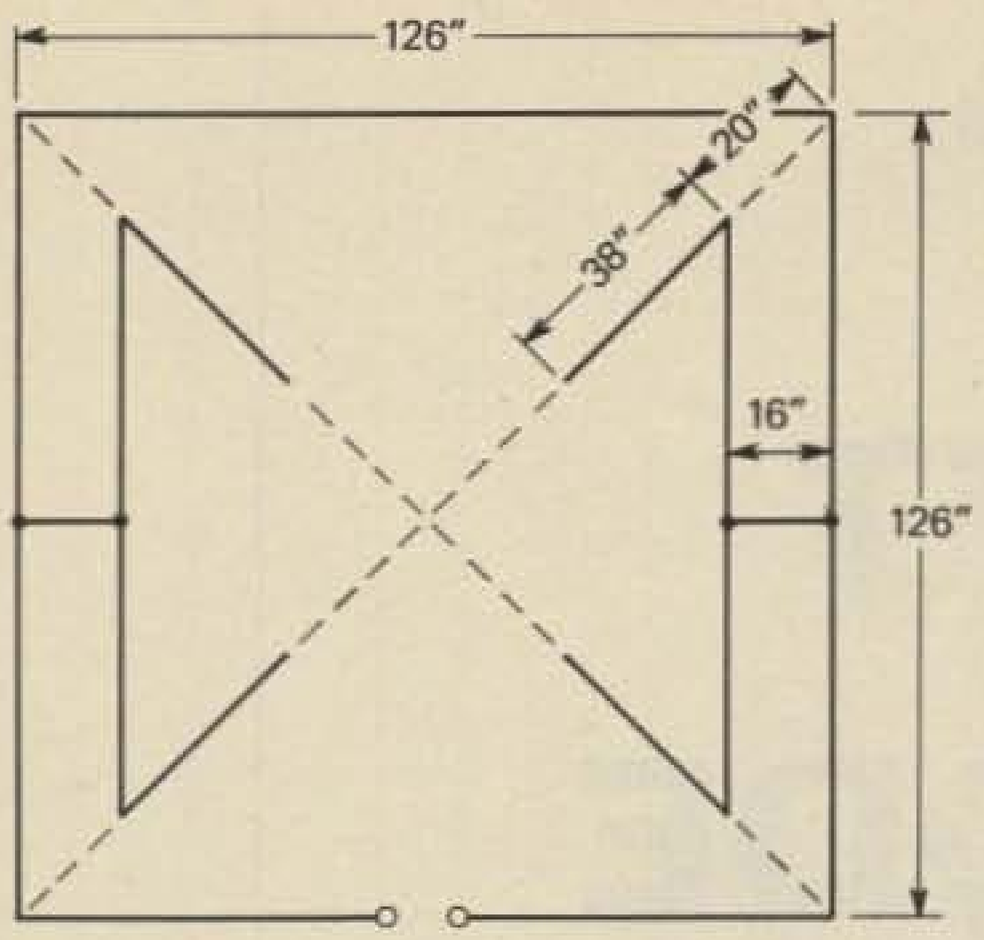


Fig. 5—Larger "top hat" wires permitted the mini-quad loop to resonate in the 14 MHz band. Connection to the quad loop is made at the center points of the sides. Loop is fed at the bottom.

gast, as he copied the illustrations into his notebook.

"Boom height was about 30 feet", I replied. "The quad was adjusted to resonance at 14,190 kHz then the stub was adjusted to provide the best front-to-back ratio. With a local station as a monitor, the best ratio turned out to be about 24 dB."

"That sounds pretty good to me", remarked my friend.

"Front-to-back readings can be misleading", I cautioned. "The front-to-back ratio of any beam can be affected by nearby objects, particularly when a close-in signal is used for test purposes. Reflection of the signal from hills or buildings can be misleading. I would much rather test front-to-back ratio on a DX signal, but that is a tough thing to do, considering the time it takes to rotate the array and the fading normally observed on DX stations".

"How about the bandwidth of the mini-quad?", asked Pendergast.

"Well, because of the reduction in size, the s.w.r. bandwidth of the array is somewhat reduced. Look at fig. 7. The antenna exhibits a 2-to-1 s.w.r. bandwidth of better than 200 kHz. This is very good, considering the bandwidth of other so-called mini-beams. When adjusted to 14,190 kHz, the mini-quad will still operate at the c.w. end of the band. The front-to-back ratio is poor, and an antenna tuning unit is recommended, because the s.w.r. is rather high—above 3-to-1. Nevertheless, the beam still functions at 14.0 MHz.

"About the gain. A reduction in antenna size means a reduction in bandwidth, but it necessarily does not mean a reduction in power gain. It is very difficult to measure antenna gain without precise instrumentation and a good antenna range. However on-the-air tests run over a long period of time by G3YDX suggests that this mini-quad is within a half-decibel of the power gain of a full-size Quad antenna. G3YDX lists an impressive bunch of DX stations with whom he tried the mini-quad against his ground plane. The increase in signal strength on both transmission and reception is impressive. In most cases it amounted to an "S-unit", or better. And in one or two difficult, long skip contacts, it was the difference between a QSO and not being heard at all".

Pendergast continued to sketch the information in his notebook. He paused and remarked, "I would think that a mini-antenna of this type would be hard to tune up".

"Well, it is important that the elements be tuned carefully. With any miniature antenna, small changes in dimension, or in assembly, can cause rather large frequency changes in resonance. G3YDX mentions that bamboo poles, even when coated with varnish, are not very good insulators in wet weather and he suggests that fiberglass fishing poles should make much better insulators.

"The inner wire sections of the elements can be supported by nylon cord, or taped to the poles. Since this places the high voltage sections of the elements in very close proximity to the supporting structure, it can be seen that fiberglass poles would provide the best insulation."

"Well", said my friend, closing his notebook with a snap, "This is certainly an interesting antenna for the DX chaser who doesn't have much room to erect a good beam antenna. I like it!"

"One more item before you trot off", I said. "You might be interested in this new development from Amphenol (fig. 8). This is a quick-disconnect coupling ring for the common PL-259 coaxial plug. You remove the standard coupling ring from the plug and screw the new ring (Amphenol part number 83-693) onto the connecting body of the plug. Presto! You have a quick-disconnect plug that snaps on and off the standard SO-239 receptacle".

"What will they think of next?", murmured Pendergast, as he replaced his World War I aviator goggles and advanced towards his *Moped* cycle." Just the gadget for the happy CBer". ■

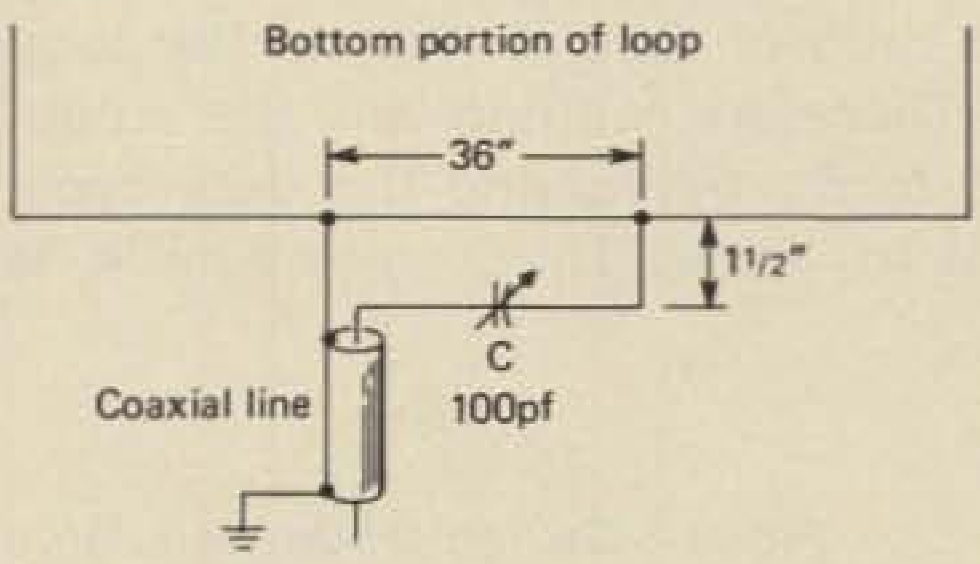


Fig. 6—Gamma match for the mini-quad loop. Gamma wire is 36" long and spaced about 1½" away from the loop. The series resonating capacitor is set at about 100pF.

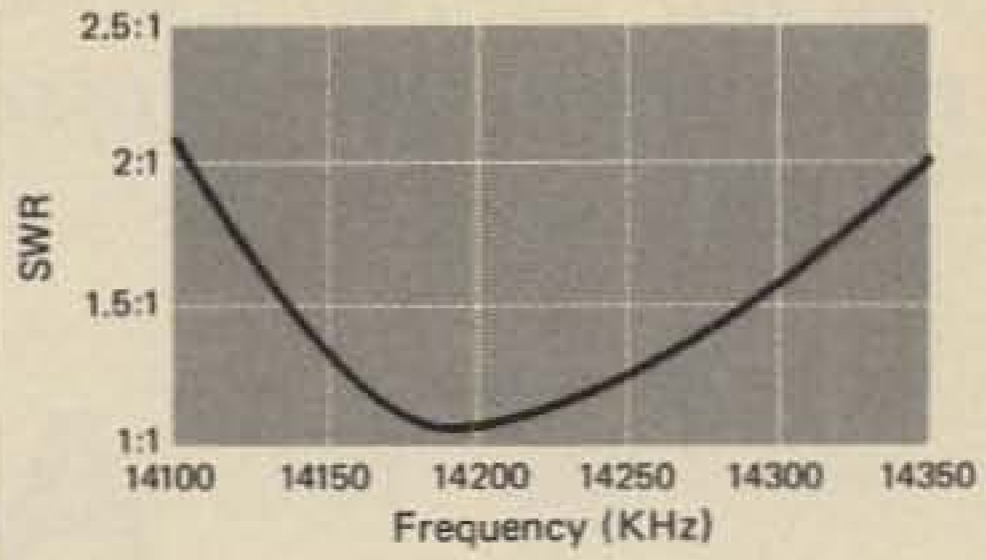


Fig. 7—Bandwidth response of the mini-quad beam. The bandwidth between the 2-to-1 s.w.r. points is better than 200 kHz. Reflector is spaced 8½' from the driven loop.

Note: Additional information on Quad antennas may be obtained from the handbook, *"All About Cubical Quad Antennas"*, by Willian Orr, W6SAI. Available from Radio Publications, Box 149, Wilton, CT 06897. Price: $4.75 plus 35¢ postage and handling. *"Radio Communication"* is a publication of the Radio Society of Great Britain, 35 Doughty St., London WC1N 2AE, England.

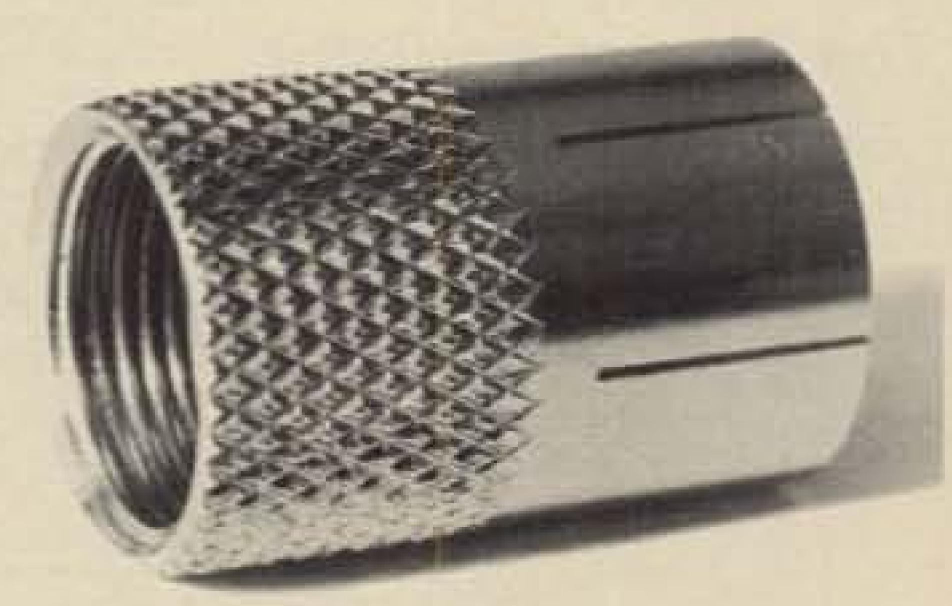


Fig. 8—The new Amphenol quick-disconnect coupling ring for the PL-259 plug. Designed to take the place of the existing ring, this new gadget provides a quick break-away for experimental work.

Use this on-again, off-again regulator to power those solid-state projects from 6V to 16V at 7.5A.

A 150 WATT SWITCH-MODE REGULATOR

BY ROLLIE J. WALKER,* W2ICG

To be complete, evey ham shack should have a variable, low voltage power supply. With today's abundance of mobile equipment, designed to operate from a 12 volt battery, a solid source of 12 volt d.c. power is particularly useful, whether it be used to charge a battery or power the rig.

The switch-mode power supply has been around for a good while now, but only recently have switching transistors and integrated circuits appeared to make the use of switchers popular. Today's improved semiconductors can be used to construct an efficient, compact, and stable power regulator capable of furnishing well over 100 watts of d.c. power. This article describes such a regulator and, hopefully, will give you enough insight as to the operation of a switching regulator, so that you can do-it-yourself.

The Basic Regulator

A simple switch-mode regulator is shown in the block diagram of fig. 1. An unregulated d.c. voltage is supplied to a switch, which chops the voltage so that a rectangular wave of voltage is applied to the filter. The average voltage applied to the filter is a function of the time the switch is on, as compared to the time it is off, and the input voltage. This can be stated mathematically as follows:

$$E_o = \frac{E_i\ t_{on}}{t_{on} + t_{off}}$$

where
E_i = input voltage
E_o = average output voltage
t_{on} = time on
t_{off} = time off

If we assume that there is no average voltage drop across the filter, then the average output voltage is the same as that applied to the input of the filter.

From this it can be seen that the average output voltage can be varied simply by varying the duty cycle, that is, the ratio of time on (t_{on}) to the total period ($t_{on} + t_{off}$). Therefore, we can vary the output voltage from zero to E_{in} by varying the duty cycle from zero percent to 100%. That, quite simply, is

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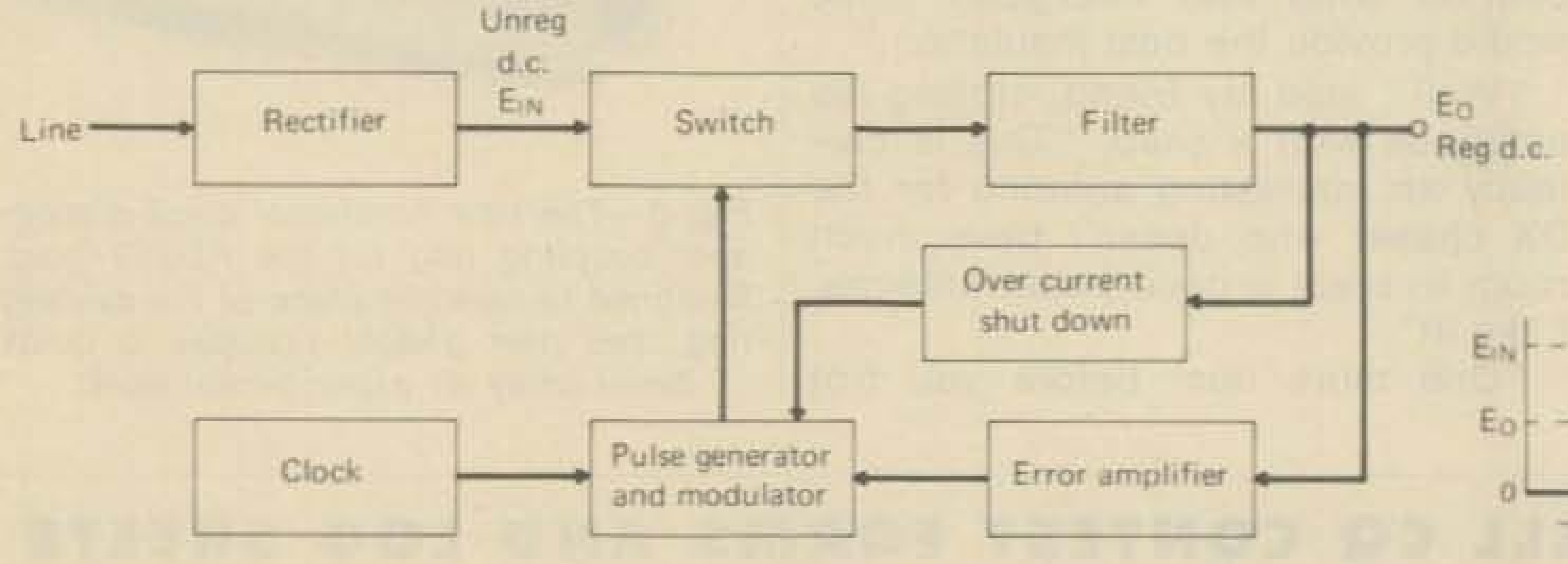

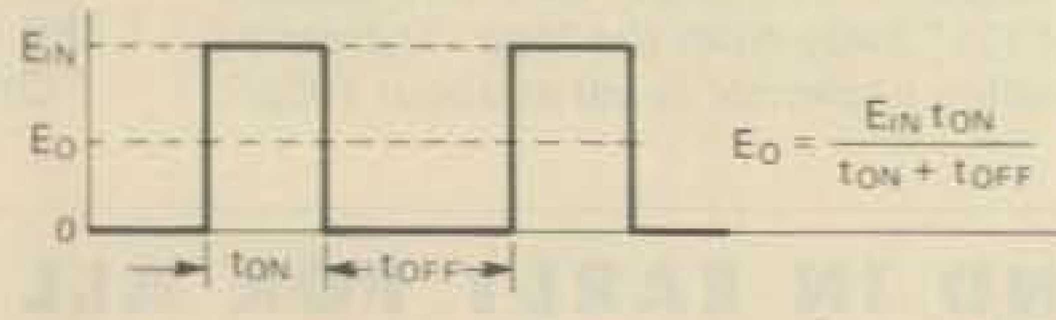

Fig. 1—Switch-Mode Regulated Power Supply.

how a switch-mode power supply works.

The Filter

The output from the switch is not very useful for power supply purposes, even though the average voltage may be just right, because it appears in the form of positive voltage pulses. All of the high-frequency components must be removed from the output by smoothing it in a filter. The best choice for our purposes is a simple RLC filter, as shown in fig. 2a. The inductor, which, in conjunction with the capacitor C, effectively limits ripple, serves a more fundamental purpose in that it limits the current through the switch. If the inductor were absent, the turn-on current of the switch would be limited only by the effective series resistance (e.s.r.) of the capacitor. This e.s.r. is about 0.2 ohms in a good capacitor, and, for good filtering, it is desirable to have as low an e.s.r. as possible.

If a constant voltage is applied to an inductor, the current will increase linearly (until the inductor saturates) as long as the voltage remains. When the voltage is removed, as when the switch is turned off, the inductor will attempt to maintain the current which was flowing at the instant of turn-off. If a path is not provided for the current to flow after turn-off the voltage across the inductor will increase to a very high value, and with reversed polarity, until the energy stored in the field of the inductor is dissipated—usually with an arc or breakdown of the switching device. That stored energy can be recovered and furnished to the load, or the storage capacitor by the use of the fly-back diode, D, of fig. 2a.

The time relationships of the steady-state voltages and currents in the circuit are shown in fig. 2b. The first waveform shows the voltage across the diode, D. Notice that the diode is blocking a voltage equal to V_{in} while the switch is closed; but, when the switch is opened, the voltage across the inductor reverses, as shown in the waveform for V_D, allowing current to flow through the diode. While the switch is on, the inductor current increases linearly to a maximum value determined by the value of the inductance, the on time, and the difference between the input voltage and the output voltage. When the swich is opened, the inductor current will continue to flow, but now it flows through the diode, D, still in the same direction as before, but will decrease until it reaches zero or the switch is closed again. In the figure, the shaded area represents current which is in excess of that required by the load, so that it flows into the capacitor for storage until the load calls for it. The unshaded current flows into the load. When the inductor current is less than that required by the load, the additional load current is delivered by the capacitor, as shown by the shaded portion of the waveform for I_C.

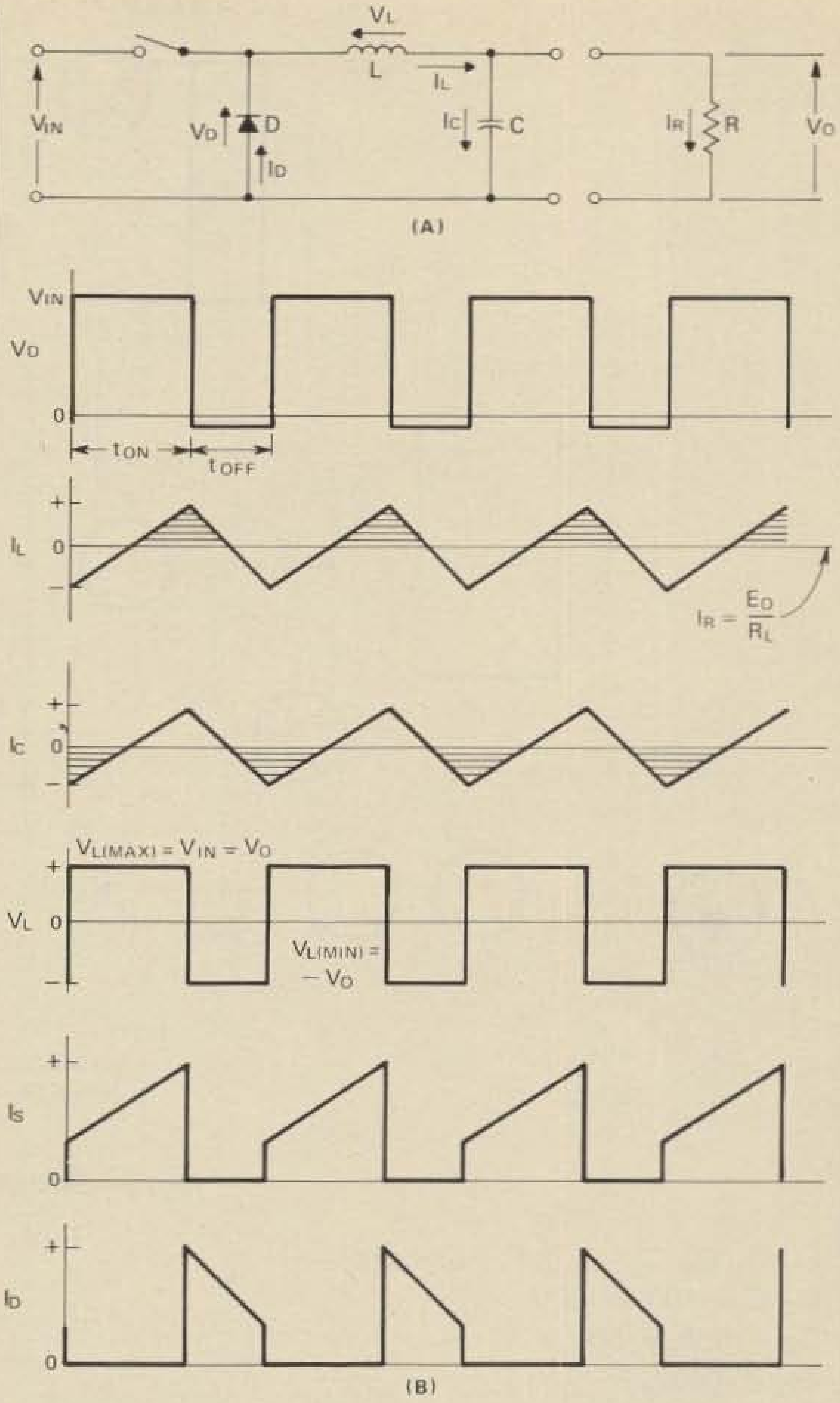

Fig. 2—(a) Basic filter network. (b) Filter circuit waveforms.

Of particular interest is the current through the switch (I_S) and that flowing through the diode (I_D). Each of these devices must be capable of conducting the peak inductor current and, since the current must be rapidly passed from one to the other, they must be fast switching devices to prevent excessive power loss. The diode, in particular, must be able to recover rapidly from a conducting state to a blocking state to prevent current through the switch from being shunted uselessly to ground. This recovery current may, if large enough, damage or even destroy the switch in the case of a semiconductor switch.

The Control Circuits

Referring again to fig. 1, we recall that the average output voltage is determined by the amplitude of the input voltage and the ratio of the on time to the length of the pulse cycle. Thus, by controlling the duty cycle, we can control the average output

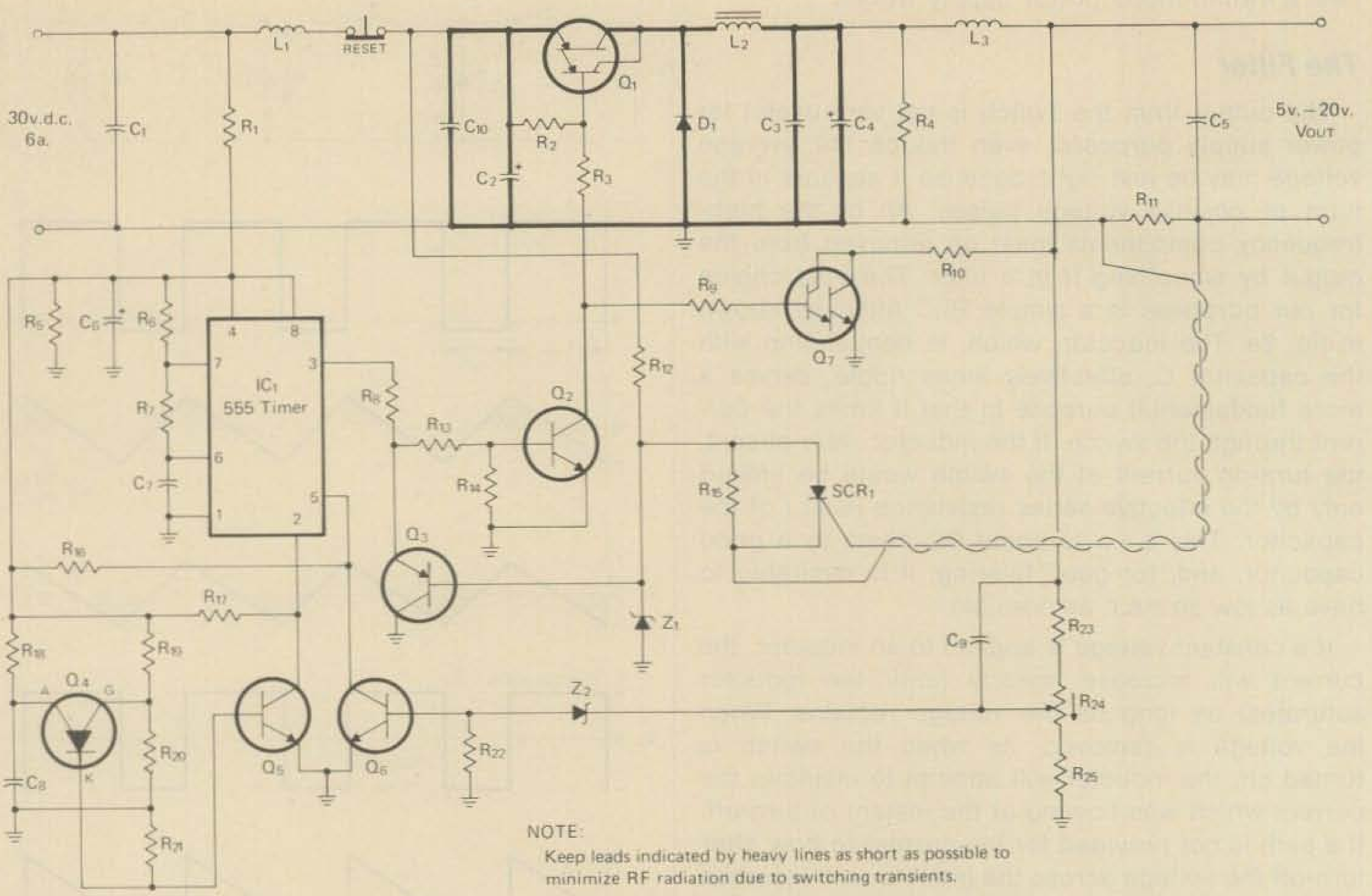

Fig. 3—Switch-Mode Regulator.

C_1, C_3, C_5, C_{10}—1.0μF, Polycarb
C_2, C_6—100μF, 50V
C_4—1000μF, 50V
C_7—0.0082μF
C_8—390pF
C_9—0.002μF
D_1—1N3890
L_1, L_3—10μhy, 10 amps
L_2—180μhy—(see text)
Q_1—D45E2 (General Electric)—
Q_2, Q_5—D33D25
Q_3—D29E25
Q_4—2N6027
Q_6—D32S4
Q_7—D40K2—Use Thermalloy 6063B heatsink, or equivalent
R_1, R_3, R_4, R_5—1.2K, ½W
R_2, R_7—110Ω, ½W
R_6—4.7K, ½W
R_8, R_{13}, R_{23}—1.2K, ½W
R_9—15K, ½W
R_{10}—20Ω, 10W
R_{11}—0.075Ω, 6 watts (see text)
R_{12}—1.5K, 1W
R_{14}—330Ω, ½W
R_{15}, R_{19}—680Ω, ½W
R_{16}—22K, ½W
R_{17}—4.7K, ½W
R_{18}—120K, ½W
R_{20}—1K, ½W
R_{21}—100Ω, ½W
R_{22}—18K, ½W
R_{24}—1K, 1W Pot.
R_{25}—390Ω, ½W
SCR-1—C103B
Z_1—1N5233B
Z_2—1N5226B
IC-1—555 Timer

voltage. There are several ways to accomplish this change in duty cycle, including fixing the on time to a constant value and varying the period of the cycle, (called pulse-position modulation), or by pulse-width modulation where the cycle time is held constant (constant frequency) and the width of the on time is varied. Pulse-width modulation will be considered here.

In the block diagram the control functions consist of the pulse generator and modulator and the clock. Output voltage regulation is achieved by sampling the output voltage, amplifying the deviation from a preset value and adjusting the pulse width of the driver circuit to compensate for the error. We can look at one way to put all these things together by referring to the circuit diagram of a practical switch-mode regulator as shown in fig. 3.

This regulator is designed to deliver any voltage from 7 volts to 20 volts at any load current up to 7 amps. The circuit is optimized at 12 volts output with respect to regulation, but does a nice job over the range indicated. At 12 volts output, the output voltage changes only 0.5 volt as the load current is changed from zero to 7 amps, indicating a source impedance of only 0.07 ohms. The low voltage end of the range may be extended to about 4 volts, at the expense of the upper voltage limit, by decreasing the input voltage to 20 volts. The supply is protected from short circuit damage by an overcurrent cut-out circuit which must be manually reset after it is activated.

This circuit closely follows the block diagram of fig. 1. A power darlington was chosen for the switching transistor, Q_1, to simplify the drive circuitry. Some sacrifice is made in switching and saturation losses with a darlington, but the D45E2 darlington has exceptionally low saturation voltage (less than 1.2 Volts at 10 Amps) and fast switching times. The D45E2 could be driven directly from the 555 IC, but an inverter (Q_2) is required to provide the 180° phase shift necessary for regulation.

The Regulator

The 555 timer provides the functions of pulse generator and pulse-width modulator. A varying voltage applied to pin 5 will modulate the pulse width linearly with respect to the applied voltage. Unfortunately, if the 555 is connected to operate in the astable mode some frequency modulation also occurs. Since it is desirable to operate at a fixed frequency the timer is connected to operate in the monostable mode, and a clock circuit is provided to trigger the timer.

In the monostable mode, the output (pin 3) of the timer is low until a negative going trigger pulse is applied to pin 2. At that time, the ouput is driven high and the timing capacitor, C_7, begins to charge. When the voltage on C_7 reaches a value determined by the volage on the control pin, pin 5, the output switches low and C_7 is discharged through R_7 and pin 7, and remains in that state until another trigger pulse occurs. Thus, the period between pulses is determined by the clocked trigger pulses and the pulse width, i.e. the time during which the output is high, is determined by the charge rate of C_7 and the voltage on pin 5. With a fixed charge rate the pulse width increases as the voltage on pin 5 is made more positive, thus keeping Q_2 and Q_1 on longer, raising the output voltage of the power

(Continued on page 74)

This simple but effective antenna will also increase the security of your new three-headed gear.

Build A Three-Purpose Antenna

BY CARL C. DRUMELLER*, W5JJ

The advent of in-dash radio units combining a CB transceiver with a broadcast receiver for both m.f. a.m. and v.h.f. f.m. has brought about a need for a single antenna that will serve the triple-purpose unit. This article tells how you can build just such an antenna.

Almost every antenna represents a compromise between the ideal and the practical, even those designed to function on a single band. Although departing from the ideal, these antennas provide fully acceptable service, especially for reception. Modern radio receivers are so sensitive to even weak signals that less-than-ideal antennas perform to the full satisfaction of their users.

With transmitting antennas, compromise is less easily accepted, especially in the Citizens Radio Service, (CRS) where power is sharply limited.

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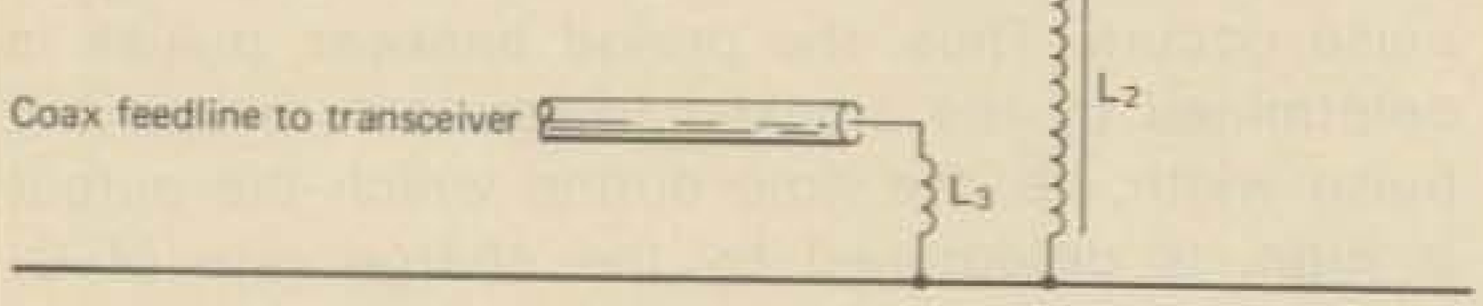


Fig. 1—Schematic of the three-purpose antenna. C1 10 to 25 pF; L1, suitable inductance to tune 27 MHz in conjunction with C1. C2, 25 pF mica; L2, suitable inductance to tune to 27 MHz in conjunction with C2 and rod antenna; L3, 2-turn link at low-potential end of L2.

Space, appearance, and other cogent considerations express compelling arguments for compromise, however. Almost every vehicle equipped with CB carries an antenna that implies a practical settlement of the several and somewhat divergent considerations.

The three-purpose antenna is a compromise, too, but one that does not appreciably deteriorate the performance of the receiver and transceiver it serves.

How Big And Where Located

Concerning size, one should keep in mind that for any transmitting antenna, the old adage "The bigger the better" holds good. There are reasonable limits, of course. A quarter-wave at 27 MHz can be a bit awkward to handle on a car but is quite practical on a recreational vehicle. For your car, your aesthetic standards probably will dictate something much less than a quarter wave. And for uniform response over a band of frequencies, such as 23 or 40 channels of the CRS, remember the law stating the ratio of diameter to height sets the bandwidth of an antenna. Here, again, aesthetic and wind-resistance considerations probably will impose reasonable limits.

As to its location on a vehicle, one consideration is feedline length, which is a more important factor for the broadcast receiver than for the CB transceiver. It is not feasible to attempt to match impedances between antenna and broadcast receiver; so the antenna lead does not function as a true transmission line. Its losses increase markedly with length. For the CB transceiver, impedance matching is easily attainable and losses are negligible for any length likely to be found on any vehicle.

(Continued on page 75)

Here's an idea on how to operate in restricted areas using a mobile whip antenna.

Amateur Radio Operation From Apartments And Motels

BY HARRY K. BOURNE*, ZL1OI

An increasing number of radio amateurs live in apartment buildings, town houses or in multiple housing units where there are restrictions on the erection of antennas, and where the location seems to offer little opportunity for amateur radio operation.

The writer has operated successfully from several apartment buildings in Washington D.C. and elsewhere in the United States. For some years he operated as G2AH/W4 from an apartment on the twelfth floor of a high rise building at a height of 120 feet above the ground, where no form of outdoor antenna was allowed by the management. Each apartment unit, as in so many blocks of this type, opened onto a small balcony, approximately 16 feet long and 6 feet wide, surrounded on three sides by an iron grille railing. The reinforced concrete floor and roof of the balcony, formed the roof and floor respectively of the balconies of the neighboring apartment units below and above. The antenna was mounted on the balcony, which was in effect a partly screened box with a slot approximately six feet high, open on three sides and screened on the fourth side by the steel frame structure of the building, a situation which would appear to be extremely poor for amateur radio operations.

The writer operated successfully from this location using a Hustler[1] mobile whip antenna mounted on the balcony railing, inclined at an angle of 35 degrees to the horizontal. The antenna was normally located inside the balcony space where it was not visible from outside the building, but it could also be swung outboard over the edge of the railing in the clear to reduce the screening effect. The antenna was mounted on a lightweight TV antenna rotator so that it could be moved into either position from the operating desk. The arrangement is shown in fig. 1.

Operation on the bands from 80 to 10 meters was provided by selecting the appropriate resonator for the antenna for each band. The antenna was fed with 52 ohm coaxial cable, with the outer shield connected to the steel railing which acted effectively as a ground plane on the 10 to 40 meter bands providing a low value of s.w.r. On the 80

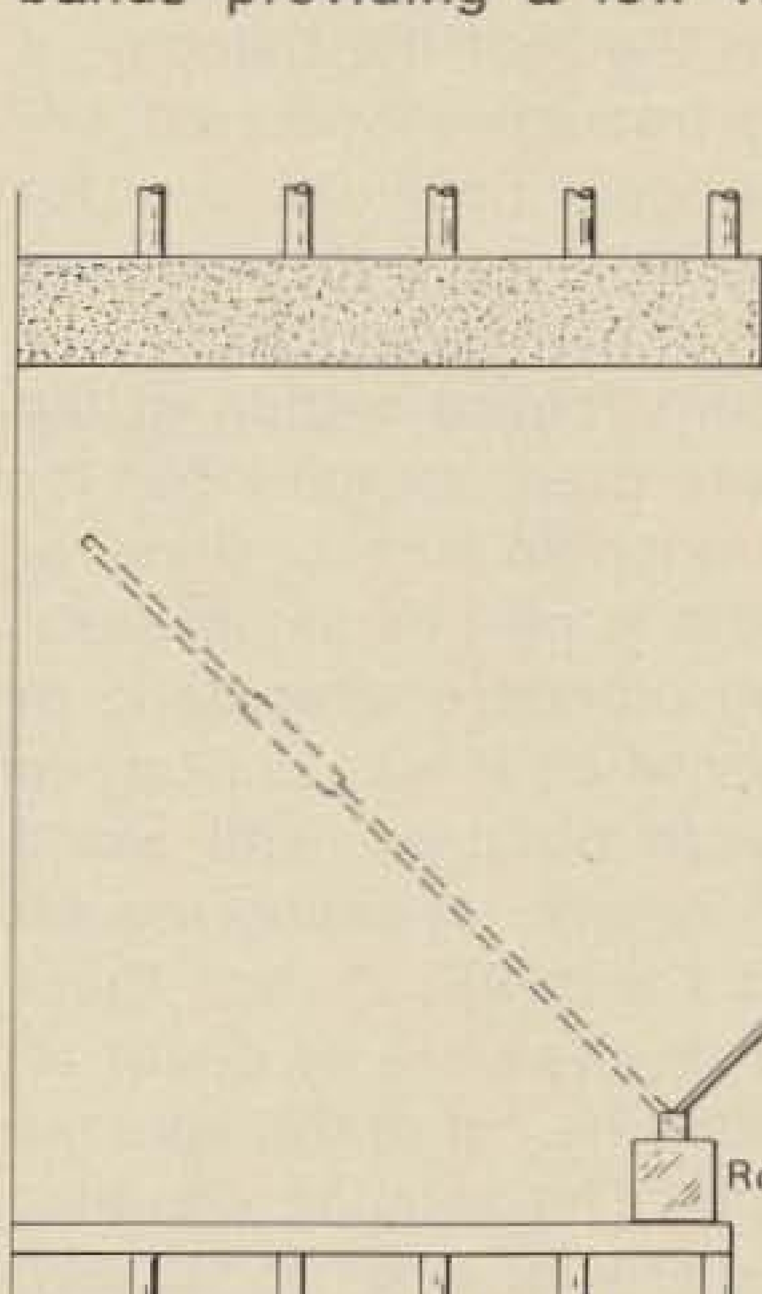


Fig. 1—The arrangement of the antenna and rotator on a balcony railing. If the balcony is made of metal, it acts as a ground plane for the higher frequencies.

*54 Whitehaven Road, Glendowie, Auckland, 5, New Zealand.

[1]The Hustler is a mobile whip with changeable resonators for each band. The resonators are available in two power ratings, 400 w.p.e.p. or 2kw p.e.p. It is manufactured by New-Tronics, 15800 Commerce Park Drive, Brookpark, Ohio 44142. The antenna is available at many distributors.

meter band the railing did not serve efficiently as a ground plane and for this band a single insulated counterpoise wire, 66 feet long, connected to the shield of the coaxial feeder at the antenna end, laid on the floor of the apartment, enabled an acceptably low value of s.w.r. to be obtained.

During the hours of daylight, the antenna was used inside the balcony. In spite of the screening effect, results on the 10, 15 and 20 meter bands were surprisingly good and many DX contacts were made on c.w. and s.s.b. using a Drake TR4 transceiver. On the 40 meter band, results were satisfactory in directions through the "slot" towards the northeast and the north including Canada, through the Midwest and Central States to the Pacific Northwest. In other directions, the signals were attenuated by the steel frame of the building and results were less favorable although communication could be maintained with all parts of the U.S.A. On 80 meters, the effect of the screening was more apparent and in this case the antenna was always used in the outboard position. This was not a serious handicap as most operation on this band was conducted after dark when the antenna could not be seen even though it was outside the railing.

On the 10 meter band the screening effect was less noticeable than on the lower bands and excellent results were obtained with the antenna in the inboard position, and the difference in results from the two positions was less marked.

Owing to the fact that the tip of the antenna was only about 12 inches from the roof the balcony, a small change of resonant frequency occurred between the inboard and outboard positions, and for the best efficiency it was necessary to reset the length of the resonator when changing from one position to the other. A compromise setting of the length of the resonator was used normally but for extended periods of operation in one position or the other, the length was set to give minimum s.w.r.

With the antenna swung outboard after dark, or in the early morning hours when it was unlikely to be seen, good results were obtained with world wide DX on 15, 20 and 40 meters, including regular contacts over a long period with VK, ZL and European countries. The good results were no doubt attributable to the considerable height of the antenna above ground, over 120 feet. The antenna was also used in the outboard position for occasional daytime contacts, and was swung inboard again immediately at the conclusion of the contact, or even between "overs." At such a height above the ground, and with exposures in the open for only brief periods separated by comparatively long intervals, the antenna was never noticed by anyone during a period of over three years.

The writer used the same type of antenna in another location in a second floor apartment only some 15 feet above the ground. In this case a wooden railing surrounded the balcony and the ground plane consisted of wire netting laid under a rug on the floor of the balcony. This gave good results on 10, 15 and 20 meters, but for operation on the 40 and 80 meter bands, better results were obtained by using two single wire counterpoises 33 and 66 feet long respectively, one along each side of the room, concealed under the carpet. In this case again, in spite of the low height of the antenna above ground, good DX results were obtained on the 10 to 40 meter bands.

The Loaded Dipole

In this location another antenna requiring no ground plane proved to be effective. This used two Hustler mobile whips mounted on a strip of insulating material to form a loaded dipole. This very compact dipole was mounted on a short wooden rod on the balcony railing and was oriented to take advantage of the directional characteristics of the dipole. After dark, the antenna was pushed outside the balcony into the clear.

The writer operated as G2AH/W4 in the Washington D.C. area for many years using antennas described above and enjoyed thousands of contacts throughout the U.S.A. and with many countries overseas.

Operation In New Zealand

The writer has also put the mobile whip antenna to good use in New Zealand where mobile and portable operation are very popular. Many of the motels in this country have iron roofs which may be used to provide a ground plane. Good results have been obtained on 40 meters with the mobile whip clamped to the edge of the roof gutter, with the shield of the coaxial feeder connected to the gutter and or the iron roof. The dipole using the two mobile whips described above mounted on a short wooden pole supporting it above a car has also been used satisfactorily and has generally given better results than those obtained from the vertical whip.

TVI

It is very important to avoid causing t.v.i. when operating in an apartment building or a motel where the t.v. receivers of neighbors may be only a few feet away, otherwise the activities of the amateur will be severely curtailed. By using a low pass filter and adjusting the antenna for minimum s.w.r., the writer has not experienced any difficulties with t.v.i. over many years of operating from apartments.

Advantages of the type of antennas described are that they may be erected inconspicuously in a wide variety of conditions, are self-contained, take little space, require no tuning unit and may be fed with 52 ohm coaxial cable. They enable the amateur to operate in conditions which may appear at first to be completely unsuitable for amateur radio. ■

a monthly feature by

BILL DEWITT, W2DD

In Focus

Television on the Amateur bands

1st Albatross SSTV Contest Winners Announced

From Prof. Franco Fanti, 14LCF, comes news of the 1st Albatross SSTV Contest sponsored by the British Amateur Television Club and the Italian firm, A.E.C., Advance Electronics of Bologna, Italy.

First prize, an SSTV scan converter made by Advance Electronics, went to Bob King, WB5IXK, of Houston, Texas. Don Miller, W9NTP, and Dr. Frank Biba, WB5SAJ, picked off second and third prizes respectively, making a 1, 2, 3, sweep for the U.S.A.

Complete scores for all entrants are shown in Table 1.

All things considered, it is amazing to me that only a couple of dozen entries were received by Prof. Fanti. Anyone who watched the picture exchanges during the contest period might well have expected a few hundred entries! Congratulations to the winners, and better luck next time to the rest. With a grand prize of such excellence, my guess is that the number of entries will go up next year.

I think that the B.A.T.C. and Advance Electronics should be commended for their sponsorship of this action-generating SSTV program. Thanks to Prof. Fanti for supplying us with the rules and final results of the contest.

*2112 Turk Hill Road, Fairport, NY 14450

I4LCF's well-equipped station includes RTTY and Fax gear as well as SSTV.

1st Albatross SSTV Contest
September 4/5 1976
Final Score

Call	
1 WB5IXK	214×10×4+5×21=31030
2 W9NTP	184×10×4+5×22=27600
3 WB5SAJ	174×10×4+5×20=24360
4 G8PY	115×10×4+5×27=20125
5 W3LSG	111×10×4+5×20=15540
6 OH5RM	72×10×4+5×24=11520
7 G3WW	62×10×4+5×21= 8990
8 I8WAM	59×10×2+5×18= 6.490
9 SM5EEP	51×10×4+5×17= 6.375
10 TA2MM	50×10×3+5×18= 6.000
11 IØPCB	48×10×3+5×18= 5.760
12 DJ2ZG	71×10×3+5×10= 5.680
13 HA5KFZ	46×10×3+5×18= 5.520
14 DL3UH	32×10×3+5×17= 3.680
15 W9HR	46×10×2+5×12= 3.680
16 I1RHB	29×10×3+5×17= 3.335
17 ON5FU	26×10×3+5×19= 3.250
18 OK5ZAS	25×10×3+5×14= 2.500
19 SP3PJ	24×10×3+5×12= 2.160
20 I4CXY	25×10×3+5×9 = 1.875
21 I4LRH	24×10×2+5×9 = 1.560
22 I1SU	16×10×3+5×12= 1.440
23 DJ6KA	20×10×2+5×10= 1.400
24 I3MIQ	16×10×2+5×10= 1.120
25 JE1WVQ	8×10×2+5×8 = 480
S.W.L.	
1 I1 58509	34×10×2+5×17= 3.570
2 DC3YC	25×10×1+5×10= 1.500
3 ONL 2717	18×10×2+5×10= 1.260
4 I8 64988	15×10×2+5×11= 1.125
5 GM3PIB	

Two views of I4LCF, Slow Scan TV Station Of Prof. Franco Fanti

We're happy to bring you two photos of Prof. Franco Fanti's station I4LCF. Franco has equipment for FAX, RTTY, and of course, SSTV!

In fig. 1 you can see RTTY gear including a nifty keyboard and a RAM generator. The square-ish receiver is a 392 surplus job. In addition to the Collins S line and (I think—) a Geloso receiver, a "Rocket" scan converter complete with CRT display can be seen at the right of fig. 2. I hope to have more details on the Rocket scan converter in an early issue.

As almost every slow scanner must know, Franco is indeed generous with his time when it comes to SSTV contest work. He has spent countless hours dispensing information and evaluating results of one contest after another! In a recent letter, he promised to send me the rules for the NEXT Worldwide SSTV Contest soon! My thanks to I4LCF for the excellent pictures of his station.

Arizona's Most Active SSTV Station, WA7QBV

Another slow scanner well known 'round the world is Bob Howell, WA7QBV, of Tucson, Arizona.

First licensed as W5NNR (Texas) in 1948, then signing K7RLB before acquiring WA7QBV, Bob is an Extra Class operator. He's been on SSTV since 1971.

Bob has had a long career in the communications field. He spent some time as a brass pounder on the battleship **Oklahoma** and was a ground station operator for American Airlines for 13 years. Prior to his recent retirement, Bob operated a TV repair business.

Bob and his wife, Pauline, have two sons and two daughters. Pauline is a Registered Nurse in one of Tucson's hospitals.

Pictured in fig. 3 is Bob's well-equipped station with Ye Op at the mike. SSTV gear includes a Venus

Note the "Rocket" scan converter in this picture of I4LCF's operating position.

Here's Bob Howell, WA7QBV, presiding over a glorious collection of low and high power gear. (Next time, say "CHEESE", Bob.)

SS-2 monitor, two fast scan cameras, and an MXV fast to slow converter.

Although he has a kilowatt-plus linear, WA7QBV's specialty is QRP SSTV with a Ten-Tec Argonaut transceiver. (I have seen many excellent SSTV pix via this QRP set up—W2DD.)

Bob works plenty of DX and holds SSTV/WAS Certificate Number 5. If you need an Arizona contact, WA7-QBV is your best bet.

Saskatchewan Slow Scan

S-A-S-K-A-T-C-H-E-W-A-N, now there's a name that can really cause trouble on slow scan TV's square format! VE5UT, operated by George Drummond of Glidden, Sask. is one of those few and far between slow scan stations of the Canadian northwest.

George is 43. He's been an active amateur for about ten years and got into SSTV about a year ago. His present equipment is a Robot 70A/80A combination acquired from VE3-BNW. (Note from W2DD, I believe that VE5UT is the only VE5 active on SSTV at this time.)

George and his wife, Bev, have FIVE girls and one boy. The childrens' ages run from 7 to 21. (Imagine having FIVE sisters, eek!)

Now, are you city-lot bound amateurs paying attention? George and

VE5UT, George Drummond, had this picture taken before the slow scan bug bit him. Next project—Chess by SSTV?

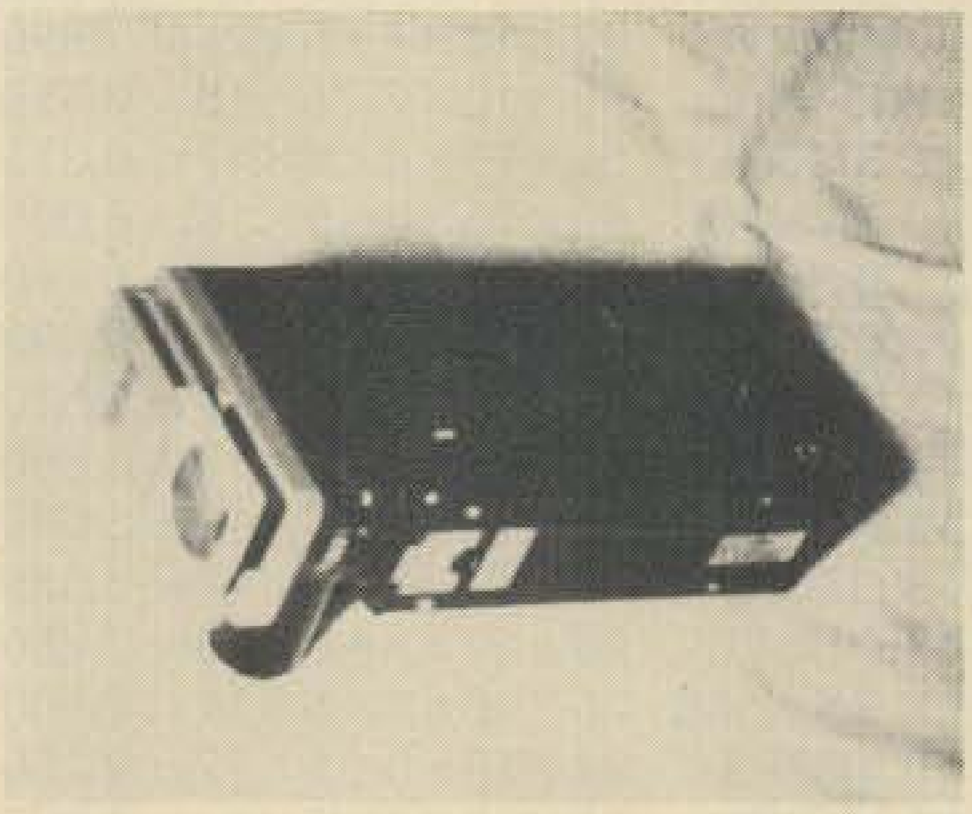
his family live on an 1100 acre grain farm. NO! His antenna is NOT in the attic. He is an avid builder and his home-brew linear feeds his home-brew atop his home-brew tower.

Like many other slow scanners, George is active on RTTY too. He has a TTL-2 converter, 19 printer, and a 14 perforator.

The picture of George, fig. 4 shows him playing chess via amateur radio. So far, I have not heard of chess via slow scan, but as they say in Montreal, *pourquoi pas?* Your move, George.

AMSAT-OSCAR 7 2 Way SSTV Pictures

October 12, 1974 is an old date on the calendar, but worth talking about. The other day, Don Muth, KH6HJF, reached down in his file and came up with some interesting picture evidence of a history-making QSO he had with JA7UAO on that date via Oscar 7.



K4FJK's Cartrivision camera with 3× magnifier attached to the camera with double-sided Scotch tape.

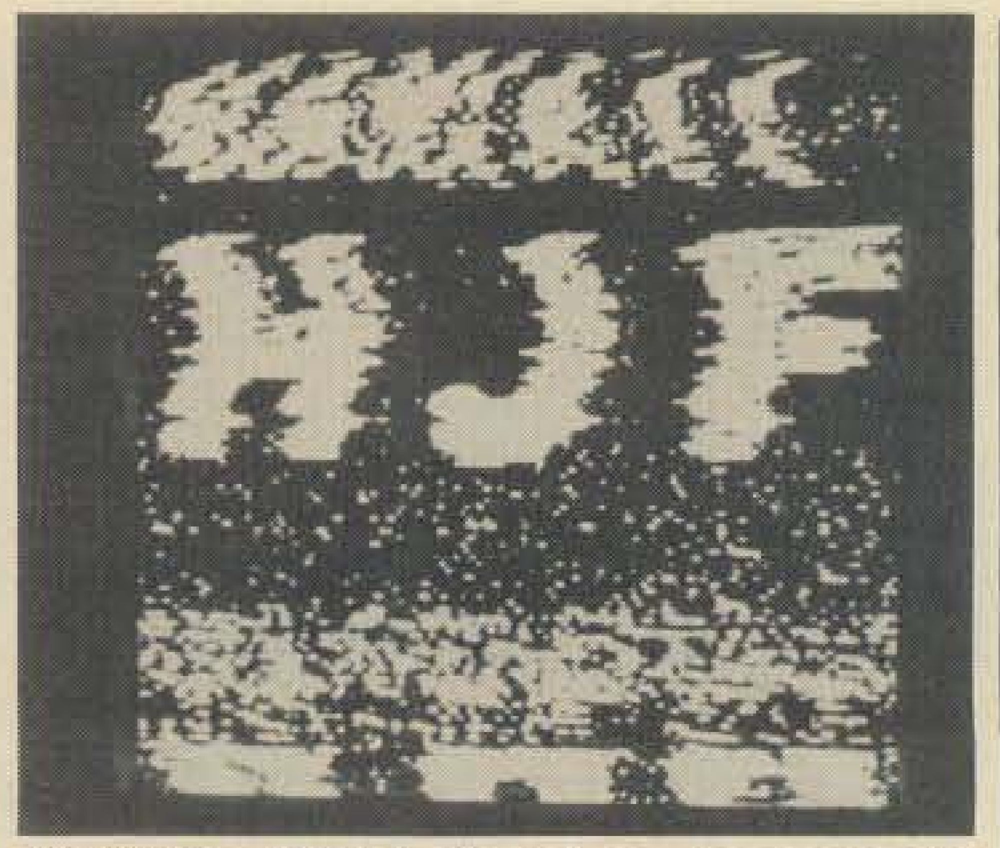
Figs. 5 and 6 show the picture exchange between Don and Hiro via the satellite. I persuaded Don to send me these interesting pictures in the hope that their publication would stimulate further interest in SSTV contacts via the Oscars, AND, in the hope that there are other slow scanners out there who will let us know what they're doing along this line!

The record making QSO between Don and Hiro was on mode A, orbit 585.

Simple Tricks For Easy Close-Ups

Here's a real winner from the home of the Kentucky Derby. Jerry Semones, K4FJK, sent in the accompanying photos and a description of how Cartrivision camera owners can obtain extreme close-ups.

Jerry's camera apparently came equipped with three screw-on close-up lenses. To get SUPER magnification, Jerry mounted an inexpensive 3× magnifier lens right on the front of the camera using double-sided Scotch tape.



KH6HJF's SSTV signal as received via Oscar 7 by JA7UAO.

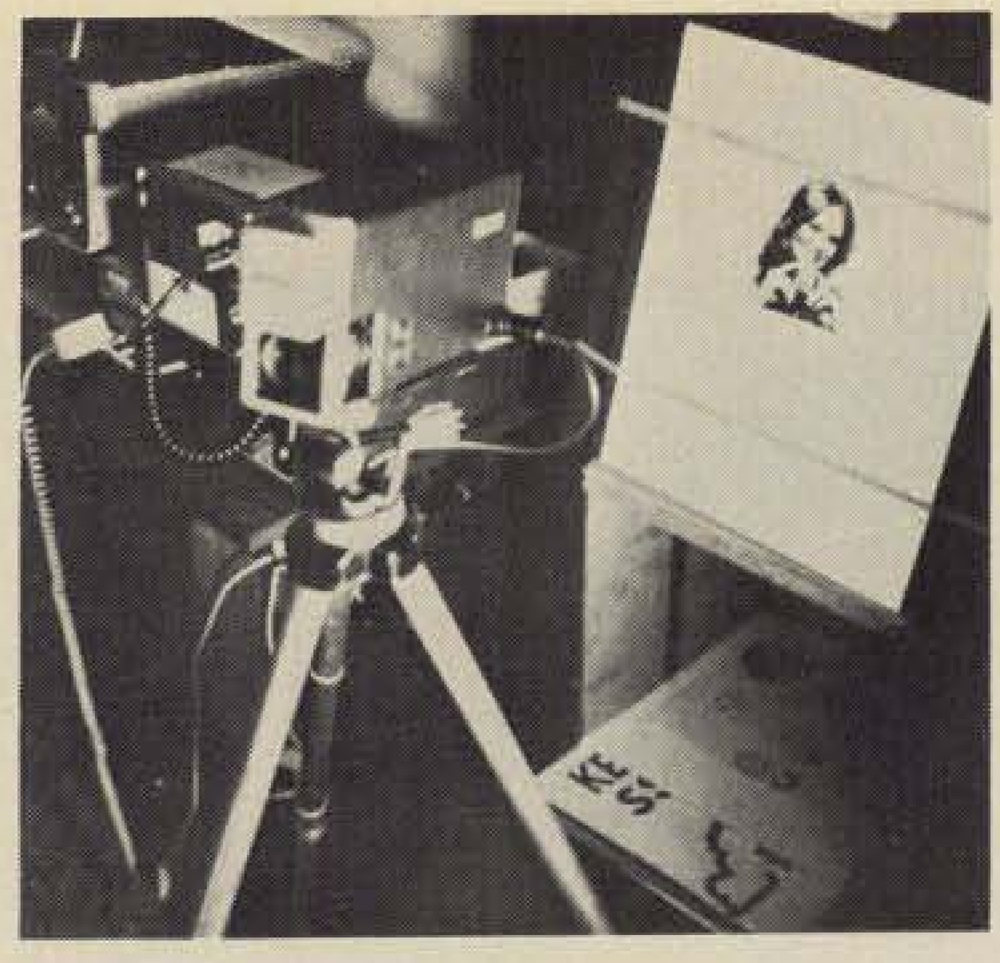
The magnifier is a plastic mounted lens that slides in and out of its self-storing holder. In fig. 7, the lens is ready for use. In fig. 8, it has been pushed back into its holder.

Jerry reports that (when used with the auxiliary close-up lenses) this magnifier enables him to "fill the screen with George Washington's eye from a one dollar bill." That works out to a magnification of about 30+ times!

If your camera is like mine, and the lens sticks out in front (!), you can improvise a little and still use Jerry's suggestion. Mount a magnifier on a cardboard tube having an inside diameter just a little greater than the O.D. of your lens. Slip the tube over the lens barrel to hold the magnifier in front of the camera lens. Now adjust the lens focus and the magnifier position. With a little experience you'll determine what magnification is possible.

Don't forget another little gimmick mentioned here a few months ago. Increasing the distance between the camera lens and the vidicon front surface will give you an increase in

JA7UAO's SSTV signal as received by KH6HJF via Oscar 7 by KH6HJF.



Another view of K4FJK's camera with the magnifier lens pushed back into its holder.

image size. To accomplish this without touching the vidicon, use a spacer ring to re-locate the lens. Spacer rings are available at some camera stores. However, if you want to experiment without spending any money, make a spacer ring of the right I.D. out of cardboard. You can slip this ring over the threads on the lens, and *Voila,* your lens will be

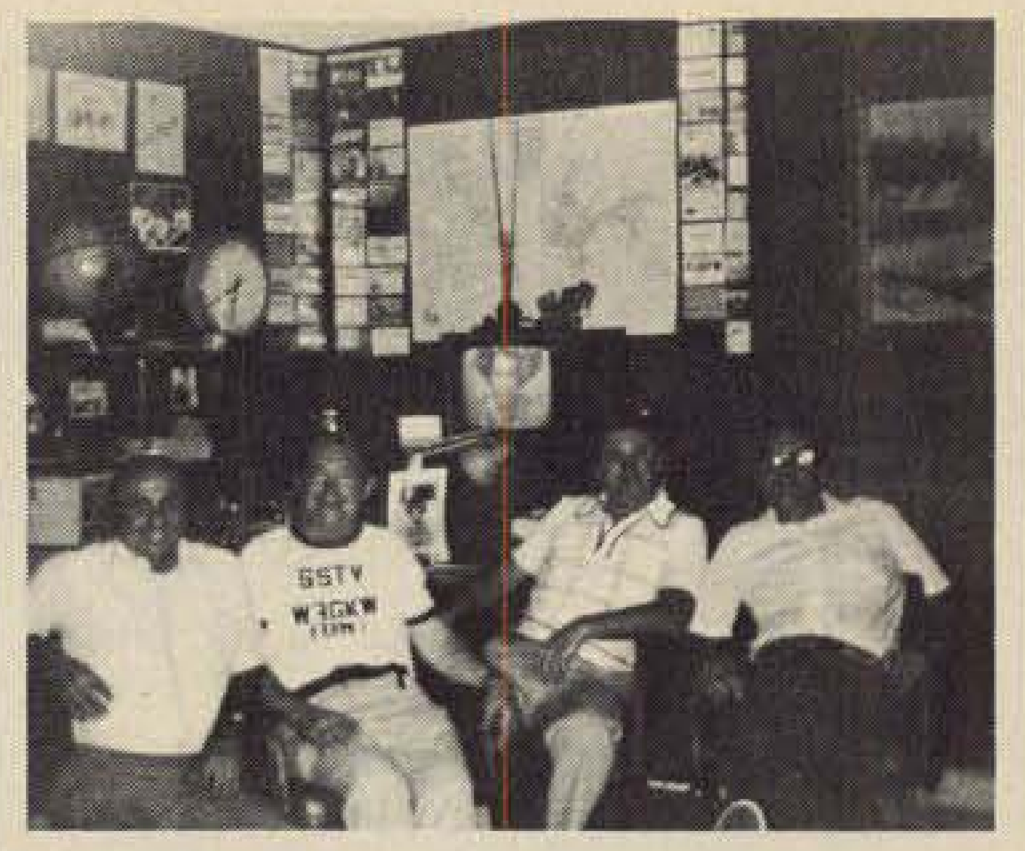
success using 2×2 slides as SSTV subjects. The following remarks are excerpts from a letter I received from "PT" describing his system.

"After many hours of trial and error, I found a system to get good results from color slides. I can 'blow up' or in effect zoom in on a small image that would otherwise be unsuitable for SSTV use.

"The system is very simple and again uses my table board to slide a back lighted screen away from or closer to my Robot camera to obtain the wanted picture size. (See accompanying sketch, fig. 9.)

"After trying frosted and ground glass and several kinds of plastics, I found that a sheet of WHITE BOND TYPING PAPER was best for a back lighted screen—NO hot spot in the center as with others.

"The paper screen is mounted in a heavy cardboard frame so that it can be moved back and forth. The frame is about 12 inches square with a cut out area 8×10 inches. Scotch tape holds the white paper in place over the cut out area.

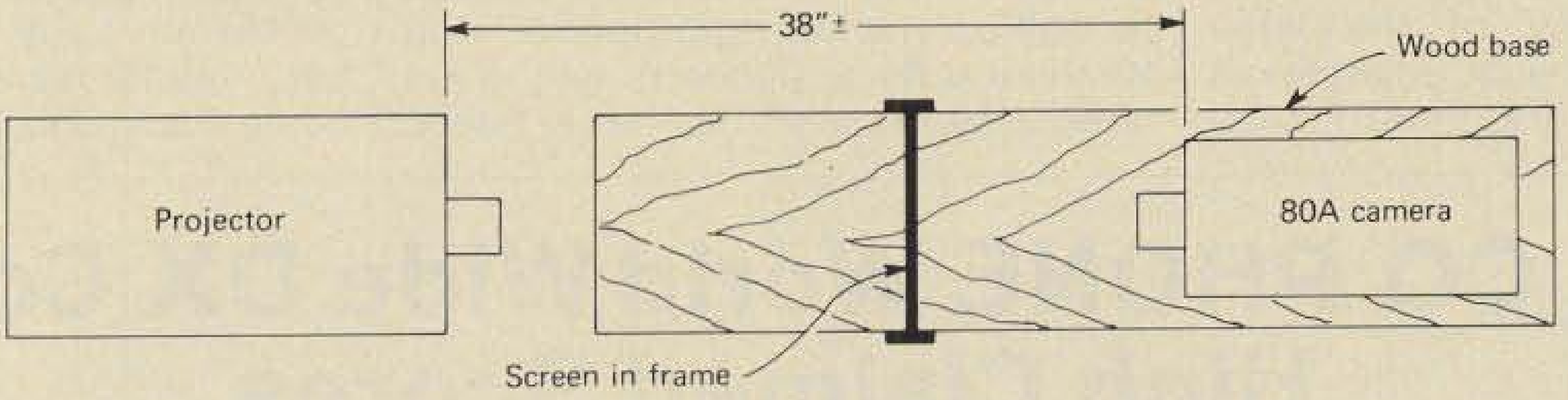


A rather dim view of four bright slow scanners! From the left, Rolph Van Jindelt, WB6JKW; Tony Pessiki, W3GKW; Peter Kuehn, WB6TOC; Paul Capetz, W6PLI.

on figs. 2 and 3 in this column for the October/November issue.

Fig. 2 should have been captioned, "Single transistor video amplifier used in conversion of Philco B311 series TV sets to obtain video output for frame grab."

Fig. 3 should have been captioned, "Single transistor video amplifier and AGC kill system for using a Philco



General arrangement of W8QZ's backlighted screen for SSTV transmission of 2×2 slides.

moved out just a little farther from the vidicon! Quite a bit of magnification can be obtained in this manner. Just make sure that your camera lens isn't hanging by one thread.

W8QZ's System For Using Slides As SSTV Subjects

"PT" Taylor, W8QZ has had great

W8QZ used his back-lighted slide system to transmit this close up of DJ0XH. Original slide was a group picture.

"As the screen moves away from the projector, the image gets larger. Each movement of the screen requires focusing BOTH the projector and the camera."

Using travel-trip slides, or just family pictures as source material for a slow scan tape opens up a lot of possibilities for most slow scanners. Certainly the opportunity to get just about any image size you want is a big advantage. (Within reasonable limits of course!) However, if you have some nice sharp slides, you can think of them as a real resource for an interesting tape on your travels, your family, or perhaps another hobby interest.

For a sample of how the system works, see fig. 10 showing a considerable enlargement from a slide. That's DJ0XH "blown up" from a group picture.

Thanks to W8QZ for this useful info complete with sketch and sample photo!

A Correction

Gremlins messed up the captions

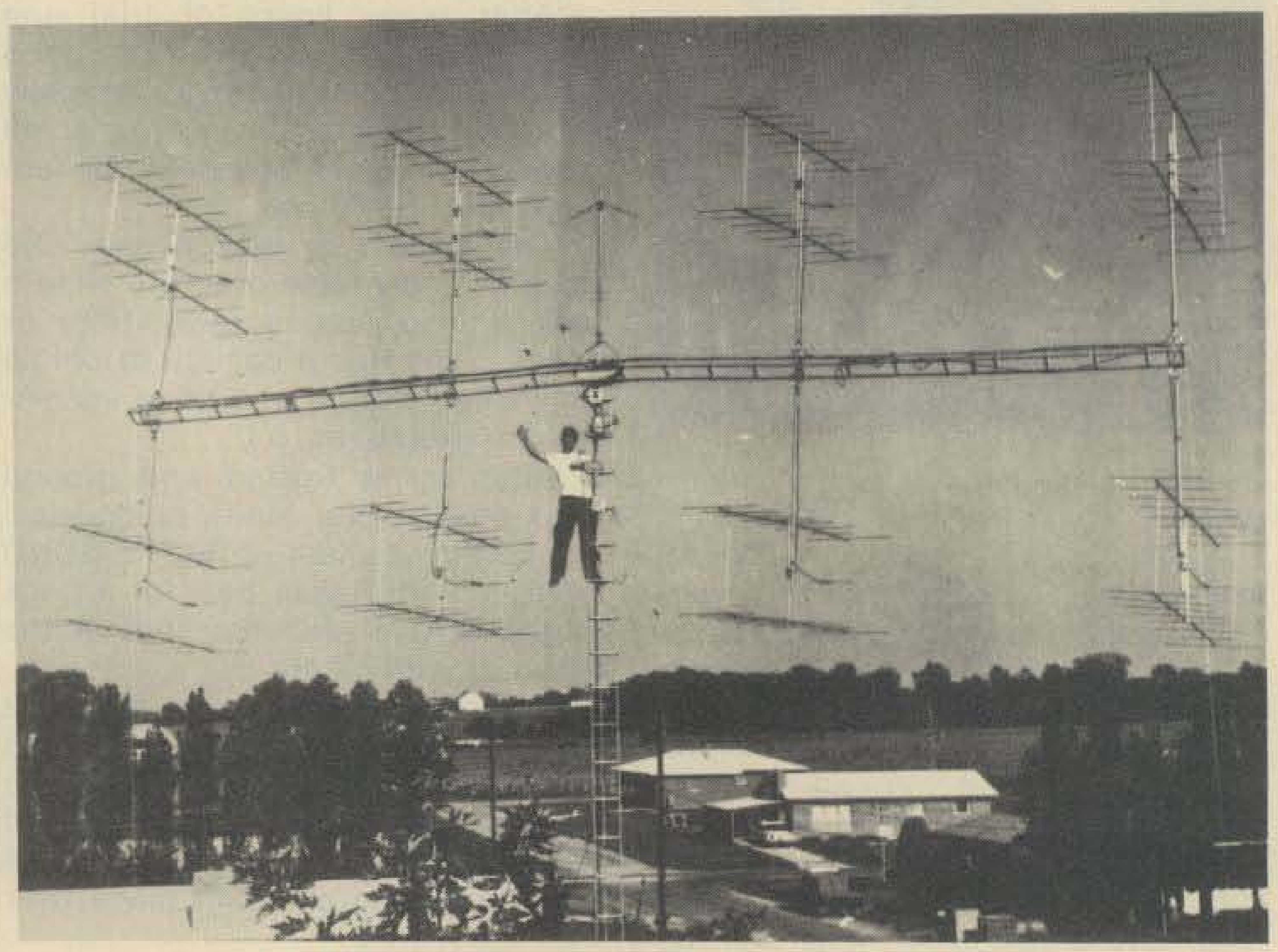
B311 series TV set as a video monitor."

The text of W8OZA's letter clearly described the purpose of each diagram—my apologies for any confusion created by the erroneous captions.

(Continued on page 73)

A beautiful home in an ideal location. WB6TOC's beam reaches for the sky from a mountain top.

K9EID Back On The Air



If you think the figure on top of the tower looks familiar or that a 128 element beam on 2 rings a bell rest assured. Bob Heil, K9EID, (*that's* who it is) was a familiar name and call during the golden days of 6 and 2 meter s.s.b. Bob was on 6 meter s.s.b. in early 1958 and was doing 2 meter mobile s.s.b. work in 1961. He was the V.H.F. S.S.B. Editor for *CQ* during 1962 and 1963. Many of you will remember the famous K9EID "SB-62" transmitting converter which helped put many low band ops on v.h.f. s.s.b.

Bob was perhaps most famous for his 128 element 2 meter array. He worked lots of moonbounce and scatter on 2 during 1964 and 1965. In 1966 K9EID went off the air, and Bob moved from Illinois to Ohio for several years. Recently Bob and his XYL Judy returned to Marissa, Illinois and K9EID is once again on the air.

Currently, Bob is founder-president of Heil Sound, the firm which builds and operates many of the large sound systems for such entertainers as The Who, Jeff Beck, Peter Frampton and The Billy Graham Crusades as well as The Midnight Special, Don Kirshner's Rock Concerts, etc. Even with what appears to be a hectic schedule Bob is active once again on the air. Look for him on 2 meter f.m., 145.10 u.s.b. and 50.110. Welcome back Bob. ■

1976 CQ PHONE World Wide DX Contest High Claimed Scores

The following are high claimed scores received **and processed** by December 25, 1976, so don't be alarmed if you don't see your score listed

USA

Single Operator

All Band

W1ZM	1,885,050
W7JST	1,678,586
W3GRF	1,412,105
W3LPL	1,405,144
W2GXD	1,382,193
W2HMH	1,323,241
K5LWL	1,178,284
W4QCW	1,161,204
W3BGN	1,133,412
W4YWX	1,116,462
AA6PGB	1,033,550
K4VX	1,010,100
WA1STN	988,234
WA7WXY	978,117
K4YFQ	930,015
K6CQF	877,251
WB9BPG	875,998
WA9BWY	805,194
W2GUH/0	775,520
AC4WSF	746,242
W4MYA	744,120
WA7NIN	743,256
W9MIJ/4	724,150

Single Operator

Single Band

1.8 MHz

K1PBW	7,280
W5USM	2,400
WB4QZT	2,160
WA4NFF/4	1,200
W4BAA	1,058

3.8 MHz

W7KW	81,136
W1CF	69,608
K8INX	68,456
K2RR	28,584
K9OTB	20,874
WB6NRK/7	15,080

7 MHz

AA6EPQ	74,100
W9ZRX	49,980
K4APL	27,880
WB4OGW	26,611
WB4SIJ	19,762
W9NZM	18,056
WA4APG	10,260
WA5IHS	10,152

14 MHz

WB0LLR	269,010
WA1RHA	253,640
WB9LHI	253,260
W3CRE	249,832
K1CMX	236,421
W8JGU	227,052
WA2WMT/0	223,245
WA9PBK	220,835
K9DX	207,214
WB6UDC	201,609
W4LBP	197,238
K2IGW	182,250
K3MBF	180,348
K8UNG	180,180
K1KDP	172,323
K9TZH/9	161,101

21 MHz

K4YYL	303,170
AA4OSM	227,360
W2HBT	191,252
W8FAW/4	166,725
WA6WZO	163,830
K4KJN	160,072
W1FXD	158,796
W4FDA	157,593
W1YN	145,672
AB9HAD	136,028
WA7YRP	120,158
K3LWM	117,132
K6SVL/4	109,616

28 MHz

WB5OAS	37,422
AB5HIH	22,952
K9EGA/2	21,770
WA1HFN	20,803
WB9KLB	19,602
W6HX	19,500
WB0QHV/0	16,409
W4UPJ	12,006

USA

Multi-Single

WA8ZDF	1,966,390
W5BJA	1,620,381
W1ZA	1,568,220
K1VBL	1,391,720
WA1NRF/1	1,313,264
W6BH	1,306,692
WA3YGH	1,286,296
W5UDK/1	1,071,630
K3GJD	964,597
W6OKK	928,908
K3AVT	913,680
K2BMI	895,104
K7RSC	882,645
W7TML	860,405
W9SZR/3	840,021
K6HIH	827,820

USA

Multi-Multi

W7RM	5,118,175
W3AU	4,500,000
W2PV	4,276,140
W4BVV	4,065,413
WB5OOE	3,531,231
W3FRY	1,956,020
W3GM	1,726,263
W3DHM	1,392,137
W3FA	995,988

DX

Single Operator

All Band

PJ9CG	5,214,510
CT9AT	3,992,120
CT4AT	3,071,325
HC1BU	2,096,586
HK4DF	2,015,246
OZ5KF	1,821,610
9Z4NP	1,734,297
KH6IJ	1,710,540
KP4EKI	1,637,740
4Z4HF	1,571,359
JH1ECG	1,426,120
EL2T	1,413,600
EP2SV	1,311,024
I3PRK	1,282,040
KZ5JM	1,233,000
HK4AOY	1,226,515
JA2JW	1,214,350
HI8MOG	1,184,330
ZF1WW	1,079,571
I4ZSQ	1,068,012
GD5BTU/A	1,061,228
WB4ZKG/KC6	936,306
VP1MPW	807,312
G3RCV	766,656
W4EV/VP9	745,485
KJ6DL	744,000
D4DBC	738,285
VE3EDC	133,496
OH1IG	124,548
JA2BAY	111,384
OH1IJ	91,584
I6BQI	87,870
VP2KF	71,840
I3BBZ	74,292
VE7IG	72,940
I5FCK	64,124
DJ3JB	61,288
OA4ALP	51,675
SM0AJU	46,200

Single Operator

Single Band

1.8 MHz

KV4FZ	37,584
VE3BMV	29,750
HK4EB	3,672
G3UBR	2,976
G4BXT	1,159
OH2BO	1,092

3.5 MHz

EA8CR	200,850
I3MAU	90,783
G3NLY	70,656
VE1AIH	50,308
YU1EXY	46,875
ZL1BIL	43,214
VE3ECP	39,104
VE7CGY	36,162
K6QHC/KG6	25,896
OA4VR	23,698
G3UKS	16,000

7 MHz

CX4CR	363,110
VR3AH	308,750

14 MHz

FY7AK	1,415,329
PY4OD	1,308,560
8P0A	923,317
K2IZN/4X	829,962
CX7BV	754,588
I1GPK	713,400
VE7BC	672,150
KV4JV	658,721
4X4NJ	639,343
OA4AHA	626,808
EI2CN	555,852
F2SI	531,598
OH2MM	500,616
KH6GMP	429,900
LU7MAL	410,688

21 MHz

CW3BR	1,094,767
YV2AMM	806,200
EA8JJ	608,076
HC2YL	505,336
YU2RBY	478,439
CX4BD	461,754
IT9KZW	364,266
4Z4LG	328,227
AH6BZF	279,180
G4CNY	261,877
VP2KAA	219,220
F6AXP	191,968
SP3DOI	182,106
I2TTL	160,512
LU6DIN	153,255

28 MHz

CE6EZ	349,246
CX3BH	257,130
D2AFW	219,345
YV4CB	155,312
CE4EM	131,652
CX5BL	111,824
9H1EL	101,022
IT9HLO	71,688
JF3BDP	63,270
I3DAB	59,262
YU3TPM	46,659
IT9WGI	37,341

DX

Multi-Single

VP2G	5,901,780
IG9PLN	4,096,960
OH2AW	3,345,003
FG0MM	3,104,768
OH1AA	2,957,172
HB9H	2,833,880
WB4SJG/6Y5	2,593,200
AJ4EAS	2,421,440
5W1AU	2,355,435
G3LNS	2,295,720
ZF1RE	2,285,088
I1GJC	2,141,592
ZS6BNX	2,052,225
HB0BHA	1,953,930
VE3AKG	1,481,579
JA1KSO	1,409,100
GW4ENT	1,320,402
I3AWW	1,124,288
DL0KQ	1,117,600
DL0JK	991,320
II4FGM	967,448
SP5PWK	934,836
LA5X	908,402

DX

Multi-Multi

VP5M	10,550,786
DK0KX	3,324,991
VE3DU	3,025,269
JA3YKC	1,432,860
JA3YDS	1,015,881
JA7YPR	715,015

Even if you buy your trap antennas, understanding how they work can help you make better decisions.

The Multi-Band Trap Antenna—Part II

BY JOSEPH M. BOYER*, W6UYH

Part I, in which the author set the stage for an understanding of multi-band trap antennas by an analogy to transmission lines, appeared in February CQ. In part II he discusses the reaction of the antenna upon itself, and upon lumped reactance.

Now we will just reverse our earlier action and restore those discarded resistive parts R_r and $R\Omega$ in our input impedance, putting them *in series* with our newly found jX reactance values. This is easy with regard to the R_r part. Every *naturally resonant* $\lambda/4$ monopole ever constructed since the first growling spark c.w. signal flashed into the ether possessed a radiation resistance R_r very close to 36 ohms in value. The $R\Omega$ ohmic part is a bit different in nature, so we will defer consideration of it for a bit longer.

Fig. 2 shows a Smith impedance chart which represents a coaxial transmission line whose characteristic impedance Z_o equals fifty ohms feeding our two monopoles. (See now why we used K_m instead of Z_o to represent our analogue line?). The vertical line from top to bottom is calibrated in values of pure resistive ohms. At the chart center on the R line we have an impedance value of $R + jX = 50 + j0$ ohms, or a perfect impedance match point yielding a v.s.w.r. of 1.0:1 in fifty ohm coax.

Now the chart is printed on the page so that the chart notation is upside down. That's perfectly ok, because the point $R + jX = 0 + j0$ ohms is then located at the very bottom on the inside rim edge of the chart. That impedance point will temporarily represent the input terminals 1, 2 of our monopole at f_o when it is *not radiating*. Adjacent to this $0 + j0$ point (representing a short circuit) we see a zero marked on the very outermost electrical distance scale which is labeled Wavelengths Toward Generator (W.T.G.). It climbs circularly clockwise around the chart and again, adjacent to each of its calibrated $\lambda = h°/360°$ points of distance (along the line or antenna) we see points of pure inductive reactance $+$ jX located right on the inside rim scale of the chart when it is upside down. The pure reactive inside rim scale ends at the top of the chart at the point $+$ jX equals infinity. Adjacent to this infinite inductive reactance point we see that the W. T. G. scale is marked 0.250 wavelengths. That 0.250 λ point represents both terminal 7 at the very top end of the monopole and the "output terminal" of the analogue line.

From that top point on the Smith chart, if you inch a hair more distance beyond 0.250 λ on that W.T.G. scale, the sign of the pure reactance marked on the inside rim edge flips to a minus and you have entered the region of capacitive reactance, as the upside down printing on the chart tells us over on the right hand side. Again, you observe that $-$ jX changes from $-$ j infinity at the top down to $-$ j0 ohms at the bottom point, where the W.T.G. distance scale is marked 0.500 λ.

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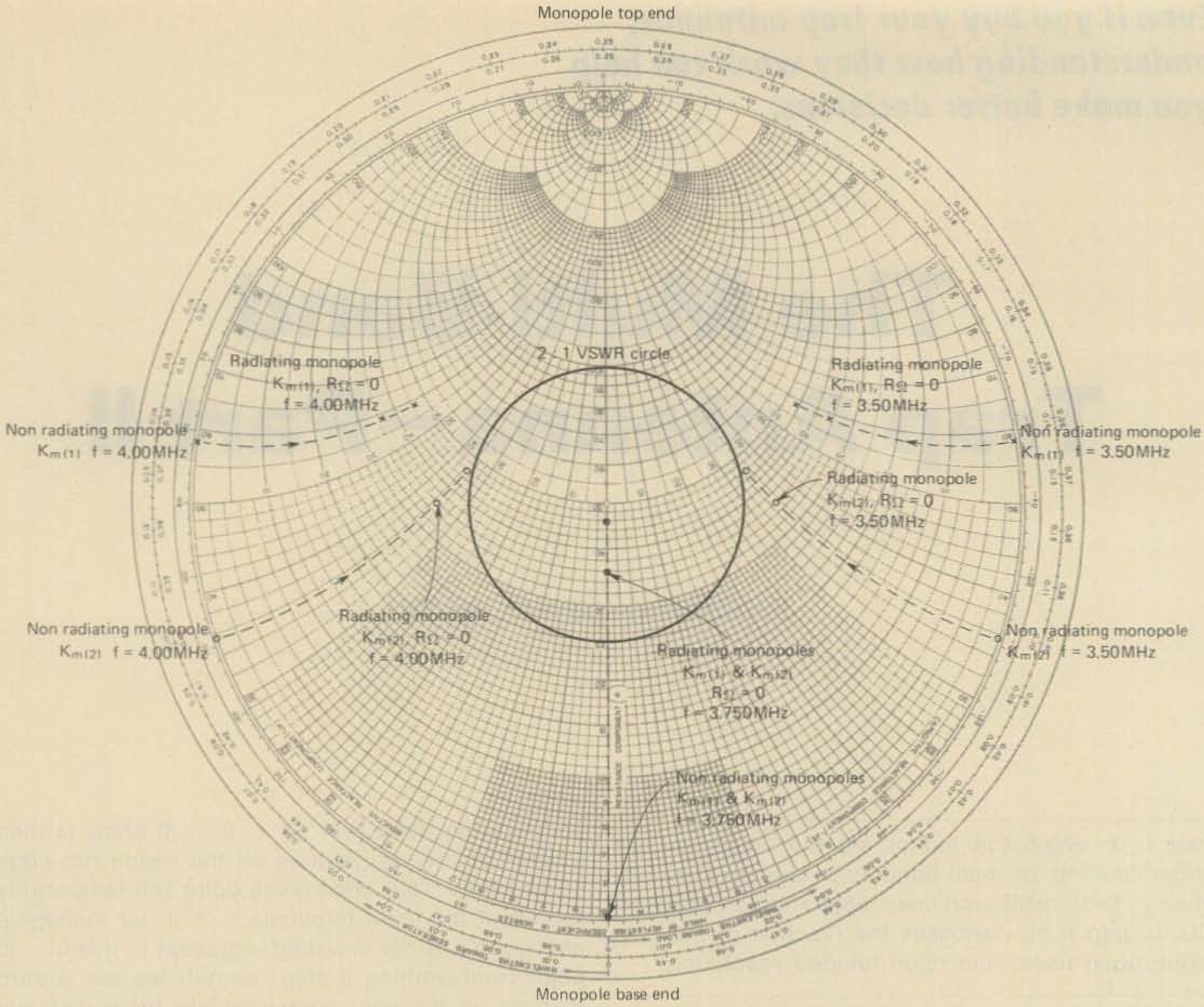

Fig. 2—Calculated input impedances for each of two naturally resonant $\lambda/4$ monopole antennas plotted on Smith chart representing fifty-ohm coaxial cable feed. Monopole $K_{m(1)}$ conductor is #10 gauge wire; Monopole $Km_{m(2)}$ conductor is 4.0 inch diameter tubing. End input impedances are those for each monopole radiating as well as operating in a $R\Omega = 10$-ohm lossy r.f. environment.

Now, for our *non-radiating* monopole case, those reactances we just calculated are shown marked as points on the inside rim edge scale. With the chart upside down, the points obtained for the high frequency band limit are located on the left as inductive reactance; those for the low frequency limit on the right as capacitive reactance. The reactances for the skinny wire monopole are indicated with small case x's; those for the fat monopole as small circles or dots. Band frequency and K_m indicators are marked next to these reactance points. If we now place our known value of R_r *in series* with each of these reactive points obtained, they travel upward along those dashed constant reactive line paths, and all stop movement when they encounter the circular line representing 36 ohms of resistance. Only the points of impedance for the band center frequency f_o lay over each other, moving up with the addition of R_r to end at a $Z_{in(1,2)} = 36 + j0$ ohms on the pure resistive center line. The impedance points for 3.500 and 4.000 MHz end up in a no-man's land of complex impedance (both R and $\pm$ jX) outside that "magic" 2:1 v.s.w.r. circle marked on the chart. That 2:1 v.s.w.r. circle is "magic" to the modern day amateur for the following reason: unlike old time ham rigs which could use almost any random hunk of chicken wire as an antenna, modern commercially-built ham rigs will not load full output power into a feed line having much more than a 2:1 v.s.w.r. Of course we love those beautiful, shiny, computerized, digital-dial read-out, miniaturized wonders with their bells and whistles. But that is why we must revere that 2:1 circle on the chart when it comes to our antennas these days. Now, back to the chart.

We wanted v.s.w.r in our fifty-ohm coax line. Ok, the v.s.w.r. for the 3.750 MHz band center impedance is easy to obtain because there is *no reactance* at this frequency. For both our monopoles, VSWR is just,

$$VSWR = \frac{50\ \Omega}{36\ \Omega} = 1.39:1\ (f_o)$$

Getting v.s.w.r. in the feed line at 3.500 MHz and 4.000 MHz gives us a bit of a problem due to the complex impedance at those frequencies. We could get fancy here and go to the bother of calculating what is called the complex reflection coefficient, and then get v.s.w.r from it. Most working antenna engineers don't bother; they use a lazy man's way to get v.s.w.r. when the impedance on the chart is complex: put the pin end of a drawing compass into the chart center point of 50 + j0 ohms, then pull out the pencil end and put its tip on say the 3.500 MHz impedance point for the radiating (but ohmic loss free) monopole of $K_{m\,(1)}$. At this radius a circle is lightly drawn on the chart. The point where such pencil circle cuts the pure resistive axis *below* the center point is "eye balled" in value. Doing this gives a pure resistive intercept of about 13.5 ohms for the $K_{m\,(1)}$ skinny monopole at 3.500 MHz, so

$$VSWR_{K_{m\,(1)}} = \frac{50\ \Omega}{13.5\ \Omega} = 3.7:1 \quad (f_{low})$$

Using the same lazy man's technique for the radiating but ohmic loss free fat monopole at 3.500 MHz gives us a resistive axis intercept of about 20.5 ohms, or a v.s.w.r. of about 2.44:1. If we had used the resistive axis intercept above the chart center (R larger than 50) and carried out the indicated division we would have v.s.w.r. going from 1.0:1 down to values *less than* 1.0. That is the way our British cousins and some Europeans figure v.s.w.r. It means the same thing, but can confuse us Yankees sometimes at first glance.

Again we see that the fatter $K_{m\,(2)}$ radiating monopole gives us a lower v.s.w.r value at the low frequency band limit than its skinnier counterpart. This illustrates a very important fact from antenna theory which says that larger diameter antenna conductors change reactance at a *slower rate* ($\Delta X/\Delta f$) with frequency and therefore give a *broader* impedance frequency *bandwidth* for a given limiting value of v.s.w.r. than skinny antenna conductors. What mysterious factor in our simple calculations here causes that effect to be seen? The neat value of antenna K_m Dr. Schelkunoff worked out for us to use.

Now we must consider the other ohmic loss term $R\Omega$. Everytime an antenna man eyes that term he winces inwardly; half of his time is spent fighting to keep it small; still it always exists in the real world of antennas. The ohmic environmental loss varies from QTH to QTH even for identical antennas. Discussing it could fill a text book. Here we can only note that in a "typical" US soil environment, using about six $\lambda/4$ radials and high conductivity antenna conductors, a "ball park" value for $R\Omega$ at the *lower HF ham frequency bands* would be about 10 ohms. If we now put this additional 10 ohms in series with R_r in our calculated antenna input impedance to get $Z_{in(1\,2)} = 36 + 10 + jX$ ohms, this added "real" part of 10 ohms pushes all our calculated impedance points a bit farther along those little dashed constant reactance curves to stop on the R equals 46 ohm circular line, and a bit closer to the chart center. We see that adding non-radiating ohmic loss also lowers feed line v.s.w.r. in this case (but that is a poor way to lower antenna v.s.w.r.!). Now that our fatter, naturally resonant monopole is radiating and operating in an environment possessing a realistic ohmic loss, its $Z_{in(1\,2)}$ impedance has almost reached our magic 2:1 circle at the 3.500 MHz band edge. Unfortunately, this is not true for the wire monopole.

Someone says, "Hey, my pencil drawn circle through the impedance at the low band limit also cuts right through the impedance point for the high band limit. Do real world antennas have pretty, symmetrical impedance curves like that, spaced equally on either side of f_o ?" Uh . . . no! Not quite! In our calculations we didn't include a *lumped* capacity which *always exists* between the base end of a monopole and, via the dielectric constant of the base insulator, to the ground plane. This lumped capacity is connected in *parallel* across the *series* input impedance of the monopole. What it does is to "skew' the shape of the Z_{in} curve with frequency about f_o so that the magnitude of Z_{in} at f_{low} is not equal to that at f_{high}, with just a change of reactance sign.[5] The use of a hollow base insulator as well as tapers in the conductor at the feed point can reduce this effect so that in well designed antennas it is minimal *at h.f.* The same thing happens in a center fed doublet from the *lumped* capacity across the feed insulator.

The Antenna Reaction Upon Itself And On Lumped Reactance

If we give a small child some adult gadget like a wind-up alarm clock to play with, the child invariably starts trying to take it apart. This inborn human instinct is intelligent and commendable—it eventually results in a better understanding of how things work.

When we try to take a $\lambda/4$ monopole apart we just end up with a number of shorter lengths of antenna; in terms of the analogue of the antenna, we then have a collection of electrically shorter transmission line sections $h_1 + h_2 + h_3 + \ldots h_n$ which *all add up* to a total h° of 90 degrees. The natural question which arises in our minds is this: how do each of these individual short sections of the total antenna end up interacting reactively on one another to produce an input reactance $jX_{in(1\,2)} = j0$ ohms as resonance?

It turns out that the answer to this seemingly academic question is an important step along the road to easy design not only of the Morgan trap antenna, but many other kinds as well. Let's take a look at this problem. To do so won't require a lot of analogue

[5] Also, the radiation resistance R_r is *slightly* larger on the f_{high} side of f_o than on the f_{low} side, and this adds to non-symmetry in Z_{in}.

line sections; just two will do. Such line dissection is shown in fig. 1 (c). All we have done is to cut the single analogue transmission line section of Fig. 1(b) into two shorter length sections h_1 and h_2. A new terminal, 3, now appears on the conductor as the "output" terminal of the left hand line section h_1, and directly below it a corresponding ground terminal, 4. A new terminal, 5, on the conductor now represents an "input" terminal for the right hand line section h_2, and directly below it a companion ground terminal, 6. All that the dual listing of K_m under both of the line sections means is that the line characteristic impedance is of the same value in both. The total electrical length $h^\circ = h_1 + h_2$ of the analogue line is still 90.000 degrees, although h_1 and h_2 may be proportioned *any way we like* as long as they sum up to this specified total length. Oh yes, there is a little dashed line conductively connecting terminals 3 and 5 together. It represents a wire "pig tail" lead of "zero" electrical length. Right now let's just reach out and break that pig tail lead so that terminals 3 and 5 are temporarily insulated from one another.

Now we know from our previous exercise with the $\lambda/4$ monopole, that when we look into the input terminals of an RF transmission line stub section when its output terminals are open circuited, equation (1.0-3.) will give us the reactanve $jX_{in\ (\ )}$ present at the *input terminals* of such stub line. The "output" terminals 7 and 8 of line section h_2 are obviously open circuited, so if we look into the input terminals of this right hand line section we should see,

$$jX_{in\ (5\text{-}6)} = -jK_m \cot h_2 \quad \text{Ohms}$$

Because we set a limit on the total line length h° *at frequency* f_o, the right hand side line section h_2 just has to be less than 90 degrees at f_o at least, unless the line section h_1 ceased to exist by making its length equal to zero degrees. Therefore, if the length of section h_1 is more than zero degrees long, the input reactance $jX_{in\ (5\text{-}6)}$ of the right hand line section will *always* come out as a capacitive reactance $-jX_{in\ (5\text{-}6)}$; in other words, line section h_2 (representing the upper section of the monopole) will *always* look like a *condenser* connected across the "output" terminals of the left hand line section h_1 (when we put our pig tail wire back in place). That sure seems strange, because we *also know* that if we move over to the left and look into the line terminals 1 and ground 2, $jX_{in\ (1\text{-}2)}$ *always* comes out to be j0 ohms *there* when the total h° equals 90 electrical degrees. Somehow that first line section h_1 does *something* to cancel out the capacitive reactance $-jK_m \cot h_2$ at its "output" terminals *no matter how the lengths of the two line sections are proportioned.* To *amplify* our mental attack on this idea, let's employ a "thinking equation" at this point which could look like this:

$$j(K_m \text{ SOMETHING } h_1) + (-jK_m \cot h_2)$$
$$= j0.00 \text{ ohms}$$

Peering at the above relation, we see that if $j(K_m$ SOMETHING $h_1)$ had the same absolute magnitude as $jK_m \cot h_2$, but an opposite reactive sign, then the two terms *would* add up algebraically to j0 ohms. We know that a coil and condenser connected in series will do that when their $+jX_L$ and $-jX_C$ have the same electrical size in ohms at f_o. Therefore, in such approach the $j(K_m$ SOMETHING $h_1)$ term could be made to look like a series inductive reactance to its "condenser" load. This idea is sketched in fig. 1 (d). Now one way to make a transmission line section *look like* a series inductance is to change the first term in our "thinking equation" so it looks like this:

$$jK_m \tan h_1 + (-jK_m \cot h_2) = jO \text{ ohms}, \quad (1.0\text{-}4.)$$

or,

$$jK_m \tan h_1 = jK_m \cot h_2,$$

and even,

$$\frac{jK_m \tan h_1}{jK_m} = \cot h_2 \quad (1.0\text{-}5.)$$

Notice that in equation (1.0-4.), when h_1 and h_2 add up to either *less or more* than 90 electrical degrees, the answer becomes finite in magnitude and flips in reactive sign to go capacitive or inductive in reactance. But that is just what our equation (1.0-3.) did with the $\lambda/4$ monopole on either side of f_o; therefore, equation (1.0-4.) converts into equation (1.0-3.) when h_1 goes to zero degrees in length. Now we can see how a naturally resonant $\lambda/4$ monopole reacts on itself, length by length, to "resonate itself" at f_o; or become plus or minus reactive on *either side* of f_o. However, our equation (1.0-5.) seems kind of dumb. It just says, "Tell me how long h_1 is, and I'll tell you how long h_2 is." But we already know the answer to that question by means of first grade arithmetic; say h_1 equals 47.000 degrees. Obviously then, $h_2 = 90^\circ - 47.000^\circ = 43.000$ degrees. What do we need this more complicated equation for? It merely echo's: $\tan 47.000^\circ = \cot 43.000^\circ$

Well, now let's become sneaky again. What if we opened up that gap between terminals 3 and 5 and inserted there a *coil* whose inductive reactance at 3.750 MHz was equal to + j150 ohms? Because we've all played with *electrically short,* coil loaded mobile whip antennas, we see that this is what we would create here: a coil loaded monopole, with the "loading coil" located at an electrical height h_1 of 47.000 electrical degrees from the base input terminals. We know something else, too: that *top* line section h_2 can not remain at 43.000 electrical degrees if we wish to obtain a resonant j0 ohms input reactance at 3.750 MHz. Our new *coil loaded* monopole and its equivalent analogue line is shown in fig. 1 (e) and (f). Now we know we must *shorten* the electrical length h_2 of our monopole top conductor section, *but by just how much?* Let's try using our new found equation (1.0-4.) to get an answer, by sticking that *known* coil reactance in series with the other terms.

$jK_m \tan h_1 + j150.00 + (-j \cot h_2)$
$= j0.00$ ohms (f_o)

Also, let's reach back and use our $K_{m(1)}$ of 560.32 ohms representing our skinny number 10 gage wire monopole. Plugging in that K_m value, plus our known length h_1 of 47.000°, we get:

$j560.32 \tan 47.000° + j150.000 + (-j560.32 \cot h_2) = j0.00$ ohms (f_o)

$j560.32\,(1.0724) + j150 + (-j560.32 \cot h_2) = j0.00$ ohms (f_o)

or,

$$\frac{j560.32\,(1.0724) + j150.000}{j560.32} = \cot h_2 =$$

$$\frac{740.887}{560.32} = 1.340 \ (f_o)$$

$\cot^{-1} 1.340 = 36.731°$ (at f_o)

Is that correct? Let's stick our found length for top section h_2 back in and see:

$j560.32\,(1.0724) + j150.00 + (-j560.32 \cot 36.731°) = j0.00$ (f_o)

$j750.887 + (-j560.32 \times 1.3401) = j0.00$ (f_o)

$j750.887 + (-j750.887) = j0.00$ (f_o) ohms.

Now we can go into the coil loaded mobile whip business if we wish. We just specify how high in electrical degrees h_1 we will place our loading coil of so many $+jX$ ohms, from the base input terminals of the whip; calculate the whip conductor K_m from (1.0-1.) on the band of interest, and then our modified equation (1.0-4.) and its conversion (1.0-5.) tells us how long electrically our top conductor section *must be* to get resonance. A reader says, "Sure, and you can turn it around and use it to solve for the needed loading coil reactance $+ jX_L$ when you know *coil height* h_1, and top section length h_2." He pauses a minute, and then adds, "And it even works for coil *base loading* when you let h_1 go to zero degrees." That reader is so right! Another OM out there pops up with, "Aren't we working a bit too hard? I mean , if K_m is uniform in value in both line section h_1 and h_2, why don't we just divide through by K_m and get rid of it to make our equation even more simple." Ok, let's do that:

$$\frac{jK_m \tan h_1 + jX_L + (-jK_m \cot h_2) = j0.00 \text{ ohms } (f_o)}{jK_m \qquad jK_m \qquad jK_m}$$

$$\tan h_1 + \frac{X_L}{K_m} + (-\cot h_2) = j0.00 \text{ ohms } (f_o) \quad (1.0\text{-}6.)$$

The above equation is still perfectly valid, except now we would have to *multiply the final answer* (if other than j0.00 ohms at resonant frequency f_o) by K_m ohms to make it come out in the *actual value* of ohms. As it stands, the above equation is in *normalized* form: normalized with respect to the antenna or analogue line's K_m. Normalization is just a fancy word for the process engineers use in making it less work to calculate impedances in circuits, antennas, and RF transmission lines. It is another "lazy man's" trick, except that this one in no way reduces accuracy as our other compass and eyeballing resistive values to get v.s.w.r. did.

Well, we have warmed up our trig and algebra, and old Mister Sprinkle back in H.S. 59 would be proud of us for that, but what the heck has the subject of shortened, coil loaded antennas got to do with the Morgan multi-band trap antenna?

Sorry OM's, but I've been kinda sneaky again here! We have just *completed* the electrical design of a *two band* Morgan trap antenna made of number 10 gage copper wire! It is operating on the eighty meter ham band, resonant on 3.750 MHz. On eighty meters, its forty meter "quarter wave" bottom conductor section h_1 ended up being only 47.00 electrical degrees in length. That 150 ohm series "loading coil" turns out to be what the forty meter *parallel* LC trap looks like at the frequency 3.750 MHz.

What we were *actually doing* was solving to obtain the *needed* electrical length of the *next* conductor section h_2 located *above* the non-resonant forty meter band trap in order to make the *entire eighty meter monopole section* of the two band Morgan end up resonant at 3.750 MHz. Notice that $h_1 + h_2$ representing the total electrical lengths of the Morgan *conductors* no longer add up to 90 electrical degrees as they did before in the *naturally* resonant $\lambda/4$ monopole at f_o. Instead, in our skinny wire monopole, that off-resonant forty meter band trap *added* 6.27 electrical degrees to our Morgan on eighty meters; We had to remove that amount of electrical degrees from our *conductor* length *above* that trap, therefore to make our Morgan resonant at 3.750 MHz. In our fatter monopole of $K_{m(2)}$, the *same* 150 ohm magnitude of series trap inductive reactance, located at the precisely *same* electrical height h_1 from the base input terminals of the monopole, would require h_2 to be only 33.455 electrical degrees in *conductor* length; the *same* non resonant trap would have added 9.45 electrical degrees to the fat monopole on eighty meters. You will find out later that this "loading" effect by the traps, when non-resonant, places a limitation on the performance of the Morgan antenna when any band section of it is compared to that of a naturally resonant monopole for that band using identical conductor diameter $d = 2a$. But we will learn how to make this limitation minimal with our new-found sneaky ways.

Now we are armed; our design muscle has grown; we are now getting a feel for this antenna/ transmission line analogue tool. We are now ready to take on a Morgan trap antenna covering all the ham bands from ten to eighty meters and make it play correctly. It is just a matter of repeating the process we used here, band-by-band, stringing all those band traps and conductor sections in series as "the foot bone's connected to the ankle bone, and the ankle bone" on and on. When we reach the "head

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It's not nostalgic, it's fun. It makes use of all that gear gathering dust on forgotten shelves. In short it's a money saving, ecologically enjoyable endeavor.

No Harry, A.M. Is Not Dead!

BY BYRON H. KRETZMAN*, W2JTP

Just a few weeks ago I was chewing the rag with W2JND. We were bemoaning the injustice to a.m. of Docket 20777. (Did you comment to the FCC?) Smitty spends a fair amount of time on 160 a.m.; I spend a little, using the rig described in the October 1973 issue of *CQ*. He says to me, "You know, there is a.m. on 75 'phone, too!" I said, "You are kidding, the ARRL buried that ten years ago!" "No way," he says. "Give a listen!" So I did. And, I was *amazed!* Here were fellows, all over the northeast, chewing the rag about the technicalities of their "home-brew" transmitters, antennas, old receiver modifications and other things fascinating to the amateur who still *builds* his gear. I sat there entranced. The QRM was almost nil, and the QRN was light. I widened out the old SX-101 to 5 kHz, sat back and enjoyed the high quality of these transmissions, so unlike the narrow range "communications" quality of s.s.b.

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This is the 75-meter a.m. station W3CIC in Edgewater, Maryland, and the operator Lawrence A. Laser. The final is a pair of 813's in push-pull modulated by a pair of Class B 805's. The receiver is an SX-28.

Well, I wasn't content to just listen. I had to get on there and find out where these fellows were getting their parts. In short order I over-hauled the old 813 rig originally built by Harry, W2IER, which I had been using on 3620 f.s.k. for RTTY. My old Clapp v.f.o.[1] was moved up to 3875 center and the diode remote tuning was set to cover 3850 to 3900. The old modulator, using a pair of 807's, had been on the basement floor on both Long Island and in Minnesota, unused for about 25 years. I cleaned off the mildew and hooked up all the chassis, spread out on the work bench. It all worked. Soon it was back in the rack cabinet, cabled for remote control, with the modulator connected to bridge the 600-ohm line from the speech amplifier in the Teletype machine. *(The New RTTY Handbook,* page 117) Connected to a 66-foot wire with a loading coil in the middle, I got out reasonably well, but I wasn't satisfied. (What really true amateur is?) In a couple of weeks I had a ½-wave antenna up about 50 to 60 feet between two convenient oaks. Zepp feeders were connected to one end. It just so happened that the feeders were ¼-wave long so I didn't have to tune them; I just soldered the 75-ohm coax to the bottom. A grid dip meter told me that the resonant frequency of the antenna, and the ¼-wave matching stub, was in the ball park. The rig loaded up beautifully, and boy, do I get out!

It had been about 35 years since I was last on 75 'phone. There were many, many, more on in those days; the QRM was fierce. (Where did they all go? 2-meter f.m.?) I had forgotten just how much fun it could be.

Working Harry, now K4GFK, on 20-meter s.s.b. it was with glee that I told him that a.m. was *not* dead. In spite of the attempt by the FCC in Docket 20777 to banish all a.m. to frequencies above 28.5 MHz; in spite of it being ignored by three out of four of the amateur magazines; in spite of the ARRL policy,

[1]Kretzman, Byron H.; "A Remote Control 80 Meter VFO for RTTY," *CQ*, June 1960, page 63.

recently echoed by a staff member on a Syracuse repeater, to "push" only "advanced" forms of communication in *QST;* it refuses to lay down and die. Incidentally, while Docket 20777 is considered by some as the height of misconception by the FCC, there are many a.m. operators who think it looks like a conspiracy to continue and to expand the promotion of s.s.b. with the objective of selling more and more magazine advertisements to sell more and more commercially built "ham" transceivers, linear amplifiers, etc. Is the prophecy[2] of VE3ABW coming true?

No, A.M. Is Not Dead On 160 Meters

If you live in the northeast, listen any evening to the operation of the many nets or round-tables going in New England on 160. These operators are Senior Citizens for the greater part, those living on reduced retirement income, those who can't plank down $500 or more for a "store bought" s.s.b. transceiver, even if they could find one that would work on 160. These fellows are using home-brew or old venerable Heathkits like the DX-60. It is much easier and much less expensive to build an a.m. transmitter; and, there are plenty of "communication" receivers such as the old HRO[3], Super-Pro[4], HQ-129, SX-28, BC-348 and many others that can be had for a song.

No, A.M. Is Not Dead On 75 Meters

Again, in the northeast, listen any day or night between 3850 and 3900 kHz. Sometimes four or five QSO's are going at once. There are a few 1 kw stations on, a fair sprinkling of those in the 500 watt and quarter-kw category, but most are using 60 to 100 watts, with good antennas. Most take unusual pride in their audio quality so they take a real dim view of the ARRL reply to Docket 20777 where they recommend to the FCC that bandwidth be limited to 6 kHz (which implies a 3000 Hz audio limit). These fellows on a.m. are the artists of home-built stations and they want their true voices and personalities to come over; they don't want to be limited to "communications" quality. It's like the early days of RTTY where fellows built their own equipment and were very proud of it. And, when something quits, these a.m.'ers don't send their rigs back to factory to get fixed, either.

No, A.M. Is Not Dead On 2 Meters

2-meter a.m. lives on, in spite of the proliferation of repeaters and heavy promotion in the amateur magazines of the $250 and up imported transceivers. Listen to the a.m. on the low end, below 146 MHz. These fellows prefer simplex a.m. operation to the stereo-typed time-limited contacts via an f.m. repeater. They are using old Gonset Communicators, Cleggs and even old SCR-522's. Uninhibited rag chewing is the order of the day, impossible on the "alligator" repeaters of f.m. where you have to

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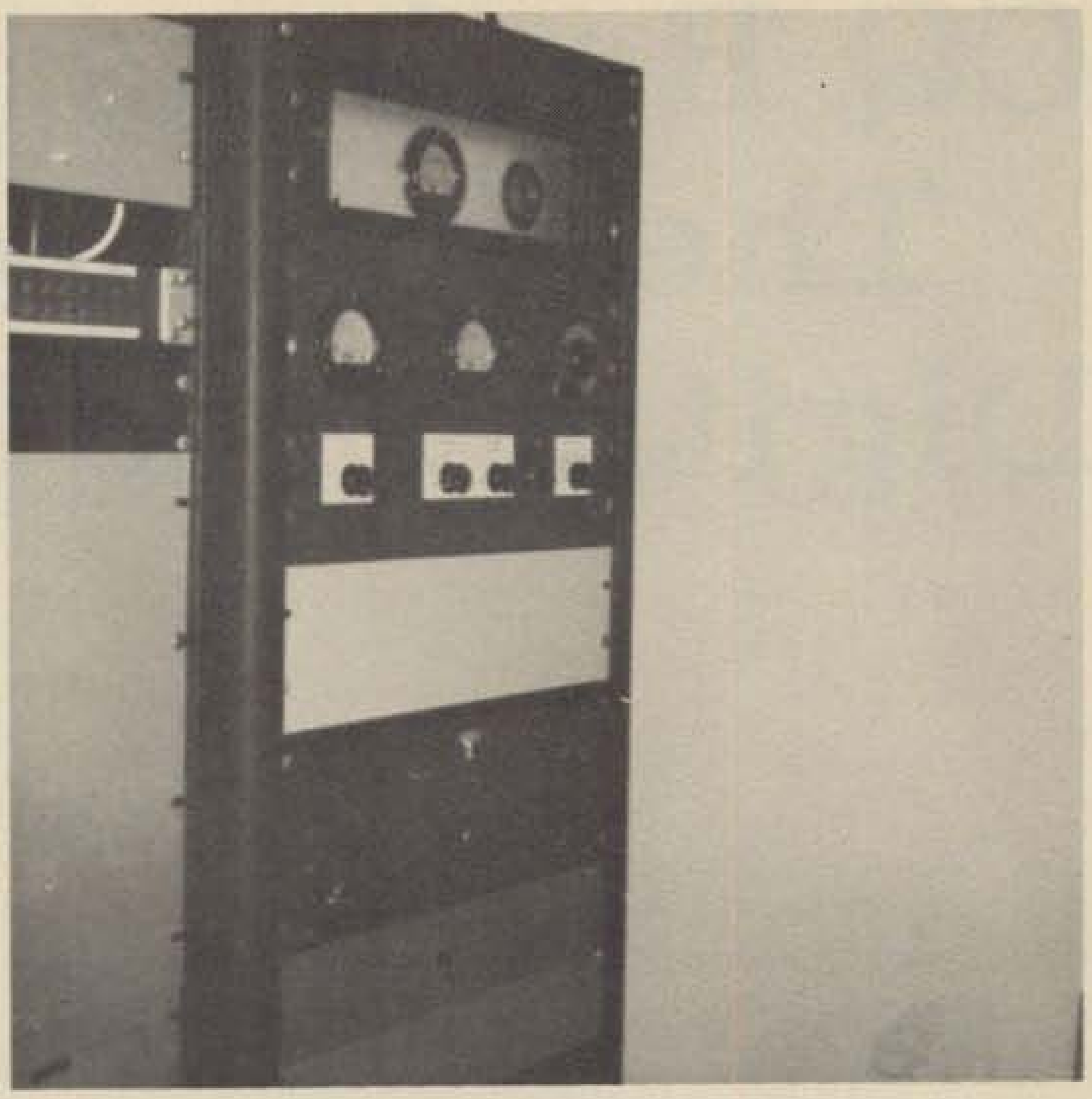
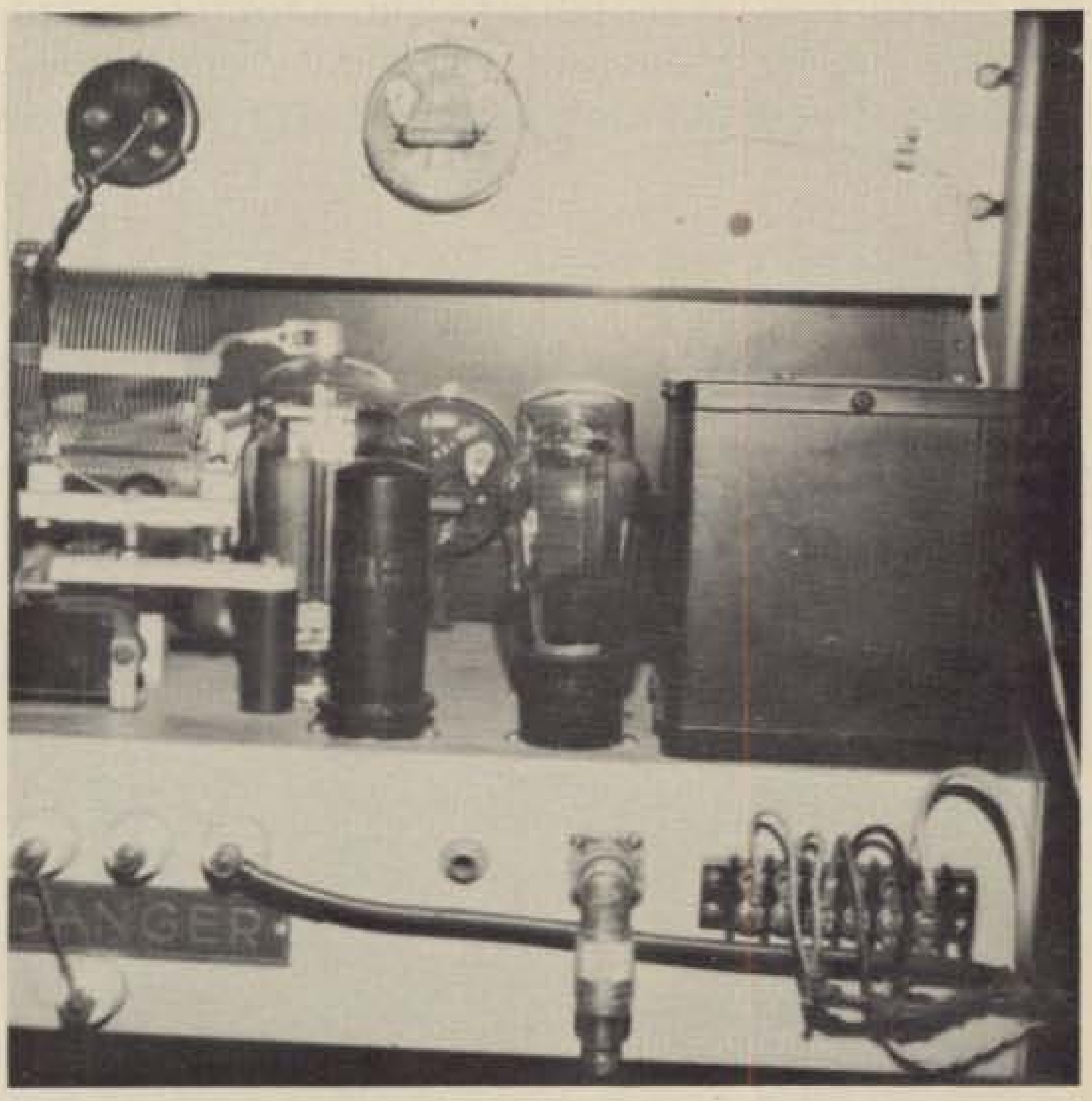


Front view of the 75-meter a.m. transmitter at W2JTP. The final is an 813 running at 220 watts input. The modulator is a pair of push-pull 807's. The entire transmitter, including the v.f.o., is remote controlled.



Rear view of the 75-meter a.m. transmitter at W2JTP. The r.f. deck also houses the heavy-duty bias supply for the 813 final and for the 807 modulators.

[2]Correspondence from Members; *QST*, February 1939, page 67.
[3]Orr, William; "The Wonderful HRO Receiver," *CQ*, May 1975, page 17.
[4]Reed, Charles E.; "The Ultimate Conversion of the Super-Pro Receiver," *CQ*, April 1961, page 38.

CQ Reviews: The Spectronics DD-1K Digital Frequency Display

BY HUGH R. PAUL*, W6POK

If you have been tempted to trade your old reliable transceiver in on one of the newer models featuring digital frequency readout, you may wish to consider an economical alternative. Spectronics of Signal Hill, California is currently marketing a line of outboard digital frequency displays for the more popular lines of transceivers. In their current product line are units for use with Yaesu, Kenwood, Collins, Tempo One and Siltronix. List price varies from $149.95 to $169.95, about what you would pay for the feature as an option on those models for which it is available from the manufacturer.

The model I had an opportunity to test was the DD-1K, for use with the Kenwood TS520, TS511 and T599. It provides a continuous six digit display of both transmitted and received frequency to a resolution of ±100 Hz. The display is formatted in MHz, kHz, and switch selectable 100 Hz readouts, which are updated 50 times per second, allowing instantaneous display of operating frequency while tuning the band. The digits are the large LED type and are red in color.

*291 Macalester Drive, Walnut, California 91789

The Spectronics DD-1K digital frequency display.

To operate the DD-1K it is only necessary to plug the unit into 117 v.a.c., connect the input cable to the v.f.o. receptacle on the transceiver, switch the selector knob to the proper band and push the mode switch to select either upper or lower sideband. There is even a WWV position to readout the 10 MHz WWV station used for calibration in the Kenwood line of transceivers.

Accuracy of calibration with my TS-520 was within 100 Hz just as it came from the factory. Due to slight differences in crystals in various transceivers of the same model, it may be necessary to recalibrate the unit slightly. Complete instructions for calibration of the DD-1K are provided in the instruction manual. Unfortunately not much other information is provided. There is no schematic or block diagram. Since I always repair my own equipment this is a negative factor. If you always send your equipment back to the factory for repair you probably don't care.

While I don't have many details on the circuit, I can tell you that it employs twenty ICs and one transistor. All components except the power transformer and the LEDs are mounted on a single epoxy board. Construction appears neat and sturdy.

The display is steady unless some r.f. gets into the unit, then the display goes banannas. A word of caution, if the display is jumping around during transmit no doubt your signal is also being affected, since the DD-1K is connected to your v.f.o. I received reports of FMing with the unit connected to the TS-520. The cure was simply a proper ground on the transceiver. Once I got rid of the stray r.f. there was no problem what so ever.

I asked Spectronics if the DD-1K could be modified for use with other makes of equipment? They advised me that it would be too costly to do so and recommended that if you sell your Kenwood transceiver you also sell the digital display unit. They keep adding to the line and no doubt will have models available to work with units other than those mentioned earlier. ■

a monthly feature by
JOHN A. ATTAWAY, K4IIF

DX

News of communications around the world

As a result of the great interest in short, vacation-type DXpeditions to nearby islands, particularly during the CQ Worldwide Phone Contest (October), the CQ Worldwide C.W. Contest (November) and the CQ WPX Contest (March), the DX column this month will be devoted to information on these events and activities. In line with this theme, De Extra features an article written by Bob Kenny, VE3EWY, for the Canadian DX Association's monthly publication *Long Skip*. The information provided in Bob's article can be very useful to anyone interested in a visit to the sunny climes for a few days with a trusty transceiver in tow.

De Extra

Amateur Licensing In The Caribbean
by Bob Kenny, VE3EWY

While I do not presume to be an authority on obtaining operating privileges on the Caribbean islands, I have operated from many of them during the last 3 years, and after reading in *Long Skip* of VE7AZC's request for information I felt there might be others interested in the procedure for licensing when they visit the islands.

After obtaining licenses for Montserrat, St. Kitts, St. Lucia, St. Vincent, Trinidad and the Dutch islands of Aruba, Bonaire, Curacao, Sint Maarten, Eustatius and Saba, I should stress that the procedure isn't consistent. For example, the only islands from which I was able to obtain licenses in advance were St. Lucia and the Dutch Antilles. All of the others required a personal visit to the appropriate official on the island in charge of issuing licenses, and this was not always the Minister of Communications.

In Montserrat, the Cable and Wireless Manager is the person to approach. In my case I had permission to operate within 10 minutes and was issued the callsign I requested, VP2-MRK. The manager had been on his day off, but upon calling his home I obtained permission verbally. I actually got the license after I had moved on to St. Lucia. The permission was accompanied by an apology that the callsign I should have been issued was VP2MX as the two-letter calls had not been all taken, but QSO's as VP2MRK were quite OK.

The man to see on St. Lucia is Stan Scholar, VP2LC, the Commissioner of Police and Radio Officer. Stan is located at Police Headquarters, Bridge Street, Castries, St. Lucia. If a photostatic copy of a Canadian license is sent with $3.00, Stan will send a license to you directly via airmail. However, if you arrive without a license a personal call on Stan will produce a ticket within a few minutes. Incidentally, Stan is very interested and visited my operation several times.

Dominica also presents no difficulty. On my last visit the Minister of Communications typed up my license and had it witnessed by the Minister of Home Affairs. When asked what call I would like, I requested and received VP2DWY. Conversely, St. Kitts is the island where the licensing procedure is the most involved and time consuming. The official who handles the licenses is housed in the Cable and Wireless Building. After he examines the documents you must prove that you are licensed back home, after which you go through a security check at the local police department. Then you return to the licensing official who tells you that it will be a few days before the license is issued. When you go back again, he will sign the license but you have to visit the Ministry of Finance and get a receipt before the license is yours. Needless to say I am very careful to keep my VP2KU callsign current.

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

The WAZ Program

Single Band WAZ
20 Meter Phone

35....VE3FJE

S.S.B. WAZ

1349....JA7GLB	1352....LA2DR
1350....CP1EU	1353....I2TTL
1351....K4DXO	

C.W.—Phone WAZ

4025....OK1VU	4030....LZ1AZ
4026....YU2RFK	4031....I5BDE
4027....LA8CJ	4032....DK7XS
4028....JA2CMM	4033....DK4TA
4029....G3PYM	4034....DK3SN

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.

The first Swiss winner of Single Band WAZ on 20 meter phone was Fritz Baumberger, HB9AQW of Guntershausen.

Many a valuable CQ contest multiplier has been received from the station of Miguel "Mike" Planas, EA3SA of Tarragonna Province in Spain. Mike recently qualified for CQ's WAZ award.

The above photo shows the equipment used by Bala, VU2LE. The box in the right foreground is his new homebrew linear. Bala continues to be active on 20 and 40 meters longpath to the states at 0000-0130 GMT. QSL via Pete, WA6MWG.

St. Vincent is more accommodating. The Minister of Communications will have a license typed by his secretary within minutes, after which you proceed to the Ministry of Finance to pay the $5.00 fee. Trinidad and Tobago can be a frustrating experience because the licensing office is open for only a limited period daily, and then you must find someone who will accept the fee. All of this must take place in Port of Spain and until you have your permission the Customs people will hold on to your equipment and they are also open only during certain times each day. When Gary, VE3GCO, and I were there in 1970 we had to pay a deposit on the value of the gear or get a bank to issue a bond for the amount. The bond will be returned when you prove that you are taking the gear out of the country.

The Dutch islands pose no problems. A letter of application with a photocopy of your VE license and $8.00 will result in a license by direct airmail. This license will be good in all 6 islands but you must state specifically which island will be your QTH. A PJ9 call is valid only for Aruba, Bonaire and Curacao, while Sint Maarten needs a /7 suffix, Saba a /6 suffix and Eustatius a /8 suffix. It is possible to obtain a PJØ call upon special request. In any case, the address for applications is Director Lands-Radio, N.A. Dienst, Willemstad, Curacao.

DJ2GW, Werner Schwickert of Coblenz Germany racked up his 40 zones on c.w. using Heath equipment qrp to a homebrew quad plus a gaspipe vertical for 40 and 80. Werner is 53 years young.

While I have never operated from Anguilla, I understand from my good friend Ken Palmer, K2FJ, that there is no problem in obtaining a license from this island. Ken says it should be noted that there is no regular electrical supply on the island although most of the guest houses are supplied with electricity from private generators which you can arrange to keep in operation on a 24 hour basis.

I hope this information will be of some use to those planning vacations in the Caribbean. Good luck in your DXing from the sunny southern islands, and 73 from VE3EWY.

The CQ DX Awards Program

S.S.B.

463....K8PYD	466....K9BQL
464....WA3YYW	467....WB4ECE
465....G3XPO	

C.W.

240....DK1OU	243....GM3TRI
241....DJ2GW	244....W7ISY
242....G3FWE	245....K9DAF

S.S.B. Endorsements

310....ZL3NS	200....K8PYD
300....WØSFU	150....G3XPO
275....K8PYD	150....K8PYD
250....JH1VRQ	150....WB4ECE
250....K8PYD	

C.W. Endorsements

310....W4YWX	300....DL3RK
310....W8LY	150....DJ2GW

3.5/7 MHz....OK1AEH

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 USA.

Reserve Your Island

The DX Department was delighted with the number of rare and semi-rare countries activated during the CQ Worldwide DX Contest weekends in October and November, 1976. Contestpedition activity, particularly to the Caribbean islands, was at a record level which is particularly gratifying at the low end of the sunspot cycle.

In one sense the contest was almost too successful. Those who delayed firming up their plans until the last few weeks were shocked to find that "all the islands were taken" for the contest. There were even some frantic calls to the DX Department seeking info on a convenient DX QTH, with a lenient licensing policy, still unclaimed for the contest.

Examples of the activity include the North Florida DX Club & Company who were in their usual form from the Turks and Caicos Islands for the phone weekend as VP5M, and K6-SDR who staked out his claim in the British Virgin Islands. Antigua was the goal of the Buffalo DX Club, Grenada by W5MYA and WB5IZN, Guadaloupe by WA1JKJ, Aruba by PJ7BB et al as PJØA, and St. Pierre by K2OJD and K9OTB. Grand Cayman was activated as ZF1RE by WA-5KLE and WB5URN, Jamaica by WB-4SJG inc., St. Vincent by 2 German operators and Madeira by Marti Laine, OH2BH.

Lloyd and Iris Colvin were busy in the U.S. Virgin Islands during the phone weekend, but QSYed to the British Virgin Islands for the c.w. contest. Other island hoppers during the c.w. weekend included Vic, K4-DSN, on St. Lucia, WA7OTT et al on Montserrat, the Order of the Boiled Owls on Trinidad, St. Martin and Sint Maarten by W5AT and W5NUT, C6A-Bahamas by W4OO and friends, Curacao by W1GNC, Western Somoa by WB6OOL and the Northern California contesters, Guernsey by G3-FXB and G3MXJ, and Ascension Island by KP4EKI and WA4TLB.

We have probably missed somebody, and our apologies, but this at least gives a sample of the activity and it was great. The moral of the story is RESERVE YOUR ISLAND EARLY! We hope that your plans for the CQ WPX Contest later this month are published and official so you aren't caught with no place to go.

Contest QSLs

As a result of the extensive contest activity we are publishing some of the contest QSL routes outside our normal format. Here goes: CT9AT—Via OH2BH, FP8AA—To K2OID, FP8-DX—c/o K9OTB, PJ0A—Via P.O. Box 383, Curacao, Netherlands West Indies, VP2G and VP2GMD—To W5-MYA, VP5M—c/o WB4QKE, W6KG/AJ3—Via YASME Foundation, P.O. Box 2025, Castro Valley, CA 94546, ZD8AA—To WA4TLB, K4IIF/C6A—c/o W4KA, PJ8CM and PJ8JM—Via W4BPD, PJ9MM—To W1GNC, VP2-VDH—c/o K6SDR, 6W8A—Via WA3-NCP, 5W1AZ—To WA6AHF, ZE1RN—c/o WB5URN, WB4SJG/6Y5—Via K4QMQ, VE2AQS/TG9—To VE2KQ and FGØCXV/FS7—c/o W4PRO.

6ZH Is Back Home

For many, many years W6ZH was the call sign of Herbert Hoover, Jr., son of former U.S. President Hoover and one of the greatest backers of amateur radio. We are delighted to learn that this call has been reissued to Herbert Hoover III, W6APW, better

The CQ WPX Program

Mixed

553....W2VAV

S.S.B.

944....VK3BHN
945....G3TJW
946....SP9EES
947....IT9UVA
948....GM3GRX
949....LA9LS
950....I6MRD

C.W.

1543....SP9BRP
1544....GM4DKO
1545....OK3IF
1546....G4BUE
1547....HA8UA
1548....DL7KL

WPNX

90....WN7DJU
91....WN6LSO

Endorsements

MIXED: 1300 WB2FMK, 1271 DJ7CX, 1026 WAØKDI, 1006 OK3EA, 682 G4BUE, 484 I5AFC, 409 I6BZH, 407 W2VAV.

SSB: 1153 I8KDB, 1066 I4ZSQ, 1023 ZL3BS, 906 W6YMV, 823 F2YT, 854 DJ7CX, 739 G3TJW, 700 WA1JMP, 567 G4BUE, 437 IT9UVA, 383 SP9EES, 374 I5AFC, 372 LA9LS, 350 GM3GRX, 302 SP9BRP, 301 I6MRD.

CW: 1150 WB2FMK, 1122 DL1QT, 975 DJ7CX, 912 W9WCE, 883 WAØKDI, 737 PAØSNG, 735 OK2-BLG, 660G5GH, 567 VK4KX, 461 DJ2GW, 452 G3FVC, 392 G4BUE, 309 DL7KL, 302 SP9BRP, 304 GM4DKO, 300 OK3IF, HA8UA.

20 Meters: GM3GRX, W4QBY.
40 Meters: G4BUE.
80 Meters: SP9EES, W4QBY, G5GH.
160 Meters: OK3IF.
Africa: W4QBY.
Asia: G4BUE, IT9UVA, W4QBY.
Europe: JA1VE, SP9EES, G4BUE, GM3GRX, IT9UVA, W4QBY.
No. America: JA1BN, G4BUE, W4QBY, G5GH.
Oceania: W4QBY.
So. America: W4QBY.

Complete rules for WPX can be found in the May, 1976 issue of CQ Magazine. Application forms may be obtained by sending a business size, self-addressed, stamped envelope to "CQ WPX Awards," 5014 Mindora Dr., Torrance, CA 90505.

Here are the new, official prefixes for the various regions of Brazil as assigned by the Communications Ministry in Brazilia. You will probably hear most of these prefixes during the CQ WPX Contest later this month. Our thanks for this information go to Bell, PT2JB, of LABRE who checks for CQ awards in Brazil and is also active in the PT/PY QSL Bureau.

known to most amateurs as Pete, an outstanding DXer who holds both the WAZ and the WPX awards. This is most fitting!

The K4IIF/C6A Bahamas Trip

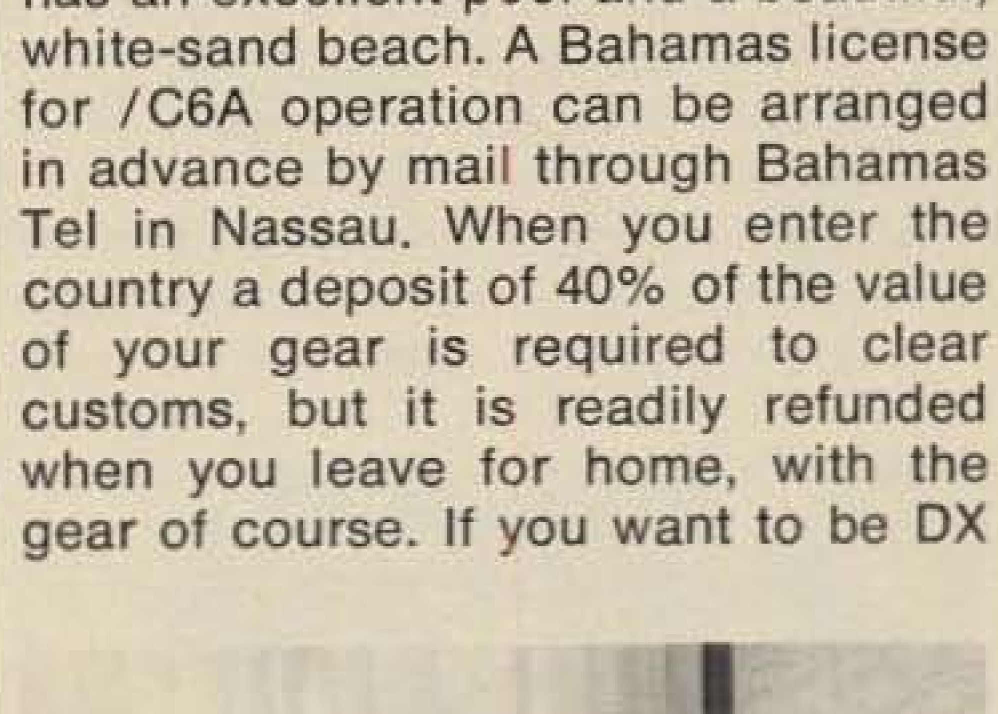
The CQ Worldwide DX Contest weekends have always been favorite occasions at the Attaway household, and the phone weekend in 1976 was particularly memorable for us as it was the first opportunity for junior op, Joe, WA4RVC, to operate from the DX end.

The demands of school dictated that the Attaway participation would be an abbreviated one. Everything was packed to rush for the airport as soon as school was out on Friday, Oct. 29, but as there were no night flights back to Florida from Freeport on Sunday the 31st, we had to close the station before noon to head for the airport 7 hours before the end of the contest.

Naturally with a tight schedule such as this, Murphy's infallible law was bound to take a hand. Just before departure the airline called to advise that our flight was delayed and would not make connections with the last flight from Miami to Freeport. The only chance was to rush to another airline, who fortunately did have space. However, when we reached the airport that flight was late also and we were switched to a third flight. To make a long story short, by dashing madly the length of the Miami terminal we made the last flight to Freeport, BUT OUR BAGGAGE DIDN'T! In fact, come Saturday afternoon it still wasn't there and our contest activity was saved only by the Atlas 210X, small enough to fit in the briefcase power supply and all, and a 160 meter diople in the handbag. The latter could be cut down for use on the other bands.

Of course you can't cut much mustard operating QRP in a contest with dipoles on 20, 15 and 10. Thanks to a magnificent location on the roof of the 16 story Atlantik Beach Hotel we got out very well on 80 and 40 meters with our 100 watts, the maximum legal power in the Bahamas, but contacts to Europe and Asia were severely limited without a beam for the higher bands. We actually ended up with more contacts on 80 meters than we had on 20 which is a mite unusual to say the least.

The management of the Atlantik Beach Hotel caters to amateur radio operators, and could not have been more cooperative. We had access to the roof on a 24 hour basis, with complete freedom to string our wires in the best available configurations. If you are looking for a spot to take the XYL and kiddies, the hotel also has an excellent pool and a beautiful, white-sand beach. A Bahamas license for /C6A operation can be arranged in advance by mail through Bahamas Tel in Nassau. When you enter the country a deposit of 40% of the value of your gear is required to clear customs, but it is readily refunded when you leave for home, with the gear of course. If you want to be DX



Dr. Carlo Crovetto, I1CCL, of Genoa is a prominent Italian physician and DXer. Carlo has earned both the WAZ certificate and the WPX certificate.

The Atlantik Beach Aparthotel in Freeport, Bahamas, site of the K4IIF/C6A operation during the CQ Worldwide Phone Contest in October, 1976. The elevator housing on the roof was the apex of our inverted vees. The Atlantic Beach is managed by Siegfried Lange (German) under Swiss ownership. There are no language barriers for either Europeans or Americans, and amateur radio operators are considered VIP guests.

without an expensive, transoceanic trip, the Bahamas are a good choice.

Top Band News, de W1BB

Congratulations to 4 outstanding 160 Meter DXers who have qualified for DXCC top band. The intrepid 4 include W1BB, W1HGT, KV4FZ and W8LRL.

The first ever WAC from Rhodesia has been chalked up by Peter, ZE7-JX, after a 2½ year effort. The final leg was an Oceania contact with VK6IZ.

A big celebration is being planned for the 75th Anniversary of Marconi's first transatlantic QSO by Whitey, W1GDB, and the Barnstable, Mass. Radio Club. A possible all-band operation is planned with emphasis on 160 as Marconi has been described as the first "160 Meter DXer." The call KM1CC will be used from Cape Cod during the 1978 event, and it is hoped that a sister station in England will help re-inact the original messages. A special, new Marconi Memorial postage stamp is also a possibility.

Our readers will remember Stig Roskvist, SM5AYY, as the first Single Band WAZ winner on 40 meter c.w. Here is Stig with the famous Roskvist tripletts plus their older brother. Its not hard to guess why he always wears headphones when operating.

The first WAS on 160 by a station outside the U.S. was made by KV4FZ in January, 1974. Any others in the interim?

Many European stations do not get on 160 because of IARU regulations. However, Larry, W4DQD, reports that footnote 194 to the 1976 edition of the regulations lists European countries whose amateurs may use top band, and adds that the governments of other European countries may notify IARU that they wish to be listed among those allowing this operation. Countries now permitting 160 operation include Austria, Denmark, Finland, Ireland, the Netherlands, Germany, the United Kingdom, Switzerland, and Czechoslovakia.

Here and There

De Dale, K6UA—Have a new curtain broadside to Europe. It's 100 feet high, 320 feet pole to pole with 6 delta loops, 3 in front of 3—30 feet apart. Have 6 quarter-wave open stubs, 67 feet, of each delta loop so system looks like 12 half-wave elements on 80 meters or 24 elements on 40 meters. It works like an atomic bomb. The material consists of 1,632 feet of wire for the elements, 967 feet of open wire line, two 30 ft. Rohn 25 steel towers used as cross arms, two 110 ft. telephone poles and 800 feet of rope. All that plus one heck of a lot of time to put it up. (For your interest, Dale was the first in the western hemisphere and second in the world to earn single band WAZ on 80 meters. Not hard to see why!—DX Editor).

De Ed, W3KVQ—I am now in my 16th year as QSL Manager for Father Moran, 9N1MM, perhaps the longest such association in amateur radio. Fortunately, I have not had too many changes of address in all that time, but there has been a change of QTH recently. All future cards to 9N1MM should be sent as follows:

Edward M. Blaszczyk, W3KVQ
539 Fairhill Drive
Churchville, PA 18966

De Carl, EP2OD/9D5B—The government of Iran has authorized the use of 2 special calls until March 21, 1977, the end of Persian year 2535, to commemorate the 50th anniversary of the reign of the Pahlavi dynasty. These calls are 9D5A, operated by Bill Snider, EP2SV, and 9D5B, operated by myself. QSLs for 9D5A go via WA6AHF and for 9D5B via K4OD. This is the first use of the 9D prefix, and the 5 symbolizes the 5 decades of rule.

For the prefix hunters who still need EQ2, I will reactivate EQ2ITU during the month of May, 1977 if I am still in Iran at that time.

De Tom, K2VC—Just a brief note to say how much I enjoy your DX column each month. Its always straightforward and easy to digest and you have the most accurate QSL Information. Thanks to your column I now have a QSL from 4S7JK.

Do you know of a club which puts out a news letter with separate listings for DX on c.w.? I would love to join such a club as c.w. is my real Love! In case there are more of us looking for the same thing, please note this request in your column. (To get the ball rolling, c.w. DXers can find separate listings for c.w. DX in the *West Coast DX Bulletin*, 77 Coleman Drive, San Rafael, CA 94901 and the *DXers Magazine*, P.O. Drawer DX, Cordova, S.C. 29039. We don't know of a club devoted entirely to DXing on c.w. If such a club exists, please let us know.—DX Editor).

De Hektor, PJ3HEC—Please allow

me to thank you very much for the kind assistance in obtaining my reciprocal license to operate in the U.S. Immediately after I received your letter I completed the FCC Form 610 and applied exactly as you suggested. Shortly thereafter the FCC sent me a Form 610A for additional information. I returned this to them and to my greatest surprise, when I arrived in New York in December I found the license waiting for me. Best wishes to you and your family for all of 1977.

QSL Information

A9XBD—Via P.O. Box 14, Bahrein
AJ3AA—To KV4AA
AJ3JV—c/o K6SDR
CT2BS—Via WA4CAD
CT3AF—c/o P.O. Box 358, Funchal, Madeira Islands
CT3BM—To P.O. Box 490, Funchal, Madeira Islands
D2AZB—c/o P.O. Box 175, Luanda, Angola
EL2R—Via WA4HHG
EP2VW—To K4DAS, 6321 N.W. First Court, Miami, FL 33150
FG7AM/M—c/o P.O. Box 957, Pointe-a-Pitre, Guadeloupe
FG7AS—Via W7RUK
FG7WO—To W4KA
FM7AV—c/o F6FBH
HL9TJ—Via K6VA
HZ1AB—WA6AHF has logs for the period July 10, 1975-March 5, 1976. Otherwise Rubin is *no longer* QSL Manager for this station.
KV4JV (October, 1976)—c/o Fernando Milia, LU2DC/W3, 3 Brookcrest Court, Rockville, MD 20854
OH5MJ—To Jorma Sinnamo, Keskust 14-B-24, SF-48300 Kotka 10, Finland
LU1BR—Luis Alberto Gomez, San Martin 1139 4P-H, Buenos Aires—1004 C.F., Argentina
PYØZAE—Via PY1CK
TR8AS—To Boite Postal 3886, Libreville, Rep. of Gabon
TU2GK—c/o K9KXA
UD26BK—Via UD6DFY
VP2GRN—To W4YHB
VP2VDJ—c/o YASME, P.O. Box 2025, Castro Valley, CA 94546
VP5BER—Via Bernie Welch, W8IMZ
VP8ON—To G2MI
VR3AR—c/o WA7GQA
VU2LQA—Via DK6TU
WA7ZLC/CT1—Henry Zimmerman, 6807 Steilacoom Blvd., Tacoma, WA 98499
XT2AG—To W1AM
YBØACP—c/o K6MQG
YJ8AN—Via P.O. Box 219, Vila, New Hebrides
YJ8DE—To P.O. Box 56, Vila, New Hebrides
YJ8KW—c/o Wallis Island, New Hebrides
YKØA—Via SP6RT
ZD8JAM—To P.O. Box 4308, Patrick AFB, FL 32925
ZE4JH—c/o WA4UPR
ZS3LK—Via DK3GI
4L1RO—To UW1CX
5N5NAS—c/o WB9MFC
5W1AB—Via W4KA, 1044 Southeast 43rd St., Cape Coral, FL 33904
6W8A—To WA3NCP
9D5A—c/o WA6AHF
9G1JX—Via DL7SI
9J2CJ—c/o DK6XF
9J2LC—To I4UVA
9J2WS—c/o W4LF
9L1BH—Via SM3CXS
9N1MM—To W3KVQ, 539 Fairhill Drive, Churchville, PA 18966
9Y4SF—c/o WA5GFS

73, John, K4IIF

Late QSL Information

YB4ACJ to K7LAY
8PØA to WA4RRB
WL2USA to K2BM
VR3AH to K2BT
C5AZ to OH2NB
ZE4JS to W3HNK
8P7FU to W3HNK
FGØMM/FS7 to WA1KJ
YB2SV to Box 73, Salatiga, Indo.
AY2DNC to LU2DNC
PJ9CG to WA1JLD
8O5ED to K4EBY
NX1US to K2BM

From Jan. 1 thru Mar. 31, 1977 I8KDB will be using the special call "IK8KDB". Qsl to I8KDB.

a monthly feature by

A. EDWARD HOPPER, W2GT

Awards

News of certificate and award collecting

The "Story of the Month", for March, as told by Pat:

Patricia L. Smith, WA7GMX

ALL COUNTIES #144, 4-5-76

"Here is the case history of one female Ham. I got into ham radio because it was such a 'bargain'. Being a YL and a Swede with Scotch blood in her veins, the word *bargain* couldn't be turned down. My first transmitter was given to me by my father, W7UZU, who lived in Ashland, Oregon at the time, and this was cheaper than long distance phone bills. It was a Heathkit AT 1. My receiver was an ancient Hallicrafter, which my brother dug out of a barrel of 'misfits' donated to the firehall. With this collection I was in business. While I was a Novice, I decided I needed to hear a bit more of what was going on via the air waves, so sent for a Heathkit SB-301. Armed with a solder gun and much determination, I soon discovered this was more fun than knitting.

"About this time, meal planning hit its first slump. Took another look at the AT 1 next to the new gear, and since I now held a General ticket, I had to have the SB-401.

"Now the problems start. The old wire antenna strung up from one neighbors tree to the tree of a second neighbor, had to go. I couldn't load it, plus the neighbor on the left was hacking away at his tree with an axe. So now a 60 foot tower with a TH6DX beam went up in the back yard by WA7CMD, Newman. He knew where I could get the antenna for a *bargain.* It was sold to me provided I take the tower down. Well, being a YL and with no tower dismantling experience, they took the tower down, delivered it 60 miles and put it up, all at the same *bargain* price. WA7-CMD made many trips at about 120 miles per trip, until he got it done to his satisfaction. Boy, there is nothing like a Ham.

"The ball is now rolling, the new antenna called for more power, so an SB-200 was added. In the mean time the OM was adding to the collection via birthdays and etc., little items such as the SB-610 and SB-630. These he knew I wouldn't exchange for a different color or size.

"The next project was to convert a non-interested object into a real ball of fire radio operator, so I bought the OM a transceiver, and every time we got into the car, the code oscillator went along. With dits and dahs ricocheting off the headliner, floorboards and windows, he couldn't do anything but absorb the code. He finally acquired a Novice ticket, WN7TLI. He also acquired a new job that required 120 miles of daily driving, so he is now an expired Novice.

"Then I stopped for a few minutes to listen to the County Hunters. That few short minutes lasted for 5½ years. Their frequency is etched on the dial now. I had fun, it was exciting, it was tiresome waiting, it was time consuming, it was almost fatal. The OM had gone through cold stove, hot transmitter days, or 'I have a headache' due to earphones being on too long. But all in all, he was as excited as I was to finish that last County.

"The magic County, Aroostook, Maine was being run by WA1PAY. It was very simple, it took the whole Net, a local ham WA7GVM, beautiful Net Controls, help by George, WA0-BPE and Ken, K6BWD/5 and two hours—yes very simple.

"Oh yes, the reason I had to do the Counties All Mobile was that KL7HKZ darn near froze his gear (and self) giving me the 2nd District of Alaska from a D8 cat, in sub zero weather. Believe he said it was 75 below.

"Perhaps the OM thinks things will settle back to normal now. NORMAL, . . . right now I am President of the MINOW's, a YL group of gals in 7 states. I am also Secretary-Treasurer of the newly formed Radio Amateurs of Skagit County, and last but not least, belong to a group of rug *hookers*".

After this was written, "Patti" moved to 301 S. 6th, Mt. Vernon, Washington 98273, but I feel sure that by the time you read this, she will be back on the Net.

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

Pattie, WA7GMX and Raleigh, W7PXA. See his "Story" next month. Foto taken at Skagit Ham-fest April '76.

Special Honor Roll (All Counties)

#159—David R. Klimaj, W4JVN 11-12-76
#160—Frank M. Kovel, W8RSW 12-4-76
#161—Pauline F. Course, WA9CNV 12-4-76

Awards Issued

Dave Klimaj, W4JVN added USA-CA-3000 and *All Counties* to his fine collection.

Frank Koval, W8RSW became #1 to acquire *All Counties* endorsed *All Two-Way C.W.*
Two-Way C.W.!

Pauline F. Course (of course!), WA9CNV was thrilled to gain them *All,* but waited until then to apply for 500 through *All,* endorsed *All* S.S.B.

Roy Eggleston, W5QEM obtained USA-CA-500, 1000, 1500, and 2000 endorsed All S.S.B., All 14 MHz, All Mobiles. Also USA-CA-2500 endorsed All S.S.B.

Larry Miller, W6ANB was issued USA-CA-500, 1000, 1500, 2000 and 2500 endorsed All S.S.B., All Mobiles.

The Radio Club, "M. PUPIN", YU1-BCD (Chief operator, YU1QBC, Construction Chief YU1NGX) qualified for

USA-CA-1000 which is #1 to YU. They already have USA-CA-500 #2 to Yugoslavia, #1 being YU1AG and #3 being YU1QZ.

Larry Moore, K6SLP won USA-CA-1000, endorsed All A-3.

Mino Cuzzoni, I1BAF had me send him USA-CA-1000, endorsed All Phone, #1 1000 certificate to Italy.

Joe Haluska, W4ZRJ (ex W2CJI, W2CHS, W2ZZF, KA2KS) collected USA-CA-1000, endorsed All A-1 All QRPp (5 watts or less).

Roy Gould, K1GSK found time for his paper work and got USA-CA-500 and 1000.

Tom Ross, K9GTQ claimed USA-CA-500 and 1000 endorsed All 75, All S.S.B., All Mobiles.

Arthur "Hox" Hart, W5WD received USA-CA-500 endorsed All 7 MHz, All A-1, and USA-CA-1000.

Vic Curling, G6VC made USA-CA-500 endorsed All A-1.

Tom Duderstadt, WØLRH became the owner of USA-CA-500 endorsed All S.S.B., All 14 MHz.

Antonio Nogueira Rodrigues, CT1-BH became #7 CT1 to receive USA-CA-500, his endorsed All S.S.B.

Paul Clement, K1TOL became #14 to receive USA-CA-500 endorsed All 50 MHz, his also endorsed All Phone.

Mixed USA-CA-500 certificates went to:

William Miller, WB2SXT.
Leo Fry, K8PYD.
Michael Gilmore, K7CLO.
Rick Roderick, WA5VDH.

USA-CA-500 Certificates endorsed All S.S.B. were won by:

Gary Flechtner, WB8HLI.
Ken Jarvis, VP2KJ (#1 to VP2K and #2 to any VP2; #1 being VP2LAW).
Curtis Gidding, WBØRTY.

Awards

"THE TOKYO 100 AWARD": Issued by the Chuou Line Amateur Radio Club (CLAC) to any licensed Radio Amateur and s.w.l.

1. Applicants must submit proof of confirmations of QSOs with 20 different Tokyo stations (5 points per QSO) along with 10 IRCs.
2. Confirmations may be submitted for any band or mode.
3. Submission of your QSL cards is not necessary. Your cards may be checked and confirmed by an officer of any authorized Amateur Radio Society or Club in the world.
4. All QSL cards or certified lists submitted must be in alphabetical order and show date and time of QSO in GMT.
5. If QSL cards are sent when no GCR is obtainable, you must include sufficient postage for return of your cards.
6. Send all mail to: Chuou Line Amateur Radio Club (CLAC), P.O. Box 23, Suginami, Tokyo 167, Japan.

The Icelandic Radioamateur Award: Issued by the Icelandic Radioamateurs (I.R.A.) which was founded thirty years ago on the 14th of August 1946. The purpose of the Award is to encourage increased activity on various bands and modes, with special emphasis on activity from Novices and to celebrate this milestone in the history of Amateur Radio in Iceland. The requirements for the IRAA are based on the I.T.U. zonal system in order that all radio amateurs may stand an equal chance in obtaining the award.

1. The award is available to licensed amateurs outside TF. Only contacts with stations of Icelandic citizens operating from Icelandic territory are valid.
2. There is no date limit.

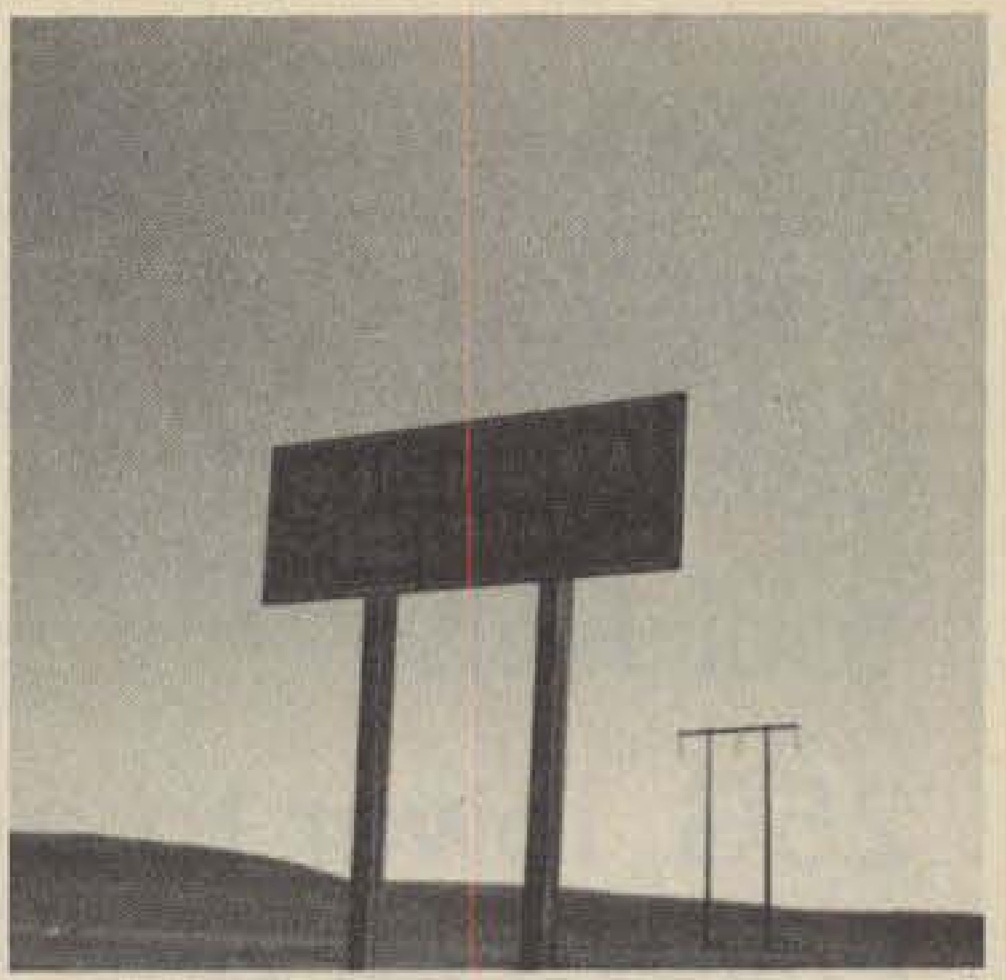
USA-CA Honor Roll

3000		1500		500	
W4JVN	181	W5QEM	312	G6VC	1134
WA9CNV	182	W6ANB	313	W5QEM	1135
		WA9CNV	314	WØLRH	1136
2500				CT1BH	1137
W5QEM	228	**1000**		W6ANB	1138
W6ANB	229	W5QEM	417	WB2SXT	1139
WA9CNV	230	W6ANB	418	K8PYD	1140
		YU1BCD	419	K1GSK	1141
2000		K6SLP	420	K7CLO	1142
W5QEM	266	I1BAF	421	WB8HLI	1143
W6ANB	267	W4ZRJ	422	K9GTQ	1144
WA9CNV	268	K1GSK	423	WA5VDH	1145
		K9GTQ	424	W5WD	1146
		W5WD	425	WA9CNV	1147
		WA9CNV	426	VP2KJ	1148
				K1TOL	1149
				WBØRTY	1150

3. QSL cards/or certified photocopies of them must be submitted to the sponsor together with a list of the complete log entries for the contacts.
4. Novice stations have five watts input and three bands. 3500-3600 KHz, 7000-7040 KHz and 2100-21150 KHz. They are identified by a three letter suffix ending in —N.
5. All contacts must be made from the same call area, or where no call area exists, from the same country.
6. The fee for the award is 14 IRCs or equivalent.
7. The address for applications (or complete rules and ITU Zone map) is: I. R. A., Awards Manager, Postbox 1058, 101 Reykjavik, Iceland.

Table of points permitted by bands and modes:

Band	Novice	C.W.	RTTY	SSTV	S.S.B.	Via Satellite
3.5	32	8	6	6	4	
7	24	6	5	5	3	
14		3	2	2	1	
21		6	5	5	3	16
28		6	5	5	3	
144					96	
432						



Picture of the new COUNTY BICENTENNIAL in Montana (formerly Roosevelt) County line of Valley and Bicentennial taken by Skip, VE4SK.

Notes: Mixed mode contacts, c.w. to s.s.b., etc. and cross band contacts are not valid, except for contacts via amateur satellites.

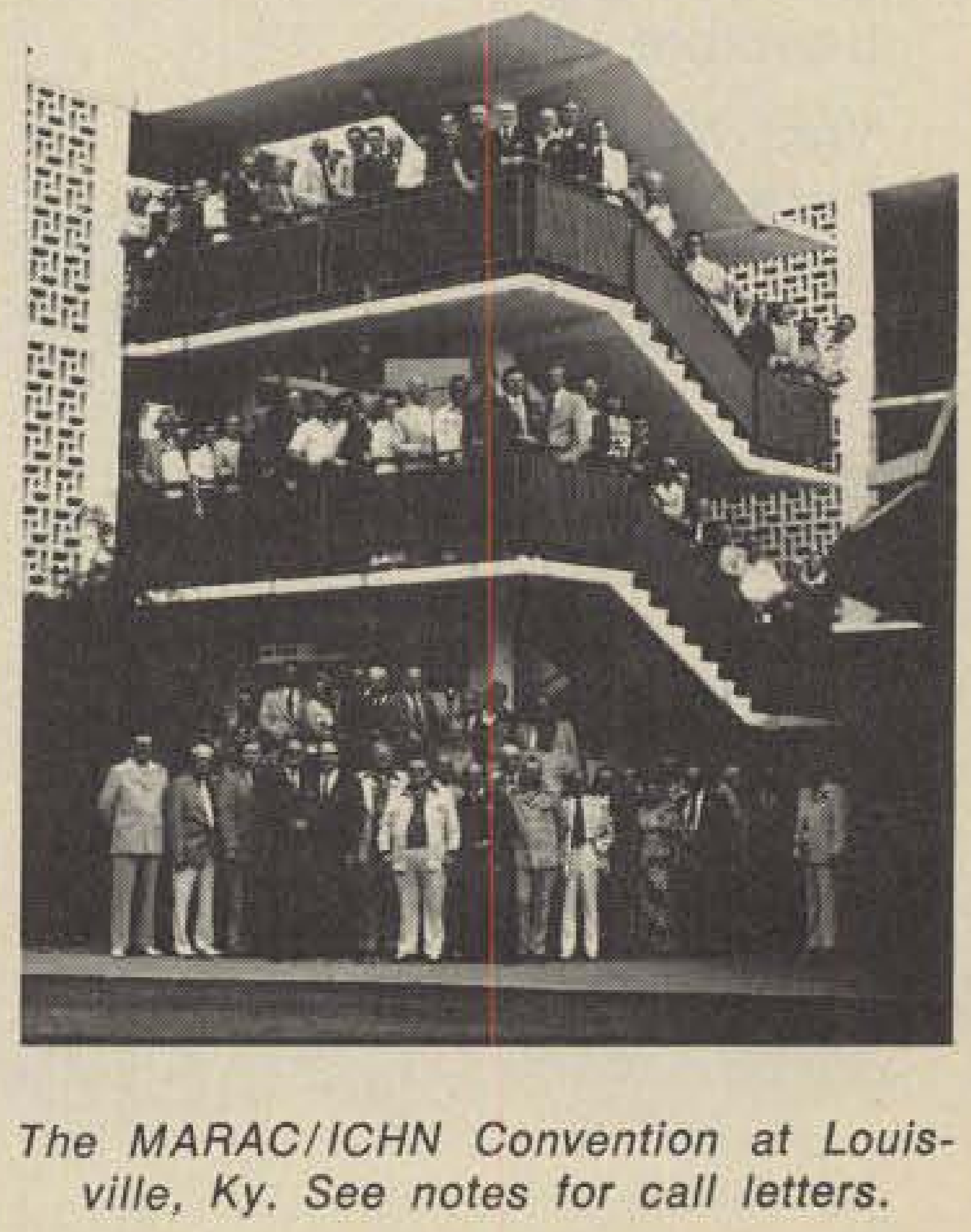
Each station may be contacted only once per band per mode, as defined by the columns of the above table.

Requirements:

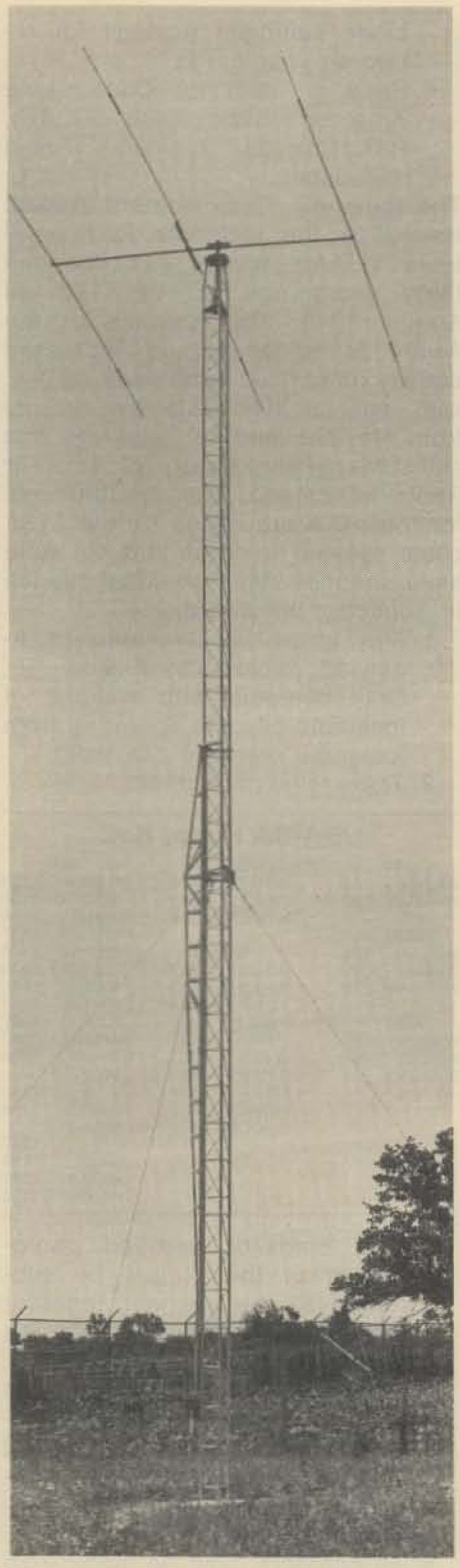
1. ITU Zones 5, 9, 18-20, 27-29 — 100 points
2. ITU Zones 1-4, 6-8, 21-26, 30, 31, 36, 37 —50 points
3. ITU Zones 10-13, 32-35, 38-40, 46-48 —20 points
4. ITU Zones 14-16, 41-45, 49-75 —10 points

Notes

I repeat, as mentioned in July and August *CQ*, no USA-CA credits can



The MARAC/ICHN Convention at Louisville, Ky. See notes for call letters.



be given for QSOs with WB6CKU.

W/VE amateurs should send their inquiries/applications for WAE, EU-DX-D, Europe Diplom as well as WAE contest logs (as per rules in September and October/November *CQ*) to WA3KWD who has moved to: Hartwin E. Weiss, WA3KWD, P.O. Box 440, Halifax, PA. 17032, U.S.A.

Dukes County, Massachusetts is available during 1977 via W1GAY who will gladly make skeds on 20, 40 or 80 and he will also help anyone who needs the Island of Martha's Vineyard for their I.O.T.A. Award. Drop a line and s.a.s.e. to: Duncan Kreamer, W1GAY, Box 637, Vineyard Haven, Maine 02568.

By error, my September '76 column listed as County Hunter QSL manager for "Charlie", CT1BY as WA4-CNI, correct that to read WA4CHI. Others are: WB2SJQ for CT1RM; K9GTQ for CT1TZ; WA3VLB for CT1UA; WA0UPL/WB8AAE for CT1-UD and K5JBC for CT1UE.

The MARAC/ICHN Convention photograph of those at Louisville, KY 1976 are:

Front: WAØWOB, WØSJE, KØAYO, W4OWE, ? W4ISF, WAØYJL, W9CNG, K9DAF, WA4ISU, Harry Dietz, K9CSL, K5KDG, WA2MIO, K3QJJ, K4FSJ, W5HDK, ? , W4IZR.

First Landing: W9IWJ, WA5YSC, WAØSHE, WB9DCZ, K2PFC, W1-LQQ, K1UNM, K9QGR, WB0BVI, K4ZA, WA2GPT, K3QJJ, K9HRC, WAØDCQ.

2nd Landing: W8LDZ, WB5DPR, K9-CSL, WBØHLW, WØKMH, WØMZQ, K5WQM, WA1AXB, W9NSM, W8-WUU, W8WUT, W1DIT, W6CCM, WA4CFI, W4YWV, W5OIB, WAØ-KQQ, WA3VLB, WAØUPL, WA4AUL, K8NQP, K4RQX, W4GGU, K8CIR, W1SSX, WAØUHC.

3rd Landing: W8RKL, K9DCJ, WA4-CHI, K4MNF, WB5QLU, W9ABM, W8ZCV, VE3CBY, WB4UUE, W4-JVN, K7ZJP, W1AQE, WA8VBF, WB8JIX, K8OOK, WA9GOM, WA0-GZA, WØLRN, WA9WIF, K9BMV, K4IVO, WA3TUC, W5RDV, W4EHN, W5AWT, WB9NUL, WA9BHH, W5-TQE, W9ZHD.

Again thanks to John, W4ISF.

With the combination of October/November issue being made ONE, *Season's Greetings* might have gotten mixed up a bit—so hope you all had wonderful Holidays and *Best Wishes for 1977.* How was your month? 73, Ed., W2GT.

a monthly feature by

GEORGE JACOBS, W3ASK

Propagation

The science of predicting radio conditions

March and April are usually interesting months for h.f. propagation.

On March 21 the Vernal Equinox occurs. This is the day when the sun crosses the equator on its apparent travel into the northern sky. On this day, the hours of darkness and daylight are of equal duration throughout the world. This equinoctial phenomenon has its related effects upon high frequency radio propagation conditions throughout most of March and April. On circuits *within* the northern hemisphere, expect daytime usable frequencies to be somewhat lower than during the winter months, while nighttime frequencies should be a bit higher. For paths *within* the southern hemisphere, opposite effects will be noted.

The most interesting propagation changes should occur on the longer openings *between* the northern and southern hemispheres, for example, from the USA to South America; to the South Pacific; to Central and Southern Africa, etc. Because it is spring in the northern hemisphere and fall in the southern hemisphere, the ionosphere is more similar and stable than during the winter and summer seasons. This "equalization" in conditions should produce a marked improvement on openings between both hemispheres, on all bands between *160* and *10* meters. The best times to look for these openings are shortly *before* local sunrise and again shortly *after* local sunset on the *160, 80* and *40* meter bands; for an hour or two *after* sunrise and again for an hour or two *before* sunset on *20* meters. On *15* and *10* meters, check for inter-hemispheric openings towards the southeast and south from a few hours before noon, through the early afternoon hours. Check later in the afternoon for openings towards the south and southwest and towards the west.

The best band for DX propagation during March should be *20* meters during most of the day, followed by *15* meters. During the hours of darknes, best band should be *40* meters, followed closely by *80* meters. When conditions are HIGH NORMAL or better, check *10* meters during the day and *160* meters at night. For more specific information, refer to the *DX Propagation Charts* which appeared in last month's column. This month's column contains *Short-Skip Propagation Charts* which are valid for *March* and *April*, as well as *Propagation Charts* centered on Alaska and Hawaii. The Short-Skip Charts contain band opening forecasts for predominantly one-hop paths, ranging in distances between approximately 50 and 2300 miles.

For day-to-day changes in h.f. propagation conditions expected during March, see the *Last Minute Forecast*, which appears at the beginning of this column.

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

LAST MINUTE FORECAST

Day-to-Day Conditions Expected For March, 1977

	Expected Signal Quality			
Propagation Index	(4)	(3)	(2)	(1)
Day				
Above Normal: 9	A	A	B	C
High Normal: 6, 10, 16, 20-21, 24	A	B	C	C-D
Low Normal: 5, 7-8, 11-12, 14-15, 19, 23, 25, 30-31	B	C	D	D-E
Below Normal: 1, 4, 13, 17-18, 22, 26, 29	C	C-D	D-E	E
Disturbed: 2-3, 27-28	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 fair-to-poor (C-D) on March 1, poor-to-not possible (D-E) on the 2nd and 3rd, fair-to-poor (C-D) on the 4th, fair (C) on the 5th, 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.

Sunspot Cycle

It's still not possible to determine exactly in which direction the cycle is going. The Swiss Federal Observatory reports a monthly mean sunspot number of 5.5 for November, 1976. This results in a running smoothed sunspot number of 13, centered on May, 1976. Based upon the smoothed sunspot numbers the cycle still seems to be stalled! A smoothed sunspot number of about 10 is forecast for March, 1977.

V.H.F. Ionospheric Openings

Chances look a little better for ionospheric openings on the v.h.f. bands during March. A seasonal increase is expected in short-skip sporadic-E type openings on *10* meters, and an occasional opening may also be possible on *6* meters. These openings are more likely to occur during the daylight hours, over distances between approximately 1000 and 1400 miles.

There is also a good chance for some widespread auroral activity on the v.h.f. bands, especially when the h.f. bands are BELOW NORMAL or DISTURBED. Check the *Last Minute Forecast* at the beginning of this column for those days that are likely to be in these categories during March.

Not much meteor activity expected this month, but some might be possible during minor showers that may occur March 14-15 and March 24-25.

Mail-A-Prop

Since the hourly propagation forecasts have been discontinued over WWV, Mail-A-Prop has taken on a considerable greater importance to radio amateurs and other users of the h.f. bands. Mail-A-Prop is a bi-weekly newsletter containing detailed day-to-day propagation forecasts for the h.f. bands for a two week period in advance. These forecasts have

HOW TO USE THE SHORT-SKIP CHARTS

1. In the Short-Skip Chart, the predicted times of openings can be found under the appropriate distance column of a particular Meter band (10 through 160 Meters), as shown in the left hand column of the Chart. For the Alaska and Hawaii Charts the predicted times of openings are found under the appropriate Meter band column (15 through 80 Meters) for a particular geographical region of the continental USA, 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.

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

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

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

3. Times shown in the Charts are in the 24-hour system, where 00 is midnight; 12 is noon; 01 is 1 A.M.; 13 is 1 P.M., etc. On the Short-Skip Chart appropriate *daylight* time is used at the *path midpoint*. For example, on a circuit between Maine and Florida, the time shown would be EDT; on a circuit between N.Y. and Texas, the time at the midpoint would be CDT, etc. Times shown in the Hawaii Chart are in HST. To convert to daylight time in other USA time zones, *add* 3 hours in the PDT zone; 4 hours in the MDT zone; 5 hours in CDT zone, and 6 hours in the EDT zone. *Add* 10 hours to convert from HST to GMT. For example, when it is 12 noon in Honolulu, it is 15 or 3 P.M. in Los Angeles; 18 or 6 P.M. in Washington, D.C.; and 22 GMT. Time shown in the Alaska Chart is given in GMT. To convert to *daylight* time in other areas of the USA, *subtract* 7 hours in the PDT zone; 6 hours in the MDT zone; 5 hours in the CDT zone and 4 hours in the EDT zone. For example, at 20 GMT it is 16 or 4 P.M. in N.Y.C.

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

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

achieved a high level of accuracy during the past three years. The format changes a bit with each issue, so that over a short period of time, band-by-band, continent-by-continent and major time periods throughout the day are covered with detailed forecasts and analyses. Short-skip forecasts are usually given at least monthly. Newsworthy items concerning radio propagation, solar activity, progress of the sunspot cycle, vhf band openings, schedules of meteor showers, etc., are also included.

Mail-A-Prop is issued every other week, covering a two week period in advance, on a day-to-day basis. The forecast period begins on a Tuesday, and the newsletter is sent via first class mail, or airmail if necessary, to reach subscribers well before the forecast period begins.

Mail-A-Prop's subscription list consists of radio amateurs, shortwave listeners and commercial users. The forecasts are mainly intended for use in the continental USA, Canada and the Caribbean area, but there are satisfied users in most other parts of the world as well.

For radio amateurs, shortwave listeners and other non-commercial users, an *annual* subscription of 26-issues is $25, postpaid. ($35 outside of North America). A *two-month* trial subscription of five isues is available for $5 postpaid in North America; $7 elsewhere. For a free sample copy send a self-addressed stamped envelope, legal size to:

George Jacobs, W3ASK
Editor, MAIL-A-PROP
11307 Clara Street
Silver Spring, Md. 20902

Take the mystery out of band openings, try MAIL-A-PROP.

Anniversary

This month's column marks the beginning of my *26th* year as Propagation Editor of *CQ*. I have found conducting this column a very stimulating and interesting sidelight to my deep interest in amateur radio. I want to thank all of you, whom, over the years have taken the time to drop me a line expressing an interest in radio propagation and in this column in particular. I also feel that special recognition is due the Editors and Publishers of *CQ* for recognizing the importance of familiarizing radio amateurs with propagation forecasts. With the impending start of a new sunspot cycle, I am looking forward to continuing to bring to readers of *CQ* the very latest news and forecasts for the h.f. amateur bands.

73, George, W3ASK

CQ Short-Skip Propagation Chart
March & April, 1977
Local Standard Time At Path Mid-Point

Band (Meters)	Distance Between Stations (Miles)			
	50-250	250-750	750-1300	1300-2300
10	Nil	Nil	08-19 (0-1)	08-14 (1-0) 14-16 (1) 16-19 (1-0)
15	Nil	08-21 (0-1)	08-12 (1) 12-17 (1-2) 17-21 (1) 21-08 (0-1)	08-10 (1) 10-13 (1-2) 13-14 (2) 14-16 (2-3) 16-17 (2) 17-18 (1-2) 18-19 (1) 19-20 (1-0)
20	Nil	08-12 (0-2) 12-16 (0-3) 16-18 (0-2) 18-08 (0-1)	06-08 (1-2) 08-09 (2) 09-10 (2-3) 10-12 (2-4) 12-16 (3-4) 16-18 (2-4) 18-19 (1-3) 19-21 (1-2) 21-06 (1)	06-08 (2-1) 08-09 (2-3) 09-10 (3) 10-15 (4-3) 15-18 (4) 18-19 (3) 19-20 (2-3) 20-21 (2) 21-05 (1-0) 05-06 (1)
40	07-09 (0-1) 09-10 (0-2) 10-12 (2-4) 12-16 (3-4) 16-18 (2-3) 18-20 (1-2) 20-22 (0-1)	06-07 (0-2) 07-08 (1-2) 08-10 (2-3) 10-15 (4-3) 15-16 (4) 16-18 (3-4) 18-20 (2-3) 20-22 (1-2) 22-06 (0-1)	06-08 (2) 08-15 (3-1) 15-16 (4-2) 16-18 (4-3) 18-20 (3-4) 20-22 (2-4) 22-00 (1-3) 00-06 (1-2)	06-08 (2-1) 08-15 (1-0) 15-16 (2-0) 16-17 (2-1) 17-18 (3-2) 18-21 (4-3) 21-22 (4) 22-00 (3-4) 00-02 (2-3) 02-06 (2)
80	08-11 (3-4) 11-18 (4) 18-20 (3-4) 20-22 (2-3) 22-00 (1-2) 00-06 (1) 06-08 (1-2)	08-11 (4-1) 11-16 (4-0) 16-18 (4-2) 18-20 (4-3) 20-22 (3-4) 22-00 (2-4) 00-06 (1-2) 06-08 (2)	06-08 (2-1) 08-11 (1-0) 11-16 (0) 16-18 (2-1) 18-20 (3-2) 20-00 (4) 00-05 (2-3) 05-06 (2)	06-08 (1-0) 08-16 (0) 16-18 (1-0) 18-20 (2-1) 20-22 (4-2) 22-00 (4-3) 00-05 (3) 05-06 (2-1)
160	05-07 (4-2) 07-09 (3-1) 09-17 (2-0) 17-19 (3-1) 19-20 (4-2) 20-05 (4)	05-06 (2-1) 06-07 (2-0) 07-09 (1-0) 09-17 (0) 17-19 (1-0) 19-20 (2) 20-22 (4-3) 22-03 (4) 03-05 (4-3)	05-06 (1) 06-19 (0) 19-20 (2-1) 20-22 (3-2) 22-03 (4-3) 03-05 (3-2)	05-06 (0-1) 06-19 (0) 19-20 (1-0) 20-22 (2) 22-03 (3-2) 03-05 (2-1)

ALASKA
Openings Given In GMT

To:	15 Meters	20 Meters	40 Meters	80 Meters
Eastern USA	21-23 (1)	21-23 (1) 23-01 (2) 01-02(1)	06-13 (1)	07-12 (1)
Central USA	21-00 (1)	21-23 (1) 23-02 (2) 02-04 (1)	06-14 (1)	07-13 (1)
Western USA	19-21 (1) 21-23 (2) 23-01 (1)	19-21 (1) 21-23 (2) 23-01 (3) 01-03 (2) 03-05 (1)	06-08 (1) 08-12 (2) 12-15 (1)	07-10 (1) 10-13 (2) 13-15 (1) 10-14 (1)*

HAWAII
Openings Given In HST

To:	15 Meters	20 Meters	40 Meters	80 Meters
Eastern USA	08-12 (1) 12-14 (2) 14-16 (1)	04-06 (1) 06-08 (2) 08-12 (1) 12-14 (2) 14-16 (3) 16-18 (2) 18-20 (1)	18-19 (1) 19-21 (2) 21-00 (3) 00-02 (2) 02-03 (1)	19-21 (1) 21-00 (2) 00-02 (1) 22-01 (1)*
Central USA	08-12 (1) 12-15 (2) 15-17 (1)	04-06 (1) 06-08 (2) 08-12 (1) 12-14 (2) 14-17 (3) 17-19 (2) 19-21 (1)	18-19 (1) 19-21 (2) 21-01 (3) 01-04 (2) 04-05 (1)	19-21 (1) 21-01 (3) 01-02 (2) 02-03 (1) 22-02 (1)*
Western USA	12-14 (1)** 07-09 (1) 09-10 (2) 10-14 (3) 14-16 (2) 16-18 (1)	03-04 (1) 04-07 (2) 07-10 (4) 10-13 (3) 13-16 (4) 16-17 (3) 17-19 (2) 19-21 (1)	17-19 (1) 19-20 (2) 20-23 (4) 23-05 (3) 05-06 (2) 06-07 (1)	19-20 (1) 20-21 (2) 21-04 (3) 04-05 (2) 05-06 (1) 20-00 (1)* 00-03 (2)* 03-04 (1)*

See explanation in "How To Use Short-Skip Charts" in box at the beginning of this column.
* Indicates best times for 160 Meter openings.
** Indicates best times for 10 Meter openings.

Note: The Alaska and Hawaii Propagation Charts are intended for distances *greater* than 1300 miles. For shorter distances, use the preceding Short-Skip Propagation Chart.

a monthly feature by

FRANK ANZALONE, W1WY

Contest Calendar

News/views of on-the-air competition

In a speech at the DXPO-'76 Convention in Washington last September, ARRL Pres. Harry Dannals, W2HD brought up a very interesting point. The fact that we need all the friends we can get at the WARC '79 Conference, and that the image we present in our contacts with overseas stations will go a long way in making friends and maybe influencing people.

It occured to me that in addition to the usual day to day contacts, we can also make a good impression in the thousands of overseas contacts made during a DX contest.

With the high level of activity generated by our CQ World Wide DX Contest, over 3800 entries from over 100 countries in 1975, it would seem to me that we are doing something right to create such an interest.

We received over 600 logs from the Soviet Union alone, with Japan, Czechoslovakia, Poland and Germany contributing approximately 200 entries each.

Where possible we send Trophies won in the Contest via diplomatic representatives of that country, thus getting additional favorable publicity for amateur radio.

Our WPX SSB Contest, without a doubt the fastest growing DX contest, is also contributing more than its share of good will to overseas amateurs.

The ARRL DX Competition in February and March which is specifically geared for contacts between the U.S. and overseas DX must also be given its due credit.

So when you hear a lot of DX activity on a contest week-end, don't knock it because its QRMing your daily round-table. Those DX stations may have a bearing on whether or not you will still be able to use your pet frequency after 1979.

73 for now, Frank, W1WY

Commonwealth Contest

Starts: 1200 GMT Saturday, March 12
Ends: 1200 GMT Sunday, March 13

*14 Sherwood Rd., Stamford, Conn. 06905

Calendar of Events

*Mar. 5-6	ARRL DX Phone Contest
*Mar. 5-6	YL-OM C.W. Contest
Mar. 12-13	RSGB Commonwealth C.W.
Mar. 12-14	Virginia QSO Party
Mar. 12-13	South Dakota QSO Party
*Mar. 19-20	ARRL DX C.W. Contest
Mar. 26-27	**CQ WW WPX SSB Contest**
Mar. 26-27	BARTG Spring RTTY
Apr. 2-3	Polish "SP" C.W. Contest
Apr. 2-4	ARCI QRP Contest
Apr. 12-13	DX-YL to W/VE YL C.W.
Apr. 16-17	Bermuda Contest
Apr. 16-17	Polish "SP" Phone Contest
Apr. 16-17	ARRL CD C.W. Party
Apr. 16-17	Florida QSO Party
Apr. 23-24	ARRL CD Phone Party
Apr. 23-24	PACC DX Contest
Apr. 23-24	Swiss "H-22" Contest
Apr. 26-27	DX-YL to W/VE YL Phone

*Covered last month.

This is the old BERU contest in which eligibility is limited to RSGB residents in the United Kingdom and amateurs licensed to operate within the British Commonwealth or British Mandate Territories. This should be of special interest to our Canadian and Caribbean area friends. (But not for W/K, we bowed out in 1776. Hi!)

Activity will be on c.w. only, and it is requested that operation be confined to the lower 30 kHz of each band.

Exchange: Just a signal report.

Scoring: Each completed contact counts 5 points. In addition a bonus of 20 points may be claimed for the 1st, 2nd and 3rd contact with each Commonwealth area. (All of the British Isles are considered one area.)

Entries may be single or multi-band, with separate log sheet required for each band. Add totals from each band for your final multi-band score. Multi-band entries are not eligible for single band awards but you may request a single band be judged for competition.

There is a *s.w.l.* category with scoring same as above. Report of station heard as well as call of station being worked should be listed. Credit may be claimed for both entries. Include a check list of call areas heard on each band.

Awards: Certificates to the first three places, both multi-band and each single band, for the UK and overseas areas. There are Rose Bowl Trophies to the overall winner and runner-up, and to the leading UK station.

Logs go to. D. J. Andrews, G3MXJ, 18 Downview Cresent, Uckfield, Sussex, England. And must be received before May 16th to be eligible.

Virginia QSO Party

Starts: 1800 GMT Saturday, March 12
Ends: 0200 GMT Monday, March 14

This one is again sponsored by the Sterling Park ARC. The same station may be worked on each band and mode, 1.8 thru 28 MHz, for QSO points. Virginia stations may work other in-state stations for QSO and multiplier credit.

Exchange: QSO no., RS(T) and QTH. County for Va., state, province or country for others.

Scoring: One point per QSO. Va. stations multiply total QSO points by sum of states, provinces, countries and Va. counties worked. All others use Va. counties for their multiplier. (max. of 98)

Frequencies: C.W.—60 kHz from low end of each c.w. and novice bands. Phone — 3930, 7230, 14285, 21375, 28575. (Check phone bands on even GMT hours)

Awards: Certificates to top scorers in each state, province, country and Va. county. Also top scoring Novice both in Va. and out-of-state. A special certificate to the top scorer.

Indicate each new multiplier worked in a separate column on your log and include a check and summary sheet with name, address and etc.

Logs must be received by April 15th and go to: Gary D. Poorman, W4UPJ, 1114 S. Dickenson Ave., Sterling Park, VA 22170.

South Dakota QSO Party

Starts: 0000 GMT Sunday, March 13
Ends: 2359 GMT Sunday, March 13

Last summer Ville Hiilesmaa, OH2MM and Martii Laine, OH2BH formally received their 1974 CQ World Wide DX Contest Trophies. The presentation took place in Helsinki and was made by U.S. Ambassador Mark Austad. Ville (L.) accepted the Anthony Susen, W3AOH World C.W. award for their Multi-Operator, Single Transmitter operation from OD5IQ. And Martii the Bill Leonard, W2SKE World Phone Trophy for his All Band operation at ZD3X. Both scores were new world records. Mrs. Austad seems to be enjoying the proceedings.

This one is sponsored by the Prairie Dog A.R.C. Its a 24 hour activity, Saturday night to Sunday night local time.

The same station may be worked on each band and mode for QSO and multiplier credit. But no SD to SD contacts permitted.

Exchange: RS(T) and QTH. County for South Dakota. State, province or country for others.

Scoring: SD stations multiply total QSOs by states, provinces and countries worked. Others use SD counties for their multiplier. (max. of 67)

Frequencies: C.W. — 70 kHz up from bottom of each band. Phone—1975, 3920, 7230, 14280, 21380, 28510. Novice — Middle of their bands.

Awards: Certificates to top scores in each section. (ARRL?)

Include a summary sheet showing the scoring and a signed declaration and mail before April 1st to: Lowell Nelson, WB0EVQ, Box 493, Springfield, South Dakota 57062.

CQ WW WPX SSB Contest

Starts: 0000 GMT Saturday, Mach 26
Ends: 2400 GMT Sunday, March 27

Complete rules will be found on page 22 of the January issue. No changes from last year except this year we do not have the special Bicentennial multiplier.

Briefly: Contacts between stations on different continents count 3 points on 14, 21 and 28 MHz, and 6 points on 7, 3.5 and 1.8 MHz.

On the same continent but not the same country, 1 point on 14, 21 and 28 and 2 points on 7, 3.5 and 1.8 MHz. (Exception: Contacts between North American countries are worth 2 points on the high bands and 4 points on the low bands.)

Contacts are permitted between stations in the same country for the purpose of obtaining a Prefix multiplier, but have no QSO point value.

The multiplier is determined by the number of different prefixes worked. Each prefix may be counted only *once, not* once per band.

The exchange is simple, the RS report plus a contact number starting with 001.

And only 30 hours out of the 48 hour contest period may be used in scoring. The 18 hours of non-operating time may be taken in up to 5 periods. That's for single operator stations, who must also show 12 hours of operating time to be eligible for any award. There is no time limit for multi-operator stations who must show a minimum of 24 hours.

Besides the usual certificates for the different classifications there are 9 Trophies for the Top scorers.

Mailing deadline is May 10th and of course go to: CQ WPX SSB Contest Committee, 14 Vanderventer Ave., Port Washington, N.Y. 11050 USA

BARTG Spring RTTY Contest

Starts: 0200 GMT Saturday, March 26
Ends: 0200 GMT Monday, March 28

Sponsored by the British Amateur Radio Teleprinter Group this contest is open to all amateurs and s.w.l. Multi-operator and s.w.l. are separate categories.

All bands may be used, 3.5 thru 28 MHz, but not more than 30 hours out of the 48 hour period may be used for scoring. The 18 hours off may be taken any time but in not less than 3 hour periods. Indicate on/off times in your log and summarize in your summary sheet.

Exchange: RST plus a three figure contact number starting with 001, and time in GMT. (full 4 figures)

Points: Contacts with stations within one's own country 2 points. With stations in other countries 10 points. A bonus of 200 points per country worked including own, on each band. Same station may be worked on each band for QSO and multiplier credit.

Multiplier: Total sum of countries worked on each band. And number of continents worked. (counted once only) Use the ARRL country list and each W/K and VE/VO call area.

Final Score: (a) Total QSO points × country multiplier. (b) Country multiplier × bonus points × continents worked. Add sum of (a) and (b) for your final score.

Awards: Certificates to the leading scorers in each class and also each continent. And in each W/K and VE/VO call areas. Final position will be valid for entry in the World RTTY Championship. There are also awards for working 25 DXCC countries and for working 6 continents.

Logs must be received by May 31st and go to: Ted Double, G8CDW, 89 Linden Gardens, Enfield, Middlesex, England EN1 4DX

Polish DX Contest

C.W.: April 2-3 Phone: April 16-17
Starts: 1500 GMT Saturday
Ends: 2400 GMT Sunday

Two major changes have been made in the SP DX Contest.

1. It is now a two week-end affair, c.w. and phone, each independent of the other.

2. Poland has now been divided into 49 Provinces. (Wojewodztwo) This replaces the old smaller dis-

tricts. (Powiat) The new abbreviation, two letters denoting the WOJ, will now be sent in the exchange.

There are three categories; Single operator, single and all band. Multi-operator, all band only. And s.w.l.

Exchange: RS(T) plus a 3 figure QSO number starting with 001 for foreign stations. Polish stations will send RS(T) and their WOJ. (i.e. 579KA and etc.)

Scoring: Each QSO with a SP/SQ/3Z counts 3 points.

Multiplier: Each different province (WOJ) worked, but counted only once regardless of band. (max. of 49)

Final score: Total QSO points times number of provinces worked. The same station may be worked on each band for QSO points, but a WOJ counted only once.

Awards: Certificates to the top scorers in each category and mode, in each continent, each country and each call area of Australia, Canada, USA and USSR.

Contacts in the contest may be credited for the PZK awards in lieu of QSL cards providing they are confirmed in the logs of the SP stations, and an application is made.

S.w.l. entries must report the call of the Polish station as well as the station being worked, and the number exchange. Scoring same as above.

Use a separate log sheet for each band and include a summary sheet with the scoring and your name and address in Block Letters. The usual signed declaration is also requested. Disqualification rules for excessive duplicate contacts and etc. will be enforced.

Entries must be postmarked no later than April 30th for c.w. and May 15th for phone, and go to: PZK Contest Committee, P.O. Box 320, 00-950 Warszawa, Poland.

ARCI QRP Party

Starts: 2000 GMT Saturday, April 2
Ends: 0200 GMT Monday, April 4

Sponsored by the QRP Amateur Radio Club International, this activity is open to all Amateurs, both members and non-members. Stations may be worked once per band for QSO and multiplier credit.

Exchange: RS(T) and state, province or country. Members will include their QRP number, non-members their power input.

Scoring: Contacts with a member count 3 points, with a non-member 2 points. Stations other than W/VE 4 points.

Multiplier: Each state, province and country worked on each band.

There is a power multiplier as follows: Over 100 watts input, × 1;25 to 100 watts, × 1.5; 5 to 25 watts, × 2;1 to 5 watts × 3. And less than 1 watt, × 5.

Final score: QSO points × states, provinces, countries per band × power multiplier.

Frequencies: C.W. — 3540, 7040, 14065, 21040, 28040. S.S.B. — 3855, 7260, 14260, 28600. (21360?) Novice: 3720, 7120, 21120, 28040.

Awards: Certificates to the highest scoring station in each state, province and country. Additional awards depending on activity. And a certificate to the station showing three "skip" contacts using the lowest power.

Include a summary sheet with your entry with a breakdown of the scoring, bands used, equipment, antennas, and power used. Your name and address in Block Letters and the usual signed declaration. Include a large s.a.s.e. if results desired.

Logs must be received before May 30th and go to: E. V. "Sandy" Blaize, W5TVW, 417 Ridgewood Drive, Metairie, LA 70001.

YL—DX to No. America Contest

C.W.: April 12-13 Phone: April 26-27
Starts: 1800 GMT Tuesday
Ends: 1800 GMT Wednesday

This is strictly a YL only affair in which DX YLs (inc. KH6 and KL7) will be working YLs on the North American continent. (KL7s however are not permitted to work VE5 thru VE8, but may work KH6)

All bands may be used but crossband contacts are not permitted. The same station may be worked on each band for QSO credit, but avoid contacts on Net frequencies. Phone and c.w. are separate contests and require separate logs.

Exchange: QSO no., RS(T) and state, province or country.

Scoring: One point per QSO. Multiply total by number of states or countries worked.

There is a power multiplier of 1.25 for stations using 150 watts or less input. (300 p.e.p. if s.s.b.)

Final Score: QSOs × multiplier × power multiplier.

Awards: To winning DX and No. Amer. stations. Thophies for c.w. and for phone. Plaques for the highest combined c.w. and phone scores. Certificates to 2nd and 3rd place winners.

Submit separate logs for each section and a signed declaration no later than May 7th, to be received by May 24th, to the YLRL Vice President. Carol Bourne, WA9NEJ, 362 Hawthorne, GlenEllyn, Ill. 60137. ■

A.M. Is Not Dead *(from page 57)*

stand in line to get to use the repeater and then get told how to use it.

Now, a.m. *is* fun; it is *not* a nostalgia trip for a bunch of old fogies—there are plenty of young fellows on who are smart enough to realize that you don't need a fat wallet to enjoy amateur radio. They have discovered the *tremendous,* almost lost, satisfaction to be had from building their own rigs and actually using them on the air to talk with other amateurs with the same interests. Much air time is spent not just on the technicality of producing "broadcast quality" a.m. but in tracking down sources for the high power transmitter components we can no longer buy over the counter. (Even if we could, the prices would be out of this world.) This is why "flea markets" and salvage yards are so popular with these fellows who build. This is why so much old fashioned horse-trading takes place.

A.M. And The S.W.L.

You know, if you stop to think, *a.m.* is what the s.w.l. listens to, not s.s.b. It is astounding to learn how many present day a.m. stations on 75 and 160 have gotten letters and 'phone calls from short wave listeners. No small number of these s.w.l.'s become amateurs because listening to *a.m.* is their introduction to amateur radio. Could the proliferation of s.s.b. be a significant factor in the failure to attract newcomers to amateur radio? Don't knock a.m., use it properly, in the right part of each band. Remember the dire predictions that RTTY would spread all over the bands when f.s.k. was first authorized on the h.f. bands? Well, it didn't happen. RTTYers stuck close to agreed frequencies and they still do. The same thing is happening on 75. Just about all a.m. stays between 3850 and 3900, and many s.s.b. operators respect this and move away from the few a.m. QSO's in progress. (There *is* enough space for all.)

To say it again, Harry, a.m. is *not* dead. Don't let the FCC and the ARRL sweep it under the rug under the guise of "deregulation." Let's keep this basic kind of radio, the radio of a.m. broadcasting, alive by local radio club activity, by active horse trading in old components, by letting magazine editors know that you want to see articles on a.m. Amateur radio *can* still be fun!

Multi-Band Trap Ant. *(from page 55)*

bone" on our last band of coverage, we're through.

Well yes, there *are* still a few minor matters yet to be covered: how to design band traps in terms of their Q and L/C ratio; how to convert conductor sections first found in electrical length over to conductor length in feet when the conductor radius is taken into account. Also, in the process, we will simplify the steps a bit more so things will be even easier to work out. We will have to do all that, however, in parts III and IV, as space just ran out. Oh, and I promise you this: no more sneaky tricks from here on out. ■

(To Be Continued)

DXosis Okinawa* Style *(from page 18)*

Ocean stations, you might try the Pacific Inter-Island Net that meets on 14305 at 0800 GMT.

Now that you DXosis patients have worked all that DX, how do you go about getting confirmations for your contacts? What is the best method to assure a high percentage of returns on QSLs? I wish I knew the answer to this one! I do share with you a method that has netted me over 90% returns from KA6DE. My procedure is simply this. The same day I work a new country, I prepare a QSL card and place it in a business size air mail envelope with sufficient International Reply Coupons for the station operator to purchase sufficient postage for air mail return of my card. IRCs cost 26¢ each at your friendly Post Office or are sometimes available for 15¢-20¢ each from QSL managers. If a station is located in a country that does not honor IRCs you might send him one large green stamp (a US dollar) and tell him you hope this deflated piece of currency will pay for his postage. I also include a self-addressed air mail envelope on which I have typed my name, address and callsign. I also type on the DX station's return address. You will never know how much DX stations appreciate this little favor. DX stations spend much time in addressing QSLs and every little thing you can do to save them time will increase your percentage of returns. You have read a lot about the great success rate of some US operators who adorn their envelopes with those big, beautiful commemorative stamps. I do not do this because it only draws attention to the envelope and a few postal workers in some countries are known to be stamp collectors. I know! They have many of my commemoratives from earlier years. I also suspect that some of them have paid parts of their food bills with my IRCs. So, keep the envelope businesslike and do not draw attention to amateur radio on it.

I hope this article has been of interest to those of you who have just recently contacted DXosis. As I said in the beginning, I certainly do not have all the answers on how to build your DXCC total. However, I did have a great time operating as KA6DE these last 15 months, and it has been fun sharing these ideas with you. My DXosis problems have diminished as of August 1975 when I return to The World for a new assignment at Lowry AFB, Colorado. As my premedical student roommate knew, all skin problems subside only to return again, so will my DXosis. However, I am not really that concerned about my disease. As a matter of fact I really enjoy having DXosis. I hope you do too. ■

In Focus *(from page 49)*

Erroneous Report Of Solar Disturbance Affecting Only SSTV

If you got taken in by a report of a special type of solar disturbance affecting SSTV only (during last October), don't feel badly. It's understandable that you would have noticed a sudden decline in SSTV signal levels/activity for at least a brief period while four of slow scan's leading Emitteurs were relaxing in the shack of Peter Kuehn, WB6TOC. I think that the accompanying indoor photo must have been taken by the use of reflections from a dead 807, but if your eyesight is perfect you may be able to identify (left to right), Rolph Van Jindelt, WB6JKW, Tony Pessiki, W3GKW, WB6TOC, and Paul Capetz, W6PLI. See fig. 11.

Peter's beautiful home near the top of a mountain looks like the place Everyham would like to retire to! No wonder WB6TOC is heard and seen everywhere! See fig. 12.

Many thanks to Tony, W3GKW for these pictures.

Another Correction

A pleasant note from Jim Thomas, WB4HCV, points out that he is NOT running Sumner Electronics. Jim is in the consulting business and operates under the name of James Thomas Industries, Inc. His letter stated, "I am also maintaining all Sumner and Thomas SSTV equipment, making mods, design improvements, etc." You can reach him at P.O. Box 651, St. Simons Island, Georgia 31522.

Final-Final

That wraps it up for this month. With Dayton's Hamvention on the way, I'm sure that there'll be lots of new slow scan goodies to be discussed in the months ahead. April's In Focus will bring you details on things you can do with a scan converter, how to combine pictures and titles etc.

Meantime, please keep those pictures and letters coming my way — especially you chaps in Europe and Australia. I KNOW there's lots of slow scan action in your areas—so let's hear from you! My address is still the same: 2112 Turk Hill Road, Fairport, N.Y. 14450.

QRP *(from page 29)*

this receiver. What does one want for the price?

If I gave credit for every idea I stole on this project, the list would fill a page. Before starting this job, I read everything I could find in this field, from the Kabbala to the wireless funny-papers. Most of the professional literature is more confusin' than amusin', in fact, downright morbid. The best sources of "live" stuff are the back-issues of *The Milliwatt* and Doug DeMaw's fine material in *QST*.

Finally, there are some spooks haunting this field that I'd like to lay to rest permanently. First, excepting MOSFET's (which are too esoteric for poor-folks like me, anyway), intelligent soldering of the leads doesn't seem to hurt most transistors. Secondly, although they may be nice, one doesn't *absolutely* need to use those silly toroids, at least for the lower amateur bands. Good old solenoidal coils, reasonably placed, seem to work quite well. Likewise, printed circuit techniques, while nice for production runs, are not necessary for solid-state success, apparently. Personally, I agree with Zenith: "Handwired chassis is the best." Lastly, one does not have to be born the seventh-son of a seventh-son to build a solid-state rig that works. *You* can too, if you're willing to struggle a little. I tried, and I think I won. . .

Specifications

TX PWR—1.4-2.0 w Input, 0.9-1.3 w output.
RCVR—Selectivity/sensitivity adequate for TX range. One microvolt signal probably usable, using good 2000ohm phones.
Power Supply—12VDC, 30ma receive, 200ma transmit.
Range—With dipole, 20ft above ground, 300 mile contacts routine. On a good winter night—you guess!

Loose Ends

Well gang, there it is, the old Rock's first solid-state venture. We'll just say that no pictures were available of his version. whether or not they were. After all, a solid-state minirig in a 9" × 12" "Bake-Rite" baking pan? I can maybe understand a mini-rig in a sardine can, or a coffee-can, but a baking pan? So, we'll let it up to the individual builder to choose his delight as far as packaging is concerned. Again, let's have some pictures. I'm going to just keep right on asking for pictures until I start getting some! Until next month,

73, Ade, K8EEG

CQ's Ham Shop is a good source of antique and hard to get items. It's a free service for CQ subscribers. Why not start collecting now?

150 Watt Switch-Mode Reg. *(from page 43)*

supply. As the output voltage increases, the voltage on the arm of the control potentiometer, R_{24}, increases, causing transistor Q_6 to conduct more current, thus lowering the voltage at pin 5. That results in a shorter pulse width at the base of Q_1, shortening the on time and reducing the output voltage.

Since the entire system is designed to maintain a constant voltage at the arm of the control potentiometer, the output voltage of the regulator can be set by moving the position of the arm along R_{24}. This system will always stabilize so that the voltage at the arm of the potentiometer is about 3.6 volts, that is the sum of the B-E voltage of Q_6 and the zener voltage of Z_2. If the arm of the pot is set near R_{23}, the output voltage must drop to maintain the 3.6 volts at the arm and, if the arm is set near R_{25}, the output voltage must rise to develop 3.6 V at that point.

The Clock

The clock and trigger circuit is comprised of Q_4, Q_5, and the associated components. Q_4 is a PUT, that is, a programmable unijunction transistor. As the timing capacitor, C_8, charges, the anode voltage rises until it reaches a point about 0.7 Volts above the voltage at the gate. The PUT then turns on, discharging the capacitor through the cathode resistor, R_{21}. The PUT will discharge the capacitor almost completely in about 5 microseconds, producing a positive pulse at the base of Q_5 and triggering the timer. Immediately after discharging, the PUT turns off allowing C_8 to begin charging again to the trigger point. In this fashion, the PUT produces a very stable clock pulse at the rate of 20 KHz, thus setting the period of the timer to a value of 50 microseconds. The high frequency allows the use of a small value of filter inductor and minimizes ripple at the output by making the filtering easier. The frequency is also high enough that it is not audible to the human ear.

Overcurrent Protection

Semiconductors are very unforgiving if they are submitted to excessive current or voltage. For that reason, any solid-state power supply must be protected against dangerous current surges. Fusing will not protect the semiconductors because even the fast-blow variety is much too slow to prevent a catastrophic failure. Protection for this circuit is provided by the sensing resistor R_{11}, the SCR and Q_3. The value of R_{11} given here (0.075 Ohm) is that necessary to cause the SCR to turn on when 7.5 amperes flows through it. Since turn-on voltage (V_{gt}) may vary a few millivolts from one device to another, this value should be adjusted so that the shut-down circuit will operate around 8 amperes. The sensing resistor, R_{11}, may be made up of four 0.3 Ω, 2 w resistors in parallel to get the 0.075 ohms specified. At 7.5 amps, 4.2 watts will be dissipated in R_{11}.

When SCR-1 turns on the emitter of Q_3 is pulled down to about 1 volt, causing Q_2 to turn off, thus shutting down the regulator. The regulator will remain shut down until the voltage supplied to the anode of SCR-1 is removed (by operating the reset switch). This circuit is fast enough to prevent regulator damage even should a direct short circuit be applied to the output. Incidentally, the zener diode, Z_1, functions to prevent the E-B junction of Q_3 from avalanching when the output of the timer is low. Such avalanching is detrimental to the beta of a transistor and, should Q_3 fail to operate, the regulator would not be protected.

Low Load Currents

A switch-mode regulator regulates poorly, and may even oscillate, with light load currents. This is usually prevented by building in some pre-loading if the load current is expected to be low. Preloading in this circuit is provided by Q_7 and R_{10}. This method of preloading is advantageous because the preload is applied only when the regulator switch is off. Since the off time is shorter at heavy loads or higher voltage, the preloading is applied when it is needed most—at low output voltage and light loads.

Construction Hints

Construction of this regulator should be straight forward. All of the parts, except the inductor, L_2, should be available from your distributor. The regulator should be constructed in such a way that all of the heavy current components are well shielded to prevent r.f. radiation from escaping. Since relatively heavy currents are being switched at a very rapid rate, any stray inductances will tend to support high frequency oscillations, possibly resulting in QRM you don't need. L_1 C_1 and L_3 C_5 are provided to reduce conducted radiation from traveling along the input and output leads. Capacitors C_{10} and C_3 are intended to shunt the high frequency currents to ground near the point where they are generated. For that reason, their leads, and all of the leads in heavy black in the diagram, should be kept as short as possible. With proper attention to these details, the r.f. radiation will be negligible.

L_2, as noted in the parts list, is 180 microHenries of inductance. It should be able to handle up to 15 Amperes without saturating. The inductor can be formed by winding 16 turns of #18 wire on a Ferroxcube 1F10 "U" core of 3C8 ferrite material. The core is "U" shaped with the open end closed by a straight bar of the same material, using a gap of about 0.005" at each end of the "U". The cross section of the core is 0.56 inches square. The outside dimension of the assembled core is 1.5" × 2.5". Make the windings tight and well taped to prevent coil movement with varying current.

The D44E2 transistor should be provided with an adequate heat sink. The tab temperature of the transistor should not exceed 80°C for reliable operation. A 4½" length of Wakefield #4666 heat sink, or other material rated at 1.7°C/watt or better, is sufficient for this circuit. Remember that the collector is not at ground potential. It should be insulated from the heat sink with a thermally conductive insulator or, better still, mounted directly to the heat sink and the heat sink electrically insulated from the chassis.

The unregulated d.c. input can be supplied from any rough power supply. The regulator will hold a constant output voltage of 12 V, even when the input voltage is varied from 24 volts to 35 volts, so the input voltage is not critical. A 30V, 5A input supply will furnish an output of 6A at 20V, or up to 7.5 amps at any output between 6 volts and 16 volts. ■

Three Purpose Antenna *(from page 44)*

Even though lead losses to the receiver are greater, receiver sensitivity is so great that a drop in signal input can be tolerated.

The location of the antenna on the vehicle will affect the radiation pattern to some degree. It's seldom, though, that a mobile radio station, with its changes in direction of travel, has need of a radiation pattern favoring any one direction. A truly omnidirectional pattern probably would be the most suitable but that would necessitate mounting the radiator squarely in the center of the top of the vehicle. Fortunately, placing the antenna on a side or on the trunk of a car does not adversely affect the radiation pattern seriously.

How It Works

The three-purpose antenna, shown in fig. 1, consists of a base-loaded CB radiator or rod, with a small capacitor beween the rod and a series coil. The coil is slug-tuned and has no parallel capacitor. Between rod and capacitor, a connection leads to a wave-trap tuned to 27 MHz.

Here's how these serve to channel signals only to desired paths. The series capacitor has high capacitive reactance to signals in the MF AM broadcast band, and the series coil has high inductive reactance to signals in the VHF FM broadcast band. Those signals therefore seek the optional path through the parallel-tuned wave-trap, which has negligible impedance to their frequencies. For CB signals, which are inductively coupled into and out of the series coil, the wave-trap presents a very high impedance. They, therefore are not attenuated by the tap-off to a broadcast receiver.

Getting The Parts Together

It's a sad state of affairs, but nevertheless true, a builder spends more time gathering parts than putting them together. This project is no exception. Only a few years ago one could obtain from any of several mail order houses slug-tuned coil forms in a variety of sizes and slug compositions. No 1977 mail-order catalog lists them! So your most probable source, if you lack a well-stocked "junkbox," is from a wrecked TV receiver. By a bit of judicious cannibalization, you can salvage coils with slugs suitable for upper-h.f. applicatons. Don't try to use forms you may find that have high-inductance windings. It's probable their slugs are of a material having high losses at the upper end of the HF spectrum.

One coil form, that for the 27-MHz wave-trap, can be the more common ¼-inch diameter. The one for the series coil possibly could be that small but a larger one would be much preferred. Fewer turns would be needed for a given inductance. Also, a better "form factor" could be achieved.

The other parts are more readily obtained. For the wave-trap, almost any capacitors between 10 and 25 pF capacitance may be used. The series capacitor should be a mica or glass type and approximately 25 pF capacitance. For the actual radiator, a wide choice is possible. A flexible rod or a rigid one with a base spring may be used. If you do use a spring, be sure to provide an r.f.

(Continued on page 80)

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WANT MORROW A/C P.S. RTS-600 S for MB560A TX. Richard W. Randall, K6ARE, 1263 Lakehurst Road, Livermore, CA 94550.

SELL: 9 (nine) EIMAC 4X150A Tubes $5.00 each. 3 RCA 832A's $5. Fred Van Pala, 70-64 45 Ave., Woodside, N.Y. 11377.

FOR SALE: Henry 3KA Linear, $1100; Tri-ex LM354 Motorized Tower, $1000; Don K6YFZ, Don Bostrom, 4447 Atoll Ave., Sherman Oaks, CA 91423.

SIGNAL/ONE NEWSLETTER & Related Information. SASE for details. For Sale Johnson 6N2 $85. Bob, W0YVA/4, P.O.B. 6216, Arlington, VA 22206.

THE 1st ANNUAL SANGAMON VALLEY RC Hamfest was a great success. Tnx to all who came. See you Sunday, Sept. 25, '77, New Berlin, IL.

WANTED: Novice needs good low priced Transceiver (HW-101, Swan 350, Temp I etc.) with P.S. and speaker. Write, WB5YHY, Tim Huckabee, Box 1451, Andrews, TX 79714.

WANTED- McMurdo Silver, Patterson, other early receivers. K4TS, Rt. 2, Box 3, Fredericksburg, VA 22401.

SELL: 62' Aluminum Crank-up - $250, 4-400A Amp. - $150. Wanted - SB220 or FL2500, 50' Crank up. Ray - WA6LBP, 1507 Buena Vista, Ventura, CA 93001. 805-643-6495.

WANTED: Radio Specialities F.M. modulation monitor, Heath weather station, Regency HR-440. K6KZT, 2255 Alexander Ave. Los Osos, CA 93402.

TECH MANUALS for Govt. surplus gear - $6.50 each: SP-600JX, URM-25D, SG-3/U, TS-173/UR, TS-174/U, LM-21, OS-8B/U. Thousands more available. Send 50 cents (coin) for 22-page list. W3IHD, 7218 Roanne Drive, Washington, DC 20021.

Three Purpose Antenna *(from page 75)*

"short" around it. The braid off a bit of RG-58U serves well. Burstein-Applebee lists a 40-inch chrome plated brass telescoping antenna, catalog number 10A7032-4, that should be quite satisfactory. Additionally, you'll need miscellaneous hardware, a shield for the base assembly, and a few feet of insulated wire for the coils.

Test Equipment Required

A dip-meter capable of tuning to 27 MHz and some sort of v.s.w.r. indicator both are needed. The later may be of the "cheap and dirty" type, for only comparative indications are necessary. Transceivers made for use in the Citizens Radio Service are designed to function properly only when attached to an antenna system (antenna plus feedline) that presents a 52-ohm non-reactive impedance to the transceiver. Any deviation from 52 ohms presents a less than optimum load which degenerates performance. Any element of reaction, whether inductive or capacitive, not only detracts from power available to be radiated but also introduces a detuning effect into the tuned load circuit of the output stage. This reduces the efficiency of that stage, causing it to be less effective as a converter of d.c. power (from the battery) to 27-MHz r.f. power.

Putting It Together

As shown in fig. 1, the circuit is simple. One portion, the 27-MHz trap, can be preassembled. No rigorous specifications are provided, as too much depends upon the type of coil form and slug you may have selected. As rough guidelines, a prototype used ten turns of #34 enamaled wire closewound on a ⅜-inch form. The associated capacitor was 22pF. This combination had a tuning range centered near 27 MHz and extending both well above and well below that frequency.

It's even more impractical to give specifications for the series coil. It'll depend upon form size and the radiator's size, too. Keep in mind that this coil handles r.f. power, even though of modest magnitude; so you'll want to keep losses low. Use a reasonably-large size wire, about #20 or #22. Place the windings on the form in such a manner as to leave room for the coupling link to be moved a bit in its relation to the main winding. Also, place it so that when the slug is screwed out to reduce inductance, it'll move away from and not under the coupling link; you want only to tune the coil, not to vary the coupling between link and coil.

As with any construction project, a "trial run" is advisable. That is, make a preliminary assembly on a large metallic base. Mount the radiator on an insulator, with the series capacitor immediately at its base, and with the series coil closely under the capacitor. Ground the coil to the large metalic base. The 27-MHz trap may be supported by the same insulator supporting the radiator. Keep the axis of the coil at a right angle to the radiator.

Preliminary Tuning

Couple the dip-meter closely to the antenna, near its base but a bit removed from either of the two coils, and determine the resonant frequency. If you're indeed fortunate, tuning the slug may bring the system into resonance at 27 MHz. It's probable, however, that you'll need either to remove turns from the coil or rewind it for more inductance. It should require no more than one or two trys to achieve resonance. Strive to have resonance at 27 MHz occur at approximately the middle of the slug's tuning range. Mounting the antenna on a vehicle very likely will affect the inductance needed to achieve resonance.

If you have available an "all-wave" receiver equipped with an "S" meter and capable of tuning to 27 MHz, connect the free end of the trap to the antenna terminal. It will be used in the next step. Lightly couple some 27-MHz power into the antenna and adjust the trap for minimum "S" meter deflection. If you don't have such a receiver, use any b.c. receiver and adjust for minimum desensitization.

To load the CB transceiver into the antenna, connect the two through a v.s.w.r. meter and tune the slug of the series coil for minimum v.s.w.r. Try adjusting the coupling link and coil; you may improve the v.s.w.r. Of course, the adjustments should be made at or near the center of the CRS band.

Installing

Having selected a site, you're ready to make the installation. Construct (or buy) a box to house the base assembly, one that'll permit access to the tuning slugs. Remember that metal walls should be no closer than one coil diameter to a coil. Ensure that the enclosure will amply protect the base assembly from both weather and physical damage.

Final Tuning

With everything in place, touch up the tuning of the series slug for minimum v.s.w.r. It's possible, but not probable, the 27-MHz trap may need a final touching-up, too.

Performance

The prototype antenna was given a thorough test in active service on the CRS band. Although not as effective as a full-size ¼-wave antenna, its performance compared well with other base-loaded restricted-height antennas. Broadcast reception was difficult to evaluate, as it was tested in a high-signal-strength area. All signals were loud. ■

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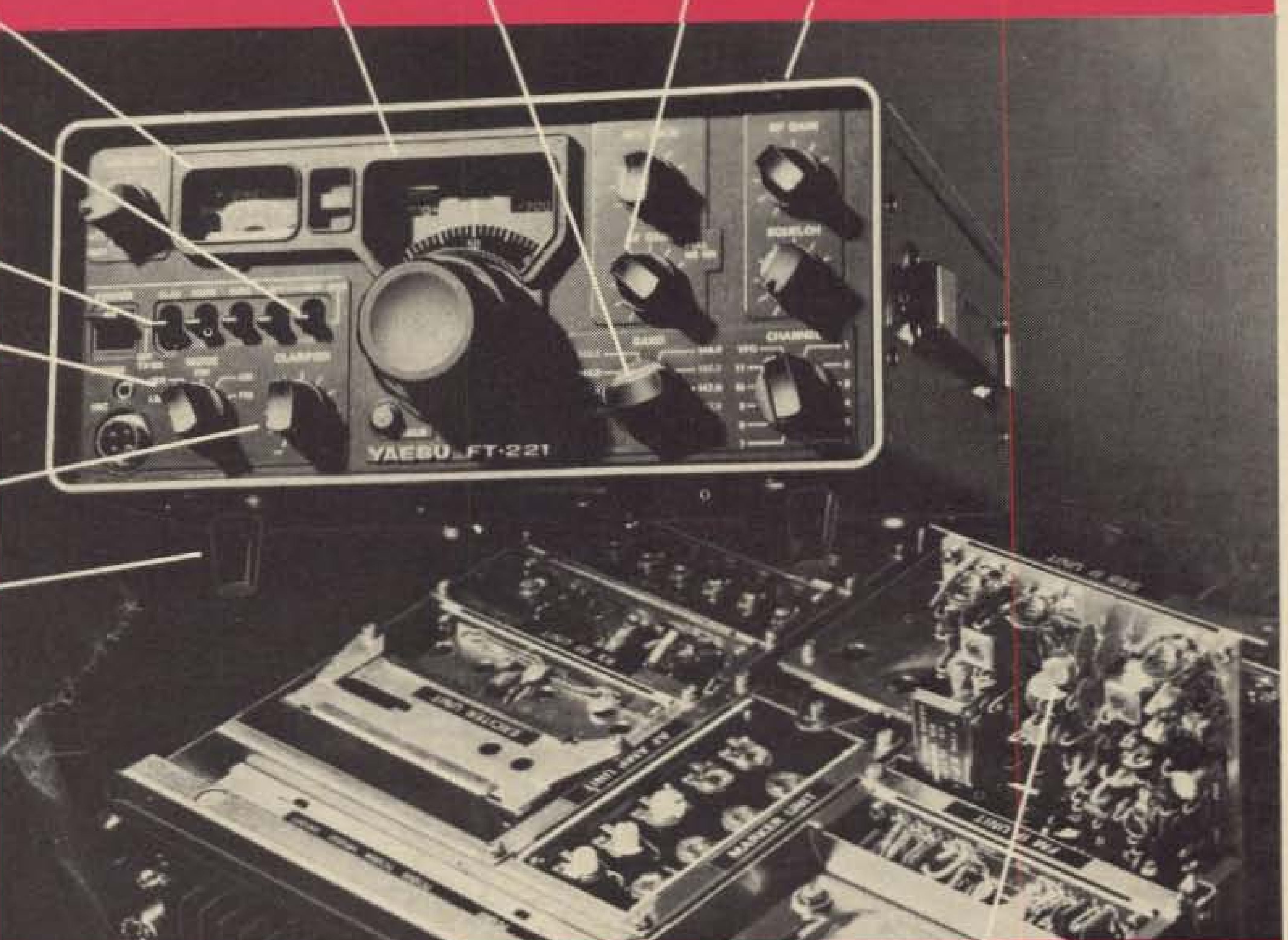

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