CQ

May 1973
$1.00

In This Issue

THE SS MARK 4 SLOW SCAN TV MONITOR See p. 33

The Radio Amateur's Journal

08240

Heathkit® 2-Meter FM gear is here!

NEW Heathkit 2-Meter FM Transceiver

179.95*

HW-202 shown above with Tone Burst Encoder installed.

All solid-state design • Can be completely aligned without instruments • 36-channel capability *— independent push-button selection of 6 transmit and 6 receive crystals •* ***10-Watts Minimum Output*** *— designed to operate into even an infinite VSWR without failure •* ***Optional Tone Burst Encoder*** *— mounts inside, gives front-panel selection of four pre-settable tones*

The Heathkit HW-202 compares with the best wired amateur 2M/FM rigs. Plus it has: 36-channel capability via independent selection of 6 transmit and 6 receive crystals. Solid-state circuitry with complete built-in alignment procedures using only the manual and the front-panel meter allow operation over a 1 MHz segment from 143.9 to 148.3 MHz. Removable front-panel bezel permits installation of the new Heathkit HWA-202-2 Tone Burst Encoder.

10-15 watts transmission into an infinite VSWR — indefinitely, with no failure! The HW-202 needs no automatic shut-down — it continues to generate a signal regardless of antenna condition. Transmitter deviation is fully adjustable from 0 to 7.5 kHz, with instantaneous deviation limiting. Harmonic output is greater than −45 dB from carrier. The push-to-talk ceramic microphone supplied has an audio response tailored to the HW-202.

Excellent reception — 0.5 uV or less produces 12 dB Sinad, or 15 dB quieting. Output at the built-in speaker is typically 2 watts at less than 3% total harmonic distortion. The receiver circuitry utilizes diode-protected dual-gate MOSFETS in the front end; an IC IF that completely limits with less than a 10 uV signal; dual conversion, 10.7 MHz and 455 kHz via a 4-pole monolithic 10.7 MHz crystal filter. Image response is −55 dB or better. Spurious response is −75 dB or better.

The Heathkit HW-202 comes with two crystals used in initial set-up and alignment, give you simplex operation on 146.94. Kit includes microphone, quick-connecting cable for 12-volt hook-up, heavy duty alligator clips for use with a temporary battery, antenna coax jack, gimbal bracket, and mobile mount that lets you remove the radio from the car by unscrewing two thumbscrews. The HWA-202-2 Tone Burst Encoder provides four presettable pushbuttons for instant repeater access. Fixed station operation is as easy as adding the HWA-202-1 AC Power Supply. The HA-202 2-Meter Amplifier puts out 40 watts for 10 watts in, and externally it's a perfect mate for your HW-202.

Kit HW-202, 11 lbs., mailable **179.95***

Kit HWA-202-2, Tone Burst Encoder, 1 lb. . . **24.95***

Kit HWA-202-1, AC Power Supply, 7 lbs. . . **29.95***

Kit HWA-202-3, Mobile 2-Meter Antenna, 2 lbs. **17.95***

Kit HWA-202-4, Fixed Station 2-Meter Antenna, 4 lbs. **15.95***

HW-202 SPECIFICATIONS — RECEIVER — Sensitivity: 12 dB SINAD* (or 15 dB of quieting) at .5μv or less. **Squelch threshold:** 3 μv or less. **Audio output:** 2 W at less than 10% total harmonic distortion (THD). **Operating frequency stability:** Better than ±.0015%. **Image rejection:** Greater than 55 dB. **Spurious rejection:** Greater than 60 dB. **IF rejection:** Greater than 75 dB. **First IF frequency:** 10.7 MHz ±2 kHz. **Second IF frequency:** 455 kHz (adjustable). **Receiver bandwidth:** 22 kHz nominal. **De-emphasis:** −6 dB per octave from 300 to 3000 Hz nominal. **Modulation acceptance:** 7.5 kHz minimum. **TRANSMITTER — Power output:** 10 watts minimum. **Spurious output:** Below −45 dB from carrier. **Stability:** Better than ±.0015%. **Oscillator frequency:** 6 MHz, approximately. **Multiplier factor:** X 24. **Modulation:** Phase, adjustable 0-7.5 kHz, with instantaneous limiting. **Duty cycle:** 100% with ∞ VSWR. **High VSWR shutdown:** None. **GENERAL — Speaker impedance:** 4 ohms. **Operating frequency range:** 143.9 to 148.3 MHz. **Current consumption: Receiver** (squelched): Less than 200 mA. Transmitter: Less than 2.2 amperes. **Operating temperature range:** −10° to 122° F (−30° to + 50° C). **Operating voltage range:** 12.6 to 16.0 VDC (13.8 VDC nominal). **Dimensions:** 2¾" H x 8¼" W x 9⅞" D.

*SINAD = $\frac{\text{Signal + noise + distortion}}{\text{Noise + distortion}}$

...and here!

NEW Heathkit
2-Meter Amplifier for cleaner
FM copy on the fringe... 69.95*

40 watts nominal out for 10 watts in — *requires only 12 VDC supply.*

Fully automatic operation — *with any 2-meter exciter delivering 5-15 watts drive.*

Solid-state design — *all components mount on single board for fast, easy assembly.*

If you're regularly working from a fringe area, the new Heathkit HA-202 can boost your mobile output to 40 watts (nominal), while pulling a meager 7 amps from your car's 12-volt battery.

Install it anywhere...in the trunk, under the hood or dashboard. Use it with any 2-meter exciter delivering 5-15 watts drive. Features fully automatic operation. An internal relay automatically switches the antenna from transmit to receiver mode when you release the mike button.

All solid-state design features rugged, emitter-ballasted transistors, combined with a highly efficient heat sink, permitting high VSWR loads. Tuned input-output circuits offer low spurious output to cover the 1.5 MHz segment of the 2-meter band without periodic readjustment. All components mount on a single printed circuit board for easy, 4-hour assembly. Manual shows exact alignment procedures using either a VOM or VTVM. And installation is just as simple.

Kit includes transceiver connecting cable, antenna connector. Operates from any 12 VDC system — additional power supplies are not required. Add HA-202 power to your mobile 2-meter rig, and boom out of the fringe. **Kit HA-202,** 4 lbs.

HA-202 SPECIFICATIONS — Frequency range: 143-149 MHz. **Power output:** 20W @ 5 W in, 30W @ 7.5W in, 40W @ 10 W in, 50W @ 15 W in. **Power input (rf drive):** 5 to 15W. **Input/output impedance:** 50 ohms, nominal. **Input VSWR:** 1.5:1 max. **Load VSWR:** 3:1 max. **Power supply requirements:** 12 to 16 VDC, 7 amps max. **Operating temperature range:** −30° F. to +140° F. **Dimensions:** 3″ H x 4¼″ W x 5½″ D.

...and here!

New Heathkit
VHF Wattmeter/SWR Bridge . . . 29.95*

Perfect tune-up tool for your 2-meter gear. Tests transmitter output in power ranges of 1 to 25 watts and 10 to 250 watts ±10% of full scale. 50 ohm nominal impedance permits placement in transmission line permanently with little or no loss. Built-in SWR bridge for tuning 2-meter antenna for proper match, has less than 10-watt sensitivity. **Kit HM-2102,** 4 lbs.

HM-2102 SPECIFICATIONS — Frequency range: 50 MHz to 160 MHz. **Wattmeter accuracy:** ±10% of full-scale reading.* **Power capability:** To 250 W. **SWR sensitivity:** less than 10 W. **Impedance:** 50 ohms nominal. **SWR bridge:** Continuous to 250 W. **Connectors:** UHF type SO-239. **Dimensions:** 5¼″ W, 5⅛″ H and 6½″ D, assembled as one unit.
*Using a 50 Ω noninductive load.

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The new transceiver has premium type glass epoxy printed circuit board construction for greater reliability, routine maintenance and features the latest state-of-the-art solid state devices throughout. The All-American made radio, priced at only $595, is also equipped with a unique integrated circuit speech compressor design for extended "talk power" plus many other built-in features—all good reasons why you should be talking with a Hallicrafters.

For additional data see your Hallicrafters distributor or write or phone:

The Hallicrafters Co., 600 Hicks Road, Rolling Meadows, Ill., 60008 U.S.A.
Phone: 312/259-9600

You should be talking with a Hallicrafters.

MAY, 1973 VOL. 29, NO. 5

The Radio Amateur's Journal

FEATURES

DEPARTMENTS

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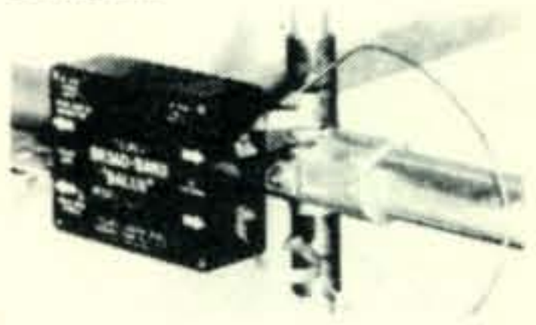

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ZERO BIAS

The recent resolution adopted by the ARRL Board of Directors (*QST*, March 1973, page 11) comes as no surprise in view of recent reports of basic philosophical differences between ARRL and the FCC.

While we understand ARRL's concern with what appears to be a tightening-up of amateur rules and regulations, and while we share the Board's concern that the denial "of traditional latitudes and freedoms" may well alter the future course of amateur radio, we lament the apparent breakdown of communications between these two bodies.

We feel that the League's hackles are up because FCC has begun to act independently of ARRL opinion. Rightly so. ARRL should be upset, as should all amateurs. But before we jump on the anti-FCC bandwagon, let's look at the situation from a different viewpoint.

Perhaps it became necessary for FCC to take the initiative in amateur regulatory matters because ARRL had failed to communicate its thoughts to FCC with sufficient vigor. Perhaps ARRL failed in its prime responsibility to represent amateur radio. Perhaps ARRL failed to exercise all its options before certain proposals became law. Perhaps FCC is not the only villain.

Instead of looking for a villain, however, maybe we should direct our efforts at rectifying the existing situation and preventing its recurrence. It is our opinion that the way to future growth in amateur radio lies not in bitter resolutions which look back in time, but in an attitude of concilliation and understanding which can only come through frank and open-minded communications between the League and FCC.

Dial-A-Prop

A number of Dial-A-Prop users have inquired about why we have not instituted a Toll-Free (800) telephone number for our propagation prediction service. The answer is, simply, cost. To provide WATS-line service on a nationwide basis would cost just under $2000 per month - a figure we just can't manage. If, at some time in the future, we see the willingness of some thousand or so amateurs to subscribe to such a service at, let's say $30 per year, then it would become possible, but for now, readers must be content with dialing 516 883-6223 at their own expense.

Individual Responsibility

Response to our editorials in February and March *CQ* has been very heavy and almost universally good, but few points have arisen which deserve comment and consideration.

Several readers noted that while we urged amateurs not to sell amateur equipment to non-amateurs, the same issue of *CQ* (March) carried ads from dealers selling equipment - mail order - which covered the 11-meter band. Such equipment, it was felt, was of interest only to CBers, and thus we were adding to the problem we wished to see solved.

Yes and no. Certainly, the fact that certain older amateur transmitters cover 11-meters is of interest to no U.S. amateur or CBer for legitimate reasons. Anyone in the U.S. buying such equipment because it covers 11 is up to no good. On the other hand, such gear is still of great value to the honest amateur looking for a bargain in a c.w. transmitter. So to refuse such advertising because the gear covers 11 is unfair to amateur and seller alike.

The burden of responsibility here lies with the seller, who must be sure of his customer's intended use of the equipment and legal right to use it. We will, however, do whatever we can to discourage advertising which clearly entices illegal application of equipment on any frequency by immature and irresponsible users.

This brings up the matter of amplifiers rated at over the legal limit and advertised to the amateur. It really could be quite a dilemma, but think about the case of the car dealer selling an auto capable of travelling 125 m.p.h. when the legal limit may be 60. Should the dealer or manufacturer be restrained from producing or selling a machine that - if misused - can break the law? Or does the responsibility lie with the user to excercise good judgement and adhere to the law? We opt for the latter.

When the need for personal responsibility for one's actions and integrity is legislated away, we are reduced to un-thinking, unfeeling robots. That day may come, but let's not hurry it's arrival. 73, Dick, K2MGA

CW or RTTY, whichever way you go,

HAL HAS TOP QUALITY YOU CAN AFFORD!

TOP QUALITY RTTY...WITH THE HAL MAINLINE ST-6 TU. Only 7 HAL circuit boards (drilled G10 glass) for all features, plug-in IC sockets, and custom Thordarson transformer for both supplies, 115/230 V, 50-60 Hz. Kit without cabinet, only $135.00; screened, punched cabinet with pre-drilled connector rails, $35.00; boards and complete manual, $19.50; wired and tested units, only $280.00 (with AK-1, $320.00).*

OTHER HAL PRODUCTS INCLUDE:

ID-1 Repeater Identifier (wired circuit board)	$ 75.00*
ID-1 (completely assembled in 1½" rack cabinet)	$115.00*
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TOP QUALITY...WITH THE HAL 1550 ELECTRONIC KEYER. Designed for easy operation; perfectly timed CW with optional automatic ID for sending call letters, great for DX and RTTY; TTL circuitry, transistor switching for grid block, cathode keying. Handsome rugged crackle cabinet with brushed aluminum panel. With ID, only $90.00; without ID, $65.00.*

TOP QUALITY... WITH THE HAL MKB-1 MORSE KEYBOARD. As easy as typing a letter—you get automatic CW with variable speed and weight, internal audio oscillator with volume and tone controls, internal speaker, and audio output jack. Smooth operation; completely solid-state, TTL circuitry using G10 glass boards, regulated power supplies, and high voltage transistor switch. Optional automatic ID available. Assembled MKB-1, $275.00. In kit form, $175.00. *

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TOP QUALITY...WITH THE HAL RKB-1 TTY KEYBOARD. Gives you typewriter-easy operation with automatic letter/number shift at four speeds (60, 66, 75, and 100 WPM). Use with RVD-1002 video display system, or insert in loop of any teleprinter, for fast and easy RTTY. Completely solid state, TTL circuitry using G10 glass boards, regulated power supplies, and transistor loop switch.
RKB-1 assembled, only $275.00.*

HAL provides a complete line of components, semi-conductors, and IC's to fill practically any construction need. Send 24¢ to cover postage for catalog with info and photos on all HAL products available.

*Above prices do not include shipping costs. Please add 75¢ on parts orders, $2.00 on larger kits. Shipping via UPS whenever possible; therefore, street address required.

HAL COMMUNICATIONS CORP., Box 365 C, Urbana, Illinois 61801

OUR READERS SAY

10 - Meter Sliders

Editor, *CQ:*

I have read your editorial, Zero Bias, in the February issue of *CQ*. I wish to commend you for the constructive approach you have taken regarding the ARS and the FCC. With the "call to arms" and other movements being taken by others, I hope *CQ* can be a stabilizing influence with the ARS fraternity.

There is no question that serious problems have arisen between the ARS and the FCC. So far, the only visible action on the part of the organization that claims to represent the ARS is an emotional attack on the FCC. The problems that have developed between the ARS and the FCC can only be resolved by working out a meaningful request for relief which is backed up with facts. Until this approach is taken, I am afraid the emotional outburst will continue and make it more difficult to resolve the problem.

I hope *CQ* will continue to provide the stabilizing influence that is so badly needed to prevent the present dispute from flaring into a major conflict. The ARS should be guided into devoting its efforts into areas such as preparation for the next WARC and a satellite program that will put the ARS in its proper place in the space age. The only groups that seem to display any interest in the future of the ARS are outside of the recognized organization. Until the recognized organization recognizes its responsibilities to the ARS, I am afraid outsiders will be forced to provide direction for the ARS. I believe *CQ* enjoys the respect of the ARS and can play a major role in providing intelligent guidance that will be so badly needed if the call to arms leads to a major war.

I urge you to continue your efforts to inform the ARS in a constructive manner. More factual editorials such as Zero Bias in February *CQ* can be very effective in pointing out why the ARS is in conflict with the FCC.

Bill Eitel, WA7LRU/W6UF
Dayton, Arizona

Editor, *CQ:*

The problem of sliders has been inevitable given the band allocations, respective band use, and above all the strange lack of FCC cooperation.

I think there are several answers. The best one could have been the FCC. Prose Walker is using his personnel to harass repeaters while jammers and sliders operate with impunity.

There have been successful instances of a group of hams RDFing an errant CB'er or bootlegger and pointing out the effects of unlicensed r.f. on the human body.

Another way is c.w. Often a pair of amateurs using 500 cycle receiver passbands can QSO right on the slider's frequency with little interference. Also, on c.w. you can be reasonably confident you are working a genuine ham.

In every organized system, order and discipline must come from somewhere. The best situation is when the legal authority operates with wisdom and intelligence. When the legal authority does not serve, another source must provide order and discipline or the system will disintegrate.

We are up against a serious problem of which the sliders are only a part. I am a federal officer and I'm astonished at the malevolent way the FCC is enforcing Part 97. In my own law enforcement work, the first rule is that we bear down hard on violators who do the most damage to the system we protect and go easy on the purely procedural and petty ones. The FCC apparently has enough manpower to choke off the most exciting field of amateur pioneering on the horizon today, but it rarely responds to complaints of jamming, bootlegging, excessively broad and powerful signals or obscenity.

The FCC's behavior is caused by two factors. The first is that the EIA includes among its lobbying efforts one to moderate CB enforcement. They don't want a vigorous FCC to slow sales of CB equipment – and illegal equipment is the most profitable of all. The second is the natural inclination of field engineers to be treated with courtesy and respect. The average field engineer who visits an illegal CB'er is loudly advised on autosexual practices; when the same engineer visits a ham he is usually told, politely, that the illegal condition will be corrected at once. So the engineer makes more cases (and looks better) with less effort by contacting us.

We must influence the Commission to return to minimum regulation and firm enforcement of serious violations. There are several ways. One might be use of the Freedom of Information Act to compel the Commission to show the number of citations issued to each service for each major category of violation, and to show the record of complaints and resulting actions. Where the enforcement actions are disproportionate to the obvious problems the full glare of publicity will nudge the Commission in the direction of true law enforcement.

Ham radio can return to health and vigor all across the spectrum.

Marty Barrack, WB6MFA
Huntington Beach, California

Equipment Donations

Editor, *CQ:*

This letter is in reply to the letter from WA2-NYE in your February issue concerning club requests for donated equipment to get on the air.

Under similar circumstances as told by Robin, we started an Amateur Radio club during my senior year at Bradford Area High School. But certain circumstances forbid such "great success" in selling for profit in our school.

At the time we attempted our fund-raising project, the following clubs were also selling during school hours: Chess Club, Yearbook, Majorettes, Drill Team, Rifle Club, 3 Choirs, and the Band. Against such great odds, we made a total of about $20 in five weeks of sales.

My purpose in writing this letter is not to weep about our bad luck, but to ask that our fellow amateurs realize that sometimes a donation is a

last attempt and should not be put down as blatantly being "greedy." With all the unused equipment that is not on the air, it shouldn't be a strain on our total ham population.

I have placed an appeal ad in *CQ* and will continue to do so if I think it will help my club get on the air.

Sanford L. Silverberg, WA3RVJ
Bradford, Pennsylvania

Announcements

Corrections

The following errors crept into the April issue of *CQ:*

Page 5 - Zero Bias - The word "nerve" was ommitted from the last line of the first paragraph.

Page 16 - Q & A - The second line of the "SB-200" question should read, "(SB-200). I drive it with a home-made ex-."

Page 50 - Fig. 1 - The junction between the 5K and 10K resistors should be grounded. Also, the portion of the drawing above the dashed line should be labeled "SB-102."

Page 61 - HW-7 Review - In fig. 1, *Q*4 should also feed *Q*1, the synchronous detector, and *Q*12 keys the sidetone oscillator as well as the driver.

Page 72 - Propagation - The area code shown for *CQ*'s Dial-A-Prop service should be 516, not 615.

WI9ANG

WI9ANG (WIsconsin 9 Air National Guard) will be on the air May 19 & 20. Special certificates will be issued to all stations worked. The operating schedule is: 7.280 mHz, +5 kHz 1300-2130 GMT, 14.310 mHz, +5 kHz 1330-2130 GMT. To obtain free certificate send QSL to WI9ANG, c/o WA9-DZL, 128th Air Refueling Group (TAC), General Mitchell ANG Base, Milwaukee, WI 53207.

Theft of Communications Equipment

The Muskegon area Amateur Radio Council reports the theft of the following equipment from their club station during the week of March 12. Electro-Voice 641 mic on Astatic GN Stand, Drake R4B No. 11578G, Drake T4XB No. 17801G, Drake W4 No. 8390, Swan 250 6m Transceiver No. F154806, Swan a.c. Power Supply No. 0653556. Any information regarding this equipment may be sent to the MAARC, P.O. Box 691, Muskegon, MI 49443 or WA8GVK. 616-722-3910 or 744-1400.

Royal Canadian Mounted Police Centennial

The Royal Canadian Mounted Police will be operating an amateur station at Ottawa to commemorate their 100th anniversary from May 23 to Aug. 30 from 1200 GMT to 0400 GMT daily on 80 through 2 meters, c.w., s.s.b. and f.m. A special call, VE3RCMP, has been issued. Commemorative QSL will be sent to all stations worked. Amateurs are invited to visit the station which will be located within a large centennial exhibit in the R.C.M.P. Training Center, on St. Laurent Blvd., Ottawa, Ontario.

Trenton, Tennessee

The Humboldt ARC will hold its annual Hamfest on Sunday, May 20, at Shady Acres City Park in Trenton, TN. Flea Market, prizes, ladies activities, and a playground. For info: Ed Holmes, W4IGW, 501 N. 18th Ave., Humboldt, TN 38343.

[*Continued on page 92*]

NAME YOUR ANTENNA...

MORE POWER, MORE FLEXIBILITY FOR THE Fixed Station...

Here are just a few

Five-Band Verticals
Model 18HT HY-TOWER 80 thru 10 Meters

- Outstanding omni-directional performance
- Automatic band switching
- Installs on 4 square feet of ground
- Completely self-supporting

Order No. 182 $199.95

Multi-Band Hy-Q Trap Verticals
Model 18AVT/WB 80 thru 10 Meters

- Wide band performance with one setting
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- SWR 2:1 or less at band edges

Order No. 386 $69.95

Model 12AVQ 10, 15, 20 Meters
Order No. 384 $29.95

Tribander Beams for 10, 15, 20 Meters
Model TH6DXX SUPER THUNDERBIRD DX

- Six elements; new Hy-Q traps
- Up to 9.5db forward gain
- 25db front-to-back ratio
- SWR less than 1.5:1 on all bands
- Takes maximum legal power

Order No. 389 $179.95

Model TH3Mk3 SUPER THUNDERBIRD

- Three elements
- Up to 8db forward gain

Order No. 388 $144.95

Model TH3JR THUNDERBIRD JUNIOR

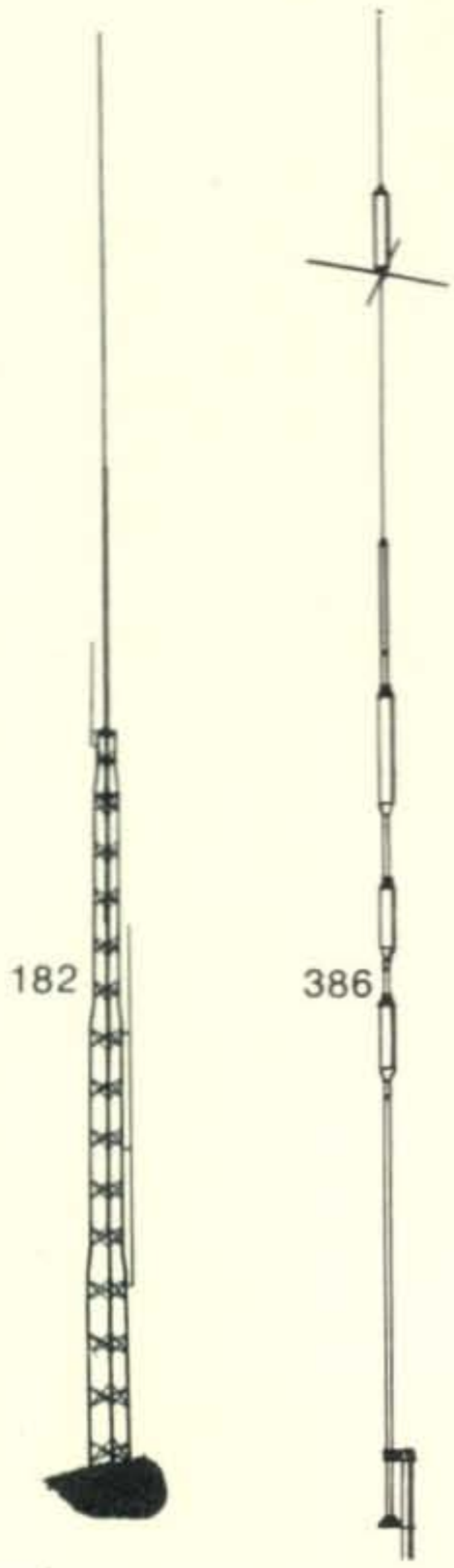
- Three elements
- Meets space problems
- Up to 8db forward gain

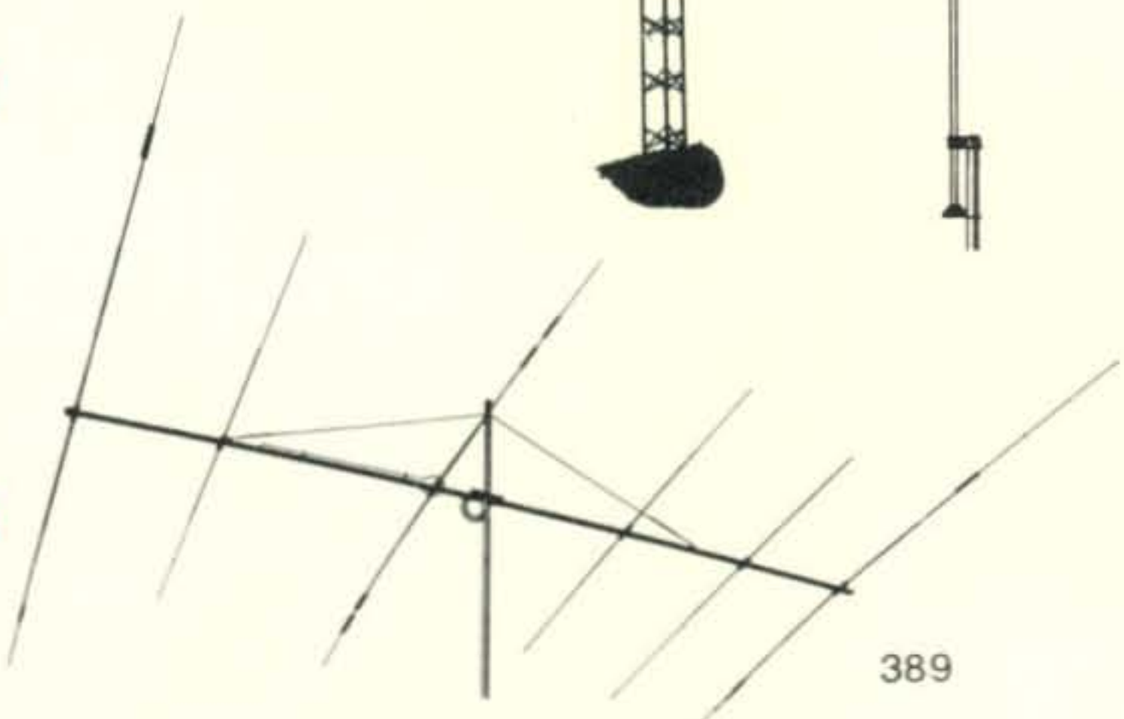
Order No. 221 $99.95

Model TH2Mk3 SUPER THUNDERBIRD

- Two elements
- Up to 5db forward gain

Order No. 390 $99.95





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Q AND A

BY CHARLES J. SCHAUERS,* W6QLV

THE time will surely come when trouble-shooting a transceiver will consist of looking at a few LED's (light-emitting diodes) that are a part of the "go-no-go" system of each module in the set.

It will work like this: any module that is not functioning properly will be indicated as "no-go" by an LED. You need merely pull out the module, ship it to the factory and receive a new one—no fuss nor muss.

Currently, for the fine set, the Yaesu FT-101 *if* you have determined that a specific module is defective, all you need do is to pull it out and send it to them and they will ship you a replacement module. This is progress!

Now how would the system work with LED's?

Well, the checking or "go-go" circuitry would consist of one or more IC's which would when properly driven keep the LED's in the off state. Should voltage or signals deteriorate below or above a given level, the LED's would come on for that particular module. Complicated? Sure! Expensive? Now, yes! But it can be done.

Imagine trouble-shooting by just looking for lights? Incredible but it will come in amateur gear, just wait and see!

Old Equipment

"Like many Novices, I am sure I'm no different when it comes to being 'suckered' in to buying old amateur equipment at a 'bargain.'

"The set I bought was a Viking Ranger transmitter and it had been checked out by a

---

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

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FEATURES:

- ☐ Adjustable C.O.R.
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- ☐ 19" Rack Panel Mounting.
- ☐ Size: 19"w x 5"h x 9"d.

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2M FM TRANSCEIVER SRC-146A

Solid state, 2 watt, 5 channel, hand held transceiver.

UHF version available

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Write for complete specifications.

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reputable dealer. It was a bargain at $50.00 so I took it.

"When I got my General class license and put the set on the air no one would talk to me, except on c.w. It seems that in order to be 'in' you must use s.s.b. So in order to be 'in' I traded the Ranger for an SB-34. Now I'm 'in'.

"I think *all* amateurs should be warned when they are contemplating buying used old gear, unless they have the advice of more experienced amateurs. What do you think?"

I agree with you. The guy at the counter of *any* dealer may be an amateur himself but he is also a salesman. If you are 18 or under I *think* it is his responsibility to tell you what you are getting and try to talk you into buying a new modern rig (on terms, perhaps). On the other hand, he may think that you know what you are doing and why should he take the time out to change your mind? The best advice is to seek out an experienced amateur to help you select the equipment you will need. There are still some good old used sets about—especially those with s.s.b. exciters; and if you don't have the money these can turn out to be real bargains for a start.

Relay Problem

"I have two relays with the same characteristics. Both take 6 volts for operation. They operate on d.c. Can I connect them in series for 12 volt operation for a circuit I am working on? They must operate simultaneously."

Yes, you can.

Power Drop-Off

"I have a Galaxy V. Recently I have noted a power drop-off on all bands. What do you suggest I check?"

The driver tube and the two final tubes. Remember, that in the V, the final tubes should be *matched*. If all tubes check ok then suspect your antenna system.

Eimac 8877

"I'm a guy who builds. All of my equipment including the receiver is homemade. Now I want to build a new linear. My current final is built around old surplus tubes and these are hard to get. Can you recommend a final tube for me that can be driven by 100 watts or so? I want the best.

Big order! But I'd suggest you use Eimac's 8877, it's a tube! Write Eimac Div. of Varian, 301 Industrial Way, San Carlos, California 94070 for full information. You'll be glad you did.

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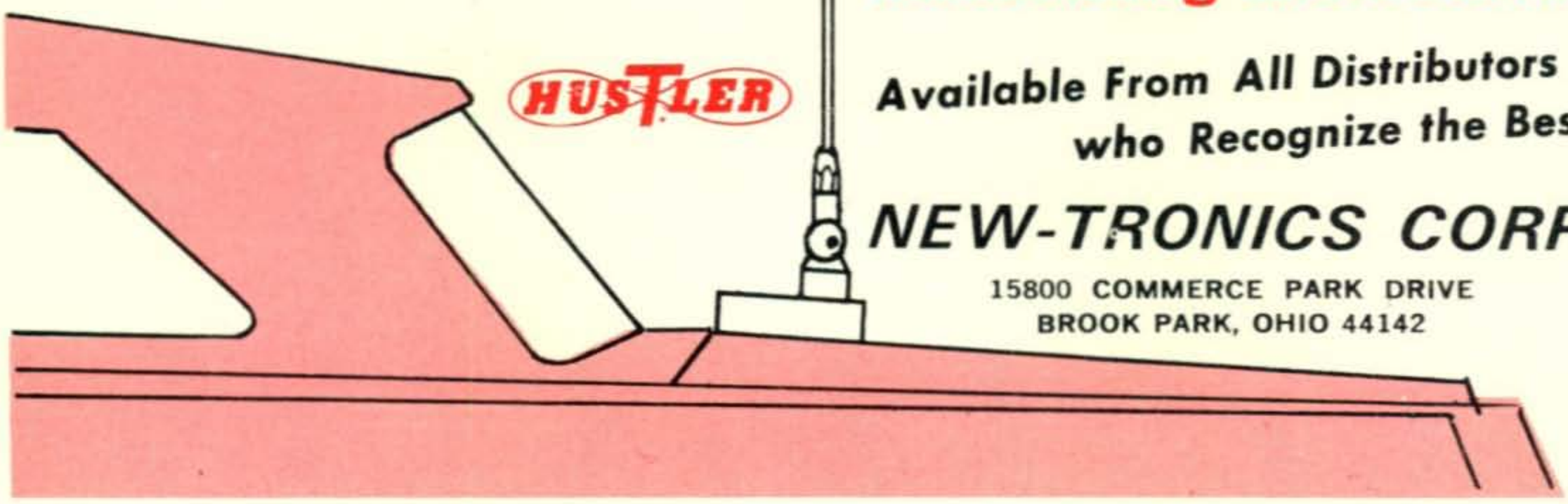
- ! SWR at resonance . . . typically 1.1:1
- ! Bandwidth . . . 7 MHz for 1.5:1 or better SWR
- ! Power Rating . . . 200 watts FM
- ! Height, including mount . . . 78″
- ! Radiator . . . 17-7 PH stainless steel
- ! Field adjustable for lowest SWR

CHOOSE FROM TWO VERSIONS

MODEL CGT-144 (illustrated) antenna complete with trunk lip mount for easy, no holes installation on side or edge of trunk lip. 180° swivel included for adjustment of antenna to absolute vertical. Supplied operational with 17′ MIL spec RG-58-U and PL-259 transceiver connector factory attached. Antenna is removable from mount. Shpg. Wt. 3.34 lbs. . . . **$37.95**

MODEL CG-144 — Antenna only with ⅜″-24 base to fit all standard mobile ball mounts. Shpg. Wt. 1.84 lbs. **$24.95**

give your mobile signal the big push! this large aperature, two meter antenna will create a new dimension in amateur mobile communications. —where action counts, get the decisive advantage of colinear power gain performance; transmitting and receiving



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Panoramic Adapter Connections

"What are the considerations involved in connecting up a pan-adapter to a receiver or transceiver?"

One of the problems with available pan-adapters is that they are usually designed to handle one specific piece of equipment, these units do not have built in circuitry for spectrum analysis (in most cases) to handle the analysis of transmitter signals.

The adapter used for receiving only must have an *input* i.f. system that matches that of the set to which it is connected. Adding frequency conversion units is not always practical if the i.f.s don't match.

Adapters do require a certain amount of drive and if you are using a transistorized receiver, you may find that the adapter won't work, even if the i.f. systems match.

Connecting an adapter to a transceiver can be very tricky because many transceivers contain stages which perform two functions, i.e., one in transmit and one in receive.

Those manufacturers who currently make and have made adapters are usually willing to furnish connection data for various sets.

If anyone has a Heath 620 Panadapter connected to a Drake TR-4, I would appreciate having the information.

Pattern Distortion

"I bought a second-hand scope and have been trying to use it to check on the output of my v.h.f. transmitter, however, the patterns are full of distortion. What I did was merely connect the vertical plates of the scope tube through a small capacitor to the final output. Any suggestions?"

Yes. Build up a small parallel resonant tuned circuit and place this in a metal mini-box. The tuned circuit must be resonant to your transmitter frequency. From this tuned circuit connect two pieces of small 52 ohm coax. Connect one of the cables to the vertical plates of the scope tube directly. On the end of the other cable construct a link which can be placed near the final coil of the transmitter. Using a grid-dip meter place it near the link and tune the resonant circuit to approximately the transmitter frequency. Remove the dip meter and then fire up the transmitter. Adjust the small parallel resonant tuned circuit for your pattern. If you still get some stray r.f. try grounding the mini-box and the scope *case*.

[*Continued on page 98*]

The Kenwood R-599 Receiver

IN ALL THE WORLD ...IT'S Unique

MOST AMATEURS HAVE NEVER OWNED A RECEIVER AS GOOD AS THE R-599

1st The R-599 is all Solid-State . . . no tubes to wear out and be replaced. Less heat so it is more stable and more reliable. Most owners report service free performance month after month, year after year.

2nd The R-599 is more versatile. It copies SSB, CW, AM and FM. And it copies them well. One half microvolt sensitivity on SSB means you hear any signal audible on any other receiver regardless of price.

3rd The R-599 has greater frequency range. All amateur bands 160 through 10 meters as supplied and including 6 and 2 meters with accessory self-contained converters.

4th The R-599 is part of a system. When operated with its companion T-599 transmitter you get full transceive operation.

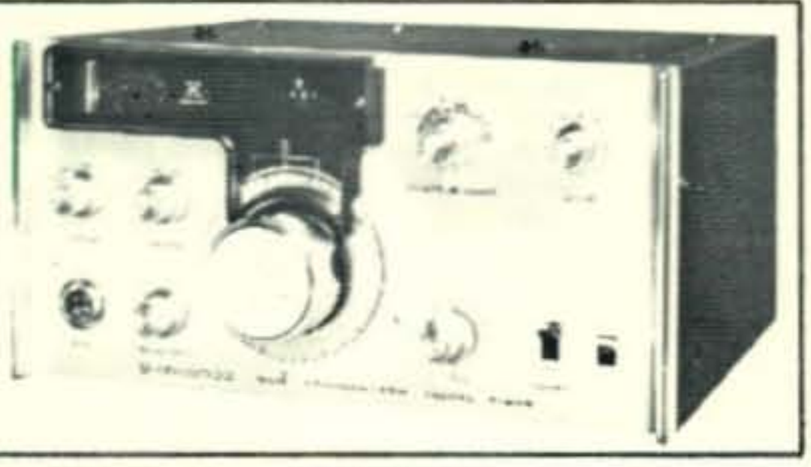
5th The R-599 literally screams value. Dollar for dollar you can't buy another receiver anywhere that will match the R-599.

6th The R-599 can be operated directly off your 12V battery . . . with very low drain. It is also an ideal novice receiver . . . having standard provisions for crystal controlling the T-599.

The Price . . . $349.00

The T-599 Transmitter: Clear, stable, selectable sideband, AM and CW • 4-way VFO flexibility plus Receiver Incremental Tuning (RIT) when used with the R-599 • Amplified ALC • Built-in VOX • Full metering, including cathode current, plate voltage, ALC and relative Power Output • Built-in CW Sidetone monitor and semi-automatic break-in CW • Built-in power supply • Maximum TVI protection • Employs only 3 vacuum tubes •

The price . . . $395.00



Another Kenwood value leader . . . the superb TS-511S Transceiver

Five bands, SSB and CW transceive. Built-in VOX, crystal calibrator, noise blanker, receiver incremental tuning, 1 KHz frequency readout, 8 pole filter, stable FET VFO, dual conversion and accessory CW filter. The price . . . $415.00.

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The R-530 is still the 0.5 to 30 MHz general coverage leader.

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- Has many features found only on military receivers costing over $3,000 yet is still priced less than $1,000.
- Phase-lock frequency conversion for exceptional stability and trouble-free operation.
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- Mounting versatility—table top or standard 19-inch rack.
- 117/230 VAC for fixed operation or 18 VDC batteries for portable field monitoring.

Write for our new R-530 brochure and compare it to the competition...
if you can find any.

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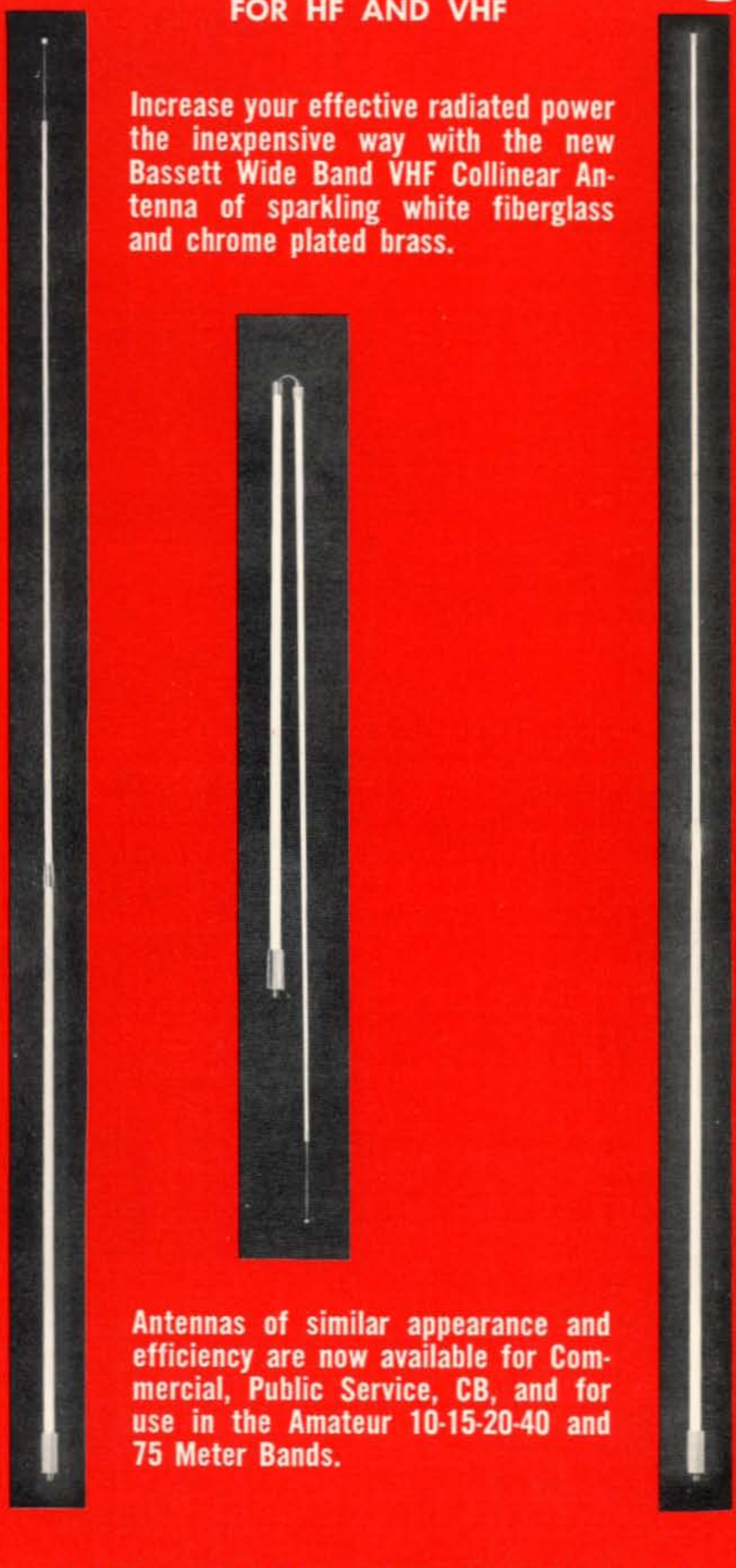

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10 watts output power nom.; accomodates 10 channels; rotatable frequency selector; adaptable for portable operation (with HamPak, below).

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Battery pack for GTX-10 portable operation. Uses 10 D cells (not included).

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(Includes portable antenna, carrying handle & mike clip)

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Additional Crystals for Xmit or receive

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Rugged, high riding mobiles. Ready to go where you go, take what you dish out...and deliver every bit of performance your rig is capable of.

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262

260 Commercial duty 1/4 wave, claw mounted roof top whip. Precision tunable to any discrete frequency 108 thru 470 MHz. 17-7 ph stainless steel whip.

261 Same as above. Furnished complete with 18' of coax and connector.

262 Rugged, magnetic mount whip. 108 thru 470 MHz. Great for temporary or semi-permanent no-hold installation. Holds secure to 100 mph. Complete with coax and connector. Base matching coil for 52 ohm match. 17-7 ph stainless steel whip.

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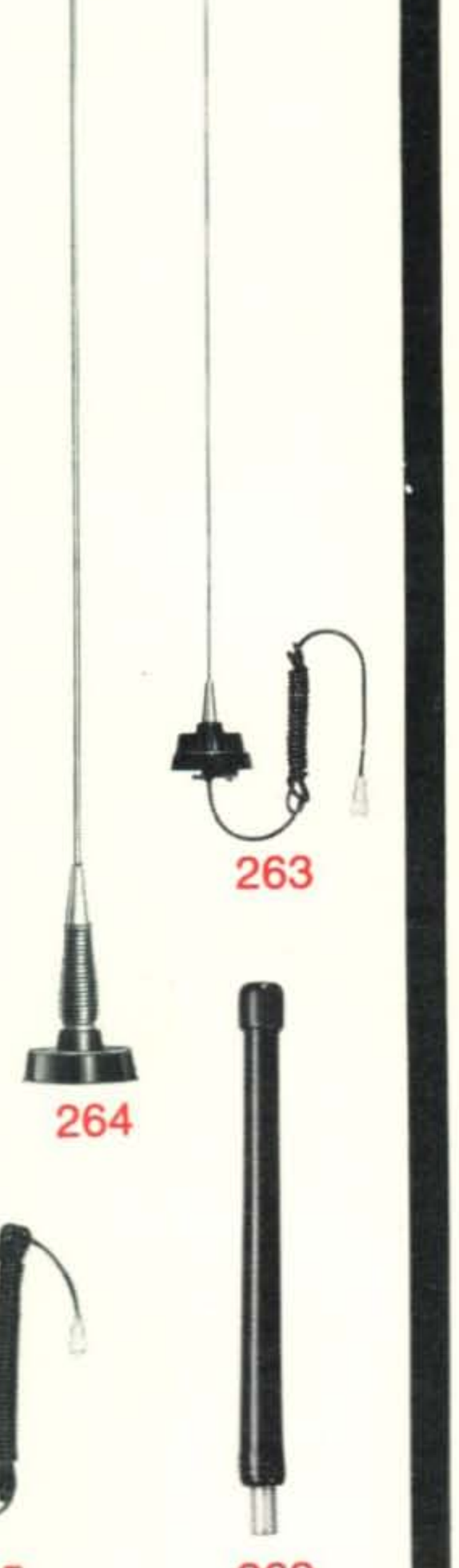

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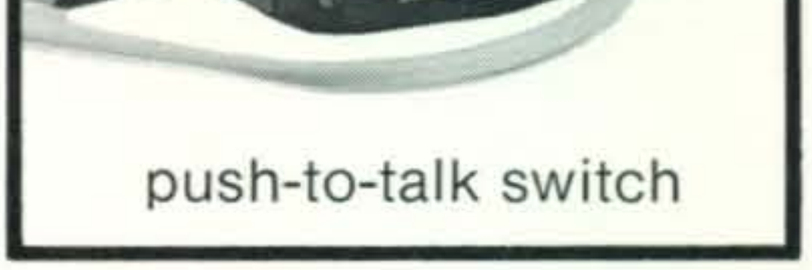

push-to-talk switch

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Another thought – a solid-state mobile installation can mean a savings of up to $140.00 when compared to the special A.C. power supplies that must be purchased for mobile use of conventional tube-type transceivers.

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HM-177
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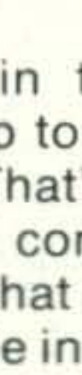
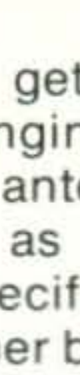
Features new high conductivity copper and nickel coated 17-7 PH stainless steel whip. Shunt fed coil encased in waterproof PVC jacket. All fittings chrome plated brass. Easy snap-in mounting. 3 dB gain.*



NEW! HM-223
1¼ Meters (220 MHz)
High performance ⅝ wavelength design for the new 220 MHz activity! Directly fed with low loss coil in new low-profile design. Spring and whip easily removable leaving only 1 3/16" high base for car wash clearance. 3 dB gain.*



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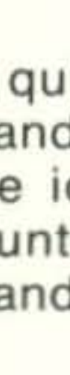

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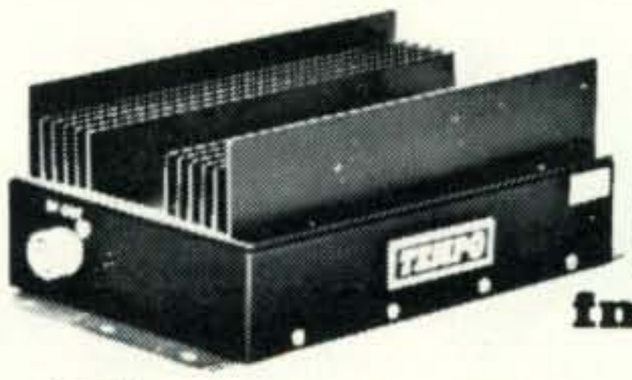

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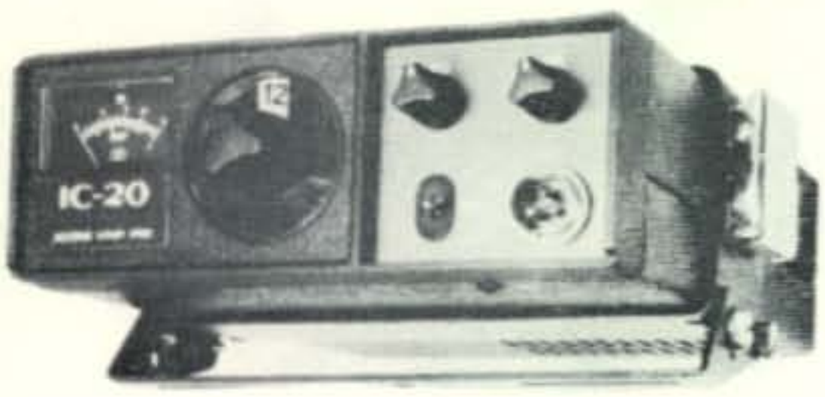

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The SS Mark 4

A High Performance SSTV Monitor Using Electrostatic Deflection

BY DAVID F. PLANT,* K9LAJ/2

THE SS Mark 4 project began last fall when Fil Galluppi of Venus Scientific retained our firm to do a study on the potential market of amateur SSTV. As part of this project, the author decided that the best way to learn about slow scan was to build a monitor, and out of this activity evolved the Mark 4.

The SS Mark 4 is an experimental model built by the author from various ham literature and does not represent the engineering advances later developed by Venus Scientific during their R & D program. The Mark 4 does, however, produce a picture as good as the other gear available today. And considering the simplicity of construction, it makes an excellent homebrew monitor.

The main difference between this monitor and the commercially available equipment is that a much smaller screen size is used. This came about from several experiments which showed that display sizes greater than 3 inches or so didn't give as good an apparent picture because the human eye couldn't integrate the horizontal lines. These tests were conducted at viewing distances of 18 inches under actual operating conditions.

Circuit Description

Looking at fig. 1, a slow scan signal from a communications receiver or other source is selected by S_1 and fed to U_1, an Op amp set up to give full limiting with input levels over 100 millivolts. Back to back silicon diodes protect the input from excessive drive.

A saturated output of approximately 25 volts peak-to-peak is produced by U_1 and this square wave signal is fed into Video Detector tuned circuit L_1-C_1. Out of this network comes amplitude modulation (video composite) corresponding to the SSTV frequency modulation. (A similar technique is used when f.m. is copied on an a.m. receiver via slope tuning.) The a.m. signal is amplified by Q_1, stepped up by T_1, rectified by D_1-D_4, and fed into the grid of a CRT providing intensity

The author compares the compact SS Mark 4 slow scan TV monitor with a standard 5" electrostatic deflection CRT.

*c/o Plant and Plant Associates, 25 5th Ave., New York, N.Y. 10003

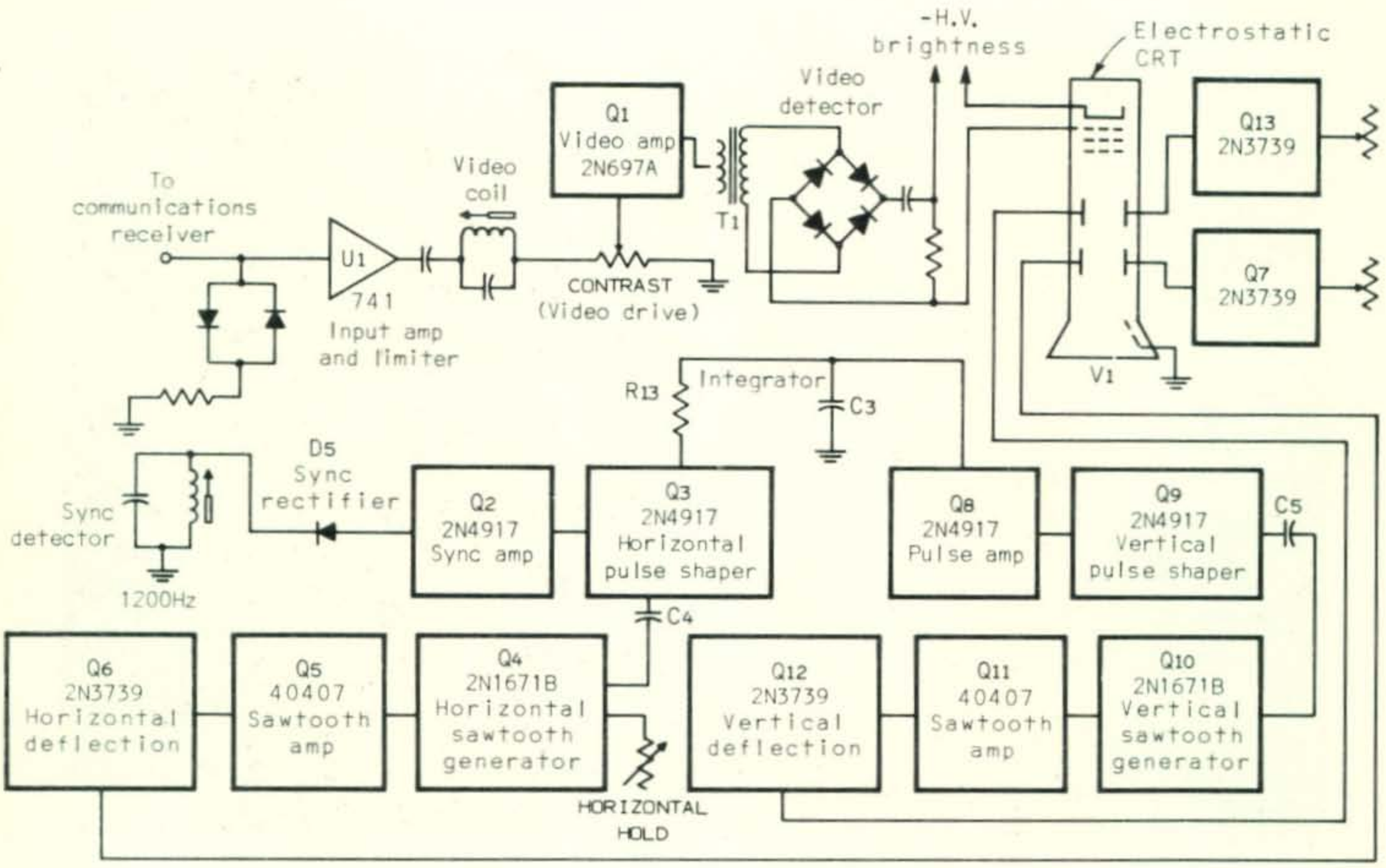


Fig. 1—Block diagram of the SS Mark 4 slow scan TV monitor.

modulation of the moving electron beam. It is the intensity (Z axis) modulation that provides the black, shades of gray, and white (green) seen on a viewed picture.

The output of the Video Detector also feeds the Sync Detector, L_2-C_2, a parallel tuned network tuned to the sync frequency of 1200 Hz. This output is rectified by D_5 and is amplified by Q_2 which drives Pulse Shaper Q_3, providing a high rise time pulse which is capacitively coupled to the B_2 leg of the Horizontal Oscillator unijunction Q_4 to provide horizontal sync.

Horizontal Pulse Shaper Q_3 also feeds an integrator network R_{13}-C_3 which ignores the 5 millisecond horizontal pulses but sees the 30 millisecond vertical pulses. These vertical pulses are amplified by Q_8, shaped by Q_9 and fed via C_5 to the B_2 leg of Q_{10}, the Vertical Oscillator unijunction.

The necessary saw-tooth wave forms to provide vertical and horizontal sweep are provided by free-running unijunction oscillators (Q_4 and Q_{10}) which are synchronized by pulses from their respective sync circuits.

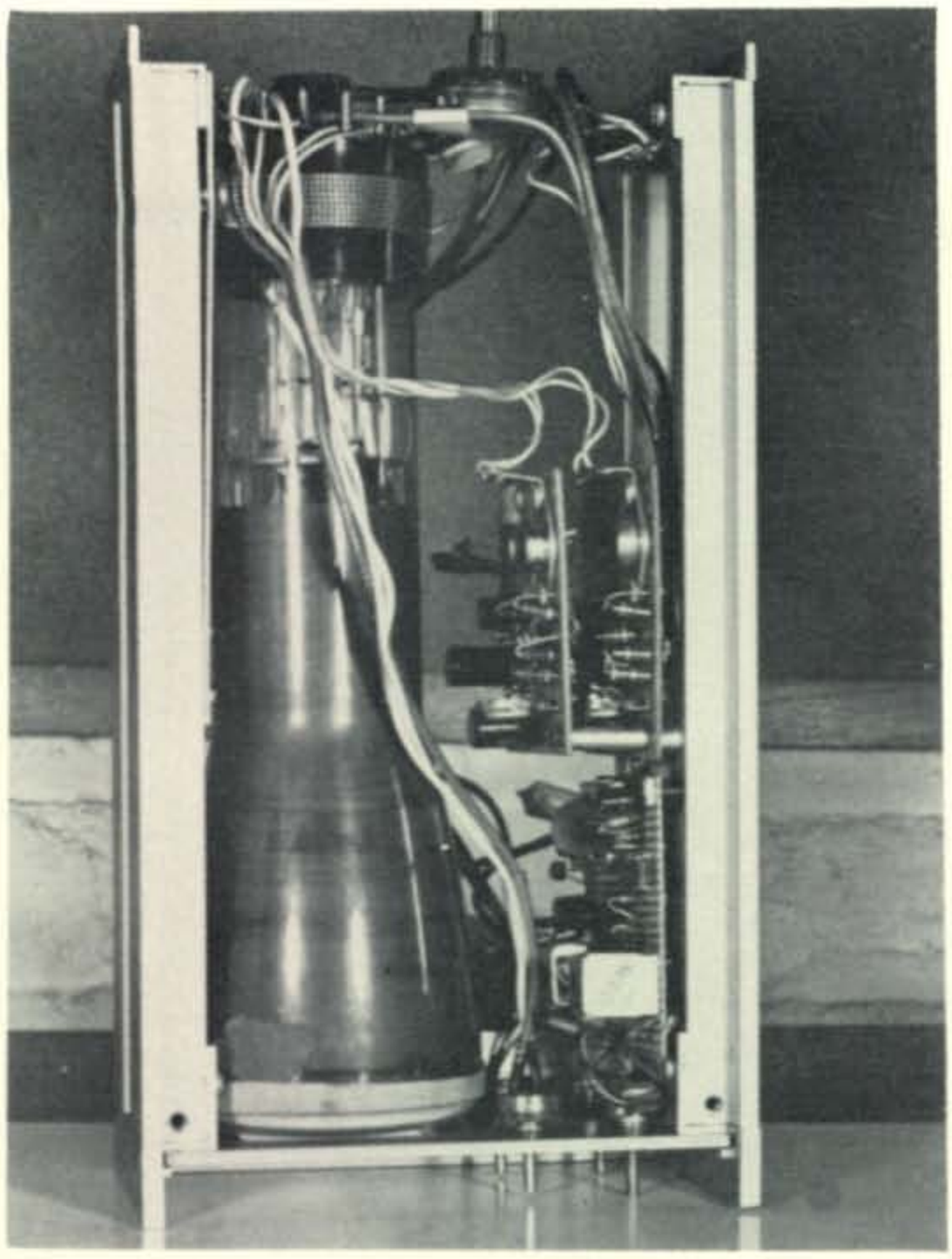
Linearity of the unijunction saw-tooth wave form is provided by feeding the timing capacitors (C_6 and C_6) from the 300 v. supply, thus giving the same effect as a constant current source. This method saves two additional transistors and their associated components.

The saw-tooth output of each of the unijunctions is buffered and fed to a differential amplifier consisting of a pair of high voltage transistors (Q_6-Q_7, Q_{12}-Q_{13}) which control the electrostatic deflection plates of the CRT. These deflection plates provide the horizontal and vertical movement of the electron beam on the face of the CRT.

Electrostatic Versus Magnetic Deflection

Electrostatic deflection was chosen with the Mark 4 because the author felt the lower anode voltage requirements of electrostatic tubes (1-2 kv vs. 6-12 kv for magnetic) would simplify construction and also, elimination of the yoke required for magnetic deflection would save both money and physical space within the monitor. Electrostatic deflection is also easier to design because all that is needed is an oscilloscope circuit suggested by a CRT manufacturer and two pairs of differential transistors to control the deflection plates. The system is, for all practical purposes, automatically linear and balanced.

Electrostatic tubes also seem more common (hence, less expensive) especially in the smaller sizes due to their popularity in test equipment. Their main drawback seems to be a greater sensitivity to stray magnetic fields In the Mark 4 the problem was easily solved by putting the power supply in a separate box. For those who want the power supply in the



Top view of the monitor showing placement of the CRT and the three circuit boards. The control at the rear (top) is the Focus control R_{12}.

monitor, Mu metal CRT shields are available. A complete line of CRT shields is available from the James Millen Mfg. Co., Malden, Mass.

The other apparent drawback to electrostatic deflection tubes is that their construction doesn't allow anode voltages higher than 2 kv typically; hence, the trace line on the screen doesn't look as bright as magnetic tubes running at 6 kv or more. However, SSTV is based on phosphor afterglow, not trace line brilliance and the author found that it took at least 5 kv more to yield a perceptable increase in afterglow.

CRT Selection

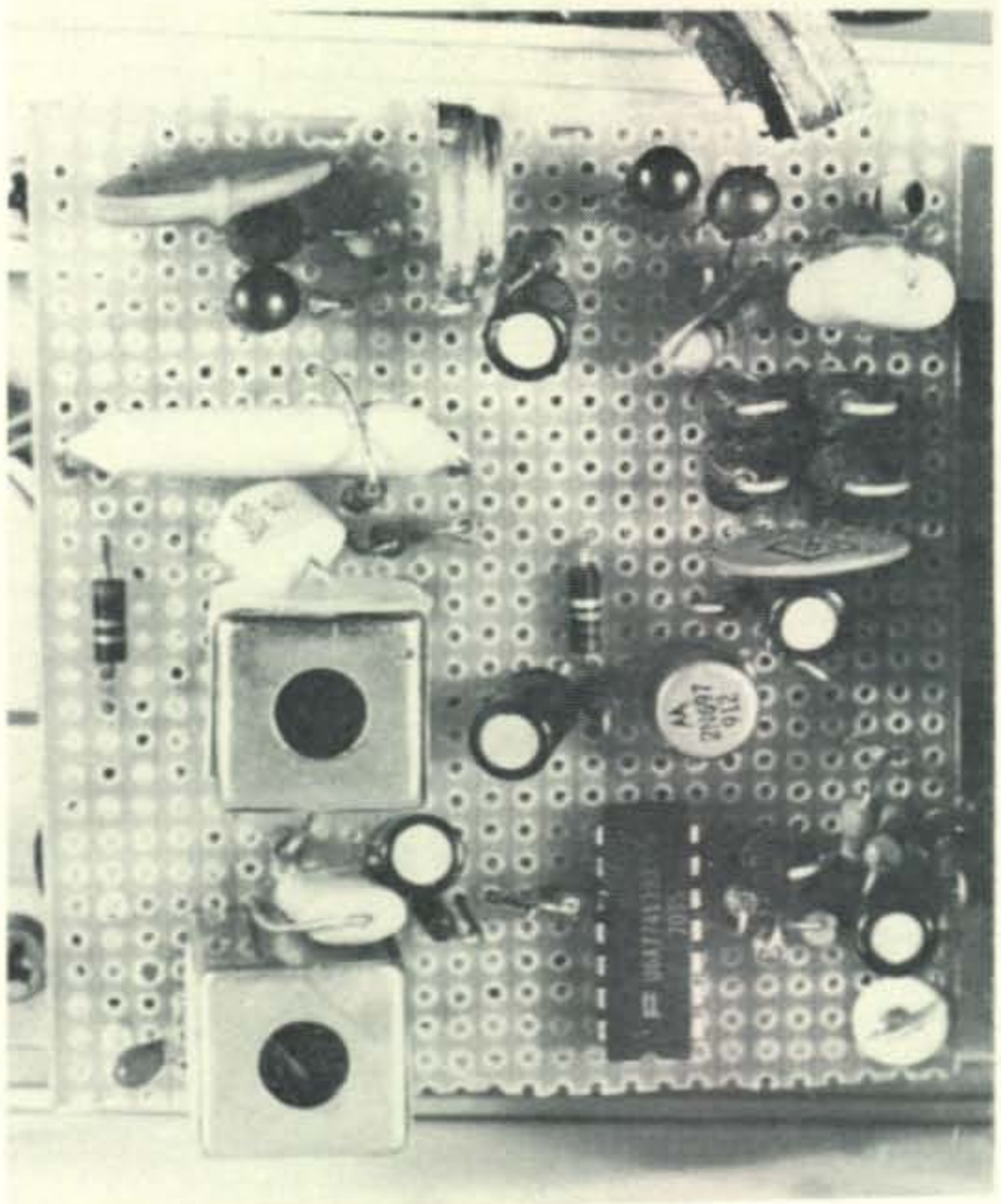
The author chose a 3JP7 for his model because of its current surplus availability.[1] Other tubes including 5UP7 and 3RP7 have also been successfully used with this circuit; however, it was found that a 5 inch tube was oversized for what the author considered the ideal display size. In the author's opinion a raster of 2×2 to 3×3 seemed the best size because a larger raster gave too much apparent line structure. The smaller size raster also gives an apparently brighter picture display as there is more electron activity on a smaller screen size.

Another thing that was observed was that all P7 phosphors are not alike and some seem to have a greater afterglow than others, possibly because in the manufacturing process more phosphor was used, or less . . . or something!

By the way, the smaller 3-inch CRT allows a greatly reduced monitor to be built because a 3-inch CRT tube length is 10 inches typically and a 5-inch tube such as the 5UP7 is 15 inches long; quite a price to pay for an extra inch or so of picture size, especially if it isn't needed.

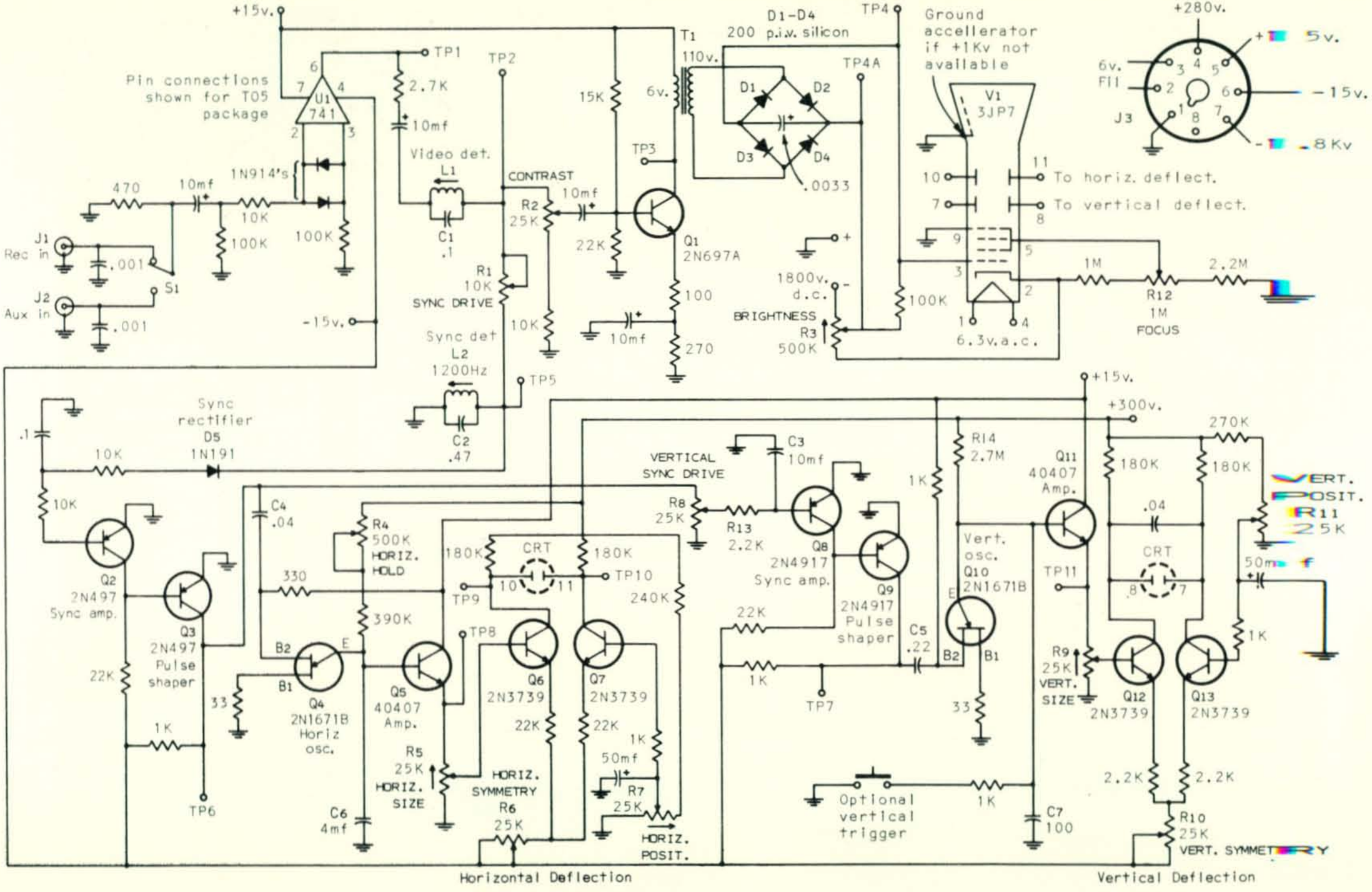
Mechanical Construction

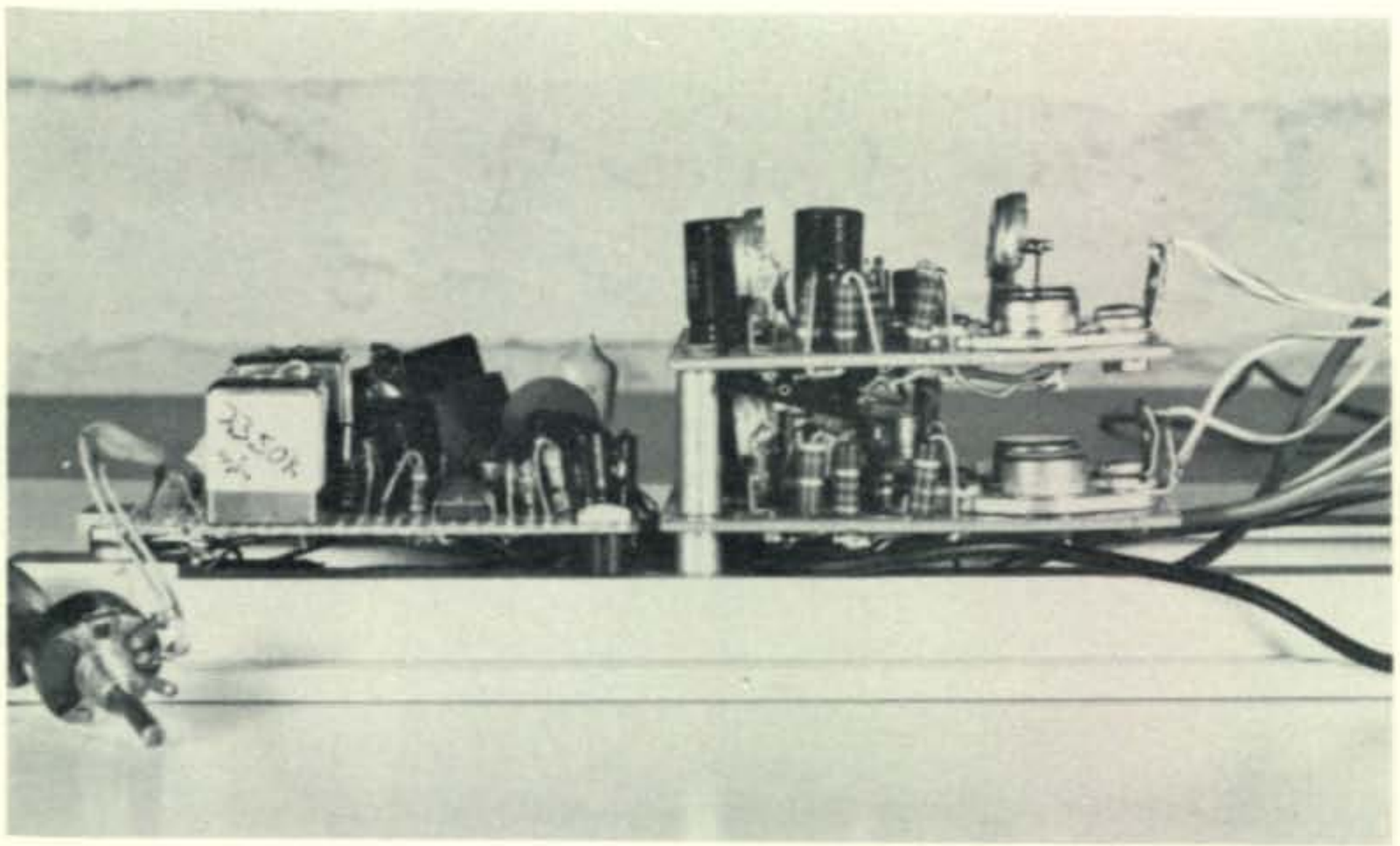
The monitor was built into a cabinet measuring 5¾ × 3½ × 13 inches deep, which is model 3501 manufactured by Buckeye Stamping Company, Columbus, Ohio 43207. If this case is used, milling of the top and bottom front braces will be required to fit a 3-inch CRT. This is not a big job and the result is a very professional appearing unit. The author also cut two inches from the rear of the case so the enclosure was compatible with the depth of other communications equipment.



Close-up of the limiter and synch detector board CB1. At the lower right is U_1, the input limiter, above which is the video amplifier stage Q_1. Across the top are the horizontal and vertical sync stages. The two shield cans house L_1 and L_2.

[1] Available from Barry Electronics, 512 Broadway, New York, N.Y. 10012


+15v.
Pin connections shown for TO5 package
U1 741
TP1
2.7K
10mf
Video det.
L1
C1 .1
CONTRAST
R2 25K
10mf
TP2
TP3
15K
6v.
T1 110v.
D1-D4 200 p.i.v. silicon
D1
D2
D3
D4
.0033
TP4
TP4A
Ground accelerator if +1Kv not available
V1 3JP7
+280v.
+ 5v.
6v. Fil
J3
- 15v.
- 8 Kv
To horiz. deflect.
To vertical deflect.
1N914's
470
10mf
10K
100K
100K
J1 Rec in
J2 Aux in
.001
.001
S1
-15v.
22K
Q1 2N697A
100
270
10mf
1800v. d.c.
BRIGHTNESS R3 500K
100K
1M
2.2M
R12 1M FOCUS
6.3v.a.c.
R1 10K SYNC DRIVE
10K
Sync det L2 1200Hz
C2 .47
TP5
Sync rectifier D5 1N191
.1
10K
10K
Q2 2N497 Sync amp.
Q3 2N497 Pulse shaper
22K
1K
TP6
33
C4 .04
330
R4 500K HORIZ. HOLD
390K
B2
B1
E
Q4 2N1671B Horiz osc.
Q5 40407 Amp.
C6 4mf
R5 25K HORIZ. SIZE
HORIZ. SYMMETRY R6 25K
TP8
TP9
180K
CRT
180K
10
11
TP10
240K
Q6 2N3739
Q7 2N3739
22K
22K
1K
50mf
R7 25K
HORIZ. POSIT.
Horizontal Deflection
+15v.
+300v.
VERTICAL SYNC DRIVE
R8 25K
R13 2.2K
C3 10mf
Q8 2N4917 Sync amp.
Q9 2N4917 Pulse shaper
22K
1K
TP7
C5 .22
R14 2.7M
1K
Vert. osc. Q10 2N1671B
E
B2
B1
33
TP11
Q11 40407 Amp.
Optional vertical trigger
1K
C7 100
180K
180K
.04
CRT
8
7
270K
180K
180K
VERT. POSIT. R11 25K
50mf
1K
R9 25K VERT. SIZE
Q12 2N3739
Q13 2N3739
2.2K
2.2K
R10 25K VERT. SYMMETRY
Vertical Deflection



View of the right side of the monitor showing the three circuit boards which contain most of the wiring. When assembled, the Horizontal Hold and Contrast controls at the left are mounted to the front panel.

As is shown in the pictures the CRT is mounted with front and rear strapping to the left side of the enclosure. On the right wall of the enclosure are mounted the three circuit boards containing the electronics and mounted between the CRT and the circuit boards is transformer T_1.

The front panel of the enclosure has four ¼-inch mounting holes for the front panel controls and a 2-inch-square cut-out for the CRT display. The author recommends that this cut-out be done on a milling machine by a machinest, for an attractive appearance.

The rear panel has provisions for the two input jacks J_1 and J_2, and power jack J_3, which is an octal male socket (J_3 can be eliminated by running a cable out the rear of the monitor through a grommet). Also mounted on the rear panel is R_{12}, the focus pot.

In this model the various connections were soldered directly to tthe pins of the CRT as sockets are very space consuming and the life of a CRT is usually quite long.

Electronic Assembly

For ease of assembly and testing, the SS Mark 4 electronics are built on three circuit boards. Circuit Board 1 has the input limiter stage, sync stages and video stage, and Circuit Boards 2 and 3 have the horizontal and vertical sweep and deflection circuitry respectively.

The photographs show the layout of the wiring on the various PC boards. Wiring is straight forward and, as only audio frequency signals are present, only a minimum of precaution is necessary.

A note of caution: The cathode and the G_1 grid of the CRT are operated at a potential of 1800 volts negative and high voltage wiring should be used in these areas. It is also recommended that the brightness control pot be insulated from the panel as this control also has minus 1800 v. The author found this step was not necessary provided anode voltage did not exceed 2 kv, but as a safety precaution and to prevent arcing, this might be explored. The author used shrink tubing over all high voltage leads where they terminated at the brightness control and at the focus control to add a measure of protection from high voltage arcing.

Testing and Alignment

Testing and alignment of this project will require an oscilloscope, v.t.v.m., and audio signal generator. Do not apply high voltage until all vertical, horizontal, and video drive circuits have been tested to prevent accidental burning of the CRT phosphor, and contact with the high voltage.

Readings on the author's model were taken with a Tektronics 532 scope and a Heath VT-1. Signal source was provided by a Heath IG-18 digital audio generator and recorded SSTV signals.

The author found that the best way to record SSTV signals for testing was to monitor 14.230 kHz, the national SSTV calling

← Fig. 2—Schematic diagram of the SS Mark 4 slow scan TV monitor. All capacitor values are in mf; all resistors are 1/4 watt. Coils L_1 and L_2 are J. W. Miller 9062 subminiature r.f. coils (15 to 40 mh). L_1 and C_1 must be tuned to 2300 Hz; L_2 and C_2 must resonate at 1200 Hz. T_1 is a small 6.3 v. filament transformer.

Close-up of the vertical oscillator and deflection board CB3. The large transistors at the upper right are the high voltage deflection pair. The P-C pots are Vertical Size, R_9, (upper left), and Vertical Position, R_{11}. The Horizontal board, CB2, is similar and is mounted below CB3 as shown in the photo on page 37.

frequency and have a recorder (preferably not cassette) standing by. Proper tuning is very important and this is accomplished by tuning the s.s.b. signals for best voice clarity before SSTV transmission. Off the air signals are very helpful because they are a good test of how the monitor performs under actual conditions, *i.e.*, interference, noise, splatter, etc.

Alignment of CB1- Limiter, Sync and Video Board:

Testing of the limiter is accomplished by feeding in a SSTV signal and observing an f.m. modulated square wave output at TP 1 of about 25 volts peak-to-peak. Full limiting should occur with input signals of 100 millivolts to several volts.

Once the limiter is working, the video detector L_1-C_1 is tuned. Alignment of the video detector and sync detector circuits requires an audio signal generator that can provide ½ volt into 8 ohms at 1200 cycles, the sync frequency; 1500 cycles, video black; and 2300 cycles, video white.

The video detector is tuned by feeding 2300 Hz at 0.5 v. or more into the monitor and adjusting L_1 for minimum signal at TP2. This should be about 1 v. p-p. Changing the audio generator to 1500 cycles (what is known as black on the video system) should produce a peak-to-peak reading of approximately 6 volts. The differential between one volt and 6 volts is applied to the video amplifier stage Q_1, stepped up by T_1, rectified, and is then used as the G_1 drive to produce black and white on the CRT.

With the CONTRAST control R_2 at maximum, the Video Amplifier Q_1 is tested by observing 1 v. p-p at 2300 Hz (white) and 6 v. p-p at 1500 Hz (black). The output of rectifier bridge D_1-D_4 (TP4-TP4A) will show approximately 7 v. p-p at 2300 Hz and 30 v. p-p (complete CRT blanking) at 1500 Hz, which is video black.

The sync detector is aligned by setting SYNC DRIVE R_1 at mid-range and feeding a 1200 Hz signal into the monitor. Alignment of the sync seperater consists of tuning L_2 for a maximum signal at test point 5. This reading will be approximately 3 v. p-p. If it is not, adjust SYNC DRIVE R_1 to attain this reading. As a point of reference, switching from the sync frequency of 1200 cycles to 1500 cycles should reduce the voltage at TP 5 to 1 v. p-p. Continuing even further, going to 2300 cycles, TP 5 should produce a voltage of 50 millivolts and going down to 800 cycles there should be a reading of no more than 1 volt.

With the scope on the collector of Q_3 (TP6) and a slow scan signal being fed into the monitor there should be a negative going pulse of 12 volts at the horizontal sync rate of 15 cycles. The sync separater L_2 can be fine tuned to produce the widest and cleanest negative going pulse at this point.

The vertical sync seperater is adjusted by feeding SSTV signals into the monitor and advancing VERTICAL SYNC DRIVE, R_8, to the point where only 30 millisecond vertical sync pulses show at TP7. This is an important adjustment because if it is advanced too far horizontal pulses will come through to trigger the vertical oscillator. The builder may wish to experiment with this control.

With both the horizontal and vertical seperaters working, there should be 15 volts negative pulses available to trigger their respective sweep circuits.

Testing of Horizontal Board CB2:

With Horizontal Oscillator Q_4 working there will be a linear saw-tooth at TP 8. This waveform should be variable from 12 to 18 Hz depending on the setting of the HORIZONTAL control, R_4, and will go from 2 v. to 7 v.

Horizontal deflection transistors Q_6 and Q_7 are set up by adjusting HORIZONTAL SYMMETRY control R_6 to yield an 80 v. saw-tooth wave at TP9 and TP10 when HORIZONTAL SIZE control, R_5, is at maximum. HORIZONTAL POSITION control R_7 will be at about mid-range.

[*Continued on page 91*]

1973 Armed Forces Day Communication Tests

EACH year, on the third Saturday in May, the Department of Defense sponsors the observance of Armed Forces Day. This years observance, the twenty-fourth, will be held on Saturday, May 19, 1973. Once again the Departments of the Army, Navy and Air Force will conduct communication tests between military radio stations and amateur radio stations to demonstrate the partnership and mutual respect enjoyed between the U.S. amateur radio community and the U.S. military.

The tests will consist of military-to-amateur crossband operations, using continuous wave (c.w.), voice (s.s.b.) and radioteletypewriter (RTTY) modes of operation and c.w. and RTTY receiving tests. QSL cards, designed especially for this occasion, will be forwarded to those amateurs who establish two-way contact with participating military stations confirming crossband communications. Certificates will be awarded to those who aptly demonstrate their operating ability and technical skill by receiving an acceptable copy of the Secretary of Defense originated c.w. and/or RTTY message(s) transmitted during the receiving portion of the communication tests. Interception by shortwave listeners (s.w.l.) will not qualify for a QSL card in confirmation of communications. However, anyone who has the equipment and the ability may copy the Secretary of Defense messages and will be eligible to receive a certificate.

Military-To-Amateur Crossband Test

The military-to-amateur crossband operations will be conducted from 19/1300 GMT to 20/0245 GMT. The military stations WAR, NSS, NPG, NØNNN and AIR will transmit on military frequencies and listen for amateur stations transmitting in the portions of the amateur bands indicated below. Additionally, consistent with operational and training commitments, U.S. Navy aircrafts using the call signs NSSAM and NPGAM, will conduct crossband operations on frequencies listed below while flying over various cities. The operators at the military stations will specify that portion of the amateur sub-band they are tuning.

Station	Military Frequency (kHz unless otherwise noted)	Emission	Amateur Band
WAR (Army Radio Washington, D.C.)	4001.5	c.w.	3.5-3.65
	4020	l.s.b.	3.775-4.0
	4030	RTTY	3.65-3.775
	6997.5	c.w.	7.0-7.15
	14405	c.w.	14.0-14.2
	20994	u.s.b.	21.25-21.45
NSS (Naval Communication Station, Washington, D.C.)	3385	c.w.	3.5-3.65
	4012.5	RTTY	3.65-3.775
	4040	l.s.b.	3.775-4.0
	6970	l.s.b.	7.15-7.3
	7301	c.w.	7.0-7.05
	7380	RTTY	7.1-7.15
	7385	c.w.	7.05-7.1
	13827.5	RTTY	14.1-14.2
	14385	u.s.b.	14.2-14.35
	14400	c.w.	14.0-14.1
NSSAM (Navy Aircraft)	27900	u.s.b.	28.5-29.7
	49.692 mHz	a.m.	50.1-54.0
	143.820 mHz	a.m.	144.1-146.0
	Aircraft to Depart Washington, D.C. 19/1300 GMT; Providence, RI 19/1400 GMT; Buffalo, NY 19/1500 GMT; Indianapolis, IN 19/1630 GMT; Memphis, TN 19/1730 GMT; New Orleans, LA 19/1830 GMT; Tallahassee, FL 19/1930 GMT; Miami, FL 19/2030 GMT; Jacksonville, FL 19/2115 GMT; Spartanburg, SC 19/2215 GMT; Washington, DC 19/2300 GMT		
NPG (Naval Communication Station, San Francisco, CA)	4001.5	l.s.b.	3.775-4.0
	4005	c.w.	3.5-3.65
	4010	c.w.	3.65-3.75
	6989	c.w.	7.0-7.075
	7301.5	l.s.b.	7.15-7.3
	7347.5	RTTY	7.0-7.1
	7365	c.w.	7.075-7.150
	13922.5	RTTY	14.0-14.15
	14356	u.s.b.	14.2-14.275
	14375.	c.w.	14.0-14.1
	14389	u.s.b.	14.275-14.35
	20983	c.w.	21.0-21.2
	20998.5	u.s.b.	21.27-21.4
	*49.995 mHz	a.m./u.s.b./c.w.	50.0-51.0
	*143.995 mHz	a.m./u.s.b./c.w.	144.0-146.0
	**148-41 mHz	a.m./RTTY	145.0-146.0
	**148.95 mHz	f.m.	146.0-148.0
	*222.0	a.m./u.s.b./c.w.	221.0-222.5
* To be operated from Mt. Vaca ** To be operated from Mt. Diablo			
NPGAM (Navy Aircraft)	148.005 mHz	a.m.	145.0-146.0
	The aircraft will be flying from San Francisco to Los Angeles to Seattle and back to San Francisco.		
NONNN (Naval Academy, Annapolis, MD)	4008.5	l.s.b.	3.775-4.0
	7350	l.s.b.	7.15-7.3
	13975.5	u.s.b.	14.2-14.35
AIR (Air Force Radio Washington, DC)	4025	l.s.b.	3.775-4.0
	7305	l.s.b.	7.15-7.3
	7315	c.w.	7.0-7.15
	13997.5	c.w.	14.0-14.2
	14397	u.s.b.	14.2-14.35

C.W. Receiving Test

A c.w. receiving test will be conducted for any person capable of copying International Morse Code at 25 words per minute. The c.w. broadcast will consist of a special Armed Forces Day message from the Secretary of Defense to all radio amateurs and other par-

ticipants. The c.w. broadcast will commence at 20/0300 GMT with a ten minute CQ call for tuning purposes with the Secretary of Defense message commencing precisely at 20/0310 GMT as follows:

Transmitting Station	Frequencies (kHz unless otherwise indicated)
WAR—Army	4030, 6997.5, 14405
NSS—Navy	4012.5, 7385, 14385
NPG—Navy	4005, 6989, 14375, 49.995 mHz, 143.995 mHz
AIR—Air Force	7315, 13997.5

RTTY Receiving Test

A radioteletypewriter RTTY receiving test will be conducted for any individual amateur or station possessing the required equipment. This is a test of the operator's technical skill in aligning and adjusting his equipment, and serves to demonstrate the growing number of amateurs becoming skilled in this method of rapid communications. The RTTY broadcast will consist of a special Armed Forces Day message from the Secretary of Defense to all radioteletypewriter enthusiasts. The broadcast will be transmitted at 60 words per minute, beginning at 20/0335 GMT with a ten minute CQ call for tuning purposes followed by the Secretary of Defense message at 20/0345 GMT as follows:

Transmitting Station	Frequencies (kHz unless otherwise indicated)
WAR—Army	4030, 6997.5, 14405
NSS—Navy	4012.5, 7385, 14385
NPG—Navy	4010, 7347.5, 13992.5 148.410 mHz
AIR—Air Force	7315, 13997.5

Submission Of Test Entries

Transcriptions should be submitted "as received." No attempt should be made to correct possible transmission errors.

Time, frequency and call sign of the station copied as well as the name, call sign (if any) and address, including zip code of the individual submitting the entry must be indicated on the page containing the test. Each year a large number of acceptable copies are received with insufficient information, thereby precluding the issuance of a certificate.

Entries should be postmarked no later than 25 May 1973 and submitted to:

Armed Forces Day Tests
Chief, Navy-Marine Corps MARS
4401 Massachusetts Avenue, N.W.
Washington, D.C. 20390
Mail Stop 394

OSCAR-6 News & Orbital Predictions

BY GEORGE JACOBS,* W3ASK

By mid-March all continued to go well with the OSCAR-6 satellite, as it neared its fifth month of operation. The only serious malfunction to report is the drastic reduction in the level of the 435.1 mHz telemetry transmitter during early January, possibly due to a defective r.f. transistor. Fortunately, the 10 meter telemetry transmissions on 29.45 mHz are back to almost full strength again, so telemetry data continues to be received on a regular basis.

With the 10 meter telemetry channel back in operation, an extra day has been added to the OSCAR-6 operating schedule. The satellite is now in service every Friday, Saturday, Sunday *and Monday*, GMT. In terms of EST, OSCAR-6's repeater will begin operating at 7 P.M. each Thursday and remain in continuous operation until 7 P.M. Monday.

The repeater will *off* on Tuesdays, Wednesdays and Thursdays to permit the solar cells on the satellite's outer surface to recharge the on-board battery system. At times the satellite may be placed into operation during the *off* days in order to receive important telemetry data. The Radio Amateur Satellite Corp. (AMSAT) urges that communications through the satellite *not* be attempted during *off* days even though the satellite might be on. This could interfere with the collection of telemetry data and the proper charging of the satellite's batteries. AMSAT also emphasizes

*Space Communications Editor, CQ
11307 Clara Street, Silver Spring, Md. 20902

that it is imperative for stations to keep their erp down to below 100 watts in order not to overload the repeater and shorten its life. This level has been found in practice to be sufficient for working through the satellite, even at maximum distances.

Satellite QSO's

OSCAR 6's two-to-ten meter repeater is getting a very heavy workout. It is estimated that about 1000 stations in 50 countries had successfully communicated through the satellite by mid-March. Most of the QSOs were on c.w. and s.s.b., but a few have also been made on SSTV and RTTY. Distance covered varies between 0 and about 4500 miles.

Unofficial leaders seem to be Dave, K7BBO and Randy, VE2BYG. From his Tacoma, Washington QTH Dave had racked-up more than 2200 satellite QSOs by mid-March, including at least 35 states and 10 countries. He holds the distinction of working many stations in both Europe and Japan.

Close behind is Randy, who by mid-March reported nearly 1500 two-way contacts from his Alouette, Quebec QTH. Among these are 40 states confirmed, 25 countries and more than 350 trans-Atlantic QSOs!

Greatest interest in OSCAR-6 seems to be in California, where AMSAT records show no fewer than 50 stations regularly working through the satellite.

OSCAR-6 is also gaining in popularity in the Soviet Union, where a dozen stations are actively communicating through it. The first USSR-North American 2-way contact through the satellite was made on December 11, between UAIDZ and VE2BYG. Several more have been made since then. (The *very first* USSR-USA satellite QSO was made on December 22, 1963 between the late UP2ON and K2GUN, now W2WD, using the OSCAR-4 satellite.)

In Australia VK3YDB reports successful 2-way RTTY contacts with VK6HK over a distance of 2000 miles. Near perfect copy was achieved using f.m. with a deviation of ± 10 kHz and narrow shift of the audio tones

Orbital Parameters

After five months in orbit, OSCAR-6's key orbital parameters have stabilized as follows:

Period: 114.9945 minutes

Inclination to Equator: 101.73 degrees

Equatorial Crossings: 28.7485 degrees progressively to the west for each new orbit in a south-to-north direction

Uplink Frequency Passband: 145.90 to 146.00 mHz

Downlink Frequency Passband: 29.45 to 29.55 mHz

Downlink-Uplink Frequency Relationship:

F down = F up — 116.456 mHz ± F doppler, where F doppler = 4.5 kHz near the beginning of an overhead pass;
= 0 kHz at the middle of the pass;
= —4.5 kHz near the end of an overhead pass.

Beacon & Telemetry Frequencies:

29.45 mHz, operating at near normal signal level

435.1 mHz, operating at very low signal level

Orbital Predictions

Here's another exclusive for *CQ*. The following table contains times that OSCAR-6 is predicted to cross the equator in a south-to-north direction for each orbit during the four day on periods in June. Orbital data for May is contained in "OSCAR-6 News" appearing in the February, 1973, issue of *CQ* (p. 39).

Time Equator Crossed (GMT)	Long. W. of Crossing	Time Equator Crossed (GMT)	Long. W. of Crossing
June 1 Friday (Initial Orbit #2860)		June 3 Sunday (Initial Orbit #2885)	
0154.0	075.9*	0148.9	074.6*
0349.0	104.7*	0343.9	103.4*
0544.0	133.4	0538.9	132.1
0739.0	162.2	0733.8	160.8
0934.0	190.9	0928.8	189.6
1129.0	219.6*	1123.8	218.3*
1324.0	248.4*	1318.8	247.0*
1519.0	277.1*	1513.8	275.8*
1714.0	305.9*	1708.8	304.6*
1909.0	335.0	1903.8	333.3
2103.9	003.3	2058.8	002.0
2258.9	032.1*	2253.8	030.8*
June 2 Saturday (Initial Orbit #2872)		June 4 Monday (Initial Orbit #2897)	
0053.9	060.9*	0048.8	059.5*
0248.9	089.6*	0243.8	088.3*
0443.9	118.4*	0438.8	117.0*
0638.9	147.1	0633.8	145.7
0833.9	175.8	0828.8	174.5
1028.9	204.6	1023.8	203.2
1223.9	233.3*	1218.8	232.0*
1418.9	262.1*	1413.8	260.7*
1613.9	290.8*	1608.8	289.5*
1808.9	319.6	1803.7	318.2
2003.9	348.3	1958.7	347.0
2158.9	017.1	2153.7	015.7
2353.9	045.9*	2348.7	044.5*

*Orbits will pass within view of areas of the continental United States.

Time Equator Crossed (GMT)	Long. W. of Crossing
June 8 Friday	
(Initial Orbit #2947)	
0038.5	057.1*
0233.5	085.8*
0428.5	114.6*
0623.5	143.3
0818.5	172.1
1013.5	200.8
1208.5	229.6*
1403.5	258.3*
1558.5	287.1*
1753.5	315.8
1948.4	344.6
2143.4	013.3
2338.4	042.1*
June 9 Saturday	
(Initial Orbit #2960)	
0133.4	070.8*
0328.4	099.6*
0523.4	128.3*
0718.4	157.1
0913.4	185.8
1108.4	214.6*
1303.4	243.3*
1458.4	272.1*
1653.4	300.8*
1848.4	329.6
2043.4	358.3
2238.4	027.1
June 10 Sunday	
Initial Orbit #2972)	
0033.4	055.8*
0228.4	084.6*
0423.4	113.3*
0618.3	142.1
0813.3	170.8
1008.3	199.6
1203.3	228.3*
1358.3	257.1*
1553.3	285.8*
1748.3	314.5
1943.3	343.3
2138.3	012.0
2333.3	040.8*
June 11 Monday	
(Initial Orbit #2985)	
0128.3	069.5*
0323.3	098.3*
0518.3	127.0*
0713.3	155.8
0908.3	184.5
1103.3	213.3*
1258.3	242.0*
1453.3	270.8*
1648.2	299.5*
1843.2	328.3
2038.2	357.0
2233.2	025.8
June 15 Friday	
(Initial Orbit #3035)	
0118.0	066.9*
0313.0	095.6*
0508.0	124.4*
0703.0	153.1
0858.0	181.9
1053.0	210.6*
1248.0	239.4*
1443.0	268.1*
1638.0	296.9*
1833.0	325.6
2028.0	354.4
2223.0	023.1
June 16 Saturday	
(Initial Orbit #3047)	
0017.9	051.9*
0212.9	080.6*
0407.9	109.4*
0602.9	138.1
0757.9	166.9
0952.9	195.6
1147.9	224.4*
1342.9	253.1*
1537.9	281.9*
1732.9	310.6
1927.9	339.4
2122.9	008.1
2317.9	036.9*
June 17 Sunday	
(Initial Orbit #3060)	
0112.9	065.6*
0307.9	094.4*
0502.9	123.1*
0657.8	151.9
0852.8	180.6
1047.8	209.3
1242.8	238.1*
1437.8	266.9*
1632.8	295.6*
1827.8	324.3
2022.8	353.1
2217.8	021.8
June 18 Monday	
(Initial Orbit #3072)	
0012.8	050.6*
0207.8	079.3*
0402.8	108.1*
0557.8	136.8
0752.8	165.6
0947.8	194.3
1142.8	223.1*
1337.8	251.8*
1532.8	280.6*
1727.7	309.3*
1922.7	338.1
2117.7	006.8
2312.7	035.6*
June 22 Friday	
(Initial Orbit #3122)	
0002.5	048.1*
0157.5	076.8*
0352.5	105.5*
0547.5	134.3
0742.5	163.1
0937.5	191.8
1132.5	220.6*
1327.5	249.3*
1522.5	278.1*
1717.5	306.8*
1912.4	335.6
2107.4	004.3
2302.4	033.1*
June 23 Saturday	
(Initial Orbit #3135)	
0057.4	061.8*
0252.4	090.6*
0447.4	119.3*
0642.4	148.1
0837.4	176.8
1032.4	205.6
1227.4	234.3*
1422.4	263.1*
1617.4	291.8*
1812.4	320.6
2007.4	349.3
2202.4	018.1
2357.4	046.8*
June 24 Sunday	
(Initial Orbit #3148)	
0152.4	075.6*
0347.4	104.3*
0542.3	133.1
0737.3	161.8
0932.3	190.6
1127.3	219.3*
1322.3	248.1*
1517.3	276.8*
1712.3	305.6*
1907.3	334.3
2102.3	003.1
2257.3	031.8*
June 25 Monday	
(Initial Orbit #3160)	
0052.3	060.6*
0247.3	089.3*
0442.3	118.1*
0637.3	146.8
0832.3	175.6
1027.3	204.3
1222.3	233.1*
1417.3	261.8*
1612.2	290.6*
1807.2	319.3
2002.2	348.1
2157.2	016.8
2352.2	045.6*
June 29 Friday	
(Initial Orbit #3210)	
0042.0	057.9*
0237.0	086.6*
0432.0	115.4*
0627.0	144.1
0822.0	172.9
1017.0	201.6
1212.0	230.4*
1407.0	259.1*
1602.0	287.9*
1757.0	316.6
1951.9	345.4
2146.9	014.1
2341.9	042.9*
June 30 Saturday	
(Initial Orbit #3223)	
0136.9	071.6*
0331.9	100.4*
0526.9	129.1*
0721.9	157.9
0916.9	186.6
1111.9	215.4*
1306.9	244.1*
1501.9	272.9*
1656.9	301.6*
1851.9	330.4
2046.9	359.1
2241.9	027.9
July 1 Sunday	
(Initial Orbit #3235)	
0036.9	056.6*
0231.9	085.4*
0426.9	114.1*
0621.8	142.9
0816.9	171.6
1011.9	200.4
1206.9	229.1*
1401.8	257.9*
1556.8	286.6*
1751.8	315.3
1946.8	344.1
2141.8	012.8
2336.8	041.6*
July 2 Monday	
(Initial Orbit #3248)	
0131.8	070.3*
0326.8	099.1*
0521.8	127.8*
0716.8	156.6
0911.8	185.3
1106.8	214.1*
1301.8	242.8*
1456.8	272.6*
1651.7	300.3*
1846.7	329.1
2041.7	357.8
2236.7	026.6

See "OSCAR-6 News" in the February, 1973 issue of *CQ* (p. 40) for a method of plotting accurately OSCAR-6's orbit knowing the time and longitude of equatorial crossings. Times of satellite signal acquisition and

[*continued on page 94*]

Converting The Western Union Telefax Machine For Use In The Amateur Service

BY IRWIN MATH,* WA2NDM

Part II—Rewiring and Preliminary Testing

LAST month we covered the "surgery" necessary to prepare our machine for this conversion. This month we will cover the rewiring phase and preliminary testing. Before beginning however, we would suggest that you check to be certain that you have some special "teledetos" current sensitive receiving paper as well as a stylus. If you do not, these two items can be obtained from our two machine sources: R & R Electronics, 311 East South Street, Indianapolis, Indiana 46225, or Van's Electronics, 302 Passaic Street, Stirling, N.J. 07980. Write to them requesting a quotation on what you need. Be sure to mention *CQ* and this article *please!* It simplifies their processing and avoids delays.

If you have trouble getting these parts remember the following: Suitable stylus wire can be obtained by cutting up a common wire brush as used for scraping rust or paint and; the common large size current sensitive paper used in all of the standard military facsimile machines can be cut to the required 4½" × 6½" size and used perfectly with this machine.

Now to the actual rewiring:

1. Thoroughly clean the unit removing any loose drill chips, wire remnants, dirt, ink, etc. The use of the various common solvents available will make the ink removal job somewhat simpler. You might also clean the various moving parts at this time but do not attempt any lubrication or adjustment of these parts however, as this will be covered later.

Again, be sure to follow all steps carefully and exactly in the order given. Also refer to figures 1 and 2 which indicate the various steps of the conversion.

2. Run a length of #20 gauge hookup wire between the top of the fuse holder nearest the front panel to the toggle switch.

3. Extend the shorter black lead of the power transformer and connect to the arm of one N.O. contact of HR. Also connect this same wire to the remaining terminal of the toggle switch.

4. Connect the other black wire from the power transformer to the top of the blank fuse holder—do not solder at this time as other wires will be connected to this point.

5. Splice together the red wire coming from the coil of the HR relay to the red wire coming from the 100 ohm adjustable resistor.

6. Connect one side of the pilot lampholder to the unsoldered fuse holder terminal.

7. Run a lead from this same terminal to all of the following places.

   a. The red and green wires of the drum motor.
   b. One lead from the feed motor.
   c. One lead from the stylus motor.
   d. One lead from the chopper motor.
   e. The junction of the exciter lamp transformer and the 2.5 mf capacitor (cut the the other lead going to the 2.5 mf a.c. capacitor at this time).
   f. One side of the coil of the TR relay (do not solder).
   g. One side of the coil of the PWR relay (do not solder).

8. Connect the remaining exciter lamp transformer lead to the free end of the chopper motor at the motor.

9. Connect the white lead also attached to

* 5 Melville Lane, Great Neck, N.Y. 11023.

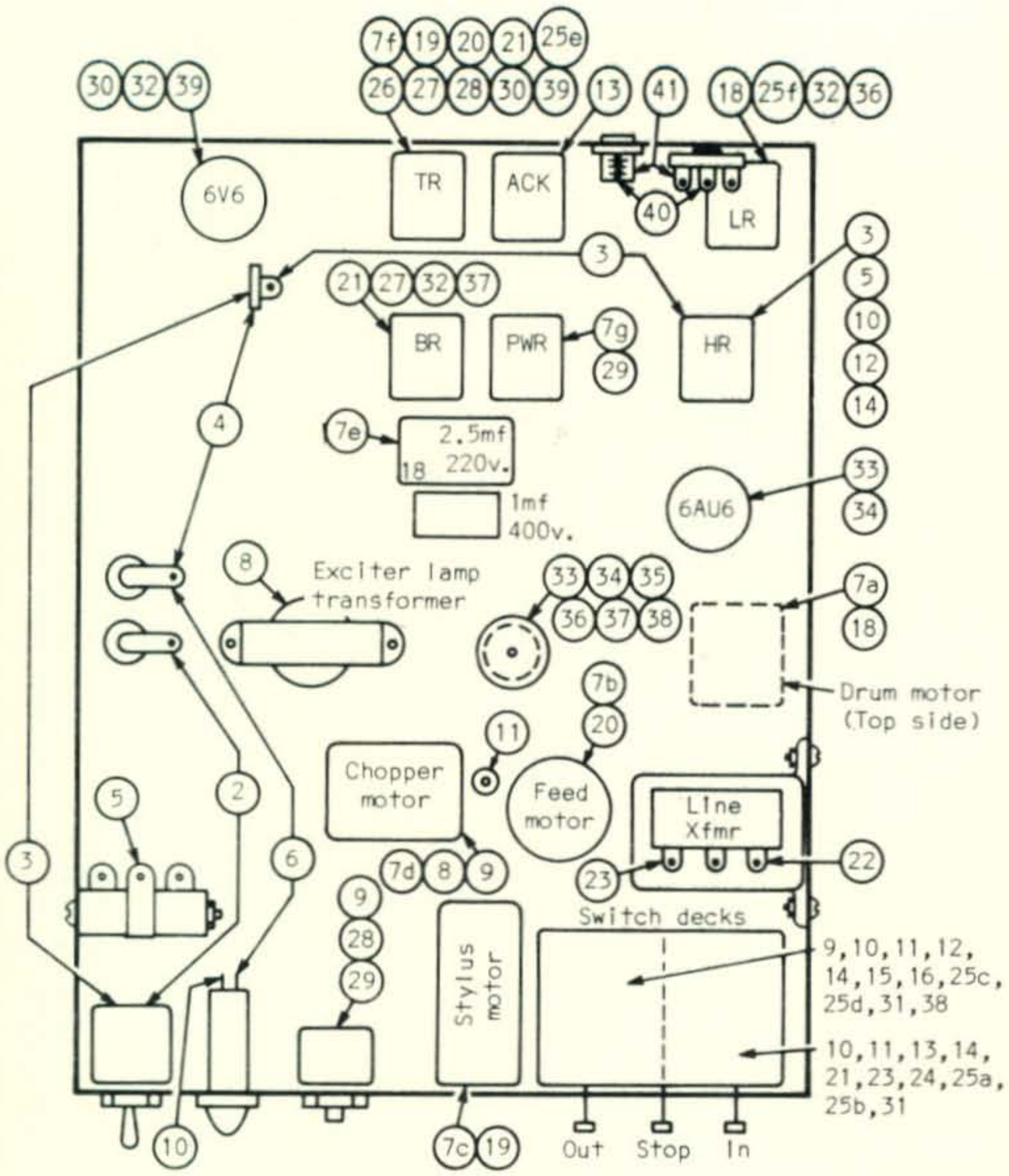


Fig. 1—Bottom view of Telefax unit showing location of all conversion steps.

this point on the motor, to one side of the push button switch and to the normally open contact of one section of the outgoing push button switch.

10. Connect the remaining contact on the section of the HR relay already being used, to the movable contact of both the incoming and outgoing push buttons and to the free side of the pilot lamp socket. Don't run this lead too close to the shielded wires.

11. Connect another movable contact on both incoming and outgoing push buttons to the ground lug near the feed motor.

12. Connect the brown wire, near the HR relay, coming from the junction of a 2K and 2.7K resistor to the normally open contact of the out-going switch section just grounded. Also connect a .01 mf disc ceramic from this same point on the terminal strip to ground.

13. Connect the yellow wire, at the rear center of the chassis to the normally open contact of the other incoming switch section just grounded.

14. Connect the remaining normally closed contact of this switch section and the outgoing switch section together and to the free end of the HR relay coil.

15. Connect the wire coming from the phase contact to a movable contact on an unused section of the outgoing switch.

16. Cut the lacing tape holding the 1 mf capacitor and swivel it (one side still remains connected) to a new location on top of the feed motor near the line transformer. Connect the free capacitor lead to the phase contact connection just made.

17. Remove and relocate the 2.5 mf a.c. capacitor on one mounting screw of the output choke coil.

18. Connect the black drum motor lead to the free side of the 2.5 mf a.c. capacitor and also to the movable arm of the LR relay.

19. Connect the free side of the stylus motor to a normally open contact of TR.

20. Connect the free lead of the feed motor to a normally open contact of relay TR.

21. Connect a wire from the movable contact of relay BR to the movable contact of TR in the stylus motor section, and to a normally open section of the incoming push button.

22. Unsolder the red and white wires from the line transformer and connect the left hand transformer lug to chassis ground at the lug next to it.

23. Connect the right hand transformer lug to the arm of the remaining open incoming switch section.

24. Connect the red shielded wire to the normally closed switch position and the white wire to the normally open position of the switch section used in step 23.

25. Connect a wire between all of the following points:

a. The movable contact of the incoming switch section going to BR and TR.

b. The normally open contact of the in-

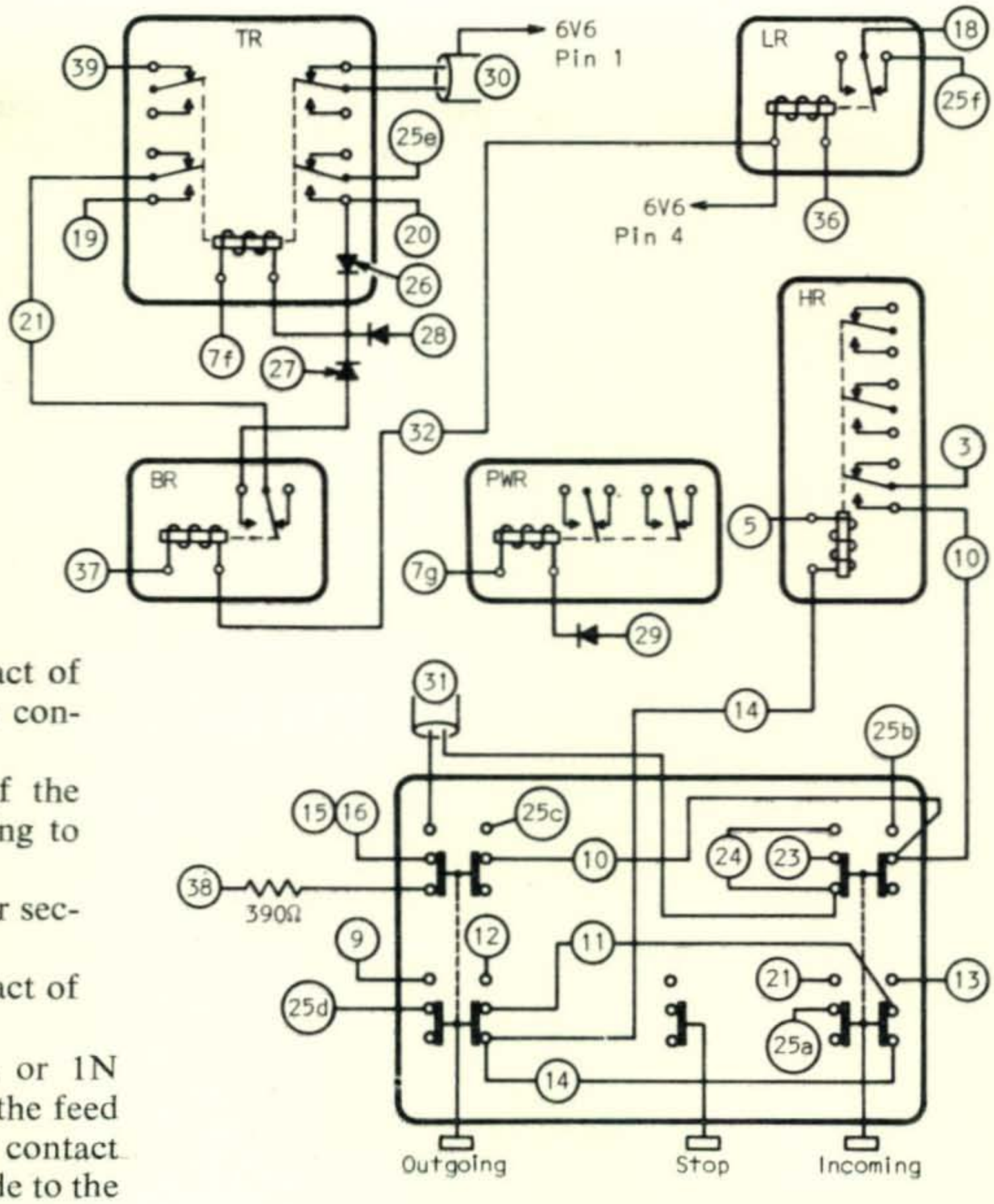


Fig. 2—Details of relay and switch wiring.

coming switch HR section.

c. The normally open contact of the outgoing switch section connected to the HR contact.

d. The movable contact of the outgoing switch section going to the push button.

e. The arm of the feed motor section contact of relay TR.

f. The normally closed contact of LR.

26. Connect a 1N2070, or 1N 4004 silicon diode between the feed motor side of the TR relay contact and the TR relay coil, cathode to the coil.

27. Connect a 1N2070 or 1N4004 silicon diode between the coil of the TR relay (same side as the previous diode) and the normally open contact of the BR relay. The cathode goes to the coil.

28. Connect a 1N2070 or 1N4004 silicon diode between the coil of the TR relay and the free end of the push button switch. Connect the cathode to the relay coil.

29. Connect a 1N2070 or 1N4004 silicon diode between the same push button terminal and the open coil contact of the PWR relay. Connect the cathode to the relay coil.

30. Connect one conductor of a 2 conductor shielded cable (or 2 separate single conductor shielded cables with the shields tied together) to an unused normally closed contact on relay TR and the other conductor to the unused movable contact of the same section. Ground the shield at pin 1 on the 6V6 tube socket.

31. Connect the other end of one of the conductors of the above cable to the normally open contact of the phase contact switch section of the outgoing switch. Connect the remaining conductor of the cable to the incoming switch deck lug with the red shielded wire.

32. Connect a wire from one side of the coil of relay LR to one side of the coil of relay BR to pin 4 of the 6V6.

33. Connect pins 4 and 5 of the new 9 pin tube socket together and to pin 3 of the nearby 6AU6 tube socket.

34. Connect pin 9 of the 9 pin socket to pin 4 of the 6AU6 socket.

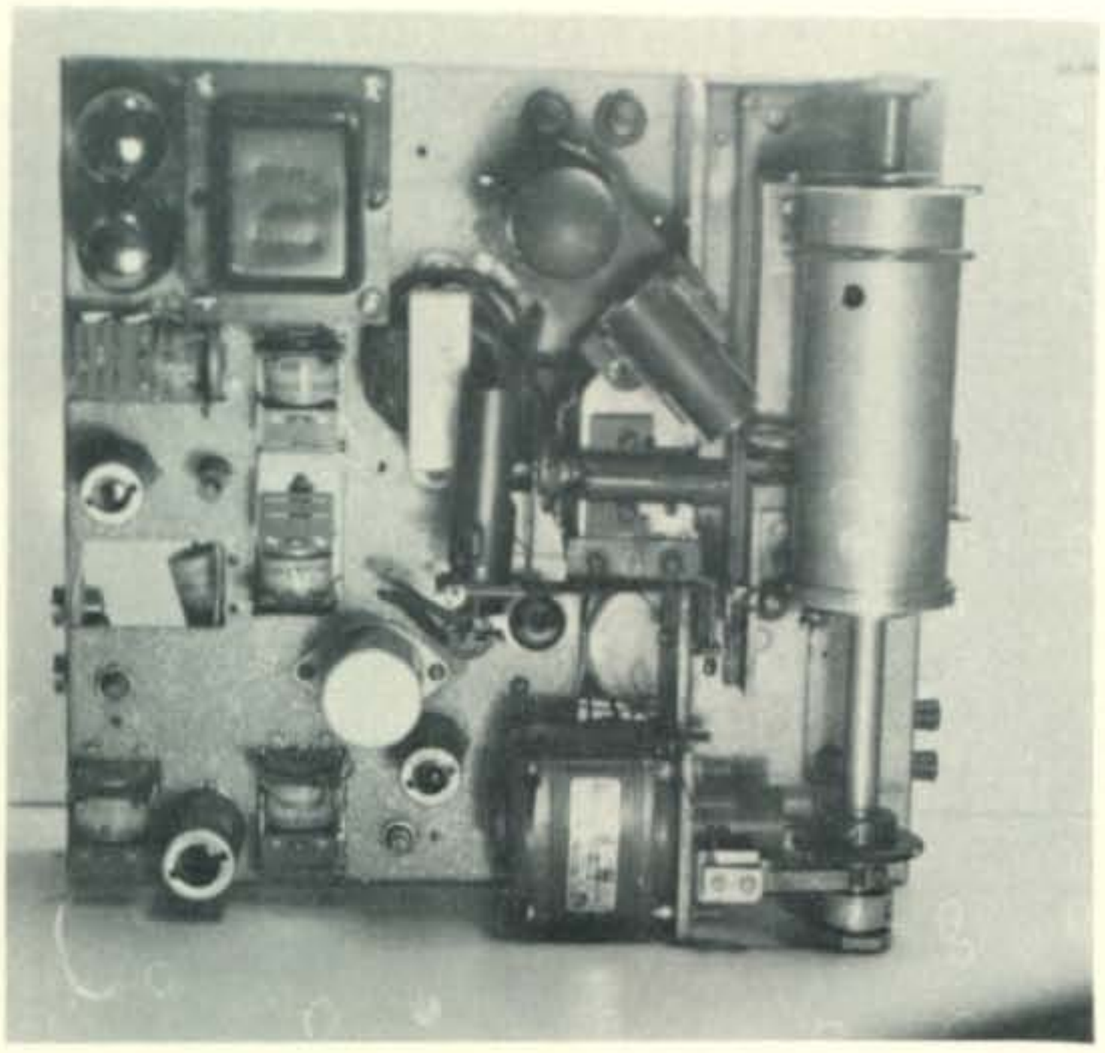
35. Connect a 390 ohm ½ watt carbon resistor from pin 3 of the 9 pin socket to ground.

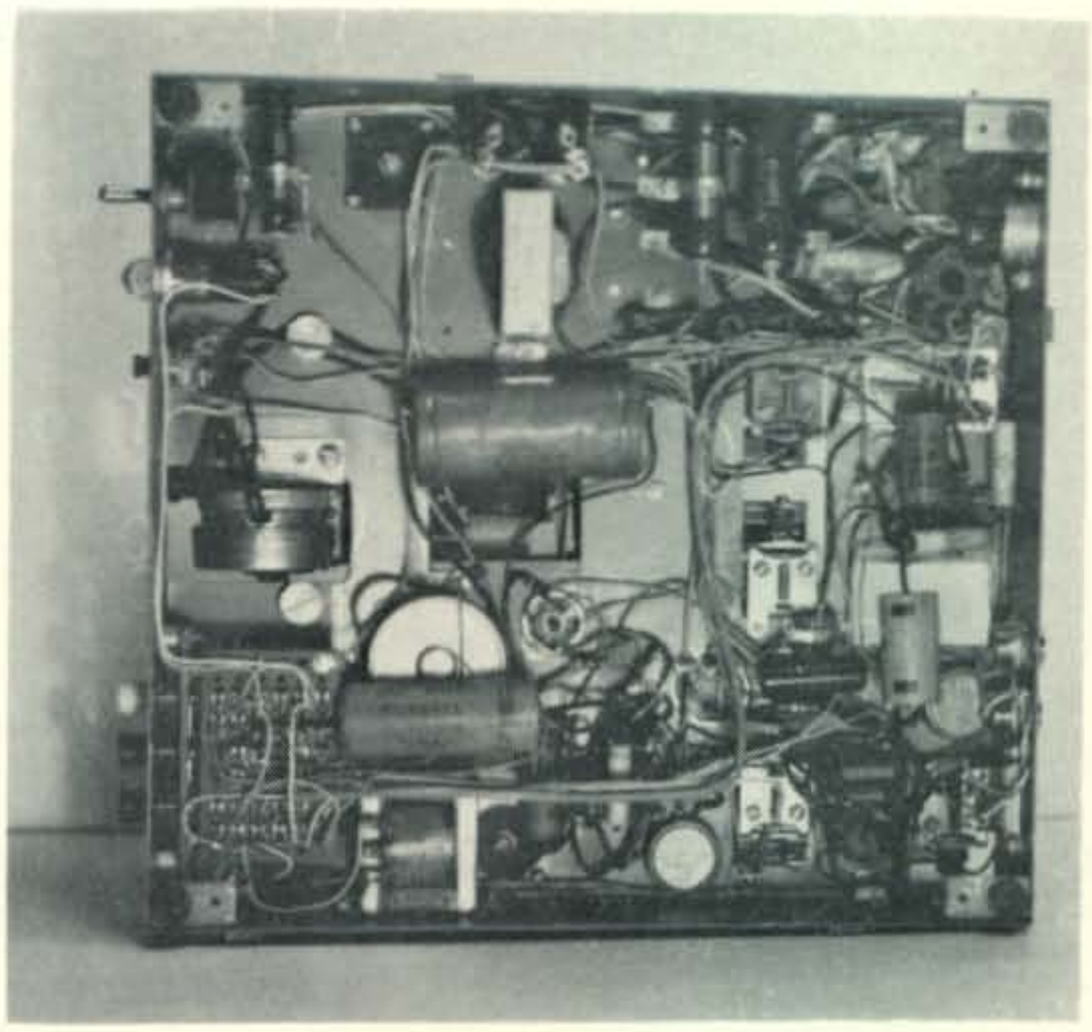
36. Connect a wire from the free end of relay LR (the coil) to pin 6 of the 9 pin socket.

37. Connect a wire from the free end of relay BR (the coil) to pin 1 of the 9 pin socket.

38. Connect a 390 ohm resistor between pin 8 of the 9 pin socket and the remaining outgoing switch deck lug (N.C.) associated with the phase contact.

39. Connect a wire from the normally closed contact of the remaining open contact section of the TR relay, to the terminal strip





The top and bottom views of the Western Union Telefax machine after Part II rewiring and preliminary testing are completed. Compare the photos with figures 1 and 2. Part III of this three part series will include the construction of sync circuits and the transmission and reception of actual messages.

side of the .05 mf capacitor coming from pin 3 of the 6V6 socket. There should also be a 47K resistor from this point to ground. If there is not, install one.

40. Connect the common or return lead of the previously installed transmitter and receiver connectors to the black ground lead on the 3 contact terminal strip on the rear chassis lip.

41. Connect the red lead to the "hot" transmitter connector and the white lead to the "hot" receiver connector.

Preliminary Testing

At this point we will perform some tests to assure that the conversion has progressed smoothly.

1. Remove all tubes and test them. Be sure to do this as we have found 2 bad ones in 3 units examined. When you are sure that the tubes are good, clean them and replace in the proper sockets. Also install the exciter lamp into its socket. You do not have to test the phototube at this point, but you should clean it.

2. Connect the line cord to the rear panel connector and the a.c. line. Be sure two good fuses (type 3AG 3 ampere) are in the holders, and turn on the power switch.

3. After about 30 seconds, relay HR should "click in" and the pilot lamp should light.

4. Press the incoming button. The drum should begin to turn. Nothing else should move.

5. Activate relay BR by hand. The stylus should now move toward the drum and the feed motor should start to operate. As soon as you are certain this is happening push the stop button. If the unit is allowed to operate, the stylus wire will be ruined.

6. Press the outgoing button. The drum should begin to turn, the chopper wheel should also begin to turn, and the exciter lamp should light.

7. Connecting a pair of earphones, or a scope across the transmitter connector on the rear panel should show the existence of a 2500 Hz interrupted tone similar to that in fig. 5, Part I, that can be varied in amplitude by the transmit potentiometer.

8. Press the start button. The TR relay and PWR relay should "click in" and the TR relay remain in when the button is released.

9. The unit should also begin to feed at this point. Let the feed progress until the drum moves completely across the light path. At this point the vertical arm of the stop button should be engaged by the drum and the outgoing push button released automatically. The drum should now return to its original position. Turn off power and again remove the rather fragile exciter lamp.

If the preceding tests have proved OK, you can be certain that the conversion is proceeding properly. In the event that any of the motors do not turn when they are supposed to, first check to be certain that there is no dirt, wire, or anything else in the mechanical path prohibiting motion.

Next month we will discuss and build the sync circuits and then be ready to begin transmitting and receiving actual messages. ■

Slow Scan TV

BY COPTHORNE MacDONALD,*
WØORX

Proper Subcarrier Shift

IF you have spent even a few hours viewing on-the-air slow-scan TV signals you realize that some hams are having problems adjusting their scanners and cameras. The major problems are obtaining sharp focus, and swinging the subcarrier over the full range—from the Black frequency of 1500 Hz all the way to the White frequency at 2300 Hz. Home brewers have a particularly tough time, as many do not have sufficient test equipment in the shack to do an accurate initial alignment job. Fortunately, a lot of help can be given over the air by those who do have the test gear, if they get set up to measure the characteristics of the other guy's transmitted signal. I am speaking paricularly about sync pulse duration, and the limits of the subcarrier shift. This month I'll go into the matter of subcarrier shift adjustment and monitoring techniques in some detail.

An F.S.S. Video Circuit

From the first use of subcarrier frequency modulation in ham SSTV, clipping circuits have been built into flying-spot scanner and camera circuits to insure that the frequency shift cannot exceed the 1500 and 2300 Hz limits, even if the video level is incorrect. Figure 1 shows a typical flying-spot scanner video amp and subcarrier oscillator. In this circuit the "white" clipping occurs when the voltage at the base of Q_2 drops to 0.7 volts or below, cutting off the Q_2 collector current and allowing the collector voltage to rise to +10v. No matter how "white" the photo-

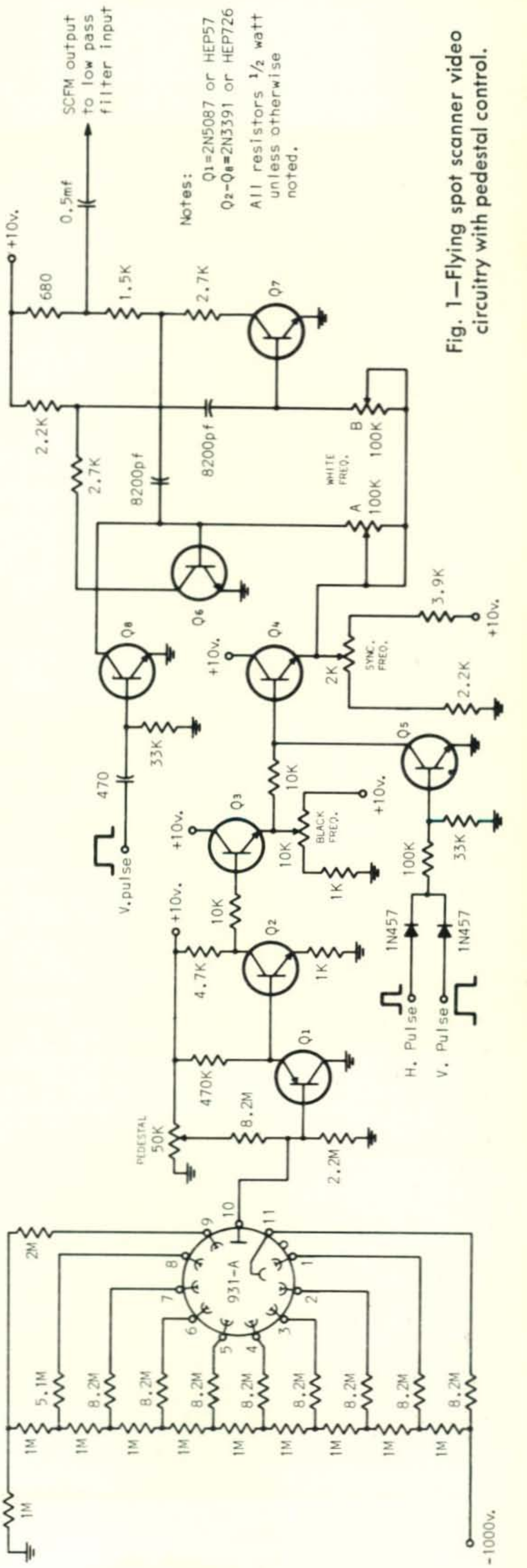


Fig. 1—Flying spot scanner video circuitry with pedestal control.

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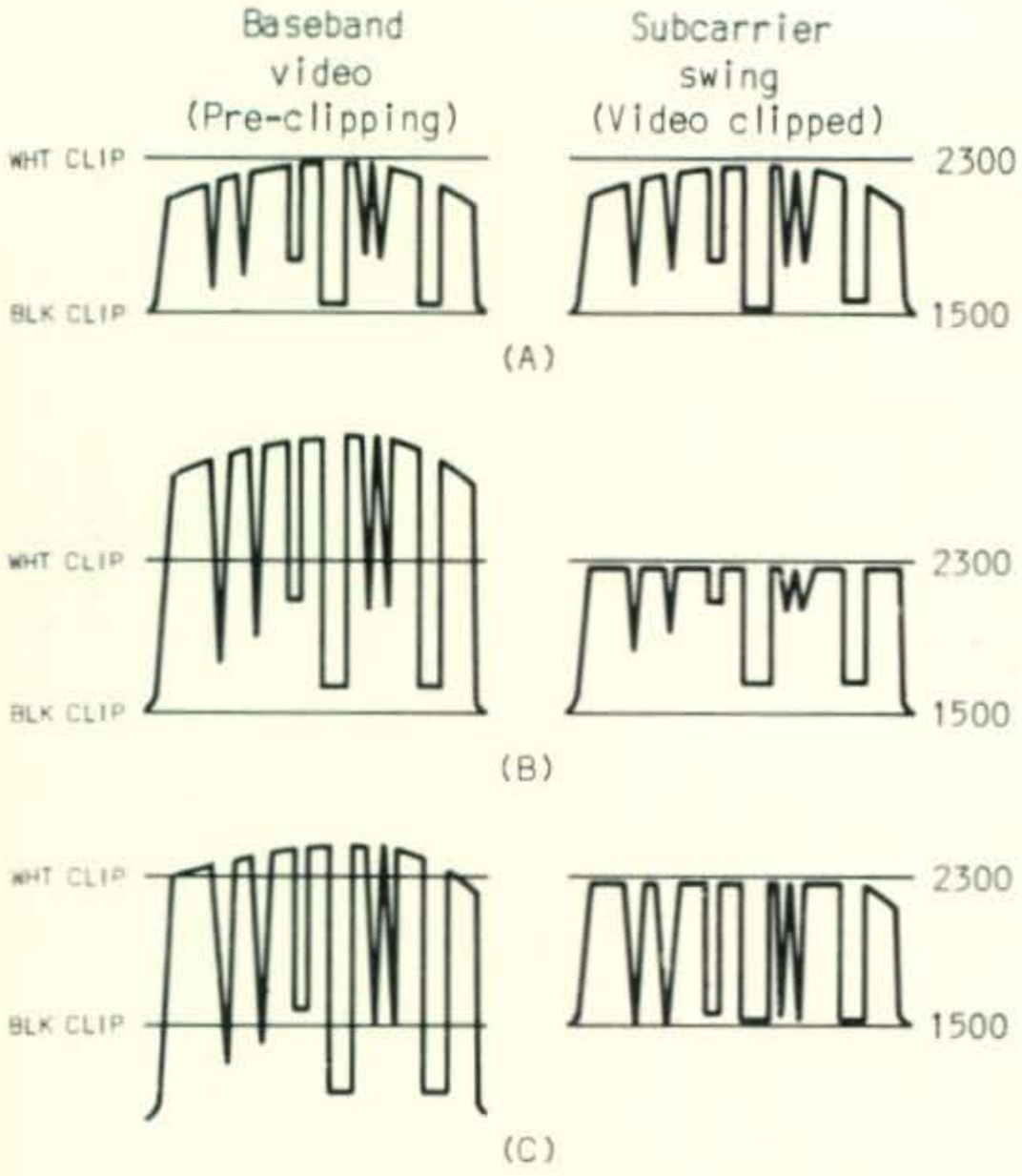

Fig. 2—Pre-clipping and post-clipping video waveforms. (A) Normal video. (B) Video with gain boosted. (C) Video with gain boosted and pedestal lowered.

multiplier output (no matter how high the output current gets) Q_2 collector voltage cannot go above +10 volts. "Black" clipping occurs when emitter follower Q_3 is cut off. When this happens the voltage at the emitter of Q_3 is determined solely by the setting of the BLACK FREQ trimmer pot. When the sync pulses turn Q_5 on, Q_4 is cut off, and the setting of the SYNC FREQ control determines the subcarrier frequency.

The adjustment procedure for this circuit is quite simple. Set the BLACK and SYNC FREQ controls about mid range. Ground the base of Q_2 and adjust the WHITE FREQ A and B controls for a 2300 Hz output, with the positive

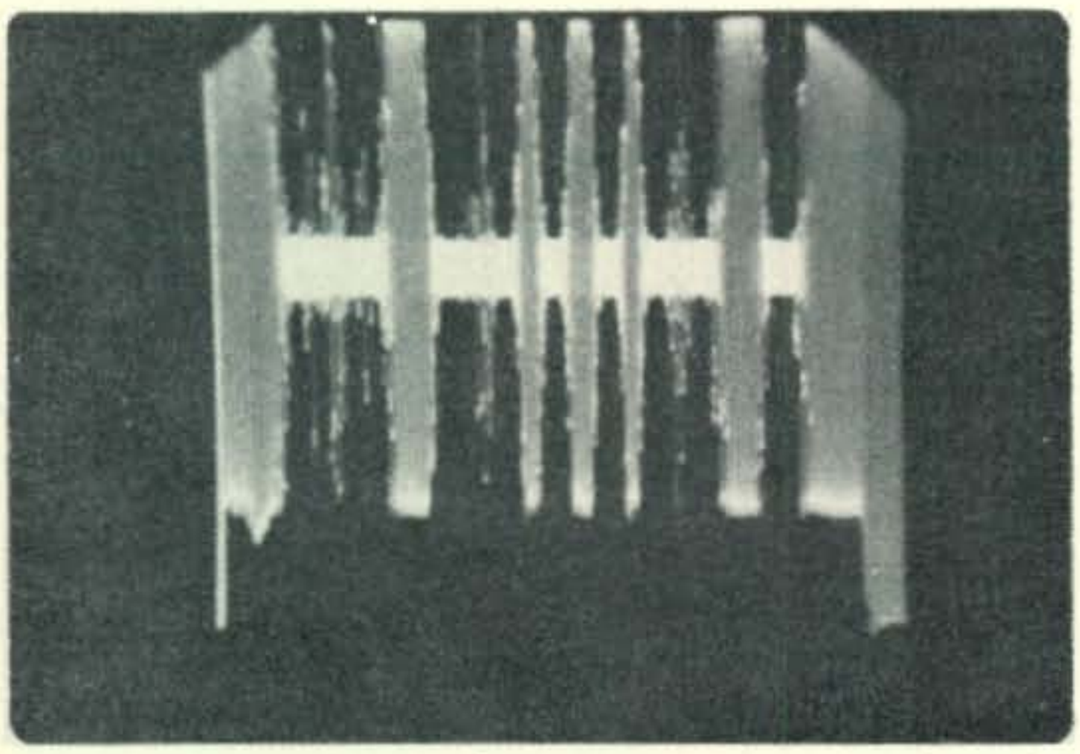

Fig. 3—Typical waveform at output of video discriminator when receiving black/white pictures with full subcarrier swing. (Top corners of waveform are off the CRT screen.)

and negative half cycles having the same duration when viewed on a scope. That ground is then removed and the base of Q_4 is grounded. The SYNC FREQ control is then set to give a 1200 Hz output. The ground is moved once again—to the base of Q_3, and the BLACK FREQ pot is adjusted to give a 1500 Hz output. The Black and White *limits* have now been set, (that is if you had a scope, and a calibrated audio oscillator or counter). The symmetry can be adjusted without a scope by connecting a high impedance (20,000 ohms/volt) d.c. voltmeter between the collector of Q_6 and the collector of Q_7. If the waveform is symmetrical, the voltmeter will read zero volts even on the lowest voltage range. If it shows a positive or negative voltage, the alternations are not of equal duration. Finding a substitute for an audio frequency standard is a bit tougher. Perhaps someone will start a dial-a-tone service.

Getting the *limits* set is half the battle, but only half. Refer to the waveforms of fig. 2. Figure 2(A) shows a typical waveform obtained when scanning a black line drawing, or printed words, on a white background. Large black areas bring the subcarrier down to the black clip level, but fine lines do not. Also there is some shading in the white area so that the signal only reaches the white clip level in the center of the scan line. We are reaching the white and black limits alright, but the picture still lacks contrast in the fine detail; it lacks "snap," and appears a bit "washed-out." Let's raise the gain, or overall video level. (In the flying-spot scanner this might be done by increasing the CRT brightness, or in a Robot camera by adjusting the CONTRAST control.) Are we better off? No. We're worse off, as we can see in the figure 2(B) waveforms. The whites are clipped heavily, but the level of our washed-out fine black detail has also moved toward the white. The answer is shown in fig. 2(C). The gain is boosted, as in fig. 2(B), but the d.c. level has been brought down so that the fine detail blacks come down to the black clip level. In fast scan TV this d.c. level adjuster is called a PEDESTAL control. (In the Robot camera it is called BRIGHTNESS.) Naturally, with this combination of settings, the contrast would be excessive for pictures with grey content. My point is that if one has both video level and pedestal controls, and he monitors the way he uses them, it is possible to get the full carrier shift, and optimum clipping, for each individual picture.

A few more words about the circuit of fig. 1, for anyone who might like to build it. The output is, of course, a square wave, and should be passed through a low-pass filter such as that shown on page 96 of the July, 1972 *CQ*. Multivibrators sometimes hang up and do not oscillate, particularly if the power supply voltage builds up slowly. Q_8 is an "unhangerupper" that feeds a short starting pulse to the base of Q_6 every 8 seconds. You may or may not find it necessary. The bleeder for the photomultiplier is the same general type used in automotive headlight dimmers. If your 931-A is ever exposed to room lighting with the voltage applied, you should consider using this more complex bleeder. The resistors in series with the dynodes limit the tube current to a low value even in the presence of very high light levels. The tube is thus able to bounce back to its original sensitivity when placed in the dark again, without appreciable "fatigue" effects.

Monitoring SCFM Shift

In every broadcast TV control room there is a special variety of scope called a waveform monitor that displays camera output waveforms at all times. We could take a similar approach and connect a scope to monitor the post-clipping waveform in our camera or FSS (emitter of Q_3 in the circuit of fig. 1). An even more useful approach would be to connect a scope into our picture monitor circuitry.

Figure 3 shows the waveform at the output of the video discriminator in my monitor when receiving a properly shifted, high contrast, black/white picture. The sync, black, and white levels are quite apparent, and by calibrating the scope I can not only check my own camera's shift, but the shift of received signals as well.

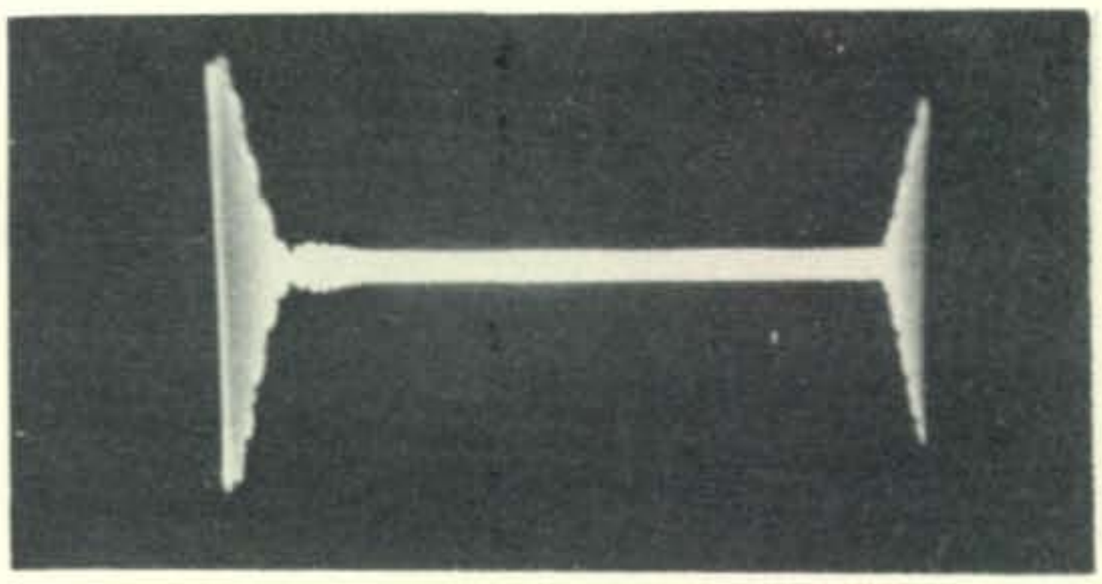

Fig. 4—Typical waveform at sync discriminator output. Receiver should be tuned for maximum burst amplitude.

Figure 4 shows the waveform coming out of the sync discriminator. This display is very handy for tuning the receiver so that the receiver audio output is exactly on frequency. The receiver is tuned for maximum burst amplitude in the display. For those with electrostatically deflected monitors there is another option. The monitor that I have been using for the past several years is designed so that the vertical amplifier input can be connected to the sync discriminator output by pushing a button on the front panel. A second set of pushbutton contacts is used to kill the video to the CRT so that the display is constant brightness, as fig. 4 shows. Ralph Taggert, WB8DQT, has pointed out that the same approach can also be used to allow the monitor to display its own *video* discriminator output. The problem with using these tech-

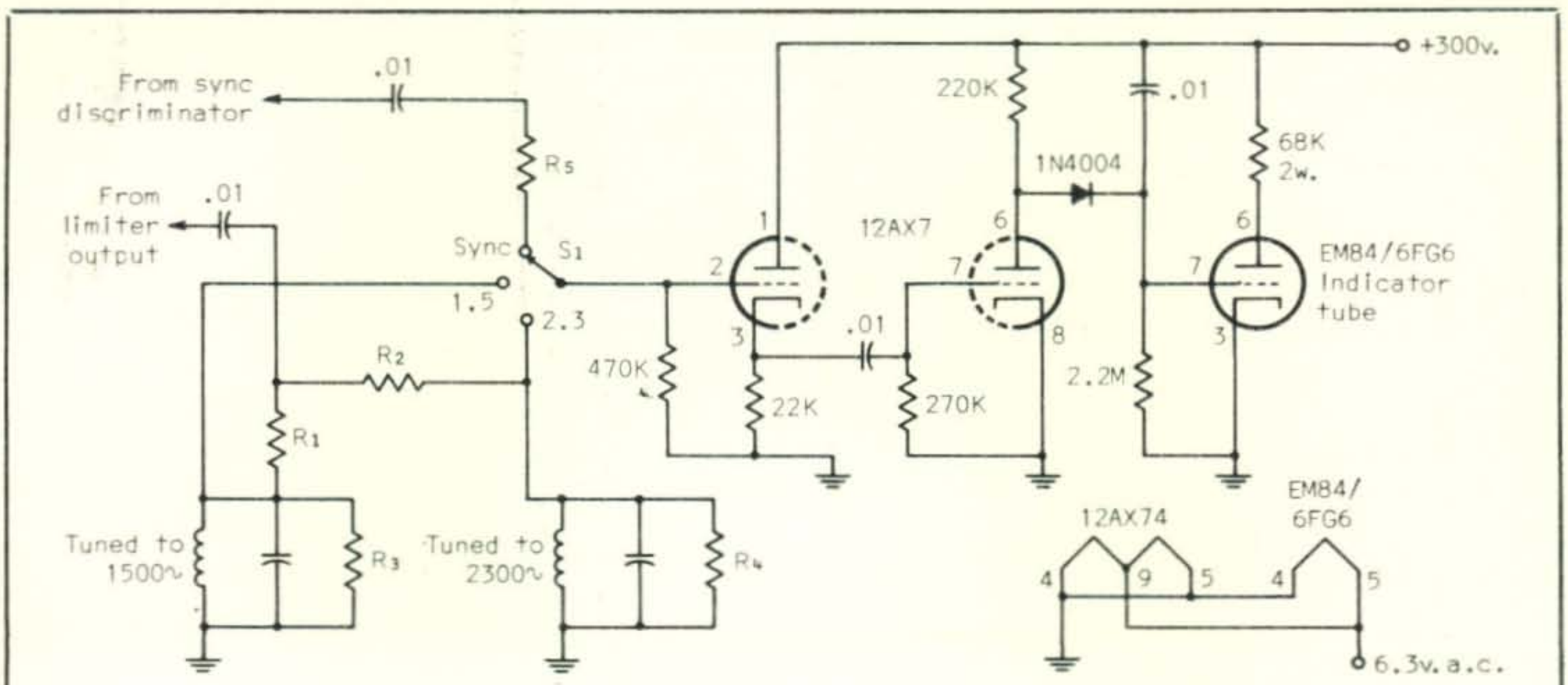

Fig. 5—Tuning indicator and frequency swing monitor using a bar type indicator tube.

niques in magnetically deflected monitors is that the low bandwidth of the deflection amplifier/yoke combination allows very little deflection at subcarrier frequencies.

The monitor that went down to Antarctica used another approach to subcarrier monitoring, as shown in fig. 5. Here the display is not a waveform on a CRT, but the relative length of two fluorescent bars in a tuning indicator tube. A three position switch allows monitoring of the sync pulses, or 1.5, or 2.3 kHz. In the SYNC position of S_1, bursts from the sync discriminator are amplified by the 12AX7, rectified, and applied to the control electrode of the EM84/6FG6. The display is a lengthening of the bars that pulsates in time with the sync. In the 1.5 or 2.3 kHz position the indicator responds to the voltage developed across a tuned circuit. R_3 and R_4 act to lower the Q, if necessary. (A suitable 3 db bandwidth is 100 Hz or so.) R_1, R_2 and R_5 are selected to make the two bars in the indicator tube just touch when the signal is on frequency.

Vy 73, Cop, WØORX

A Kilowatt Plate Transformer For $25

BY PETE WALTON,* VE3FEZ

AFTER checking all the local supply houses for a linear amplifier plate transformer capable of handling 2 kw I became very discouraged. It seems that these beasts are worth a great many dollars, so many that it really put a damper on any high power experiments. On the way home we were joking about using the hydro pole transformers that hang on just about every pole. Why not! A quick phone call to the local utility company verified that they do sell used transformers in this power range for about $25, and this was worth thinking about. The man from Hydro suggested that we come down and look over what was available.

On arrival we saw transformers stacked in the yard like cord wood; big ones, small ones, burned ones, and some that looked to be brand new. The transformer that we liked was rated at 5 kva with a secondary voltage of 4800 or 2400 depending on whether the input voltage was 110 or 220 and it appeared to be in very good shape. The hydro man took our transformer inside and put it through all kinds of hair raising tests at high voltage. The tests showed that it was in excellent condition and they told us we could have it for $25.

Have you ever tried to load a 5 kva pole transformer in your car? It ain't easy. It weighs about 270 pounds, and one hundred pounds of this is just the cooling oil. We finally got it in position in the front bucket seat with the seat belt around it holding it securely in position, a strange looking passenger indeed. If you want to attract a lot of attention just drive along a main street with a 5 kva pole transformer in the front seat.

After a bit of back breaking work we finally got the big beast into the apartment shack and removed the lid. There it was, way down in the bottom of the can under nine gallons of cooling oil and associated terminals, a perfect linear plate transformer about one foot square. Now came our next big problem. How does an apartment dweller dispose of nine gallons of transformer oil. Wait a minute, maybe we should keep it. It's excellent for cooling dummy loads and good stuff like that. Hmm, what to put it in. Nothing around that would hold nine gallons of oil. The next idea was to remove the transformer from the can while the oil is still in it. This sounds good, but how do you keep the oil from running all over the floor when you pull the transformer out of the can? Put the whole thing in the bath tub, pull out the transformer and, let it drip-dry. That should work ok.

Standing in the bath tub can be rather hazardous under the best of conditions, but it's even more hazardous when the tub is full of oil. We did however manage to remove the transformer from its container without any lost time accidents.

This type of transformer works well with the 4-1000 tubes and is good for 2 kw with just air cooling. It's not overly large as linear plate transformers go and the price is right. It also was a very interesting evening project to say the least. ■

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Tuning In On Touch-Tone Pads

BY JOHN J. NAGLE,* K4KJ

Part I—Touch Tone Principles

A NUMBER of articles have appeared on the use of touch-tone pads, but very little information has appeared in the amateur literature describing the pads themselves or their repair and adjustment. Fortunately, the pads are relatively reliable devices and once they are working properly usually continue to do so. However, working pads will occasionally require repair or adjustment; also, amateurs frequently acquire, at little or no cost, pads that are not on frequency and they would like to be able to adjust them. This article will begin by describing the pads and will then discuss the frequency adjustment of touch-tone pads and steps to taken when the proper frequency can not be obtained. Discussion will be limited to "telephone type" pads as these appear to be the most popular; information on the IC pads available commercially should be available from their manufacturers.

First, in order to know when a pad is working properly, we will give a brief description of the operation of the touch-tone dialing system followed by a description of the oscillator circuit. Each of the ten digits 0 through 9 plus * and #, when used, is transmitted by two tones; one tone is selected from a group of low-frequency tones 697 to 941 Hz while the second tone is selected from a group of higher frequency tones from 1209 to 1477 Hz.[1] For a given digit to be successfully detected by the receiver, it is necessary that both tones be detected at the receiver. The various combinations are given in Table I.

The frequencies may appear peculiar, but a close study of them will show (1) that no two frequencies are harmonically related and (2) that no frequency is the sum or difference of any two other frequencies nor the sum or difference of any harmonic of any other frequencies. The reason for this, of course, is to insure error-free transmission by preventing an allowable frequency from being generated from any combination of other allowable frequencies by means of non-linear distortion in the equipment or transmission path.

As we mentioned above, when any single button is pushed, two frequencies are generated. If two buttons are pressed simultaneously the result depends on the relationship between the buttons that were pressed. Comparing Table I with the face of a touch-tone pad will show that all the digits in any horizontal row have the same low-frequency tone which does not appear in any other horizontal row. Similarly, all the digits in any vertical column have a high-frequency in common and this high-frequency tone does not appear in any other column. Therefore, if two buttons in the same row are pushed, say 2 and 3, a single low-frequency tone will result, 697 Hz in this case. If the two buttons are in the

Table I—Frequencies Used in Touch Tone Dialing

Digit	Low Frequency Tone (Hz)	High Frequency Tone (Hz)
1	697	1209
2	697	1336
3	697	1447
4	770	1209
5	770	1336
6	770	1447
7	852	1209
8	852	1336
9	852	1447
*	941	1209
0	941	1336
#	941	1447

NOTE: Frequency tolerance is ± 1.5 percent. The # and * do not appear on all pads.

*12330 Lawyers Road, Herndon, Va. 22070.

[1] A fourth tone in the high frequency group of 1633 Hz is used on some data sets to provide additional functions, but is not found on "normal" touch-tone pads.

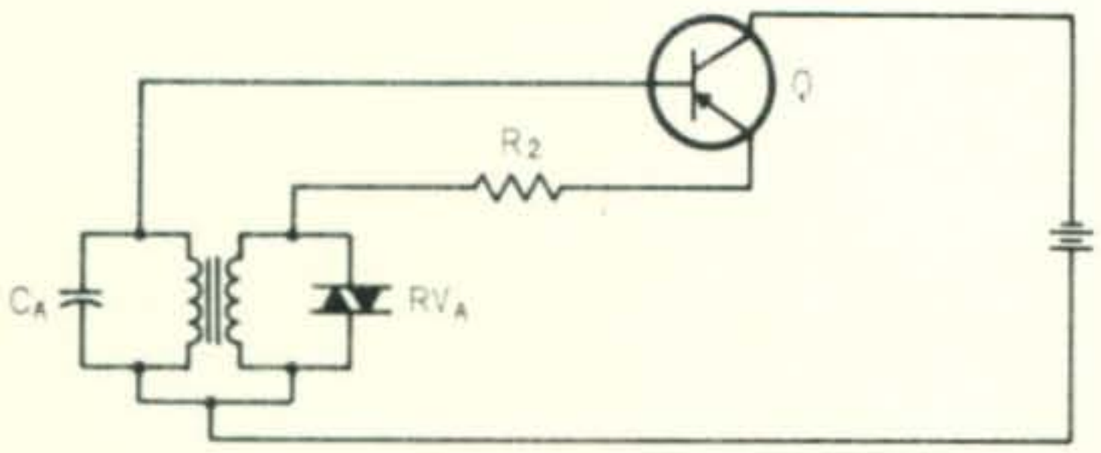

Fig. 1—Basic Touch-Tone pad oscillator; single frequency.

same column such as 2 and 8, a single high-frequency tone will be generated, 1336 Hz here. If the two buttons are in neither the same row nor the same column, 5 and 9 for example, there will be no output.

While pushing two buttons simultaneously may generate a single tone which is convenient for testing the pad, the receiver decoder requires that one low-frequency and one high-frequency be present simultaneously to accept a digit; if two buttons are pushed at the same time, at most only one tone will be transmitted and neither digit will be decoded at the central office.

Summarizing, each of twelve digits is represented by a unique combination of one tone from a low-frequency group and one tone from a high-frequency group which are generated by pushing a single button. Depressing two buttons in any row will generate the low-frequency tone corresponding to that row while pressing two buttons in any column will generate the high-frequency tone corresponding to that column.

The oscillator in the pad is a relatively simple device although a review of the literature[2,3] will show that a lot of thought went into the design of it. The information that follows was obtained primarily from references 2 and 3. These particular issues also have articles on other aspects of the Touch-Tone system such as tone decoders and will be of interest to anyone involved in this type of activity.

A brief description of the touch-tone oscillator will be of interest, especially to those who have tried to trace the circuit from the pad itself. The basic oscillator circuit is shown in figure 1, on a single frequency basis. The output of an emitter follower amplifier is transformer coupled back to its own base. As is well known, an oscillator must have a voltage gain around the loop of unity; even though an emitter follower has a voltage gain less than unity it can have a considerable power gain. The necessary voltage gain is obtained by adjusting the turns ratio of the transformer to have a voltage step-up. The capacitor C_A resonates with the stray inductance of the transformer at the desired frequency of oscillation. The device marked RV_A is a varistor which is basically two zener diodes back-to-back and is used to obtain limiting action. The reason for obtaining limiting action in this manner will be explained later. The basic circuit is seen to be simple and straight forward with no tricks or gimmicks.

Figure 2 shows a more complicated form of oscillator. This oscillator is still a single frequency device in that only one frequency at a time can be generated; however, this frequency can be changed by changing the tap on winding A. The coils A, A', and A" are magnetically coupled to each other. As before RV_A is used to limit the amplitude of oscillations and is tapped across coil A to obtain a closer match between the amplitude of oscillation and the characteristics of available devices.

The varistor RV_1 is used to provide a constant bias voltage at the base of the transistor as the available d.c. voltage may vary over a wide range depending on the distance from the central office. With a constant base voltage the collector current is then controlled by the emitter resistance R_2; this is set to be about 20 ma. (My pad draws 11 ma in operation.)

The next step in the development of the circuit is shown in fig. 3 which provides for dual frequency operation and shows a rudimentary connection to the telephone set.

Dual frequency operation is obtained by using two tuned transformers in series. Wind-

[2] Schenker, L., "Pushbutton Calling with a Two-Group Voice-Frequency Tone," *BSTJ*, Jan. '60, pp. 235-255.

[3] Ham, J. H. and West, F., "A Touch-Tone Caller for Station Sets," *IEEE Trans. on Communications and Electronics*, March '63, No. 65, pp. 17-24.

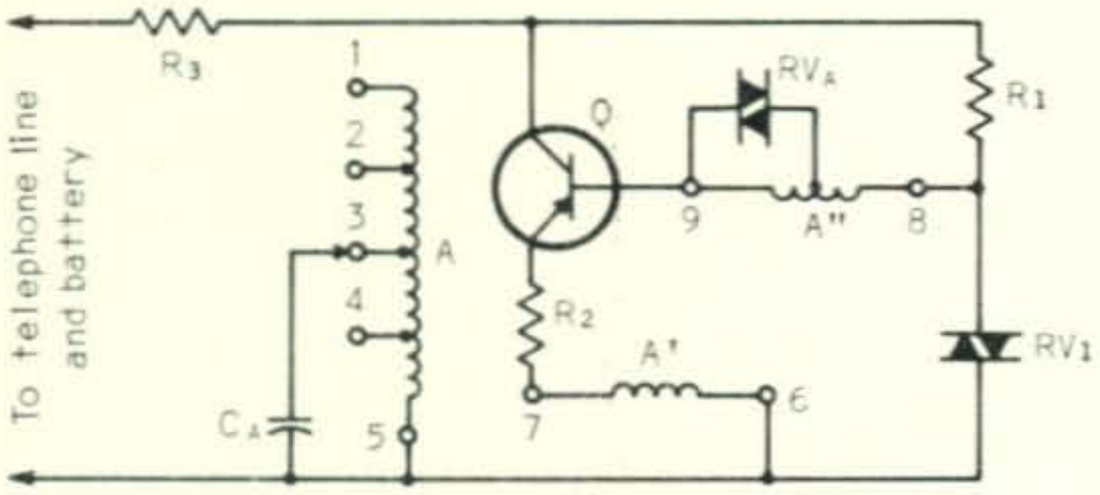

Fig. 2—Basic Touch-Tone pad oscillator; single group—multiple frequency.

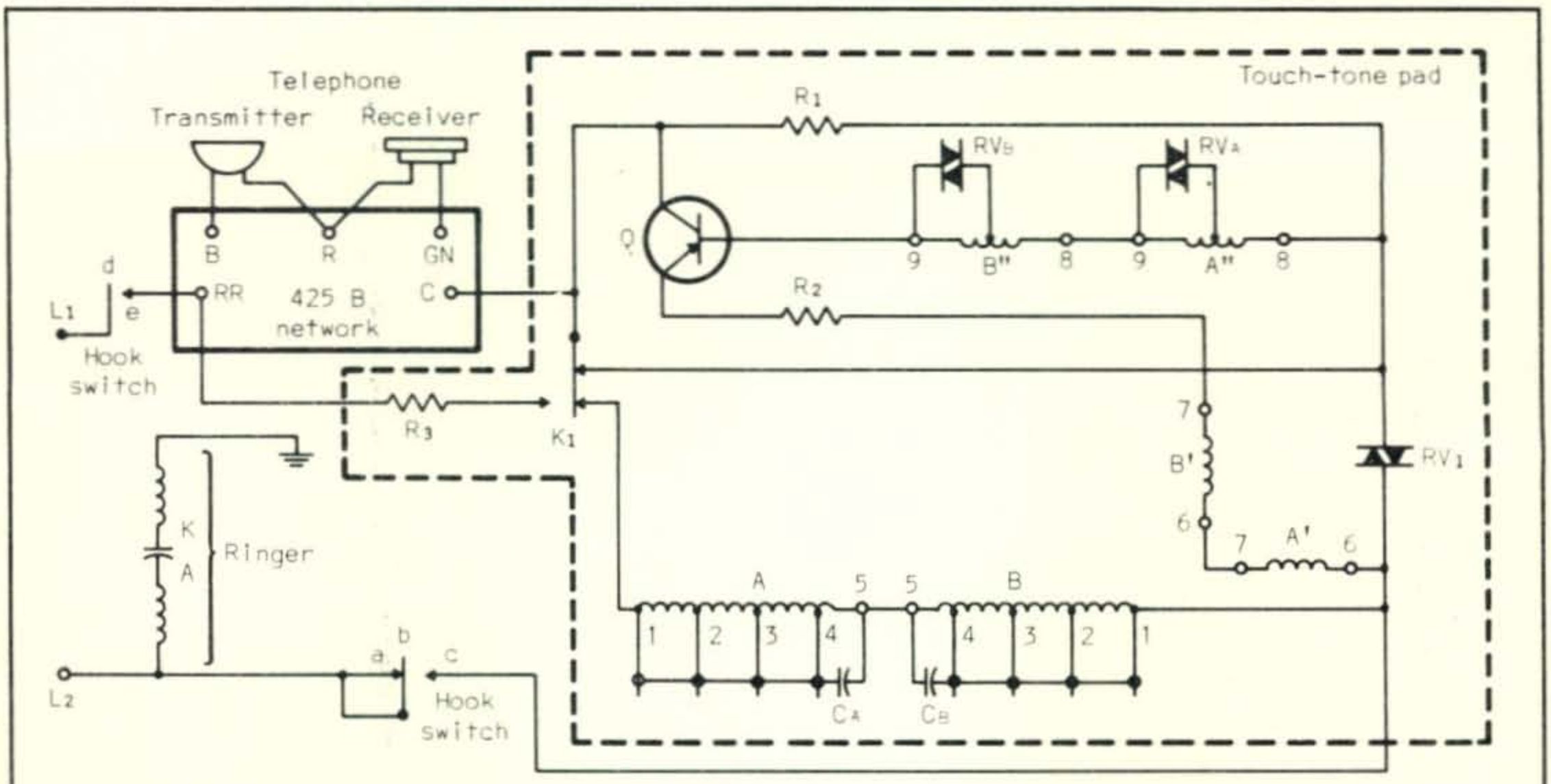

Fig. 3— Basic dual frequency circuit as applied to a Type 500 telephone set.

ings A, A' and A" are magnetically coupled as are windings B, B' and B". There is no coupling, however, between transformers A and B, Varistor RV_A (limits the amplitude of the A set of frequencies while RV_B does the same for the B set. When a button is pushed, capacitors C_A and C_B are connected to the appropriate taps on their respective coils and the switch, K_1, which is common to all push buttons, is activated. This serves to disconnect the carbon button transmitter in the handset and to insert attenuation into the telephone receiver to reduce the amplitude of signal to a comfortable level.

The final step in the development of the oscillator is shown in fig. 4 which shows the pad connected to a type 500 telephone instrument. The instrument circuitry is shown for reference only; do not try to trace the signal through the instrument as mutual coupling between the various inductances is not shown. A very readable description of the instrument circuitry is given by D. C. Coy[4] in the September 1968 issue of *CQ* which does show the transformer couplings. Those interested will probably find signal tracing through the instrument easier by comparing fig. 4 above with fig. 12 of Coy's article.

The use of two tuned circuits in series results in some frequency pulling when two tones are being generated as compared to single tone operation. The pulling effect is most pronounced when the two frequencies are closest to each other. This occurs when the highest frequency in the low group and the lowest frequency of the high group (the star, 941 Hz and 1209 Hz) are activated. Under this condition the pulling is about 3 Hz. The shift is reduced to approximately one-half this by adjusting the taps on the inductors.

Dual frequency operation also requires that the amplifying device be made as linear as practicable. This restricts the amplifier to a class-A device with external limiting as provided by the varistor RV_1. If the amplifier were allowed to operate in the usual class-C manner, all possible sum and difference frequencies would also be generated. The transistor used is listed as a Western Electric type 12D which is an alloy junction PNP type with a minimum α of 0.95.

The pushbutton assembly also deserves some comment. Early in the down stroke each tuning capacitor is connected to the appropriate tap on the transformers. Later in the downstroke contacts which are common to all pushbuttons are activated. The common contacts accomplish the following functions in the order listed:

1. Attenuation is inserted into the telephone receiver to reduce the sidetone level to a comfortable level.

2. The telephone transmitter circuit is opened to prevent speech or background noise from interfering with the signal and

[4] Coy, D. E., "Phones and Phone Patches," *CQ*, Sept. '68, pp. 16-25.

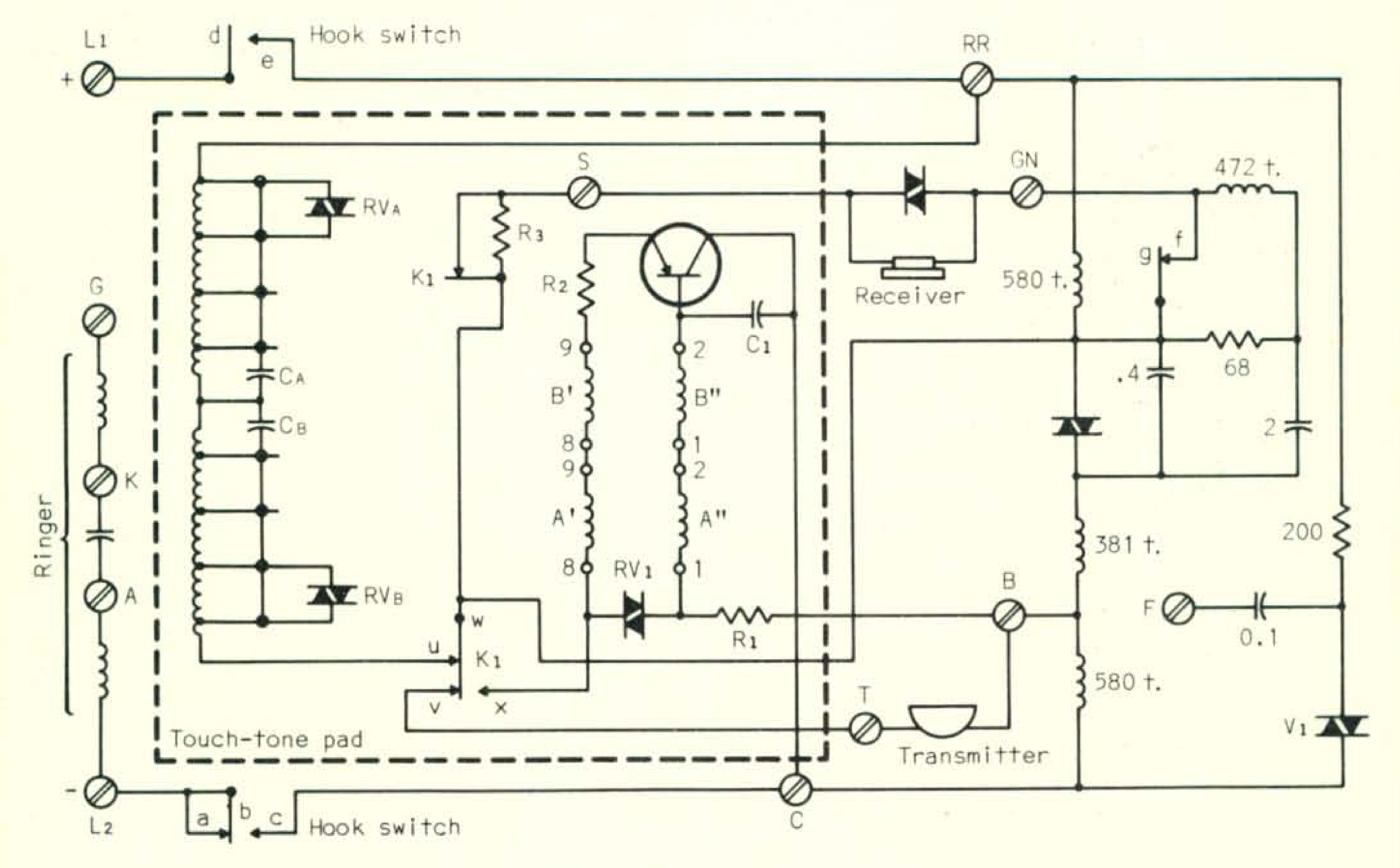

Fig. 4—Integration of Touch-Tone pad into telephone instrument.

confusing the central office decoder.

3. Power is applied to the transistor.

4. Direct current through the tuning coils is interrupted to initiate the signal at full amplitude by shock excitation. This occurs last so that none of the energy stored in the tuning coils is wasted prior to activating the transistor.

The multiplicity of functions done by the common terminal, many of which interface with the telephone instrument itself, explains the large number of leads to the oscillator pad.

The information given above was obtained from articles published by Bell System authors in 1960 and 1963. I have tried to obtain up-to-date information on the circuitry and service instructions on touch-tone pads from the Bell System but was notably unsuccessful. In fact, the Bell System refused to comment on an early draft of this article. I do not believe that any major changes have taken place over the years in the philosophy or construction of touch-tone pads, so that the above information is basically accurate; however, minor changes may have occurred as a result of manufacturing and field experiences with the pads. In any case, with the Bell System

[*Continued on page 95*]

Table II—Touch Tone Pad Characteristics

Signal Levels (as measured into a 600 ohm test termination):

Nominal level per frequency —6 to —4 dbm

Minimum level per frequency:
Low group .... —10 dbm
High group .... —8 dbm

Maximum difference in levels between frequencies .... 4 db

Maximum level per frequency pair .... +2 dbm

Frequency Deviation: Tone frequencies should be within ±1.5 percent of their nominal values.

Extraneous Frequency Components: The total power of all extraneous frequencies accompanying the signal should be at least 20 db below the signal power, in the voice band above 500 Hz.

Voice Suppression: Voice energy from the telephone transmitter or other source should be suppressed at least 45 db during tone transmission.

Rise Time: Each of the two frequencies of the signal should attain at least 90 percent of full amplitude within 5 ms from the time that the first frequency begins.

F. M.

BY GLEN E. ZOOK,* K9STH

The Well Rounded Amateur

What is a well rounded amateur? A well rounded amateur is an operator who does not let one narrow facet of amateur radio monopolize his entire talents and efforts at the expense of other interests both within and without amateur radio. Unfortunately, the well-rounded amateur is becoming more and more rare in f.m. circles. Just talking day in and day out, or just building, or just anything that is one single effort tends to warp one's opinion of other facets of amateur radio.

F.m. is rapidly gaining a reputation in some circles as being a haven for escapees from the Class D CB band due to the seeming preoccupation with idle chit-chat on many repeaters with little or no purpose to the communication. The nature of present f.m. activities in most cities on repeater channels *is* akin to the CB channels due to the relatively few frequencies available for a large number of users. This, coupled with the newcomer's or casual listener's baptism of fire on the usual repeater combinations, tend to extend the notions that f.m. is just another CB band. The convenience of channelized communications which are the primary benefits of f.m. operations lead to the preoccupation with little else except repeated contacts with the same few persons time after time.

F.m. is only a medium of communications, just as a.m. is also only a medium. What information is put on the basic carrier and what is done with that information are the real benefits and enjoyments of f.m. Chit-chat is quite enjoyable, and is certainly not restricted to 2 meters or f.m. Take a look at 75 meter s.s.b. operation any evening. The same thing has been going on down on the h.f. bands for years. The reason f.m. appears to have more "chit-chat" is the small number of channels in use. Such operation should be only a portion of the activity of the average f.m. operator. Other activities are a natural for v.h.f. such as emergency communications, propagation study, experimentation and building, and the many other areas of amateur radio which have existed for many years.

The unfortunate circumstance is that participation in other activities seems to be "out" in many areas. Emergency preparedness is such a "drag" that many operators now have

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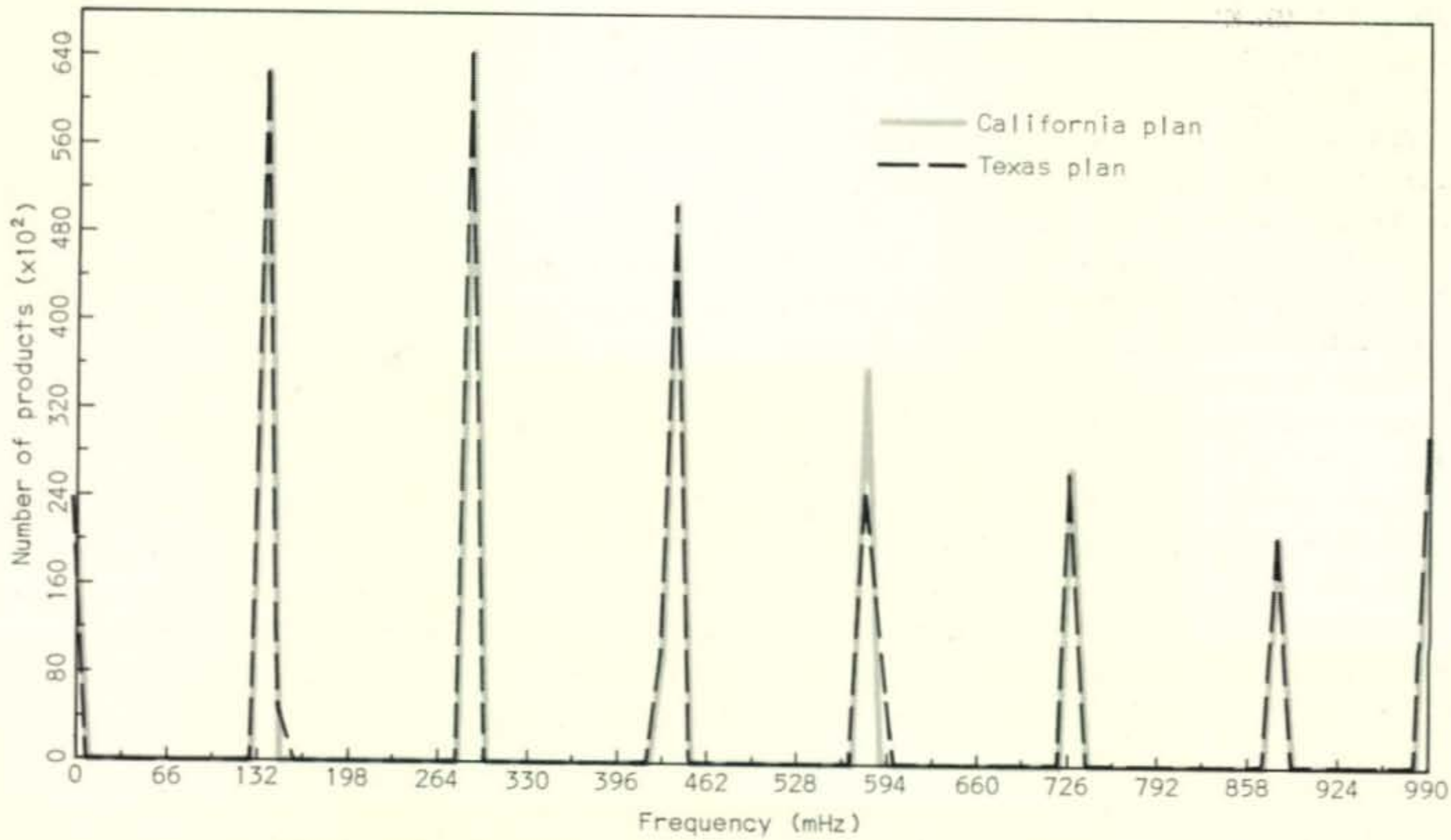


Fig. 1—Comparison of Texas and California 2-meter band plans. Overall, the two plans appear almost identical.

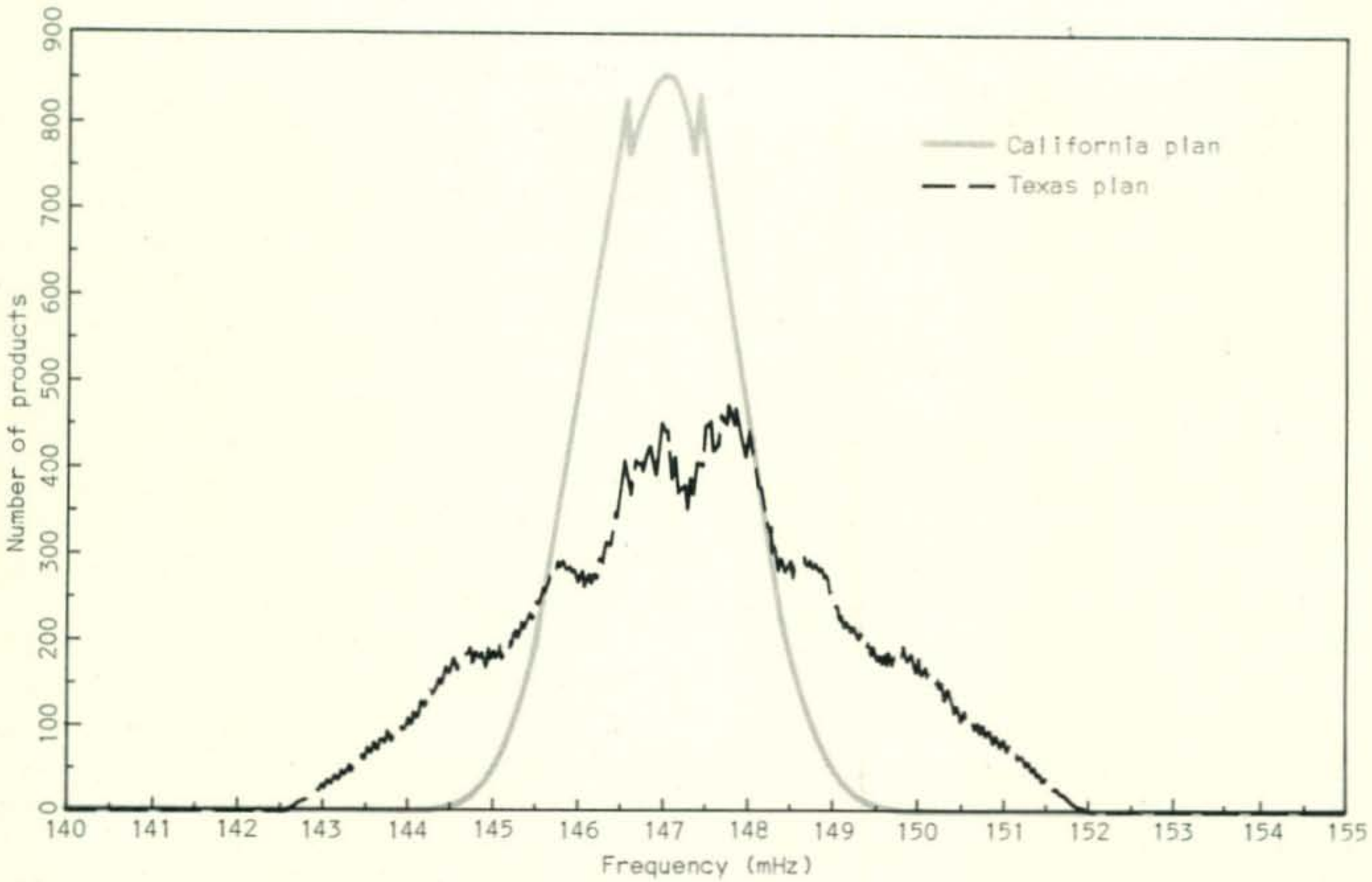


Fig. 2—All intermod products falling within the 2-meter and commercial highband frequencies.

no idea, let alone desire, how to really operate during a true emergency. Other f.m.'ers don't realize that a repeater is not always necessary, or for that matter, even desired for many types of operation on v.h.f. f.m. For example, two fixed stations with good antennas can often work over a given path better than the repeater without tying up the entire countryside. Sure it means a bit more work in the antenna and making sure the equipment is working properly, but isn't that also necessary for the best repeater operations? F.m. operators who have re-discovered direct or simplex operations are having a ball on 146.-520 mHz and other channels.

Building and experimenting on v.h.f. and f.m. are not as complicated as they used to be, especially when dealing with simple equipment. The major amateur magazines have been featuring construction articles on f.m. that can be built by just about anyone who knows enough to pass his theory exam. Even an occasional look at another mode or band can be quite a help in broadening the f.m. operator. There is a bit of activity on c.w. and s.s.b. on 6, 2, 220, and 450. Some f.m.'ers may want to take an occasional look at those bands. Those operators who can work the lower bands may want to take a look down there once in a while just to appreciate the benefits of v.h.f. f.m.

The FCC is forcing amateurs to update, and broadening interests makes updating just a bit easier. Sure, not everyone is a EE, but many operators with no technical training are making significant local contributions in f.m. Building and experimenting helps with the understanding of theory and those higher class exams. Getting on c.w. once in a while keeps us legal when we say on our renewal forms that we can still take 5, 13, or 20 w.p.m. Also, with the recalling of many amateurs with mail-order Technician and Conditional licenses, becoming familiar again with c.w. and theory is a must to stay on the air. Thus, by broadening interests f.m.'ers can not only help themselves, but with the higher level of technical competence, we can do even more for f.m. Think about it.

Technical Talk

The April Technical Talk featured the start of a study by Jack Mason, W5NSQ, comparing the two prevalent two meter band plans, Texas Plan and California Plan, on an intermod product basis. The graphs last month were computer generated and based on the happenings within the amateur two meter band. Since intermod products fall outside the amateur frequencies as well as within, further work was necessary to get a better picture of just where these products were going. In the comments for April it was mentioned that preliminary examination of the spectrum outside the amateur bands

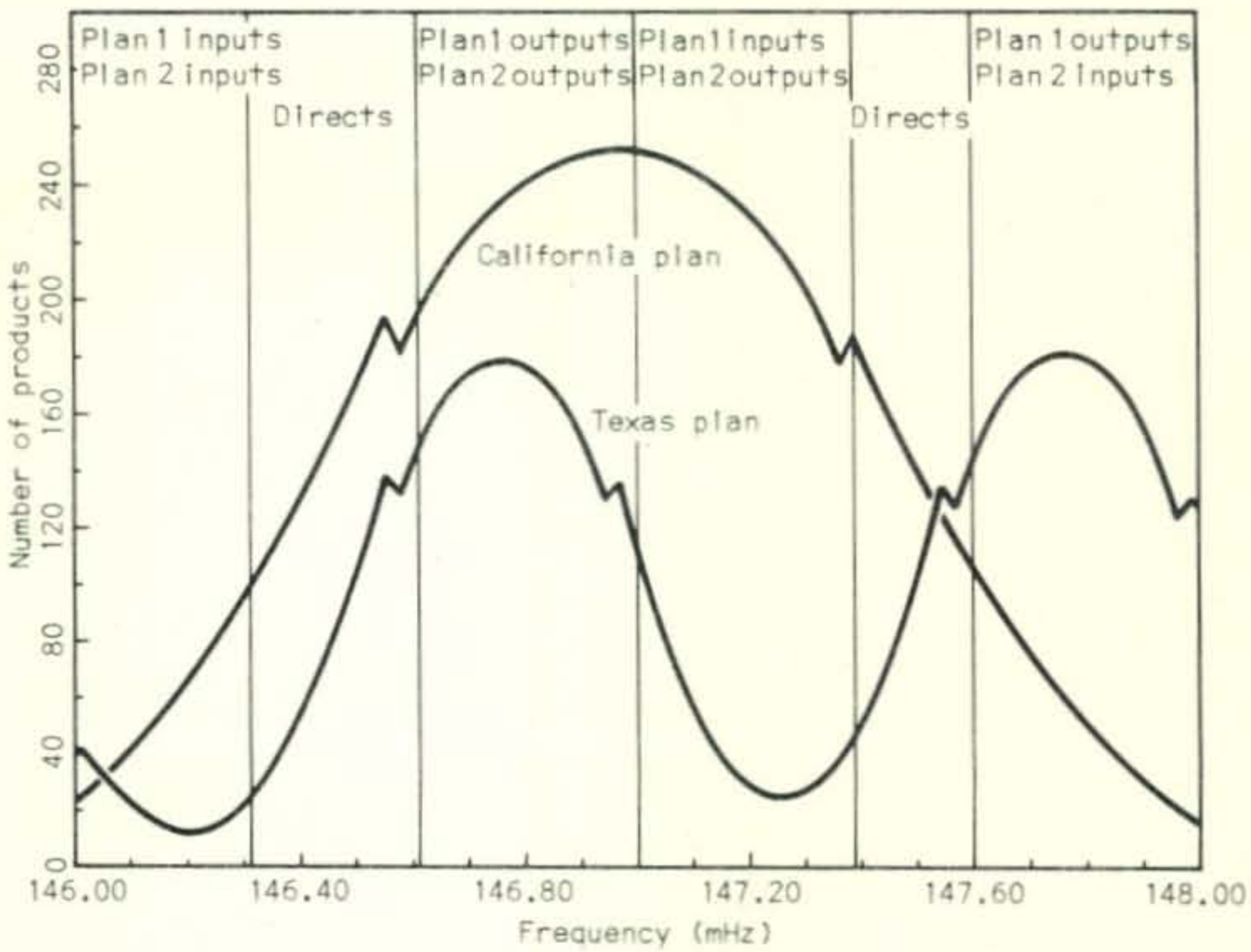


Fig. 3—Third order products appearing within the f.m. portion of the 2 meter band. The shaded areas are referenced to the text.

placed the California Plan further into the commercial high-band segments than the Texas Plan. However, the final graphs do not bear this out. The Texas Plan has products up to about 150.8 mHz, the beginning of the normal high-band commercial frequencies, and the California Plan drops off at about 149 mHz, in the MARS, CAP, military ranges. However, within the two meter band the California Plan produces many more products than the Texas Plan.

Since the beginning of the studies of the Texas versus California plans a third plan has been proposed by *73* magazine, namely 1 mHz spacings with 20 kHz channels. A comparison of this plan versus the two previous plans is now underway by W5NSQ and WA5SKN. When completed, the results will be made available. One must remember that the studies are being made based on a "worst" case situation. That is, all frequencies operating at the same time, from close physical locations, and at the same signal strength. In practical applications this worst case will be very unlikely to occur. The idea is to look at all possibilities rather than to discount any in an arbitrary manner.

The graphs were actually generated by the computer, so care must be taken when comparing one figure to another since the "x" scales are similar but the "y" scales differ from figure to figure. The wierd scale points are due to the computer trying to expand the graphs as much as possible on a given size sheet of paper. Of course direct comparison between Texas Plan and California Plan on any one figure can be made. Typically odd order intermod products are much stronger

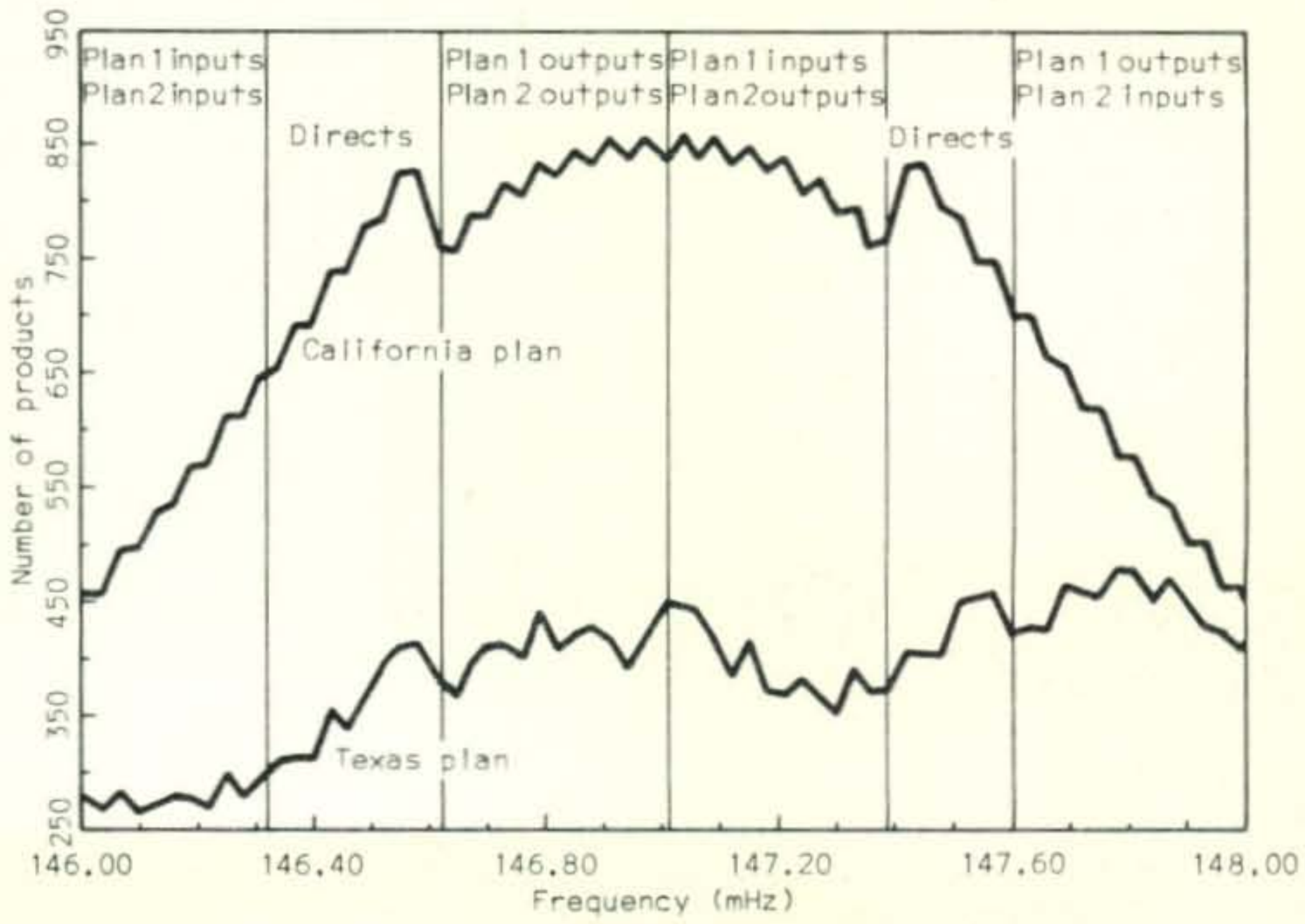


Fig. 4—All intermod products within the f.m. portion of the 2-meter band.

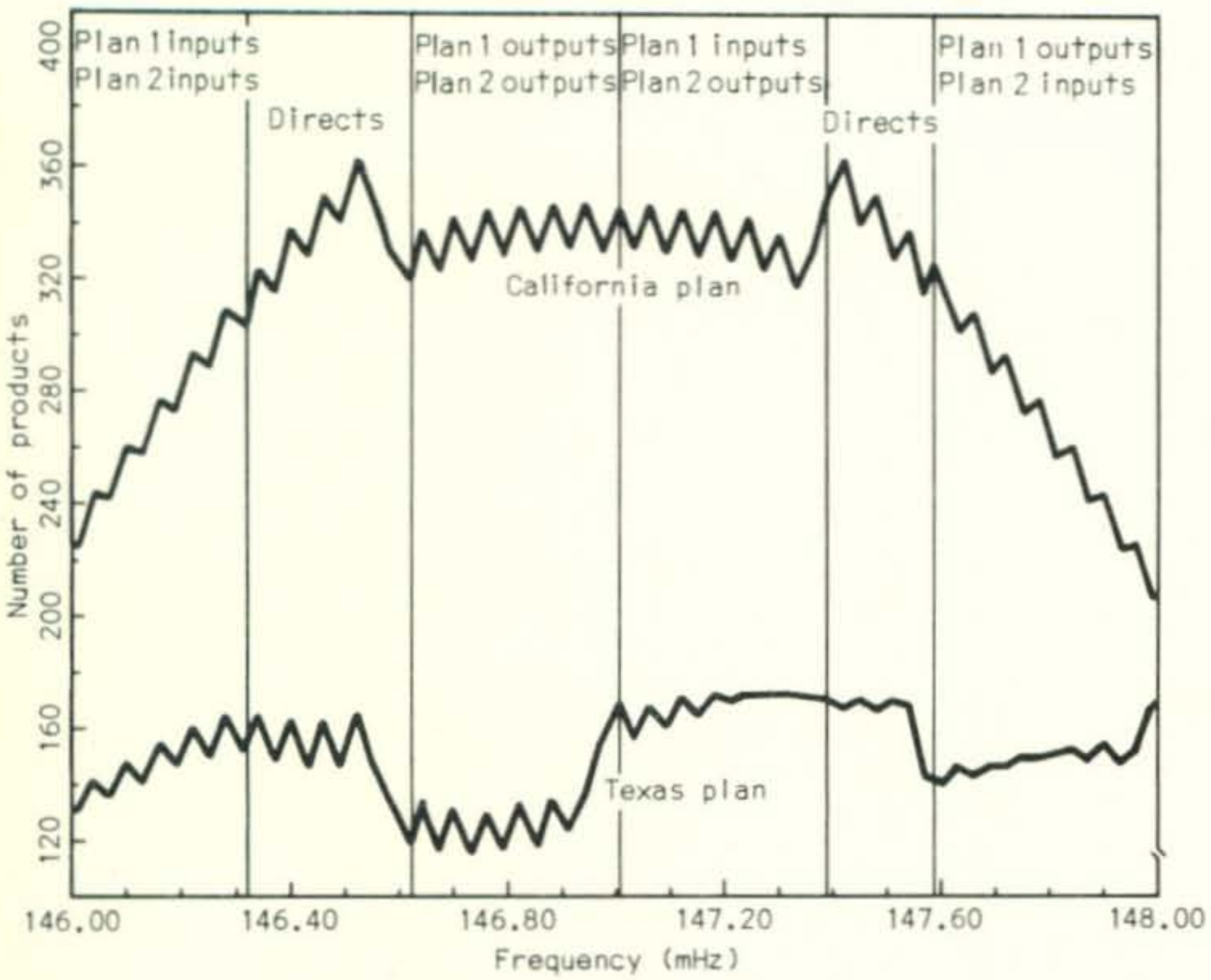
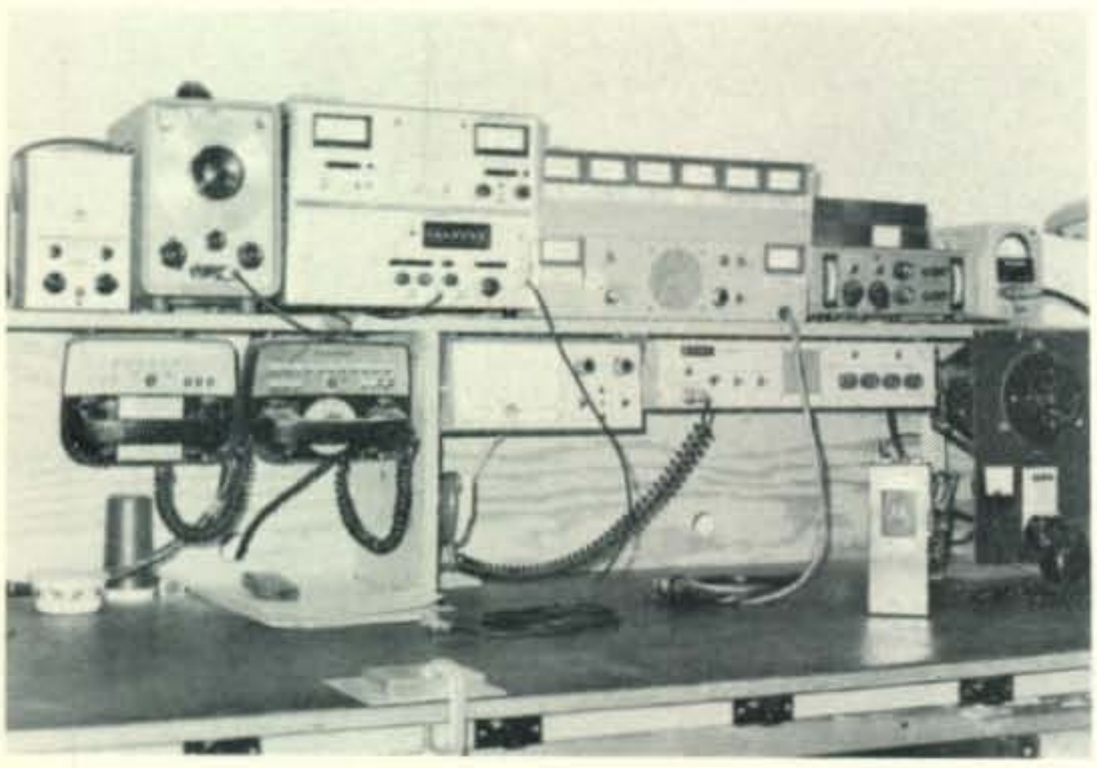


Fig. 5—Fifth order intermod products within the f.m. portion of the 2-meter band.

than even order products thus causing many more possible problems. Therefore, the comparison graphs for the odd order and total pictures are presented to conserve space. Also, not all products fall within the amateur or adjacent commercial frequencies. Due to harmonic mixing other belts of products appear about every 150 mHz up to 1 gHz (study made only up to 9th order products). In the case of these additional products the Texas and California plans come out just about equal. Fortunately these products are at lower signal levels and do not fall into civilian or military air traffic frequencies.

When looking at the graphs pay particular attention to the relative number of products appearing in the sub-bands. Plan 1 is the Texas plan and Plan 2 is the California Plan.

The first graph of special note is fig. 3, 3rd order products. The first sub-band is the present input portion of the two meter band. This is intended to remain as the input portion in both plans. In this segment the California Plan definitely has more products. The other two input segments, 4th segment for Texas and 6th segment for California show about the same number of products appearing on the repeater inputs. Of course the fewer products on the repeater input frequencies the less chance for them to tie up the repeater and cause problems.



The bench on which the majority of f.m. equipment tests are made looks like this. A regulated d.c. power supply has been added since the photo. The bench is equipped to handle commercial as well as amateur gear.

As would be expected both plans have peaks in the repeater output segments. However, the California Plan has a higher number of products in the output portions than does the Texas Plan. This can be seen by comparing the areas under the curve segments for each plan. The Texas Plan produces significantly fewer products in the simplex portions of both plans than does the California Plan. The remaining odd order graphs show the Texas plan lower in intermod products in all cases. There were no 9th order products appearing in the desired frequency segment.

Things are still a bit sticky when trying to compare the total picture in that there is a definite reduction in signal strength as the order number increases. Just how much that affects levels is now under study, and the final reports on all three plans will take into consideration a weighting factor based on decreasing signal levels of the products. When that is done the pendulum could swing towards either plan. However, preliminary looks point to the Texas Plan as being an edge better.

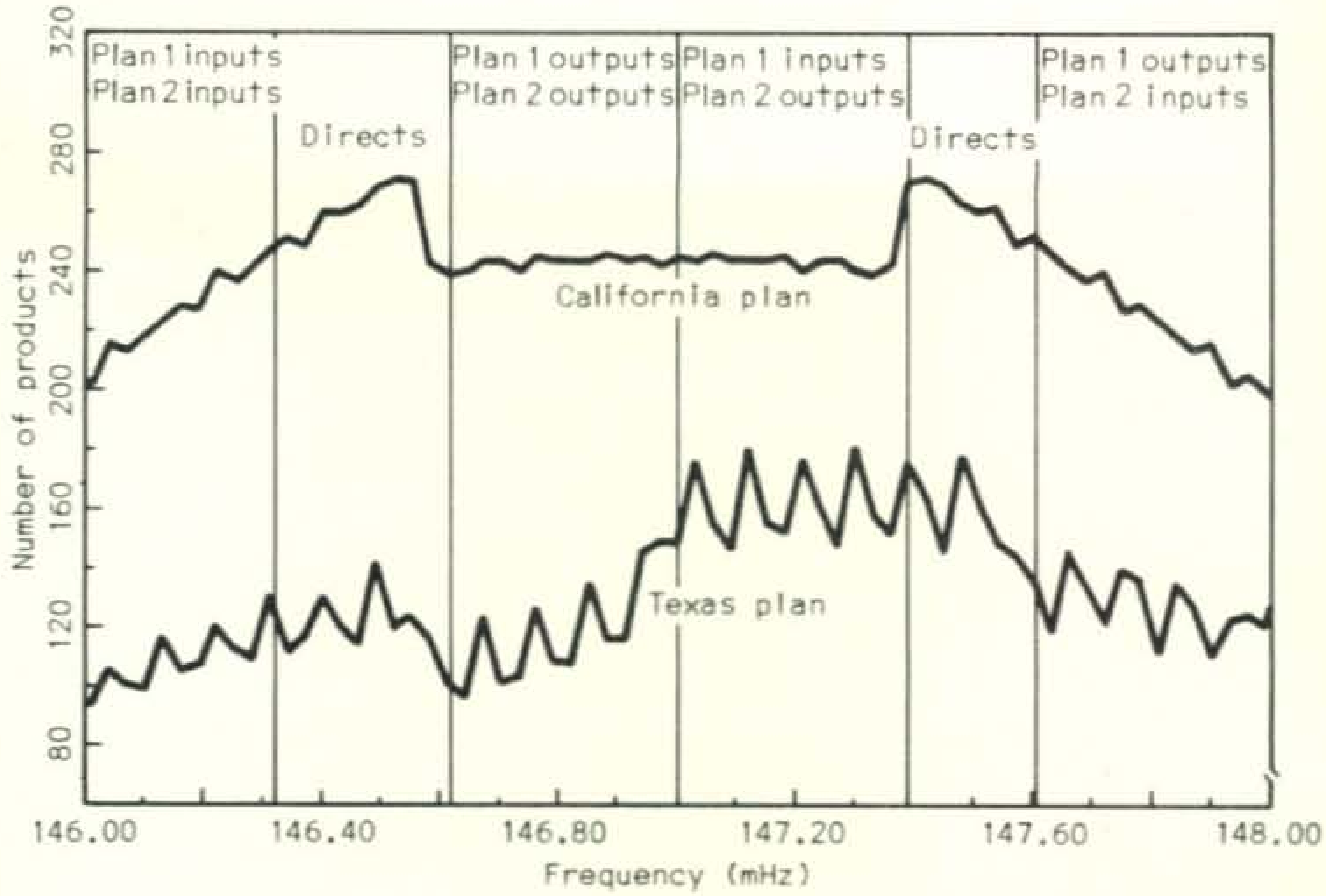


Fig. 6—Seventh order intermod products. There were no 9th order products in the f.m. portion of the 2-meter band.

As more information becomes available it will be published ASAP in this column. Again many thanks to Jack Mason, W5NSQ, and his able computer man, Dan Danz, WA5-SKM, for their help and efforts in making the intermod information available.

For Newcomers Only

Newcomers to the f.m. ranks have by now noticed that the various amateur magazines occasionally run reviews of f.m. equipment. The reasons behind these reviews is to give the prospective buyers an idea as what to expect in terms of performance, construction, potential problems, and related areas. Just how the other magazines review and test the equipment is unknown, but here's how *CQ* reviews f.m. equipment.

In all cases the equipment is compared primarily with the specifications set by the manufacturer. Since there are many factors including relative price levels, it is often unfair to try to compare equipment on an item by item versus what the competitor has (*e.g.*, Regency versus Standard versus Inoue). If the specifications of the manufacturers differs much from the usual norm, such as 0.5 microvolts for 20 db quieting in 2 meter receivers, this is definitely pointed out. Poor construction and workmanship get special note as do excellent pieces and samples of workmanship.

When a piece of equipment arrives for review, it is treated as though it was just bought from a local ham store and is immediately put on the air from the home shack. Since many amateurs are familiar with this columnist's voice, usual signal strength, etc. their comments are solicitated. If the unit seems to be working properly it is used for one or two evenings to get as many comments as possible. After that, or if the unit is not functioning properly, it is then taken to the technical facility for a real wringing out. Receiver sensitivity, adjacent channel rejection, image rejection, audio output quality and power are given a thorough going over as well as frequency stability and preset frequencies in both transmitter and receiver. The transmitter is also checked for power output and deviation.

The test equipment used in making these measurements are among the best items now available for f.m. communications checking. Frequency, sensitivity, and deviation measurements are made with a Motorola "Service Monitor" which is a synthesized instrument covering 100 kHz to well over 990 mHz in "dial-up" 100 Hz increments. Deviation readout is both by averaging meter and with oscilloscope readout for true peak deviation. Any tones required either for receiver power out or for transmitter audio checking are generated by Hewlett-Packard generators. Power output is checked with a Bird Termaline model 6154 wattmeter (5% accuracy). Checks for image and spurious responses are made with a continuously tunable generator with calibrated output due to somewhat easier coverage of a large frequency range than with a digital dial-up generator.

Readings are taken and recorded during each test. These are then taken a second time as a check on the accuracy the first time around. The unit is then returned to the shack, pictures taken, and the article written.

[*continued on page 95*]

A Tilt-Over Tower For $50

Or "Are You Sure This Is Going To Work?"

BY RUSSELL E. LEONE, JR.,* K7HEA

THERE you stand (or cling), some 45′ off the ground, hands full of quad or yagi, and you can't get it on the mast. Or maybe this is the eighty-third time since you put up your beam that adjustments or repairs were needed. And you don't like to spend your weekends entertaining your neighbors with feats of daring. And climbing that tower just isn't as much fun as you think it used to be. Or else you never did like more than one of your feet to leave the surface of the Earth at any given time. (If God had meant man to fly . . .)

I had a conventional tower, guy wires and all (remember what fun it is to get a beam up through the guy wires?), and a new home-brew quad which I was physically unable to assemble while clinging precariously to my 45′ high perch. After two attempts, and some dark thoughts about what would happen if (when?) some bamboo breaks or adjustments proved necessary, it was more than obvious that I had to find some way to tilt that @&%# tower over, stick the quad on, and tilt it back up.

Sound familiar? You bet. And I'll bet that you have often wished you could afford to replace your conventional tower with a tilt-over, fold-over, crank-down, collapsible yum-yum from the local purveyor of such merchandise, (what did you say the price was?) I wanted one. Now I've got one—cost me about $50—and some sweat—and a couple of nights I didn't get to sleep very early because the solution to the problem evaded me. Well, I have a solution to the problem, and I am happy to share it with you.

What if we fabricated a hinge to fit between sections? Seems like that would be fairly easy—then what? Hmm . . . have to build some sort of boom to stick down from the folding top sections so we can attach a cable from a winch to lower and raise the thing . . . now that's a problem. That sort of thing would require a lot of material ($$$) and to hire a welder ($$$) and maybe a truck ($$$) to get the boom to the QTH. No, too much money, too much fabrication, and too many complications would be encountered

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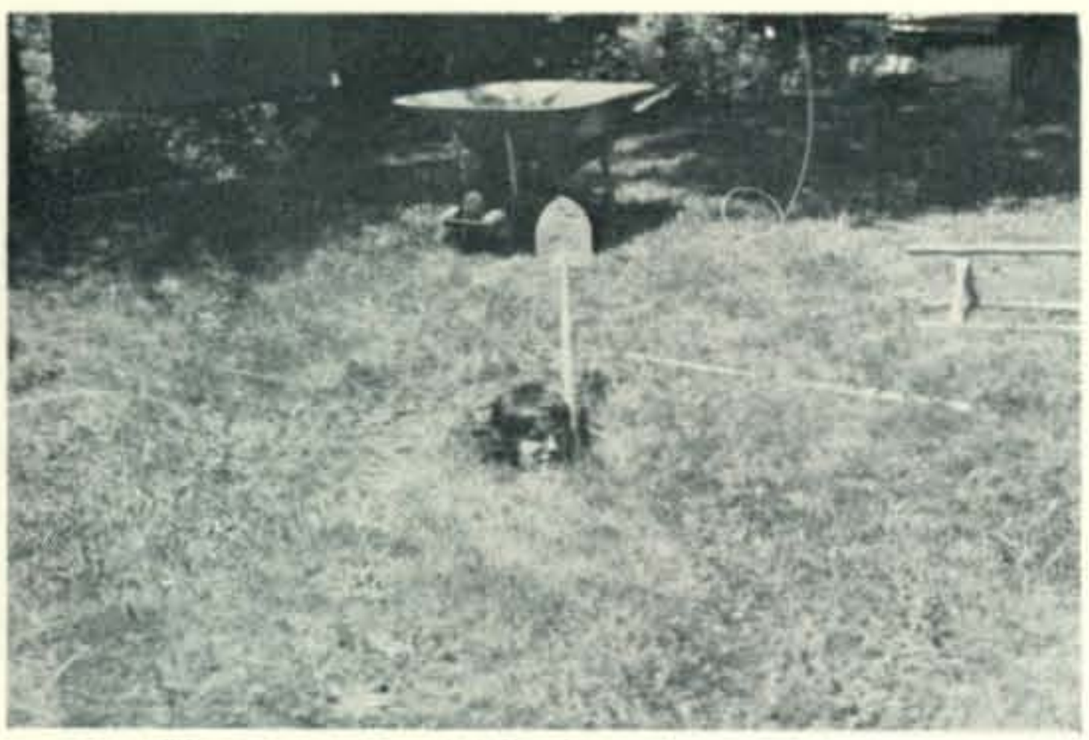


The hole should be deep enough . . .

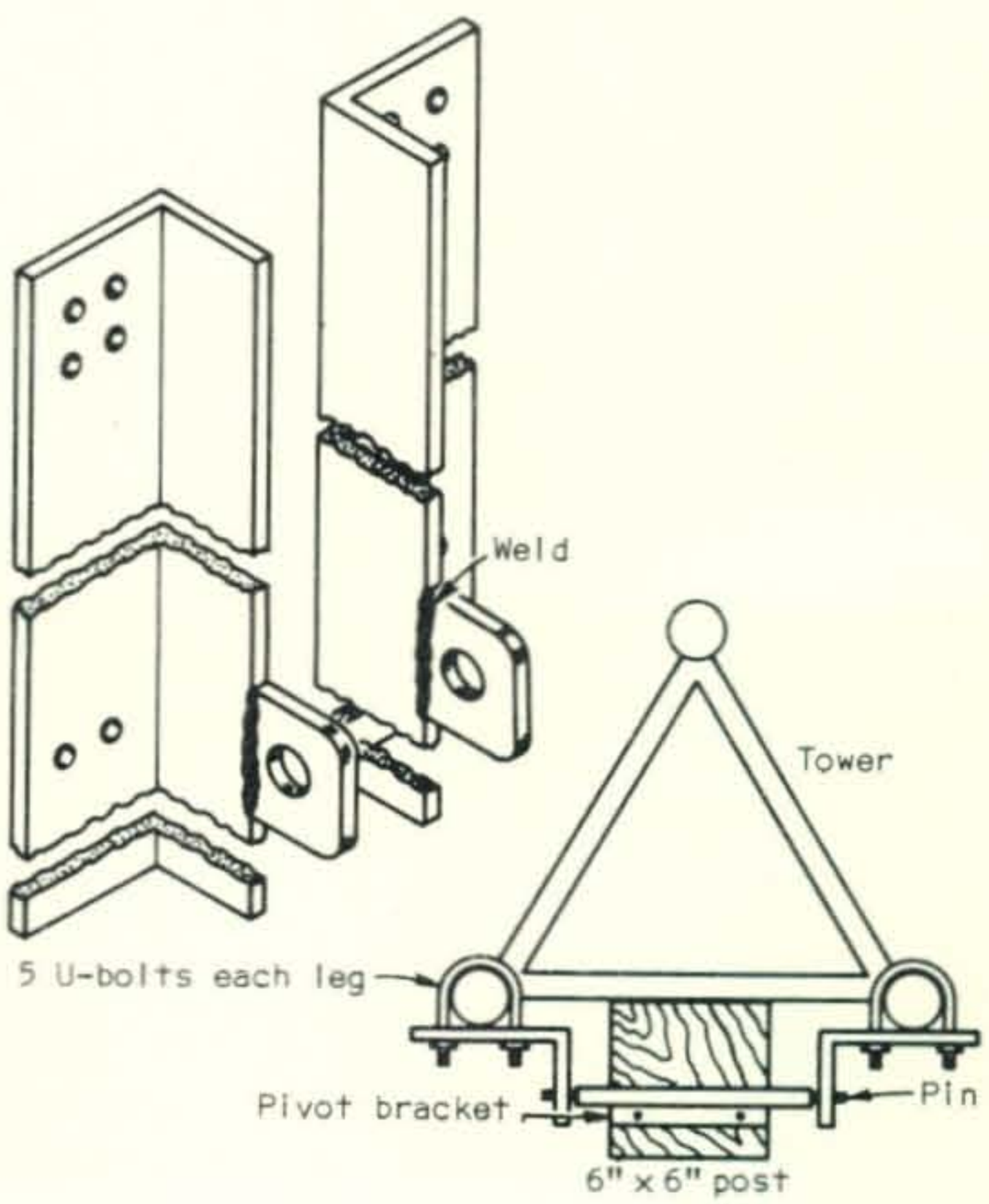


Fig. 1—Construction and installation of tower brackets made from heavy gauge angle iron.

on that course. Now what?

Well, what if we tilted the whole tower from the base? It would be hard to haul back up by hand, and if a winch is used there would have to be some winching point. Now we're getting somewhere, but it sounds like money again . . . besides, we don't have the room. Ah . . . a revelation, a vision!

First, let's get that thing down out of the air (I hope this is the last sky work I have to do . . .) and enlarge that hole. Be sure it's deep enough. Use your own judgment or consult the local expert about width and depth, we settled on three feet deep, eighteen inches wide at the bottom, with sides tapering to the top. In his hole went a six inch square by twenty feet long fir timber, the butt treated and set in an appropriate amount of concrete. Four 10′ sections of tower were assembled and brackets (fig. 1) were attached to the assembly with U-bolts. A pivotal bracket (fig. 2) was bolted to the top of the timber (are you sure this is going to work?), the tower assembly lifted into place, and the brackets coupled with a sturdy pin. Now we have what looks like a large, lop-sided see-saw (fig. 3) (are you SURE this is going to work?). Before the beam goes on, we must tilt the tower upright and cut the guys to the right length (this thing ain't self-supporing), as well as check out the mechanics of the system. That done, back down with the tower, on with the beam, back upright with the system, and we are on the air. To lower our system, it is necessary to disconnect only one guy and the fasteners at the base of the tower. Now we don't have a @&% # tower, we have a tilt-over tower.

I have purposely tried to simplify the above explanation (this project takes sweat, not blue prints and step-by-step instructions) trusting that your natural abilities will lead you through this article and the project. To further that end, I am offering the following suggestions which I believe important and urge you to observe.

In general:

1. The stated cost is around $50, and it was, but materials and related costs will vary with locality, availability, and your bargaining power.

2. Dimensions are not shown as they will vary according to your particular tower and the materials you use.

3. Be sure that your XYL, (are you SURE this is going to work?) has patience, stamina (Be sure it's deep enough.), and a good sense of humor.

4. Don't do this if you are going to move next year.

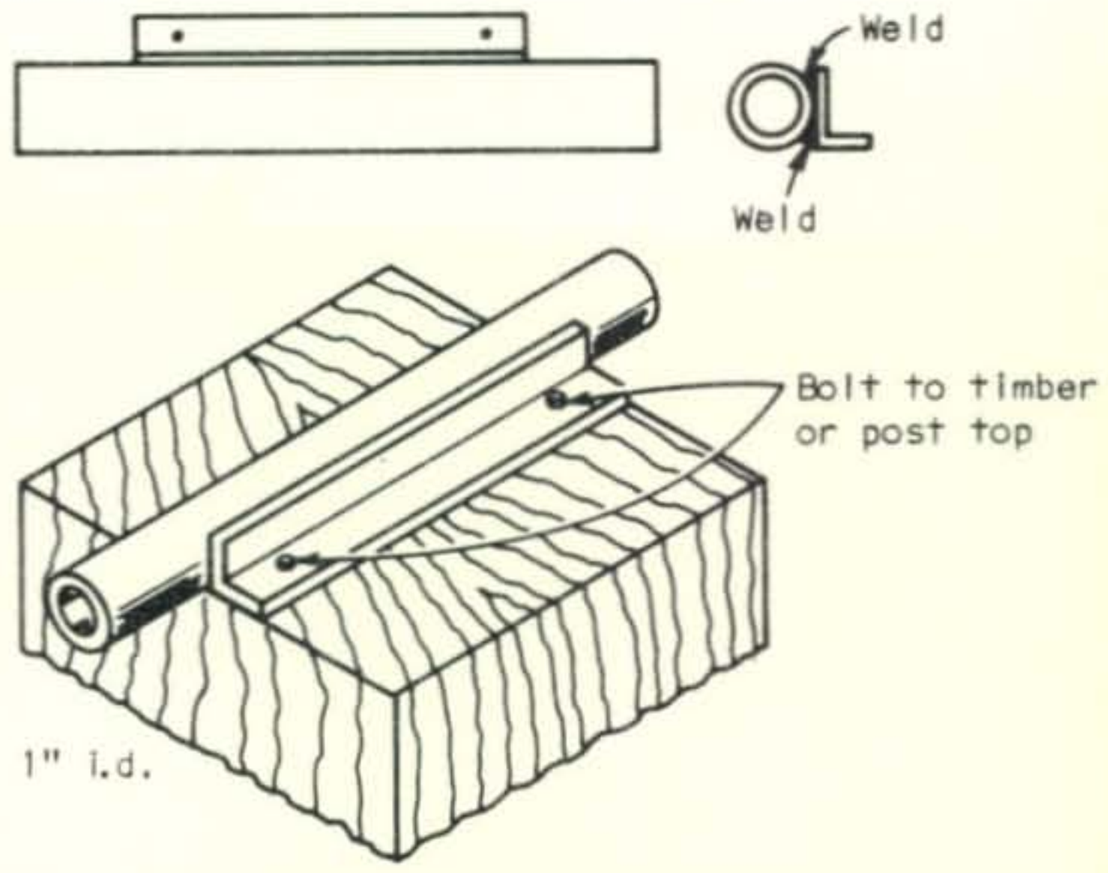


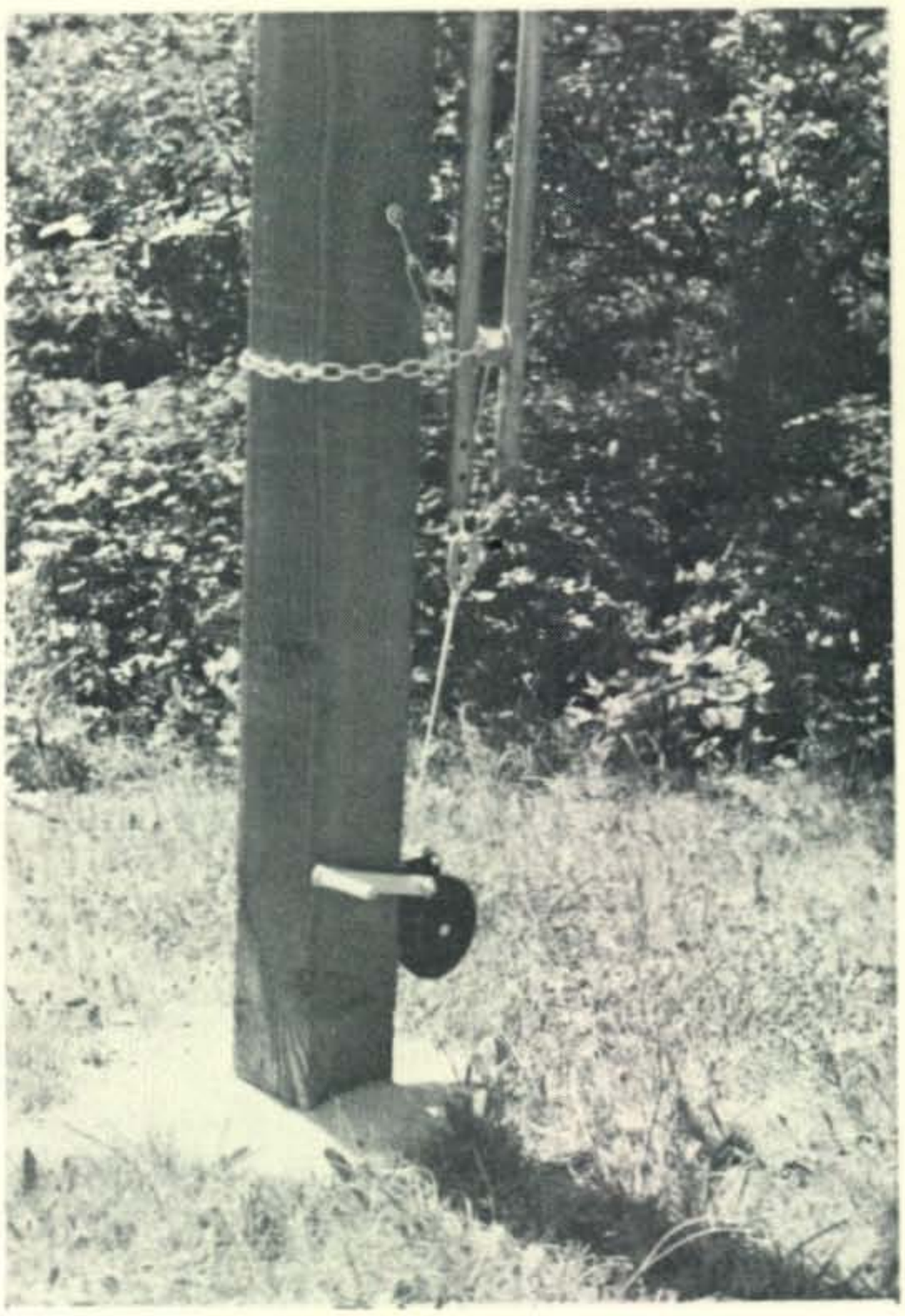
Fig. 2—The pivot bracket is made from a short section of 1" i.d. pipe welded to a 6" long section of angle iron. The bracket is bolted to the top of a 6" × 6" × 20′ fir timber set in concrete.

5. Don't call me if it doesn't work.

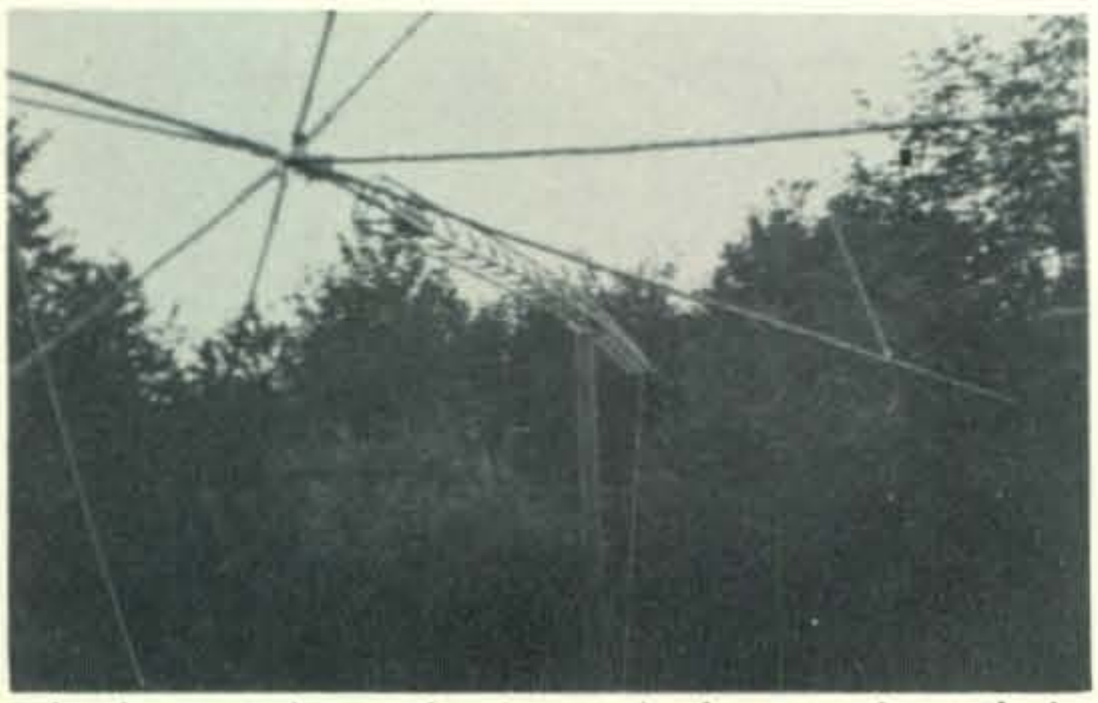
Specifically:

1. Pick the location for your tower carefully, being sure the beam and the lower end of the tower have room to clear surrounding objects.

2. Let the concrete cure one week before putting the tower in place. I am told this allows the



A double-ratchet boat winch bolted to the bottom of the timber allows easy raising and lowering of the tower. Note the chain used to secure the tower against curious children.



Tilted over, the author's tower shows only a slight bowing.

concrete to set sufficiently hard to bear the lateral thrust created when placing the tower on top the post, and later.

3. Use a double-rachet boat winch (try Sears) and be sure to attach the winch line to the lower end of the tower before lifting it into place. Also, carefully consider the weight the winch line must bear, and choose it accordingly.

4. It would be well to arrange some sort of pulley to enable you to lift the tower into place without resorting to brute strength. The winch, which is bolted to the post near ground level, should help a great deal. I didn't think my tower was very heavy and didn't use such an arrangement—an error which weighed heavily upon me.

5. Don't depend upon the top of the post to

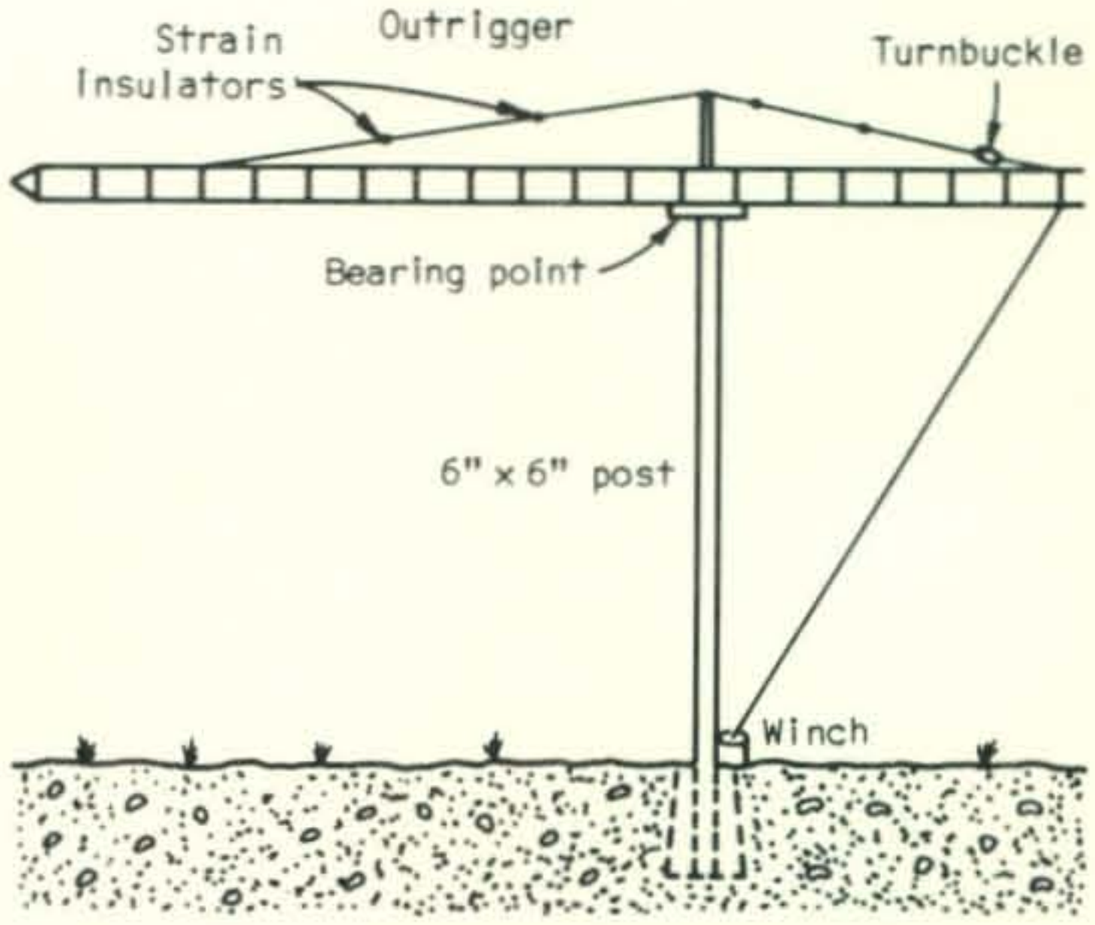


Fig. 3—In the tilted position the tower resembles a lop-sided see-saw. If the tower requires it, an outrigger assembly may be added for rigidity.

bear all the weight of the tower and beam, use some turnbuckles (or some similar device) at the bottom to hold the tower tightly against the post and help bear the load (see picture). As you can see, the cross pieces in the tower should fit tightly against the entire length of the post. Carefully take measurements of your tower and carefully consider placement of the brackets to insure your success.

6. Don't be alarmed at the limberness of the post if you should happen to be startled by the give in it when placing the tower. Presumably, you, or someone easily bribed, will be standing on an extension ladder leaning against the timber while the tower is lifted into place and the brackets coupled.

7. If you believe your tower is not strong enough (or don't want to experiment) to stand the weight of the beam when the assembly is horizontal, you won't be alone. An outrigger at the bearing point is suggested (fig. 3). Use guy wire, a turnbuckle, and (if you think it necessary) break it up with strain insulators to prevent loading. Use your imagination on the outrigger itself as I didn't think one necessary on my tilt-over (so far I'm right).

8. As an afterthought, I put a chain through the legs of the tower near the bottom and around the timber, padlocking the ends together. Hopefully this serves as a deterent to vandalism or a harmonic's curiosity.

There are many variations that can be made to this project for your particular needs. Perhaps a bigger timber (around or in length), or a short telephone pole instead of a timber, or another section of tower, or some other variation may appeal to you. My tilt-over works as told and illustrated here. We hope that you can profit from our project. Good hamming—hope to see you on soon with your new tilt-over. ■

MATH'S NOTES

BY IRWIN MATH,* WA2NDM

At the risk of having this column become the "power supply forum" we have one more new, interesting one for you this month.

Just made available is the Motorola MC-1468 dual ± 15 volt regulator chip. This device, which will be welcomed by operational amplifier users in particular, supplies equal positive and negative regulated 15 volt outputs at current up to 100 milliamperes from the chip alone. Higher currents can be obtained by the use of external power transistors.

Some features of the MC1468 are: the ± 15 volt outputs track each other to within .3 volts worse case and .05 volts typical; line and load regulation is .06%; provisions are present for current limiting as well as remote sensing; and hookup is extremely simple.

The MC1468 is available in three package styles depending on the heat sinking desired. These are shown in fig. 1. The G package dissipates .8W in free air, the L package (a DIP) dissipates 1W while the R package handles 2.4 watts. Incidentally, the R package case is at ground potential allowing a very simple installation on a chassis for even greater dissipation.

Figure 2 is a schematic diagram of a basic 50 milliampere dual regulator. Also included is a suitable unregulated source. Pin numbers in parentheses are for the L package while others are for the G and R packages. Rsc is the current limiting resistor and its value can be determined by the graph in figure 3.

Figure 4 is an adjustable version of the simple regulator. Notice that there are two potentiometers in this circuit. One, R_1, adjusts the output voltage to exactly 15 volts and the other, R_2, is used to make the + and − supplies both exactly equal. The R_2 function, incidentally, is only available in the DIP

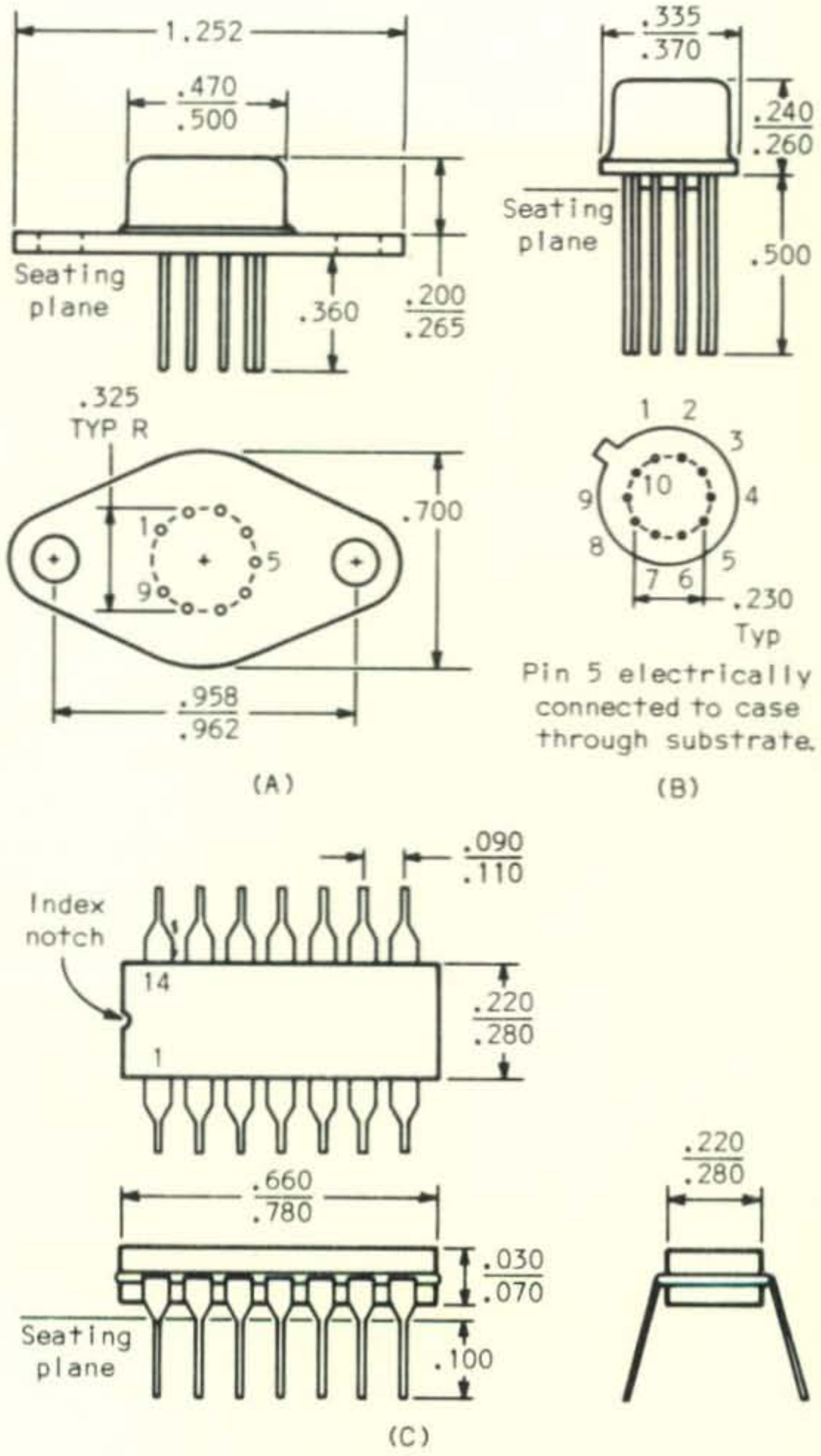


Fig. 1—The basic R, G, and L case styles for the MC1468.

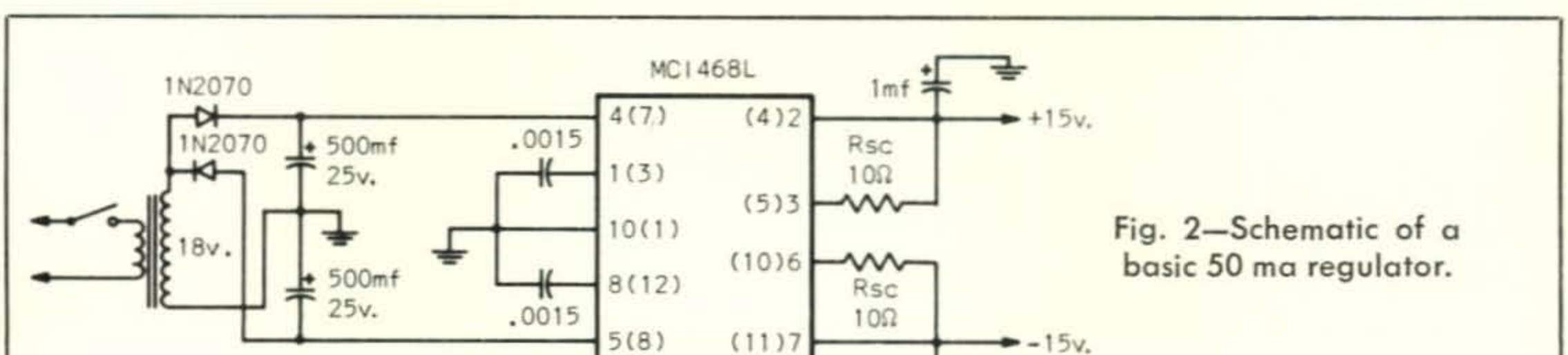


Fig. 2—Schematic of a basic 50 ma regulator.

* 5 Melville Lane, Great Neck, N.Y. 11023.

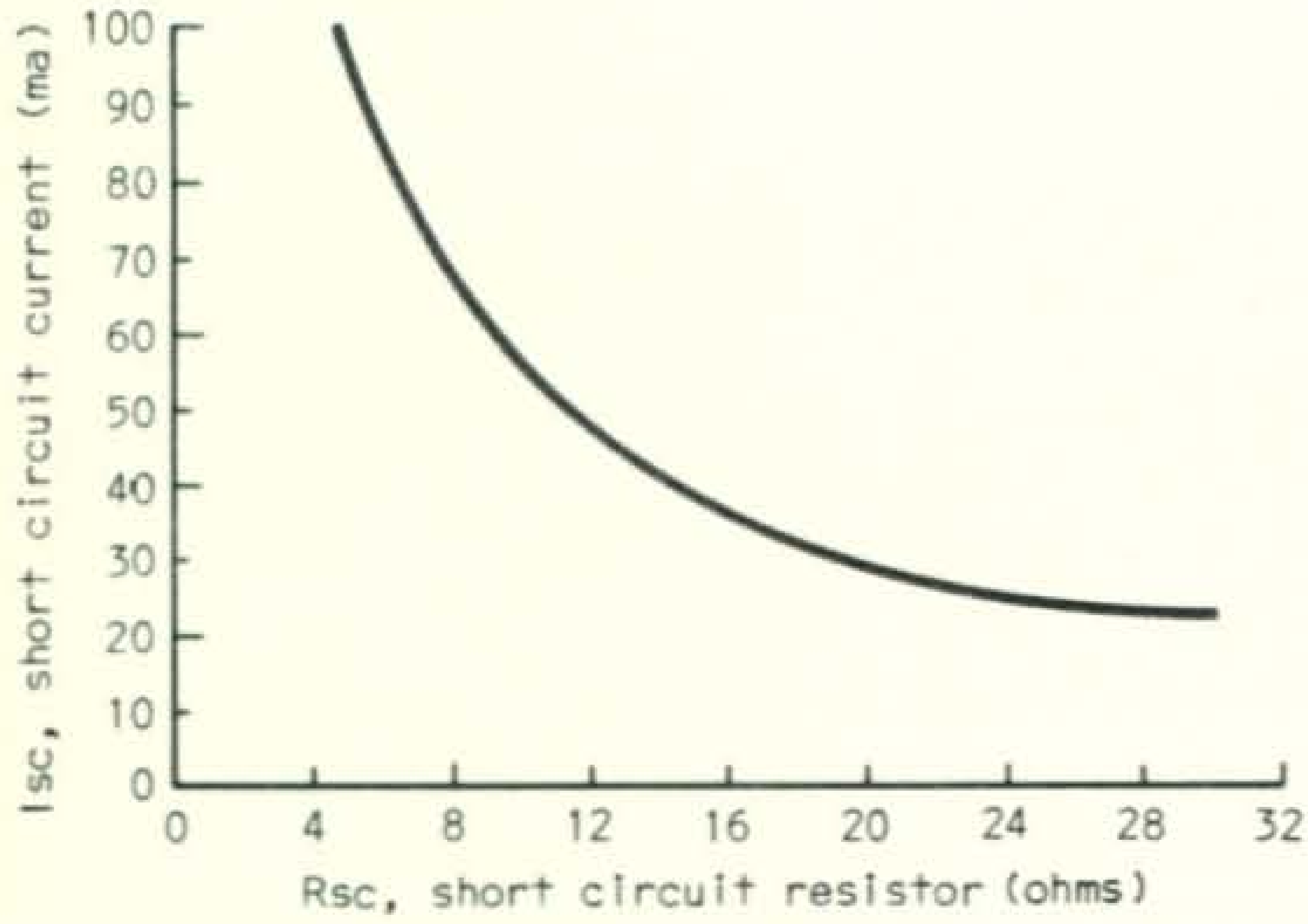


Fig. 3—The graph used to select the value of R_{sc}.

version of the MC1468.

Cost for this integrated circuit in 1-24 quantity is: MC1468L—$4.35, MC1468G—$4.20, and MC1468R—$5.62. We have used all three kinds and are pleased to report that they do indeed work quite well.

There are some new items we have become aware of that we would like to mention this month. On of these is a new low cost family of silicon rectifiers being offered by General Instrument, at 600 West John St., Hicksville, N.Y. 11802. These diodes, their G3 series, are packaged in glass envelopes with axial leads (about ¼" long and ¼" in diameter) and boast a full 3 ampere current carrying capability. Peak inverse voltages are available from 50 volts to 1000 volts. Since cost is only 39¢ in 100 quantity, these diodes should be perfect for high power, low cost transmitter use.

Solitron Devices, 1177 Blue Heron Blvd., Riviera Beach, Florida 33404, now has available a low cost line of germanium power transistors with current handling capabilities of 50 amperes and voltages of up to 60 volts. These transistors, designated SDG-604-5-6 and 7 are packaged in TO-3 cases with extra heavy leads to handle the higher currents. Being germanium, their internal drop is of course lower than silicon, which is extremely important at high currents. Prices for these units start at $1.75 each and they should be available at the time you read this.

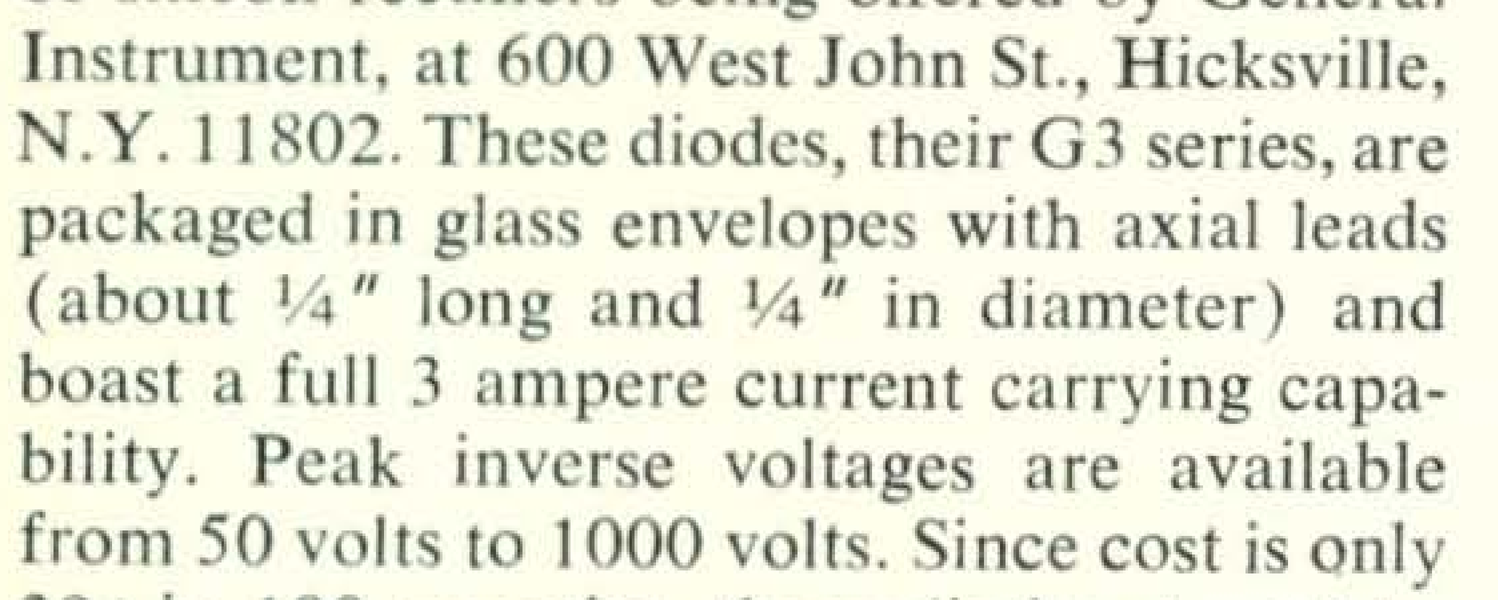


Fig. 4—Adjustable version of regulator for exact matching. The value of R_{sc} can be found in Fig. 3.

Remember the uA7800 series we described last month? National Semiconductor, 2900 Semiconductor Drive, Santa Clara, Calif., 95015, now has similar units, their LM340 series which are like the Fairchild units, available in pre-adjusted outputs of 5, 6, 8, 12, 15, 18 and 24 volts. Also available is the LM120 series, which are similar but for use with negative supplies. Voltages for these units are -5, -5.2, -12, and -15 at currents of up to 1.5 amperes. A request to National will bring data sheets with all information.

MJF Enterprises, P.O. Box 494, State College, Mississippi, 39762, has sent along some information to us pertaining to a highly selective filter that they offer that will be of utmost interest to the c.w. man. The CWF-2 is a selectable bandwidth active filter employing operational amplifiers that is said to have a slope of 60 db per octave with an 80 Hz bandwidth and center frequency of 750 Hz. What this means is that a c.w. signal being received through this filter (after being beat to 750 Hz, the other frequency) will be 1000 times stronger than one at 1.5 kHz or one at 375 Hz. Signals further away than ± 750 Hz will of course be even more attenuated. Two other bandwidths, 110 Hz and 180 Hz can also be obtained by means of a simple switching scheme. The filter is supplied on a 2 × 3 inch printed circuit board and works from 6 to 30 volts d.c. at a few milliamperes. Input impedance is high, 680K, while the output impedance is less than 2 ohms, allowing the use of phones or a small speaker. Cost for the CWF-2K in kit form is $9.95. Completely wired, it is known as the CWF-2 and sells for $12.95. Boards, schematics and separate parts are also available from MFJ.

There is some good news for radio amateurs needing coaxial antenna relays this month. A look at the new "old standby brand" price is rather discouraging. A look at what Magnecraft has to offer, however, brightens things up again. Their class 128 coaxial series, rated at 250 watts of c.w. power, 50 ohms matched (s.w.r. of 1.25:1 max.) up to 500 mHz are only $18 plus some charge for s.p.d.t. units and $20 plus charge for s.p.d.t. coax contacts and d.p.d.t. power contacts. Coils are available for 115 v.a.c.,

[*Continued on page 96*]

CQ Reviews: The Hallicrafters FPM-300 "Safari" SSB Transceiver

BY RICHARD A. ROSS,* K2MGA

THE Hallicrafters Model FPM-300 "Safari" is a hybrid single conversion filter type s.s.b./c.w. transceiver in the 250 watt input class. The unit is solid state with the exception of the transmitter driver and final amplifier which employ vacuum tubes.

Intended as a complete flexible station, the FPM-300 incorporates many of the most useful and desirable operating features which the state of the art permits, in a single, small, easily transported unit. Among the features of the Safari are: Full band coverage of all bands 80-10 meters; upper or lower sideband available on all ranges; 250 watts p.e.p. input on s.s.b.; 180 watts d.c. input on c.w.; built-in a.c. *and* d.c. power supplies; built-in vox and push-to-talk; semi-full (vox) break-in on c.w.; c.w. sidetone; 100 kHz/25 kHz calibrator; "flip-top" cabinet for easy access to internal adjustments; accurately calibrated, stable, v.f.o.; high-ratio gear drive/planetary drive tuning; modular construction on MIL-quality glass-epoxy circuit boards. Accessories available are a blower kit and a mobile mounting kit.

The Hallicrafters FPM-300 s.s.b. transceiver. The tuning knob skirt markings each represent 1 kHz; increments on the main calibrated dial are 10 kHz. Below the tuning knob is a knurled thumb wheel for calibration adjustment.

Basic Circuit Lineup

The FPM-300 employs single conversion on both transmit and receive with an i.f. of 9 mHz. Refer to fig. 1, a block diagram of the unit. On receive, incoming signals are amplified by Q_{501}, a dual gate MOSFET and fed to a balanced mixer U_{501} where it is mixed with a heterodyning signal to produce the 9 mHz i.f. output. R.f. and mixer input circuits are tuned by switching inductance or capacitance across parallel *L-C* circuits tuned by ganged pre-selector tuning capacitors. On 80 meters the heterodyning signal is derived directly from the 5 mHz v.f.o. On all other bands the 5 mHz v.f.o. output is premixed with the output of crystal heterodyning oscillator Q_{405} to produce the necessary heterodyning frequency for signal conversion to 9 mHz. These conversion frequencies are shown in Table I.

The i.f. signal is then amplified by another dual gate MOSFET before being fed to a 6-pole crystal lattice filter at 9mHz. One more stage of i.f. amplification follows the filter. An IC product detector, fed also by either of two crystal-controlled b.f.o.'s, demodulates the 9 mHz signal to audio where it is amplified by several a.f. stages.

BAND (METERS)	FREQUENCY (kHz)	HETERODYNE OSC (MHz)	INJECTION FREQ (KHz)	VFO (kHz)
80	3450	NONE	5550	5550
	4050		4950	4950
40	6950	21 500	15950	↓
	7550		16550	↓
20	13950	28 500	22950	↓
	14550		23550	↓
15	20950	35 500	29950	↓
	21550		30550	↓
10	27950	42 500	36950	↓
	28550		37550	↓
10	28450	43 000	37450	↓
	29050		36050	↓
10	28950	43 500	37950	↓
	29550		38550	↓
10	29450	44 000	38450	↓
	30050		39050	↓

Table I—FPM-300 conversion frequencies.

*Editor, *CQ*.

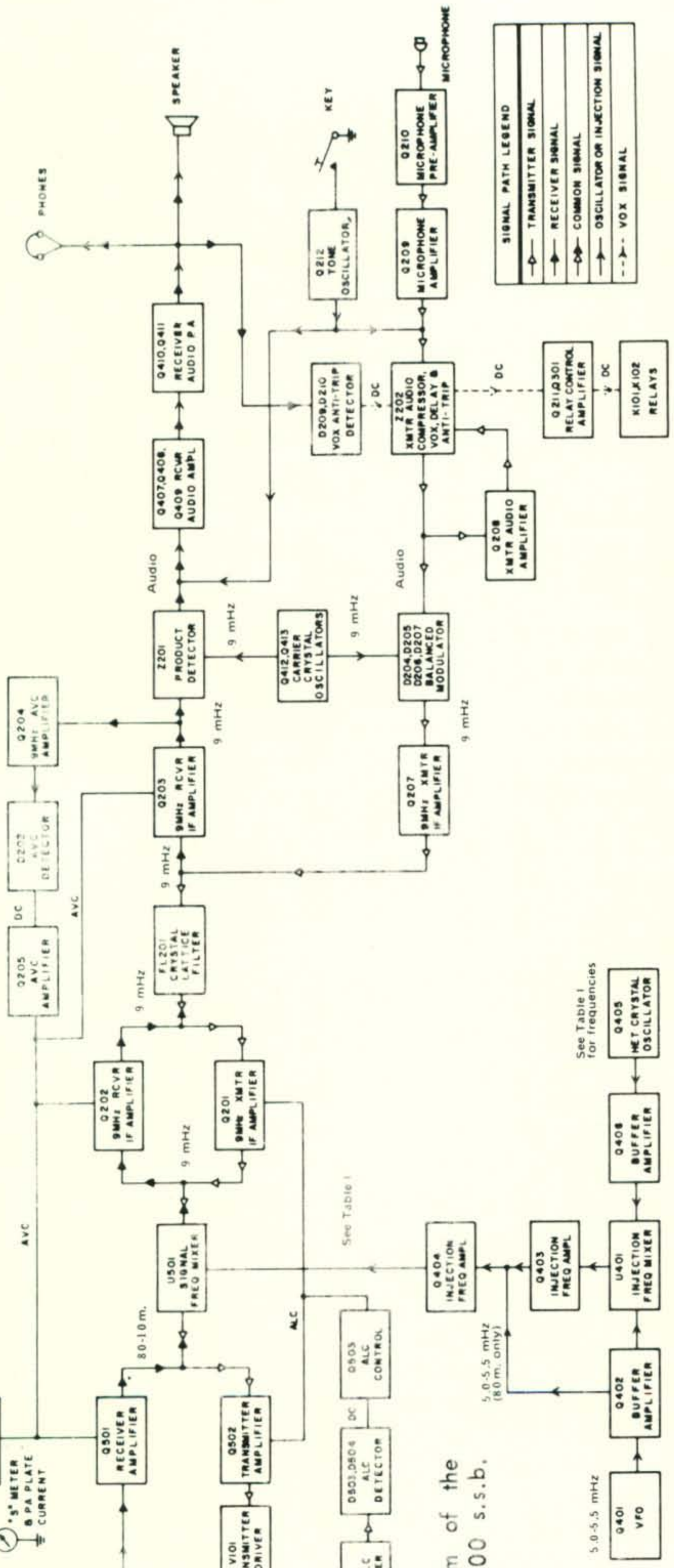


Fig. 1—Block diagram of the Hallicrafters FPM-300 s.s.b. transceiver.

On transmit, microphone output is amplified and fed through an audio compression amplifier to a ring modular which modulates a 9 mHz carrier oscillator signal to produce a 9 mHz double sideband signal with suppressed carrier. This signal is amplified by Q_{207} and fed to the crystal lattice filter where one or the other sideband is removed, depending on the frequency of the carrier oscillator signal appearing at the ring modulator. One more stage of amplification follows the filter. The amplified s.s.b. signal is fed to the same signal frequency mixer as used for receive, which in turn is fed by either the 5 mHz v.f.o. directly on 80 meters or the output of the pre-mixer on all other bands. The resulting signal-frequency s.s.b. signal is amplified by Q_{502} before being fed to a 12BY7A driver and then to a single 6KD6 power amplifier. A pi-network with a range of 40 to 70 ohms tunes the PA plate circuit.

ALC and Speech Compression

The automatic load control system used in the FMP-300 is of the amplified type, requiring small excursions into the PA grid-conducting region before a.l.c. control voltage is developed. In operation, grid current in the PA develops signal voltage pulses across the grid-bias adjusting pot. These pulses are amplified by Q_{504}, detected, and the resulting d.c. control voltage amplified again by Q_{503}. This amplified a.l.c. voltage is applied to gate G_2 of Q_{502}, the transmit r.f. amplifier, and G_2 of Q_{021}, the transmit 9 mHz i.f. amplifier, reducing the stage gains of these amplifiers, reducing PA

drive, and minimizing the possibility of severe flattopping due to overdrive.

In addition to the a.l.c. circuit, the FPM-300 incorporates an effective speech compressor to equalize and limit audio drive to the balanced modulator. When adjusted as instructed in the operating manual, an audio signal of 10 mv at the mic jack will develop full transmitter output. Mic input signals in excess of 10 mv are limited to minimize over drive and flattopping.

Viewed from the rear, the FPM-300 shows the perforated rear panel area and mounting holes for the optional cooling blower. The switching transistors for the d.c.-to-d.c. converter are heat sinked to the rear panel.

AGC & Metering

Automatic Gain Control in the receiver is accomplished by amplifying and detecting a sample of the i.f. signal at the input to the product detector IC, Z_{201}. This d.c. signal is then amplified and applied directly to the G_2 gate of Q_{203}, the second i.f. amplifier. The control voltage is also applied—through the r.f. gain control—to the G_2 gate of first i.f. amplifier Q_{202} and to G_2 of r.f. amplifier Q_{501}.

The d.c. output of the a.g.c. amplifier is also applied to the base of Q_{206}, the S-meter amplifier. The meter is diode-switched between the collector of Q_{206} and the cathode circuit of the power amplifier. The metering circuit is shown in fig. 2. On receive, the PA is cut off permitting current from the S-meter amplifier to flow through D_{104} and the meter. D_{103} does not conduct. On transmit, forward bias is applied to D_{103} and D_{104} through R_{105} from a relay-switched 12.6 v.d.c source connecting the meter to the PA cathode circuit. The voltage drop across shunt resistors R_{113} and R_{114} is then measured by the voltmeter circuit consisting of the diodes, the meter, and R_{115}. The amount of forward bias applied to the diodes through R_{105} controls the plate current calibration.

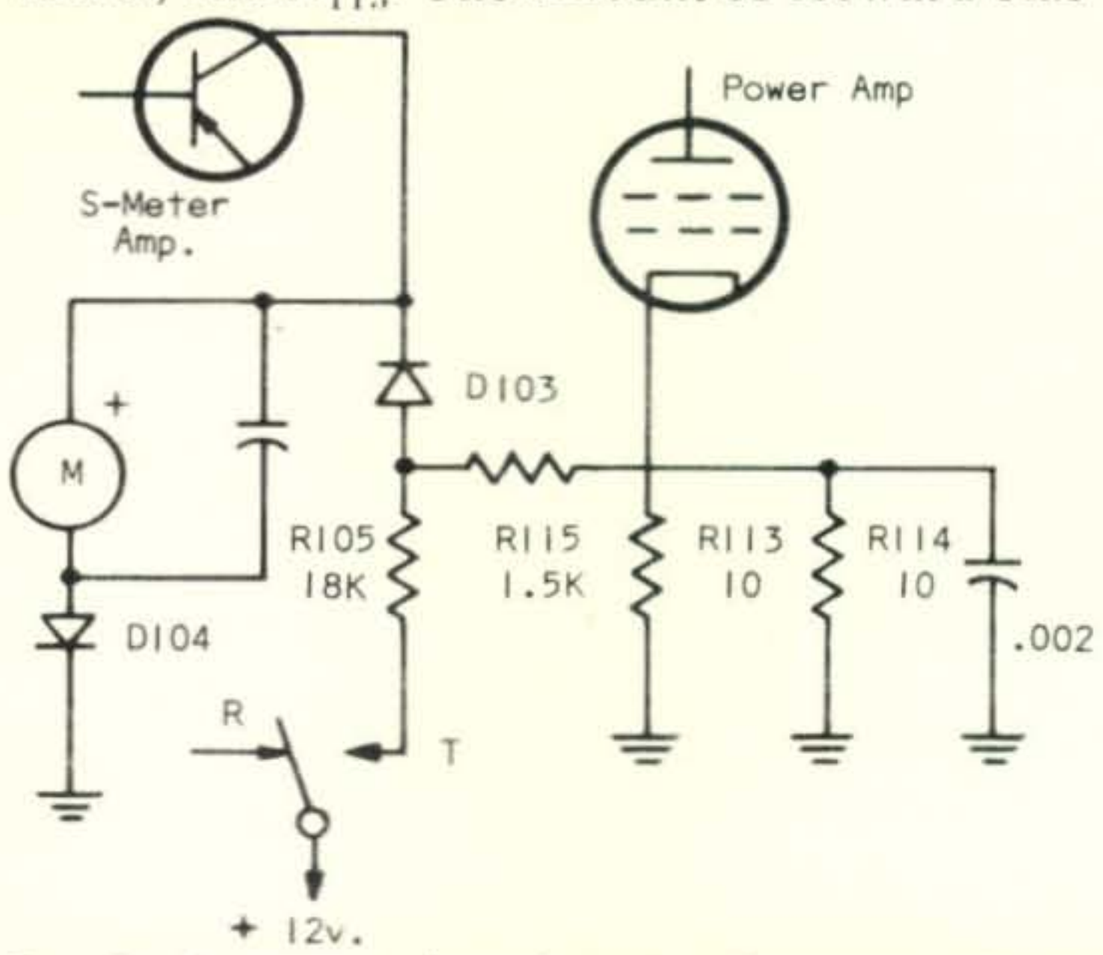


Fig. 2—Meter switching between S-meter and PA cathode current functions is accomplished by means of diode switches as described in the text.

Switching and VOX

Switching between transmit and receive conditions is accomplished by two multi-pole relays actuated by the vox or p.t.t. circuits, and the Mode and Function switches. In the REC and STBY positions of the Function switch, all T/R switching circuits are disabled, and the transceiver is left in the receive condition. Advancing the Function switch to PTT with the Mode switch at LSB or USB enables normal p.t.t. operation; with the Mode switch at TUNE, the transmitter is energized in low power with tone, but mic amp stages disabled. Advancing the mode switch to C.W. leaves the transmitter on, but permits keying and sidetone generation.

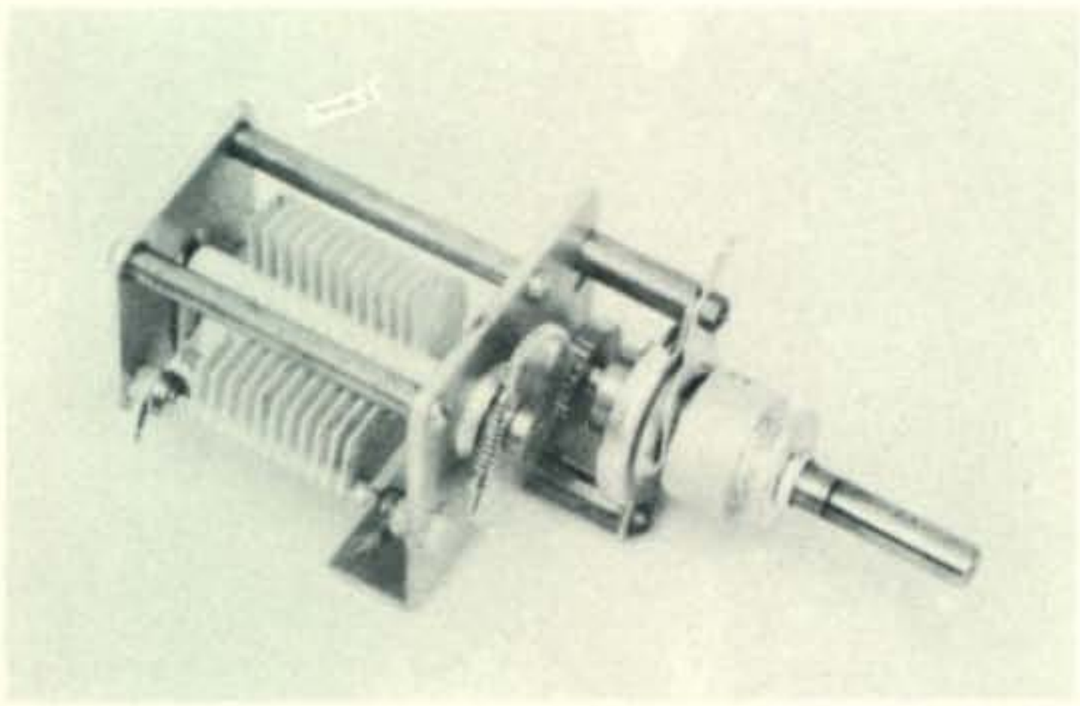
In the VOX position of the Function switch, normal vox operation on both upper and lower sideband is accomplished; TUNE functions as before, and c.w. is semi-breakin through the vox circuits.

The mechanics of switching between transmit and receive are handled through the relays by signal switching (antenna), d.c. power supply switching and controlling bias on diode switches which in turn switch i.f. and r.f. stages on or off as necessary.

Switching is quiet with only a slight click in the speaker when returning from PTT to STBY.

C.W. and Tune-Up

C.w. operation is accomplished by keying a 1750 Hz audio oscillator which in the c.w. mode is connected to Z_{202} a multi-function IC providing vox and audio compression. Thus, the transmitted c.w. signal is simply a 1750 Hz audio tone transmitted via s.s.b.



The heart of the v.f.o. is a high-quality double ball bearing wide-spaced tuning capacitor assembly driven by a spring loaded split gear/spur gear pair which in turn is driven by a 6:1 reduction planetary drive.

Carrier level is controlled by varying the level of audio fed to the transmit ring modulator with the mic gain control.

The transmitted c.w. signal is always on upper sideband, 1750 Hz above the indicated v.f.o. dial frequency.

C.w. sidetone is provided by feeding the 1750 Hz signal to the receiver audio amplifier stages which in the c.w. mode are left in an on condition. Carrier for tune-up is provided in the same manner as normal c.w. operation except that the key contacts are shorted, and the receiver audio stages are disabled, removing the sidetone.

Semi-break-in c.w. is achieved by letting the 1750 Hz tone key the vox circuits. Hold-in time is adjusted by using the vox delay control on the transceive function board. True full break-in in the traditional two-antenna manner is not possible, although a reasonable facsimile can be created.

Calibrator

The crystals calibrator consists of a JFET 100 kHz oscillator, feeding on IC flip flop, Z_{701}, which divides down the 100 kHz output to produce 25 kHz markers. Output is fed directly to the receive pole of the antenna relay, which on transmit is grounded for protection. Marker output is strong and relatively uniform on all bands.

VFO

V.f.o. tuning is by a well constructed silver plated variable capacitor with the shaft driven by a split gear/spur gear arrangement which, in turn is driven by a 6:1 reduction planetary drive. The total reduction is about 53:1 from tuning knob to capacitor shaft giving a tuning ratio slow enough to please the most critical operator. In addition, the high ratio results in nearly effortless tuning which is so light that provision is made to "heavy it up" by means of felt and fiber washers behind the knob.

Linear calibration is provided over the entire tuning range with the knob skirt marked in 25 1 kHz increments spared 5/16" apart. Interpolation to less than ½ kHz is thus easily accomplished. The 1 kHz marks are not otherwise identified, so a move "up 5 kHz" would require counting off five dial units. A distinguishing mark every fifth kHz would simplify matters in this respect. The larger dial is calibrated each 10 kHz over a 500 kHz range with 50 kHz of additional calibration above and below the 500 kHz range. Tuning on all ranges increases in a clockwise direction. Band-to-band coincidence of calibration was within 1 kHz on all bands when calibrated at 3.750 mHz.

Power Supply

The FPM-300 incorporates power supply circuitry permitting operation from 13.4 v.d.c., 117 v.a.c., or 234 v.a.c. For a.c. operation, a multiwinding power transformer feeds three silicon rectifier bridges to supply PA B+, PA screen voltage/driver B+, and 13.4 v.d.c. for all transistorized circuitry. A half-wave rectifier supplies PA grid bias from another winding which is also tapped to provide filament voltage for the PA and driver. Two 117 v. windings are either series or parallel conected for 117 or 234 v.a.c. operation.

For 13.4 v.d.c. mobile use, transistor operating potentials are derived directly from the d.c. source after filtering by the same filter network used for a.c. operation. Filaments are fed through a 2.8 ohm resistor directly from the d.c. source. D.c. is also supplied to a transistorized d.c. to d.c. converter using two 2N1522 silicon transistors heat-sinked to the rear cabinet panel. The square-wave output of the converter is fed to another power transformer winding to produce normal operating potentials.

An optional blower is recommended for application where high ambient temperatures or poor ventilation are encountered. When operating the FPM-300 from an a.c. source, the blower with a 250 ohm series dropping resistor is powered across one 117v. transformer winding. For 13.4 v.d.c. use, the resistor is shunted, and the blower functions normally from the square-wave a.c. appear-

ing across the otherwise unused 117v. winding. In a.c. operation the blower is energized continuously as long as the on/off switch is at on; on d.c. it functions only when the d.c. to d.c. converter is operating, *i.e.*, only when standing by or transmitting.

Construction

The Safari is enclosed in a "flip-top" steel cabinet designed for easy access to internally-located controls, whether at the home QTH or in mobile installations. The flip top is hinged at the top rear and secured at the front by means of two "over-center" type latches.

In mobile use a hanger bracket is mounted beneath the auto dashboard and the FPM-300 secured at the front by thumb screws threading into captive nuts welded into each side of the flip top and at the rear by the ground stud. When access to the interior is needed, it is only necessary to release the two side latches, allowing the transceiver to drop down.

A 3-inch speaker is mounted in the left (driver's) side of the flip top, and our only criticism of this arrangement is that the speaker leads should be longer by perhaps an inch or so that in home station use the lid could be raised sufficiently high as to hold its position without slamming closed at an inopportune moment!

While no adjustments or controls are located at the rear or sides, headphone and microphone jacks are grouped at the left front side of the unit. Connections are through standard 2 and 3 circuit phone jacks.

Connections at the rear are: antenna (SO-239), extra normally open relay contacts (phono jack), key jack, ground post, blower power jack, and 18-conductor power connector. A fuse post and zeroing adjustment for the 25 kHz/100 kHz crystal calibrator are also located on the rear apron.

Front panel controls are Main Tuning, Rec Gain (r.f. gain) with power on/off switch, V.f.o. Calibrate, Receiver Audio Gain with a pull-switch for calibrator on/off, Mode switch, Function switch, Mic/CW Level, Bandswitch, Preselector Tune, PA Tune and PA Load.

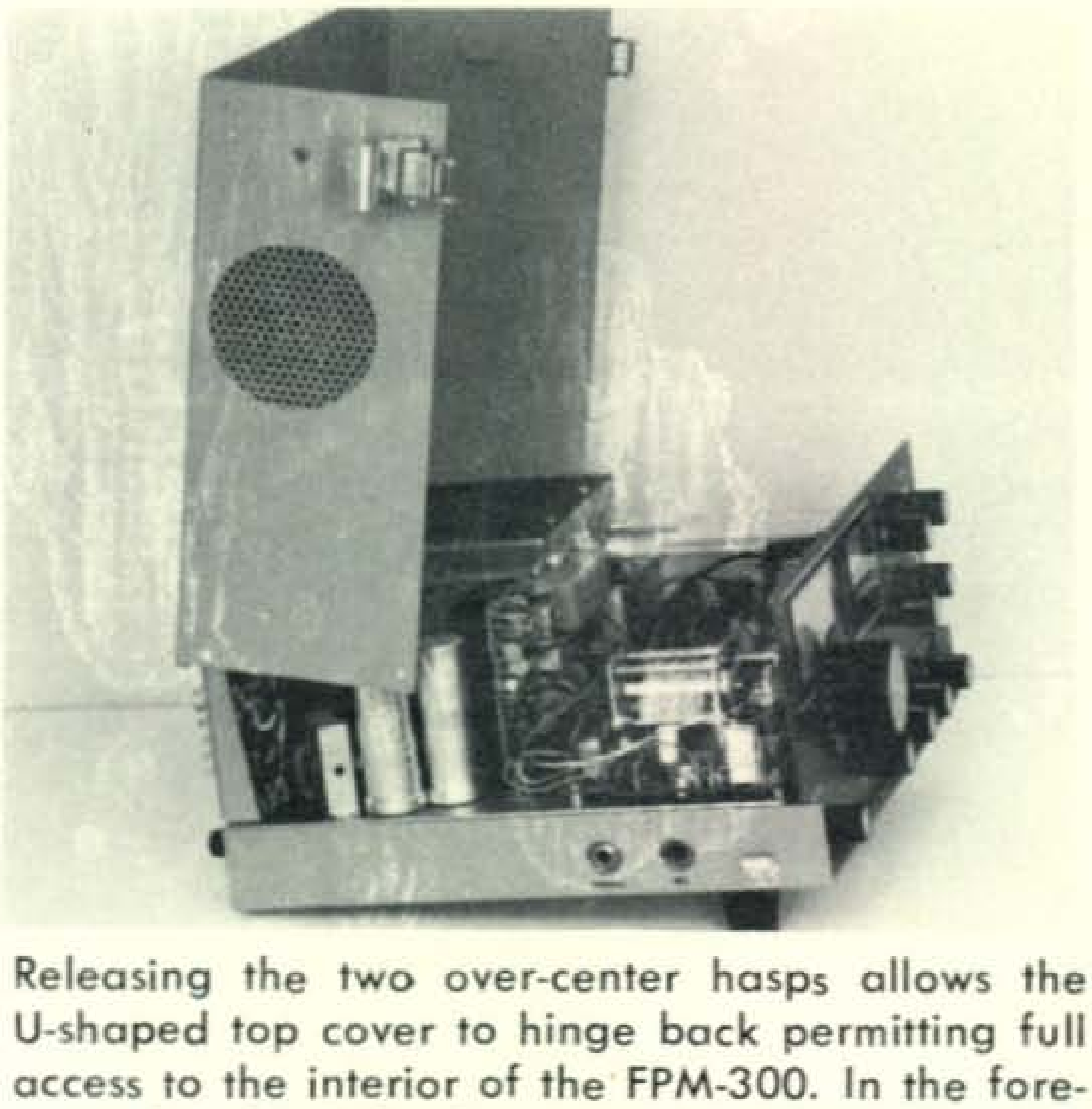
The 4-position function switch operates as follows: REC: Receiver circuits and driver filament only are energized; STBY: Receiver circuits energized, driver and PA filaments lit; PTT: On c.w., transmitter is on continuously and subject to keying. On s.s.b., push-to-talk operation; VOX: Semi-breakin keying on c.w.; voice control on s.s.b.

The power supply and driver/PA stages are constructed on a plated steel chassis which also is punched to accomodate the V.f.o./Pre-Mixer/Audio circuit board and the Pre-Selector/A.l.c. board, both of which are wired into the various harnesses by means of push-on pin connectors. The third major circuit board is designated as the Transceive Function module and incorporates the i.f. stages, receiver a.g.c., transmitter a.l.c., vox, audio compression amplifier, s.s.b. ring modulator, S-meter amplifier and 9 mHz crystal lattice filter. This large board is edge-mounted vertically in a multi-contact PC connector and braced at the top with a sturdy rod anchored to the rear of the cabinet. R.f. connections to this board are through two coax leads to push-on pin connectors.

Vox sensitivity, anti-trip, and delay, as well as audio compression level and S-meter zero are all controlled by means of color-coded edge-mounted PC pots easily reached on the Transceive Function board.

Band switching is accomplished from a single control shaft to which are ganged seven PC-type switch sections on the V.f.o./Pre-Mixer board and Pre-selector board and one in the PA compartment. Board Layout requires that the seven PC switch decks be

[*Continued on page 92*]



Releasing the two over-center hasps allows the U-shaped top cover to hinge back permitting full access to the interior of the FPM-300. In the foreground, behind the front panel, is the v.f.o./premixer/audio board mounted to the chassis, while the transceive function board is mounted vertically mid-way back. The PA compartment is at the far rear corner. Headphone and mic jacks are on the left side of the unit; the speaker is mounted in the left side of the lid.

DX

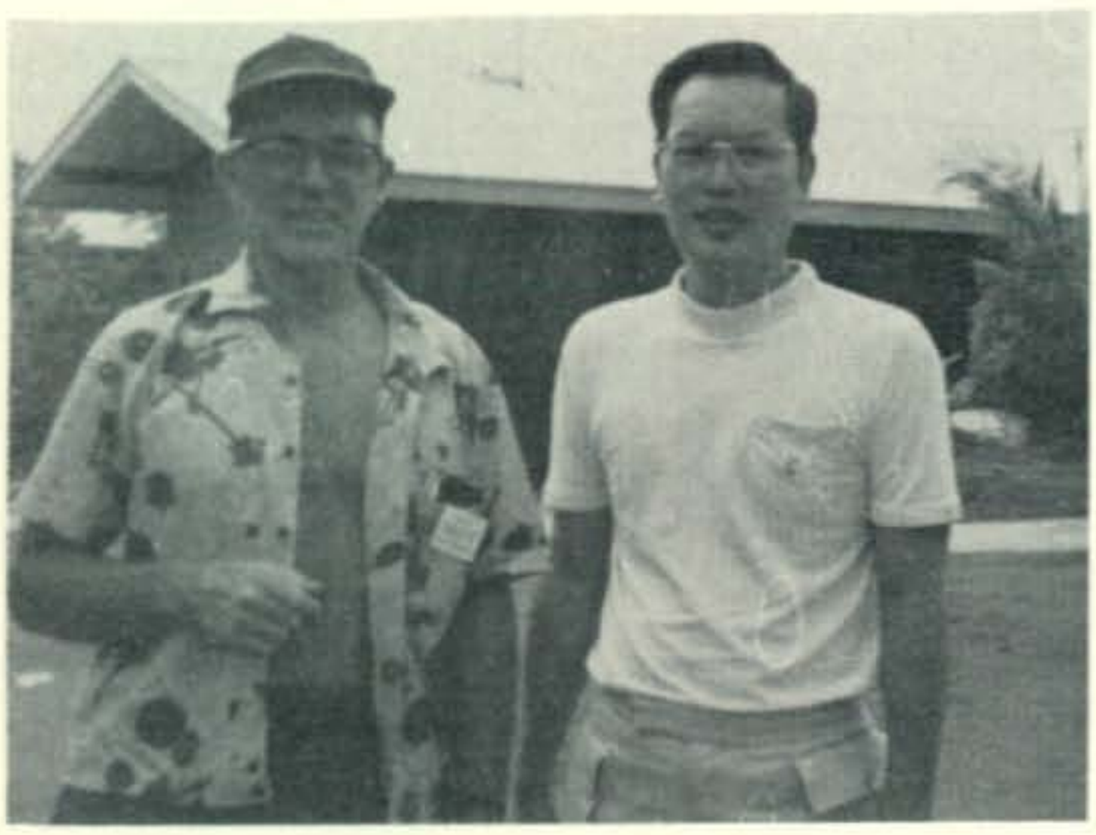
BY JOHN A. ATTAWAY,* K4IIF

THE life's blood of a magazine DX column, or of a serious effort to earn DX awards, is the information you receive concerning notable DX events. This column depends on the many fine weekly DX information sheets, monthly club bulletins and special interest publications which we receive, and we take this opportunity to thank the hard-working editors who do so much for all DXers.

If you are working for some of the major DX awards and don't presently receive a weekly information sheet, we suggest you consider one of the following. The call letters or names of the editors are shown in parentheses:

Long Island DX Association Bulletin (K2KGB), P.O. Box 73, Coram, N.Y. 11727; *DX News-Sheet* (Geoff Watts), 62 Belmore Rd., Norwich, Norfolk, England; *West Coast DX Bulletin* (WA6AUD), 77 Coleman Drive, San Rafael, CA 94901; *DX'ERS Magazine* (W4BPD), P.O. Box DX, Cordova, S.C. 29039; *DX'Press* (PAØINA), P.O. Box 1166, Arnhem, Netherlands; and *Long Skip* (Nick Sawchuk and Jack Reed), P.O. Box 717, Station Q, Toronto 290, Ontario, Canada.

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



Left to right are Kenny, K60PG, and Edgar, DU1EJ. This shot was taken at Edgar's QTH, 14 kilometers north of Manila.

Among the interesting club bulletins, generally available to *club members only*, are the *Totem Tabloid* (Western Washington DX *Club*, WA7JCB, Editor), 16702 33rd. Ave. S.W., Seattle, WA 98160; *The DXer* (Northern California DX Club, K6AUC and K6HIH, Editors); *The Camel Drivers Radio Club Bulletin* (YA1AB, Editor), P.O. Box 297, Kabul, Afghanistan; *The Florida DX Report* (K4KQ, Editor), 2210 S.W. 27th. Lane, Miami, FL 33133; and the *Southern California DX Club Bulletin* (W6EJJ, Editor), 5128 Jessen Drive, La Canada, CA 91011.

Special interest publications of great value include the *160 Meter DX Bulletin* (W1BB, Editor), 36 Pleasant St., Winthrop, MA 02152; *The Milliwatt* (K8EEG/Ø, Editor), devoted to under 5 watt operation, c/o Wes Mattox, 1444 Front St., Binghamton, N.Y. 13901; and *QUAX* (G3DME, Editor), emphasizing 10 meter band operations, Southview Road, Crowborough, Sussex, England.

Propagation Forecasts

Amateurs may now receive the very latest propagation forecasts, revised weekly, by dialing (516) 883-6223. This is a special *CQ* service.

Here and There

160 Meters: W1BB's 160 *DX Bulletin* reports an excellent winter season on top band, particularly during the *CQ* 160 Test. As of Jan. 31, 1973, Stu had worked 120 different DX stations in 37 countries despite 2 weeks out for a Caribbean cruise. On Dec. 23, 1972, WA8IJI made the first W8/JA QSO on record when he had a solid contact with JA7AO. This is the greatest distance east worked by a JA station on 160 meters. Ralph, W1HGT, made a first ever dual QSO with VR1W and KB6DA during the sunrise peak on Oct. 1, 1972. Ralph now has 65 countries on 160. Charles, W2EQS, second only to W1BB on the all time 160 list with 86 countries, has moved from New Jersey to Indiana. Starting over on that 100 countries will be a tough row to hoe.

QRPp Leaders: Top DXers among the very low power enthusiasts are the following: K4OCE, 148 countries (5 watts); K4FS, 102 countries (5 watts); W4VNE, 76 countries (1 watt); W5TVW, 66 countries (5 watts); WB4WRF, 65 countries (10 watts); WØQZR, 54 countries (2 watts); and WA8DDI, 50 countries (1 watt).

Zone 34, 80 Meters: ST2SA has been reported on 3790 kHz. Sid is a great catch for 80 meter WAZ.

Canadian World DXpedition: This top flight group is led by VE6BAA, VE6TP, and VE6BAW. Their objective is to put the 40 most wanted countries on the air, and they plan to devote full time to this effort. An ocean-going trimarran will be in use by June.

DX Club Officers: The new officers for the Southern California DX Club are W6APW, President; W6JPH, Vice President; W6OK, Secretary; W6EUF, Treasurer; and WB6UDC, W6GC and K6SVL, Directors.

Iris Colvin, W6DOD, is President of the Northern California DX Club, completing the term of W6HVN who found it necessary to resign.

Toronto DX Club officers are VE3FOR, President; VE3BIZ and VE3CDX, Vice Presidents; VE3BIF, Secretary-Treasurer; VE3ENU, Recording Secretary; and VE3WT, VE3DBT and VE3GMT, Directors.

DOTM: W2GHK has the logs for the major African DXpeditions by DJ6QT in 1970 and 71. Your QSL and s.a.s.e. to Box 7388, Newark, N.J. 07107, can get you a confirmation for any of the following: CT3/DJ6QT, TY9ABC, TYØABD, TZ2AB, TZ2AC, XT2AB, VE3EUP, Recording Secretary; and VE3- and 5V8WS.

New and Rare Prefixes for WPX

A4F—The new prefix and first suffix letter for Muscat. A4FA, active on 15 meter s.s.b., is John Cooper, ex-MP4MBB.

CI—Special prefix for Prince Edward Island. CI1GV is VE1GV.

DX4Ø—DX4ØPAR was an exhibition station commemorating the 40th anniversary of the Philippines Amateur Radio Club. QSL to DI1EJ.

FGØ—FGØANA was reported on 14105 at 1934Z.

GW6—GW6GW was a special operation during the **CQ** Worldwide C.W. DX Contest in November. QSL to GW4BLE.

HR6—Leo, W5MTE/HR6 and Mike, WØAAD/HR6, have been on from Swan Island. QSL Leo to K3RLY and Mike to Box 810, Kansas City, Missouri.

IC8—IC8HN was reported on 14274 at 1510Z.

IV5—IV5VEC was heard on 14260 at 1330Z. QSL to 15DOF.

IZ9—IT9 stations used this special prefix in December. IZ9BWO was IT9BWO, etc.

Joel Chambers K1MTJ, operating the station at KG6ALV, Guam.

The WPX Program

S.S.B. WPX

732.....G5GH
733.....JA6ID
734.....WA1KVC
735.....W8WPC
736.....EA4KC

C.W. WPX

1229.....SM7ACR
1230.....SMØCGO
1231.....SM7CMV

Mixed WPX

376.....G5GH
377.....SM5BFJ
378.....W9CRW
379.....JA1NPV
380.....IS1AEW
381.....WA6GFY

WPNX

54.....WN3QJR

WPX Endorsements

S.S.B.: WØYDB—800, CR7IK—600, WA6TAX—600, WB2NYM—600, DJ1XU—450, and WB4SIJ—350.

C.W.: W6ISQ—650, WA6JVD—600, K8MFO—600, W9HDR—500, OK3CGP—500, SM7CRJ—450, WA2EAH—400, SM7ACR—400, DJ2IW—400 and SMØCGO—350.

Mixed: W4BQY—900, W6ISQ—800, W9IRH—750, PY4AP—750, JA2KA—550, KØIEA—500, SM5BFJ—500, WA4DLM—500, WB4SIJ—450 and IS1AEW—450.

VPX: SM4-3958—450.

20 Meters: W6KYA and K8MFO

15 Meters: K8MFO

Asia: SM4-3434

Europe: K6TZX, W6KYA, SMØCGO and WA5ZWC

North America: OK3CGP

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

CQ DX AWARD HONOR ROLL

The *CQ* DX Award Honor Roll recognizes those DXers who have submitted proof of confirmation with 273 or more countries for the mode indicated. The ARRL DXCC Country List, LESS DELETED COUNTRIES, is used as the country standard. Effective with this listing credit has been granted for the new country of Mt. Athos which has been added to the ARRL DXCC Country list. Scores also reflect the deletion of Swan Island which was deleted from the DXCC active countries list effective August 31, 1972. The total number of current countries on the DXCC list is now 320.

C.W.

K6EC 315	WØAUB 302	K1SHN 292
W6ID 315	DL3RK 301	WA6EPQ 291
W8LY 308	W6ISQ 301	WA6MWG 284
K6LEB 306	ON4QX 299	WA8DXA 283
W4IC 305	W6NJU 296	W4YWX 282
VK3AHQ 304	W4BQY 294	DJ7CX 275

2XSSB

W2TP 319	W4IC 310	OZ3SK 297
TI2HP 318	W6YMV 309	SM3CKS 297
WA2RAU 317	XE1AE 309	K1SHN 297
W3NKM 317	F2MO 307	YS1O 297
W9ILW 317	VE2WY 307	ZL3NS 297
DL9OH 316	G3DO 305	WØYDB 294
IØAMU 316	WA6AHF 305	WB2RLK 291
K2FL 316	W9QLD 305	XE2YP 291
W6REH 315	VE3ACD 304	YV1LA 291
W6RKP 315	F9MS 303	K8GQG 288
G3FKM 316	K6EC 303	K1KNQ 284
SM5SB 313	KH6BB 303	K3GKU 283
W6EUF 313	I1ZV 302	HP1JC 282
W6NJU 313	WA2HSX 302	OE2EGL 278
ZS6LW 313	W6KZS 301	WAØKDI 278
I8KDB 312	W6FW 300	K6GUY 277
VE3MR 312	WA6MWG 300	OK1MP 277
W3AZD 312	VE3GMT 299	WAØCPX 276
W3DJZ 312	K4HJE 299	DL1MD 274
W6KTE 312	W9KRU 299	W8ZOK 274
W9JT 312	ZL1AGO 299	K9LUI 274
IT9JT 311	G3RWQ 298	G3KYF 273
WA2EOQ 311	WA3IKK 298	G3WW 273
W9DWQ 311	K4RTA 298	WØSFU 273
I1AA 310	YV1KZ 298	

JX6—JX6VO was a Norwegian operation by LA6VO. QSL to LA1RQ.

JX8—JX8FG was reported on 14205 at 1650, and **JX9**TM on 14195 at 2330Z.

Twin Cities DX Club Officers. Left to right: Dennis Luther, KØWWX, 1971-1972 Secretary-Treasurer; Bill Higgans, WØYDB, CQ DX Committeeman), 1971-1972 resident; Fred Deziel, WØHP, 1973 President; Jack Chapman, WØHZ, 1973 Secretary-Treasurer.

OK5—OK5SZM was a c.w. operation, 10-160 meters, from the First Congress of the Socialist Union of Youth at Bratislava. QSL to OK3TFM.

SQ5—SJ5Z on 20 meter c.w. operates from the Warsaw Technical Museum. QSL to SP5-PMT.

TY5—TY5ABK skeds his QSL Manager, Ray, W8CNL, daily. A polite note to Ray might set you up with a good one.

WC4—WC4SFF, Jan. 26-Feb. 4, 1973, was signed by the West Palm Beach Radio Club from the South Florida State Fair. QSL to W4HAW.

WG3—WG3SFC was active during the Apollo 17 mission. QSL to Goddard Amateur Radio Club, Box 86. Greenbolt, Md. 20770.

WI9—WI9ANG will be on May 19-20 from General Mitchell ANG Base, Milwaukee,

Wis. to commemorate Armed Forces Day. QSL to WA9DZL.

WM4—WM4SFC was active from the Marshall Space Flight Center in Alabama during the Apollo 17 mission.

WZ4—WZ4USA will be on May 19-31 from Camp Pickett, Va. to commemorate Armed Forces Day. QSL to W6ANN.

YA0—YA0CDRC is a special Afghanistan club station. CDRC stands for Camel Drivers Radio Club.

YB—QSL YB5AAQ via W4ADZ. YB9AAT to W4YUU and YB0ABE c/o K5GUZ.

YS—YS6FB has been heard on 14197 at 0925 GMT.

YV0—YV0AA was the Venezuelan Radio Club operation from Aves Island. QSL to Box 2285, Caracas, Venezuela

ZD80—From May 27,-June 2, 1973 this special prefix will be used by Ascension Island operators. A special card will be sent to anyone contacting 2 Ascension stations during this period.

ZP—ZP6BL on 21260 at 1045Z and ZP8-AQ on 14185 at 2030Z are 2 rare Paraguan prefixes reported recently.

3E—Used in February by Panamanian Amateurs to commemorate the 7th Bolivarian Games.

4M4—4M4UA during the c.w. contest in November was Jim Neiger, W6BHY. QSL to W6CUF. The 4M4AGP operation was by W6OAT.

The Twin Cities DX Club of Minnesota. This group shot shows about 90% of the present membership. Left to right: (Back Row) WØUUE, WØSFU, WØJS; WØYCR; WØELA; KØVVW; WØTRF; (Center Row) W2TA/Ø; KØWWX; WØYDB; WØHP; WØHZ; WAØ-KVL; WØCA; (Front Row) WØNAR; WØNG; WØ-PAN; WAØVBV; WØNUH. *(Photo tnx WØYDB).*

5V7—5V7GE was heard on 14212 at 2250Z. QSL to PP.O. Box 2, Bassari, Republic of Togo.

QSL Information

A2CCY—Via K4CDZ
A4FA—To G3LQP
A4FD—c/o G3XEC
CE9AT—Via CE3RR
CR9AK—To CT1BH
CT2AZ—c/oW0JHY
CT2BG—To WA2BCK
CX2CO—Via W2GHK
DA1AA—To WA5VWH
DJ9ZB—c/o K4AEB
DKØIBF—Via DK2TZ
EL2DK—To W5PAQ

The WAZ Program

S.S.B. WAZ

1062.....W8QBG
1063.....W9MIJ/4
1064.....SM5AWO
1065.....SM6BD
1066.....F5II
1067.....W8FKY
1068.....W5KHP
1069.....ZL2VN

C.W.—Phone WAZ

3497.....UK4PX
3498.....KP4DLW
3499.....WB2BNJ
3500.....K4DWO
3501.....SP5GX
3502.....SP1BNS
3503.....SM2CSA
3504.....SM4DHF
3505.....SM1CNS
3506.....SM7ABL
3507.....SM5AWO
3508.....SM5CLE
3509.....SMØCCM
3510.....SM5CPC
3511.....SMØCGO
3512.....W1DAL
3513.....VE3FAA
3514.....W1OR
3515.....W8IHD
3516.....G3JZV
3517.....W3BRB

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

The CQ DX Award Program

C.W. DX

110.....DK1BP
111.....W7YBX

S.S.B. DX

252.....W7YBX
253.....KG6SW
254.....JH3CIQ
255.....DJ4FT
256.....DJ2VZ
257.....SM6CKS
258.....WA6AHF
259.....JA2LA
260.....K3SWZ
261.....K2GBC
262.....K6GUY

Endorsements

C.W.: W6ISQ—300, KØEKR—200 and DK1-BP—150.

S.S.B.: SM6CKS—300, WA6AHF—300, WA6MWG—300, K6GUY—275, W7YBX—250, DJ2VZ—200, W8IHD—150, JH3-CIQ—150, DJ4FT—150, JA2LA—150, and K3SWZ—150.

Low Band: OK1MP and JH3CIQ

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

EP2PR—c/o K4HLJ
EP2TC—Via K3RLY
ET3USB—To WB4UKA
ET3USE—c/o WA4AGT
FØADO/FC—Via VE8RA
FB8XA—To F2MO
FB8XC—c/o F2MO
FB8ZA—Via F6BFA
FGØAFC/FS7—To W3HNK
FGØAMC/FS7—c/o F2QQ
FK8BQ—Via F6BBQ
FM7WN—To K2KGB
FO8BW—c/o W6JFM
FPØBG—Via VE1AIH
FY7AL—To WA2RZB
GM5AXO—Via WA4UAZ
GM6RV—To K9KLR
HC8FN—c/o WA2WUV
HH2ZZ—Via WAϕFAA
HI3EI—To W2KF
HI8LC—c/o W2KT
HKØBKX—Via WA6AHF
HL9WI—To WA5ZWC
HTØA—c/o DL3OH
HTØV—Via YN1VMD
JY3BZ—To WA3HUP
JY6RS—c/o WA3HUP
KC4USP—Via K2BPP
KM6DY—To WB4WRN
LG5LG—c/o LA4YF
MP4BIN—Via WB2FVO
PJ8DX—c/o K2FJ
PJ9BB—To W2VIA
SV1CH—c/o WA3KSQ
SVØWMM—Via WB2JGZ
SVØWWW—To W5KDJ
TF5TP—c/o DL7FT
TI8PE—Via WA5GFS
TJ1BG—To K4WQS
TR8MC—c/o W2YY
TU2AA—Via WA6EJI
TY5ABK—To W8CNL
TY8ABB—c/o WA4SPG
VK9AJ—Via WA7OMZ
VP2GNE—To W4YHB
VP2MAH—c/o W4GSM
VP2VAN—To K2FJ
VP5LD—Via WA5MLH
VQ9RK—To W9VNQ
VS6AW—c/o WB6ZUC
WZ4USA—Via W6ANN
XG1J—To XE1J
XT2AG—c/o VE6AJO
YA1BYS—Via W2RHK
YA1RA—To K2GTZ
YS1JFE—Via WB0FDO
YV4AGP—c/o WØYVA/4, P.O. Box 6226, Shirlington Station, Arlington, Va. 22206
ZC4DS—To WA2KWP
ZD3M—c/o K3GJD
ZD9BM—Via K3JUL
ZF1PL—c/o W1RFW
ZF1VD—To W4HAW
ZS1MH—c/o VE7BWG
3D2DI—Via VE6TK
4S7DA—To W6FJ
4Z1IB—c/o WA2KWP
5R8AP—Via K4DEN
7P8AD—To VE3JH
7X2MD—c/o VE3TL
8R1M—Via WA3HUP
9H3B—To VE3MR
9J2BL—Via SM6CKU
9K2CA—c/o W5KKZ
9Y4TM—Via VE3CBG
9Y4VU—To W3GVW

73, John, K4IIF

SEE CQ COUNTRY CHART OFFER ON PAGE 80

THE awards PROGRAM

BY ED HOPPER,* W2GT

USA-CA HONOR ROLL

3000					
WB6RMZ	114	W7VSE	172	W7VSE	288
W3FNT	115	W3FNT	173	W3FNT	289
WA5ALB	116	WB5DVT	174	WB5DVT	290
WB5DVT	117	**1500**		**500**	
2500		W6CCM	210	WB4WBP	924
W6CCM	147	W7VSE	211	DL2JO	935
W3FNT	148	WA5YSC	212	W6CCM	936
WB5DVT	149	W3FNT	213	W3FNT	937
2000		WB5DVT	214	DL1RA	938
W6CCM	171	**1000**		WB5DVT	939
		W6CCM	287	K3NEZ	940

Special Honor Roll All Counties

#93—Richard R. Brege, K8ODY, 1-19-73.
#94—Gerald J. Collins, W3FNT, 1-23-73.
#95—Rogers E. Garrett, WB5DVT, 2-1-73.

THE May, "Story of The Month" as told by Dick himself is:

Richard G. Werth, WAØGZA

(All Counties #79, 7-13-72)

"My interest in amateur radio was first aroused during my high school days, but never reached the point of getting a license (that being during the big depression in the '30s).

"When Uncle Sam called during World War II, I chose the Navy with its radio technician program and went to Great Lakes for boot training. From there it was four weeks at Wright Jr. College in Chicago, twelve weeks at Texas A & M for basic radio, followed by secondary service school at Ward Island, Corpus Christi, Texas. Finished up there just in time for VJ-Day, so was mustered out of the Navy a few months thereafter.

"I returned to my job in chemistry only till the opening of school that next fall, when I entered graduate training in chemistry at Wisconsin. When I finished that four years later with the PH.D. Degree, I decided to try my hand at teaching and joined the faculty here at Concordia College, Moorhead, Minnesota.

"It was while on a sabbatical leave spent at Oak Ridge National Labs, that I took the time to brush up on radio theory and learned the code along with son Gerald, who was in fifth grade at the time. Received my Novice call WN4LCS in December of 1962, which was changed to WNØGZA upon returning to Minnesota the following June. My current call was obtained in April 1964.

"My introduction to County Hunting was on the forty-meter net that next September when I ran a couple of counties from the mobile. Finally got into it myself the following spring while on another mobile trip to a meeting of the Minnesota Academy of Science.

"Summer vacation periods were the major periods of activity, both from the home station and while on mobile trips. Have made contacts from around 500 counties in twenty five of the states, mostly in the eastern half of the USA. Since getting the last county in Montana from K2UAR/M7, I have been

Dr. Werth, WAØGZA giving out some new ones.

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

Dick Werth, WAØGZA, must be before a trip, he looks so fresh.

working at finishing them all on 20 meters, and all by mobiles. That looks like it could take a while to complete.

"In addition to amateur radio, I am or have been active in several other leisure time pursuits. For a number of years I taught beginning classes in square dancing, and the wife and I continue to be active in square and round dance clubs. Have been playing postal chess for years, and lately have started over-the-board activity with others on campus. My interest in stamp collecting is mainly in my topical collections of chemistry on stamps, and chess stamps. At one time I was quite active in raising tropical fish, but amateur radio phased that out the past few years. Have a latent interest in photography, but find little time to be active in the field. The wife says it seems I have so many hobbies that thre is no time left for my regular job as professor of chemistry."

It would take many more pages to tell of Dr. Werth's accomplishments in the field of chemistry *and* to list his amateur radio awards/certificates/memberships. Son Gerald has the call WAØLRC.

Dick waited until he had them *all* and applied July 13, 1972.

Awards Issued

They did it again, 3 new *All Counties* this issue.

"Moby Dick" Brege, K8ODY finally decided to send in for them *all*.

"Doc" Collins, W3FNT waited until he had them *all* before sending any application and he got them 500 through *all, All S.S.B.*

Roger Garrett, WB5DVT also waited until getting them *all* before forwarding any application. Congratulations to them all.

Duain Schunke, WB6RMZ was issued USA-CA-3000 endorsed All 14, All Mobiles, All S.S.B.

John Dyer, WA5ALB qualified for USA-CA-3000.

Dave Manescu, W6CCM won USA-CA-2500 endorsed All 14, All S.S.B.; and 500 through 2000 endorsed All 14, All S.S.B., All Mobiles—where did he find time for all that paper work?

Vic Seeberger, W7VSE acquired USA-CA-2000 and 1500 Mixed; and USA-CA-1000 endorsed All A-1, All S.S.B., All 14, All Mobiles.

Dr. Bill George, WA5YSC filed for USA-CA-1500 endorsed All S.S.B.

John Criner, Jr., WB4WBP received USA-CA-500 endorsed All 75 S.S.B. His Father is WB4SXM.

Heinz Freymann, DL2JO won USA-CA-500.

"Henry" Buerger, DL1RA was issued USA-CA-500 endorsed All S.S.B.

Howard Berlin, K3NEZ applied for USA-CA-500.

Awards

Utah All County Certificate: Issued for any mode, any date upon receipt of GCR List for *all* 29 counties and is mailed first class, flat (not folded) for fifty-cents (50¢). Certificate is *free* to non-USA or handicapped hams. Custodian—A. D. "Mid" Middelton, W7ZC, Box 303, Springdale, Utah 84767. (He is in Washington County).

Diploma Guglielmo Marconi: The A.R.I. (Associazione Radiotecnica Italiana) has instituted the "Diploma Guglielmo Marconi" to commemorate the work of the great scientist. Also to celebrate the experiments carried out by Marconi in various parts of the world and bring them once again to the attention of radio amateurs.

The award will be issued to those who have made contact with (or listened to) the localities in which Marconi conducted his experiments.

It will be issued free (but include IRCs to cover cost of return of your QSLs). To obtain the award it will be necessary to send to the A.R.I. a log containing all the details of contacts or listenings made, *and*: 40 QSLs chosen from the localities listed later, *or* 35 QSLs chosen from localities listed, *plus* the QSL from the official commemorative station, II4FMG, and one from any other G. Marconi Memorial station (a total of 37 QSLs).

When required by the list, the QSL must

clearly indicate the city or region. The award can be obtained in a.m., s.s.b., c.w. RTTY, SSTV and Mixed. There is no limitation to the band used, except normal regulations.

COUNTRY	CITY	PREFIX
Cape Verdi Islands		CR4
Portugal	Lisbon	CT1
Madeira Islands		CT3
Morocco		CN8
Spain	Cadiz	EA7
Ireland		EI
France		F
Corsica		FC
England	London	G
England	Flatholm Is.	GB
England	Wight Is.	G
Northern Ireland		GI
Scotland		GM
Switzerland		HB
Vatican		HV
Italy	Bologna	I4
Italy		I5
Italy	Rome	IØ
Italy	Fondaz. G. Marconi Villa Grifone	II4FGM
Italy	Torre Tigullio Marconi (GE)	IP1TTM
Italy	Sicily	IT9
Italy	Sardinia	ISØ
Japan		JA
Argentina	Buenos Aires	LU-A-D
Belgium		ON
Brazil	Rio de Janeiro	PY
Sweden	Stockholm	SM
Sweden	Gotland Is.	SM1
USSR	Leningrad	UA1
Canada		VE1
Newfoundland		VO1
Labrador		VO2
Australia	Sydney	VK
Bermuda		VP9
USA	Mass.	W1
USA	N.J. or N.Y.	W2
USA	Missouri	WØ
USA	Illinois	W9
India		VU
Gibraltar		ZB2
Yugoslavia		YU2
Libya	Tripoli	5A
———	Memorial Stations	———

Starting date is 1 January 1973 and the first awards will be issued on the occasion of the 1974 Marconi Celebrations. The list of Diplomas issued will be published in the official journal of the A.R.I. Send all log data, QSLs and fee to cover return of your QSLs to: A.R.I., V Scarlatti 31, 20124 Milano, Italy.

Utah All County Certificate

Worked Italian YL: Issued by the Italian YLRC and available to all OMs-YLs- s.w.ls. Contacts for points must be dated after 1 January 1970. All bands/modes ok but only one contact valid. Charter members count 2 points, other Italian YLs count 1 point, Jolly—station counts 4 points. Italians need 10 points and must send 10 IRCs; Other Europeans need 8 points and must send 15 IRCs. Others need 6 points and must send 20 IRCs. Send log extracts certified by two other amateurs, (don't send QSLs). Free to handicapped. Charter members are: IP1YG, IP1-MOG, IØYL, I8ATB, I3BL, I2CWK, I8LIA, I3ZMT, I4CLL, I3GLK, I2ZRE, IP1ZNA, I8LBP, I4RGI, I4XYL, I8SGZ, I2YD, I7-LIL, I8PLH, I3TEH, I3DCW. Awards Manager: I4RGI, Ginevra RESTANI, POB 28, 46100 Mantova, Italy.

Editors Notes

On a tip from Charlie, WA4EPH, I wrote to the proper office and was informed that as of July 1, 1972, the County of Nansemond became the City of Nansemond. Also I have heard that there might be some additional changes as of January 1, 1974. Also apparently there is much misunderstanding about Independent Cities—a QSL (and *only* once per City) from an Independent City can be used for a *county* it touches, *not* a county that is across any water or any county that is separated from it by a bay, county, etc. . . . I realize that other awards might have other rules but they do *not* apply for USA-CA.

As this is being written, the County Hunter

[*Continued on page 96*]

Propagation

BY GEORGE JACOBS,* W3ASK

DURING May, optimum frequencies for DX propagation are expected to be seasonally *lower* during most of the daylight hours, but *higher* during the late afternoon, early evening and nighttime hours, than was observed during the winter months. A considerable increase is expected in sporadic— E ionization during the month, and this should result in frequent short-skip openings on each of the h.f. bands, and on 6 meters as well. A seasonal *increase* in the static level is also normal for May.

The following is an overall picture of h.f. amateur band openings forecast for May, 1973. For specific times of DX openings, refer to the DX Propagation Charts which appeared in last month's column. This month's column contains Short-Skip Propagation Charts valid for May and June, as well as Charts centered on Alaska and Hawaii. The Short-Skip Charts contain propagation forecasts for circuits varying in length between distances of 50 and 2300 miles. For day-to-day propagation conditions expected during the months, see the "Last Minute Forecast", which appears at the beginning of this column, or call DIAL-A-PROP.

10 Meters: Except for an occasional daytime opening to some southern or tropical areas, not many DX openings are forecast for this band during May. Frequent short-skip openings between distances of approximately 750 and 1400 miles, however, should be possible.

15 Meters: A seasonal decrease in DX openings on this band is normal for May, but some fairly good openings still should be possible, especially to southern and tropical areas. DX conditions should peak during the late afternoon and early evening hours. Numerous shortskip openings, between approximately 600 and 2300 miles, are also expected during the month.

*11307 Clara Street, Silver Spring, Md. 20902

LAST MINUTE FORECAST

Day-to-Day Conditions Expected For May, 1973

	Rating & Forecast Quality			
Propagation Index	(4)	(3)	(2)	(1)
Date				
Above Normal: 6-7, 11, 24, 26, 30	A	A	C	C
Normal: 2-5, 8-10, 12-13, 17-18, 20-21, 23, 25, 27, 29, 31	B	C	D	E
Below Normal: 1, 14-16, 19, 22, 28	C	D	E	E
Disturbed None	D	D	E	E

Where *expected signal quality is:*

A—Excellent opening, exceptionally strong, steady signals.

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

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

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

E—No opening expected.

HOW TO USE THIS FORECAST

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

2. With the *propagation index*, use the above table to find the expected signal quality associated with the particular opening for any day of the month. For example, all openings shown in the Charts with a *propagation index* of (4) will be fair on May 1, Good on May 2-5, and excellent on May 6, etc.

20 Meters: This should be the best band for DX propagation during May. Opening shortly after sunrise, good DX conditions should prevail to one area of the world or another, through the evening hours. The band is also expected to remain open to some southern and tropical areas during much of the hours of darkness. DX conditions should peak during the late afternoon and early evening hours. Numerous short-skip openings are also forecast for distances between approximately 350 and 2300 miles. Quite often, especially during the late afternoon hours, optimum conditions may exist for both short and long-skip and stations a few hundred miles away will be heard at the same time as DX stations from several thousand miles away.

40 Meters: Fewer DX openings are expected during May as a result of the shorter hours of darkness and a higher level of static. Fairly good openings to several areas of the world still should be possible, however, from shortly before sunset, through the hours of darkness, until shortly after sunrise. Good daytime short-skip openings can be expected over distances between approximately 150 and 750 miles, with nighttime openings extending up to beyond 2300 miles.

80 Meters: Fewer hours of darkness and a higher static level are also expected to reduce

DX openings on this band during May, but a few fairly good openings still should be possible to some areas of the world during the hours of darkness. Excellent short-skip openings are forecast for the daylight hours over distances ranging between approximately 50 to 250 miles. During the hours of darkness, the short-skip range should increase up to approximately 2300 miles.

160 Meters: Propagation conditions on this band have passed their seasonal peak, and are expected to decline until the early fall months. Openings up to a distance of 1000 miles, or so, should be possible this month during the hours of darkness and the sunrise period. An occasional opening well beyond this range may also be possible when static levels are exceptionally low.

V.H.F. Ionospheric Openings

Sporadic-E ionization should increase considerably during the month, and this is expected to produce some fairly good 6 meter short-skip openings over distances between approximately 1000 to 1400 miles. These openings are most likely to occur between 9 A.M. and 1 P.M. and between 5 and 9 P.M. local standard time, although they can occur at other times as well. During periods of intense and widespread sporadic-E ionization, two-hop openings considerably beyond 1400 miles may also occur on 6 meters, and openings on 2 meters may be possible over distances between approximately 1200 to 1400 miles. Refer to "V.h.f. Ionoshperic Propagation", which appeared in the November, 1969 issue of *CQ* (page 37), for a do-it-yourself method for predicting v.h.f. sporadic-E short-skip openings.

The *Eta Aquarids* meteor shower should produce some fairly good meteor-scatter openings of short duration on the v.h.f. bands during May 3-6. This is a major meteor shower, and it is expected to reach maximum intensity during the early morning hours of May 5, with a predicted hourly meteor count in excess of 20.

Some fairly good 6 meter trans-equatorial (TE) scatter openings should be possible during the month. They are most likely to occur between 8 and 11 P.M., local standard time, on long north-south paths which cross the geomagnetic equator at approximately a right angle. TE openings favor locations in the southern third of the USA, but an occasional opening should be possible into the central and northern regions during May.

How To Use The Short-Skip Charts

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

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

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

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

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

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

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

While auroral activity is generally at a seasonally low level during May, some displays may occur during periods of below normal or disturbed ionospheric conditions. During such periods, openings are likely on 6 and 2 meters for distances up to approximately 1200 miles, resulting from the reflection or scatter of the radio signal from the ionized patches produced by the auroral displays. Check the "Last Minute Forecast" at the beginning of this column, or DIAL-A-PROP, for the periods that are expected to be below normal or disturbed during May.

Sunspot Cycle

The Federal Solar Observatory at Zurich, Switzerland reports a monthly sunspot number of 42 for January, 1973. This results in a 12-month smoothed sunspot number of 67, centered on July, 1972. The decline of the present solar cycle continues and a smoothed sunspot number of 41 is predicted for May, 1973.

73, George, W3ASK

CQ Short-Skip Propagation Chart
May & June, 1973

Band Openings Given In Local Standard Time At Path Mid-Point Using 24-Hour Time System

Band (Meters)	*Distance From Transmitter (Miles)*			
10	*Nil*	07-09 (0-1) 09-13 (0-2) 13-17 (0-1) 17-21 (0-2) 21-23 (0-1)	07-09 (1) 09-13 (2) 13-17 (1-2) 17-21 (2) 21-23 (1) 23-07 (0-1)	07-09 (1-0) 08-21 (2-0) 21-23 (1-0) 23-07 (1-0)
15	*Nil*	06-09 (0-1) 09-13 (0-2) 13-17 (0-1) 17-21 (0-2) 21-00 (0-1)	06-09 (1-2) 09-13 (2-3) 13-17 (1-3) 17-19 (2-3) 19-21 (2) 21-00 (1) 00-06 (0-1)	06-09 (2-0) 09-16 (3-1) 16-19 (3-2) 19-21 (2-1) 21-22 (1) 22-06 (1-0)
20	09-20 (0-1)	06-09 (0-2) 09-12 (1-3 12-17 (1-4) 17-19 (1-3) 19-20 (1-2) 20-22 (0-2) 22-06 (0-1)	06-07 (2) 07-09 (2-3) 09-12 (3-4) 12-17 (4) 17-19 (3-4) 19-20 (2-4) 20-22 (2-3) 22-00 (1-2) 00-06 (1)	06-07 (2) 07-09 (3-2) 09-15 (4-3) 15-20 (4) 20-22 (3) 22-00 (2) 00-06 (1)
40	07-09 (1-2) 09-11 (2-4) 11-17 (3-4) 17-19 (2-4) 19-21 (1-3) 21-23 (0-2) 23-07 (0-1)	07-09 (2-4) 09-15 (4-2) 15-17 (4-3) 17-19 (4) 19-21 (3-4) 21-23 (2-3) 23-07 (1-2)	07-08 (4-3) 08-09 (4-2) 09-15 (2-1) 15-17 (3-1) 17-19 (4-2) 19-21 (4) 21-23 (3-4) 23-02 (2-4) 02-04 (2-3) 04-07 (2)	07-08 (3-1) 08-09 (2-1) 09-17 (1-0) 17-19 (2-1) 19-21 (4-3) 21-02 (4) 02-04 (3) 04-06 (2) 06-07 (2-1)
80	07-10 (4) 10-18 (4-3) 18-22 (4) 22-00 (3-4) 00-05 (2-3) 05-07 (3-4)	07-10 (4-1) 10-16 (3-0) 16-18 (3-1) 18-20 (4-2) 20-00 (4) 00-05 (3-4) 05-07 (4-3)	07-08 (1) 08-10 (1-0) 10-16 (0) 16-18 (1-0) 18-20 (2-1) 20-22 (4-3) 22-02 (4) 02-05 (4-3) 05-07 (3-2)	07-08 (1-0) 08-18 (0) 18-20 (1-0) 20-22 (3-2) 22-02 (4-3) 02-05 (3-2) 05-07 (2-1)
160	05-08 (4-1) 08-09 (2-0) 09-18 (1-0) 18-20 (3-1) 20-22 (4-2) 22-05 (4-3)	05-08 (1) 08-18 (0) 18-20 (1-0) 20-22 (2-1) 22-00 (3-2) 00-03 (3) 03-05 (3-2)	07-08 (1-0) 08-20 (0) 20-22 (1) 22-00 (2-1) 00-03 (3-2) 03-05 (2) 05-07 (1)	07-20 (0) 20-00 (1) 00-03 (2) 03-05 (2-1) 05-06 (1) 06-07 (1-0)

ALASKA

Openings Given In GMT*

To:	*10 Meters*	*15 Meters*	*20 Meters*	*40/80 Meters*
Eastern USA	*Nil*	20-02 (1)	22-00 (1) 00-02 (2) 02-04 (3) 04-05 (2) 05-06 (1) 10-12 (1) 12-14 (2) 14-16 (1)	*Nil*
Central USA	*Nil*	21-04 (1)	22-02 (1) 02-03 (2) 03-05 (3) 05-06 (2) 06-07 (1) 12-13 (1) 13-15 (2) 15-16 (1)	08-21 (1)
Western USA	*Nil*	20-03 (1) 01-03 (1) 03-05 (2) 05-06 (1)	00-02 (2) 02-04 (3) 04-07 (4) 07-08 (3) 08-09 (2) 09-15 (1) 15-18 (2) 18-00 (1)	07-09 (1) 09-14 (2) 14-15 (1) 11-13 (1)*

HAWAII

Openings Given In Hawaiian Standard Time*

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

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

Note: The ALASKA and HAWAII Propagation Charts for distances *greater* than 1300 miles. For shorter distances, use the preceding Short-Skip Propation Chart.

Contest Calendar

BY FRANK ANZALONE,* W1WY

Calendar of Events

Apr. 28-29	PACC DX Contest
Apr. 28-29	WAEDC RTTY Contest
May 5-6	Bermuda C.W. Contest
May 5-6	Helvetia 22 Contest
May 5-6	Georgia QSO Party
May 12	World Telecomm. C.W.
May 12-13	USSR DX C.W. Contest
May 13	YL ISSBers C.W. Party
May 19-20	YL ISSBers Phone Party
May 19-20	Tennessee QSO Party
May 19-20	Five Flags VHF Contest
May 19	World Telecomm. Party
June 1-4	CHC/FHC/HTH QSO Party
June 10-14	Mass. Cities & Towns
June 10-17	Mass. Amateur Radio Week
June 17	WAB VHF Phone Contest
June 25-July 15	NRL 50th Anniversary
July 28-30	County Hunters C.W. Contest
July 28-30	Kentucky QSO Party
Aug. 11-12	WAEDC C.W. Contest
Aug. 18-19	New Jersey QSO Party
Aug. 18-19	SARTG RTTY Contest
Sept. 8-9	WAEDC Phone Contest
Sept. 29-30	Delta QSO Party
Oct. 27-28	**CQ WW DX Phone Contest**
Nov. 24-25	**CQ WW DX C.W. Contest**

Bermuda C.W. Contest

Starts: 0001 GMT Saturday, May 5
Ends: 0200 GMT Sunday, May 6

The phone section was run off a couple of weeks ago. Logs for both sections must be received no later than June 30th and go to: The Radio Society of Bermuda, P.O. Box 275, Hamilton, Bermuda.

Helvetia 22 Contest

Starts: 1500 GMT Saturday, May 5
Ends: 1700 GMT Sunday, May 6

Mail your logs within 30 days of the end of the contest to: USKA Traffic Mgr., HB9-AHA, im Moos, 5707 Seengen, Switzerland.

Details of the above 4 events appeared in last month's CALENDAR.

* 14 Sherwood Road, Stamford, Conn. 06905.

Georgia QSO Party

Starts: 2000 GMT Saturday, May 5
Ends: 0200 GMT Monday, May 7

Thsi is the twelfth annual QSO party for the Columbus ARC. The same station may be worked on each band and mode for QSO points and Ga. to Ga. contacts are permitted.

Exchange: QSO no., RS(T) and QTH. County for Georgia; state, province for others.

Scoring: Each QSO counts 2 points. Georgia stations multiply total by number of different states and VE provinces worked. Out-of-state use Ga. counties for their multiplier. (max. of 159), DX may be worked for QSO points but not for multiplier credit.

Frequencies: c.w. - 1810, 3590, 7060, 14060, 21060, 28060. s.s.b. - 3975, 7260, 14290, 21410, 28600. Novices - 3718, 7125, 21110, 28110. Try 160 at 0300Z. 10 on the hour, 15 on the half hour.

Awards: Certificates to the highest scoring station in each state, province, country and Georgia county. Also to the top Ga. and non Ga. Novice. There are plaques for the top Ga. station, out-of-state station, Ga. Club with the highest aggregate score, and top scoring mobile or portable outside own county.

Make up your log in the usual sequence, include a summary sheet and a signed declaration. Mail before June 11th to: Columbus ARC, Att: John T. Laney III, K4BAI, P.O. Box 421, Columbus, Georgia 31902. Include a large s.a.s.e. for copy of results.

USSR C.W. DX Contest

Starts: 2100 GMT Saturday, May 12
Ends: 2100 GMT Sunday, May 13

The Radio Sports Federation of the USSR invites all radio amateurs to take part in their "CQ-M" Contest to strengthen friendly relations among all amateurs.

This is a world wide contest, so do not confine your activity to working USSR stations only. Use all bands 3.5 thru 28 mHz, c.w. only.

The group that operated SMØMC in the 1972 CQ WW Phone Contest has been the winner for Sweden in the multi-operator catagory, as SM5AZU and other calls in the past. They have now accumulated enough certificates to distribute one to each of the operators. Here's Bo SM5BGM, Bert SM5-AZU, Kell SMØATN and Stan SMØMC drinking to the occasion.

Categories: Single operator, both single band and all band. Multi-operator, single transmitter. And s.w.l.'s.

Exchange: RST plus the number of their Oblast (region) for the USSR, RST plus a progressive QSO number for the rest of us.

Points: One point for QSO's between stations on the same continent, 3 points between stations on different continents. Contacts between stations in the same country have no value.

A station may be worked once on each band for QSO points, but a multiplier is counted only *once. (Not once on each band)*

S.w.l.'s credit 1 point if a station is reported, 3 points if both sides are reported.

Multiplier: Is derived from the countries and territories in the "R-150-S" list which is essentially the same as our DXCC country list, but the following oblasts are counted as a separate multiplier. (02, 13, 14, 56, 84, 85, 86, 87, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 105, 128, 138, 139, 153, 159.)

Final Score: Total QSO points from all bands times the country/oblast multiplier.

Awards: To the top scorer in each category in each country, first 3 places in each continent, and the top 6 places among all groups. *(Note: single band awards for each band)*

Awards will be made in the forms of certificates and badges, depending on the classification. A minimum of 6 hours operation is required for country awards and 12 hours for the continental entries. In countries where the returns justify, awards will be made on a call area basis. There is also the "Krenkel Award" to the top single operator and multi-operator stations.

Contest contacts may be credited for the many USSR awards in lieu of QSL cards. (R-150-S, R-100-O, W-100-U, R-15-R, R-10-R. R-6-K and "Jubilee.")

All entries must be postmarked no later than July 1st and go to: Krenkel Central Radio Club, P.O. Box 88, Moscow, U.S.S.R.

1972 USSR CQ-M Contest Results
Single Operator

All Band

K3HTZ	47,931
WA1LKX	47,480
W3GN	39,463
WAØKDI	81-096
W1PL	16,660
WB8EUN	12,180
W6UA	10,260
W6DQX	7,900
WA1NRV	7,638
W8DSO	5,124
W2CKR	5,040
W9HE	3,703
W4WSF	2,460
K3CUI	1,734
K4LDR	624
WA1MYK	510
W9TXF	432

Single Band

K2KUR	48,330
W2SZ	39,984
WB2SQN	32,301
W5EQT	25,760
K1OME	18,500
W8QXQ	12,404
WA3NQX	12,231
WA8GLY	3,192
W3ARK	2,848
W2EUO	1,872
W3CBF	1,392
W6KYA	858
W6GBY	384

Multi Opr.

W9EXE	51,348

World Telecomm. Contest

C.W.—0000 to 2400 GMT Saturday, May 12
Phone—0000 to 2400 GMT Saturday, May 19

The Brazilian Ministry of Communication announces its 4th contest commemorating "World Telecommunications Day" (May 17th)

Operation is limited to single operator stations, fixed or maritime, 10 thru 160 meters.

Exchange: RS/RST plus your I.T.U. Zone.

Scoring: QSO points as follows:

	10/15/20	40	80/160
Same country	0	0	0
Other countries			
same Zone	1	1	2
Other Zones			
same continent	2	3	4
Other continents	3	5	6

Final Score: Total QSO points multiplied by number of different I.T.U. Zones worked. The same station may be worked on each band for QSO points but Zone is counted only once.

Log entries in this order: Time in GMT, station worked, number sent/received, band, continent, zone and QSO points. Separate log is required for c.w. and phone. Include a summary sheet and a signed declaration.

Awards: Diplomas to the three highest scoring stations in each country. Gold, silver

and bronze medals to the three top scorers in the world. (Awards for both c.w. and phone.)

The I.T.U. Trophy goes to the country with the highest aggregate score, determined by the mathematical average of the scores of the top 5 contestants of that country. The Trophy remains in the possession of the national association of that country, affiliated with the I.A.R.U., for a period of one year. It is permanently retired if won 3 times within a 5 year period.

Mail logs before June 30th to: Ministerio das Comunicacoes, DENTAL, 70000—Brasilia—DF, Brazil.

YL ISSBers QSO Party

C.W.: 0000 GMT to 2400 GMT May 13
Phone: 0000 GMT May 19 to 2400 May 20
C.W.: — 24 hrs., one 6 hour rest period.
Phone: — 48 hrs., two 6 hour rest periods.

This year's party again is a two week-end affair, but unfortunately the dates were changed and the c.w. section conflicts with the USSR contest, a very active affair.

The same station may be worked on different bands for QSO points, but the multiplier is counted only *once*.

Categories: DX/WK teams, YL/OM teams and single operator. (Non-members enter this category only).

Exchange: Name, RS(T), SSBer number, country, state, partner's call. (if any) (non-members send "no number.")

Points: Two points for contacts with members in the same continent, 4 pts. if it's on another continent. Non-members in the same continent are worth 1 point, but 2 pts. if on another continent.

Multiplier: DXCC countries, Canadian provinces and USA states.

Frequencies: C.W.—3565, 7065, 14070, 21070. Phone—3973, 7273, 14333, 21373, 28673. Listen for DX on 3775 & 7090.

Awards: Certificates to highest score in each country, province and state.

Trophies to the top scoring single operator, DX/WK team, YL/OM team and c.w. only score. Plaques to 2nd & 3rd place winners in teams.

Pairing of DX/WK teams must be cleared thru W7EOI. YL/OM teams must be related pairs. Write to W7EOI for party forms and other information.

Logs must be postmarked before June 30th and go to: Lyle W. Coleman, W7EOI, 412—19th Street S.W., Great Falls, Montana 59404.

Tennessee QSO Party

Starts: 2200 GMT Saturday, May 19
Ends: 2200 GMT Sunday, May 20

This is the 3rd QSO Party sponsored by the Tennessee Council of Amateur Radio Clubs. Tenn. stations may work other in-state stations for QSO and multiplier credit. Stations may be worked on each band and mode, and portables and mobiles reworked if they change counties.

Exchange: Signal report and QTH; county for Tenn., state or country for others.

Scoring: *For out-of-state stations:* Tenn. QSOs × Tenn. counties worked. (max. of 95) *For Tenn. stations:* QSO points × states + VE districts + Tenn. counties worked, this total plus the bonus. (Note: Since the bonus applies to Tenn. stations only, and its lengthy and complicated I recommend you write to K4PJ for details.)

Frequencies: C.W.—3550, 7050, 14050, 21050, 28050. Phone—3980, 7280, 14280, 21380, 28580. Novice—3775, 7125, 21125, 28125. (Avoid traffic nets.)

Awards: Certificates to the highest scorer in each state and VE districts. An achieve-

Results 1972 WAEDC Contest
Single Operator

Phone USA

W3AU (Opr. WA3IAQ)	**370,010**
WB2SQN	**346,502**
K1CPF	**238,377**
W4WSF	**228,232**
K1CSJ/1	162,022
DL7KK/W2	124,503
K1OME	104,208
K8IDE	**83,185**
W5QBM	**73,836**
W∅MYN	**72,268**
WB8EUN	51,012
K6SVL	**45,792**
W9ZTD	**23,306**
W6DGH	12,276
W4DQD	11,514
W1BPW	5,460
W6DQX	4,956
W4KMS	4,332
K9EYA	2,080
WB9BXX/5	1,368
W6KYA	1,152
WA2PAT	588

C.W. USA

K1JHX	**502,200**
W3AU (Opr. K3EST)	**458,784**
W1FBY	**455,872**
W1PL	**339,192**
W1BPW	90,723
K1OME	75,840
WB4JYB	**45,885**
K2MFY	**43,800**
K4PGM	37,400
W4HOS	36,915
WB8EUN	**35,838**
K4LDR	33,354
W∅BMM	**31,900**
W8DSO	31,680
W6AU	**30,874**
WA5ZWC	**29,682**
ON8RA/W3	28,210
W3ARK	27,200
W6DGH	26,220
W6DQX	22,782
WA3HMM	18,476
WB4OGW	17,856
WA6NGG	16,940
K2GI	15,038
W9LKI	13,680
K5ABV	10,472
W4WSF	6,550
WA3DMH	4,816
W6KYA	4,416
W4JUK	1,640
W2MLO	1,540
W4KMS	1,155
W6GBY	792
WA2PAT	720
W6RQZ	600
W2GKZ	336
WB9BXX	170
WA2DZD	72

Continental Leaders

Phone		C.W.	
DJ4LK	788,020	K1JHX	502,200
UW9WR	730,422	YU3EY	464,013
IH9JT	586,530	4X4VE	447,948
W3AU	370,010	ZE1BL	101,712
DUIFH	257,873	CX8BBH	34,632
YV5BPG	115,107	VK2APK	22,704

ment certificate for each contestant working ten or more Tenn. stations. Two plaques for the highest Tenn. and out-of-state scores. And certificates for the many Tenn. categories. (Home, portable, mobile and club stations.)

Logs must be postmarked no later than June 22nd and go to: Mel Wardell, K4PJ, Box 489, Oak Ridge, Tenn. 37830.

Five Flags VHF Contest

Starts: 0001 GMT Saturday, May 19
Ends: 2400 GMT Sunday, May 20

This is a new one sponsored by the Five Flags ARC of Florida. Activity will be on all v.h.f. bands above 50 mHz.

Exchange: QSO no., RS(T) and ARRL section.

Scoring: Contacts per band as follows: 50 mHz, 1 pt.—144 mHz, 2 pts.—220 mHz, 3 pts.—420 mHz, 4 pts.—all above 420, 5 pts.

Power multiplier: up to 5 watts × 4, up to 30 w. × 3, up to 300 w. × 2, over 300 w. no multiplier.

Section multiplier: ARRL sections and countries on each band.

Contacts made on modes other than c.w. or s.s.b. receive additional multiplier of 2.

Final Score: Total points multiplied by total sections worked on each band. (Rules on scoring were a bit vague, suggest you write to WA3ODA/4 for detailed information.)

Awards: Certificates to the top scorer in each ARRL section with 2 or more entries. The W4UC award is given to locals contacting 10 or more FFARC members. Others must contact 5 members. Single operators only.

Mailing deadline for logs is June 1st to: WA3ODA/4, 1801 Border Street, Lot 37, Pensacola, Fla. 32505. Include a s.a.s.e. for results or request for rules and log sheets.

IARS/CHC/FHC/HTH Party

Starts: 2300 GMT Friday, June 1
Ends: 0600 GMT Monday, June 4

It is adviseable you send a s.a.s.e. to K6BX for detailed information for this one.

Following are rules in brief:

Exchange: QSO no., report, name, CHC/FHC no., state, county or similar division. Non-members omit no. and send HTH instead.

Scoring: *For CHCers*—1 point per QSO with other CHCers, 2 points if its a HTHer, and 1 additional point if its a YL, B/P, FHC, Novice, CHC-200, Merit or Club station, or if it is on VHF/UHF. Double above points if QSO is out of own country. *For HTHers*—Contacts with other HTHers 1 point, with CHCers 3 points. Rest same as above. S.w.l. use same scoring system as HTHers.

Multiplier: Each continent, country, ITU zone, and U.S. state. (counted only once.)

Final Score: Total QSO points from all bands × sum of the multiplier. Multi-operator stations divide score by number of operators. (Same station may be worked on different bands and modes for QSO points, but not for multiplier.)

Frequencies: C.W.—3575, 3710, 7070, 7160, 14075, 21075, 21090, 21140, 28090. Phone—3770, 3790, 3943, 3960, 7090, 7210, 7275, 14320, 14340, 21360, 21440, 28620, 28690. And 50.1-50.5, 145-147. For US and DX as allowed.

Awards: The party supports hundreds of certificates and Trophies, in all categories and divisions. A s.a.s.e. will get you a list. Include extra postage for list of ITU, IARU, IARC, IARS country, prefix and zone list.

Send all requests and your logs to: International Amateur Radio Society, K6BX, P.O. Box 385, Bonita Calif. 92002.

Editor's Notes

The OZ-CCA contest usually run on the first week-end in May has been discontinued. However, a new award certificate is now being issued, details will be given in Ed. Hopper's W2GT Award Column.

The Bristol Group of the RSGB is running a contest, January thru August of this year. A very attractive award to be delivered in time for Christmas is the top prize. G3PTO will give you all the details. (24 Shaldon Road, Hartfield, Bristol BS7 9NW, England.)

We had a good one on 160 back in January. Conditions were unusually good and DX was coming in from all directions. It seemed to me the North/South path was at its peak. Both VP8KF and LU5HFI putting in very good signals.

The "DX Window" was fairly free of stateside QRM. The few that found themselves there by accident or were unaware of the gentleman's agreement, quickly QSYed when advised of the situation. Except one quick-tempered K4 who made everybody's "black book" with his obscene remark when he was asked to please QSY. (Hope the FCC was monitoring his signal.)

73 for now, Frank, W1WY

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Converted for 35-50 mHz. 10 preset pushbutton channels or manual tuning. Complete with 10 tubes, checked out, like new..... **$39.50**

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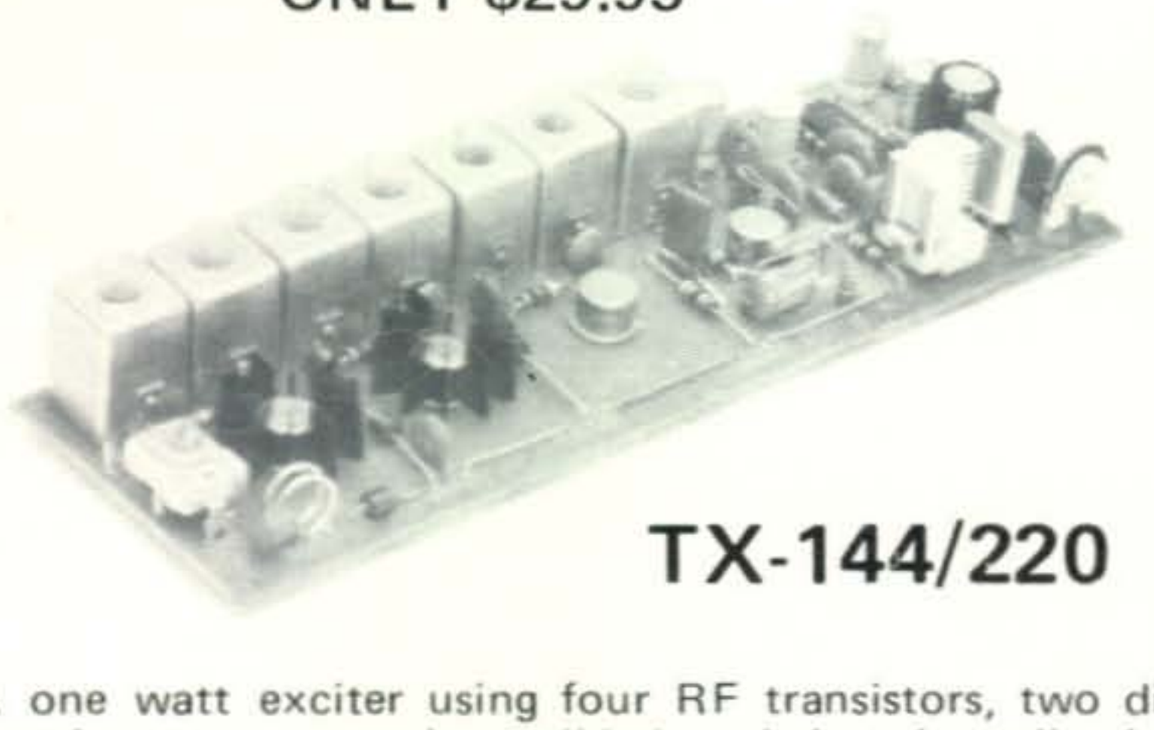

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- TYPICALLY 1 1/2 WATTS OUTPUT AT 12.6 VOLTS (1 WATT ON 220)
- ADJUSTABLE DEVIATIONS TO 10 kHz
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A one watt exciter using four RF transistors, two diodes, and one integrated circuit. The RF transistors are operating well below their ratings allowing long keying periods without damage. The exciter may be used alone as a transmitter or with out PA 144 or 220 amplifier for a fifteen watt station.

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SURPLUS sidelights

BY GORDON ELIOT WHITE*

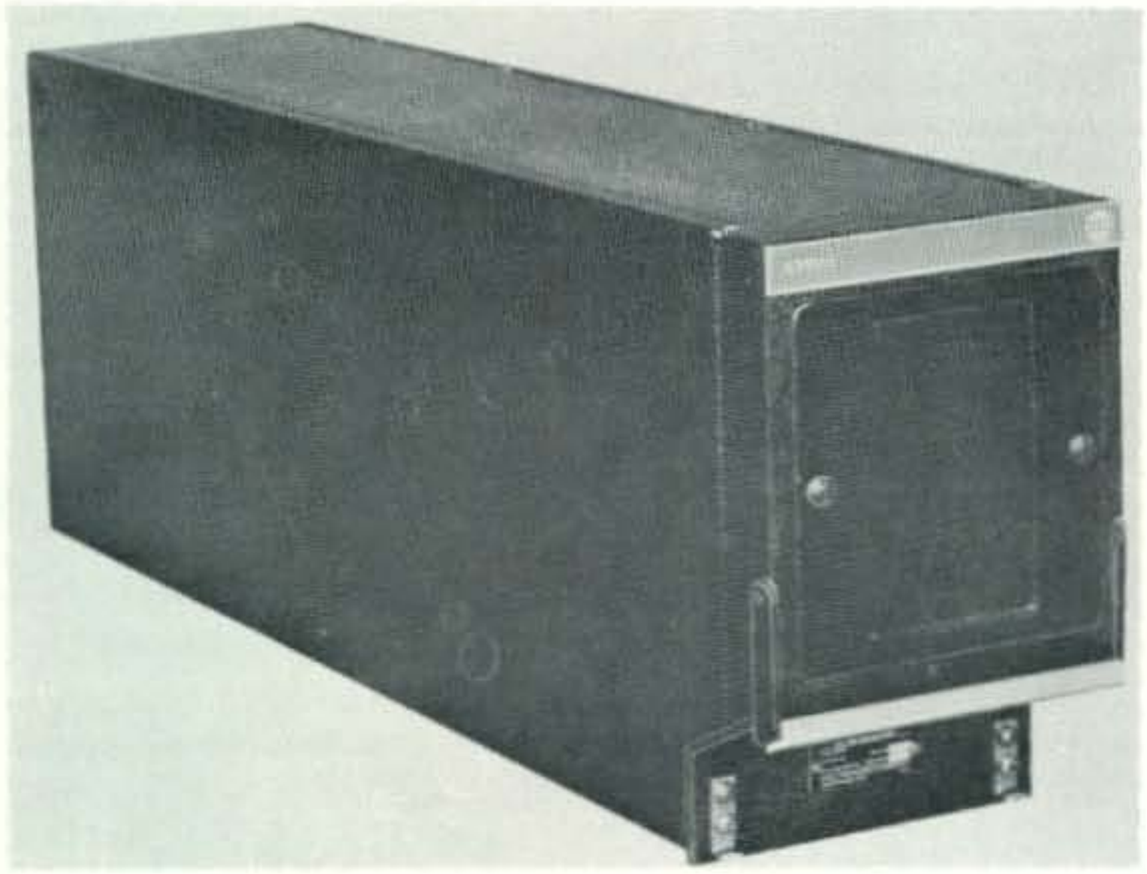
WHAT is made by Collins Radio Co., has a quantity of sand in it, and is used in aircraft? My surplus "find" this month fits that interesting description, for it is an F-1039A/U digitally tuneable bandpass filter covering 2.000 to 29.999 mHz.

The sand is a "heat sink" in a servo-amplifier module. This was a jolt to me, after hearing for years that sand was to be kept *out* of delicate electro-mechanical equipment. Collins, however, seals the sand in the module with threaded caps on each end of the two-inch tubing container, and the threads are sealed with Silastic 731 RTV sealant. Apparently the relatively dense sand conducts heat better than potting compound, or Collins was providing a "potting" substance which could be removed to allow maintenance of the components. That is a thoughtful thing, since most potted components are throw-aways if one resistor goes bad. It is almost impossible to take the solid potting material off the individual components without destroying them.

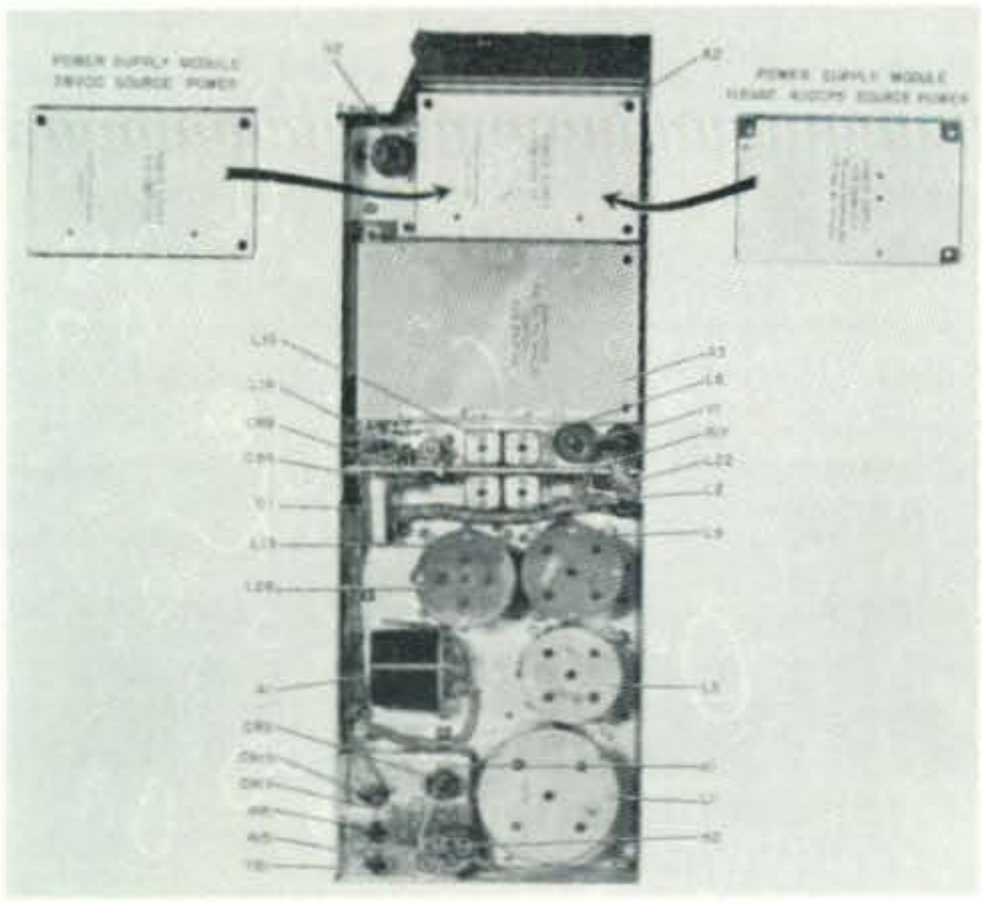
The F-1039A is airborne gear which was probably used on an air command post for the Strategic Air Command, where there were all sorts of circuits in constant-occasionally conflicting-use. Its function was to allow a receiver to operate adjacent to a high-powered transmitter, as close as ten percent in frequency, with a power of 1,400 volts r.f.

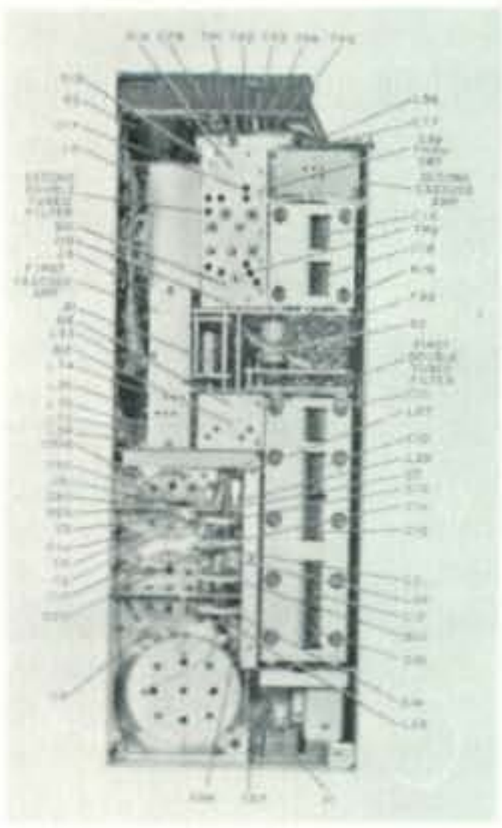
Known also by civilian nomenclature of 635V-1 the unit is remotely controlled, and contains a "sharply selective bnadpass filter with integral linear radio frequency amplifiers." It can receive and amplify extremely weak r.f. signals, despite the presence of nearby transmitters. It eliminates cross-

*1502 Stonewall Rd., Alexandria, Va. 22302



The F-1039A (635V-1) Bandpass Filter is shown on top. The right-side view is shown on the bottom right with the cover removed and the left-side view with the cover removed is shown on the bottom left.





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R-4C RECEIVER 160-10 Mtrs.	$499.95	MC-4 MOBILE CONSOLE	69.00
4-NB NOISE BLANKER for R-4C	65.00	DC-4 POWER SUPPLY Mobile 12VDC	125.00
R-4C IF FILTERS .250; .500; 1.5; 6.OKHZ Each	50.00	L-4B LINEAR AMPLIFIER with power supply	825.00
2-C RECEIVER 80-10 Mtrs.	255.00	CPS-1 POWER SUPPLY SC-6	19.75
SPR-4 PROGRAMMABLE RECEIVER	579.00	MS-4 MATCHING SPEAKER	22.00
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T-4XC TRANSMITTER 160-10 Mtrs.	530.00	MN-4 MATCHBOX	99.00
2-NT HF TRANSMITTER CW 80-10 Mtrs.	175.00	MMK-22 MOBILE, Dash, Desk Mount TR-22	9.95
TR-4C 80-10 Mtr. TRANSCEIVER	599.95	WV-4 WATTMETER 20-200 mHz	73.50
RV-4 REMOTE VFO for TR-4	110.00	W-4 WATTMETER 1.8 to 54 mHz	61.95
MMK-3 MOBILE MOUNT TR-4	6.95		

34-PNB PLUG-IN NOISE BLANKER for TR-4 Above S/N 31320 ..... 100.00
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CTR-144 TWO RIGS IN ONE: AM-FM VFO coverage 143.8 to 148.2 mHz, 6 watts output, 115 VAC and 12 volts DC built-in. U.S. made 459.95

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MODEL 333 DUMMY LOAD WATTMETER DC-250 mHz, fully metered, 250 watts 79.95
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MODEL 375 PROTAX ANTENNA SWITCH with automatic grounding, 1000 watts, 6 positions, rear mounted SO-239 connectors 17.50
MODEL 376 same as above only side mounted SO-239 connectors 17.50
MODEL 850A PI-NETWORK INDUCTORS for final amplifiers, use with 813, 4-125A, 4-250A, 4-400A, 4-1000A all band 80 thru 10 mtr., rated 2 KW 59.50
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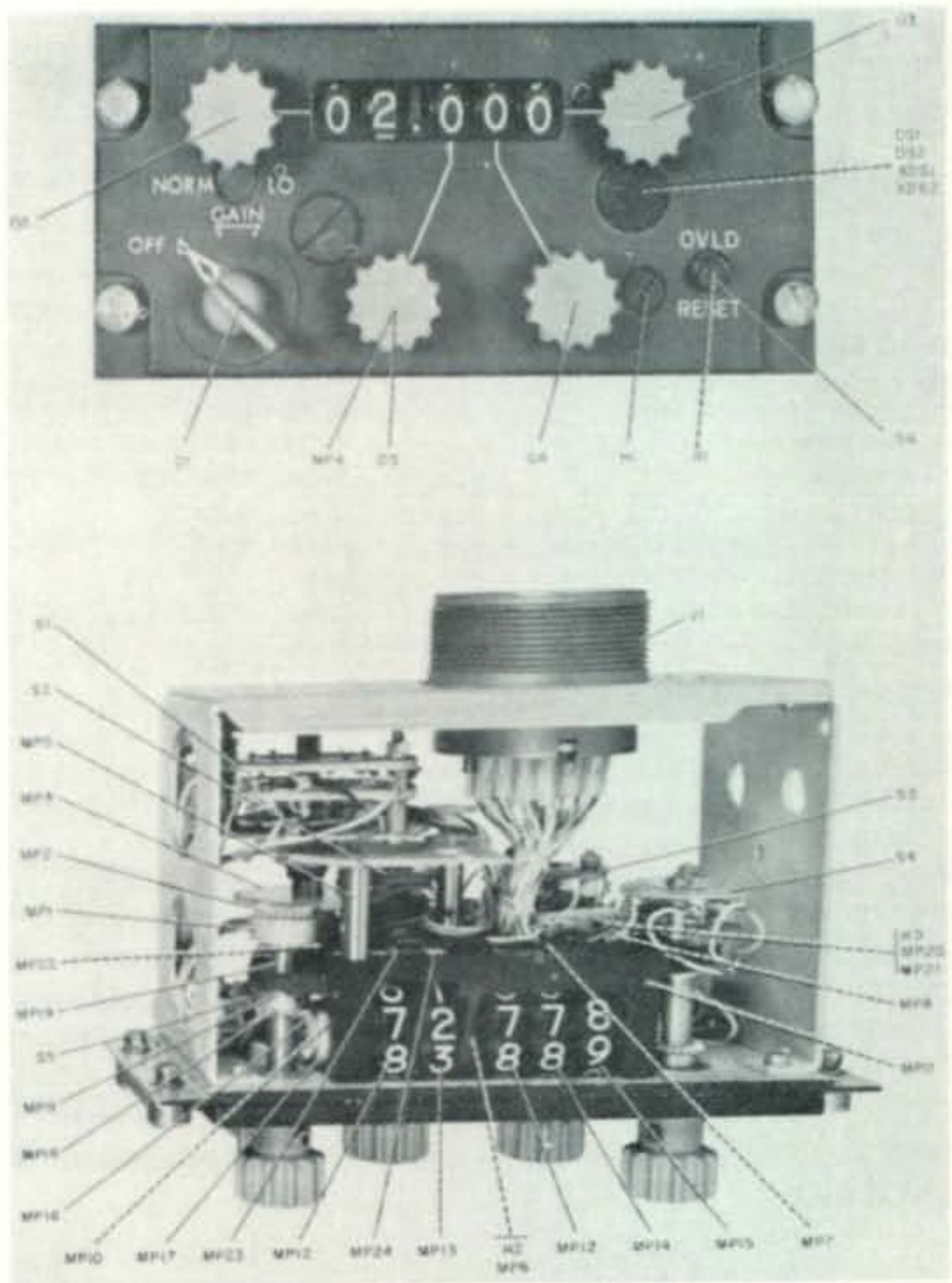

Exterior and interior views of the 914B-3 remote control head used to digitally tune the filter unit.

modulation and intermodulation, and provides protection against r.f. overloads to itself and its associated receiver.

The filter was designed to be used with the Collins 618T single sideband aircraft receiver which covers the same tuning range.

The remote control, digitally tuned, with level controls, and a reset button for the r.f.-protection circuit breaker is shown in the photo.

This goodie incidentally, is available from ANCOM Electronics, in Hawthorne, California.

Amateur applications of the filter might include both elimination of noise and hash in the high-frequency bands in electrically noisy locations, protection of receivers when their antennas were mounted on buildings near other transmitting stations including broadcast stations, use in a repeater operation, or simply use as a pre-amplifier, as the unit has a sensitivity rated at 0.25 microvolt input at 2 mHz for 10 db signal plus noise to noise ratio in a 2.7 kHz bandwidth. This should hop up most amateur receivers. Even at 29.999 mHz the sensitivity falls off only to 0.6 micro volt for the same S/N ratio.

Gain in the "normal" setting of the control is between 6 and 18 db. (The "low" position reduces gain 35 db) Input and output im-

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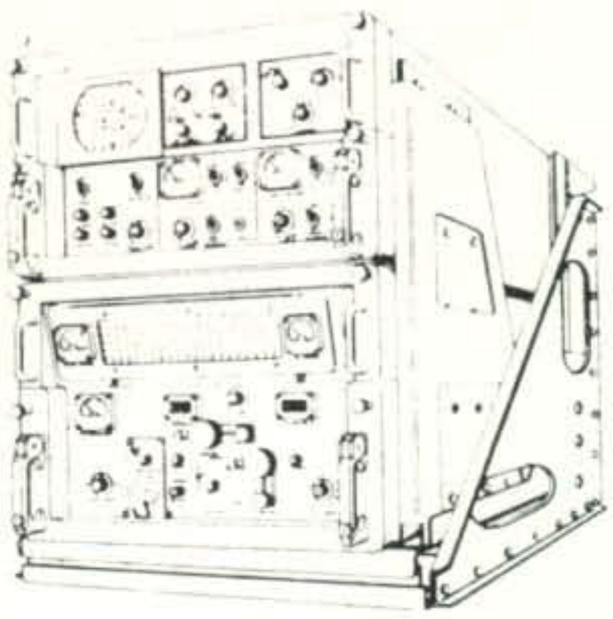
Save over $9,000.00 on this AN WRR-2 SSB Receiver!



Original government cost: over $10,000.00! One of Navy's most modern radio receiving sets. Built by National Radio Co. in last decade. A triple conversion super-heterodyne. Frequency range: 2 to 32 MC. continuously, or in 1 kc increments. 4 bands. Featuring full carrier suppression, unit receives AM, CW, MCW, voice, facsimile, Teletype and ISB. REQUIRES NO MODIFICATION! Greatly superior to earlier R390A/URR model. Good cond. Complete, operational. Spec sheet available. Spare parts as needed.

Xerox copy of Operation Repair Manual: $35. Add $100.00 for 1/2 kc in lieu of 1 kc increments.

$495.

Overhauled and certified.... **$595.00**

RADIO RECEIVER R-108/GRC

Late model Army Comm. Recvr! 20-28 Mc. FM. Cont. or pre-set freq. OK for AM with simple modification. With schematic and hook-up info. Like new. Smashing low price! **$19.95**

24 VDC POWER SUPPLY for above.....$4.95

NAVY TCS TRANSMITTER

Just arrived! This collector's item is now available in new condition! 1.5 to 12 Mc. CW and AM. 50 watt CW. Ideal for a raft of multi-purpose uses. Designed by Collins Radio. Brand new! A Columbia special.....**$75.00**

Columbia Electronic Sales, Inc.

P.O. Box 9266-Q, 7360 Atoll Ave, North Hollywood CA 91609 Tel (213) 875-2970 & 764-9030

pedances are 50 ohms, unbalanced (coax fittings).

The unit comes supplied with one of three power supplies, usable on 28 volts d.c., 115 volts a.c., 400 Hz, or 115 volts a.c. 50 to 400 Hz. Fortunately the one I had to work with had the 50-400 Hz power unit (Collins part number 528 0644 001.) This made the "conversion" a snap—just finding the proper plugs and hooking it up.

Other specs on the unit are: weight 24 pounds, size 5 × 20 × 7½ inches (fits ½ ATR aircraft rack).

The NavShips manual is 0967-120-9012, and there is a Collins, manual on the civilian 635-V version, which is identical.

R.f. input is fed to a double-tuned capacitor/inductor circuit, amplified, and again filtered in a second tuned circuit before being fed to a final r.f. amplifier and thence to the receiver. The circuit uses three type 5687 nine-pin miniature twin triodes in cascode amplifier configuration. According to Collins' the circuit gives "exceptionally linear low-noise amplification."

The second tuned circuit filter section is of lower "Q" than the first because it is loaded with "Swamping" resistors (R_{27}, R_{28}, R_{29}, R_{35}).

Reader John Hutchings suggests it might be possible to sharpen the response by removing the swamping resistors (82K, 47K, 10K, and 10K) in the second section. This is located in a small (5 x 2 x 2½") aluminum box at the front of the left side of the unit. Getting at the resistors looks difficult. This modification *has not actually been tried.*

Most of the real complexity of the F-1039A is in its tuning circuits. It is remotely digitally tuned, and that necessitates digital-to-analog conversion, servo systems, and all that kind of nice stuff. This is accomplished by the familiar servo loop, with error voltages, servo amplifiers, and feedback to achieve zero error voltage when the set is properly tuned.

The power supply, whatever its input voltage, contains a rectifier bridge and a 400 Hz power oscillator which feeds a transformer tapped appropriately to provide the necessary working voltages which are then rectified, filtered, and regulated.

To protect the unit and the receiver, there is an overload relay, K_1, which opens during bandswitching, and whenever high r.f. voltages may be present on the antenna. ■

Testing of Vertical Board CB3:

The vertical oscillator unijunction Q_{10} is set for a 9.5 second saw-tooth at TP11 by resistor R_{13}. In the author's model this value was 2.7 meg. A 9.5 second vertical cycle was chosen so that the conventional 8 to 8.5 second SSTV frame would synchronize the monitor. A d.c. scope or v.t.v.m. was to be used with the vertical sweep section because of the long sweep rate. Otherwise the alignment procedure used with the horizontal circuit board is the same for the vertical.

The VERTICAL and HORIZONTAL SYMMETRY, and SYNC DRIVE pots were replaced by fixed resistors in the author's model because they will require no further adjustment.

Final Alignment:

Set the BRIGHTNESS and HORIZONTAL and VERTICAL SIZE controls to maximum and apply high voltage. HORIZONTAL and VERTICAL POSITION controls, R_7 and R_{11} can then be adjusted to center the raster. The SIZE controls are then set to provide a square picture within the viewing space. The picture size can also be varied by adjusting the anode voltage. Less voltage produces a larger picture because the deflection plates have more relative effect.

Feeding in an SSTV signal and advancing CONTRAST while retarding the BRIGHTNESS control somewhat should start producing an SSTV picture. A little practice with the HORIZONTAL, and there is a new and interesting facet of amateur radio.

Power Supply

Bcause of the sensitivity that electrostatically deflected CRT's have to stray electromagnetic fields, the author built the power supply section on a separate chassis. The preponderance of inexpensive scopes on the market are proof that this isn't a necessity, but if compact construction of a slow scan monitor is desired, a separate power section can save many hours of juggling transformers for minimum ripple on the CRT screen.

The monitor requires ±15 volts, 300 volts and the high voltage required for the cathode ray tube. The ±15 volts is obtained by use of a center tapped bridge circuit from a 24 n.c.t. transformer.

The 300 volts required for the deflection transistors and the unijunction timing capacitors is obtained with a 125 volt transformer and a simple doubling network.

In the author's model the high voltage was obtained from power supply model K-30Y manufactured by Venus Scientific, Farmingdale, N.Y. This unit requires 0 to 15 volts in to yield 0-3 kv out and provides a completely adjustable anode supply.

For those who wish to build their own, a suitable high voltage power supply appeared in Copthorne MacDonald's August 72 Slow Scan column. A switch is provided so the monitor can be aligned without high voltage on the CRT.

A note of caution here: The voltages present in this supply are potentially hazardous and should be treated with respect. And both the 300 v. and 1.8 kv lines should be discharged whenever additional experimenting is being done.

Semiconductor Substitution

The 2N3739 deflection transistors were chosen because of their 300 volt V_{CEO} rating. Substitutes for these devices could be any line-operated 300 volt device such as the RCA 40327-28 series. Because these stages dissipate little power to speak of, one watt TO-5 units would be adequate. The TO-66 units shown in the photographs are overrated.

The video amplifier transistor 2N697 can be any unit with a beta of 50 or more and a voltage rating of 50 volts V_{CEO} at a power level of 1 watt. The 2N4917 sync stages can be any high speed low saturation PNP switching transistor with a beta minimum of 150.

The author does not recommend substitution of the unijunction saw-tooth oscillators as different unijunctions have not been tried in this portion of the circuit.

Conclusion

The SSTV bug has bitten this writer. The many hours of listening and looking at SSTV have shown that this medium offers fantastic potential for goodwill and just plain fun.

Circuit boards and a kit of parts for the SS Mark 4 are available from Gailek Solid State, 34 W. 13 St., New York, N.Y.

The author wishes to thank Venus Scientific, Inc. for permission to publish this article. Also owed a great debt is W4MS, whose many hours of sending test patterns to help fellow amateurs served this project well.

Photos for this article as well as the cover of this issue by Manuel Narciza, New York, N.Y.

Credit also goes to W7ABW and W7FEN for their article in June, 1970 of *QST;* and Copthorne MacDonald's excellent SSTV series in the current issues of *CQ*. ■

Announcements [*from page 8*]

Pittsburgh, Pennsylvania

The 19th Annual Breeze Shooters Hamfest is Sunday, May 20 at White Swan Park (Parkway West, 4 miles east of the Greater Pittsburgh Airport). No fees, free parking. Tables for swap and shop, amusement park. For info: Herb Heller, W3OFI, 2873 Beechwood Blvd., Pittsburgh, PA.

Ottawa, Illinois

The Starved Rock Radio Club will hold their annual SRRC Hamfest at the La Salle County 4-H Home and Picnic area southwest of Ottawa, IL on June 3. $1.50, or $2.00 at the gate. Food, ample parking. For info: G.E. Keith, W9QLZ/W9MKS, RFD 1, Box 171, Oglesby, IL 61348.

St. Petersburg, Florida

The St. Petersburg Amateur Radio Club will hold its annual Hamfest on Sunday May 6, from 9 a.m. to 3 p.m. at Lake Maggiore, 9th St., So. at 38th Ave., St. Petersburg. Registration $1 per family. Ample parking, free prize drawing, swap tables. For info: Lee L. Kanarian, K4WXS, 461 Pinellas Way, So., St. Petersburg, FL 33707.

Fresno, California

The Fresno Amateur Radio Club will hold their 31st Annual Fresno Hamfest on May 4-6 at the Sheraton Inn, Highway 99 & Clinton Ave., Fresno, California. Home-brew contest and segment of interest to FM. For info: F.A.R.C., P.O. Box 783, Fresno, CA 93712.

Lake Delton, Wisconsin

The 3rd annual Yellow Thunder Hamfest will be held at the Dellview Hotel in Lake Delton, Wisconsin on May 19. Navy MARS, ARPSC and VHF repeaters, cocktail hour and banquet. For info: Ken A. Ebneter, K9GSC, 822 Wauona Trail, Portage, WI

Annapolis, Maryland

The Maryland Mobileers will hold another spring Hamfest on Sunday, May 20, at Anne Arundel Community College, 6 miles north of Annapolis on College Parkway which branches off Maryland Rt. 2.

Registration only $1, tailgating $2. Ample parking. Prizes. Refreshments. Exhibits. For details: Larry Sheets, WA8FTK/3, Rt. 4, T-63, Crestwood Trailer Park, Severn, MD 21144.

Saline, Michigan

The Huron Valley Amateur Radio Association will hold its 7th annual Swap and Shop, Sunday, May 27, at the Saline Country Fairgrounds, Saline, Mich. Sales will be outdoors, or in case of inclement weather, a large building is available. Donation $1.25, or $1 in advance. Contact Terry Marsh, 702 Stanley, Ypsilanti, MI 48197. (313) 482-9577.

Peoria, Illinois

A.E.S. announces their 2nd annual Electronics Garage Sale on May 6, at Exposition Gardens in Peoria, IL. The Domestic Arts Building will provide shelter, illumination and a.c. power. Set up time starts at 11 a.m. Sale 1 p.m. to 6 p.m. Space rental $5.00 per 10 ft. space. For info: Bill Chapman (309) 745-9547.

Washington, D.C.

The Naval Research Laboratory Amateur Radio Club, W3NKF, will sponsor a 2-meter tune-up clinic on Saturday, May 19 from 9 a.m. to 12 noon to be held in Bldg. 222 of the Naval Research Laboratory located in S.E. Washington, D.C. just off Rt. 295. There will be no charge for this service.

Anderson, Indiana

The Madison County Amateur Radio Club presents their annual spring Hamfest Sunday, May 6, from 10 a.m. to 5 p.m. at the Madison County Civil Defense Building 4 miles north of Anderson, IN. Plenty of refreshments and prizes.

Rochester, New York

The 40th Annual Western New York Hamfest and VHF Conference will be held the weekend of May 12 at the Monroe County Fairgrounds, Rt. 15A near Thruway exit 46. Activities include speakers, MARS, AREC, QCWA, VHF meetings, flea market. For info: WNY Hamfest, Box 1388, Rochester, NY 14603.

Gaithersburg, Maryland

The Gaithersburg Swapfest is Sunday, May 20, at the Gaithersburg Civic Center, located on South Summerset Ave., next to the U.S. Post Office. Talk-in is on 52, 94, and 04/64. For info: Larry, W3ZPO, at 948-9029 or write to MARC, P.O. Box 611, Gaithersburg, MD 20760.

Erie, Pennsylvania

The Presque Isle Amateur Radio Club Hamfest will be held on May 19 at 7 p.m. For info: Sunflower Club, Metz St., Erie, PA.

Kansas City, Missouri

The P.H.D. Amateur Radio Association will hold their 4th annual Northwest Missouri Hamfest on Sunday, May 6, from 9:30 a.m. to 4:30 p.m. at the Kansas City North Community Center, 3930 N. Antioch Rd., one mile south of the Antioch Road-Highway I & 135 Interchange. For info: Bill Smith, P.H.D. Amateur Radio Ass'n., Inc., P.O. Box 11, Liberty, Missouri 64068.

CQ Reviews FPM-300 [*from page 69*]

quires that the seven PC switch decks be mounted in two parallel groups and their shafts ganged by means of nylon cog-wheels and a ribbed fiberglass drive belt. Separate detents are used at each group for positive engagement of all sections.

Performance

Hallicrafters has traditionally rated its amateur equipment quite conservatively, with our lab measurements usually indicating performance exceeding claimed ratings. The FPM-300 bears out our findings in this respect. The following are the manufacturers specified ratings followed by our figures in parenthesis where measured.

Receiver: SENSITIVITY—1 μv for 15 db s + n/n (80, 40 and 20 m., 2 μv; 15 m, .25 μv; 10 m, .28 μv for 15 db s + n/n). INTERNAL SPURIOUS—Less than 1 μv equivalent (In-band, greater than 10 db below 1 μv;

within tuning range 4 db below 1 μv.). AVC FIGURE OF MERIT—60 db or more r.f. signal input change for less than 10 db change in audio output (70 db for 10 db change). IF REJECTION—60 db minimum (70 db min., 80 db on 80 m.). IMAGE AND SPURIOUS REJECTION—50 db minimum (75 min; spurious 60 db min.). Frequency stability—Less than 500 Hz first hour after 15 min. warmup; less than 100 Hz/hr. thereafter (240 Hz, 90 Hz. See fig. 3).

Transmitter: PEP OUTPUT—100 watts, slightly less on 15 and 10 (140 w. on 80, 125 on 40, 135 on 20, 100 on 15 and 10). C.w. OUTPUT—(80 m.-110w., 40m.-90w., 20m.-105w., 15 and 10m.-75w.). AUDIO RESPONSE, OVERALL—500-2500 Hz at 6 db (300-2400 Hz at 6 db). FILTER SHAPE FACTOR—(1.35). CARRIER SUPPRESSION—50 db below PEP output (65 db). UNWANTED SIDEBAND REJECTION—50 db, 800-2200 Hz (65 db). SPURIOUS EMISSION—50 db below PEP, HARMONIC SUPPRESSION—40 db below PEP.

We found the FPM-300 to be a well-designed piece of equipment, meeting or surpassing all its claimed specifications. In use, it is smooth operating and flexible. The a.g.c. works extremely well with no strong signal pumping, and a control range well down into the moderate signal region. The location of the audio gain control well forward in the receiver audio amplifier chain unfortunately results in some residual noise at the speaker even with the audio gain at full off.

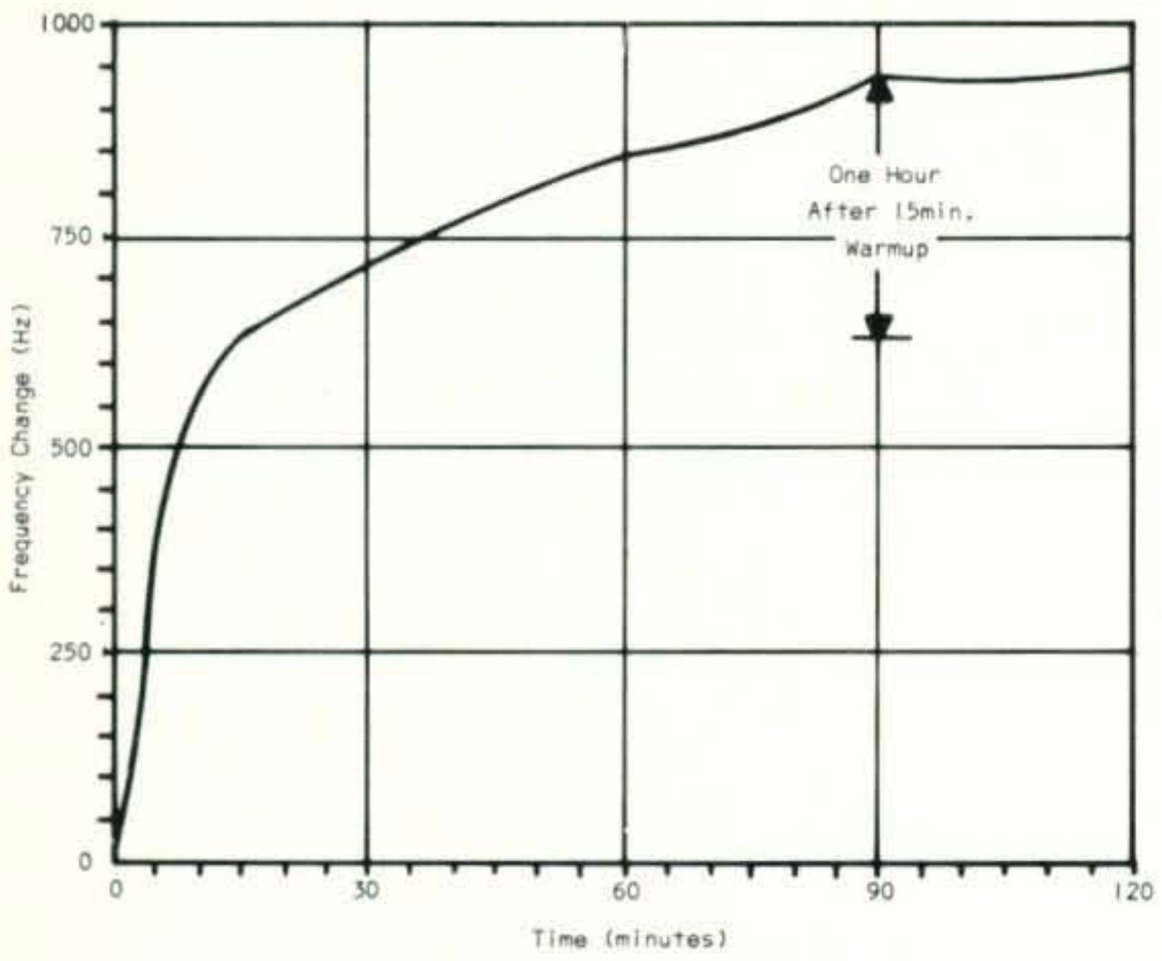


Fig. 3—Warm-up drift characteristics of the FPM-300 transceiver v.f.o. Note that the total drift illustrated is less than 1 kHz. Readings were taken under worst-case conditions: transmitter cycled on ½ hour, off ½ hour.

In our test unit, a small amount of backlash was apparent in the v.f.o. tuning mechanism which was traced to uneven crimping on the Jackson Brothers planetary drive. A replacement tuning mechanism corrected the problem.

The combination of audio compression and a.a.l.c. work very effectively towards preventing PA overdrive and its associated flattopping. Scope observations revealed that the operator must work exceedingly hard to create any observable flattopping. The audio compressor is very effective in limiting audio levels to the transmitter balanced modulator.

Receiver audio was of good communications quality, but as with most of transceivers, the small speaker prevents the listener from taking fullest advantage of what the unit has to offer. A good set of headphones or a larger well-baffled speaker make a significant improvement in home station use. Sufficient audio output was available even for mobile use under fairly noisy conditions.

Keying was clean and click-free, with a medium-soft quality. The vox break-in worked smoothly on c.w. as well as on s.s.b., and was easily adjusted with little interaction.

No provision is made for the addition of a c.w. filter for receiving. There is no noise limiter or noise blanker. No provision is made for a.m. reception, a sign of the times.

The FPM-300 measures 5½"H. × 12¾" W. × 10¾"D. It weighs 25 pounds and is finished in satin finish light grey with a darker grey panel. Panel markings are silk screened in black and white. Knobs are black with polished metal inserts.

The FPM-300 Safari is priced at $599.95 complete, less mobile mounting kit, blower kit and extra 10-meter crystals. It is a product of the Hallicrafters Co., Rolling Meadows, Illinois. —*K2MGA*

Oscar 6 News [*from page 42*]

loss can also be determined for any QTH using the referenced method.

A simpler, but somewhat less accurate method, is to use the following rule of thumb.

Orbits crossing the equator between approximately 30 and 130 degrees west longitude will be within view, or pass over areas of the continental USA travelling in a generally *south-to-north* direction during the evening hours. Acquisition of the satellite will usually occur within 2 to 7 minutes after it crosses the equator.

Orbits that cross the equator between ap-

proximately 210 and 310 degrees west longitude will be within view, or pass over areas of the continental USA travelling in a *north-to-south* direction during the morning hours. Acquisition should take place between approximately 35 to 40 minutes after the satellite has crossed the equator.

For example, the prediction table shows that the initial orbit on June 15 (#3035) will cross the equator at 0118 GMT at 066.9 degrees west longitude. Acquisition of the satellite should take place over the United States between 0120 and 0125 GMT.

Communications should be possible for up to twenty minutes during nearly overhead passes and progressively less for passes to the east and west of a specific QTH. ■

Touch-Tone Pads [*from page 54*]

"not talking," this is the best information I have been able to find.

The Bell System did provide me with other information on the characteristics of the pads, however, that may be of interest. This is given in Table II.

The B+ voltage requirements appear to be rather broad. Most amateurs use a 9-volt transistor radio battery and this appears to be satisfactory, although I believe it is near the high end of the usable range. In a telephone system the battery voltage at the central office is 48 volts and should not be much below this at the subscriber location with the telephone on hook. With the telephone off hook the voltage may be considerably lower than this depending on the cable distance and the size of wire used between you and the central office. In my own location the battery voltage measured 49 volts on hook and 5.4 volts with one instrument off hook. This voltage went up to 6.5 volts when a button was pushed. Apparently the pad does not draw as much current as the c arbon microphone which, as we said earlier, is disconnected when a button is depressed.

CQ readers interested in subscriber signaling for dialing or data transmission and who have access to a good technical library may also be interested in an article by Orr[5] et al. on an integrated circuit *R-C* oscillator for touch-tone dialing. We will not take the space to describe this pad as it does not appear to be similar to the commercially available pads.

[5]Orr, Rickert and Hill, "An Integrated RC Oscillator for Touch-Tone Dialing," *IEEE Transactions On Communications Technology*, Aug. '68 p. 624.

An article by Sessler[6] et al. describes a new touch-tone actuator based on the electret principle which describes things to come in touch-tone pads.

In the above material we have discussed the basic principles of the touch-tone system and have described the basic oscillator circuit. Next month we will describe the frequency adjustment and alignment of the pad and also show a simple, basic circuit for using the pads. ■

[6]Sessler, West and Wallace, Jr., "New Touch Actuator Based On The Foil-Electret Principle," *IEEE Transactions On Communications*, Jan. '73 p. 61.

(To Be Continued)

F.M. [*from page 59*]

After completion the manuscript is forwarded to the Editor of *CQ* for publication. A copy is also sent to the manufacturer or importer for his information only. The manufacturer cannot make any changes to try to "cover-up" or gloss over any problems. Of course if a manufacturer wishes not to be referred to as a CB manufacturer or similar title, that reference can be deleted. Many manufacturers want to be identified by their activities in either the Marine band v.h.f. field or commercial communications. There is just too much of a stigma attached by many amateurs to the CB band and manufacturers. Finally, the unit is returned to the manufacturer. (And you thought I got to keep them!)

Finale'

The technical comparisons of the two meter band plans have taken up much of the space in the last two columns. However, due to the seriousness of standardizing frequencies and input/output relationships the space has been put to good use. Maybe the June column can get back to normal with Q&A, news, and the like. By the way, I had another go at the Post Office when my mail volume dropped sharply for the second time. This time a long chat with the Postmaster was undertaken with positive results. Although no mail is held anywhere, many letters three or four weeks old suddenly arrived as did magazines, circulars, and the like! Can't take full credit, however, for several neighbors also began complaining. Now if we can just get the PO to deliver *CQ* within a reasonable length of time. Pony Express anyone? See you next month.

73, Glen, K9STH/5

Math's Notes [*from page 64*]

12 v.d.c. and 24 v.d.c. There is also a miniature version, the W120X-14, which boasts 100 watts of c.w. power, a 12 v.d.c. coil, 50 ohm impedance matched up to 500 mHz (s.w.r. of 1.25:1) and a cost of less than $10. All prices are for quantities of 1-9.

We would suggest that you check with your local Magnecraft distributor who is also quite probably one of the larger component distributors in your area. You can alternately write to Magnecraft at 5575 North Lynch Avenue, Chicago, Ill. 60630, for more information as well as the name of nearby distributor.

73, Irv, WA2NDM

Awards [*from page 77*]

Nets for c.w. are: Saturdays 14070 at 1400 and 2000 GMT. Sundays 7055 at 1430 GMT and 1800 GMT on 21070. Tuesdays 0030 GMT on 3582 and Wednesdays 7055 at 2300 GMT. Yes, there is much activity on c.w. and many Mobiles on c.w.

S.s.b. County Hunter activity daily starting about 1300 GMT on 14337 and when that band folds look on 3930 or 3943, there is also activity on 7280.

Have listed others who sell special county hunter QSLs, now have note from Ron, K7-LTV, 37 Wyoming Avenue, Billings, Montana that he sells them for $5.50 for 500 and $11.00 per 1000, postage paid.

Am now investigating some more *poor* award Custodians, more data later. Oh yes, in reply to my registered letter of complaint of poor service on the "Admiral of the Great Lakes" Award, I received a letter of apology and explanation of a series of unfortunate events which caused this bad service. Also a promise that service would be good from now on. Data on this award was in *CQ*, November 1971.

Thanks to Lynn Benjamin of Newport, Kentucky for the recent *US callbook* which I will be pleased to forward to a deserving overseas amateur.

Hope that by the time you read this, Don Brickey, W7OK and XYL Milly will be tiptop again. First whiplash from being rammed while stopped at a red light, then a bit of trouble with Dons ticker.

Ran out of space again, write and tell me—How was your month? 73, Ed., W2GT

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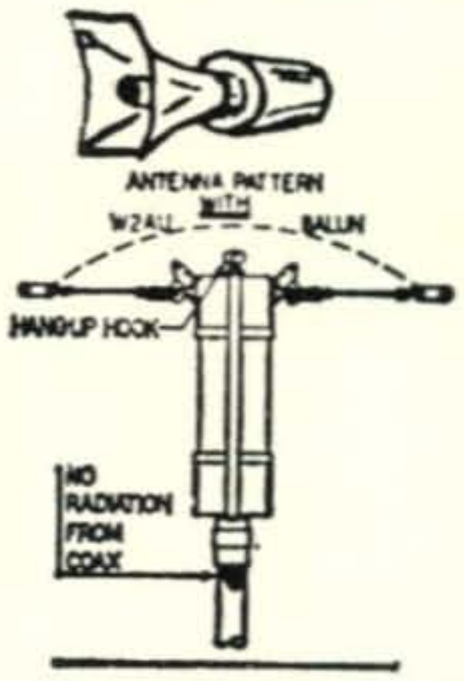

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Ham Clinic [*from page 14*]

Extra I.F. Stage

"Since the input and output taps for the noise blanker on a Swan 250-C are quite handy and if the noise blanker accessory is not used, do you see anything to be gained by plugging in an external i.f. amplifier stage at this point in place of the blanker?"

No, I don't.

NC-300 Sensitivity Lack

"My NC-300 receiver lacks sensitivity which gets progressively worse as I go up in frequency. I have changed tubes and realigned the set but to no avail. What next?"

I paraphrased your question for lack of space, but you did indicate no sensitivity on 10 meters at all. This leads me to believe that you have antenna trouble or even a bad antenna coil (which could have been burned up when r.f. from a transmitter was fed into it).

Transistor Substitution

"Any information on the 2N6084 and 2N5591 transistor substitutions?"

No information on the 2N6084. For the 2N5591 you can use the following: HEPS-3007 and 2N5705.

SR-150 Sideband Problem

"Way back when, I bought an SR-150 Hallicrafters transceiver which has given me excellent service. I operate 10 to 80 meters. During the last couple of weeks I have noticed that the lower sideband does not work very well. When I switch to it the sound *seems* to increase in frequency—very little bass. I have checked out evrything I can, voltages, tubes, etc. Any suggestion?"

Yes. First of all check alignment. Sets do age you know. Then as a last resort check the lower sideband crystal, you may need one.

Diode Markings

"I obtained a large number of diodes of different kinds at surplus the other day. Some of them are marked merely with a band, a spot of color on one end or K. How can I tell which is the cathode and anode?"

Easy. The marked ends either a "+", "K" or cold bands or spots are always the cathode; the unmarked end is the anode.

73, Chuck, W6QLV

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Our circulation department has made an exhaustive study of the costs involved in processing renewal subscriptions. This study indicates that the average short term subscription renewal costs approximately $2.00, taking into account postage, printing of renewal forms, labor, etc.

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Did you know that new supplements to the book, "CQ YL," are now available? They bring the book up to date with ULRL Officers through 1973 and the 6th YLRL Convention, held at Long Beach in May '72. If you have a copy of "CQ YL" and would like to add the new supplements (the pages are "slotted" so they fit directly into the "CY YL" spiral backbone), drop a note with your request to author/publisher, W5RZJ, Louisa Sando, 4417 - 11th St., NW, Albuquerque, NM 87107. Please enclose two 8 cent stamps to cover cost of mailing. The one and only book about YLs in ham radio, "CQ YL," contains 21 chapters, over 600 photographs. Order your autographed copy, or a gift copy. From W5RZJ, $3.00 postpaid.

QSL'S "Brownie," W3CJI, 3111 Lehigh, Allentown, PA 18103. Catalog 25 cents.

QSL, SWL, WPE cards. Samples 25 cents. Log books, file cards, decals. Malgo Press, Box 375, Toledo, OH 43601.

CREATIVE QSL cards. Personal attention. Imaginative new designs. Send 25c. Receive catalog. samples and refund coupon. Wilkins Printing, Box 787-I, Atascadero, CA 93422.

QSLs. Second to none. Same day service. Samples 25 cents. Ray, K7HLR, Box 331, Clearfield, Utah 84015.

WANTED: Pre-war National NC101X. Pre-war Hammarlund Comet Pro. Pre-war Collins transmitter. Write Bill Orr, W6SAI, care of EIMAC, 301 Industrial Way, San Carlos, CA 94070.

TRADE: 8 MM Movie outfit, mint; for Mint SB-200; SB220; 30L1 Linear. Replies Answered. WAØGYX, George, 1422 So. Pearl, Independence, MO 64055.

NEWS: Free sample copy of "Worldradio," Amateur Radio's Newspaper. 2509-B Donner Way, Sacramento, CA 95818.

HAMFEST: June 3rd. Save this date for the annual Starved Rock Radio Club Hamfest at Ottawa, IL Write George E. Keith, W9QLZ/W9MKS, RFD 1, Box 171, Oglesby, IL 61348, for details, or see May QST Hamfest Calendar.

Rubber address stamps. Free catalog. 45 type styles. Jackson's, Box 443F, Franklin Park, IL 60131.

FOR SALE: Lafayette PF 300 VHF/UHF Receiver. Tunable, crystal controled. Almost new. $135. John Wallace, 735 W. 165th Place, Gardena, CA 90247.

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FOR SALE: Heath Marauder, Viking Ranger II & 6N2, Hammarlund SP600JX17, Central Electronics 200V, Elmac AF67 & 68 with supplies, Hycon 617T scope, Teletype 28KSR console, Ameco TX-62, Gonset Comm III 6 mtr linear, Gonset Comm IV 6 mtr. All gear mint, W6OJF, 9337 Gotham St., Downey, CA 90241 Ph 213-869-3292.

HELP! My kingdom for a good used-condition "Colordaptor!" Besides asking price (less $100?), willing (sob!) to part with two prized like-new condition WD-11 tubes, to boot. Darcy Brownrigg, Chelsea, Quebec, Canada.

Estate of K4JIB. Galaxy V MK II with Microphone and phone patch $275. Matching linear Amplifier $275. c/o WB4BAP, 250 The Highlands, Tuscaloosa AL 35401.

D & R Electronics specials for this month. R-390A-Receivers checked out very nice. $595 supply limited. R-390-checked out nice $450. R-391-checked out nice $450. R-392-vehicular version-390 checked out@$225. 51J4-receiver 3 filters mine $475. We offer a complete repair service on all -388-389-390-390A-391-392 all S- line receivers. All receivers lab checked for accuracy before being returned after repair. We stock and sell all parts & subassembles -panels-main frmaes for the above receivers. We will send price list upon request. D & R Electronics, R.D. No. 1. Box 56, Milton, PA 17847.

COMPLETE STATION: KX-500 Exciter provides SSB AM CW FM FSK modes, Eldico SSB-1000F Linear with self contained modulation monitor, SX 111. HQ-180AC, Waters 384 Dummy Load, Heath SWR Bridge, Heath Hybrid Phone Patch, 5 position B & W Coaxial switch, Turner 454C Microphone, 1 KW Johnson and 100W Drake low-pass filters, 3 coax relays with DPDT Aux contacts, Telrex TC-99D Tri-band beam, E-Z Way tower with motorized hoist and C-D Ham-M rotor. Take all for $1750 or make offer for item you need. W2NLU, 24 Julliard Dr., Plainview, NY 11803. Contact for detailed description or to arrange viewing. 516-681-2255.

Electronics Equipment; Test Equipment; Panel Meters; Connectors; Capacitors; Tubes; Transistors; etc. Inquirier Invited. F.F. Williams, P.O. Box 7057 Norfolk, VA 23509.

SIDEWALK SALE-Every first Saturday-now in its fourth year. Turn your surplus electronics into cash at the Southwest's leading ham store-it's FREE! Electronics Center, Inc., Dallas, TX 75204.

WANTED: Hallicrafters Model WR-3000 receiver. Fred Haines, 132 Rural Ave., Lewisburg, PA 17837

MODERNIZE FOR PEANUTS! Frame and display QSL's with 20 pocket plastic holders. Two for $1, 7 for $3. Prepaid, guaranteed, universally used and approved. Order now. TEPABCO, Box 198Q, Gallatin, TN 37066.

Thunderbolt Linear with two 4-400 and three PL-175A tubes-$200.00; Johnson KW Matchbox with coupler-$90.00; Central Electronics 200V-$325.00; Central ElectronicsMM 2-$40.00; 20M 5 el Telrex Model 20M536-$200.00; Telrex Rotator Model TS 435-RIS-$150.00; 70 ft. 3 post Aermotor Tower-$100.00. W9UZC, Southwest Acres, RR 2, Harrisburg, IL 62946 (618) 252-7064.

WANT: 1930 vintage xmitter coil forms, variable and mica capacitors, sockets, etc. Building W6SAI 1934 rig. CW Nov. '71, Cohen, OLAA, Det. No. 3 Box 1512, APO, S.F., 96525.

FOR SALE: 5 band Heath HW101 w/PS and SB 600 new, complete, excellent, for cash or will take Heath Freq. Counter. Art Streeter, 1619 Holiday Pl., Bossier City, LA 71010.

SAFETY BELTS Tower Climbing, Nylong (new), Lanyard/snap (used), $23.50. Link, Rt. 111, Monroe, CT 06468.

WE would like to correspond with many radio amateur operators in the United States. The purpose of our club is to make friends through radio and by mail. Please give us letters to the following address. THE GREEN CLUB, Z.C.—591 I-25, Shinonome, Sakai, Osaka, Japan. Club Manager, Masuo Inoue, JH3BCZ.

HP325B Distort. Anal.; Heath 20-mtr single bander w/ DC supply; Eico 753 w/AC supply; all with books, exc. cndx, $120, $119, $159 respectively. incl ship 48 states. WB2LRS/6, 5025 Thacher Rd., Ojai, CA 93023.

SELL: A superb rcvr, 75A-4 (SN 5325), mint, VCZ mods, 3 filters, spkr, must be seen, $475; 32S-1 (SN 363), mint with 516F-2 (SN 21753), $375, Henry 2KD-3 (SN E147J8), mint with pwr supply (SN B1234J8) and 2 new finned 3-500 Zs, $575 also Hy-Gain 400 Rotor and Waters Dummy Load-Wattmeter 374; prefer pick-up sale; Ed Schmults, W2VNA, 9 Turner Dr., Chappaqua, NY 10514. (914) 666-2087.

KWM-2, 516F-2, excellent condition. Will ship. $550. R. Doege, 3421 N. Paiute, Phoenix 85251.

HAMFEST - Waisash County ARC Fifth Annual Hamfest, Sunday, May 20, rain or shine. Admission is still only $1. Flea market, food, tech talks, and much more. For information, write Bob Mitting, 663 Spring, Wabash, IN 46992.

WANTED: A copy of the March 1972 issue of CQ to complete my collection. Please contact Anders Rosengren, Sexmansvagen 3, S-230 30 OXIE, Sweden. Thank you.

CANADIANS Free 120 page Electronics Catalog. ETCO, 464A McGill, Montreal.

WANT OLD RADIO TRANSCRIPTION DISCS. Any size or speed. Send full details to W7FIZ, Larry, 7554 132nd Ave. N.E., Kirkland, Wash. 98033.

SELL: Plate transformers 3600-0-3600 with 110-220 primary. 1 amp $25, 1.7 amp $40. WØAIH, Paul Bittner, 814 4th St. S, Virginia, Minn 55792.

SELL: Hammarlund HQ170C, 160 thru 6m, $125, xcvr Eico 753 $90, Mini Products beam $60, others All in good cond. WA6GCJ, 5408 Simpson Ave., N. Hollywood, CA 91607.

Robot SSTV monitor, camera, asses. "Fast Scan" DuMont, $200 below present cost. SASE. W4API, Box 4095, Arlington, VA 22204.

Novices: For WAS or QSL send available time, freq to WN4WUY, Frank Griffin, 5217 Germanton Rd., Winston-Salem, NC 27105.

RTTY TU CV-31D, dual div. with 115v 60 cy p.s., Asking $75 or trade for CV-89 or ? W.E. Waldschmidt, Box 163, Cannelton, Ind. 47520.

WANTED: Drake RV3 in like new cond. State price and serial no. or age. WA9FUV, 1507 N. Villa Dr., Evansville, Ind. 47711.

Heath HW-32. Mint $75. Pete Briggs, 914-939-5159.

Heath CW-SSB VFO combo. HX20 xmtr-HR20 rcvr HP20 AC. Mint on CW. Carrier Null trouble on SSB. you fix. Deal $125. K3HTO (212) 231-3635.

FOR SALE: Telegraph keys WWII, new mint $5 PPD. Goodman, 5826 S. Western Ave., Chicago, IL 60636.

WANT: Tower capable of supporting 30 sq. ft. of antenna. Prefer Chicago area. K9KLR, RR2, Box 70E, Hebron, IN 46341.

Oldies: Have over 1000 radio tubes in original boxes. Vintage 30's SASE for list. Carol Kimber, K7WUR, 590 Bonnie Brae St., Lander, Wyo 82520

Garrard SL-65B turntable $35. Sansui 200 receiver amplifier $80. WN4UCC, No. 96 Hallmark Estates, Athens, GA 30601.

FOR SALE: Like new deluxe Johnson portable field Pack (250-0825-003) $100. Ross Hansen, WN7TZU, Preston, Ind. 83263.

WANTED: QST, CQ, 73 binders & Johnson or equiv. matchbox. Tom Dornback, K9MKX, 2515 College Rd., Downers Grove, IL 60515.

WANTED: Dust cover and rcvr xtals for SP-600. State freq and price. W4BFQ, 65 Georgia Ave., Merritt Island, FL 32952.

DIODES: 3 amp @ 1000 piv. only 3 for $1. Marty WB6NWW, Box 15015, Long Beach, CA 90815.

FOR SALE: Heath EC-1 analog computer. New. $175. WA8CKT, John Wagner, 950 Sue Dr., Caro, MI 48723.

WANTED: Antique radio tubes with brass basses, & Taylor T-300, T-100. W9LGH, 610 Monroe Ave., River Forest, IL 60305.

FOR SALE: Collins 75A4 Mechanical filters 1500 and 6000 cycles $41. PPD bank or P.O. money order only! R. A. Berk, WØNXF, 5218 Prescott, Lincoln, NB 68506.

SWAP: Three old radios for one good rcvr, must have SSB and AM. Will send picture. Robert Jewell R.F.D. No. 3, Skowhegan, Maine 04976.

Rochester, NY is the place to go for the largest Hamfest, VHF meet and flea market in the northeast, May 12th. See Announcements column for details.

SWAP: Two ea: Blonder-Tongue TV camera, ITT monitor chassis, cam. control. Fully transistorized, for Swan Cygnet, 270B in work. cond. Write: Oberstein, 55 Knolls Crescent, Bronx, NY 10463.

SELL: HQ110, clock, calibrator, spkr, man. State price. R. Oras, W9ZEW, 3636 S. 59th Ave., Cicero, IL 60650.

WANTED: TV doy/bar generator and 2 m fm equipment. K5BCQ, 5114 Geneva, Friendswood, TX 77546.

WANTED: I need a W.R.L. transceiver, cash. Ernie Palmer, K6YVB, Box 1005, Avalon, CA 90704.

FOR SALE: Codax model 361 elect. keyer $35. DX-60 xmtr & NVX-1 40 & 80 meter crystal VFO $90. J. Pluth, 6092 Chase St., Downers Grove, IL

WANTED: 30 Hams for communications network in Baja, Mexico. 6-9 June or 6-10 Nov '73. Receive XE2 call. K6ICS/XE2ICS, 9418 Florence Ave., Downey, CA 90240.

Too many duplicates of CQ & QST from 1947 to 1970. Full years $1.20 plus postage & insurance. 1st come, 1st served. Erv Rasmussen, W6YPM, 164 Lowell St., Redwood City, CA 94062.

WANTED: Magnum Six for Collins. Robot SSTV camera and lens. Mike Ludkiewicz, 143 Richmond Rd, Ludlow, MA 01056.

Teletype. Model 26 in. perfect shape. Table and all hand books. $50 check. WA8VFK, 314 S. Western Ave., Springfield, OH 45506.

Ham heaven QTH- Super Deluxe home on 3 acres, 120 foot tower & 3 85 foot poles installed, many extras, near Chicago. K9CSM, 312-563-8022.

NEED: Coils for R388/51J3 rf 3.5-7.5 mc. Collins No. 5043060001 & mixer coil .5-1.5 mc. K9BSL., 122 Country Club Dr., La Porte, IN 46350.

R/C system. 10 chan. reeds, nicads, 5 servos, complete, operating, exc. cond. $55. WB2FKA, 28 Bridlemere Ave., Interlake, NJ 07712.

WANTED: E.F. Johnson "Signal Sentry," Mod. 250-25 CW monitor. State cond. price. R. W. Johnston, K3CVL/6, P.O. Box 1589, Santa Monica, CA

SELL: SBE-33 CW/SSB xcvr $140. Drake RV-5 $70 Jones 10-100-1k watt mtr .5-225 mHz $45. K3-NXU, Baltimore, MD 301-661-5588.

SWAP: 1 "Globster 5" bd port'ble SW radio in exc. cond. for any of the foll: Hallies S-120A, S-125, or any sim. rcvr in gd condx. S.L. Ballinger, 11 Lown Ct., Pough, NY 12603.

SELL: 120 Sams folders from 223 to 1084 for $60 H-P 525A plug-in $28, Robert Ireland, Pleasant Valley, NY 12569.

Heath counter, Motorola 43GGV, 2kw amplifier, other goodies, WA5CMC, 2309 Bullington, Wichita Falls, TX 76301.

Bargains: New Westinghouse 0-300 volt AC panel meters $3.50 PPD. Pair unused 4X150A tubes with pair Eimac sockets. $20. Samkofsky, 4803 Brenda Dr., Orlando, FL 32806.

Collins 51J4, w/3 mech filters. 1-R391 & 1-R390 sale or trade, interested in Collins 62S1. 614-267-4923, K8MJD, 4672 Indianola Ave., Cols, OH.

Weston 3" square panel meter. Model 301. 75-0-75ma. $2.50 plus postage. Ken Maas, Burlington, Wis. 53105.

Linear Buildings Send SASE for Lo-Price list of Hi-Power parts. Mace, 8600 Skyline Dr., Hollywood CA 90046.

Need general license course. Window or apt. Antenna. Kennedy, 791 Greenwich St., NYC 10014.

HT9 100W xmtr $40. 10BP4A pix tube $10. 35mm Leica camera $60. Revere Turret movie camera 8 mm $60. W. Rabe 349 Eggleston, Elmhurst, IL

WANTED: DC pwr sup for Galaxy GT500. K5ENL Ed Block, Rt. 4, Box 127, Grandview, TX 76050.

SX140 good condx. Many xtras $45 or best. WN6-PXM, 5917 Stoneview, Culver City, CA 90230.

Prop pitch motors and selsyns available. Pete Butler 3 Elizabeth Dr., Merrimack, NH 03054.

SELL: R390A/URR, mint. cond. with operator and service manuals, $450. Roger Motta, 111 Kentucky Ave., Warwick, RI 02888.

WANT TO BUY: Rotory spark gap, spark transformers, oscillation transformers, and early wireless equipment. T. Soukup, 161 Bob Hill Rd., Ridgefield, CT 06877.

DXers! My DX QSL return is 92% (instead the usual 20% - 30%) SASE tells you how. K3CHP, Joe Mikuckis, 6913 Furman Pkwy., Riverdale, MD 20840.

SELL: Motorola 80D with Sensicon rcvr, with all acces. 12V. $50 or trade for? Jay Mineck, WB6-MWL, 4537 Harvard Ave., Montclair, CA 91763.

Swan 260 $250. Eico 324 $30, Johnson Viking 6N-2 and Ameco PVV pre-amp $50. C. Dahleen, WB9-EQX, 3735 Oakwood Manor Dr., Hubertus, WI 53033. 414-628-3271.

Neighbor problems? T.V.I.? P.R. help? Send large SAE & 2 stamps for copies of useful articles. WA1-GFJ, Gabe, 17 Whiteney St., East Hartford, Ct

2 Freq GE Voice Commander III w/new nicads, chgr, carrying case. 34/94T, 94R $150. W7CTX, J. Bishop, 1914 Penninger, Boise, Ida. 83705.

SELL: Collins KWM-1 with a.c. sup. $225 plus shipping. George Kimeldorf, WB4ORH, 3007 Brandemere Dr., Tallahassee, FL 32303. 904-385-3281.

SELL: VCS300 $25, Rustrak millivolt recorder $25, and others. Trammell, 1507 White Oak Ct., Martinsville, VA 24112.

SWAP: DeJur Movie Camera, Argus 35mm Camera Law books, What Have you Got? D. Freeman, P.O. Box 133, Newburyport, MA 01950 (617) 465-0722

SALE: HP-13 DC sup. $35, Conar Scope 250 with probes $80, Conar Color TV 600 $150, Fr. Miller, 210 Spurce, Clarkson, NB 68629.

Anyone having information concerning three tube rel receiver vintage thirties made by Radio Engineering Laboratories, New York City, contact W9-ZEN, 124 Glen, Oglesby, IL 61348.

Wednesday Nights 7:30 p.m. E.S.T. (0030z Thur) County Hunters' Net 7055 kHz.

FOR SALE: Filament transformers P-4089 @ $5 ppd. Goodman, 5826 S. Western, Chicago, IL

WANTED: 8 Henry 160 ma filter choke. 1216 mhz transceiver. WBØEIB, Wallace Domier, Buxton, No. Dak. 58218.

WANTED: Interphone for W. E. Type SCR 59 airplane receiver, cabinets for a Radiola IV, and others Consider junder chassis, need not be working. Joe Horvath, W6GPB, 522-Third St., San Rafael, CA

Lampkin 105B, clean with man. $99. Collins mech filter F455FA08, 800c for 75S-3B, $30. PPD. K5-STL, Box 227, Cedar Crest, NM 87008.

SWAP OR CASH OFFER: CV-591A/URR SSB rec. conv. units com. with man. & unchecked. Clem K8HWW, 33727 Brownlea, Sterling Heights, MI

Old battery radios, wireless receivers & transmitters as well as book, mags. wanted. Have mags. to trade or pay cash. Erv Rasmussen, W6YPM, 164 Lowell St., Redwood City, CA 94062.

SWAN TV-2, 50 mHz IF $120. Swan 250 with 117 AC PS $185. WB6NKM, 2534 El Tonas Way, Carmichael, CA 95608.

811-A 200 watt linear amp. in 1068 Radio Amateurs Handbook, all parts except chassis for 80-40-20. Sale or trade. WBØADV, 3037 Bunker Lake N.E Anoka, MN 55303.

FOR SALE: GT550, Cal 25, 5C550 $375, RF550 $50 PT preamp $35, F-3 filter $20. W8IIT, 281 Jenny Lane, Dayton, OH 45459.

Teletype, FM, Ham, Test, Photo gear. Free list, low prices, T. Perera, K2DCY, 410 Riverside Dr., NYC 10025.

WANTED: FT-243 type crystal holders. Thousands are needed. Write & give price in first letter. W6DOR 2921 Loyola Dr., Davis, CA 95616.

WANTED: 40/80M Cliff Dweller antenna rod. W7-YBX, 5632 47th SW, Seattle, WA 98136.

VHF converter, Midland deluxe for car, never out of Box, warranty $25 PPD. WA4ZYU, 1904 114 Ave., Tampa, FL 33612.

CQ Birthday AM Radio Klub, Month/Christmas winners. Send call, QTH B/D Favorite freq. SASE Mem. Yr $2. BARK, K4CLA, 5/111A Oak, Lexington, SC 29072.

HELP! SASE brings info about new, sure way to get almost 100% DX QSL return. It works! K3CHP, J. Mikuckis, 6913 Furman Pkwy, Riverdale, MD 20840.

Receiver National NC-303, Xmitter Johnson Invader, make fair offer each. W3GEB, 4640 York Rd., Baltimore, MD 21212.

WANTED: Old battery operated radios of the early 1920's. Need not be in working condition. State model & price. McKenzie, 1200 W. Euclid, Indianola, IA 50125.

WANTED: W8FYO key, Ameco model PLF preamp, Millen solid state dipper, Q-meter. John Becker, 201 E. Marion, Prospect Heights, IL 60070.

QRPP Handbook-authoritative, definitive first three years of the Milliwatt: National Journal of QRPp. Vol I $4, II $3.50, III $3.50, all three $10. Subscriptions $3.40. Ade Weiss, K8EEG, 213 Fores, Vermillion, SD 57069.

SELL: Drake 2-C new $180. 2-CQ spkr/q-Mult & notch fil $30, 2AC 100KC cal. $15, others. W9CO, 604, Wyatt, Lincoln, IL 62656.

WANTED: Dust cover & rcvr. xtals for SP600. State freqs & price. W4BFQ, 65 Georgia Ave., Merrit Island, FL 32952.

SAROC National Convention, Flamingo Hotel Convention Center, Las Vegas, NV January 3-6, 1974. QSL to SAROC, Box 73, Boulder City, NV 89005 for details.

SALE: Heath, SB10 w/ cables, manual, good $50. Hewlett Packard, 200AB Audio Osc. like new $100 KØCXL, 715 San Marco, Rapid City, SD 57701.

Johnson Ranger 160-10m. $30. Needs pwr xfmr. Pick up. John Tate, 9 Diane Dr., Malvern, PA 19355

FOR SALE: Gem Quad, 2 element, 10, 15, 20 meters, $65 plus shipping. 301-881-7571, 11704 Ibsen Dr., Rockville, MD 20852.

WANTED: Hygain beam mod. DB-10-15A in excel. cond. Also need 2 Hygain mod. BN-86 baluns. WA9HRN, 5 Whitehall St., Buffalo Grove, IL 60090

FOR SALE, TRADE: Scope Mod. 400 Sylvania TV 6" screen excel. cond. Ben, W4BBO, 4243 Loveless Dr., Ellenwood, GA 30049.

FL-8A 3-way switchable audio filters, 2 each, both $20. Anderson, 639 No. Wahsatch, Colo. Springs, Co. 80903.

FM Repeater WB4QGE is now 146.04/146.64. Winston Salem, NC 27103.

SALE: Heath HP-13 DC supply $35, Conar 5" scope No. 250 with probes $80. Conar Color TV No. 600 $150. F. Miller, 111 Clarkson, NB 68629.

SELL: Drake transceiver, TR3 with AC3 power supply, Heathkit HM-102 wattmeter/SWR bridge. Best offer. Zanoni, RFD 1, Box A-9, Saunderstown RI 02874.

FOR SALE: SB303-HA10 KW-75A3-HT37-SX101 S37 Swan 350 w/ps Model 19 TT-ART13-MAR xcvr-TRC8 All FB. W7KSG, 1876 E. 2990 So., SLC UT 84106.

BC-342, 1.5--18 mHz rcvr with matching LS-3 spkr and manual. AC pwr. $70. Silbert, White Sulphur Springs, NY 12787.

Collins 455 kHz mech filters. BW2-16 kHz, J and K cases. Also USB/LSB sets. K6FV, 1134 Royal Ann Dr., Sunnyvale, CA 94087.

SB102 prof wired Used 20 hours. Like new $300 less p/s Call 214-231-6667 or R. Cranford, 14018 Brook Green No. 1080, Dallas, TX 75240.

SELL: Heath SB200 Linear, 1 year old and in per. cond. Built by 1st phoen eng. $185 including shipping. W. V. Fair, 3949 Menlo Dr., Doraville, GA.

SELL: Collins 32S-3 mint $590. Collins 75S-1 a beauty $285. LM309 K-5 VOH regulator $.95. New K5ZDW, 2421 Utica Dr., Dallas, TX 75227.

SELL: SP-600-J11, $250. SB-620 $75. Navy ARB, 190-9050 kHz, $15. K4MSG, Box 2606, Avon, NC 27915.

Drake 2B rcvr, 2BQ qmult-spkr, 2AC xtal calibrator 2 extra crystals, original owner with manual. $185. WB2FJX, Gerry, 212-641-4573. 158-14 85st, Howard Beach, NY 11414.

Linears-PR813 1400 WPEP, 3-6LF6 800 WPEP. Both 80-10. SASE for pix and details. M. Caldwell, 1068 Windsor, Morgantown, W.Va 26505.

SELL: Heathkit SB-300, SB401, SB600 with mike Pick up prefer. $400. Call or write K2TKE/W2AAF 516-751-8236.

WANTED: 4CX300A and SK-760 socket. Swap 811A's, 7094 etc or cash. K4EPI, R. Guard, 750 Lily Flagg Rd., Huntsville, Ala. 35802.

FOR SALE: Heath RF signal Gen. IG102. New $25 FOB. Want phone patch. W3MSN, 5108 Boulder Dr., Oxon Hill, MD 20021.

SELL: Eico 753 (triband) xcvr with s/s VFO & a/c p/s. K5ESV, 124 Peyton Pl., Arlington, TX (817) 275-1763.

Clegg Interceptor 6 and 2 meter RX. $150 or best offer or swap for SBE xcvr. K9ZAT, 913 S. Carpenter, Chicago, IL 60607.

SELL: HW22 with Hb ac supply, manual WA5BFN 1003 Electra St., Longview, TX 75601.

FOR SALE: Central electronics 100-V $250. All bands, all modes, no tuning required. excel. cond. K8EKG, 1020 4th SW, Massillon, OH 44646.

SELL: SB401 without xtal pack $200. 2C, 2AC, 2-CQ, spkr $210. W8CUT, 1776 Walnut St., Coshocton, OH 43812.

Hallicrafters SB-100 dble-conv. rec. 500 Hz select. Notch fltr, cal., book. Exc. cond. Write. Was $325. Sell for $150. J. Herro, K9YRA, 60 E 32 St., Apt. 704, Chicago, IL 60616.

Relays, 12 vdc Dunco 415 XBX, 15A-dpdt, new, $2 ppds. K3MPJ, 1261 Brinton Rd., Pittsburgh, PA 15221.

Have a Mobile Kilowatt: SBE-33 trans. with new P & H compact Spitfire linear. 2 mobile mounts, 2 inverters, cabling, manuals $399. W7BIF, 107 Wyoming, Boulder City, NV 89005.

Heath SB-10/manual, mint cond. $55 plus shipping K4VCP, 2537 Cannaday Rd., N.E., Roanoke, VA 24012.

WANTED: Bird No. 43 thruline and slugs. Jim Gysan, 53 Lothrop St., Beverly, MA 01915.

Call letter license plates wanted for collection. Can you help? I'll pay postage. Art Phillips, WA7NXL, 3401 N. Columbus Apt. 5-O, Tucson, AZ 85712.

Sig Gen TS-452 5-100 mc $45, Rec 175-260 mc $25, Gonset G-150 on 121.8 mc $50, Panadapter SA3 $75. W. Davis, K6KZT, 4434 Josie Ave., Lakewood, CA 90713.

FOR SALE: TA33 Triband beam $50. No shipping. John Kersten, WØNY, 717 Crest Ave., Ft. Dodge, Iowa 50501.

WANTED: Heath IT-17 Tube check, Heath motor speed control, and line voltage monitor, also need 400 ft. open ladder line. T. Coddington, WB6AWC, 7825 Scotts Valley Rd., Lakeport, CA 95453.

WANTED: Msc Atwater-Kent breadboard parts, type F cond., type TA units, pot., tube sockets, ,ge

WANTED: Msc Atwater-Kent breadboard parts, others. Joe WBGPB, 522-Third St., San Rafael, CA

28ASR and KSR cab. RO base and LESU Int. gear and reperf ribbon drive for sale or trade. Need page printer. D. C. Harrington, 1620 Gardena Ave., Fridley, Minn. 55432.

SAROC National Convention Air Tour via scheduled air carriers Jan. 3-6, 1974. Flamingo Hotel, QSL to SAROC, Box 73, Boulder City, NV 89005 for details.

WANTED: 75A4 with .5 1.5 2.1 mech. filters, any cond. if price is right. 75A2, 75A3, or 75SI if cheap. Don Winfield, K5DUT, 6080 Anahuac, Ft. Worth, TX 76114.

SELL: HW-16 $75, Conar 400 $20, TR-106 $65. All in gud condx. J.G. Swaney, 10534 California, Aurora, OH 44202.

Need Tech man. for freq. meter FR149/USM159. 125kc to 1000mc. Can you help? W5RNE, 24771 Kay Ave., Hayward, CA 94545.

FOR SALE: Realistic DX-120 in excel. cond. you ship $50. Eddie Danford, 109 Colby Rd., Oak Ridge, TN 37830.

SELL: Hallicrafters SR-160 with AC and DC sup. Mint. $250. Jim Fleming, 6N705 Harvey, Medinah, IL 60157.

NEW: FT101 $460, FV101 $65, SP101P $45, FT-2-FB $166, others. All plus post/ins. K1CJV, 51 Midland Ave., Stamford, CT 06906.

NCX-500 a.C. supply, new manual in carton $285. Xceivers-Knight TR-108 $100. Knight TR-106 $100 W2VEZ, 230 Schiller St., Buffalo, NY 14206.

FOR SALE: Laff. HA-35A, w/12V pow. 6 mts $50 EMC 208 tube tstr $15, Century 103 crt tstr $15. Heath TO-1, test osc. $20. All FOB, WB2YYX.

SELL: Galaxy GT-550 w/ac p.s., VOX, xtal calibrator and mike $400. WAØGQG, 3262 So. 130 Av. Omaha, NB 68144.

FOR SALE: 110 V radar, 50,000 W, type CRP 52ABE-1, type CRP55AFH. $200 or best offer. Ross Hansen, WN7TZU, Preston, Id 83263.

Would like to start in RTTY. Do you have eqpt to sell, advice to give? B. Lentz, WA1DND, 53 Holden Attleboro, MA 02703.

WANT: 2-813 & Isolantite coil form 2-3D. 5 or 6" long or Natl. XR10A. Reasonable. K4GDG, R 4, Box 165, Crossville, TN 38555.

FOR SALE: QST mags 1915-1929. Will break collection in complete years. Also have Canon FL85-300mm telefoto zoom lens. Paul Kluwe, Box 28, Cedar Lake, MI 48812.

Eico No. 460 Scope, Perfect CRT and operating cond. With 3 probes and manual. PPD in the 48 for only $90. H. Marhoff, P.O. 569, Largo, FL 33540.

WANTED: Swan or linear systems mobile DC sup. K6SHA, 411 Mission Dr., Camarillo, CA 93010.

SELL: Radio tel & tel-Duncan & Drew. Elements of radio. Marcus pract. radio comm. Nelson & Hornung. $3.50 ea. FOB. Douglas, 2254 Pepper Dr., Concord, CA 94520.

HELP! Urgently need man. for HQ-110A. Will pay post. both ways with hearty thanks for the use of one long enough to have it dup. WB2NDS, Bob, Drawer G, Pittsford, NY 14534.

Send news clippings of good activities of hams. We need P.R. send to G. Gargiulo, WA1GFJ, 17 Whitney St., E. Hartford, CT 06118.

Diodes: IN4004 400PIV 1A @ 12 cents. IN4725 1000PIV 3 amp @ 40 cents ea. Marty WB6NWW, 5349 Abbeyfield St., Long Beach, CA 90815.

Need 4D32 for Collins 32V2 or a mod. to any other final(s) except 829B. Will pay. G. Ferrin, WA7RYS Box 59, Winkelman, AZ 85292.

Drake SC-2, SC-6, CC-1, CPS, Gonset 2m 900B and 6m 910B SSB xcvrs. Laf HA-750 for sale. WA1-NGR, P.O. 76, Chester, CT 06412.

Giant 6 page list of ham gear, meters, components, transformers, nicads, test equip., etc. For sale/swap Send stamp. WA2JTN, 300 Lawrence Av., Oakhurst NJ 07755.

FOR SALE: Swan 500C, 117XC, VS2, very clean. Lot price $425. Bill, WØMS, 7190 S. Franklin Way Littleton, Colo. 80122. 303-798-6255.

Oscilloscope, Knight KG635, DC to 5 mHz, excel cond. $80. Electronics sw. included. W9TVV, 2028 Oriole Trail, Michigan City, Ind.

FOR SALE: Two-er $35, Ameco R5-A rcvr $65, Converted BC-229 less pwr. sup. $20. PPD in UPS area. WBØCTE, 2338 E. South Ave. No. St. Paul, Minn. 55109.

SELL: Com. Business band radio system. Solid state am. $600 Firm, Consider Trades. Trammell, 1507 White Oak Ct., Martinsville, VA 24112.

FREE: Research paper on Amateur Radio, K6ICS, Dr. Michael K. Gauthier, 9418 Florence Ave., Downey, CA 90240.

WANTED: Hammarlund APC-140-B, APC-50-B, VAR cond. unused. Fred Haines, 132 Rural Ave., Lewisburg, PA 17837.

Drake 6 & 2 m. preamp, conv., Vanguard 6 & 2 m. preamp & conv. Drake T4XB xmit. $350. SX71 $80 SASE list. Colella, WA2HQD, 105 18 131 St. Richmond Hill, NY.

Lampkin 105B with PPM meter $185. Hickok 288 AX Universal Sig. Gen. $210 or trade for SB-102. K8OFQ, Rt. 7, Box 241, Fairmont, WV 26554.

Cleaning out shack: Tubes 53 cents up, bag of electronic com. $1. PPD all 1001 items. SASE list. WA5USU, A.R. Bergeron, 616 N. Eleventh St., Carlsbad, NM 88220.

Invader 200 $150. Frank WA2KWB, 26 Valley View Rd., Yardville, NJ 08620. (609) 585-4188.

WANTED: For museum antique tubes with brass or ceramic bases, and Eimac, Taylor. W9LGH, 610 Monroe Ave., River Forest, IL 60305.

RTTY-2 Model 15 printers with keyboards, 1 typing reperf, 1 tape transmitter, homebrew converter $150 or trade for SB200 you pick up. Blann, 106 S. Knox, Dermott, Ark.

WANTED: Stancor modulation transformer A3888 W7JI, 235 E. 15 St., Tempe, AZ 85281.

An easy way to learn the code. Details explained from novice to extra class $3.74. K4EUW, P.O. Box 312, Milan, TN 38358.

FOR SALE: Mint KWM2 $625, 312B5 round emblem $425, Long 312B5 $350, Drake DC 3 $85. WA3IFQ, 1138 Boxwood Rd., Jenkintown, PA.

SB300, SB400, 500 watt linear (pair 811's) all grid, all for $300 or trade on 75A4, 32V3 any condition. W. Small, 27828 E. 15th St., Hayward, CA 94544.

60Hz power xfrm 12.6 vac 35 amp $9.95. 10 Henry chokes at .300 amp. $.69 ea. or $5 dozen and postage. J. Schrenk, 2707 McDivitt Rd., Madison, WI 53713.

Collins all band Antenna excellent for 80-40 meter DX work 237-W1X worth $7200 will take $350 or trade. WAØEMS, Box 11, Liberty, MO 64068.

Join the Radio QSL club of Greater New York. Details: Mitchell Rakoff, 64-33 98th St., Rego Park New York 11374.

Worked South America Certificate: Work all 13 countries. Send list and $1. HC1TH, 4805 Willowbend Blvd., Houston, TX 77035.

RBL $30, RBS $30, RAK $30, BC-639 $50, DZ $25, SX24 $35, SX28 $75, SRR-11A $100, S36 $125 others. Pickup only. SASE W6CRG, 11007 Explorer Rd., La Mesa, CA 92041.

FOR SALE: WRL duo 300 AC/DC pwr sup. $45. BC221 freq. meter w/ AC sup. and man. $25. J.A. Heise, WA4VQD, 243 Fairway Dr., Fairborn, OH

FOR SALE: 30S-1, new spare 4CX1000A, $1050. KWM2 No. 36460, 516F2 (both round emblems) $1000 and more. Craig, 29 Sherburne Ave, Portsmouth, NH 03801.

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RCA-6JB6 tubes new never used $2.50 ea. or 3 for $7. PPD. Two 100 watt L.P. filters $4 ea. PPD.P. Feely, 15 Locust Hill, Yonkers, NY 10701.

FOR SALE: Antique Morris coil winding mach. $10 Handbook of Chemistry and Physics 39th Ed. $8. W6BLZ, 528 Colima St., La Jolla, CA 92037.

SELL: Pair 6 element 6 meter beams, new $35. Want B & C tx heads from TRC-24. WA8MLV, 1008 Englewood Dr., Parma, OH 44134.

SELL: New Swan, 12 Channel, 10 W, 2M FM 1210 A xcvr, xtals for 10 chan., AC pwr sup, mike, mobile mount, DC cable $285. K2HNB, 57 Meeting Ln, Hicksville, NY 11801, 516-796-9595.

FOR SALE: Collins 32S-1 $300, 75S-1 $200, KWM 2A $600, 516F-2 $100. All in excel. cond. FOB. Charles Simmons, Box 575, Atwater, CA 95301.

FOR SALE: Ranger I $65, Swan 240 with AC sup. $150, Tecraft 2 mtr xmtr and converter $30. K1-LGB, 135 Country Ln., Bristol, CT 06010.

Autopatch Touchtone Equipment. SASE for information. Autopatch Systems Ltd, Box 291, Western Springs, IL 60558.

BARGAIN: Com. Station, Heath HR10B, DX60B plug $50 acces. all for $100. Local prefer, if poss. SASE for list. Samkofsky, 4803 Brenda Dr., Orlando, FL 32806.

WANTED: In any cond. Heath Two-er & Tecraft VHF gear. U pay shipping. U.P.S. Ed WA8MEC, 352 Cambridge, Mt. Clemens, MI 48043.

FOR SALE: Drake TR-6, RV-6, MS-4 spkr and AC pwr. sup. Firm $475.00. E. Metz, K4FDO, 166 Oakwood Dr., Grove Park, New Port, Richey, FL

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SALE: Heath 80 meter single bander HW-12 with DC PS and bumper mount ant. $100. W8WUU, 114 So. Hooker Ave., Three Rivers, MI 49093.

Collins Mech. Filter 455FAO5, 500 cycle BW for 75S3B, in orig. Collins carton, $35. W1DL, 24 Cherry Rd., Framingham, MA 01701.

WANTED: Collins KWM2A. Must be an A only. Prict to: Cal Moss, KL7HEN, PO Box 2191, Fairbanks, Alaska 99707.

WANTED: Low band HT-200, or HT-220. Need not be working, but must be intact. M. Naumoff, K7LYK, 116 Stewart St., Seattle, WA 98101.

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WANTED: Heath HG-10B VFO with man. state cond. es price first letter. WA2EXX, 136 Manhattan Waldwick, NJ 07463.

WANTED: Conv. for NC303; NC-30002 (2m) & NC-30006 (6m). Bro. Leo F. Scholz S.M., W9SWB/Ø, St. Mary's High School, 4701 S. Grand, St. Louis MO 63111.

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HQ129X w/prod. det. org. owner $75. Eico 360, $5., FOB. Kinne, 1163 Ingerson Rd., St. Paul, MN 55112.

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SELL: HQ110, clock, xtal calib., matching spkr., with man. W9ZEW, R. Oras, 3636 S. 59th Ave., Cicero, IL 60650.

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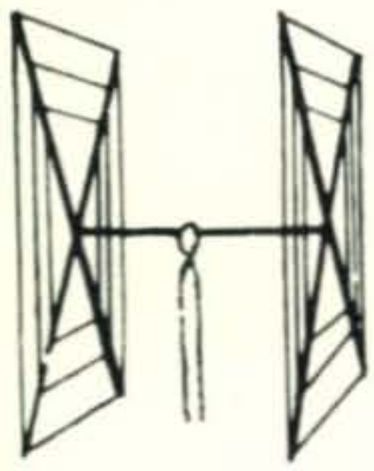

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Operation Mode: All
SWR: 1.05:1 at resonance
Gain: 8.1 db. over isotropic
F/B Ratio: A minimum of 17 db. F/B
Boom: 10' long x 1¼" O.D.; 18 gauge steel; double plated; gold color
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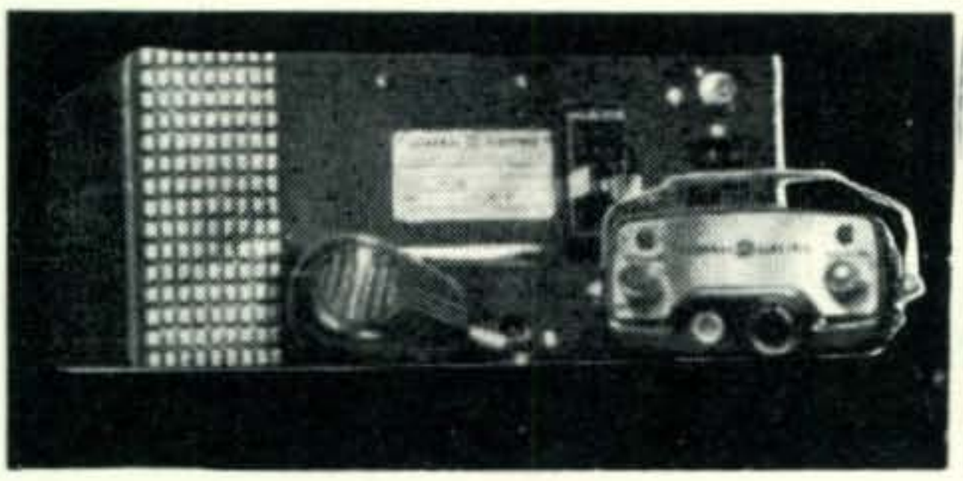

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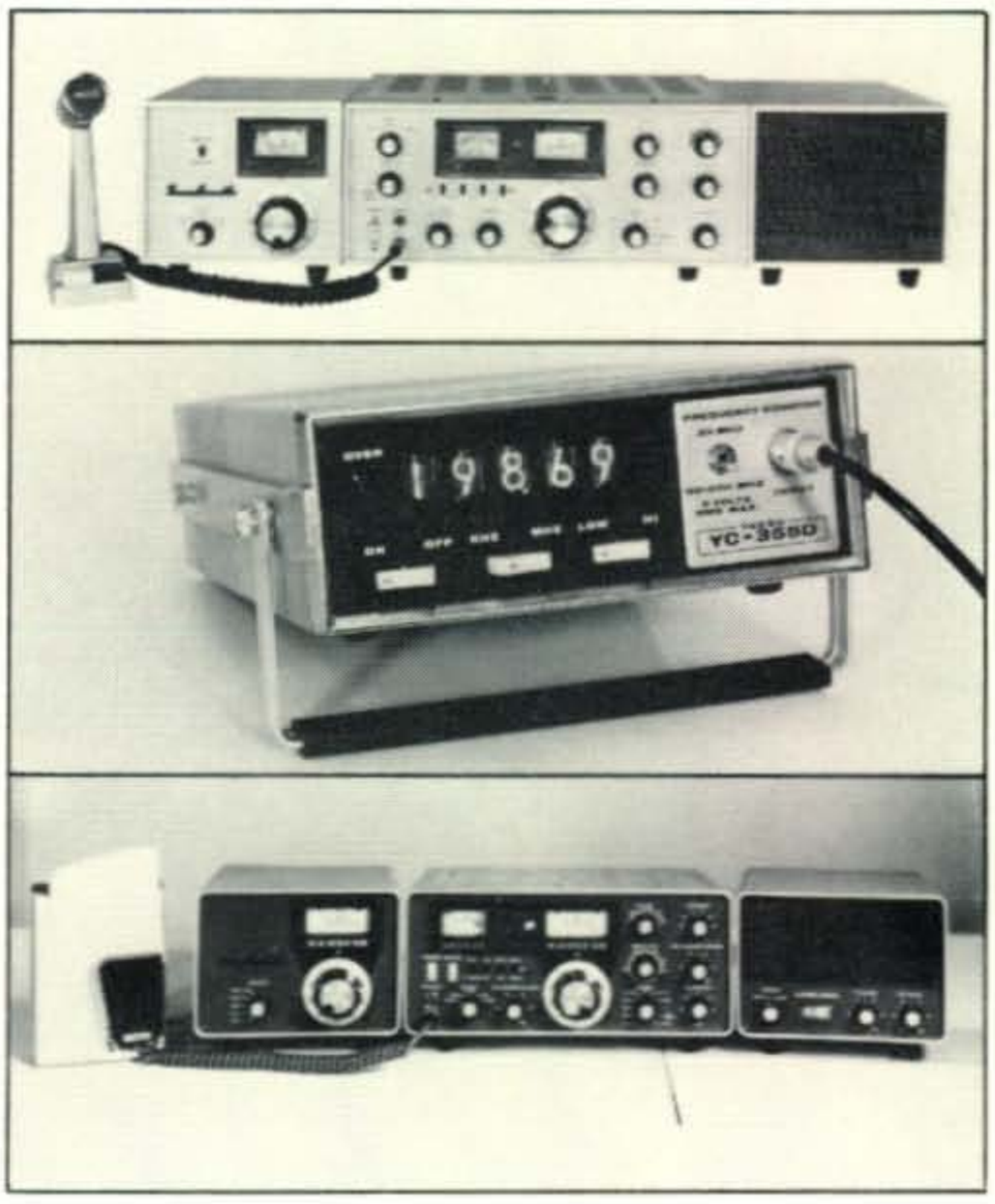

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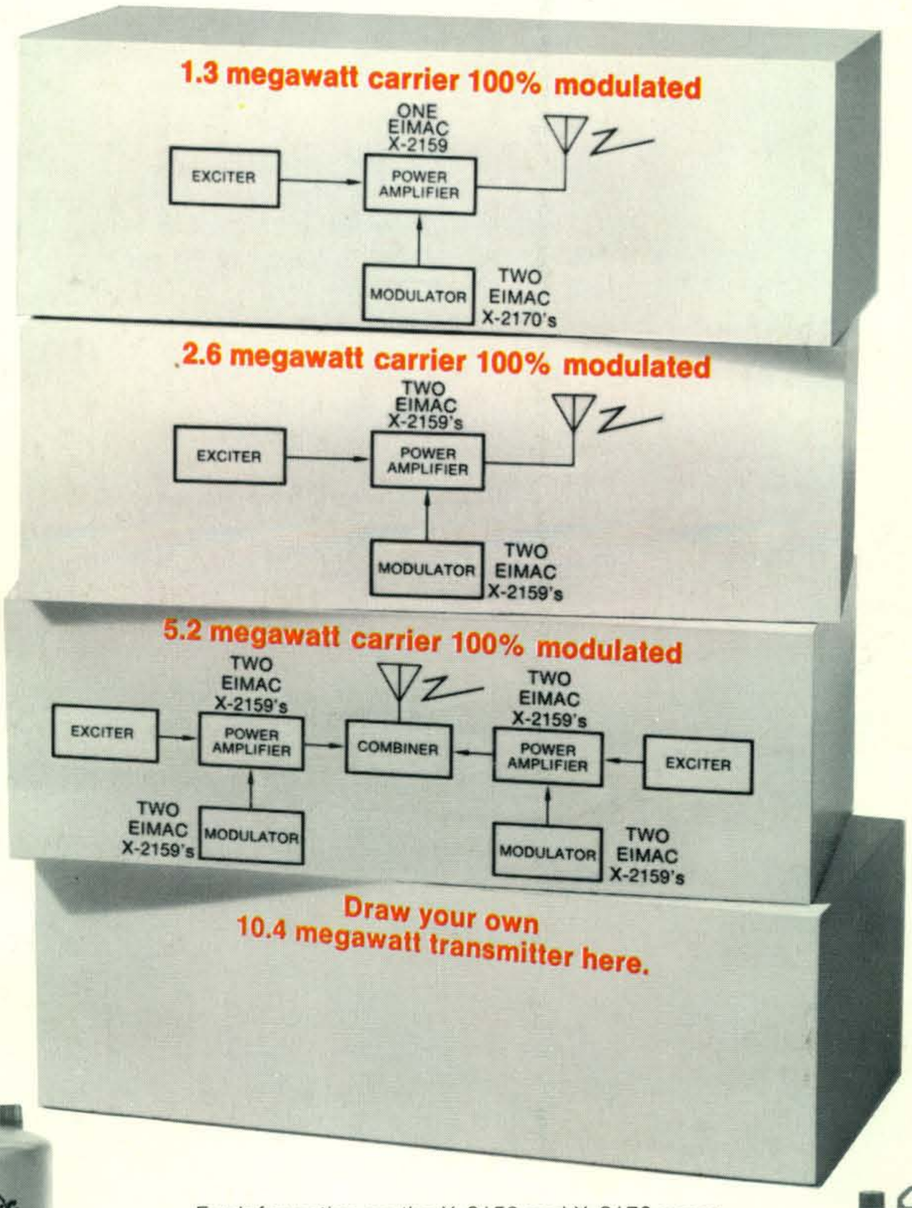
10,400,000 Watts!

EIMAC super-power tetrodes provide transmitter "building blocks" up to 10.4 megawatts, 100% modulated.



X-2159

For information on the X-2159 and X-2170 super-power tetrodes, contact the EIMAC Division of Varian, 301 Industrial Way, San Carlos, California 94070. Or any of the more than 30 Varian / EIMAC Tube and Device Group Sales Offices throughout the world.

X-2170

Eimac® division varian