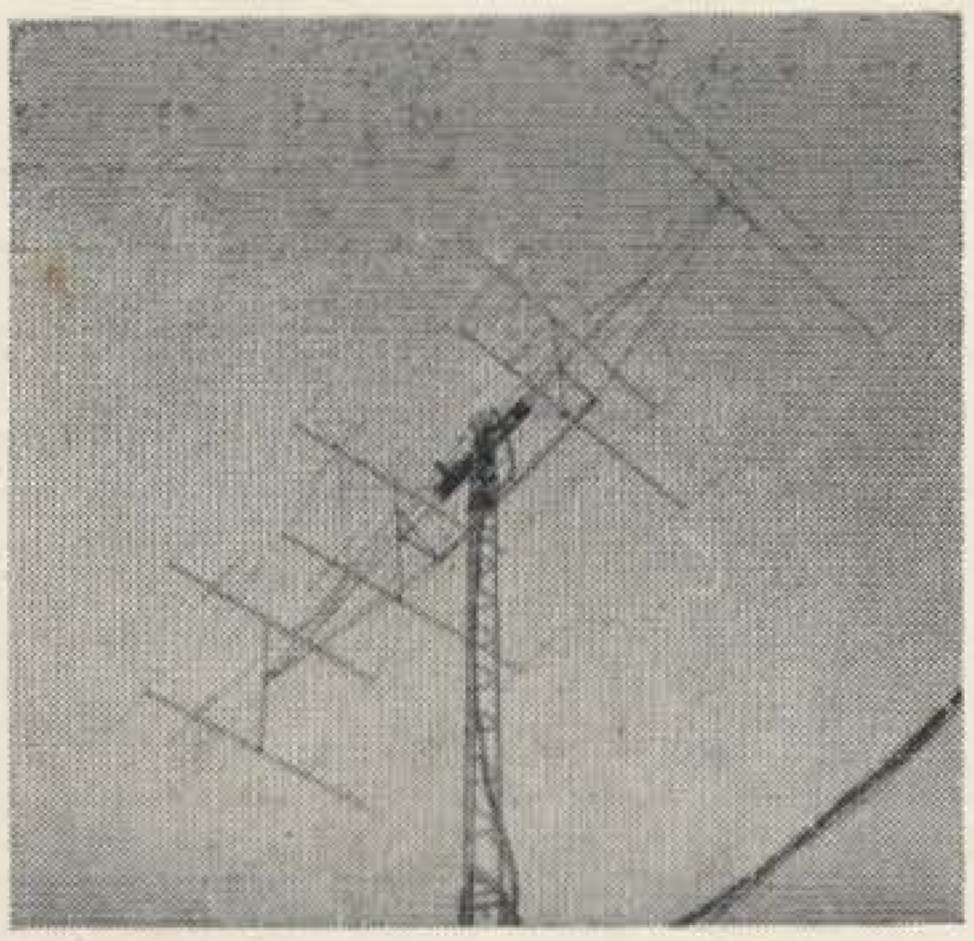
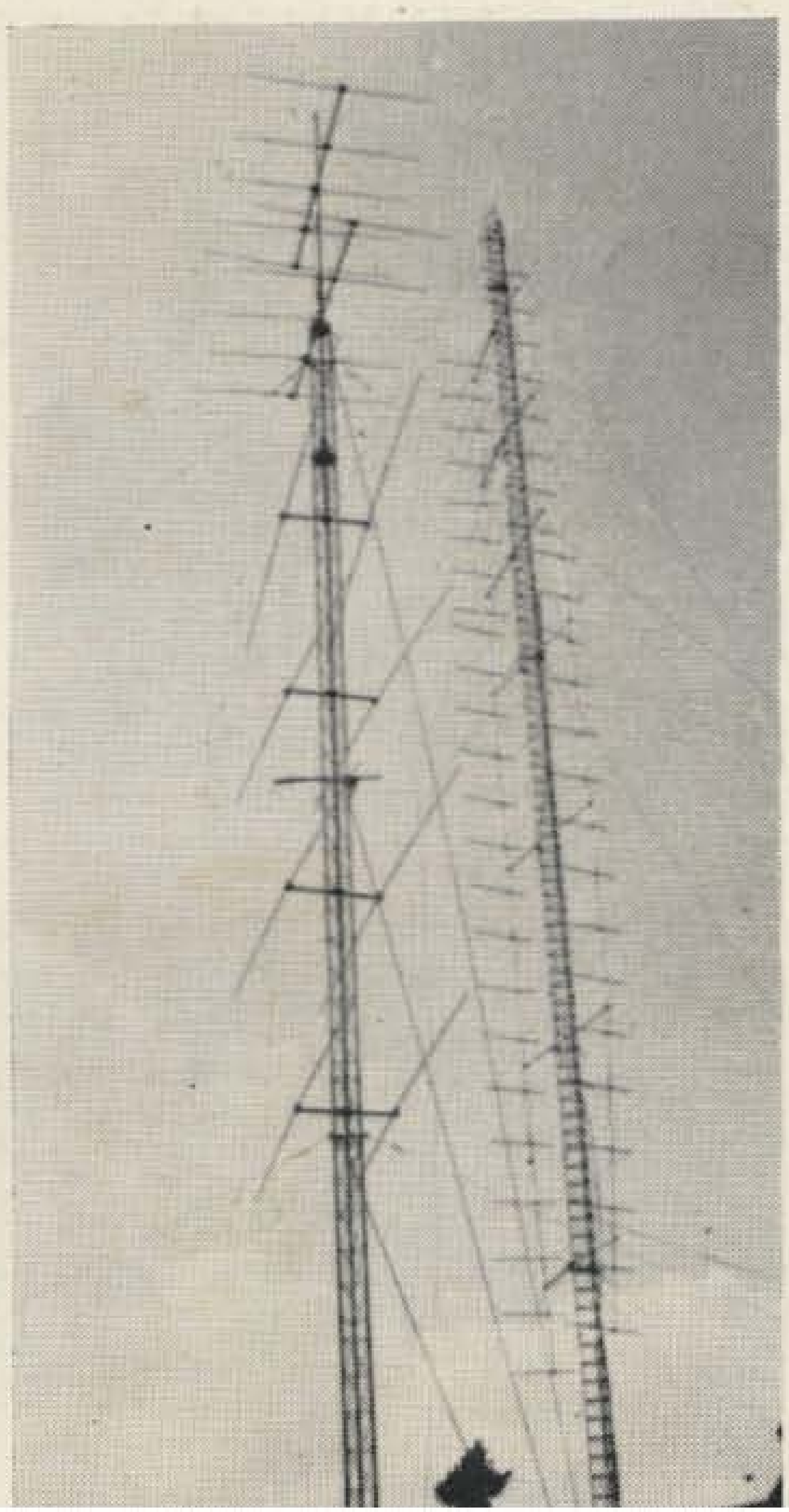
73

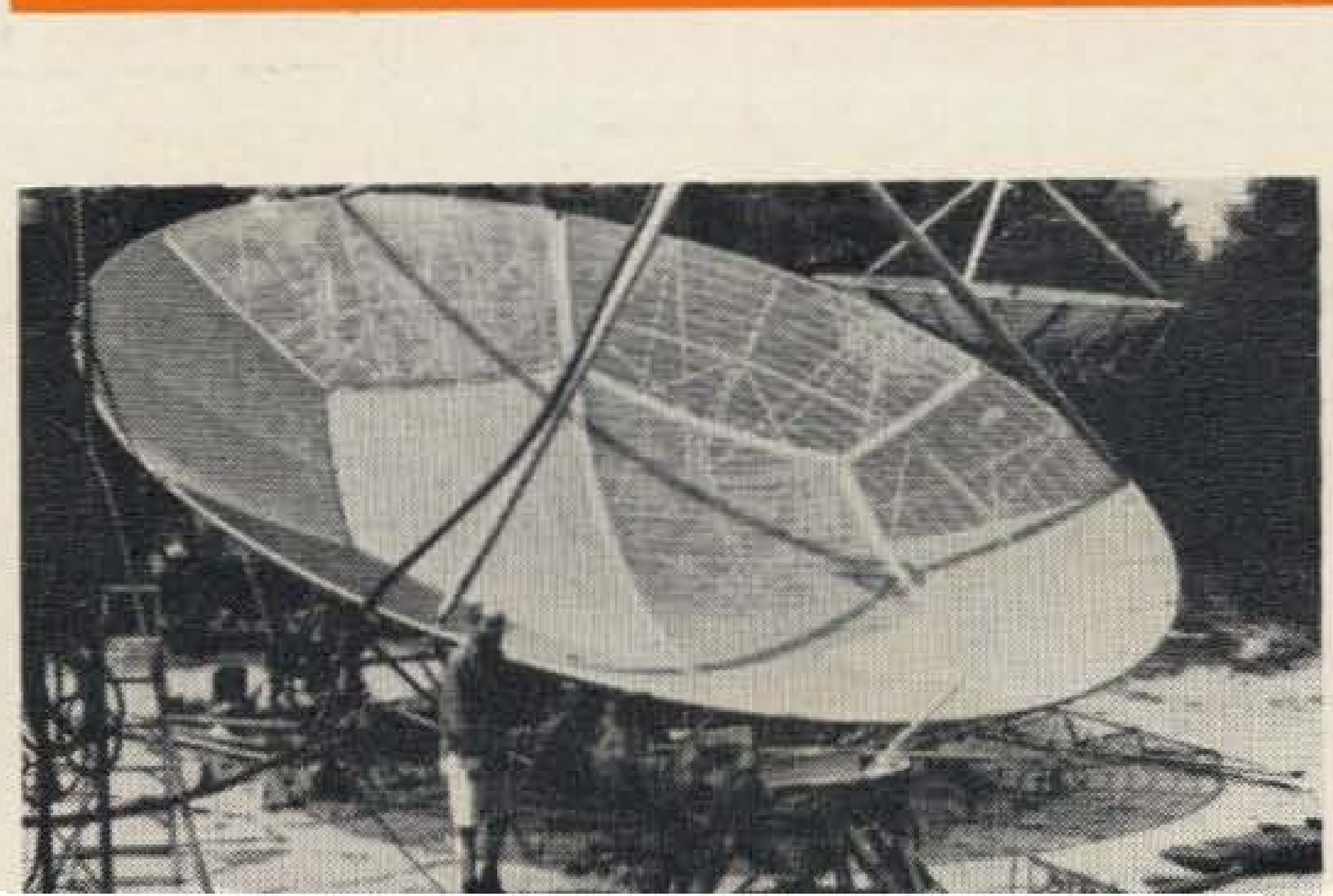
Amateur Radio

JULY 1964
Special Sale: 40c





SPECIAL VHF ISSUE

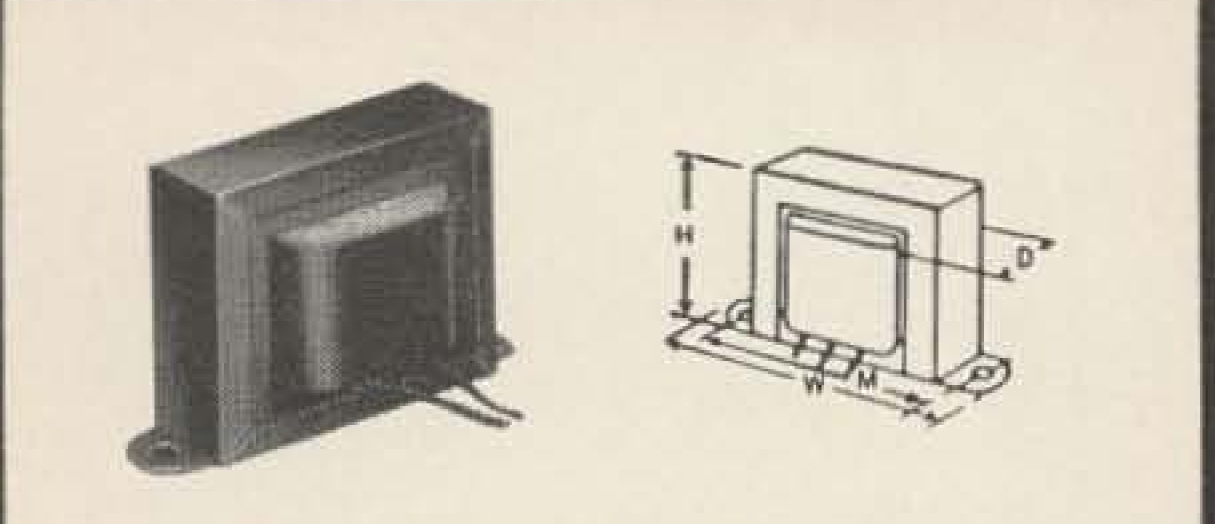


REPLACEMENT TYPE TRANSFORMERS & REACTORS

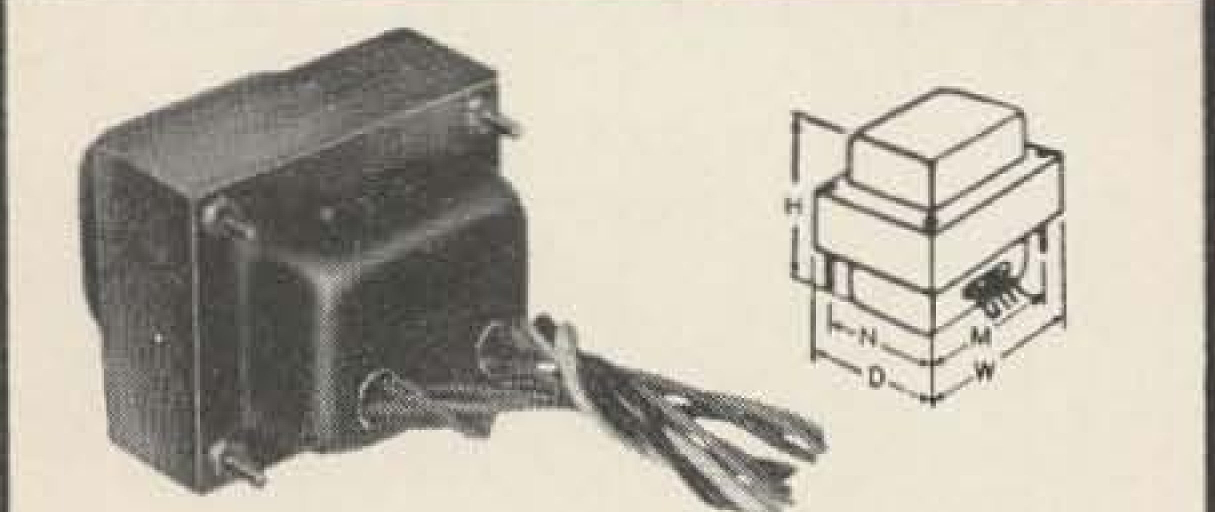
PIONEERS IN MINIATURIZATION

Thirty years of pioneering by UTC's research, design, and engineering staffs assures you quality and reliability unexcelled in the industry. UTC's line of stock and special custom built items covers virtually every transformer and filter requirement for both military and commercial use.

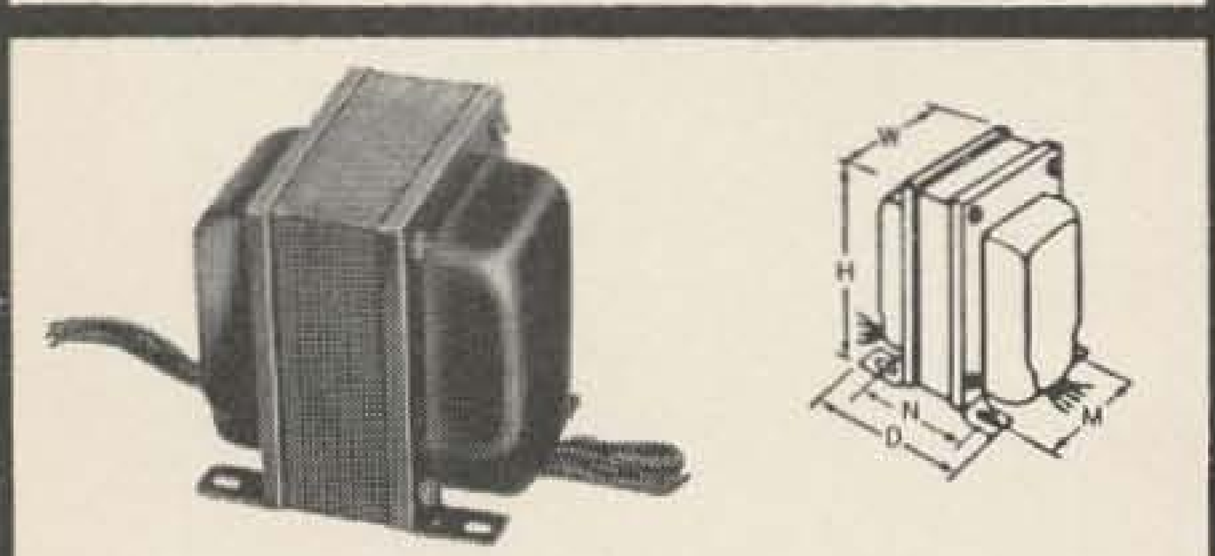
UTC replacement type transformers, here described, (Pri. 117 V. 50/60 cycles) provide the highest reliability in this field. All units are low temperature rise, vacuum sealed against humidity with special impregnating materials to prevent corrosion and electrolysis. Shells are finished in attractive high lustre black enamel.



CHANNEL TYPE



DOUBLE SHELL TYPE



VERTICAL SHELL TYPE

CHANNEL FRAME FILAMENT/TRANSISTOR TRANSFS.

Pri. 115 V 50/60 Cycles—Test Volts RMS: 1500

Type No.	Secondary	W	D	H	M	Lbs.
FT-1	2.5 VCT-3A	2 7/8	1 1/2	1 11/16	2 3/8	3/4
FT-2	6.3 VCT-1.2A	2 7/8	1 1/2	1 11/16	2 3/8	3/4
FT-3	2.5 VCT-6A	3 5/16	1 7/8	2	2 13/16	1
FT-4	6.3 VCT-3A	3 5/16	1 7/8	2	2 13/16	1
FT-5	2.5 VCT-10A	3 3/4	2 1/8	2 5/16	3 1/8	1 1/2
FT-6	5 VCT-3A	3 3/4	2 1/8	2 5/16	3 1/8	1 1/2
FT-7	7.5 VCT-3A	3 3/4	2 1/8	2 5/16	3 1/8	1 1/2
FT-8	6.3 VCT-8A	4	2 1/2	2 5/8	3 5/16	2 1/2
FT-10	24 VCT-2A or 12V-4A	4	2 5/8	2 5/8	3 5/16	2 1/2
FT-11	24 VCT-1A or 12V-2A	3 3/4	2 1/8	2 5/16	3 1/8	1 1/2
FT-12	36 VCT-1.3A or 18V-2.6A	4	2 5/8	2 5/8	3 5/16	2 1/2

Taps on pri. of FT-13 & FT-14 to modify sec. nominal V, −6% +6%, +12%

Type No.	Secondary	W	D	H	M	Lbs.
FT-13	26 VCT-.04A	2 1/8	1 3/8	1 1/4	1 3/4	1/4
FT-14	26 VCT-.25A	2 7/8	1 5/8	1 11/16	2 3/8	3/4

DOUBLE SHELL POWER TRANSFORMERS

Type No.	High V.	DC ma	5V. Fil.	6.3 VCT Fil.	W	D	H	M	N	Wt. Lbs.
R-101	275-0-275	50	2A	2.7A	3	2 1/2	3	2 1/2	2	2 1/2
R-102	350-0-350	70	3A	3A	3	2 1/2	3 5/8	2 1/2	2	3 1/2
R-103	350-0-350	90	3A	3.5A	3 3/8	2 7/8	3 15/16	2 13/16	2 1/4	4 1/2
R-104	350-0-350	120	3A	5A	3 3/4	3 1/8	3 7/8	3 1/8	2 1/2	5 1/2
R-105	385-0-385	160	3A	5A	3 3/4	3 1/8	4 5/16	3 1/8	2 1/2	7

VERTICAL SHELL POWER TRANSFORMERS

Type No.	High V.	DC ma	5V. Fil.	6.3 VCT Fil.	W	D	H	M	N	Wt. Lbs.
R-110	300-0-300	50	2A	2.7A	2 5/8	2 13/16	3 1/4	2	1 3/4	2 1/2
R-111	350-0-350	70	3A	3A	2 5/8	3 7/16	3 1/4	2	2 3/8	3 1/2
R-112	350-0-350	120	3A	5A	3 5/16	3 11/16	4	2 1/2	2 5/16	5 1/2
R-113	400-0-400	200	3A	6A	3 7/8	4 5/16	4 5/8	3	3 1/8	8

CHANNEL FRAME FILTER REACTORS

Inductance Shown is at Rated DC ma—Test Volts RMS: 1500

Type No.	Induct. Hys.	Current	Resistance Ohms	W	Dimensions, in. D	H	M	Wt. Lbs.
R-55	6	40ma	300	2 3/8	1 3/8	1 3/8	2	1/2
R-14	8	40ma	250	2 7/8	1 1/2	1 11/16	2 3/8	3/4
R-15	12	30ma	450	2 7/8	1 1/2	1 11/16	2 3/8	3/4
R-16	15	30ma	630	2 7/8	1 1/2	1 11/16	2 3/8	3/4
R-17	20	40ma	850	3 5/16	1 5/8	2	2 13/16	1
R-18	8	80ma	250	3 5/16	1 5/8	2	2 13/16	1
R-19	14	100ma	450	3 3/4	1 7/8	2 5/16	3 1/8	1 1/2
R-20	5	200ma	90	4 1/8	2 1/4	2 5/8	3 5/16	2 1/2
R-21	15/3	200ma	90	4 1/8	2 1/4	2 5/8	3 5/16	2 1/2
R-220	100/8 Mhy 25/2 Mhy	2.5A 5A	.6 .16	3 3/4	2	2 5/16	3 1/8	1 1/2

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73 Magazine

Wayne Green W2NSD/1
Editor, etcetera

July, 1964

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de W2NSD/1

never say die

It has not escaped me that I am being attacked in letters and publications from the ARRL, by CQ, the Washington News Letter, etc. You've probably read some of these attacks, or at least heard about them over the air. Let's see what this is all about.

Basically you have to decide whether amateur radio is fast losing ground or whether everything is in safe hands with no need to worry. In support of my hypothesis that all is not only not well, but is in really bad shape I point to articles in QST and 73 discussing the ITU and our problems with our own government. We find that more and more fellows who have an understanding of the overall situation believe that the bulk of our low frequencies are in great danger of loss at the next ITU administrative conference and that our VHF's are being lost right here at home.

Obviously some alarm is being felt at ARRL HQ or else the directiors wouldn't have OK'ed $100,000 for preparations for Geneva when they believe that they are going to have a net loss of about $50,000 for the year without that expenditure.

If I am wrong and there is really nothing to worry about then obviously I am either naive enough to be mislead or am out to stir up controversy in the hopes of greedily filling my own pocket as a result. If I am wrong why did they vote that $100,000?

Now, suppose I am right and things are in bad shape. This puts me in the position of being one of the few people that are actually doing anything about the situation. What have I done? First of all I have initiated the Institute of Amateur Radio which is now in the hands of a set of interim directors and has established the foundations for a lobby in Washington which will represent amateur radio and help counter the pressures aimed at taking away our VHF bands and also try to set up the best possible atmosphere for support of amateur radio by the U. S. delegation at Geneva. The Institute is sending out a regular newsletter to every U.S. Senator, U.S. Representative, Governor and official in Washington that is involved in amateur radio.

On my own hook, and without any connection with the Institute, I have been trying to bring clear thought into the matters of incentive licensing, RM-499 and other ARRL dogmas. I intend to try to bring light into the ARRL Directors elections this fall in the hopes that this will result in the selection of some intelligent and dedicated amateurs.

What are *you* doing? What have *you done*? I've had a helping hand from a small group of fellows, but I've had a lot of QRM too. As far as I know, no one in history has ever been able to accomplish anything without others fighting him tooth and nail.

CQ has been biting at me for the last couple months. Having worked for the Cowan family for five years I feel I know them pretty well. I don't know of anything *they've* done for ham radio. I feel they are strictly commercial and that they thought that a controversial editorial or two would help sell their magazine.

I have perhaps gotten a little nastier than I should have in some of my editorials. Perhaps this was me fighting back at the personal attacks on me . . . or maybe it was carrying the battle to the combatants. Ham radio is in the fix it is in right now because a few people have inexcusably blundered. Perhaps I should be polite and not mention names and not point my finger at the blunderers.

If we all recognize the difficulty that we are in and do everything in our power to straighten things out we could keep ham radio going for a long time and have it continuously improve. I don't know how much can be done with ARRL HQ fighting every inch of the way.

Unfounded Rumor

Back in the May issue of 73 my terseness tripped me up again. If you'll allow me to slowly disengage my moccasin from my mouth, I'll explain.

Due to a lousy upbringing which instilled in me a compulsion to be right, I go to great lengths to make sure that what I write is true at the time it is written. Unfortunately the courts of our land sometimes take a dim view of rightness and have been generously awarding large sums of money in libel suits, even where the writer proves conclusively that what he wrote was true. I personally think things have come to a pretty pass when the truth of a statement is no defense, but as long as that is the law of the land you'll find my facts equivocated, complete with "unfounded rumors."

In looking over my editorials for the last three months I see no instances of rumors

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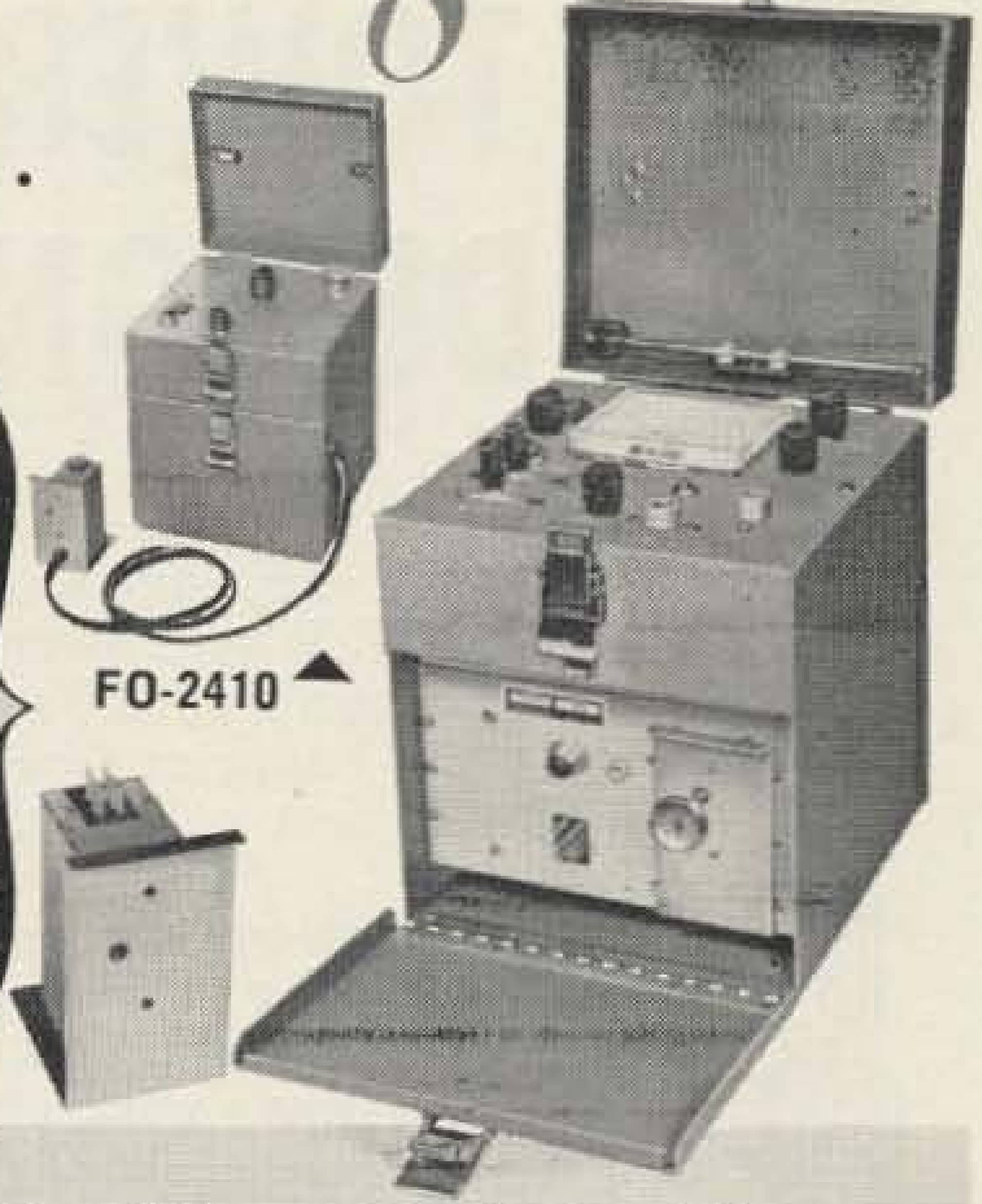

FM-5000 FREQUENCY METER 25 MC to 470 MC

The FM-5000 is a beat frequency measuring device incorporating a transistor counter circuit, low RF output for receiver checking, transmitter keying circuit, audio oscillator, self contained batteries, plug-in oscillators with heating circuits covering frequencies from 100 kc to 60 mc. Stability: ± .00025% +85° to +95°F, ± .0005% +50° to +100°F, ± .001% +32° to +120°F. A separate oscillator (FO-2410) housing 24 crystals and a heater circuit is available. Dimensions: FM-5000, 10" x 8" x 7½".

FM-5000 with batteries, accessories and complete instruction manual, less oscillators, and crystals. Shipping weight: 18 lbs. Cat. No. 620-103 . . . . . $375.00
Plug-in oscillators with crystal $16.00 to $50.00

C-12B FREQUENCY METER For Citizens Band Servicing

This extremely portable secondary frequency standard is a self contained unit for servicing radio transmitters and receivers used in the 27 mc Citizens Band. The meter is capable of holding 24 crystals and comes with 23 crystals installed. The 23 crystals cover Channel 1 through 23. The frequency stability of the C-12B is ± .0025% 32° to 125°F, .0015% 50° to 100°F. Other features include a transistorized frequency counter circuit, AM percentage modulation checker and power output meter.

C-12B complete with PK (pick-off) box, dummy load and connecting cable, crystals and batteries. Shipping weight: 9 lbs. Cat. No. 620-101 . . . . $300.00

C-12 CRYSTAL CONTROLLED ALIGNMENT OSCILLATOR

The International C-12 alignment oscillator provides a standard for alignment of IF and RF circuits 200 kc to 60 mc. It makes the 12 most used frequencies instantly available through 12 crystal positions 200 kc to 15,000 kc. Special oscillators are available for use at the higher frequencies to 60 mc. Maximum output .6 volt. Power requirements: 115 vac.

C-12 complete, but less crystals. Shipping weight: 9 lbs. Cat. No. 620-100 . . $69.50

C-12M FREQUENCY METER For Marine Band Servicing

The International C-12M is a portable secondary standard for servicing radio transmitters and receivers used in the 2 mc to 15 mc range. The meter has sockets for 24 crystals. The frequency stability is ± .0025% 32° to 125°F, ± .0015% 50° to 100°F. The C-12M has a built-in transistorized frequency counter circuit, AM percentage modulation checker and modulation carrier and relative percentage field strength.

C-12M complete with PK (pick-off) box and connecting cable, batteries, but less crystals. Shipping weight: 9 lbs. Cat. No. 620-104 . . . . $235.00
Crystals for C-12M (specify frequency) $5.00 ea.

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which were unfounded or even any facts which have not withstood the test of time. About the only change that has come about since writing the editorials is that now, probably as a result of my needling, K2US is permitting visiting amateurs to operate. 73 still is not acceptable as an exhibitor at the ARRL National Convention. It is possible that I'm just hearing from a bunch of soreheads like myself, but I get the feeling that this ARRL National Convention may lay the biggest egg in ham history. One of the largest ham manufacturers, after some serious second thoughts, has just cancelled out of the convention. Others have turned thumbs down on it on ethical grounds. In addition to HARC's frightened rejection of 73 there is still their mysterious involvement in the Coca-Cola affair to cool interest in the convention.

I've been under pressure to sue HARC/-Dannals to have 73 admitted as an exhibitor at the convention. I probably could make it stick too, for it would not be difficult to show that their action is definitely a restraint of trade and would cause 73 considerable damages. Somehow I just don't like to resort to that. I suppose I should be practical about it and blast in, but I don't like to be that way. I guess it is the same feeling that has kept me from suing CQ for the fortune they still owe me.

Let's see, where was I? Oh, yes . . . regarding my editorials. If you think you've found any place in my editorial where I don't have my facts straight you let me know and I'll try to clear up the item for you.

B of D

The July issue of QST will have the full minutes of the ARRL Board of Directors. It'll be back there in the fine print. As you read through the unbelievable inconsequentials that filled most of few scant hours of the meeting perhaps you'll share my disappointment that the directors should go to all the trouble to get together for so little results. Dividing the time of the meeting by the number of issues taken up we see that about seven minutes each were devoted to the matters at hand. This is about enough time to read the proposals to the assembly and record the invariable (except for one item) unanimous vote.

Ham radio is more in danger of complete demise today than it has been in most of our lifetimes. We're losing the VHF's here at home and the short waves at Geneva. At this crucial time in history we desperately need a

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IoAR News

Founding Members of the Institute of Amateur Radio

KØGZN	K2ATG	W6FUV	W5GHY	W7ABD	F2BO	K4AQV
W1ELL	W5TIE	WØNVE	W5AKZ/4	W5CDM	K2JXL	K9KHE
W1PCD	K2GCL	K5WYN	W6QWE	KØPZT	WA8EJX	WA2VMV
W1AFW	K2ZSA	WA9PHH	W9IIU	K8GGW	WA5CXG	K4QYC
W1BEY	WB2ASY	WA8GRI	XE2WH	WN2JBB	WA5ERV	K9ATG/4
KØEBV	KN3YPV	K3FKN	K8NZD	W6FPO	K2QKS	K5OMD
W8DBK	W2COT	WA4AYP	K9UTN	WA9GAA	K8ENY	WØOPA
W6BRW/1	W7UVR	K7QKN	DL4UC	K6GLJ	KØFYM	W4RLS
VE3CAH	K9ZTE	W9RLH	W8BPY	WA6UNL	WØJHY	W6FAV
WØKZZ	WA2FMC	WAØCSE	WA2PGY	W1EGE	W7GBJ	W7PXA
KH6ARL	KØKPG	W4EVU	W3CAY	K8UFJ	WA6QVS	K8KSC
WA1AWG	K5AJP	WN8BYM	WA4PDX	WA6VAT	WA4GMV	W1HIV
W5WNF/1	W6QDO	W5AEW	W7VBH	K1RFX/7	K4LOL	W6RDB
K1LKK	W9AFG	W3BIG	K5ZZP	K5RKG	W5HDY/Ø	W2LMP
W1OFK	W8BKO	WB2DML	W5QKA	W8GRT	WA5EKQ	W2GQY/4
K1AFH	W2NSD/1	K5OZN	K2SEP	W6CRA	K4BNZ	WB6GOB
W2MAB	K6UVL	WA6YOV	K1QAC	WA6JNI	WØGBG	KØMUJ
K9HMC	W9CDQ	K9FLX	WA4ABR	W7DIE	K6IZY	KH6BW
KØJXN	WA2UHV	K2VBH	K6AYO	W6EXI	WA6NCD	KH6DDZ
K8UBG	K9TZJ	K5ZXL	K1FJT	WA6KRJ	WA6TAG	K8DMG
WB2LZQ	WAØAVG	W1TXS	WA2QDJ	WØCZA	K3URS	WØEXG
W8PJJ	K7YNY	W9UIK	WA2PWG	K8JTT	K7UCR	KØATZ
KØPWS	W4WNI	K9VEO	KØUIW	W3KIZ	WA4FTM	W2PDH
WA9COE	W2KEG	K3BNS	W2QR	WØRQY	WB6BIG	WA4HWH
W8JXU	WA6EWV	K6VYJ	W5LVQ	W7IUF	WAØDEM	K5ERF
W3AEH	K5VKO	WA8DOT	K8YRE	W2LO	K6GII	WA4LYG
K3QEY	WØYVR	W2HS	WA8HPE	K9ESN	WA6NAT	WA6KII
K3PKL	WB2FYB	W7IDF	WA4HLJ	DL4HU	Edward/W1	W4UQK
K4UOT	WA8FTX	WA4FEI	K7JAR	K7JQZ	WA9DRI	WA4RME
WØDSO	W2OBM	K5KLN	K1VOL	K9APJ	KØOKB	K9OFG
WA2DRK	KØJTQ	WA6JJK	K7NYH	WA4ILX	K9VWX	K9AHX
K9GNK	WØFVP	W6DKZ	W2YGA	K1VII	K8LBU	WAØEYE
W2DLP	K6UGT	W2DUD	KN3FML	K9PCQ	W7AER	WA6VGR
W4GIO	W7YKR	WA8ASU	WN1AJG	K5HVS	K4UBZ	W8CWF
K9WHE	KØKUP	W2ISD	K8ODY	W6LSW	K4JFZ	W9DIA
WA2NDC	WA2YNO	Igor/W2	W9FNQ	KØWZX	K2SWE	KØVFV
KØWVF	W6FGJ	WA4ABZ	K5TJW	WA6RWU	K5JPK	WA6TVR
W9DKY	WAØBUH	W3KFB	W5TEL	K6ELR	W6DAD	K4ZJK
K9SQH	W5ITU	WA2LIY	W4FMF	K9LMG	WA9AXU	WA6ZMT
KØKRX	W7GZA	WA6OIV	K9HUK	W5NSD	WØLYX	K7VUR
K8TGP	W2MSN	KZ5LC	WA5EZW	K5ARO	K6LRX	W6AVR
K8APU	W5THI	WA2UCP	WØHMK	K2VRV	WB6AYJ	WA8ITN
W2CQY/4	W1IAZ	K3GLL	K1KHH	W3PBR	W1ZMM	KH6EDR/6
W9JWW	K5RBA	K9KBQ	K5ESF	KØBIY	W2CNQ	WA6SSK
K9QPX	KØGUQ	W7DIC	W5YNL	W9MYN	W6FUW	W3PQZ
W8SDZ	K7TCY	WA2YIA	W3OGP	K6TWX	WA2SPB	W5CND
K8AMF	WA2PHF	W8RZZ	VP5BB	K4GWV	K3MTW	K1JWU
K9UON	K6SLR	K2EAF	W6BXY	W7OE	K1QNQ	W5DYR
W9KLR/8	WA4DQS	KØMVM	WA8FOE	W6UKD	W2GHK	WA6SDW
K8EIO	K1SCC	WB2DXT	K1QHT	W6AVN	K6OPG	W2SHZ
K3DYH	K5RLP	K8OHP	K1CJD	K6IFO	K2JXB	W1GJL
WA2ZID	WA2GHP	K6MIM	WA4CMW	K6GRD	K8RSC	W6SLK
WA2WLZ	WB2GVO	KØPTL	WAØELO	K5BFQ	KØCBN	K6UZB
WØRGT	W9YMF	W4COY	WB6EXR	W9SIR/4	WA6ABZ	K9JQS
K5SKA	WØKYQ	WØWUZ	WA4NGZ	K6GNG	W3HIQ	WB2ISM
W5AQN	K7KYG	W5HWL	W3WTO	K1UDF	W4QLX	K3ZNM
K5IXH	WA4FSK	WA2STD	W4NGZ	W6JWF	WA2KXH	W7SOD

An Open Letter to Every Technician Licensee

You may feel that all the recent controversy, political name-calling, petitioning for HF license changes, and loss of large chunks of (or *all* of) 40, 75, and 20 meters has nothing to do with you. You LOST 1645 mc's a couple of years ago in a *closed door* committee decision that QST buried in its back pages in such fine type that I can't even find it to give the exact date. Let me quote: *"The Bands 220 through 10,500 mc are shared with the government radio positioning service, which has priority."* You can get a phone call—the voice on the other end can tell you to get off any of these frequencies—AND YOU WILL GET OFF!

Carefully smoked-screened and carefully dealt off the bottom of the deck a card at a time, over a ten year period, is a series of legal little-publicized committee decisions that are resulting in a complete re-allocation of all frequencies from 25 to 890 mc. *You are going to lose 6, 2, 220, and 432.*

"Electronics," a highly respected industry-wide publication, stated on page 29 of its April 20th issue, "The Electronic Industries Association's monumental analysis of Federal Communications Commission license data for most of the radio transmitters used in vehicles will be completed before the first of May. It was started nearly eight months ago and covers some 1.9 million authorized stations, etc." "For example, some 200,000 mobile station authorizations cannot be immediately identified geographically, etc." "Another group, the National Association of Manufacturers, feels that unused channel assignments should not lie idle. Its communications committee has proposed a pilot test employing television channels 14 and 15, etc." "The proposal is comparable with those of the EIA, American Automobile Association, and Automobile Club of Southern California." "The Commission recently withheld action on the NAM proposal and slapped down another that would have re-allocated frequencies between 25 and 890 mc's. However, FCC requested another study by EIA and the Joint Technical Advisory Committee, representatives from industry and members of the IEEE, to see if mobile radio channels can be fitted into TV channels 2 thru 13." Unquote.

OM: Just where do these actions leave the amateur? Who is representing our interests in these associations and committees we have never heard of? Yet they are making daily decisions that effect our most valuable frequency bands.

We have heard a lot of yak-yak about how tough it is going to be to talk some thatched-roof politico from New Lower Slobovia into letting us keep our 4, 7, and 14 mc bands. How do you think we are going to make out against the professional lobbies representing EIA, NAM, IEEE, AAA, etc. These are multimillion dollar organizations representing over *one million, nine hundred thousand* business radio installations. These groups are experts in our government processes and have years of hard-earned experience in wheeling, dealing, and outright arm-twisting. These people don't go to Washington cocktail parties—*they give them.*

The ruling that requires every TV set now manufactured to have a built-in UHF tuner of sorts is just one small step in a long series of moves that will give business radio all of the low TV channels.

Because they ignored 15 years of amateur experience on 5 and 2½ meters, the FCC botched up the original TV channel allocations so thoroughly, with no help from the networks, that it now requires a complete reshuffle of allocations. And business radio interests are making hay while the sun shines. Through a very well organized series of moves over a ten year period, these people are completely relocating the entire radio spectrum over 25 mc.

I have never been so horribly aware that we are amateurs in a lot of ways other than radio.

I hear many dc band hams worrying as to whether the trade-in value of the thousand dollars or so in appliances cluttering up their operating positions may be affected. I have over 25 years of my life invested in what we can do on 6, 2, 220, and 432, if we can just manage to save some of these bands.

The gang of electronic undertakers representing business radio buy and sell entire corporations just to get control of a 5 kc communications channel. Don't think they haven't divvied up and dealt out our VHF amateur bands into the reallocation pot long ago.

We quit using modulated oscillators on 2½ meters in 1939, but QST still features one about every three months in their effort to

(Turn to page 66)

The Outboard RF Stage

An inexpensive and easy-to-make trough-line 432 megacycle rf amplifier using the well-known and low-cost 6AM4.

Bill Hoisington K1CLL
83 Bellevue Ave.
Melrose, Mass.

The rf stage shown here has a gain of about 20 db at 432 megacycles and will thus relieve the crystal (which is described in the next section) and the first *if* of setting the noise figure. This is good too, because with only a crystal ahead, you need something like a cascode or neutralized low-noise triode to conserve the noise figure of the crystal. There are other reasons too. Cost of a low-noise crystal; almost complete elimination of harmonic detection. Stop a minute. This last one is a real nasty. I live only a few miles from an FM station and a Tee Vee source. Not long ago I was tuning up a transistor rf stage on a weak signal generator and noticed the diode detector microameter moving around on its own. Putting my reliable little high-gain outboard transistor af amplifier in the output revealed blasts of distorted FM audio from the diode. Checking up on this assorted junk on the air I find a real offender near here is the 175 megacycle TV tower whose blinking red lights I can see at night from the window.

Harmonic detection is a name usually given to the production of *if* in a superheterodyne by the harmonics of the *oscillator* beating with strong local signals. (Just wait till all those 82 channels get going!) (So what? Just move to 1296!)

The difference in some complete rigs between reception "out in the country" and

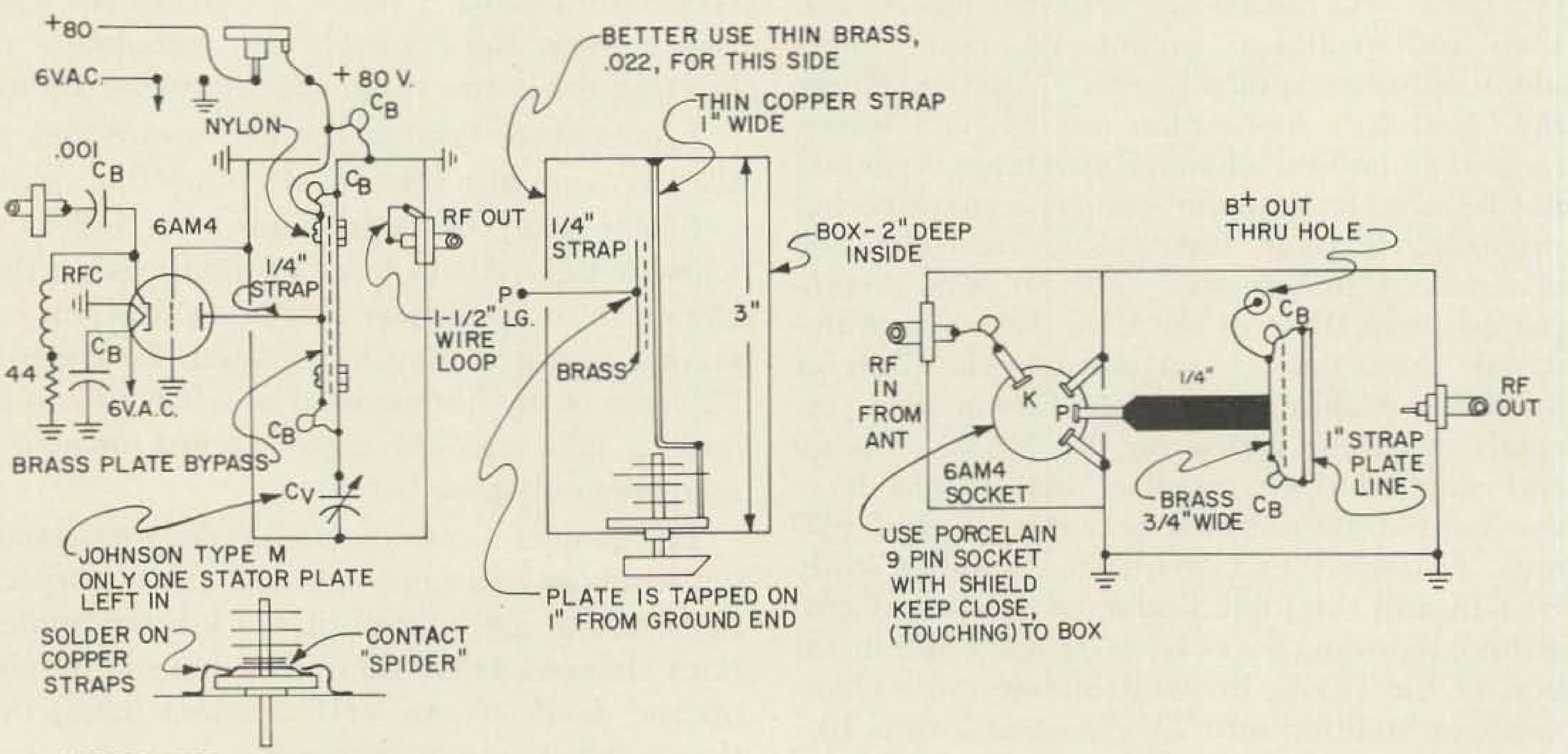


Fig. 1—Pictorial schematic of the 432 mc amplifier. Fig. 2—Trough-line dimensions for the 432 mc amplifier. Fig. 3—Front view detail of tube socket placement for the 432 mc amplifier.

"in town" is sometimes startling. Again, lots of nice hilltop locations serve to put "birdies" and horrible spurious signals all over the dial because you are now line-of-sight from a collection of FM and TV towers.

The rf stage shown removes a great deal of this junk. It also peaks up sharply on the *desire*d stations, such as on 432 (like on Wednesday at 8 P.M.)

The Circuit

Nothing too *new* here, except the trough-line box. I've seen lots of articles where it says "the box is made of brass stock, to the following dimensions, etc., etc." Well, I think machine shops are F.B. In fact I've spent plenty of time in them trying to get hard-headed foremen to build nice round cavities and things. I've also tried to build boxes of brass. Somehow, this seems to be someone else's job! I can make new devices. I can tune up a transistor on 2000 megacycles, I can devise an Infinite Shift Mechanical Transmission, but I *can't* make a decent square-cornered box! So you will find mine made of (of *course*!) copper-clad Bakelite. A ruler, tinsnips, and a soldering iron is all. And it works. High Q, shielding, *good tuning*, and all. Fig. 1 shows the basic schematic. I spent lots of time on the input cathode circuit. There appears to be very little to gain from tuning it. The filament chokes tried did not do anything for it either. Some folks carefully put chokes in *both* filament legs, some put a choke in one side and then *ground* the other with a bypass, and some do not use any. I'm in the last group, at least on this one. When the manufacturer isolates the cathode from the filament (inside the tube) so that it will *not* conduct under the stress of considerable red-hot temperature, he goes into plenty of detail and, generally, good ceramic insulation.

Circuit-wise, there is plenty of choice also. Diagrams are shown of all kinds of inputs, from direct to the cathode, to matched, resonant jobs, and even a capacitive match to the cathode on top of that. I spent more time on the input just for this reason than on the rest of the circuit, and I just do *not* find any great advantage. The straight-through rf choke shown in the cathode with the large value coupling capacitor to the antenna cable input, is not an *exact* match but near enough to show some 20 db gain. Between the last sentence and this one I plugged it in; checked it again. Just for fun, I varied the cathode resistor versus B plus, and find that a low value resistor (of 22 to 44 ohms), and a low B plus (of about 80 volts on the plate), is F.B.

Believe me, this little unit will be *very useful* around a 432 megacycle station. A *very low noise* first rf stage needs a *good* second stage after it. This is the *good* second stage.

The rest of the circuit goes along more or less standard. All grids grounded, both filaments bypassed, til we get to the plate. Here is where the trough-line begins.

Fig. 1 shows the schematic. But remember, *configuration* (i.e., shape, length, width, etc.) plays an ever increasing part from "6 UP." At 432 megacycles it is already of great importance. Mount the socket so close to the box that the shield *jams on*. Make that plate lead as short as you know how. If you tap on the plate lead *too* near Cv, you won't tune *up* to 432. You could, just maybe, make the box ¼ or ⅜ inch shorter inside, for a little greater tuning range.

Make up a brass plate with socket hole, as per Figure 3, to mount the socket and get good ground connections. There are a total of *six* of these, including one side of the filament, and five grid leads.

Put all the copper sides of the box *inside*, naturally. That's where the rf is.

RFC is about 20 turns, enamel No. 24, about ⅝" long. All the Cb's are 500 or 1000 mmfd 75 volt jobs, about ⅜ inch square. Except those on the plate bypass. These should be 250 volts. They are about 1/16 inch bigger. The B plus lead lays flat on the center one inch strap and out a hole in the rear. Being close to the plate line and running out *through* the ground end, it is *part* of the ¼ ground circuit, and will be found to be at rf ground potential at that point. For good measure, another Cb is added there. (Also 250 volts).

The output loop is about the right size to link over to the crystal mixer. A simple plate current metering phono jack is shown which current metering phono jack is shown which suits most of my meters. A ten cent shorting plug allows use of the meter on the next job.

So that's about all. It works FB and has about 20 db gain, as mentioned.

. . . K1CLL

The 432'er

Bill Hoisington K1CLL

RF Amplifier

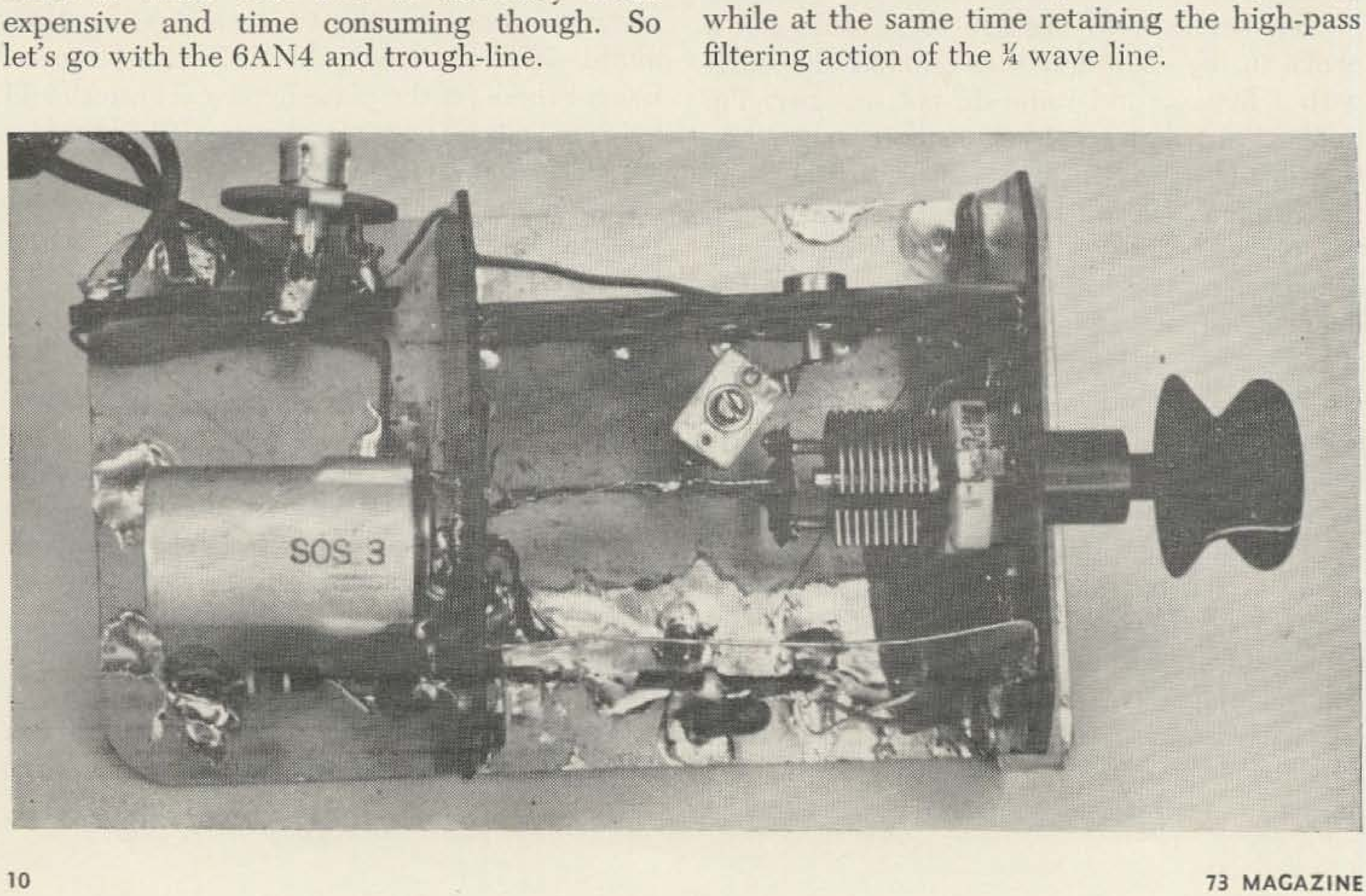
Series tuned quarter wave trough-line

A second low-cost easy-to-make 432 megacycle rf stage is described. Featured in this one is the use of a 50 mmfd variable capacitor for tuning on 432 megacycles. It functions somewhat like the big capacitor in a pi network.

Delving further into the mysteries of rf amplifiers for 432 megacycles, we were pondering on series tuning for a ¼ wave line. Using a 6AN4 and a small 50 mmfd variable might be a neat simple way to do it. Of course, your present writer's liking for clean sharp resonant tuning presents difficulties on 432 megacycles, especially when a "build-in-a-day" unit is proposed. In one sense it is a lot easier to take a disc-seal tube (nowadays called a planar triode) like the 7077, and put it into the end of a plunger-tuned cylindrical cavity and make it work OK. This is definitely more expensive and time consuming though. So let's go with the 6AN4 and trough-line.

The schematic is shown in Fig. 1. Note that this is essentially a ¼ wave line. I say essentially because it is actually a little longer, being series tuned. The theory behind this deal is quite easy, really. If Cv was 1000 mmfd at 400 megacycles, the line would be a true ¼ wave line. (anyway, 99.99%) However, as you go lower in capacity the line begins to tune, that is, increase frequency a little. In the 50 mmfd region as shown, the 432 megacycle tuning is quite nice and spread out.

Note the choke coil attached to the cold end of the line. That is, it is almost cold, but gets hotter with rf as you tune towards 500 megacycles. This unit is also FB for 440 ATV work. (Amateur Tee Vee, Junior) Note that this circuit has also nicely avoided the always troublesome feature of plate line bypassing, while at the same time retaining the high-pass filtering action of the ¼ wave line.



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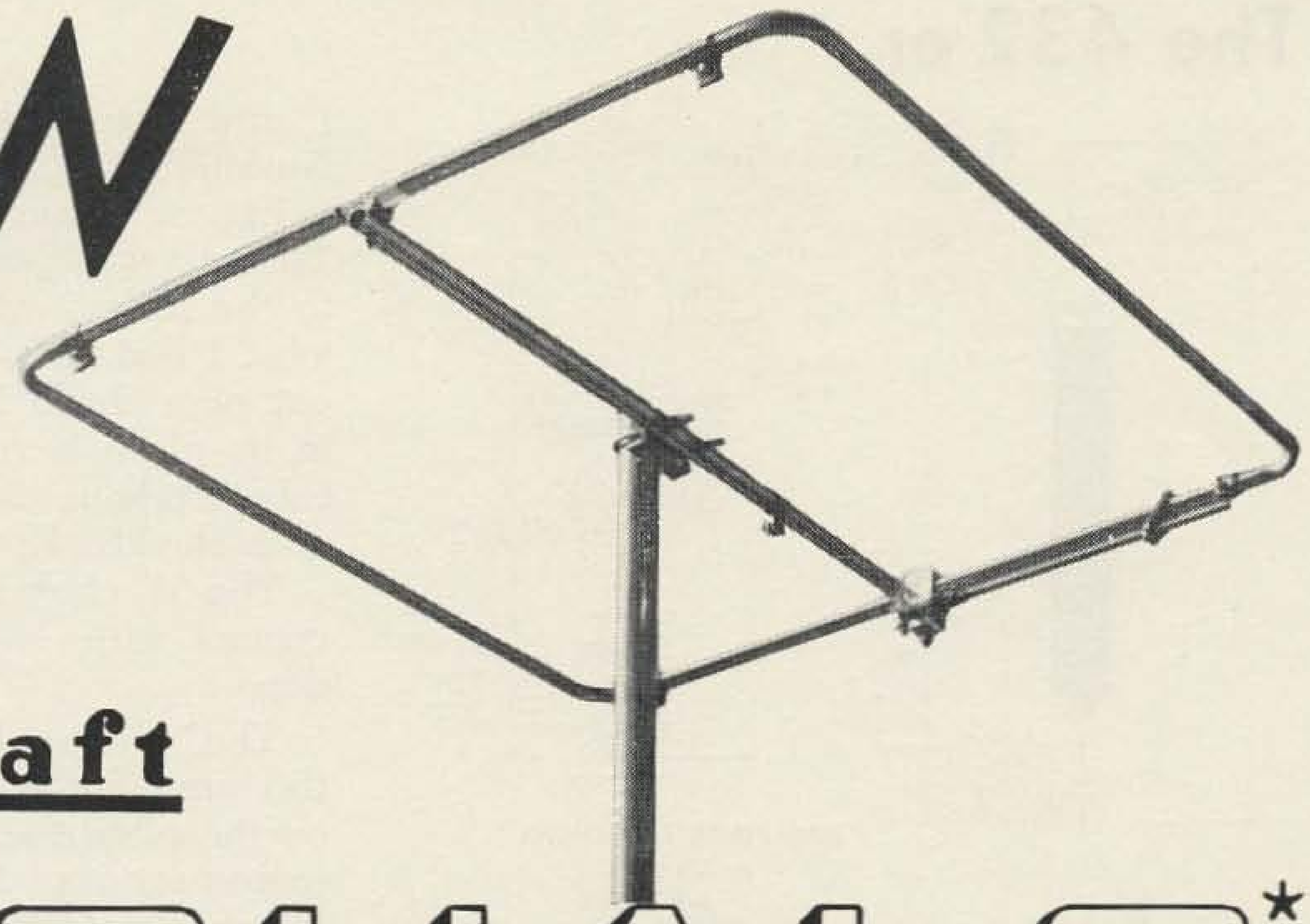

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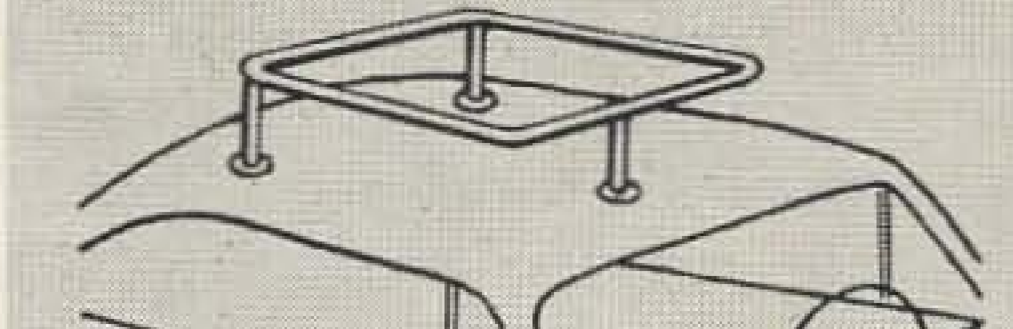

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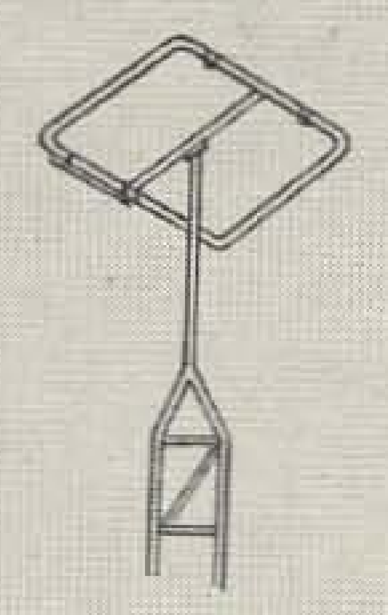
ON A MAST



*Pronounced Squaylo

Cush Craft

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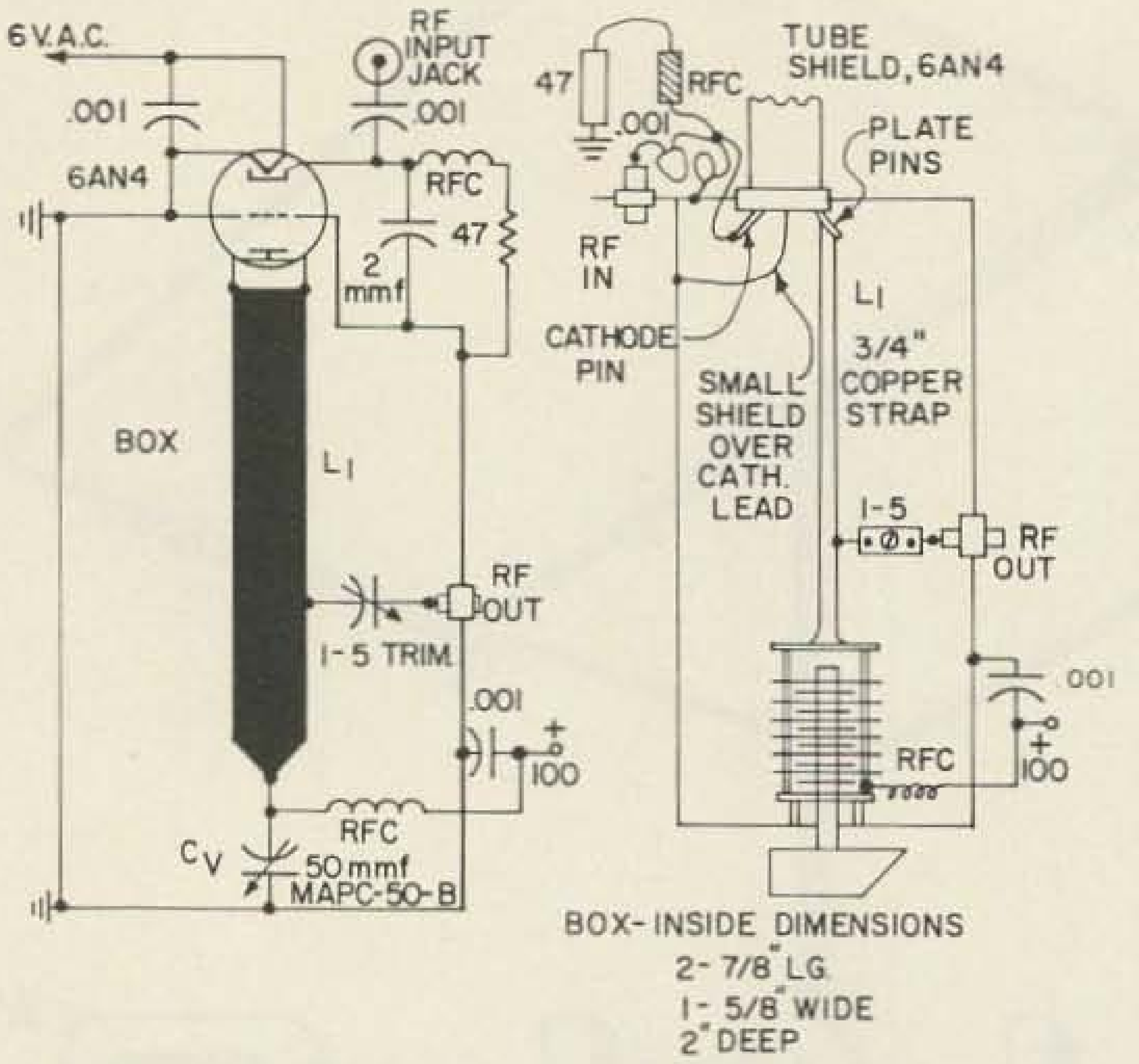
The 432'er



Schematic and top view of 432 mc rf amplifier.

The 6AN4 has only 7 pins which makes it easier to work with than the 9 pin 6AM4. It can use more voltage than the 6AM4, but about 100 volts is plenty. It is also supposed to be a more "modern" tube type. I might mention here again: rumors of Nuvistor difficulties such as short life, increasing noise figure, and Military spec delays. I repeat these are only rumors, as far as I know. Maybe somebody can let us know for sure about this? I sure would like to know as I have some Nuvistor units in the works myself.

Fig. 2 shows some top view dimensions. The two grid pins are bent back and soldered to the socket, which is one of the *thin* UHF jobs. I had to take the thick porcelain socket out of a shield holder and put the thin one in its place in order to get a shield over the tube. Perhaps these sockets are now available with shields. How about that, Socket People?

The rf chokes are some 20 turns no. 22 enamel wire, on 3/16" forms, held with coil dope.

The photo shows how relatively simple this amplifier is to make up. With 100 volts on the plate the mils should be about 6—well under ratings. The gain is 20 db or over, which should do FB to set the noise figure of the mixer and first *if* following.

Most of the other items brought up in the article on the 6AM4 apply here also, such as usefulness in the 432'er, etc.

Note that this is not a completely shielded planar job, and there is a slight amount of regeneration when L1 is unloaded. Remember, this is quite high-Q circuit, with the output cable disconnected. With 50 ohm cable matched in and going to the mixer it is quite stable, however, with no need of neutralization.

Tuned Trough-Line Mixer

Bill Hoisington K1CLL

Continuing the receiver section of the "432'er," the tube mixer naturally comes next. 6AM4's, 6AN4's, and my favorite 1200 megacycle tube—the 6AF4 or 6AF4A—were tried. The 6AF4 won out here, with noise about equal but more gain and better tuning. The large number of grid leads and the larger grid structure itself (of the two grounded grid type tubes, the 6AM4 and the 6AN4) probably account for this.

Table one shows comparative results of the crystal mixer, the tube mixer, the crystal mixer with rf, the tube mixer with rf, and—just for fun—the tube mixer with two rf stages.

Further tests on the air with the completed front end of the 432'er are described in the next section. The tube mixer with the rf stage works very FB. Resonating the rf stage shows plenty of "life," bringing up the noise about 1½ S units, and the signals even more.

The two trough-lines (see previous section on rf stages) can be built together with a common wall if desired. Of course, as a "permanent experimenter" my receivers are almost always in sections.

Construction follows along the lines of the rf stages already built, and uses a ¼ wave trough line, series tuned with a 50 mmfd

TABLE I

Front End	Morrow "S" Meter
Crystal mixer	8.4
6AF4 mixer	9 + 2.5 D.B.
Crystal mixer plus R.F.	9 + 10 D.B.
6AF4 mixer plus R.F.	9 + 14 D.B.
Ditto, plus 2nd RF stage	9 + 26 D.B.

capacitor which handles well on 432 megacycles; using it somewhat as the large capacitor of a PI network. See Fig. 1. This capacitor also serves as the grid capacitor with the grid resistor tied to the cold end of the line.

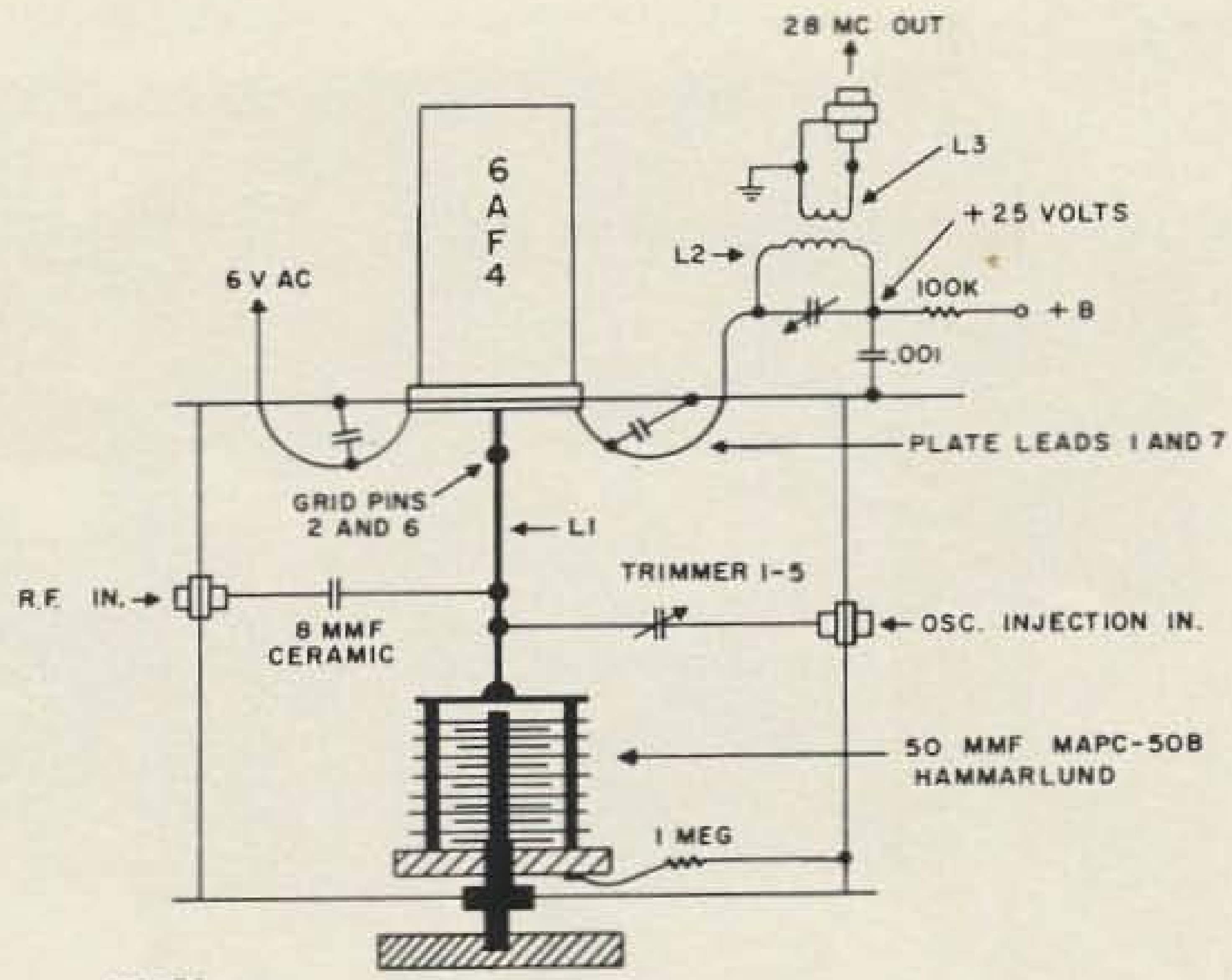
Both inductive (loops) and capacitive input circuits were tried. Not too much difference, so capacitors were used. They are also more readily adjustable, for loading and matching.

The 432 megacycle rf is bypassed out of the two plate leads of the 6AF4 with a small 5 mmfd to ground on each plate. See Fig. 2. The tuning of the 28 mc output plate coil, of course, includes that 10 mmfd.

Adjust the link, L3, for your receiver and the cable. I use RG-58/u everywhere, but suit yourself on that. With links, the cable may be of any length. On 28 megacycles, three turns of tight coupled link is too much coupling. Two turns for L3 at the cold end of L2 is about right, but check with a little looser coupling if L2 does not peak up properly.

The plate voltage of the 6AF4 was given special attention, which was justified by the results. Do not use more than 25 volts, with some 1 to 2 mils current. This is by far the most sensitive operating point found here under test with DX signals.

The local oscillator chain, which follows this article, using two 12AT7's in a doubler chain, ending up on 404 megacycle in a high-



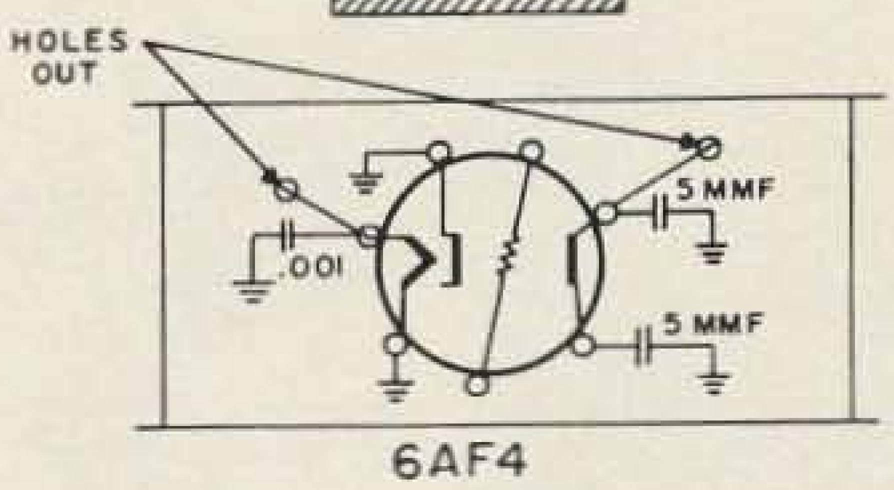
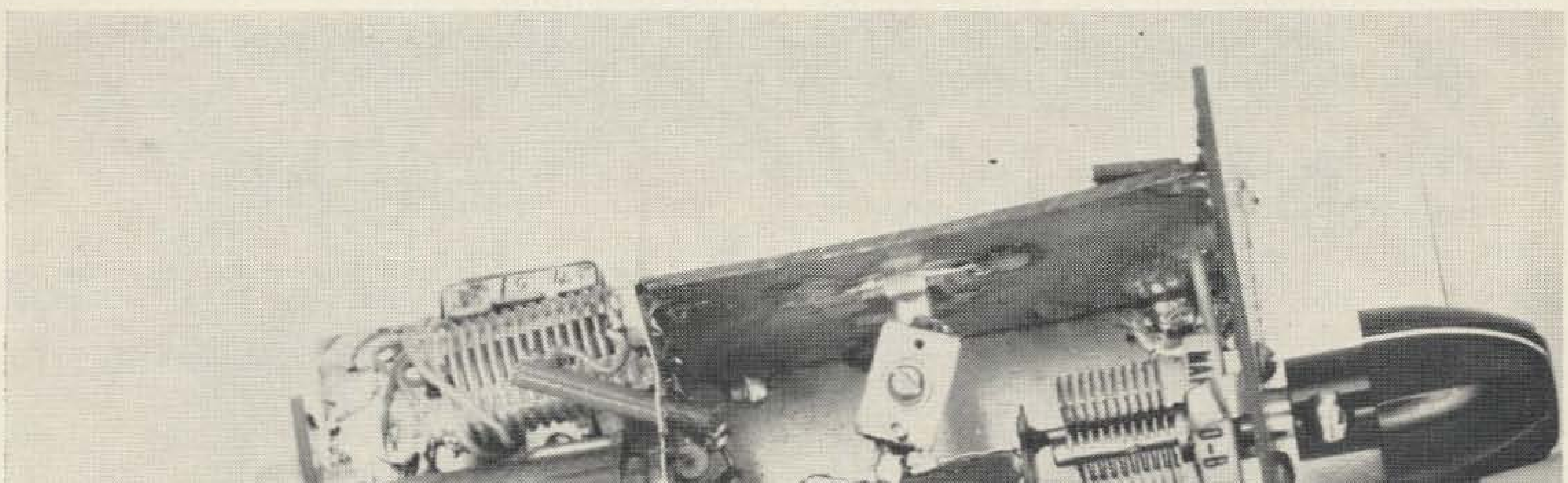
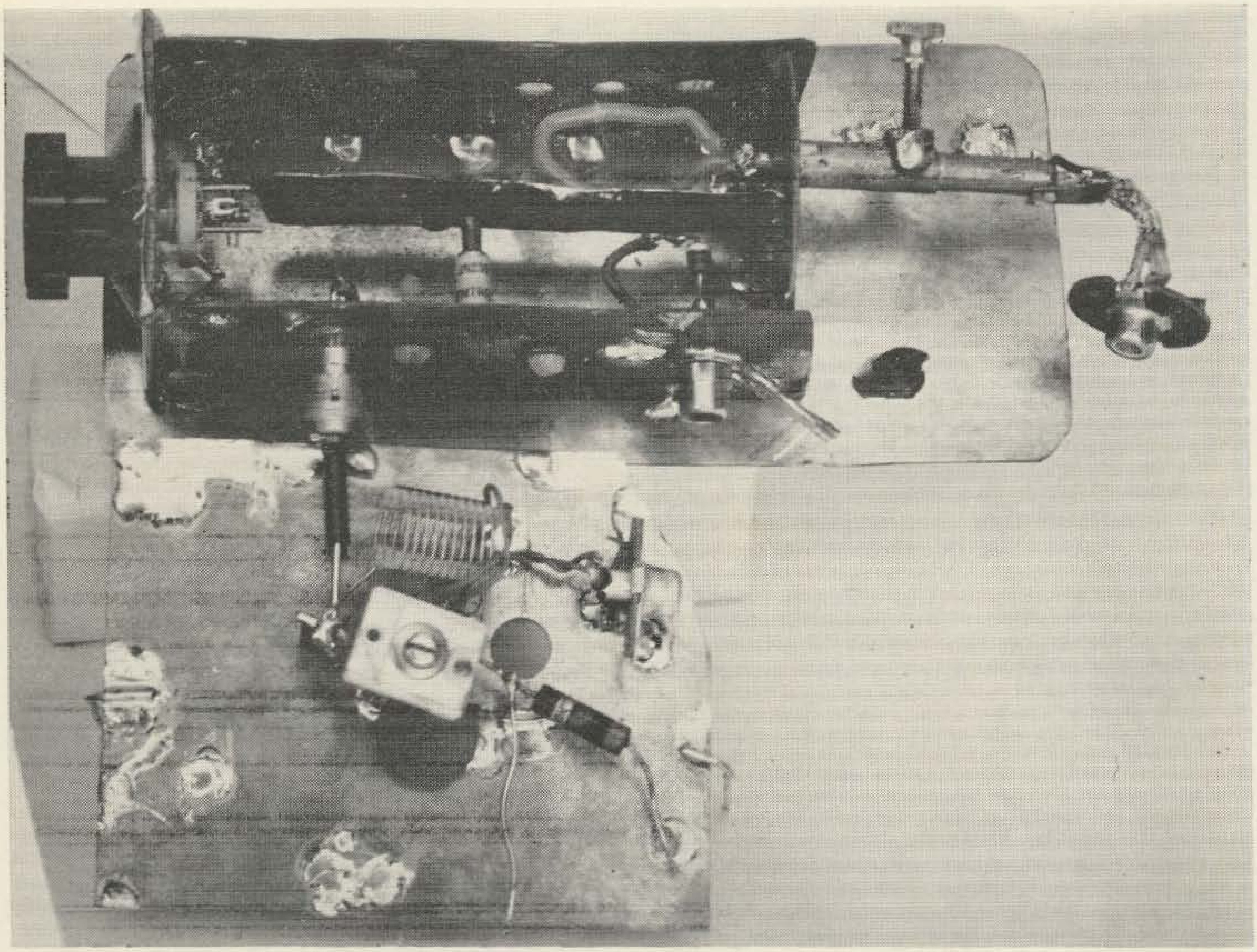


Fig. 1—Top view 6AF4 Mixer—432 mc. Note: Grid strap L1 is 1½" long by ¾" wide. Trough-line is 2⅝" long by 1⅝" wide. I.D. Walls are 2" high. L2 is tuned to 28 mc, 12 turns airwound, 16 per inch. L3 is 2 turns around cold end

Fig. 2—Inside rear wall detail of 6AF4 Mixer, 432 mc. Note: The bypasses shown must be small and use short short leads. Both grid pins, 2 and 6, are soldered to L1.





pass small parallel-tuned strap line that almost completely eliminates the 202 megacycle energy. About 150 volts is used on the 12AT7 L.O. chain. This also suits the rf stage but is not critical.

Again I would like to mention the question of tube versus transistors for amateur use. There appears to be considerable trend towards transistor UHF circuits in the Tee Vee world. But even here one large manufacturer puts out a UHF front end in two models; one with a tube oscillator and one with a transistor oscillator—both using the same preselector and crystal mixer. So you see, it's your choice—at least for the present. Personally I'm not sure myself which I will prefer eventually.

Incidently it is very interesting to note that some of the Tee Vee front ends "steal" the plus 12 volts for the transistor oscillator from the regular 150 volts supply in the set! This, of course, is possible because of the NPN silicon transistor used. Just remember when transistors have an "N" at the beginning and end, like NPN, they may be considered to conduct with electrons which need a positive voltage to attract them, like the plate circuit of vacuum tubes.

So, that winds up the tube mixer stage.

. . . K1CLL

CORRECTIONS

Dear Wayne,

Please refer to May 64 "Inboard Calibrator for the NCX3 article." What is the value of the unidentified resistor?

Tnx, H. Stephens, WA6UWT

The unidentified resistor is R3 and its value is 22K.

Dear Wayne,

In response to my article in May 64: No power Supply tube type is given, but if terminals 2&7; 3&4; and 5&6 of the tube socket are connected together, the lucky novice may use a 5AU4, 5AW4, 5R4 5U4, 5AS4, 5V3, 5V4, 5X4, 5Y3, or 5Y4 depending upon which is subject to scrounging.

Robert Sressel K1WXY

Dear Wayne,

W1MEG's article on the TS-118A/AP watt meter had an error. You cannot use this as a dummy load on frequencies below 20 mc by disconnecting the meter M201 at jack J202 for there is a 5 uh choke bypassed with a 500 mmfd capacitor from the 50 ohm line to J202. This choke and bypass must be removed to use it below 20 mc or zap. This can easily be done by removing J202 and unscrewing the choke through the hole.

Nick Skeer K1PSR

The 432'er

Local Oscillator Chain

Bill Hoisington K1CLL

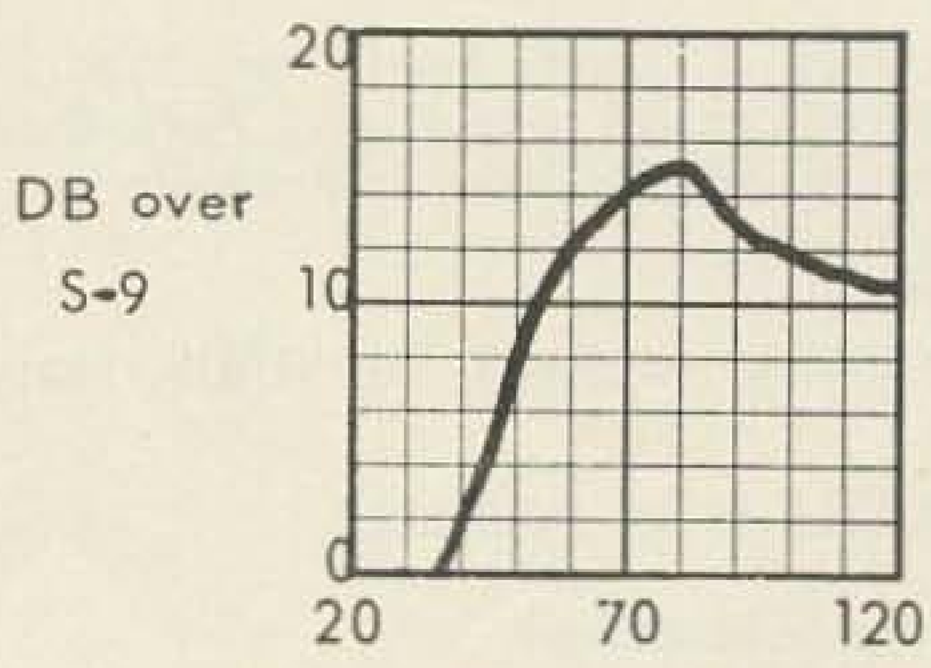
There is "solid" controversy on the question of "Tubes Versus Solid State." With higher power for 432 and 1296 definitely here, and climbing, the danger of transistor deterioration when used near transmitters is still with us. Granted, protection means are available, but at increased cost and complexity. Some *tubes* need protection too! It appears that Nuvistors *may* be among these! The subject of receiver *vulnerability* and protection is a study in itself, to be gone into later.

L. O. Chain

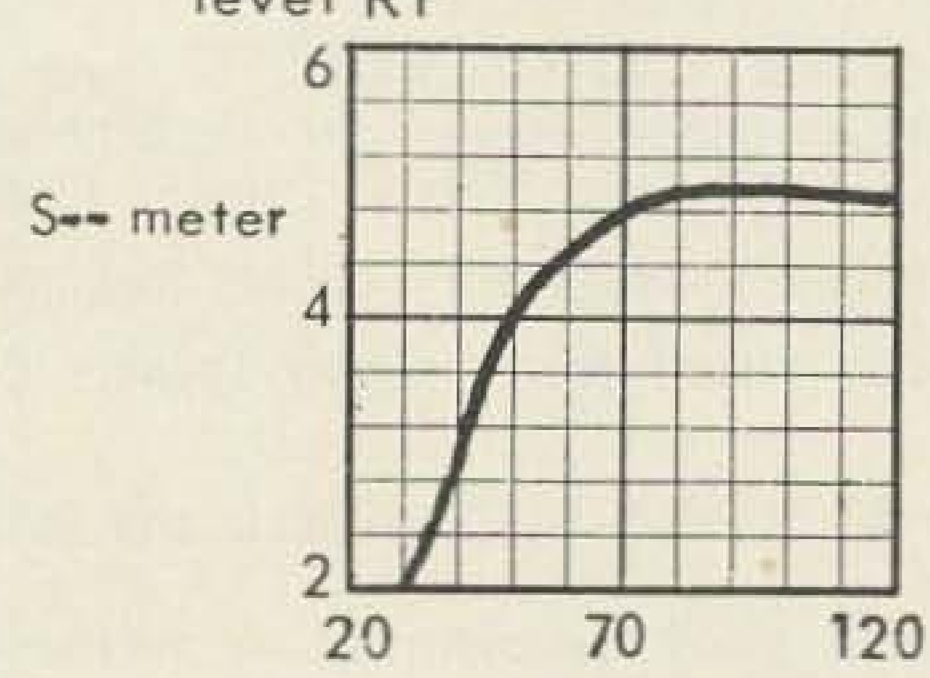
Success with strap-line circuits to 1300 megacycles using transistors and 6AF4 tubes recently (just look in 73) gave us some new ideas on how to build low-cost, easy-to-make versions for 432 chains with the "lowly" "ever-present" 12AT7's. Plenty of circuits to 400 megacycles have been shown using the same, but the ½ wave line can be subject to considerable 200 megacycle feed-thru into the final tank. The use of sheetmetal B plus bypass capacitors, combined with ¼ wave strap line and 50 megacycle crystals, works out quite well. We were able to build the following crystal controlled local oscillator chain for the 432'er in less than a day.

Again, with a preference for fool-proof, *good* operation, the four circuits operating as shown in Fig. 1 put out 500 microamperes of good clean rf on 404 megacycles with *only* a 25 volt plate supply! (See curves below for best operating voltage.) I do not like oscillators or circuits that are running maximum or over dissipation in order to keep going. For example, the 6AF4 is a FB tube, and still works well in the 1100 to 1300 megacycles region as a tuned oscillator. But over 1300 the dissipation is climbing rapidly and the plate mils for oscillation go up. It still lights a bulb with rf at 1296 megacycles, but at about 1500 megacycles it is all through. So the low-voltage test is always a favorite of mine. Funny thing about Super-Hets. Somewhere in it there is always an oscillator or two, and these had better be *good* ones. Again, the emphasis is on easy-running ones, *without* much *voltage* in them. So the above chain, which will loaf along FB with only 50 volts B plus, qualifies.

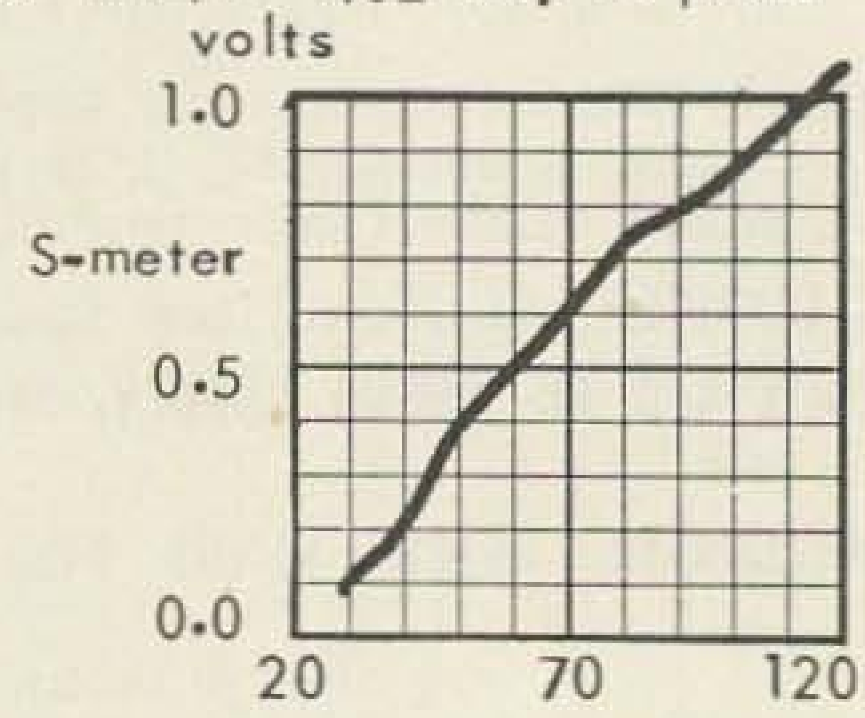
CURVE 1 'S' Meter Vs overall plate volts



CURVE 2, 'S' Meter vs plate volts, low level RF



CURVE 3 RF output 432 mc, vs plate volts



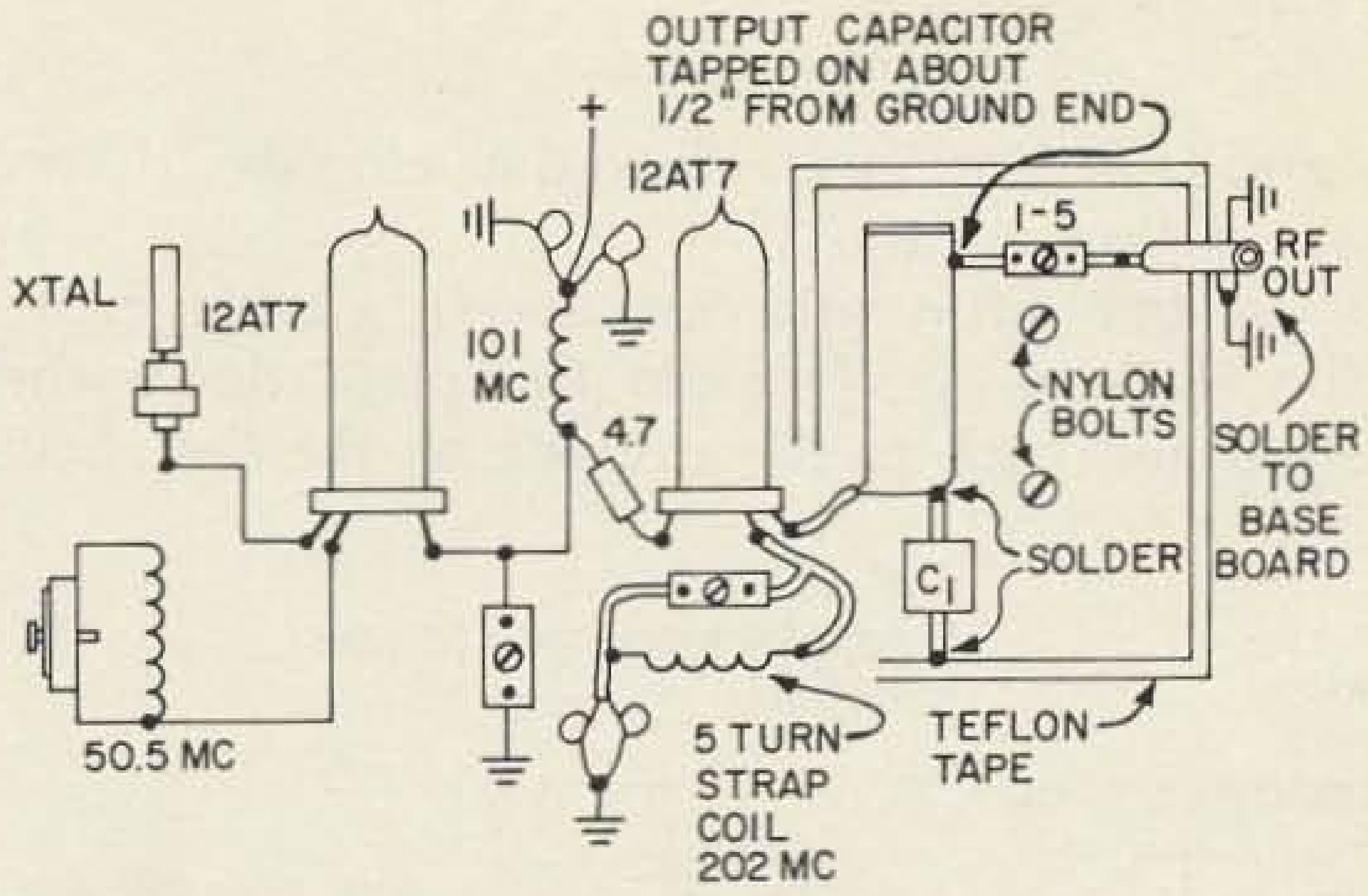
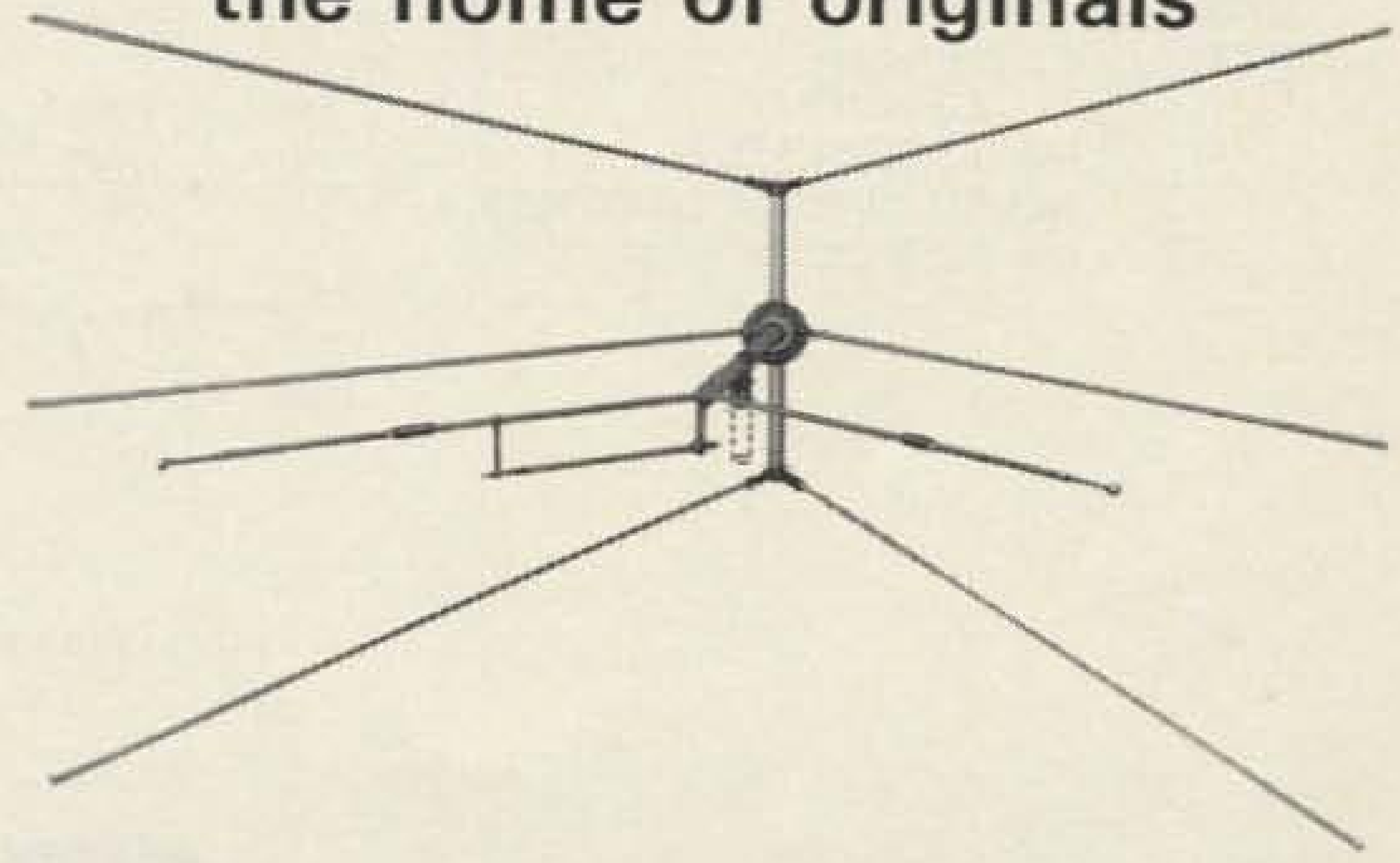


FIG. 2 GENERAL LAYOUT, TOP VIEW, 404 MC LOCAL OSCILLATOR CHAIN

Actually, more can be used—anywhere up to 250 volts, at which point a 120 milliwatt bulb can be lit on the plate circuit. Careful checks have been run on the amount of oscillator injection needed, with both tubes and crystal, and these tests are greatly facilitated by an efficient L.O. chain with variable B plus. These tests are already done by yours truly, and it is *not* necessary to repeat them unless you *want to.* (See below)

The oscillator circuit, (see Fig. 1) using ½ of the first 12AT7 and a 50.5 megacycle crystal uses a *regenerative* grid circuit. The *degenerative* coupled crystal phase reversing circuit, used with transistors and pentodes, works with the 12AT7's, but more output is obtained with the *regenerative* coupling. I have checked about a dozen crystals around this frequency and they all work the same. The doubler stages—50.5 to 101 and 101 to 202 megacycles—use well known simple circuits. Just use the capacitors and coils shown and check carefully for *desired* frequency versus *undesired* frequency, with absorption wavemeters and tuned power detector units, and you can't miss. Just for fun we tried copper strap for the 202 megacycle plate coil, and it has 5 turns, or one *more* turn than the 101 megacycle coil! Part of that is the smaller diameter, but also it shows the low inductance value of strap coils!

The 202 to 404 megacycle stage needs a little more care. Notice that at 202 megacycles the plate coil already uses strap and has only 5 small turns. Putting down a good plate inductance return, or B plus bypass, in combination with a ½ inch copper strap will do the job. The "Hammerlund type MAC helps



too! The point to observe here is that the rf wave (not the electron path!) flows down the plate inductance and must get back to the starting point, which in this case was the cathode. Watch out for that. In grounded-grid, "grid-wall," or "grid-separation circuits" different action occurs.

In our little 404 megacycle circuit here, the rf flows nicely from the plate down the strap and back to the cathode on the flat sheet

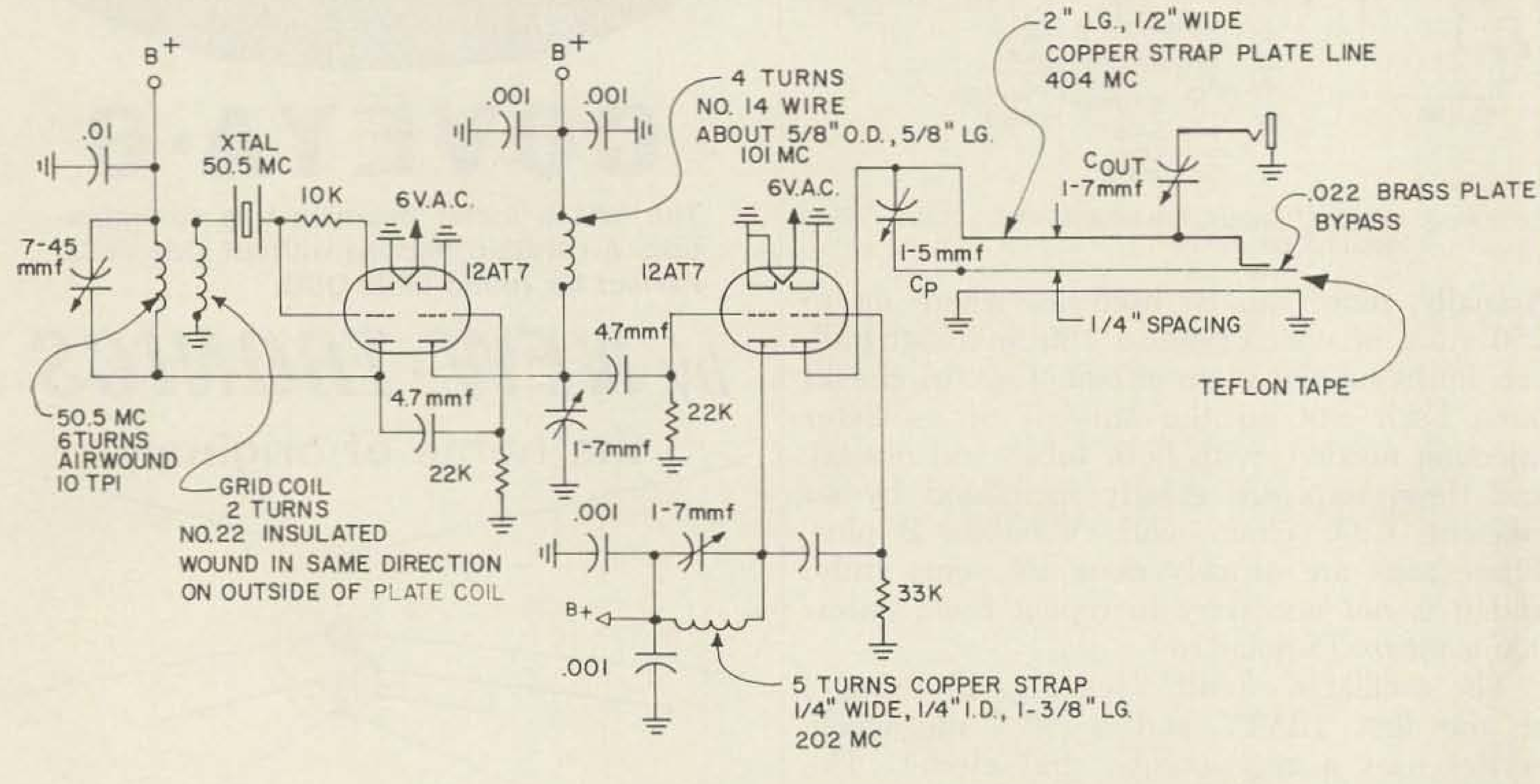
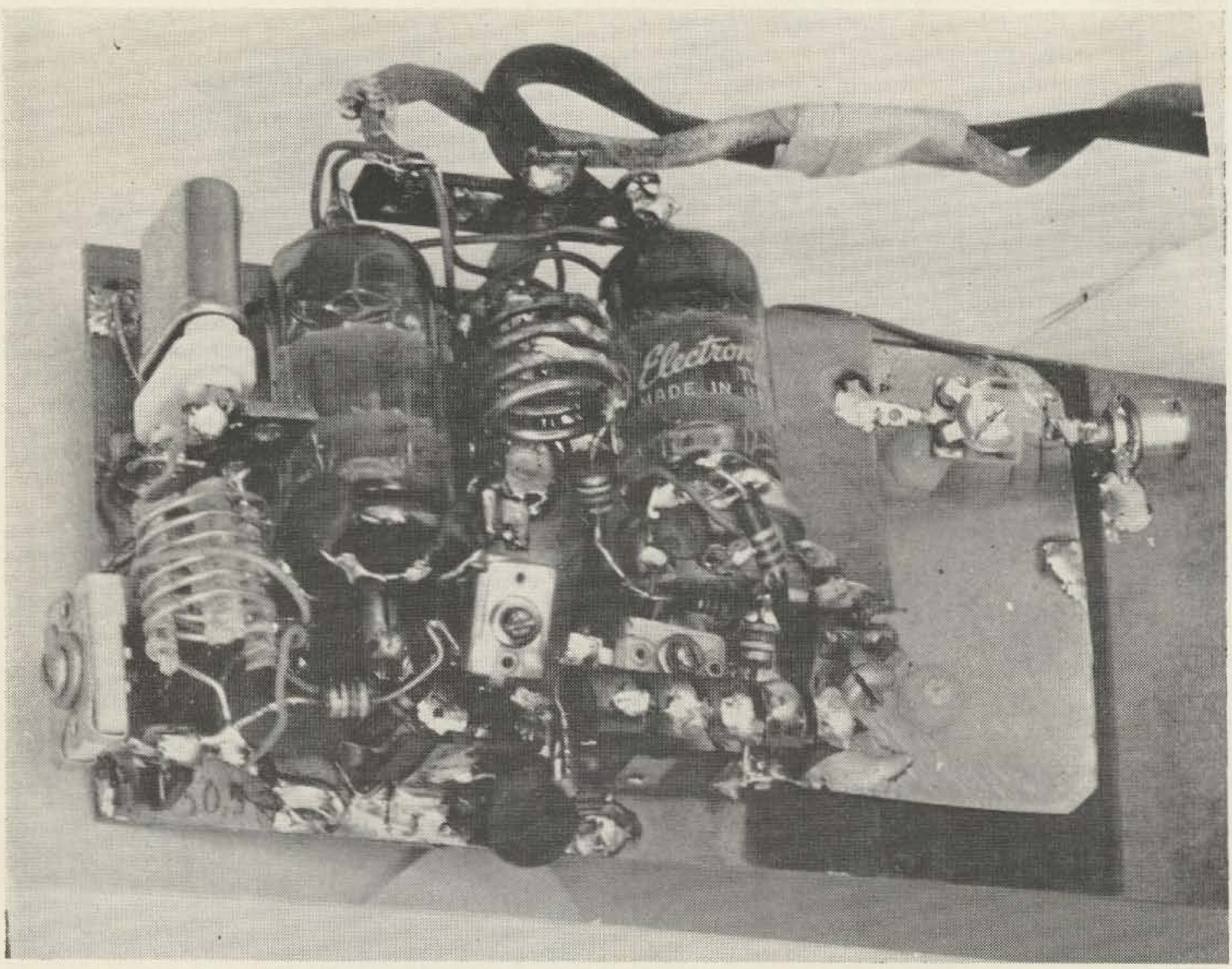


FIG. 1 12AT7 LOCAL OSCILLATOR CHAIN, 404 MEGACYCLES



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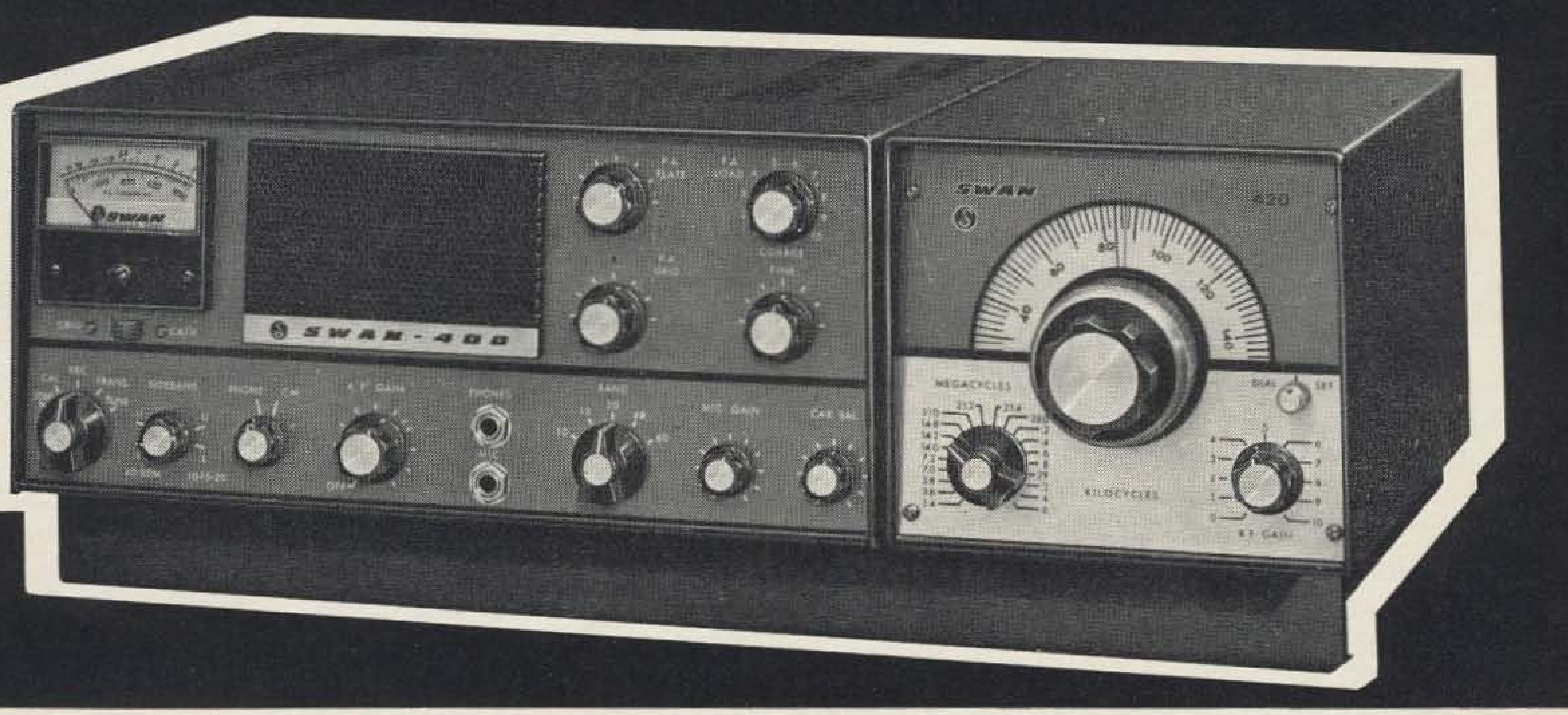

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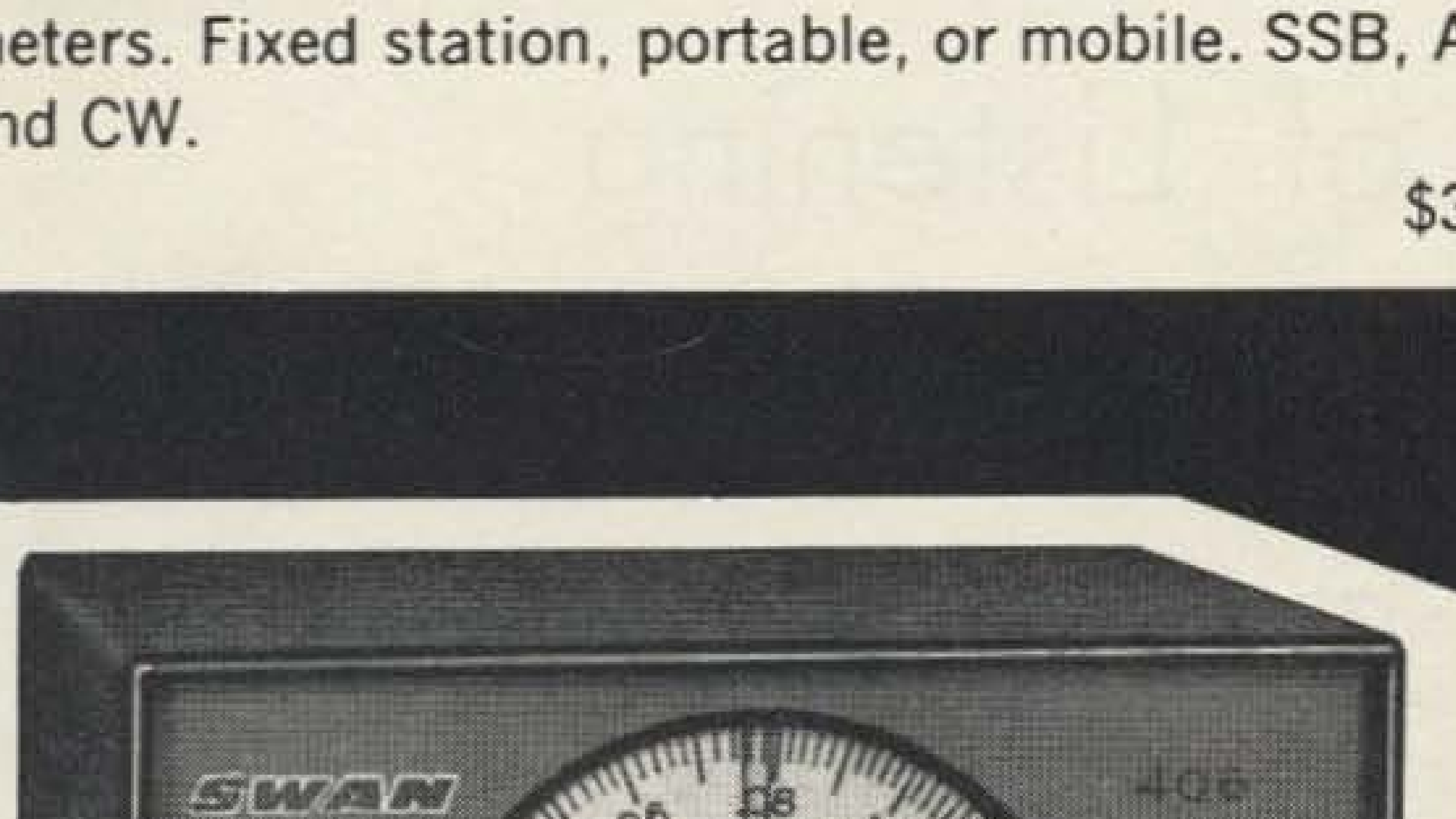

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The 432'er

brass capacitor which also forms part of the plate inductance.

Note carefully that if you leave this line "float," as a half-wave line (longer, of course) with a small capacity on the far end, it is a perfectly legitimate 404 megacycle circuit—but you can get a *lot* of 202 through it. If you use it as a ¼ wave circuit, bringing the sheet bypass back to the cathode, (rf-wise, that is) you have a high-pass circuit which cuts off at 400 megacycles, and little 202 shows in the output.

Well, that's pretty near all the fine points. The output cable matching capacitor works well. You will find an intriguing point here. No matter how you tune the plate line, a much greater output will be found with C-out at the proper point. Of course, both capacitors work together, near this point, but the influence of C-out is very apparent.

The old reliable No. 49 Mazada pilot light, 2 Volts - 60 M.A. (120 milliwatts if my arithmatic holds) will light from the 404 megacycle rf when about 250 volts of B plus is applied to the chain. This is still under the dissipation of the 12AT7's but no such amount of milliwatts are needed for L.O. service.

The proper amounts of oscillator rf for the crystal mixer are shown in the attached curves.

Careful checking for crystal oscillator stability versus sensitivity (see the attached curves) shows that little or no regeneration is needed. Looking at both the chains finished, I find no more than two turns are needed.

Pursuing the ultimate goal of making up a good, low-cost, 432 megacycle complete station, we checked operation of the tube L.O. chains with the crystal mixer previously described. The results are shown in curves 1 and 2. Curve 1 shows B plus voltage (for the whole chain) versus S meter readings. This is on my Morrow Receiver, (a 13 tube job with 6 tuned stages at 200 kc, fairly representative of a "Receiver-type I.F." at 28 megacycles,) using an "S9" signal from the underfed mixer at 30 volts, to the best region of around 80 volts, and then a slight drop-off at plus 120.

For a check on a weaker signal, curve 2 was run. Note that this also peaks on 80 volts but is flatter up to 120 volts.

Curve 3 shows the rf volts out of the L.O. chain corresponding to the B plus used.

These rf volts were measured as dc voltage output of the tuned 432 megacycle power detector previously described.

Bill Hoisington K1CLL

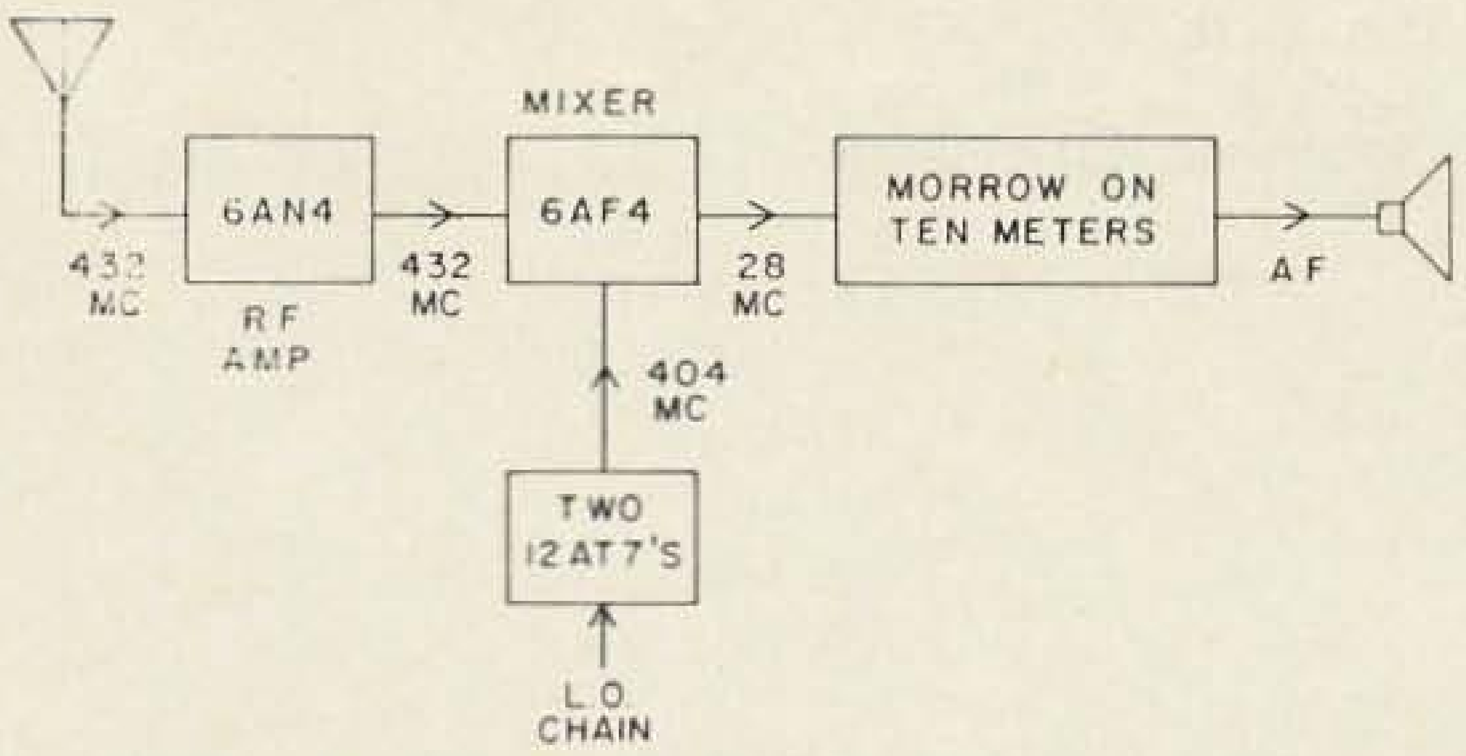
First Evening of Listening on 432

Needless to say, I approached the first on-the-air trial with considerable anxiety. You've planned and worked on everything—crystal-controlled signal generator, infinite attenuator for "DX type" signals, cable matching (not perfect yet of course), rf stages with good gain and tuning, mixer ditto, local oscillator chain heterodyning away on 404 megacycles, Hammarlund receiver on the job on 28 megacycles—*but* will it work? It did!

Putting up a 14 element beam on top of one of the five foot sections, and one of the ten foot sections of the Tee Vee masting and a small rotator, with more cable than I like to see connected to it for a total of over 50 feet of RG-8/U, it (the cable) finally wound up on the bench.

The location here is 12 miles North of Boston, Mass., and is exactly 100 feet above sea level, so I call it average. The house is one of the comfortable old-fashioned kind with plenty of stairs! This does elevate the roof though. The beam is about 50 feet above the ground.

The rf stage, mixer, and L.O. chain were plugged together with RG-58/U and connected to a small 150 volt power supply. See Fig. 1. Another coax cable brought the 28 mc over to the Hammarlund and the dials were twirled. Sounded plenty "live." Took the transistor signal source out to the barn. Over S9 but not much directivity on the beam. Kind of like trying to peak a good two meter beam (horizontal) on one of those infernal ground-



BLOCK DIAGRAM 432 RECEIVER

planes that some well-meaning but misguided 2 meter lads get on the air with at times.

At 7 PM I started tuning for real. Soon a carrier came on, with some raucous almost intelligible modulation, clearing up some after a while. About S5. "W1EHF testing, Medfield, Mass. About 25 miles away. (What were you using Frank, transistors?) Incidently, you might be interested to know that that famous "Rhodydendron Swamp" is over 300 feet above sea level.

A little later Frank came on again, this time S7 and over. "W1BU calling CQ 432." Modulation very FB. QRM, low.

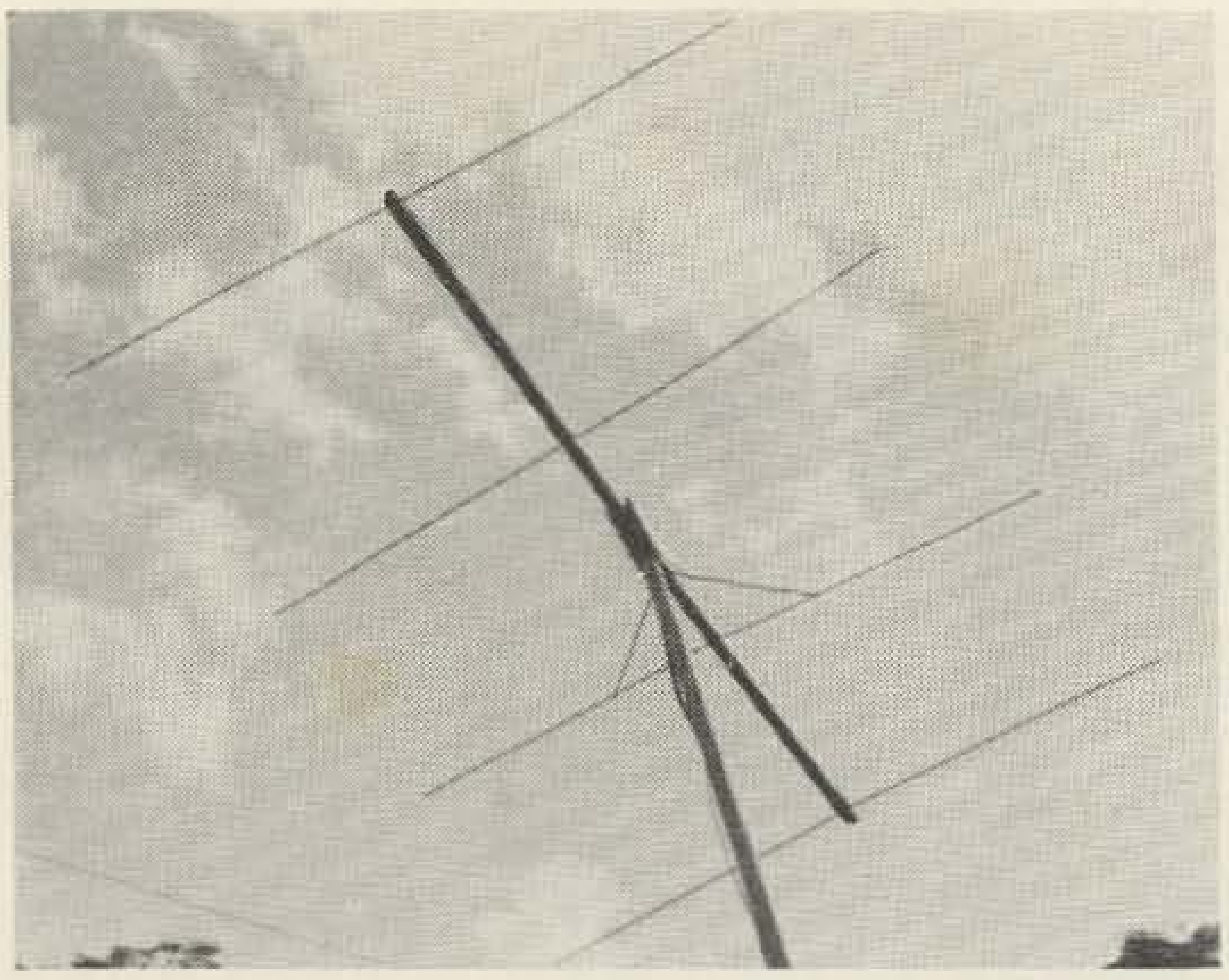
He is soon connected with W1QKA in Nashua, N.H., and gives out with both his own and QKA's kilocycles away from 432. This is the FB kind of info you need on 432. I might say they were mighty close to the black line of 28 mc on the Hammarlund dial also. With this information and putting the beam up N. W., I was able to find WIQKA also. Nashua is some 30 miles airline from Melrose, Mass.

After checking over the various units on the air and listening to as much news as I could at the same time about the 432 mc band, I heard mention of CW signals. Well, why not? On with the BFO Tuning close around 432 mc, I soon heard what I am sure was an SSB station in there, about 432.050. Could not quite identify. Then came the final reward of the evening. Nice CW signal with an exciting DX type QSB on it, "CQ de W1QWJ." He is in Springfield, Mass., down in back of Mt. Wilbraham and associated hills, some 83 miles away from my flat-land location.

The later part of the evening was naturally spent in getting together various transmitter sections. I *will* be on real soon now!

Note the *cost* so far. A 6AN4, a 6AF4, two 12AT7's, a handful of good Hammarlund small tuning capacitors, and a few copper coils and straps.

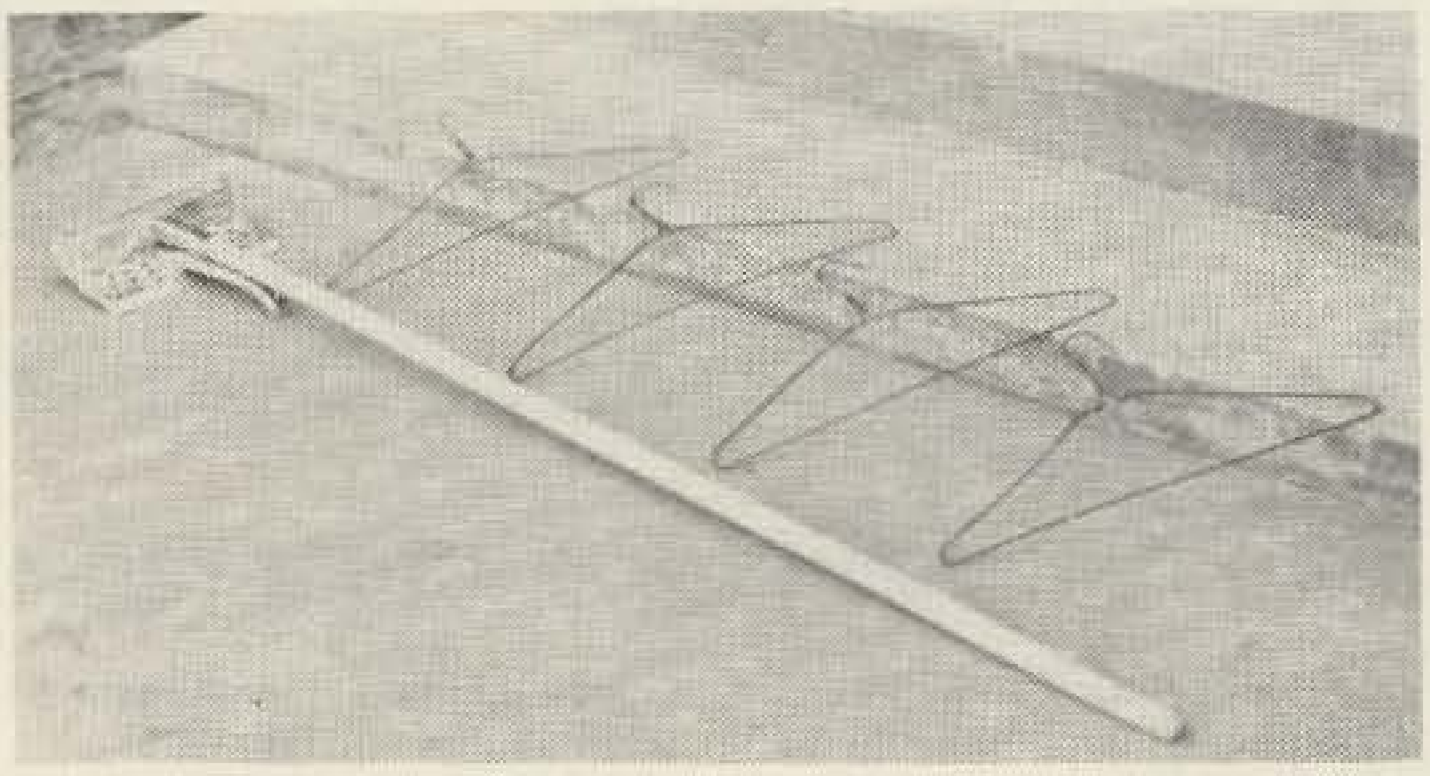
. . . K1CLL



Jim Kyle K5JKX
1236 N.E. 44th St.
Oklahoma City, Okla.

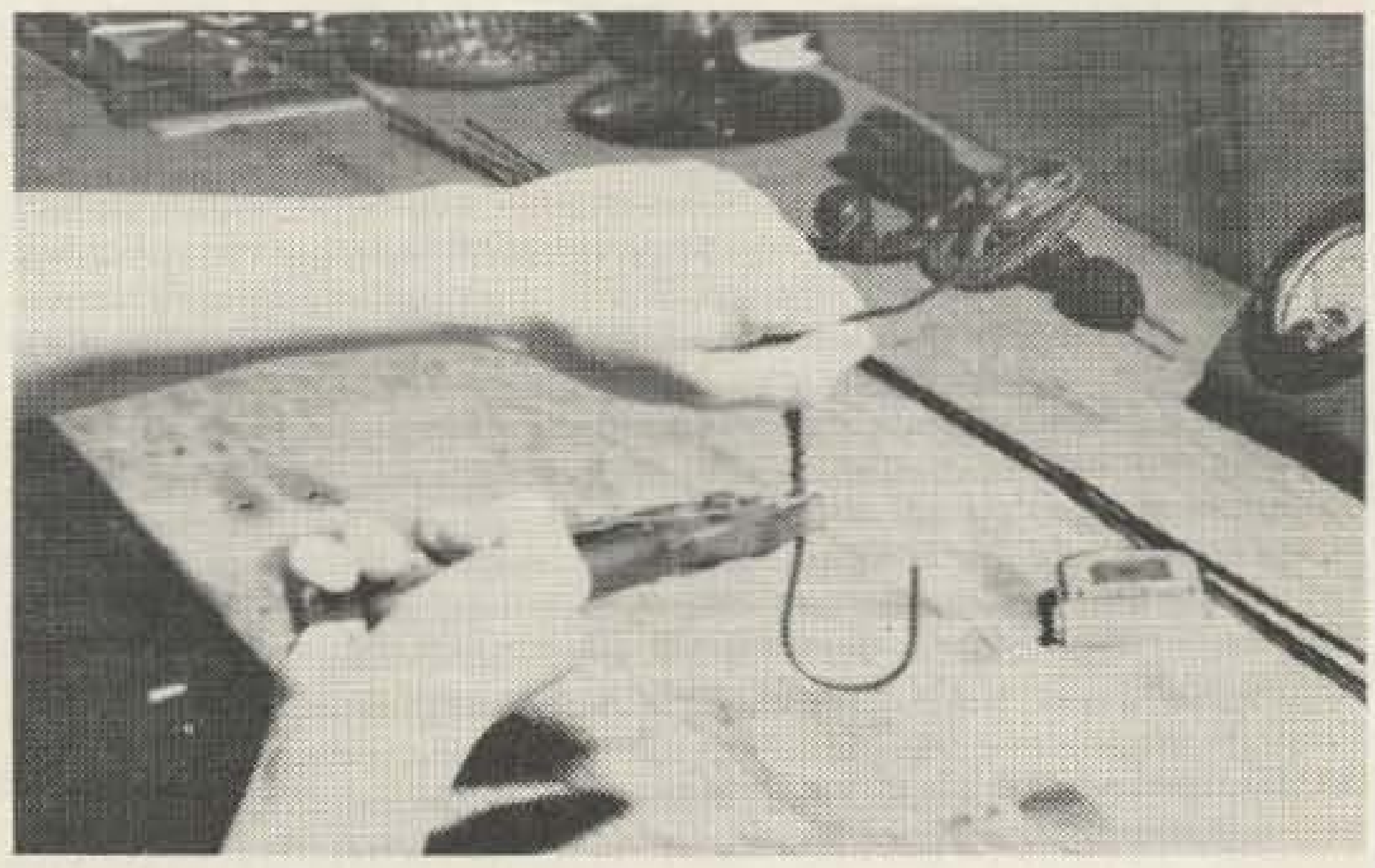
A two meter beam you can build in half an hour at no cost

The BH-2

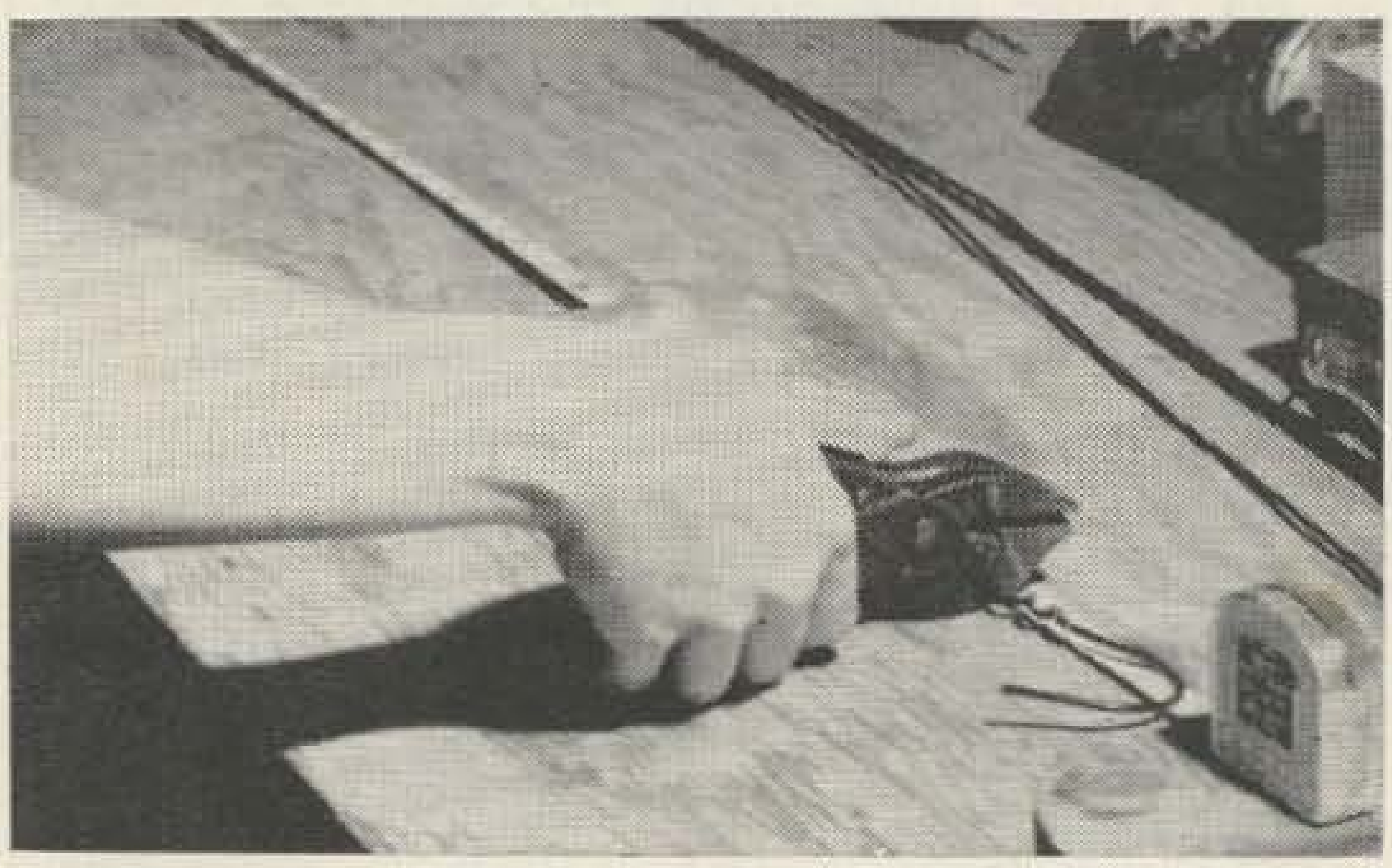


Dissatisfied with the range you're getting out of your halo or ground-plane on 2 meters? And short of the cash you think you need to put up a beam? Try the BH-4 then, for some 6 db power gain (equal to increasing your power by 4 times!). All you need to build one are the parts shown in this photo: four coat hangers and an old discarded broom or mop with a 4-foot handle on it. Cost—nothing. Time to build it—about half an hour.

These are the tools you'll need to build your BH-4: hand drill with 3/32-inch bit, pliers, tape measure, soldering iron, and file. You'll also need a hammer and a couple of nails to mount the finished antenna in place atop a second broom handle, and some ordinary insulating tape to fasten the lead-in wire to the supporting mast. Either twinlead or coaxial cable can be used for feedline, but twinlead is recommended since it has far less loss per foot.

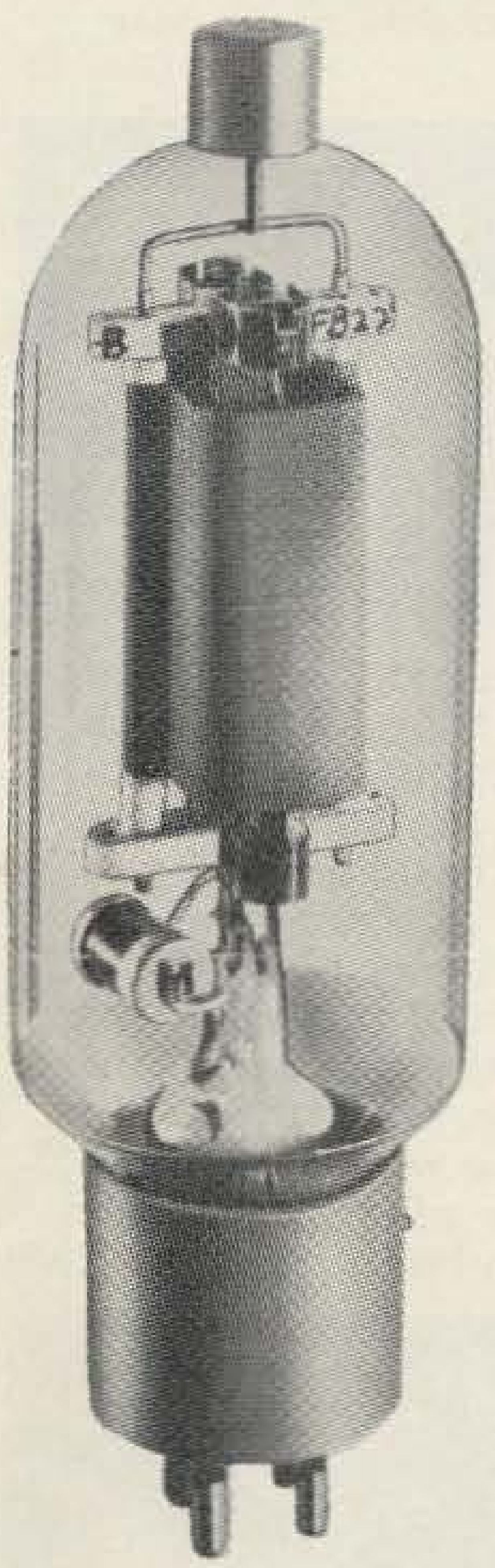


First step is to straighten out the four coat hangers; grab them with the pliers as shown here and twist gently. They will pop apart leaving a kinky portion which is very brittle; on two of them, flatten the kinks with care. On the other two the kinks may be cut off. This saves hangers if the first one breaks!



With all four coat hangers straight it's time to cut them to length. The longest one should be 40 inches tip to tip; the next one is 38 inches. The two shorter ones are 36 inches and 35½ inches long, respectively. The photo shows the shortest hanger being cut while the other three lay on the workbench.

WATERS UEW 572B HIGH POWER ZERO BIAS AMPLIFIER TRIODE



The Waters UEW572-B is a zero bias power triode ideally suited for use in grounded-grid linear RF amplifier service. The UEW572-B has a heavy graphite plate, is built in a hard glass envelope, and has a plate dissipation of 160 watts.

The UEW572-B may be substituted *directly* in equipment where 811-A tubes have been used, providing higher RF output and longer life.

One UEW572-B is the equivalent of two 811A tubes. Users of today's popular linear amplifier using 811A's will benefit from the high plate dissipation and considerably increased "power sensitivity." For example, typical performance of the UEW572-B in the Collins 30L-1 Amplifier is shown in the ratings under four tubes in grounded-grid service at plate voltage of 1500 volts.

GENERAL CHARACTERISTICS — Filament: Bonded Thoria Voltage 6.3 volts; Current 4 Amperes; Amplification Factor 170

Direct Interelectrode Capacitances: Grid Plate 6 uuf; Grid Filament 5.9 uuf; Plate Filament .8 uuf

Base: Medium Shell Small 4-Pin (A4-10) Overall Dimensions: Length 6.50 max.; Diameter 2.063 max.; Cap. C1-5

TYPICAL OPERATION 4 TUBES* Grounded-Grid Operation Volts, Plate 1500; Milliamperes, Plate 725; Driving Power, Watts 100; R. F. Output Power, Watts 800

*This data taken with Collins 30L-1 Amplifier, driven by Collins 32S-1 Exciter

AF OR RF POWER AMPLIFIER CLASS B (PUSH-PULL) MAXIMUM RATINGS D.C. Plate Voltage 2,750 V; Maximum—Signal D.C. Plate Current 225 ma; Maximum—Signal Plate Input 600 W; Plate Dissipation 160 W

TYPICAL OPERATION 2 TUBES D.C. Plate Voltage 1,500, 2,000, 2,500; D.C. Grid Voltage 0, 0, 0 V; Peak A.F. Grid-to-Grid Voltage 170, 160, 210 V; Zero—Signal D.C. Plate Current 60, 70, 80 ma; Maximum—Signal D.C. Plate Current 350, 360, 400 ma; Effective Load Resistance Plate-to-Plate 12,500, 16,500, 15,000 ohms; Maximum Signal Driving Power 5.5, 7, 8.5 W; Maximum—Signal Power Output 380, 530, 730 W.

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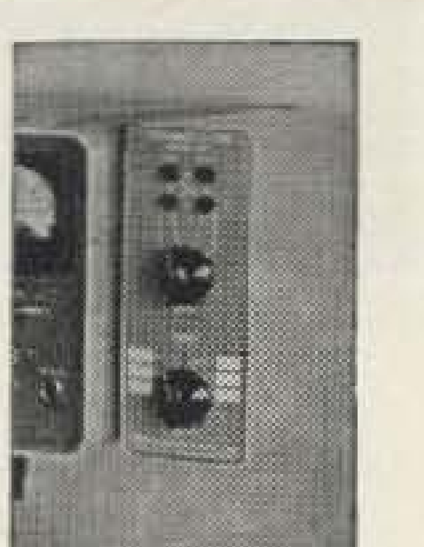

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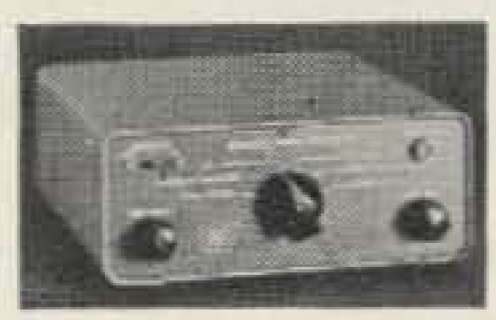

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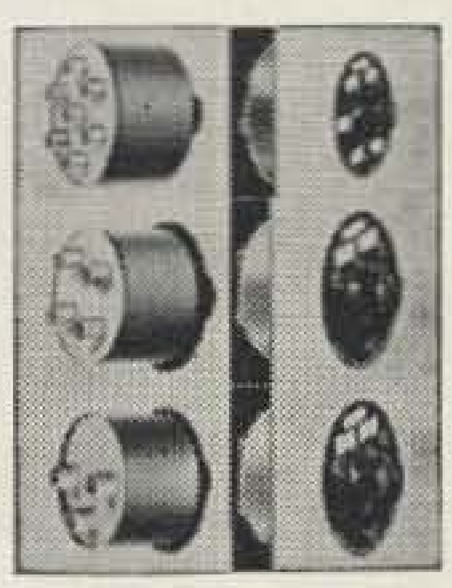

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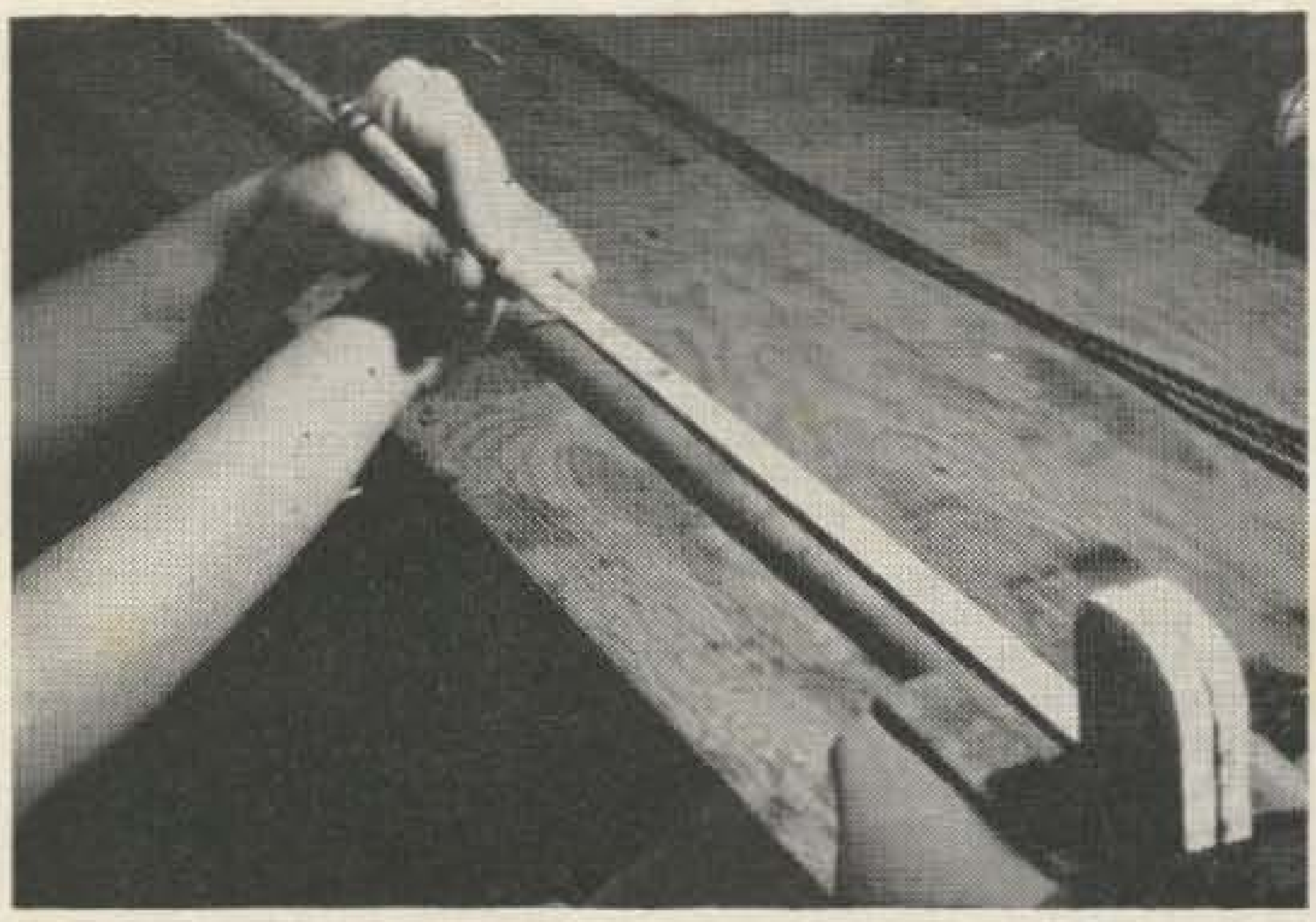
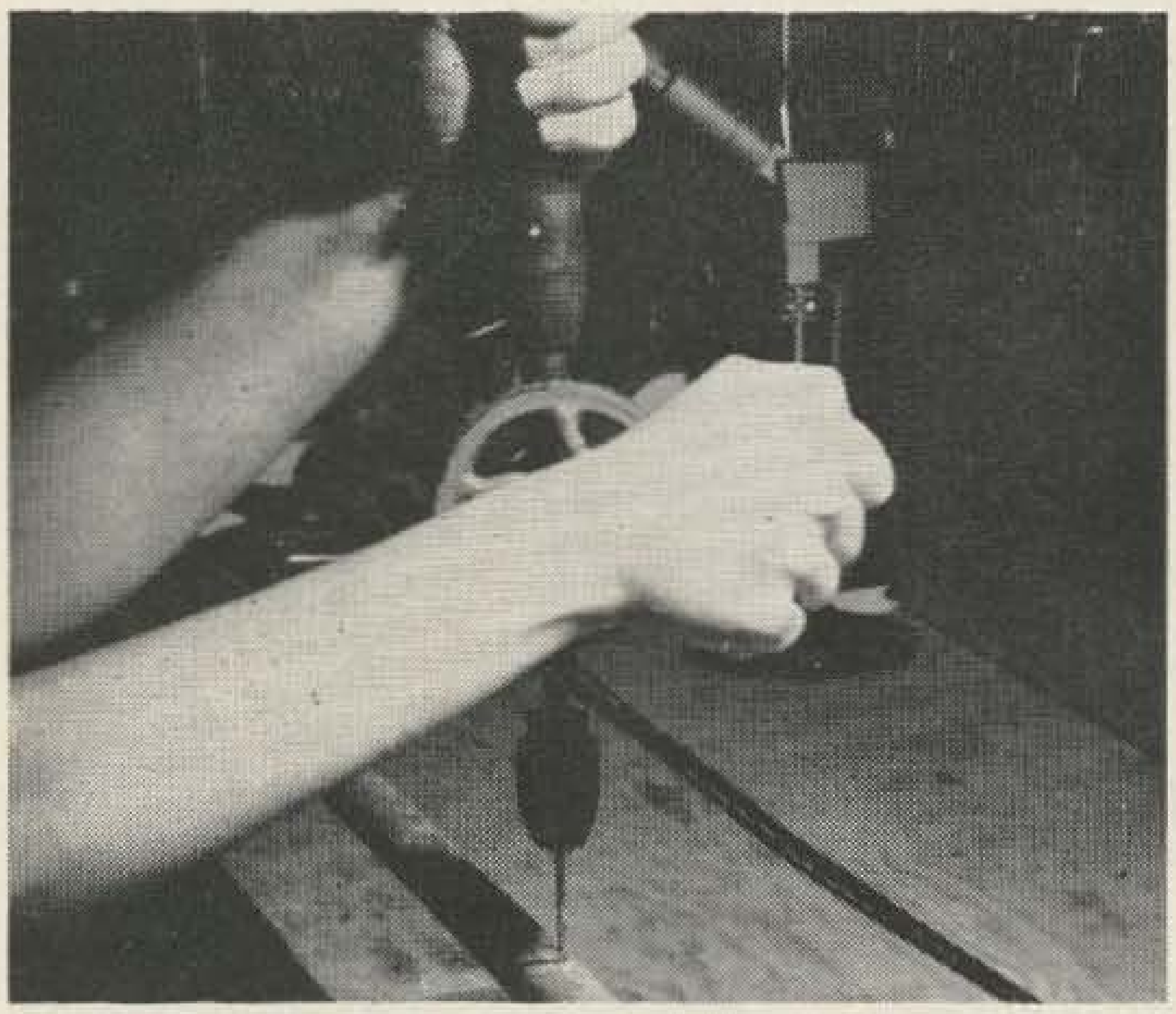
WATERS — WAYLAND MASS

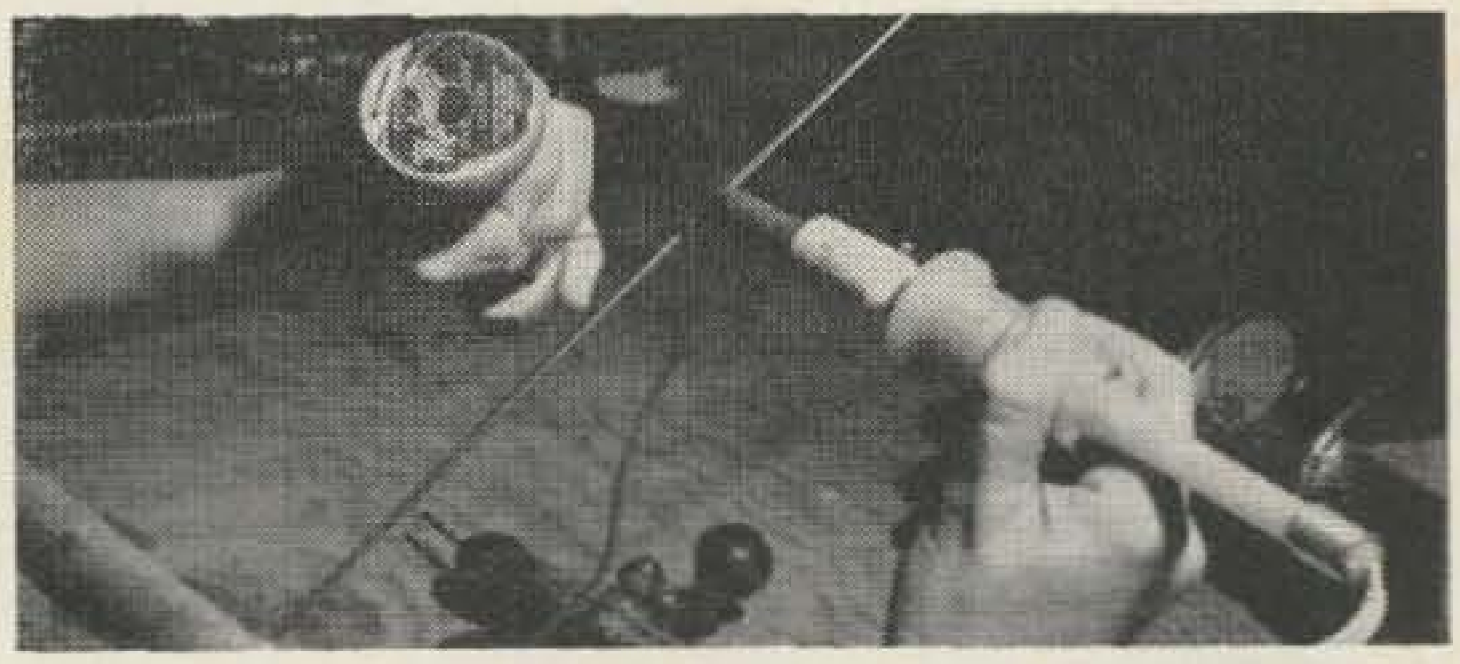


Put the cut coat hangers aside and take the handle off the broom. It must be at least 4 feet long. Mark a hole location 1 inch in from one end, and three more holes spaced 16 inches apart down the length of the handle.



Using a 3/32-inch bit in the hand drill, drill through the handle at each of the four marks. Make sure the holes are all parallel so that the elements of the BH-4 won't be titled cattywampus when it's all done; clamping in a vise as shown helps.

Now it's time to assemble the beam. Put the 40-inch hanger in one of the end holes. The 38-inch element goes in the next hole, the 36-incher next, and the 35¾ inch one goes in the last hole. They should be a tight force fit in the 3/32 inch holes; push them through until the same length of wire sticks out on each side of the handle. If the fit is loose, kink the element right at the mid-point (it can be bent straight again later and the kink will hold it).



Slit the end of your twinlead back about 12 inches. Measure out 6½ inches from the center of the handle, on the 38-inch element, and file through the paint to bare metal. Measure back 7 inches from the element toward the center of the antenna and mark the spot. Stretch the twinlead from this spot to the filed portion of the boom (as shown in the next photo) and mark the length. Strip the insulation from this point on out to the end, wind the wire around the element, and solder it in place. Use only rosin core solder; a hot iron helps much here.

When both wires of the twinlead have been connected, stretch the feedline back as shown here and tape it firmly to the boom. The distance between connections should be 13 inches, and the distance from the taping point to the driven element along the boom should be 7 inches. Use several layers of tape for security.

To mount the antenna, cut two triangles of thin plywood and nail them to a second broom handle. Leave space at the top for the antenna boom to fit. Then nail the antenna boom in place as pictured here and and you're finished. The completed BH-4 should be mounted at least 20 feet in the air. If you can get hold of a TV rotator it's ideal to turn it, but the Armstrong method also works!

1000 WATTS..WITH WHEELS

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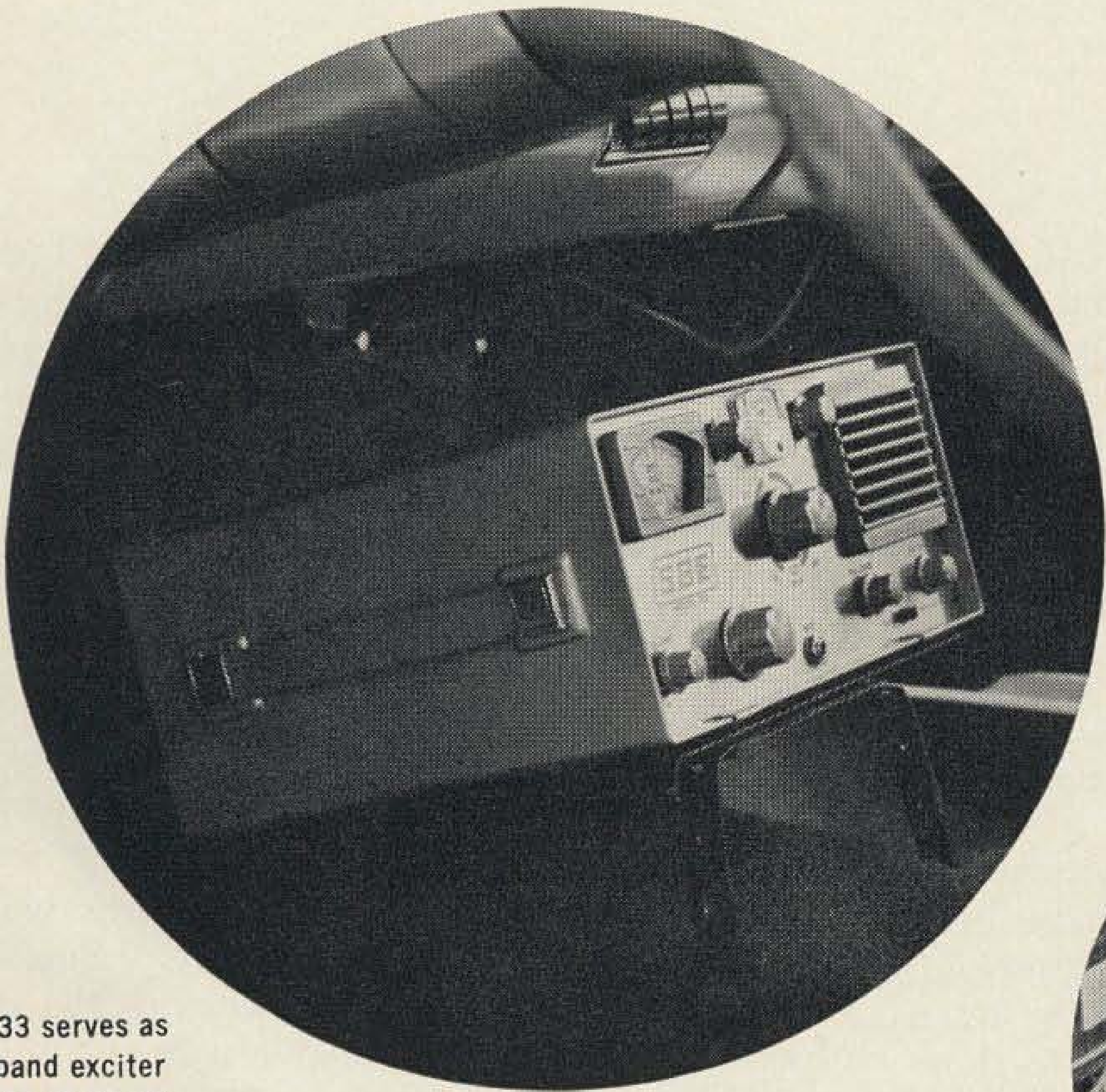
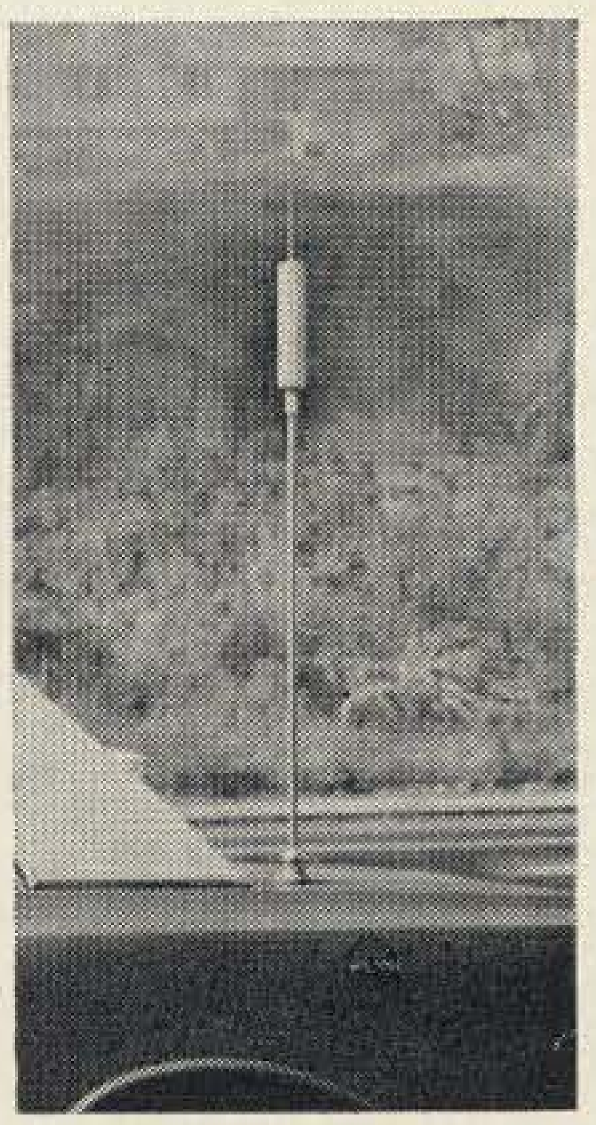
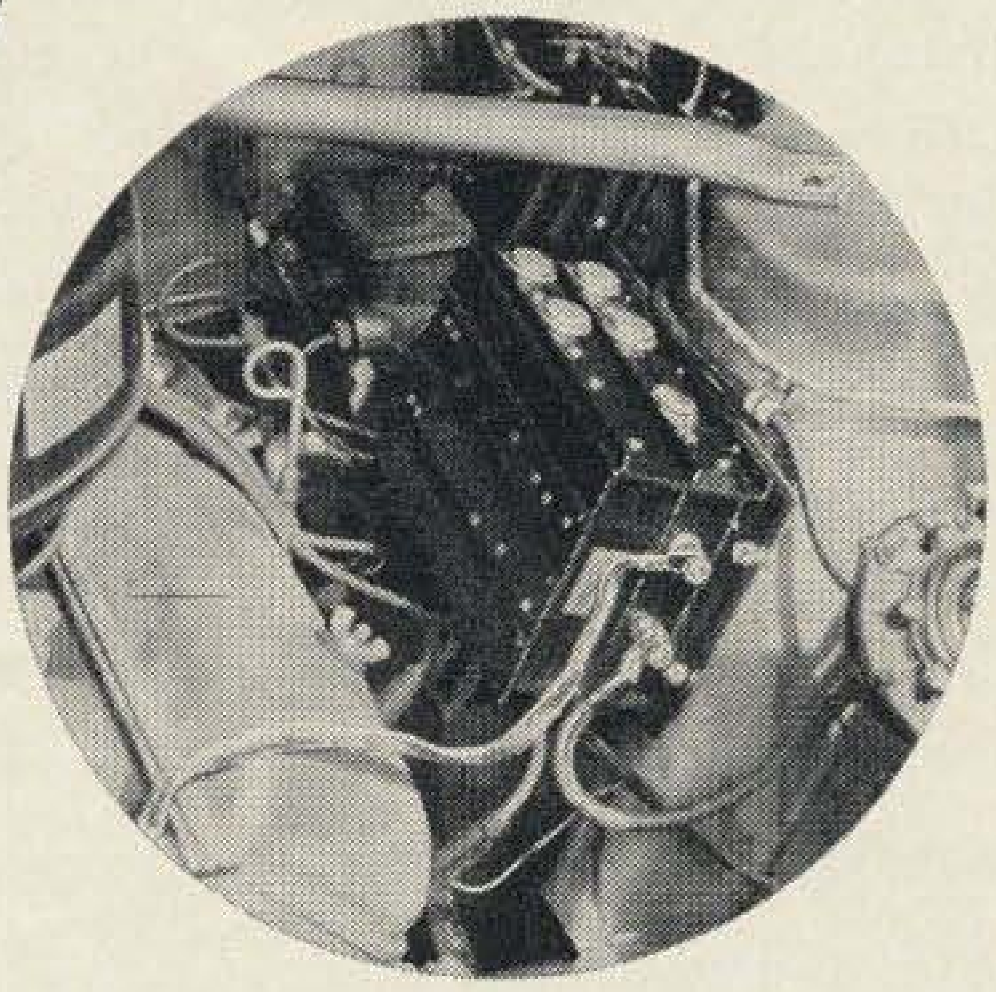


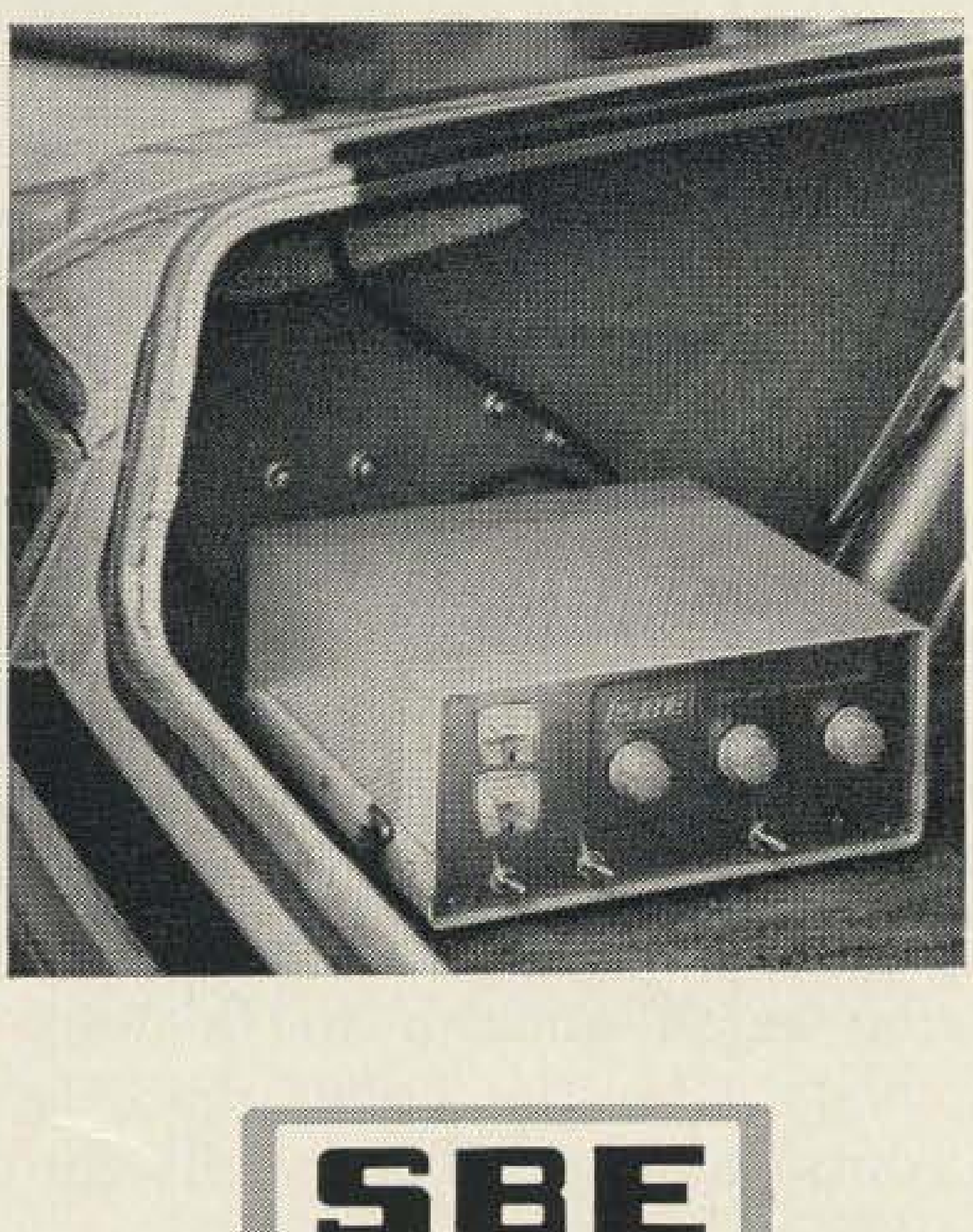
SB-33 serves as 4-band exciter (80-40-20-15) Note how little space it occupies.



Band-spanner "top-sider" antenna with one of the new "gallon" coils, tops off this powerhouse on wheels.



Power supplies, SB2-DCP for SB-33 and SB-3DCP for SB1-LA are tucked into engine compartment.



The SB1-LA 4-band linear occupies modest space in a seldom-used corner of the rear trunk.

SB-33 . . . . 389.50

SB1-LA 279.50

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David H. Sandrock K7YJF
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2300 Mc Wavemeters

One of the most fascinating areas of amateur radio for the experimenter is that of the microwave assignments. One large problem looms immediately; frequency measurement. Above 450 mc, the use of open wire lecher lines becomes impractical due to the short distances to be measured and the excessive radiation. The solution to the radiation problem is to shield the lines or to use coaxial or cavity wavemeters. A good mechanical system, employing a vernier for measuring the small distances, is necessary for accurate frequency measurement.

This article describes a coaxial cavity wavemeter for the 2300 mc band that can be built entirely by hand tools found in the average ham shack. While presented primarily as a construction article, it is also intended to show what can be done with simple tools and easily-available materials in the field of amateur microwave work.

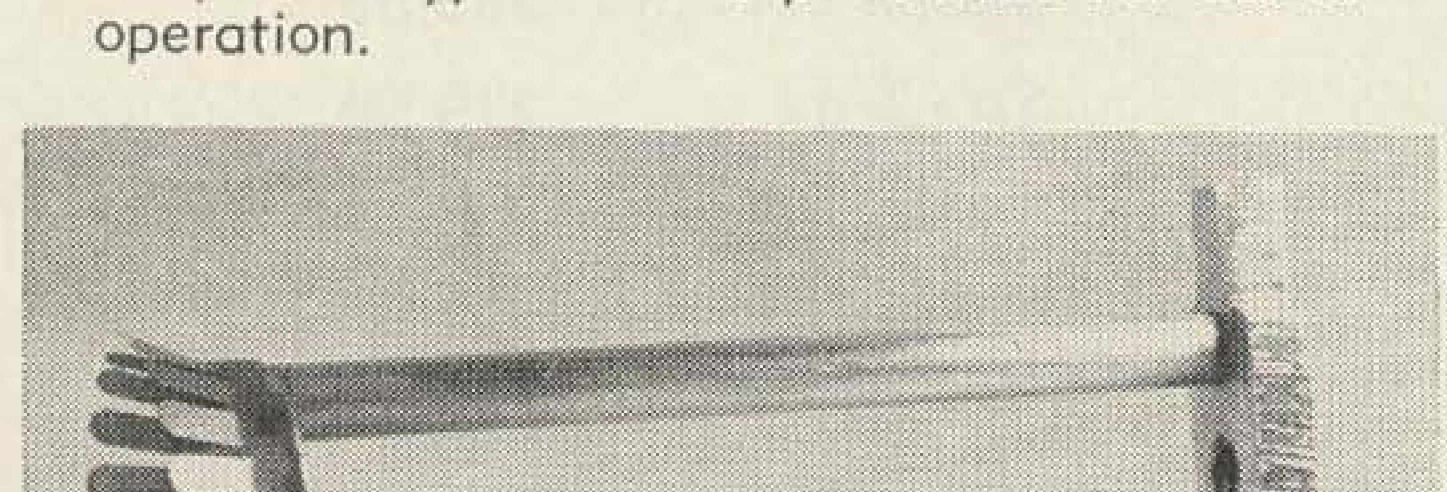


Fig. 1—A 2300 mc coaxial wavemeter which can be built entirely with hand tools. A spinner type knob is preferable for easier operation.

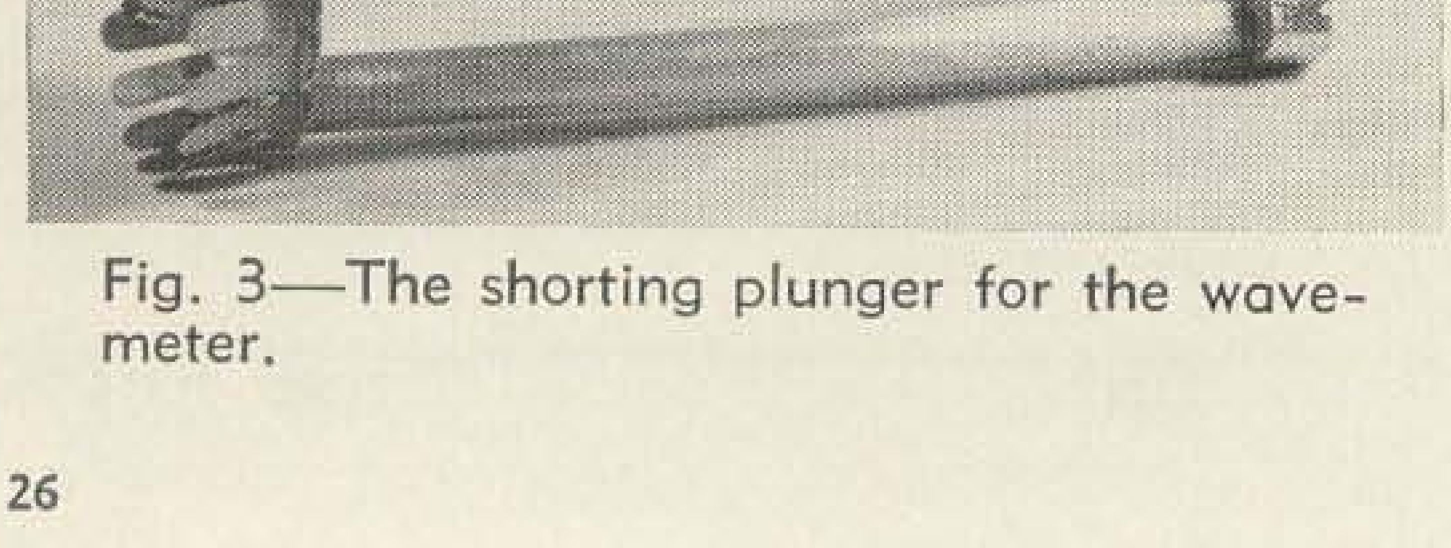


Fig. 3—The shorting plunger for the wavemeter.

If the constructor is careful to do a good job, a fairly accurate instrument will result; one which can measure a frequency difference of approximately 4 mc. At these frequencies this represents about 1.6%. With the wide band of 150 mc available, this allows operation quite close to the band edges.

Construction

All necessary dimensions are given in Fig. 2. The following information will be helpful in choosing materials and building the various parts.

A. Wavemeter Body: This is thin walled brass tubing such as used for sink drains. The nut guide slot can easily be cut with the edge of a large, fine file. Then give a final touchup when fitting the nut (E).

B. Cavity End Plate: All three of these discs (B, C, D) can be cut out of a sheet of the material with a circle cutter using a very slow feed. Drill out the center hole to ⅜″, and use a ⅜″ bolt chucked in a drill as an arbor. Clean up the edges and turn to exact size with a file.

C. Cavity End Plate and Bearing Mount: Aluminum is called out as it is easy to work, but any other suitable material available may be used.

D. Cavity Plunger: After cutting this out, drill the center hole to ⅜″; mount on the arbor bolt and turn down as before. It must be small enough to fit into the wavemeter body after the finger stock is soldered to the outside edge. Then drill the center hole to 19/32″.

E. Nut: Steel is best to use, but is much harder to work than aluminum. The number 13 drill is not the usual one to use for 1/4-20 threads, but it leaves more material for threads than the usual number 8. Be careful

when starting the tap to keep it perpendicular to the nut.

F. Plunger Motion Rods: When fitting these to the plunger and nut, thread the 1/4-20 rod through the nut far enough to extend through the plunger center hold. Then with small amounts of filing on the rods and nut, or shims under the rod ends, the threaded rod can be brought to the exact center of the plunger.

G. Coax Center Conductor: If ordinary copper tubing is used, make sure it is straight and free from small dents.

H. Threaded Rod: This is 1/4-20 threaded rod available in various lengths for homemade U-bolts, etc. File or grind a flat on one end for the outer bushing and knob set screws. File a flat that will be positioned properly for the inner bushing. Let about 5/8″ extend from the bearing on the knob end of the rod.

J. BNC Connector Mount: File to size; file the 5/8″ radius with a half-round file. This is soldered to the wavemeter body. The coupling loop clearance notch can be filed through both pieces after soldering.

K. Bushings: These bushings are to prevent longitudinal motion of the threaded rod. One goes on each side of the shaft bearing.

L. Vernier Holder: Any suitable sheet metal on hand may be used.

M. Scale Holder: Same as above.

N. Coax Shorting Fingers: A source of finger stock is Eimac contact finger stock, carried by Allied Radio Corp; catalog number 42 P 086. This comes in 17/32″ width and is three feet long. The price is high: $5.77. As it takes less than six inches for this project, it would be best if you could get several who were interested in building this wavemeter to go together on the purchase of this item. However, if you can get some small scraps of phosphor bronze or beryllium copper, it is possible to make your own. It need not be silver plated. Solder the inner shorting fingers first, as they will stay in place while the outer fingers are being soldered A good way to hold the outer fingers in place while soldering is to wrap a wire around them and then sweat solder, after tinning both surfaces. Clean off any excess solder.

O. Coupling Loop: When assembled, the loop should extend no more than ¼″ into the cavity. If the loop extends too far, the coupling will be too tight, thereby lowering the Q and broadening the response. If this is so,

[Text continues on page 32]

FIGURE 2a

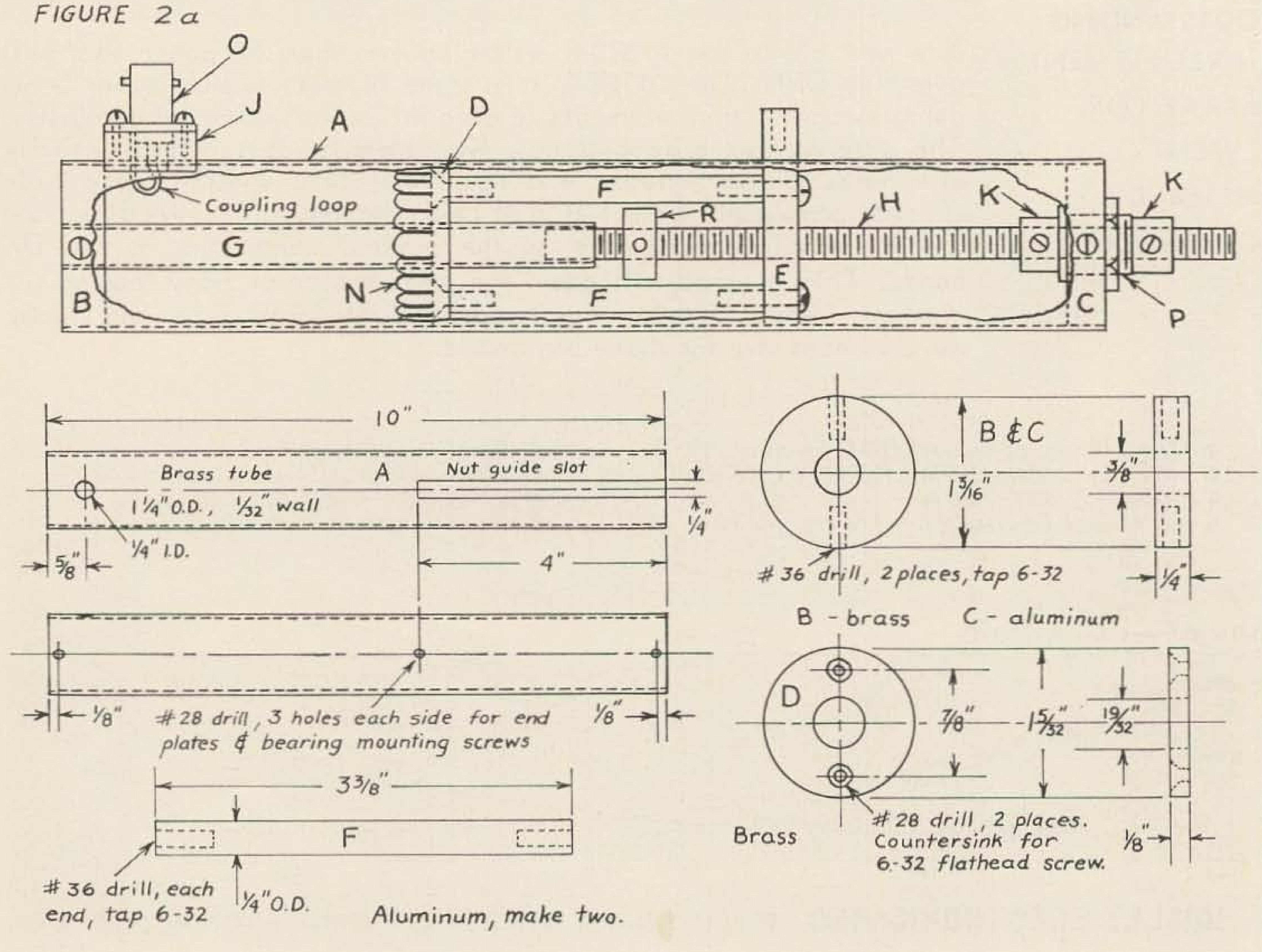
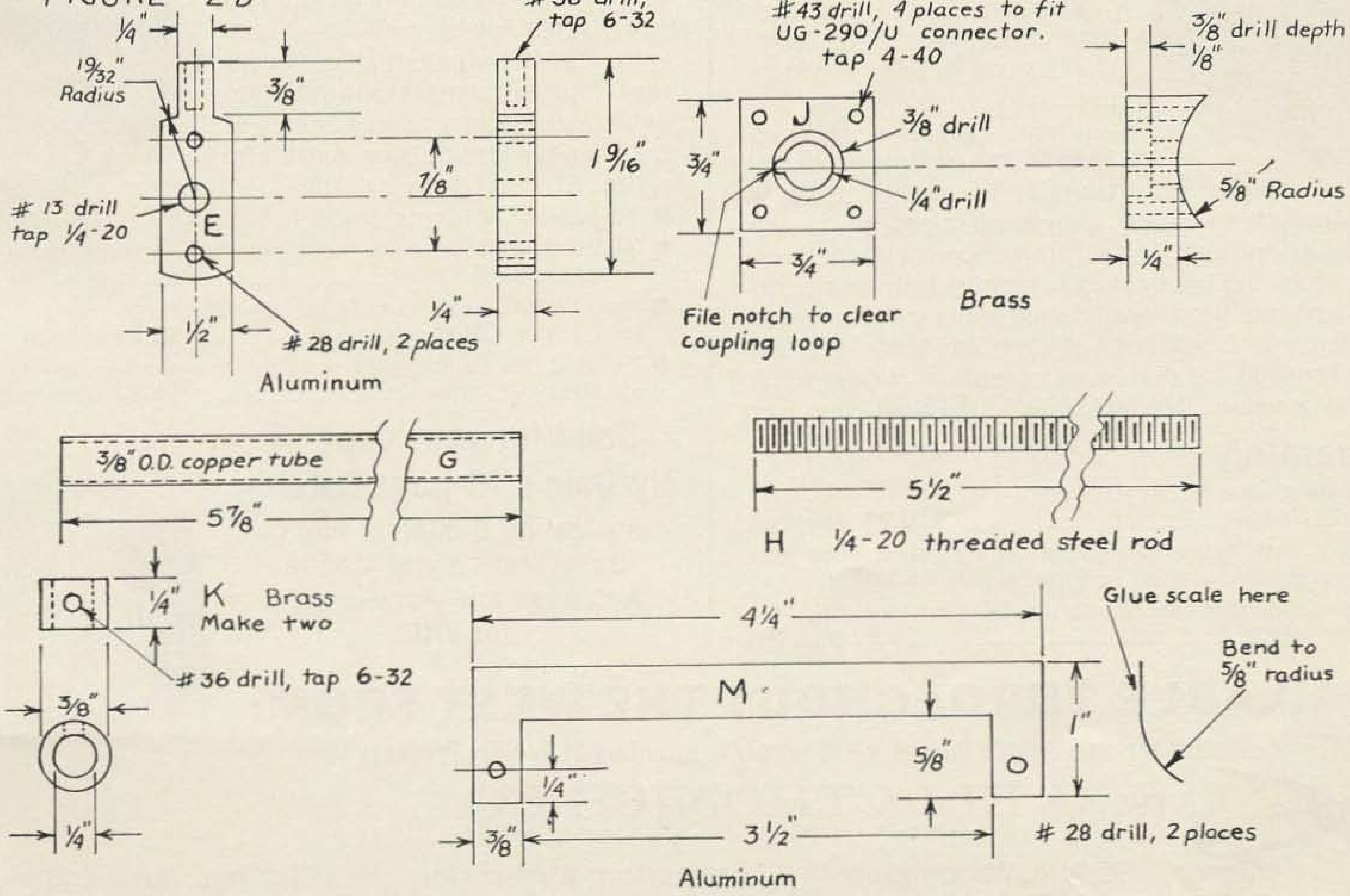
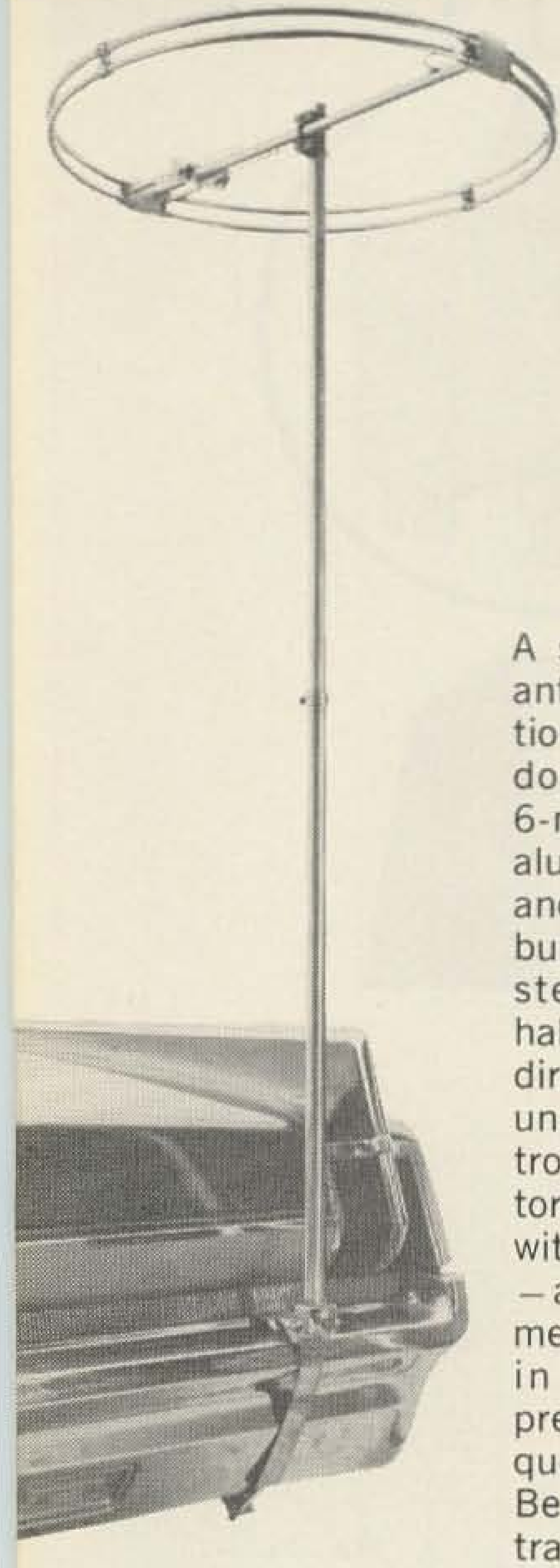


FIGURE 2b



1/4"
19/32" Radius
3/8"
7/8"
13 drill tap 1/4-20
E
1/2"
28 drill, 2 places
Aluminum
36 drill, tap 6-32
1 9/16"
1/4"
#43 drill, 4 places to fit UG-290/U connector. tap 4-40
J
3/8" drill
1/4" drill
3/4"
3/4"
File notch to clear coupling loop
Brass
3/8" drill depth
1/8"
5/8" Radius
1/4"
3/8" O.D. copper tube
G
5 7/8"
5 1/2"
H 1/4-20 threaded steel rod
1/4" K Brass
Make two
#36 drill, tap 6-32
3/8"
1/4"
4 1/4"
M
1"
5/8"
1/4"
3/8"
3 1/2"
28 drill, 2 places
Aluminum
Glue scale here
Bend to 5/8" radius

Performance-packed mobile antennas



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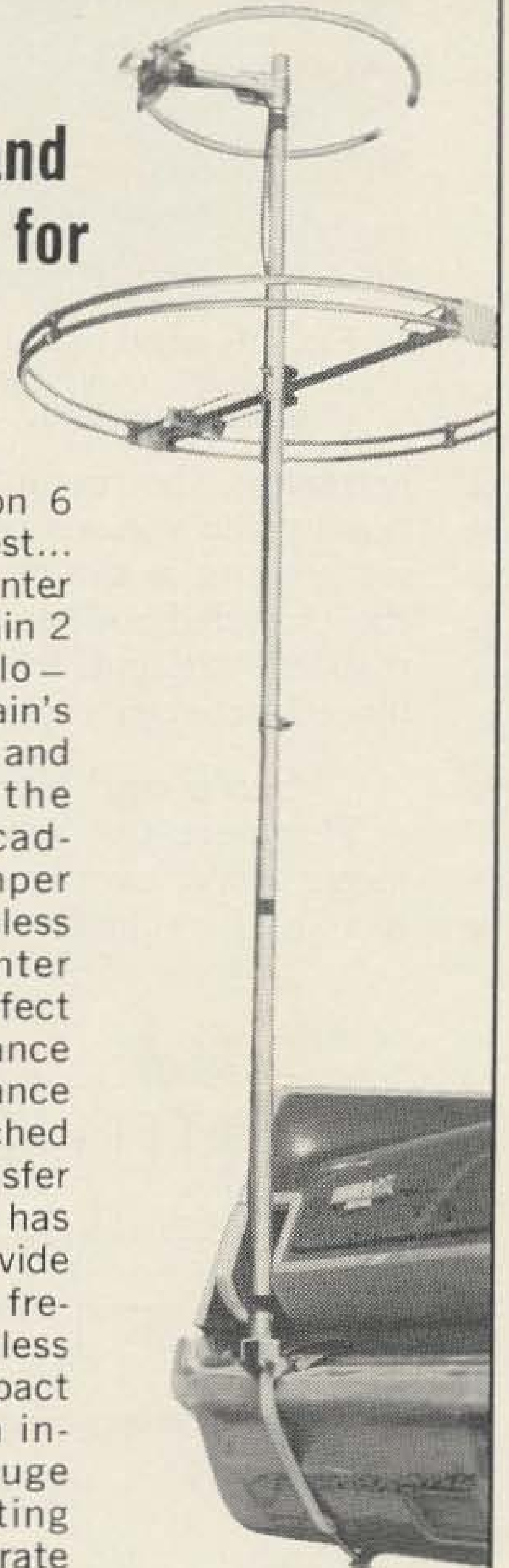
or 6 and 2 meters from hy-gain

Horizontally Polarized Duo-Band Halo Installation for 6 and 2 Meters

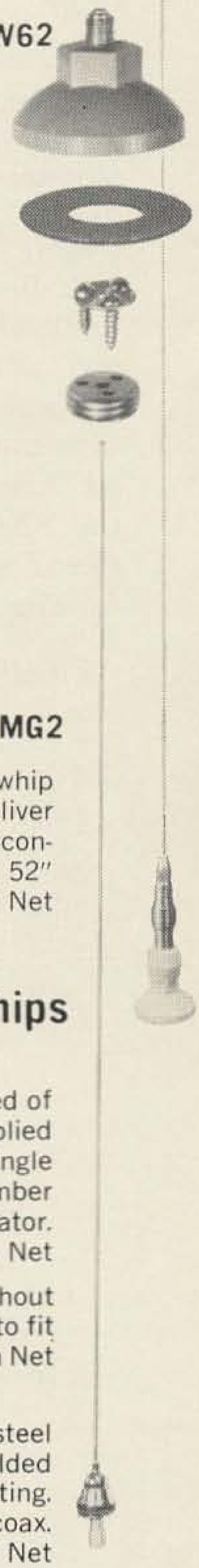


Duo-Band performance on 6 and 2 meters at its Halo best... a new Hy-Gain 6 meter center mount halo—a new Hy-Gain 2 meter center mount halo—both mounted on Hy-Gain's heavy wall aluminum mast and securely attached to the vehicle with Hy-Gain's cadmium plated steel bumper mount with exclusive stainless steel strap. Rugged center mount halos deliver perfect omni-directional performance with incomparable impedance control. Halos Beta Matched to provide an optimum transfer of energy. 6 meter halo has built-in tuning rods to provide precision adjustment to frequency. Heavy gauge seamless construction with high impact injection molded styron insulators and heavy gauge machine-formed mounting hardware. Fed with separate 52 ohm feedlines for maximum performance. Complete Duo-Band Stacked Array with Mast and Bumper Mount...

- Model HH2BA 2 Meter Center Mount Halo **$5.95** Ham Net
- Model HH6BA 6 Meter Center Mount Halo.................................... **$10.95** Ham Net
- Model HMBA heavy duty Telescoping Mast with standard ⅜"x24 stud at base........ **$5.95** Ham Net
- Model BPRS Cadmium Plated Steel Bumper Mount with stainless steel strap........... **$5.97** Ham Net

6 and 2 Meter Whips

Fabulous Duo-Band Whip for 6 and 2 Meters Model MW62



The most efficient Duo-Band Mobile Whip available...electrically extended to ⅝ wavelength on 2 meters to deliver 3.4db of omni-directional gain...electrically extended to ¼ wavelength on 6 meters for outstanding omni-directional performance. Features hermetically sealed base matching inductor to insure lasting durability. Unique high impact molded styron base assembly permits installation from exterior surface of vehicle. Whip is constructed of top quality taper ground stainless steel. Designed for roof or deck mounting...largest hole required for installation, ¼ inch. Feeds with 52 ohm coax that connects internally in roof mount. Overall height, 52 inches. Model MW62...**$15.60** Ham Net

2 Meter Mobile Whip Delivers 3.4db Gain Model MG2

A vertically polarized omni-directional whip electrically extended to ⅝ wave-length to deliver 3.4db of omni-directional gain. Same quality construction features as Model MW62 above. 52" overall height. Model MG2.....**$15.60** Ham Net

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For 6 Meters...
Top quality ¼ wavelength whip constructed of taper ground 17-7PH stainless steel. Supplied complete with heavily chrome plated single hole body mount for installation at any number of places high on the vehicle. 60 inch radiator. Model MW6........................**$10.95** Ham Net

Model W60—Same as Model MW6 above without body mount. Terminates into ⅜"x 24 stud to fit standard body mount or spring.**$6.00** Ham Net

For 2 Meters...
Taper ground ¼ wavelength stainless steel whip. Complete with unique high-impact molded styron base assembly for roof or deck mounting. Features solderless connector for RG-58/U coax. Model MW2..........................**$2.82** Ham Net

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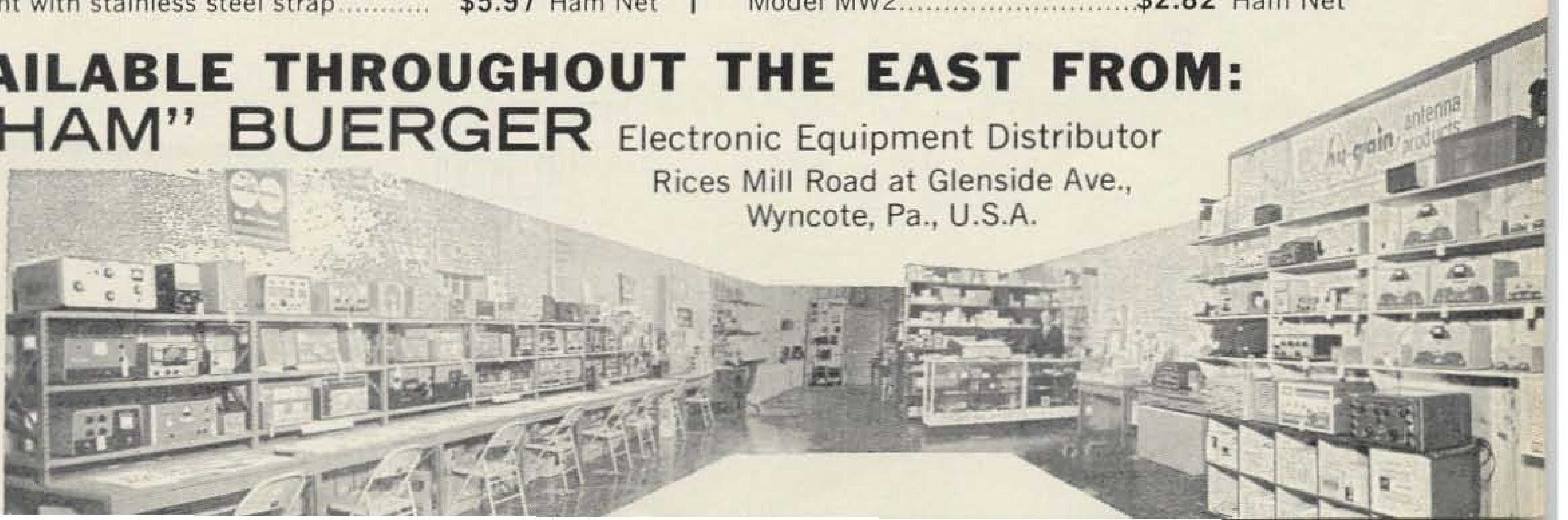


[Wavemeter from page 29]

trim down the loop, or twist it to reduce coupling.

P. Shaft Bearing: An excellent source of bearings for this and other uses such as panel bushings are old potentiometers.

R. Bearing: Any metal on hand may be used. This supports the free end of the threaded rod.

Assembly

Mount the internal parts together as shown in the photographs and drawings. Push the plunger as far down on the coax center conductor as it will go, and insert the entire assembly into the brass tube from the slotted end. Be careful when starting the plunger not to bend the shorting fingers; also watch the end of the slot. When tightening the mounting screws, tighten each one a small amount at a time to keep everything properly centered. After all internal parts are in place, install the BNC connector. Oil the bearings and the threaded rod lightly after assembly. Now try turning the shaft. If there is any binding, try loosening the mounting screws and repositioning the various parts. A troublesome place for binding is the two bushings on the end of the threaded rod. It may help if several small washers are cut from brass shim stock and placed between each bushing and the bearing.

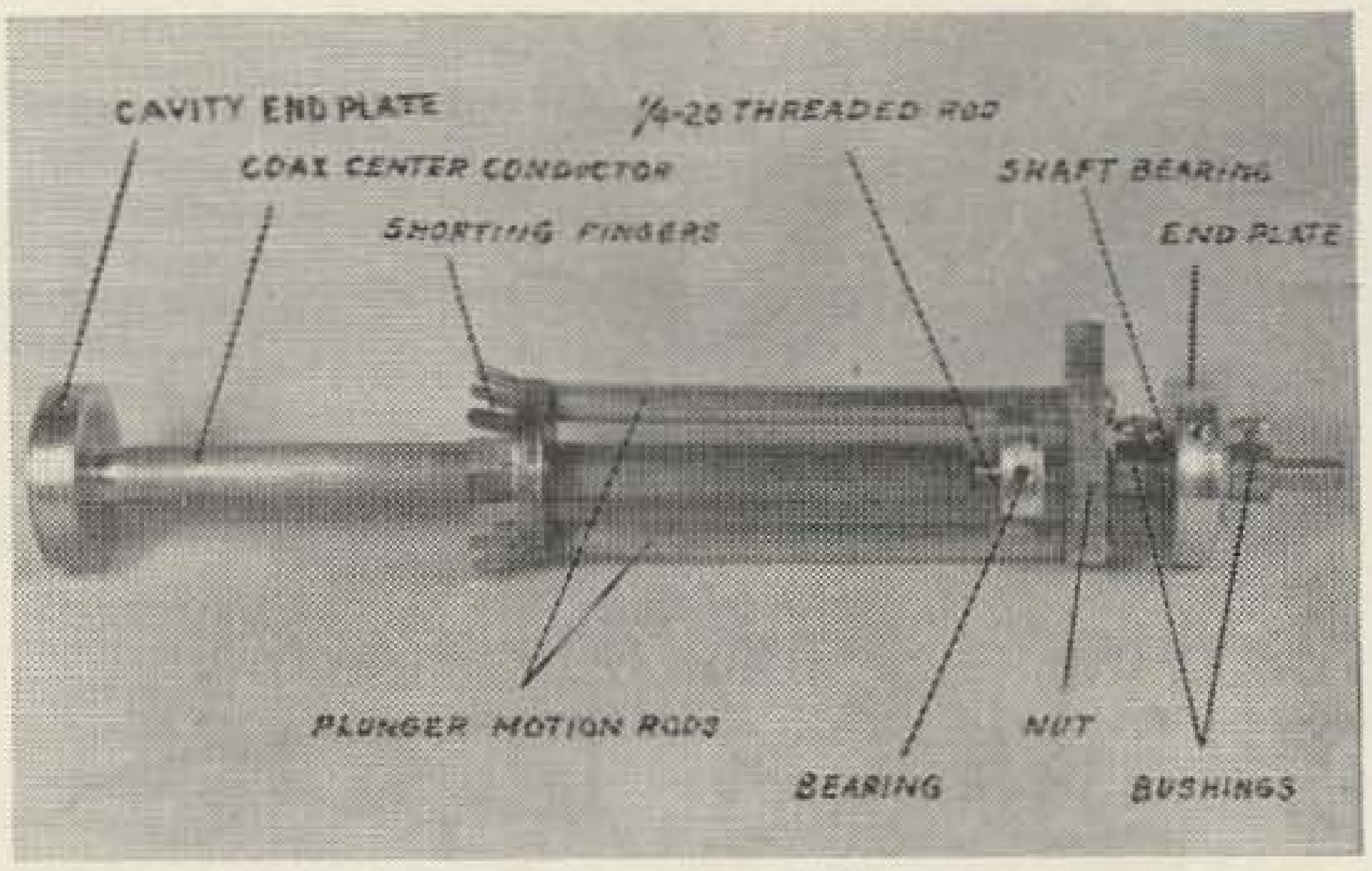
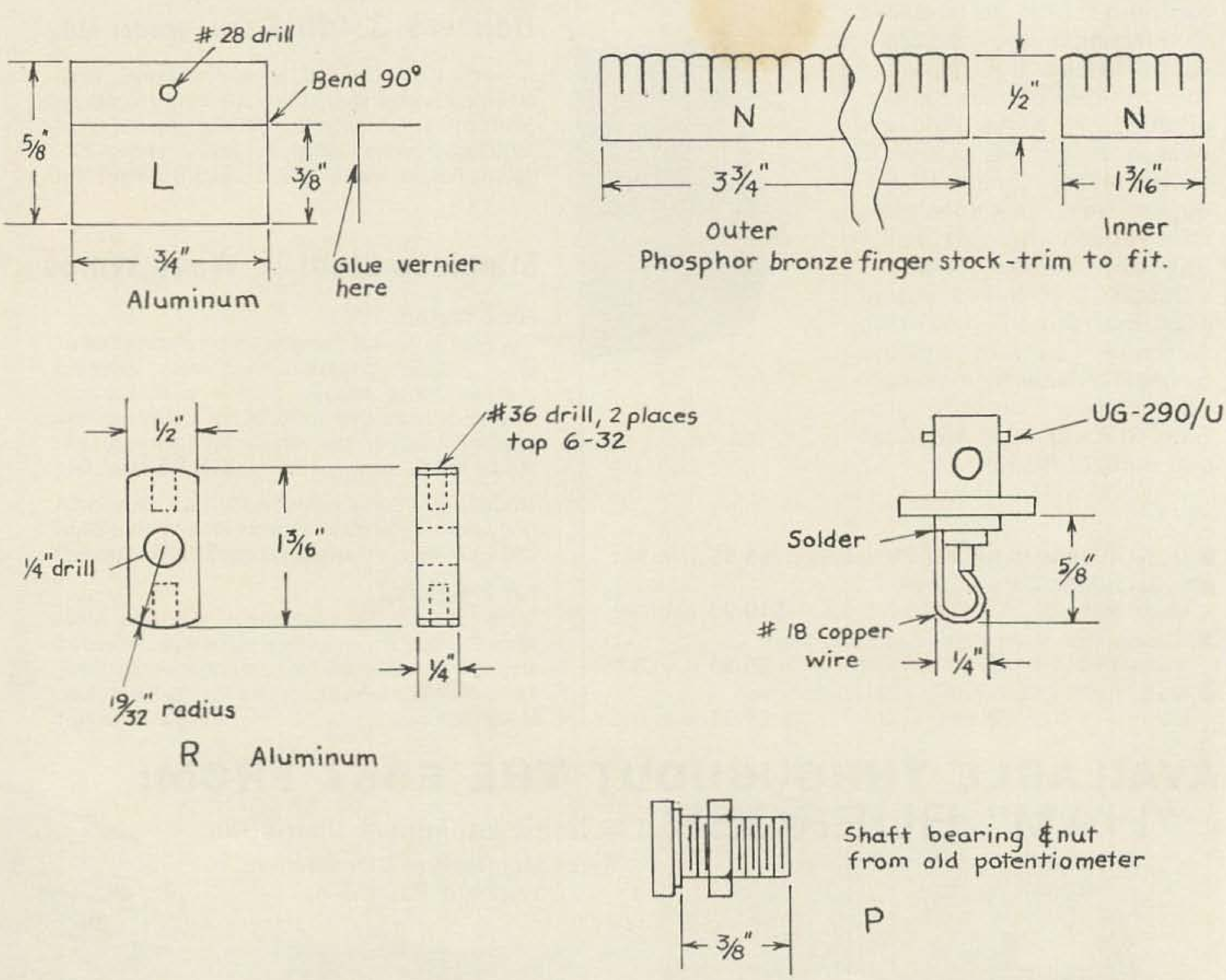


Fig. 4—This view shows how all parts should be assembled before placing them in wavemeter body.

Scale and Vernier Construction

There are two advantages in using a centimeter scale over an inch scale. One is the increased resolution; about twice as good with

FIGURE 2c



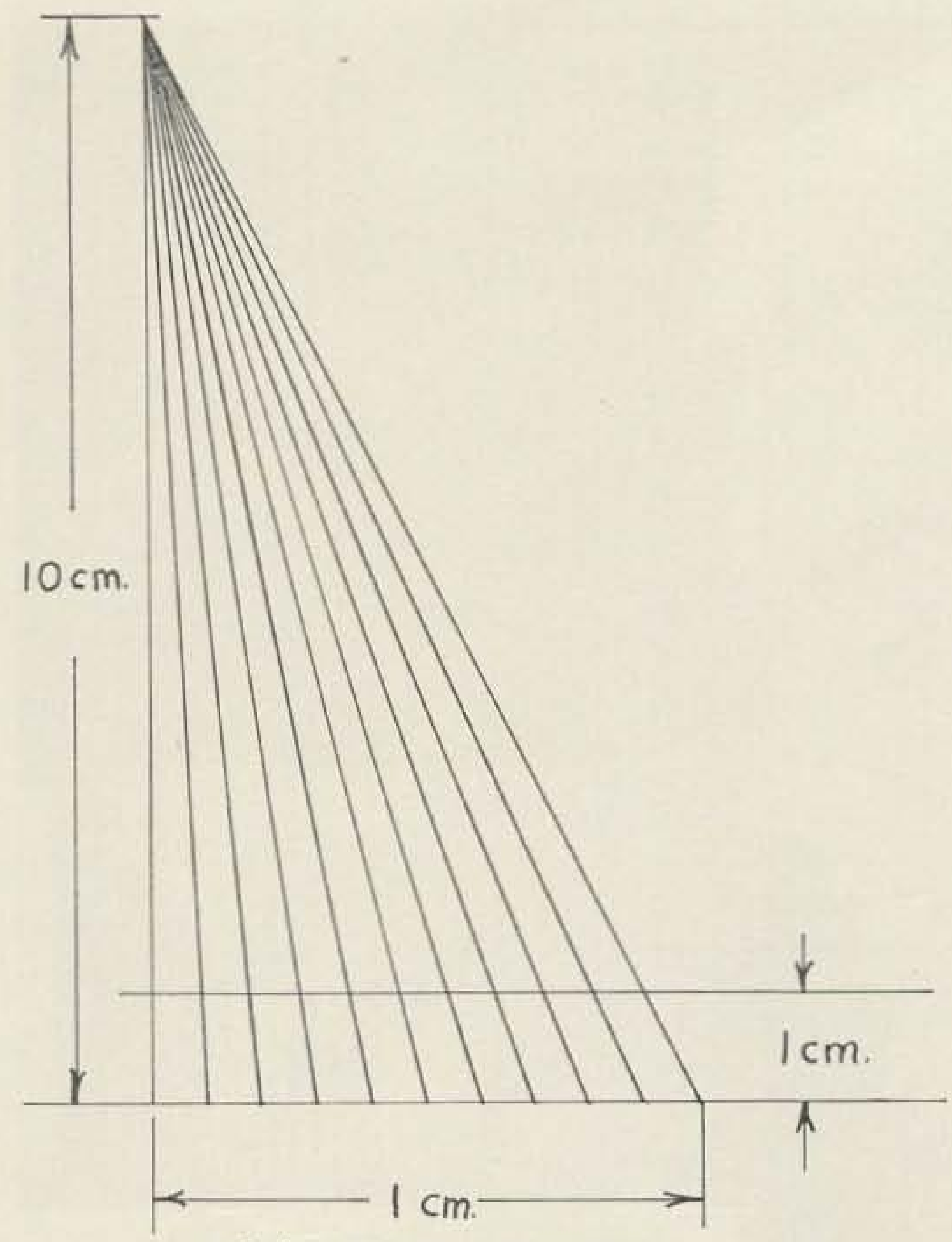


Fig. 5—Vernier construction. Horizontal scale greatly exaggerated for clarity. Use the line one cm. above the base for the vernier scale divisions.

the centimeter scale. The other advantage is the ease of converting readings to frequency. However, it is much more difficult to construct the centimeter vernier because of its small size.

A good source of centimeter scales are the combination inch and centimeter wooden rulers. The centimeter scale is cut off and sanded to size, then glued to the scale holder.

Draw a right triangle with a height of 10 cm. and a base of one cm. Draw a line parallel to the base one cm. above the base. Divide the base into millimeters direct from the scale. Connect each of these millimeter marks with

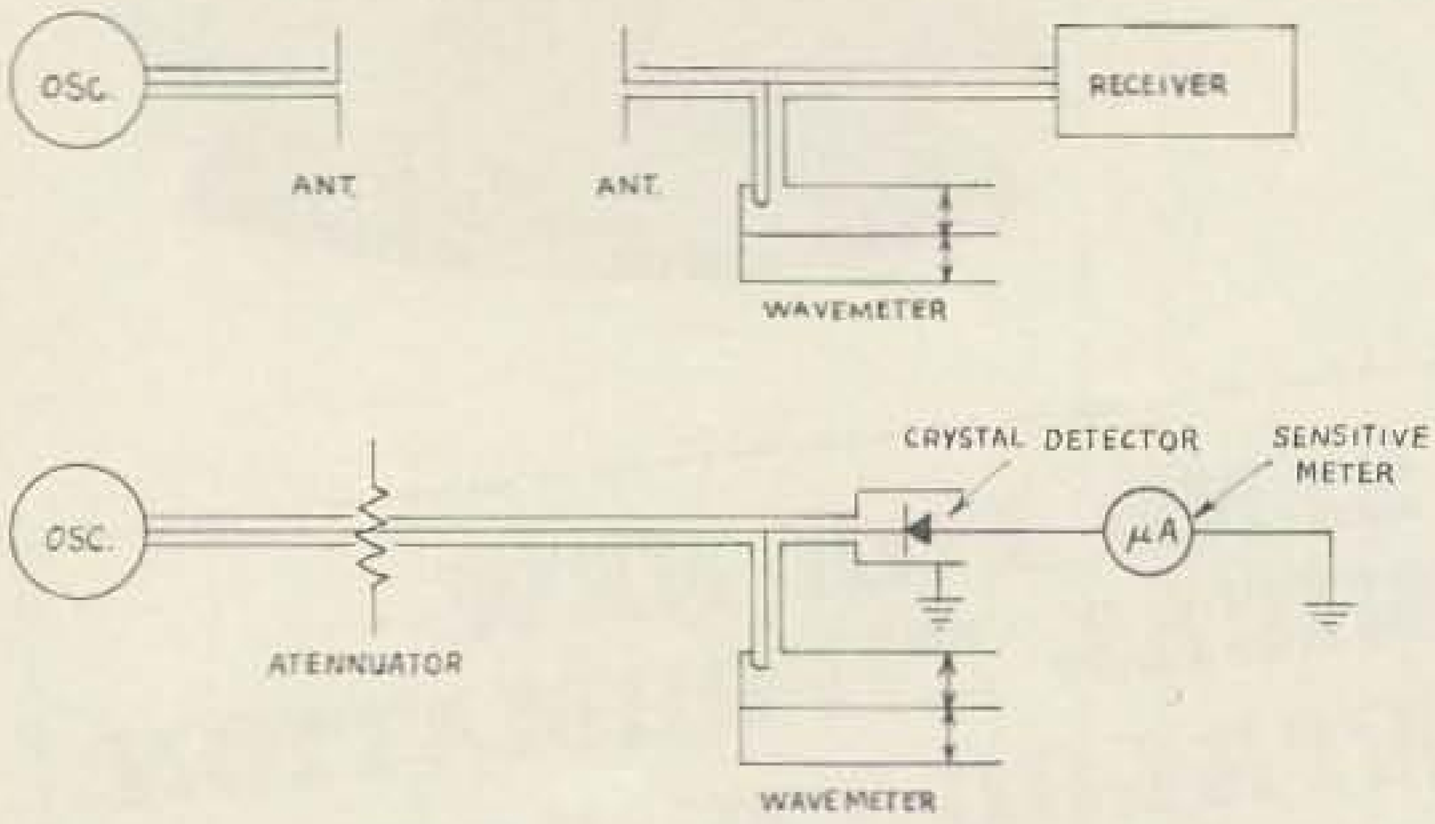


Fig. 6—Schematic of test setups. For attenuator, use a long section of coaxial cable; or vary spacing between the two dipole antennas. At resonance, the indication is a minimum reading.

the apex of the triangle (see Fig. 5). Where they cross the line one cm. above the base, they are 0.9 mm. apart, which is necessary for the vernier scale. Construct the vernier scale with these measurements, using a very fine lettering pen and india ink. After gluing this to the vernier holder, cover with clear lacquer or varnish for protection.

If inch scales are desired, the vernier may be drawn in the same manner using inches for all measurements.

A vernier caliper graduated in both inches and centimeters is available from Edmund Scientific Co., Barrington, New Jersey, for $1.80 postpaid. (Catalog number 40,598) This could be modified for use if desired, rather than constructing your own.

Calibration and Use

This coaxial wavemeter is an absorption device, like a set of lecher lines. The distance between two null points is equal to a half wavelength. The instrument is therefore self calibrating. To measure frequency hook up the circuit as shown in Fig. 6, either using a crystal detector with a sensitive microammeter (50-100 microamps), or a receiver covering this range such as the APR-5. Apply rf power and adjust the wavemeter for two successive nulls, noting the distance between them in centimeters. Divide 3,000 by twice this amount to get the frequency direct in megacycles.

If several different frequencies are measured, and the reading of the null farthest from the input is used, it can be plotted on a graph against frequency. Now, only these readings need be used for frequency measurement. Do not attempt to use the distance from the input end to the first null as a direct reading without calibration. There are capacitive loading effects which tend to shorten this difference, giving an incorrect reading.

Do not try to measure frequencies higher than 3000 mc with this wavemeter. The diameter of the outer coax is large enough to support other than the dominant TEM or coaxial mode, and spurious reading may result.

If further study along these lines is desired, a bibliography is given which should be very helpful to the experimenter.

1. **Techniques of Microwave Measurements,** C. G. Montgomery, M. I. T. Radiation Lab. Series, 1st. ed., 1947, McGraw-Hill Book Co., N. Y.

2. **Reference Data for Radio Engineers,** 4th ed., 1956, International Telephone and Telegraph Corp., N. Y.

3. **Radio Engineers Handbook,** F. E. Terman, 1st ed., 1943, McGraw-Hill Book Co., N. Y.

4. **Electric Designers Handbook,** R. W. Landee, D. C. Davis, A. P. Albrecht, 1957 McGraw-Hill Book Co., N. Y.

5. **Microwave Techniques,** prepared by M. I. T. Radiation Lab. For sale by Sup't. of Documents, Gov't Printing Office, Washington 25, D. C., for $0.55. (NAVSHIPS 900,028)

New Products

Mobile?

Scientific Associates, Box 1027, Manchester, Conn., have announced some transistorized converters which plug into your car radio and convert it into a short wave receiver. The 40, 80 and 160 meter models are $14.95, others up to six meters are higher. Write for info and prices.

Boxes

If you like to build you'll find a whole line of interesting chassis and cabinets available from Holstrom Associates, Box 8640, Sacramento, California. Send them a card for their catalog 464. They've got some real modern cabinets; worth looking into.

New Mosley Catalog

This new 32 page catalog lists in detail all of the Mosley ham products, complete with specs, curves, etc. They give data on installation, tuning info, and just about everything else you could want to know. Drop a card to Mosley Electronics, 4610 North Lindbergh Blvd., Bridgeton, Missouri 63044. It wouldn't hurt if you mentioned 73.

VHF Tunable Oscillators

E. M. Shulman KØCZD
Chief Engineer
World Radio Laboratories
Council Bluffs, Iowa

Ever build a 6 meter transceiver with a tunable oscillator in the receiver? And listen to it tune half the band in half an hour with nary a twitch of the dial? Like I mean, DRIFT, man?

Not to mention the ANL that lived up only to the first two letters? Like I mean it made noise auto-(and I do mean AUTO) matically, but never heard of that *"limit"* bit?

And speaking of "heard," the local FM stations were what you heard, 150 kc wide in several spots, especially the spots where your neighbor said the DX was?

Well, ol' buddy, welcome to the club. I went through the same thing and would like to pass along some hard earned, useful, and simple information.

First that matter of receiver oscillator drift. My first try used the circuit of Fig. 1. Very simple, practically right out of the good ol' dependable ol' wrong ol' book. You can't temperature compensate this baby! The first one I tested was drifting in the negative direction (oscillator going higher in frequency as it warmed up) even with no TC condensers in the circuit! Sure I heard of P100 positive

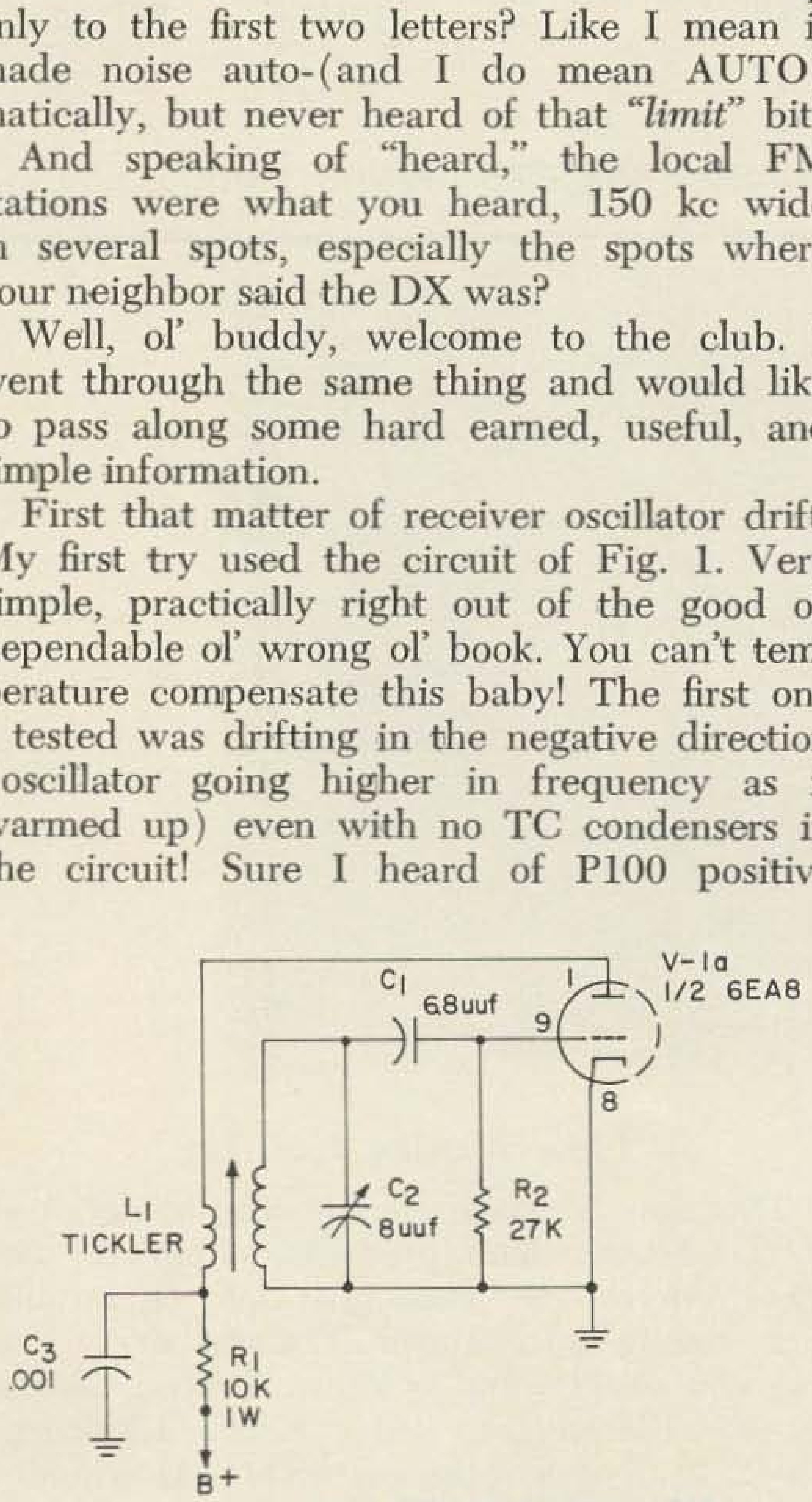


FIG. 1 UNSTABLE OSCILLATOR

temperature coefficient capacitors. Very handy, until I plugged another tube, same type, into the socket, and saw the little beastie pull a real broken field reverse and take off for the other goal line, drifting just as fast in the opposite direction. That one could be compensated, but who wants to change the TC condensers every time I change the tube? There must be an easier way.

And of course there is. Look at Fig. 1. That tickler coil in the plate provides the feedback that tickles the oscillator into oscillating, as the book says. But it also couples the plate structure rather tightly to the fairly Low-C frequency-determining tuned grid-circuit. That means anything changing in the plate circuit has a direct first-order immediate effect on the frequency of oscillation. And how the plate moves inside the tube as it heats up depends on relatively uncontrolled variables such as the amount of stress remaining in the internal welded connections of the tube and whether Mama Minnie sliced the mica spacers straight. It is simply not predictable. In fact, I was unfortunate enough to find half a dozen tubes in our original lab models of the TC-6 transceiver that stayed put very well, resulting in a problem that I didn't know existed until complaints brought about a second look and our TC-6A re-design.

And that's only part of the problem. Here's another. Watch out for slug tuned coils! They drift with temperature changes. In most coils, the slug is in direct metallic contact with the chassis through the adjusting screw and end mounting. This means the slug will be as hot as the chassis, and also will change temperature when the chassis does. And in a transceiver that usually means every time you make a fairly long transmission. Answer? Use a

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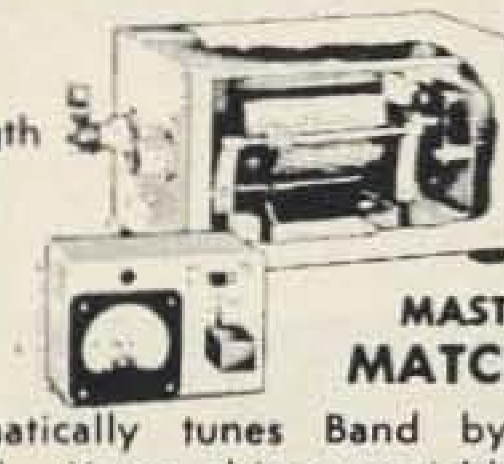

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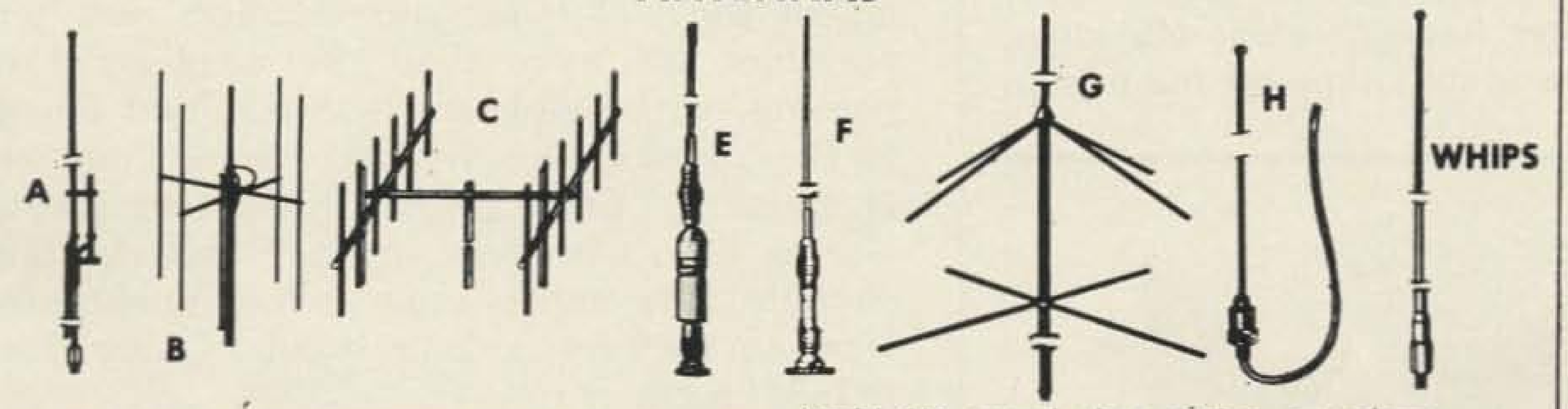

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D (Not Shown) AM-4 same as above except 6 element beam. **8.95**

E AM-7 Sentry "Shorty" 2 meter 1½ wave top loaded fiberglass antenna with mount for CB use. **16.75**

F AM-10 "Shorty" as above except it's 6 meter shortened ¼ wave with mount. **10.95**

G Model 300 ground plane antenna outperforms any type verticle dipole. Ideal for CD and defense nets. **12.95**

H No. 613 Master VHF rooftop antenna for 140-165 Mc. Comes with 10' coax. cable. **4.95**

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FIBERGLASS WHIPS — Flexible, indestructible universal antenna with ⅜" x 24 thread base fitting chrome plated. **FG-60 60" 4.95; FG-72 72" 4.95; FG-84 84" 5.15; FG-96 96" 5.25; FG-103 103" 6.95.**

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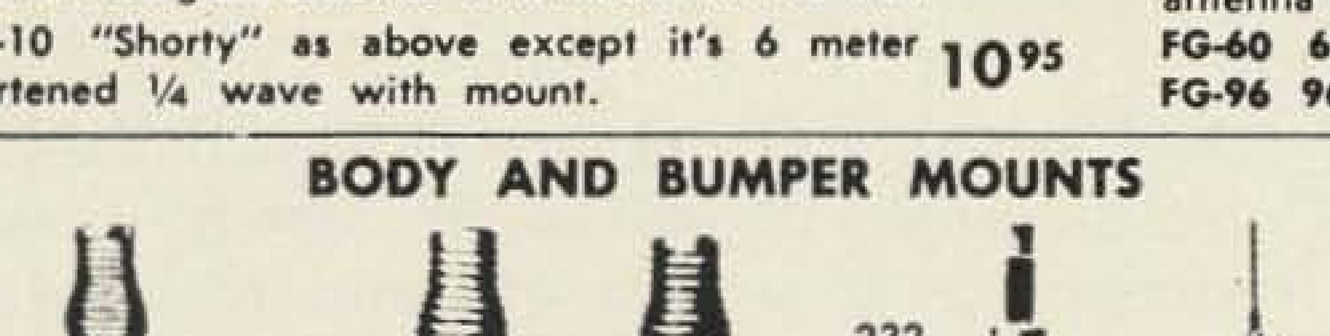
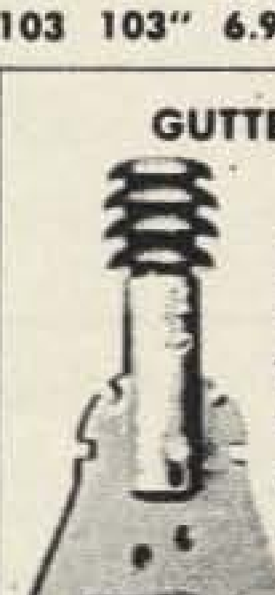


BASE MOUNT	DESCRIPTION	NET
232	D'ble Tapered Spring—Swivel Base	8.75
232C	D'ble Tapered Spring—Swivel Base Coax. Conn.	8.75
232SS	D'ble Tapered Spring—Spec. Stainless	12.95
232SSC	D'ble Tapered Spring—Spec. Stainless — Coax. Conn.	12.95
232X	Heavy Duty—D'ble Tapered Spring—Swivel Base	9.85
232XC	Heavy Duty—D'ble Tapered Spring—Coax. Conn.	9.85
232XSSC	Heavy Duty—D'ble Tapered Spring—Spec. Stainless — Coax. Conn.	14.95
232XSS	Heavy Duty—D'ble Tapered Spring—Spec. Stainless	14.95
232XX	Extra Heavy Duty Spring	10.85
232XXC	Extra Heavy Duty Spring—D'ble Tapered—Coax. Conn.	10.85
232XXSS	Extra Heavy Duty Spring—D'ble Tapered—Spec. Stainless	15.95
232XXSSC	Extra Heavy Duty Spring—D'ble Tapered—Spec. Stainless—Coax. Conn.	15.95
445	Universal Mount—Threaded, ⅜"-24—Chain Mount	7.95

GUTTER MOUNT CG-275



Eliminates hole drilling. Positive locking, retractable and adaptable for any ⅜" 24 thread whip.

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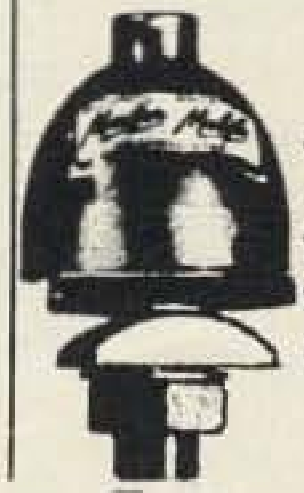

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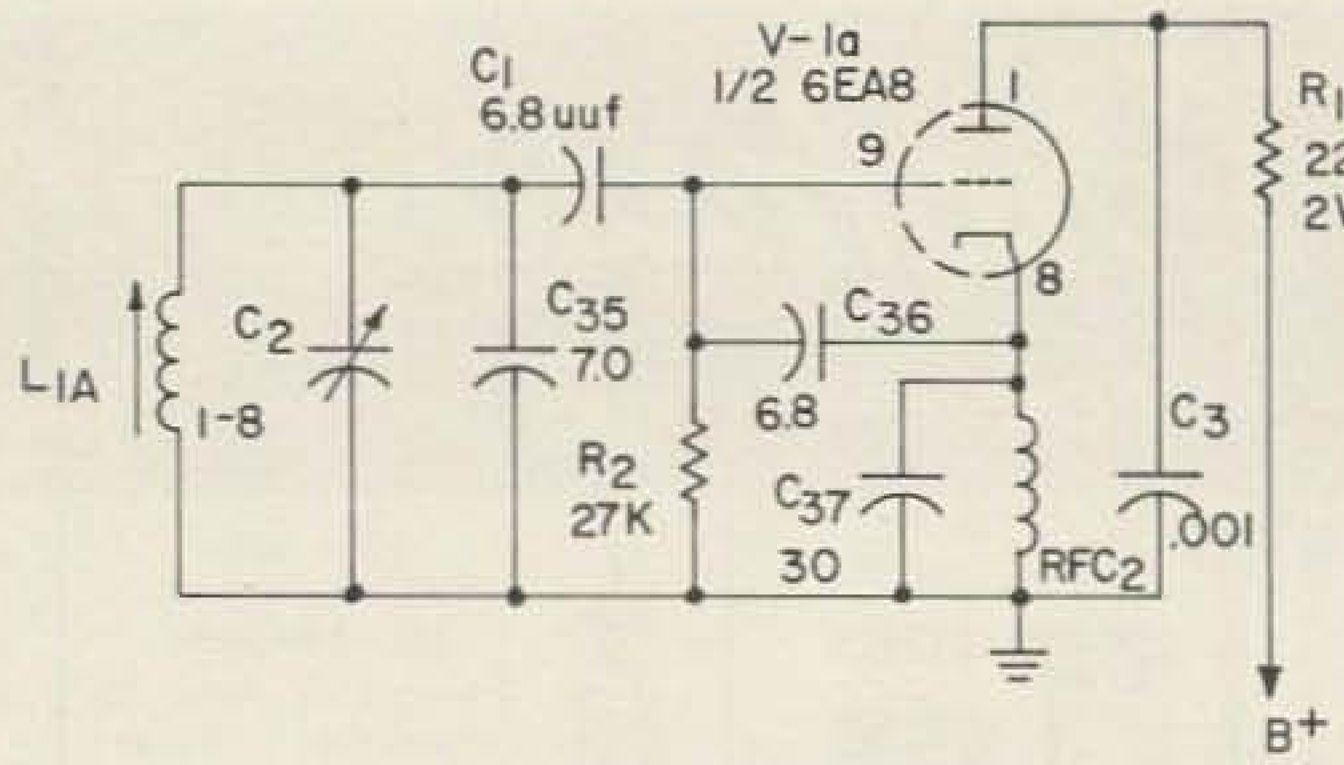

FIG. 2 STABLE OSCILLATOR

slug tuned coil of the type that has a threaded core and a slug that you adjust with an insulated hexagonal tool.* The insulating coil form is pretty good insulation against heat as well as against electrons. Oh, as to why the slug makes the coil inductance change with temperature. It's more than the mechanical expansion of the slug and the resultant change in the physical position; the durn thing also changes in permeability with temperature. Use as little a slug as you can and still have enough adjustment range. You might even want to hacksaw a long standard slug down to half length or so.

Also make sure the coil is well doped with something that will keep the wires in their place, like Q-dope or Liquid-Dope.

And finally, use a circuit that couples the tube as loosely as possible to the tuned circuit. Make any changes in the tube to have as little effect on the frequency as you can. See Fig. 2.

And when you get done, it will drift. But don't despair. It will drift slowly lower in frequency as it warms up, and the drift will be the same even with different tubes.

AND . . . AND . . . as the bearded one might say,

With a TC here and a TC there
Never fear and don't despair
Like a Porsche with a four-speed shift
It'll take a right angle corner without a drift!**

That is, the right choice of temperature compensating capacitors will bring the galloping critter to a hobbled halt. In the circuit of Fig. 2, everything in the grid and cathode circuits is NPO zero-temperature drift except the 7 mmfd from grid to ground, which is TCN-330.

Few other minor points. Plate dropping resistor in Fig. 2 is larger, resulting in lower

* Suitable form with 50 mc coil and slug available from World Radio as part #42-10, price about 75 cents.

** Over 110 MPH Porsche owners refer to it as a "controlled drift" or "Migawd, Virginia, I thought you'd hit the wall!"

plate voltage and cooler less-drift operation. Also, the plate in Fig. 2 is bypassed directly to ground, minimizing its effect on the tuned circuit vastly, compared to Fig. 1 where it is coupled directly to the tuned circuit. The grid-cathode capacitance of the tube,, 3.0 mmfd, is shunted by a 6.8 mmfd NPO condenser which serves three purposes. It decreases the tuning range of the oscillator (or increases the bandspread. Same thing); it makes any change in the grid capacitance a smaller part of the total capacitance, making for less drift; and it decreases the coupling between the tube and the tuned circuit. Make this one as large as you can and still have good oscillation and sufficient coverage of the tuning range. The 30 mmfd NPO from cathode to ground serves much the same purpose.

Now for that ANL bit. See the circuit in Fig. 3. Good ol' series gate self adjusting noise limiter, except I cleverly saved space, weight, and money by using one o' them thar l'il ol' diodes. The handy 1N34, D2.

With a back resistance that made the gate look open even when the instantaneous noise-applied bias said it should be closed.

And that cute l'il diode labeled "high-back resistance 1N54" didn't cure the trouble? It did not!

Explanation? At least one manufacturer's 1N54's are not as high a back resistance as advertised! I use Ohmite 1N54's for D2 now. The back resistance depends of course on what back voltage you measure at, but on a Triplett model 630-APL on the ohms x 100 K scale with about 18 volts applied, the back resistance is above 20 megohms. On a Simpson 260, R times 10 K scale (highest on the meter) with about 7½ volts of battery in the instrument, the needle barely budges off the pin. That limiter works now.

And that last item, those FM broadcast signals. First, how do they get in there, anyhow? Second, how many ways can you get rid of them, and which is easiest?

Well, we better look at some figures now, but we will only add, subtract, and multiply by 2, so if a kook like me with no degree can figure 'em thru, you can too.

Our *if* frequency is 2.1 mc. My oscillator operates on the low side of the signal, which means that from 50.0 to 52.1 I don't hear any ham images, and there is not too much commercial stuff in the 47.9 to 50.0 image range, giving me a nice clean no-birdies receiver over at least the popular first couple of megacycles. Except for those blasted FM stations!

Now the multiplying. Let's say the receiver

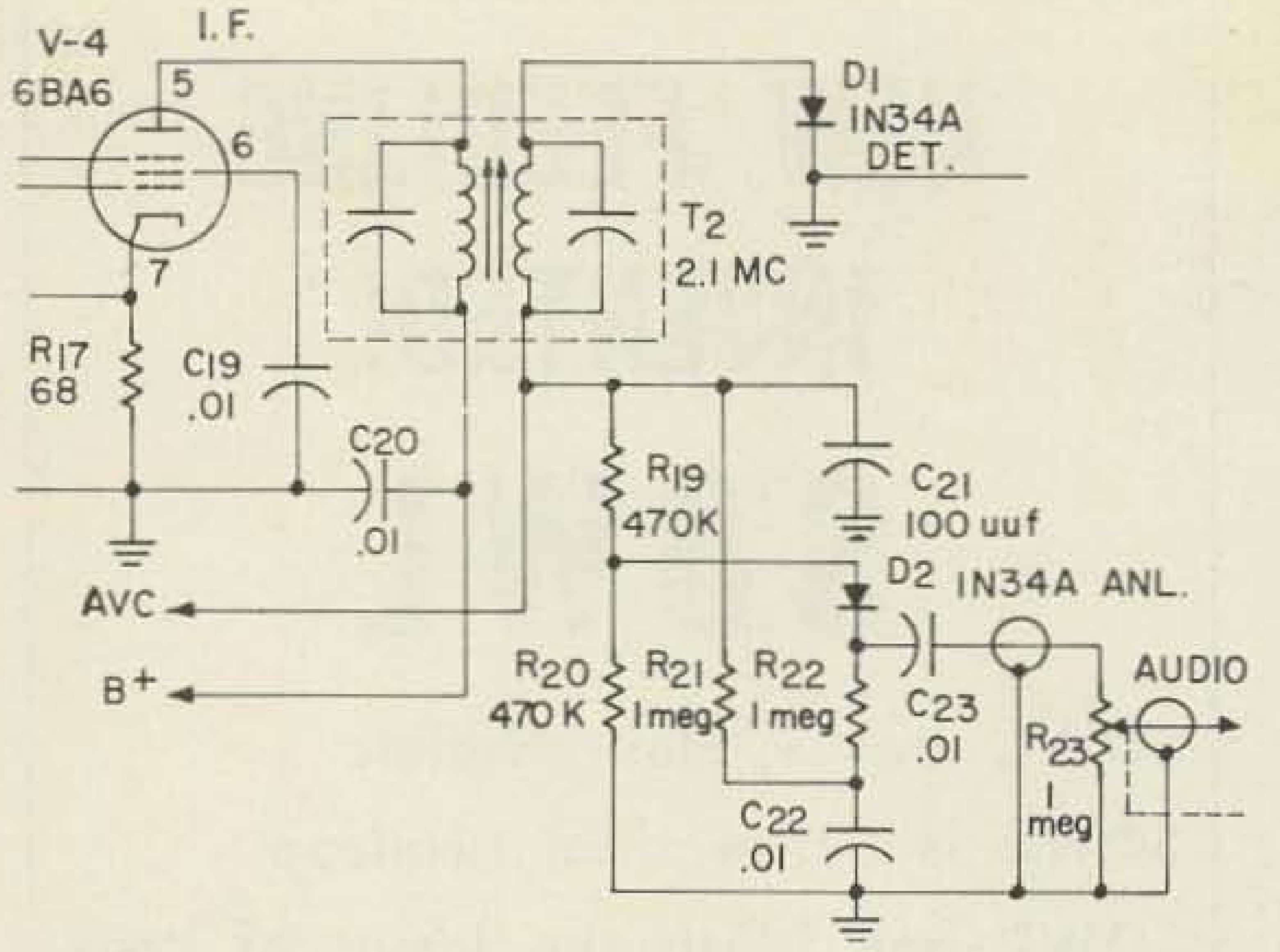

Fig. 3 Series Valve Noise Limiter

is tuned to 52.1 mc. The oscillator is then 2.1 mc lower, or 50.00. The *second harmonic* of the oscillator is at 100.00 mc. If a very strong signal gets through to the mixer on 102.1 or 97.9, it will be converted down to 2.1 and barrel right through the *if*. My Measurements Model 80 Standard Signal Generator says it takes about 300 microvolts to be noticeable. And remember, most ham receivers consider 50 microvolts S 9. This means it takes an S 9 plus 15 db or so signal up in the FM band to give trouble. But brother, when you live in the same town with a 20 or 30 or 50 *kilowatt* FM signal, he *is* S 9 plus 15—and then some.

There are three ways to lock the barn door before the wolf gets to the horse's ear. One: Use enough high-Q tuned circuits at 50 mc so that the FM signal never gets into the mixer. Two: Thoroughly shield the oscillator and bring the output through a low pass filter so the oscillator second harmonic does not get to the mixer and the FM signal has nothing to beat with. Three: Trap out the FM signal with a tuned circuit.

If you are building the ultimate receiver, use methods one and two. Method one means you'll have to gang-tune the rf stages, no broad-banding, which also helps eliminate cross-modulation and images. It is excellent, but expensive and time consuming. Method two will help eliminate *all* birdies and spurious responses, but it also is not cheap and easy.

Method three has one drawback: each tuned circuit will really knock out the interference only over about 500 kc to perhaps 1 mc at the most, but that is usually all that is really needed. And it is cheap. And it is easy. See Fig. 4. Make up a little slug tuned coil. Connect a small NPO condenser across it and grid dip it to make sure it will tune 88 through 108 mc, the FM band. Then hook it up with the condenser in series with the coil, and connect it from grid to ground of the rf stage. For the ultimate in suppression, connect another one from grid to ground of the mixer. On 6 meters, the circuit will look like a small condenser. It will look to be ¾ the size of the condenser used, as the series coil will cancel out ¼ of the condensers' reactance at a frequency ½ the resonant frequency. That is, if you use a 4.0 mmfd condenser in the circuit, it will look like only 3.0 mmfd to the converter on 50 mc. This will mean you'll have to back out the slug or remove a turn or two from the antenna coil or mixer coil with which the FM trap is used

[Continued on page 42]

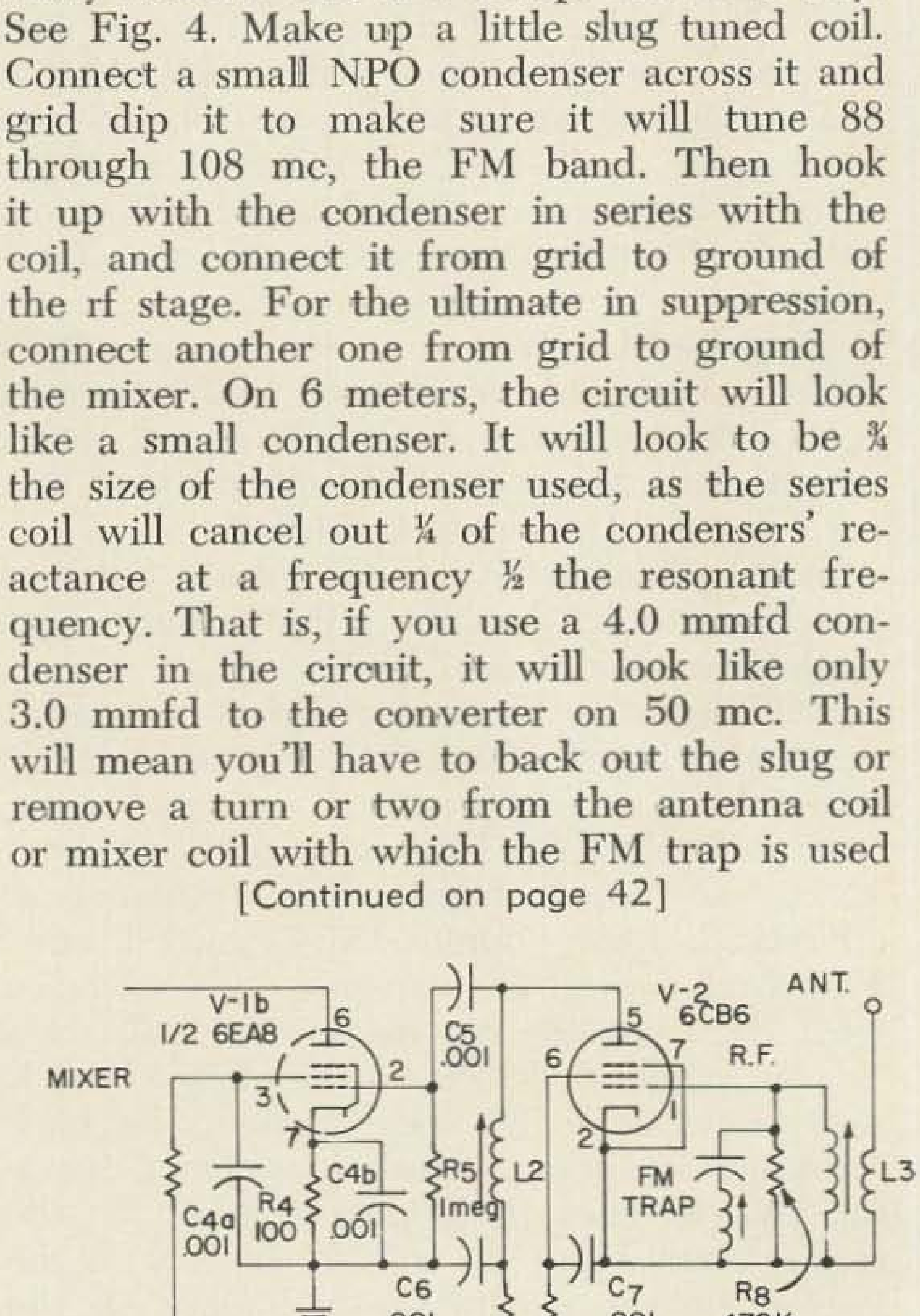

Fig. 4 FM Series Trap in RF Stage

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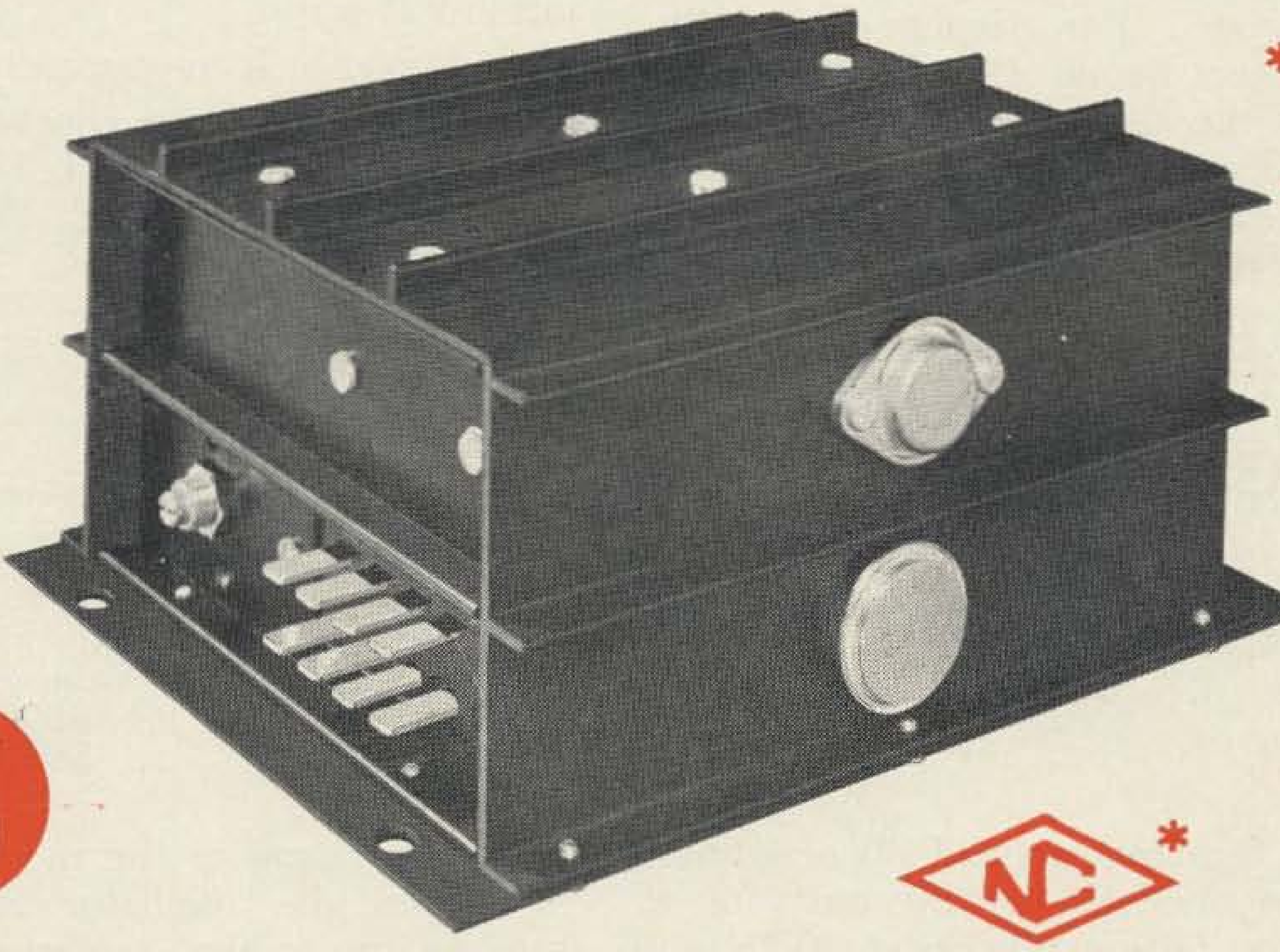

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[Oscillators from page 40]

to repeak the converter on 50 mc.

Tune in a real loud interfering bothersome FM signal. Tune the FM trap slug. As you go through the right spot, the FM signal will disappear. Our signal generator says where 300 microvolts at 102.1 was audible before, it now takes about 6 THOUSAND microvolts to interfere. That's about 26 decibels rejection. In practice, it has made the difference between speaker blasting noise over 150 kc of the band and completely inaudible—except maybe if you put a bfo on, you kinda think you might be able to spot a wishy heterodyne where they used to be, unless it's W1FZJ or HOY on forward scatter. And that was with just ONE trap in the rf stage grid.

To summarize: For oscillator stability, watch these four items. (1) Use a circuit which couples the tube loosely to the tuned circuit. (2) If you must use a slug tuned coil, use a threaded form where the slug has no metallic heat-path to the chassis and use as small a slug as possible. (3) Dope your coil so the wire can't shift with heat. And (4) build like a vfo. Or like a battleship. They should be synonymous. Make it physically solid. Good idea to put the oscillator in the *corner* of a chassis, as that usually wiggles less than a spot near the middle.

To make a noise limiter work, if using the series type, make sure the diode has a very high back resistance. Measure the thing on your ohmmeter. If you can't find one in at least the 10 to 20 megohm range on a VOM (don't use a VTVM, it may fool you), use a tube instead of a crystal.

To get rid of FM interference, build a good expensive design with shielded and filtered oscillator and several gang-tune rf circuits, or put in FM traps.

And good luck on your next project!

Note: The FM trap consisting of slug tuned coil wired to 3.3 mmfd NPO condenser is WRL part #43-3, about 75c. The 7.0 mmfd N-330 condenser is WRL #20-21 about 50c.

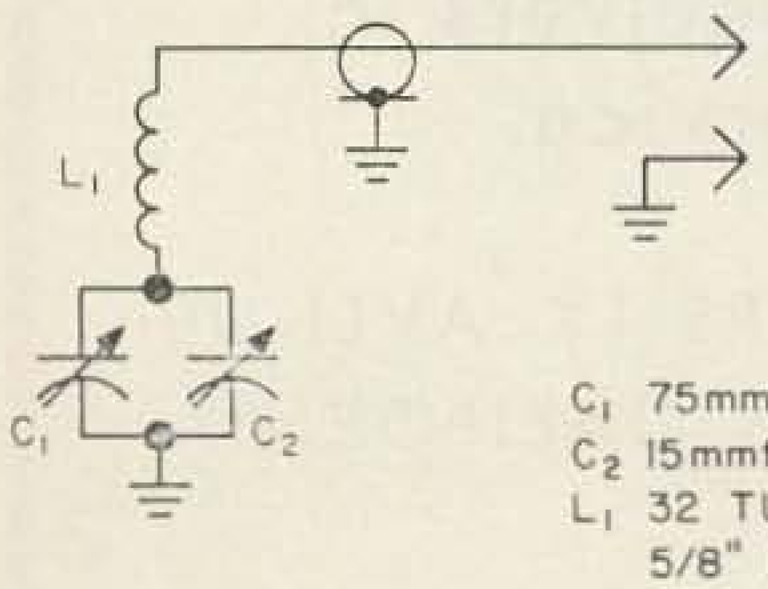
---

6 Meter VFO The Easy Way

Jerry Boucher WA6CDO
909 Haight St.
San Francisco 17, Calif.

This spring 6 meters opened up and found me with three crystals and 20 watts of rf. Since there was quite a pile-up at 50.25, and the frequencies above 50.5 are a no man's land out here in the land of Channel 2, I became aware of the value of a vfo.

My being a little strapped for funds, completely without test equipment, and having the state-of-the-art conditions (no drift) to comply with, presupposed some pretty stringent conditions: namely—economy, simplicity, and no goofs.



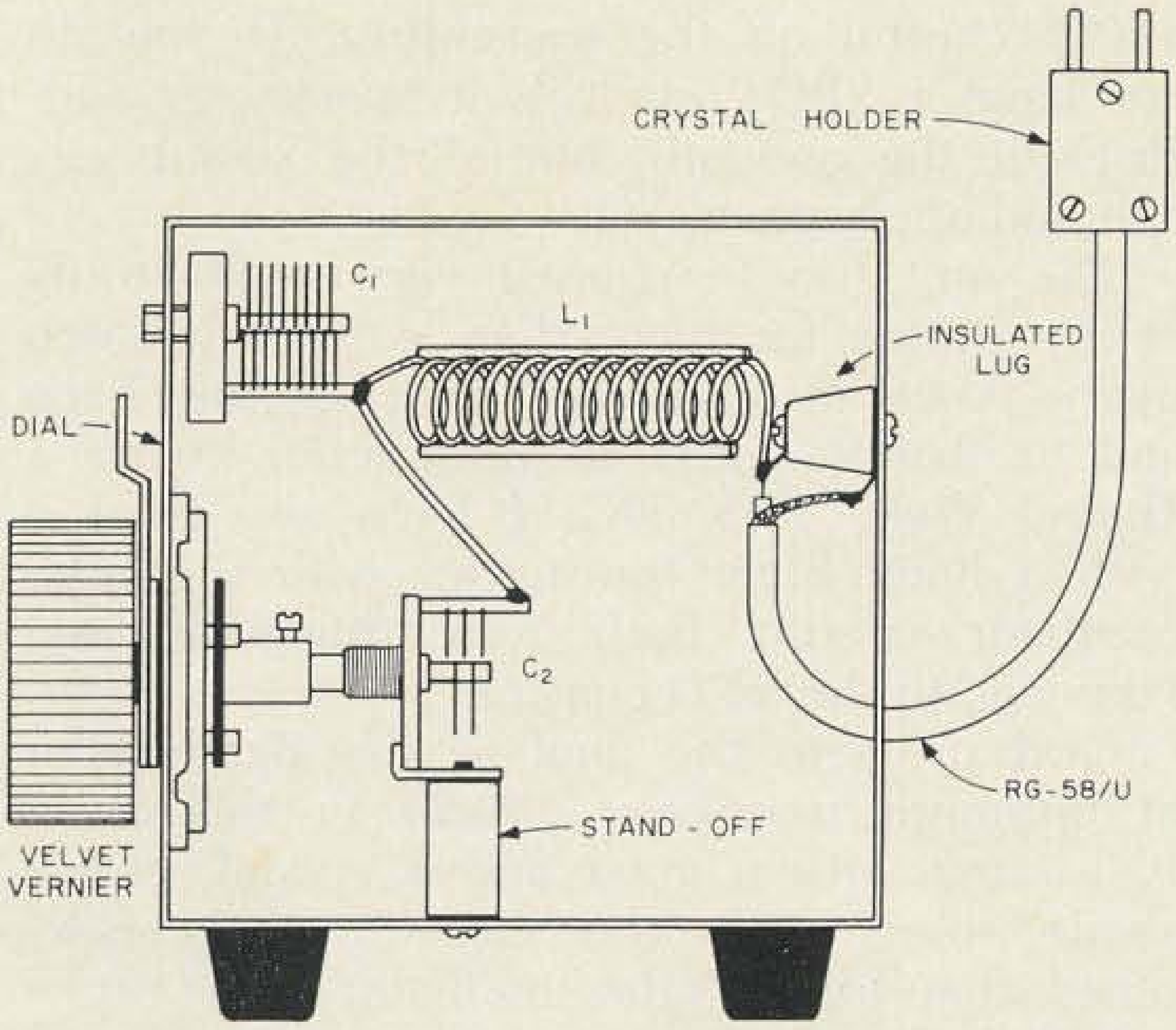
C_1 75mmf AIR TRIMMER
C_2 15mmf VARIABLE
L_1 32 TURNS #20 ENAMELED WIRE 5/8" DIA. 2" LONG (*B&W* 3007)

FIGURE 1
VFO CONTROL

A comparison of the more popular vfo circuits and the oscillator in the transmitter brought me to the conclusion that I *had* the oscillator—I needed only to shift its frequency around a bit.

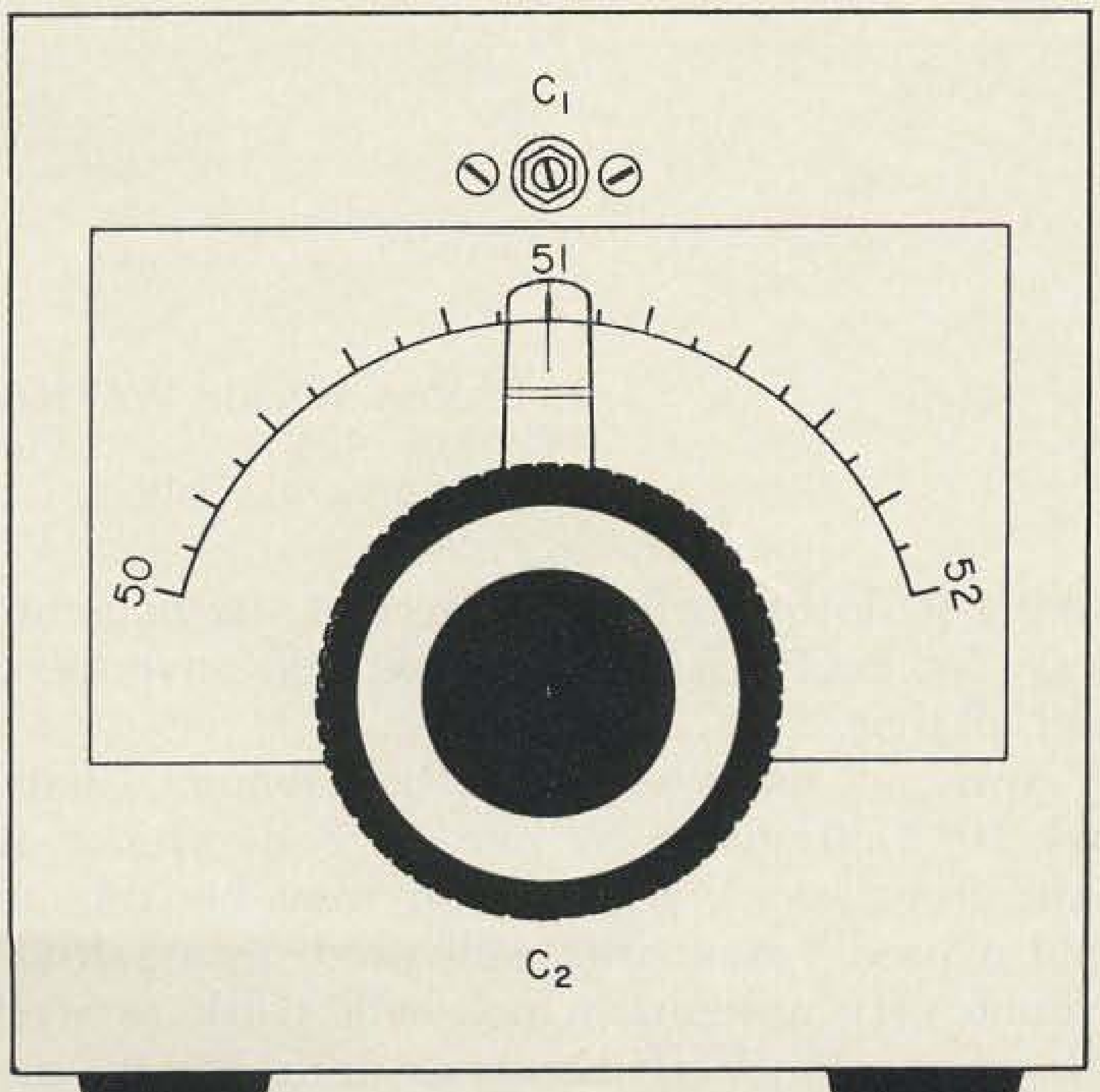
A few sorry attempts at rubber crystals left me with the idea that I had an impossible problem, until I tried plugging a series-tuned circuit at 8 mc into the crystal socket—and it worked! The grid drive was actually slightly higher than I had been getting with the crystals. The advantages of this circuit became immediately apparent. Varying only the oscillator in the transmitter meant that there was very little voltage present in the vfo control, no extra power supply to build, and no tubes to heat and cause drift. All necessary parts—two variable capacitors, a piece of miniductor, a vernier dial, and a cabinet—were in the junk box or could be picked up at the local surplus store for almost nothing.

Construction was quite simple. I used a 4 inch square aluminum box that I had handy because it allowed plenty of room to mount an



old National Velvet-Vernier mechanism. The larger capacitor was mounted above the dial and the small capacitor was mounted on a ceramic spacer from the bottom of the box. The coil is supported at one end by the frame of the larger capacitor and at the other end by a stand-off insulator on the rear panel. The connecting cable is terminated at this point—the center conductor soldered to the coil and the braid to a grounding lug under the insulator. A No. 12 copper bus wire was used to insure good ground connections to all ground points and to the coax. The box was mounted on rubber feet to avoid mechanical vibration. The dial was inked on white paper and attached to the panel under a piece of clear plastic by three small self-tapping screws.

A word of caution to those not experienced in vfo construction. Mechanical rigidity is very



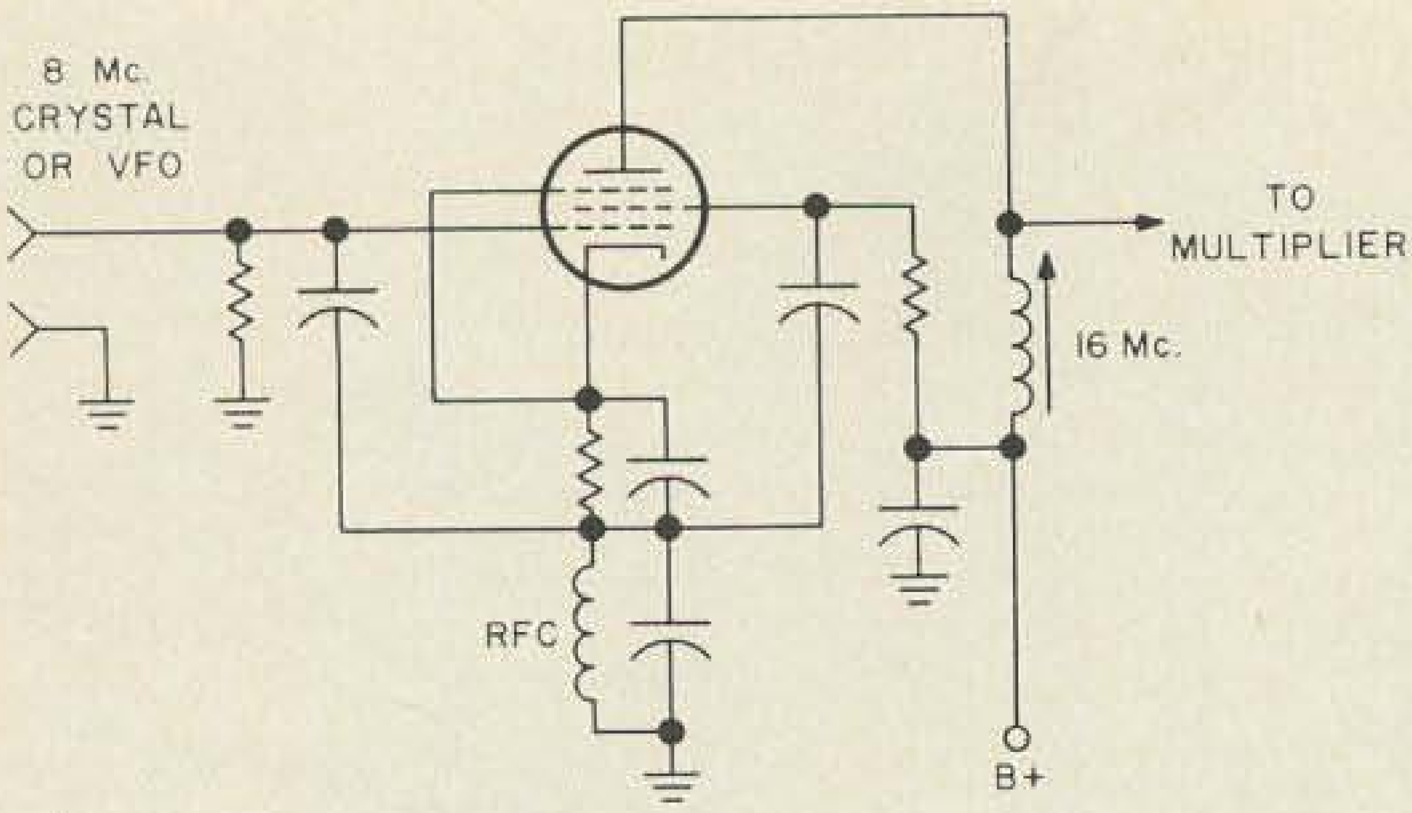


FIGURE 2
OSCILLATOR IN TRANSMITTER

important in the tuned circuit of any vfo. This circuit is subject to capacity between the cabinet and the components. Any movement of the coil or capacitors will result in a frequency shift which can be considerable when used in a circuit multiplying to 50 mc. Good symmetry in placement of the components should also be observed. No. 12 copper wire was used for all connections within the unit to avoid vibration. The box itself is rigid enough to stand all but direct pressure against the sides.

The unit was calibrated against an accurate receiver, first setting it to about 8 mc with C2 fully meshed and tuning C1. Next, the harmonic was picked up at 50 mc by varying C2. A mark was placed on the cabinet at 50 mc and every 100 kc up to 52 mc. (Another setting of C1 will be necessary for 52 to 54 mc if you want that part of the band). A dial was made from heavy white paper and inscribed at 50-kc intervals using the spots on the cabinet as a guide. (This is best done using the SPOT control on the transmitter. If you do not have a SPOT control, it is easy to add. Just cut the oscillator out of the keying circuit and apply power with the key up).

The unit has functioned very satisfactorily at my station for more than six months with many hours of on-the-air time. It has been and is being used in conjunction with a Harvey-Wells TBS 50C. I have also tried it with a home-brew transmitter with a similar oscillator circuit. Both transmitters respond very well to the VFO control.

Grid drive to the final of the Bandmaster at optimum frequency (50.25 in this case) is 1.9 ma with a good active crystal, and a shade more with the vfo. At frequencies other than where the oscillator and tripler are peaked, drive is even higher with the vfo. For example, 1.4 vs 1.2 ma on the rock at 50.6 m.

The Bandmaster is a 6AQ5 oscillator-doubler, 6AQ5 tripler and 807 final (running at 30 watts input here). The only thing special about the oscillator is the 50 mmfd capacitor from the grid to the bottom of the cathode resistor. This was added at a much earlier date to improve the response to weak crystals. The oscillator with the tuned circuit in place of the crystal will not oscillate without this capacitance.

The vfo has been used at WA6CDO for six months in many local QSOs and with eight states, Mexico and Canada, and has only once been accused of drift. This complaint came from a local friend and is repeated each time I work him. His receiver . . . ? (I get the same report with a rock in the socket!)

. . . WA6CDO

Low Cost VHF Yagis from TV Antennas

R. F. Van Wickle W6TKA
P.O. Box 4051
Santa Barbara, Calif.

There's only one thing better than a low-cost antenna, and that's a no-cost antenna. But don't let me fool you; unless someone gives you an antenna, there just ain't no such animal.

But, then, someone gave me an antenna. It was a ten-element Channel 10 television Yagi, and it lounged around my garage for two years before I got wise to its possibilities, and then only after my ten-element two-meter Yagi fell down. (It fell down because I was taking it down to fix it. I fixed it, permanently.) Necessity is the mother of invention, and all that.

Now, not everyone has a ten-element Channel 10 Yagi given to him, but the point is this: if you look around you may be able to find a used (mine was well used, in a salt-air climate) tv antenna which will work as well for you on the VHF bands as mine has for me on two meters.

A ten-element channel 10 Yagi is about

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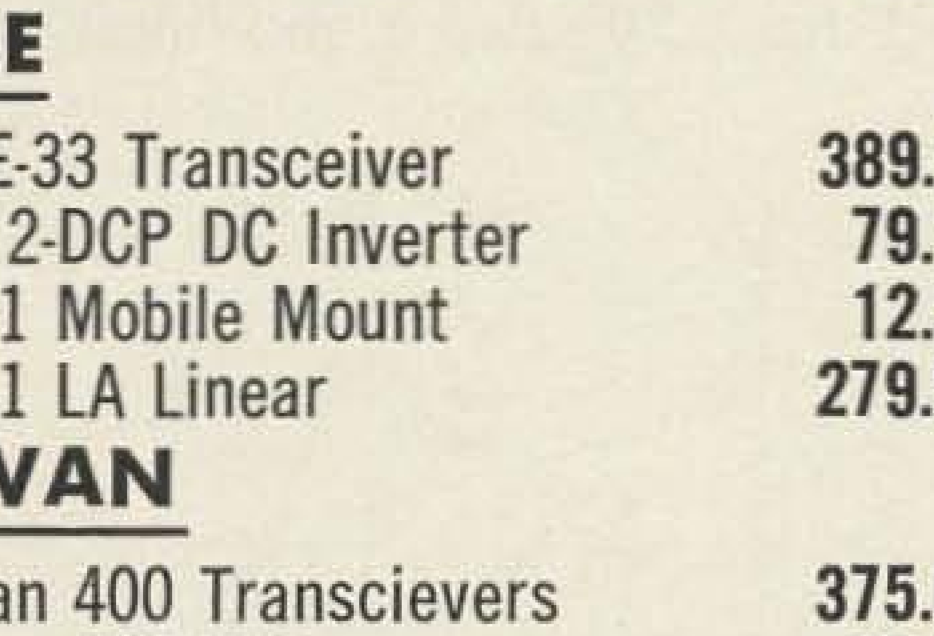

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73 Stan Burghardt WØBJV

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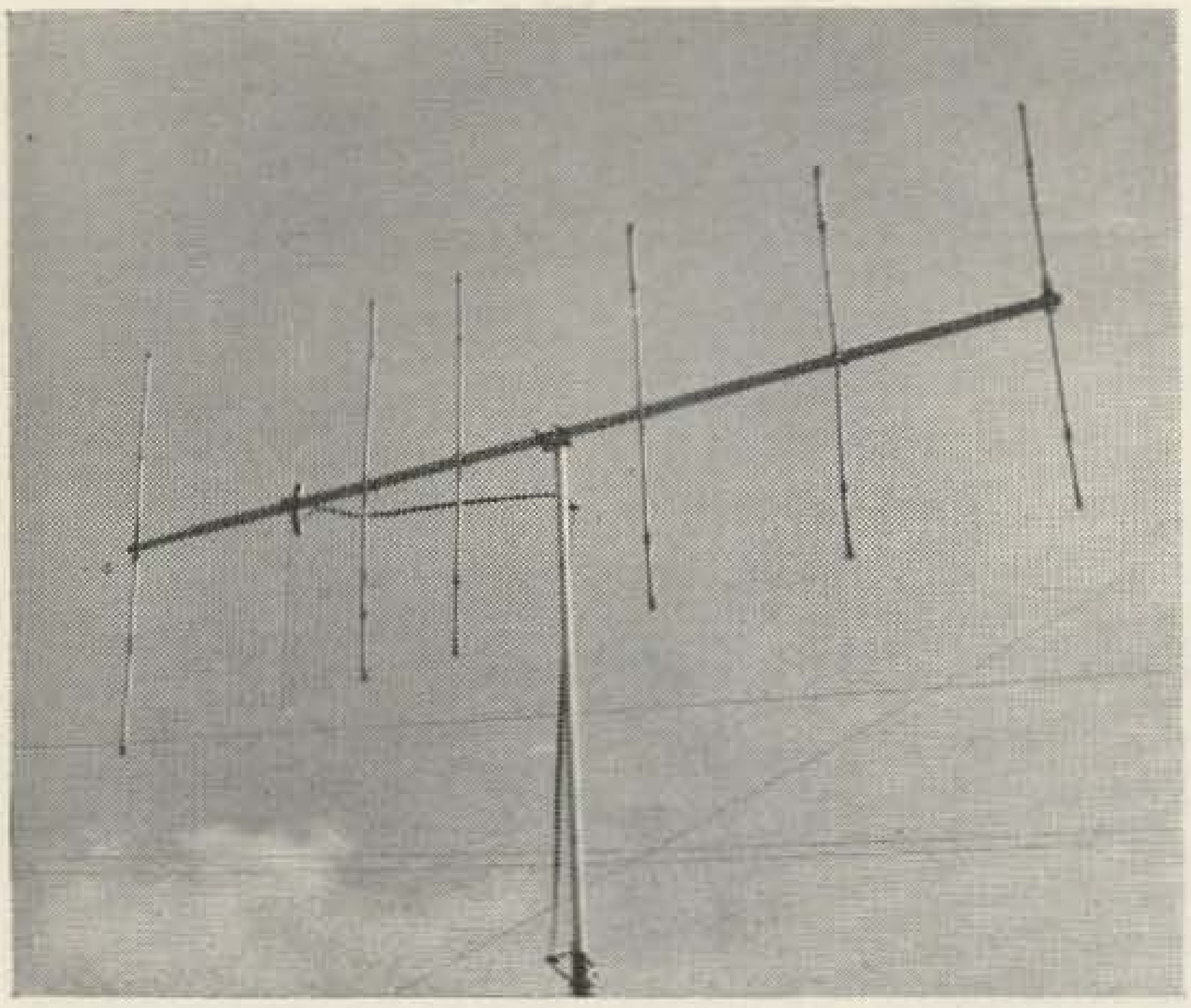


W6TKA's two-meter Yagi, made from modified Channel 10 TV antenna.

seven feet long, and has ten elements (naturally) spaced about 8½ inches. As you will note from the sketch, I removed the original driven element and used about six inches of the large-diameter portion of it to extend the boom about six inches so I could space the new reflector (see sketch) 16 inches (0.2 wavelength) behind the driven element, which I fashioned from a length of aluminum clothesline wire. (Sears, Roebuck and Co. catalog. Don't attempt to use tv ground wire which the radio supply houses sell because it is too soft.) I left the first and second directors in their original 8½-inches-apart location, which is approximately what the spacing for these two elements should be in a two-meter Yagi. I then removed every other director, and wound up with a seven-element beam. But with elements much to short for two meters.

Aha! Those elements I removed! As per the sketch, I attached (with 6-32 machine screws, lockwashers and nuts) the necessary additional lengths to make the elements the required lengths for two meters. The seamed tubing cuts easily with sharp tin shears (mine are dull), and I hammered the ends of the elements flat.

Now . . . as to mounting this beast, you will note that I reside in Southern California, where the sun shines 24 days out of the year. Out here in this intellectual wasteland (as some of my Eastern contemporaries are fond of describing this locale) we use vertical polarization on two meters. This means two holes have to be drilled in the boom to relocate the "U" bolt so that the antenna can be mounted vertically. I used a length of dowel (well, an old broomstick, if you must) to mount the antenna on top of a steel mast, since the idea of a metal mast sticking up among the elements did not appeal to me, nor would the antenna have liked it very well.

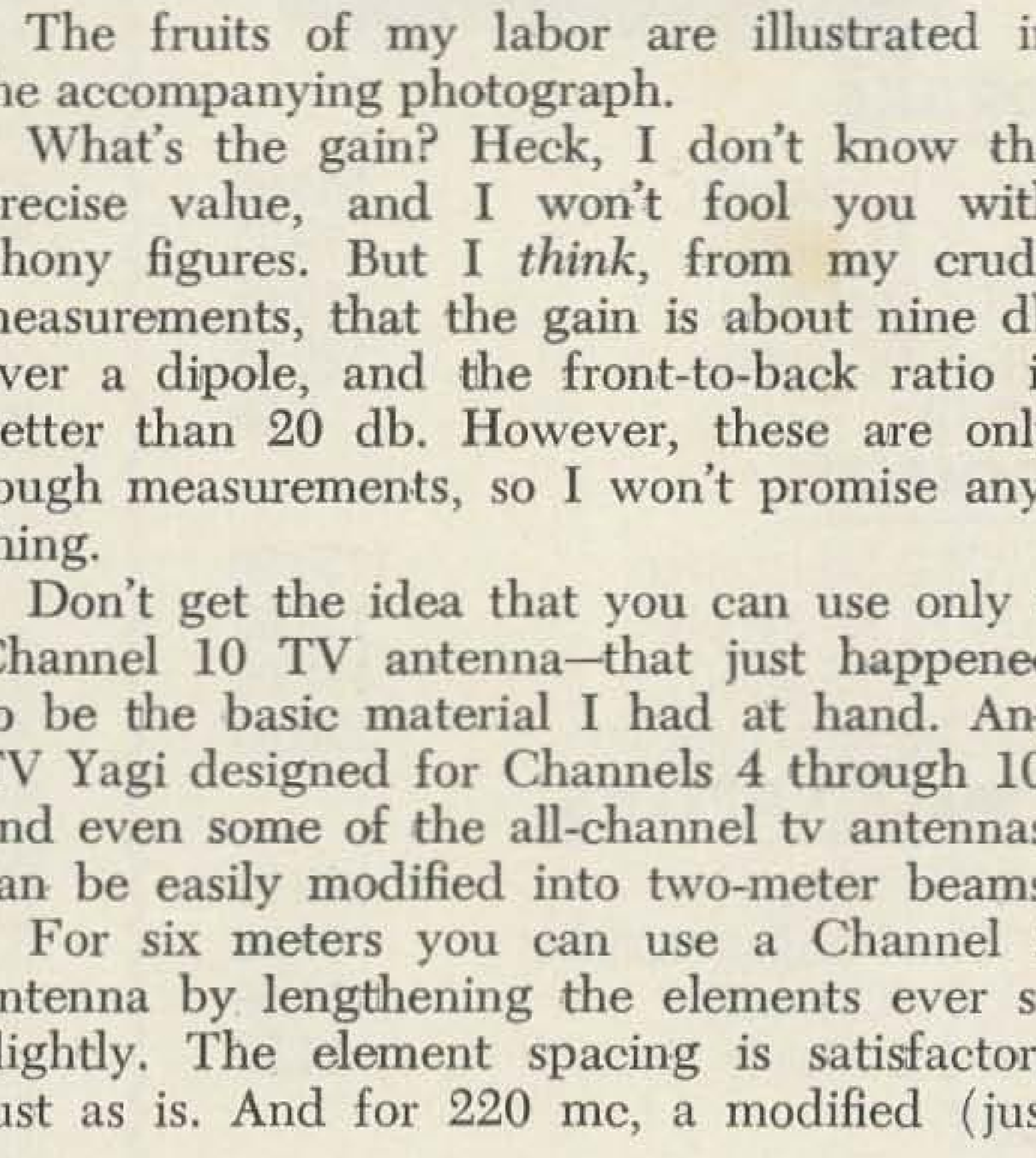
SWR? 2.5 to 1 at 146 mc, 2.0 to 1 at 144.2 mc. The purists will protest, but I think about the small additional losses caused by SWR on a low-loss line (I use a good grade of 300-ohm tv line) and realize that there isn't much to worry about. Besides, I plan to install a simple stub or "Q" section matching arrangement which will reduce the SWR to a much lower value.

The fruits of my labor are illustrated in the accompanying photograph.

What's the gain? Heck, I don't know the precise value, and I won't fool you with phony figures. But I *think*, from my crude measurements, that the gain is about nine db over a dipole, and the front-to-back ratio is better than 20 db. However, these are only rough measurements, so I won't promise anything.

Don't get the idea that you can use only a Channel 10 TV antenna—that just happened to be the basic material I had at hand. Any TV Yagi designed for Channels 4 through 10, and even some of the all-channel tv antennas, can be easily modified into two-meter beams.

For six meters you can use a Channel 2 antenna by lengthening the elements ever so slightly. The element spacing is satisfactory just as is. And for 220 mc, a modified (just



* Original TV antenna elements removed.
A—Original reflector removed and tubing from original dipole attached to extend boom for proper reflector spacing.
B—New reflector, made from two removed elements.
C—New driven element (folded dipole) made from 1/8" aluminum clothesline wire.
D—Portions of removed elements attached to existing elements to make directors proper length. See text.
E—Yagi is fed with 300-ohm TV line, or through "Q" matching section or stub for lower SWR.
All elements, except feed point of driven element, are connected directly to boom; no insulators used.

shorten the elements) Channel 13 Yagi is inexpensive and works splendidly. Even if you have to buy a new TV antenna, you're still money ahead. Consult any catalog (Allied, Newark, Harrison, to name but three) and you'll usually find TV antennas cheaper than VHF ham band antennas. (Of course, if you can con a TV serviceman out of a good, used antenna, so much the better!)

A new, ten-element Channel 10 Yagi will cost under $66.00. A Channel 4 or Channel 6 Yagi costs less than $13.00. That Channel 2 Yagi for six meters costs under $14.00. (Think of it! Ten elements on six meters for $14.00!) And a Channel 13 Yagi for 220 mc will cost about the same as the Channel 10 Yagi.

Compromise? Sure, but it's cheap, and it works.

Eight-over-eight skeleton slot antennas, perfectly-matched Yagis, and all that, are just dandy, but for the ham who occasionally finds himself short of cash, or who simply doesn't want to tie up much money in ham gear, this is an example that there are several ways in which you can have a VHF antenna that will perform quite respectably. I can't help but think that too many of us hams buy nearly all of our gear ready made. I'd like to see more nuts, like me, build or improvise their own gear, especially antennas, about which I am especially nutty.

. . . W6TKA

Swampscott

The Swampscott Convention is still the largest in the country, with close to 4000 in attendance. The big prize this year, a Galaxy Transceiver, was won by R. W. Carlsen W2ZBS of Poughkeepsie, N.Y. and is here presented by Gene Hastings W1VRK, co-chairman of the convention.

NOW!

TWO NEW COMPACT 300-WATT SSB/CW TRANSCEIVERS

Part II

Smaltz for Semiconductors

Robert A. Kidder

In the first half of this treatise we covered the conversion of ac line power to low voltage dc. This half will deal with the voltage regulation of transistor power supplies and also with methods of varying the output voltage. (Those of you who tuned in late can obtain the back issue for a paltry 50 cents.)

Power supply regulation was mentioned several times in Part One. Regulation refers to the ability of a supply to maintain a constant output voltage in the face of a varying current drain. In cases where the dynamic load is light, or where Class A loads (the average current drain is essentially constant) are involved, voltage regulation isn't a problem because the amount of the current variation is small when compared to the total load current. Therefore, the voltage change from minimum load to maximum load will be small also, especially if the power supply impedance has been kept as low as practicable. The voltage regulation is then said to be good, or at least adequate.

However, when the load variation is large, or when the current drain is intermittent, as with Class B loads, the regulation of the supply can be something of a headache. The reason for this is that at high current levels the impedance of the supply becomes an appreciable fraction of the load impedance. As the load current increases due to a decrease in the load impedance, the supply voltage begins to drop across the supply itself and the voltage available to the load goes down as a result. The regulation under these conditions is poor, and among other evils it can cause signal distortion. In these circumstances it behooves us to find a method of stiffening the power supply.

Figure 5A shows a simple method of stabilizing the output voltage for light loads. The action of this circuit is similar to its gas tube counterpart, except that there is no initial voltage overshoot. Once the breakdown potential of a zener is reached, the voltage remains constant at that point. The procedure for selecting the dropping resistor, R_D, is the same as for gas tubes, and it consists of taking the difference (in volts) between the filter output voltage (E_s) and the zener operating voltage (E_r) and dividing it by the maximum current (I, in amps) at which regulation is to be maintained. This current figure should be about 10% in excess of the actual maximum anticipated load current at which regulation is desired, so that when this point is reached, enough current will still be flowing through the zener to keep it operating solidly beyond the break in its characteristic curve (known as the zener knee). This will insure proper regulation at the desired maximum load current. The formula which describes the value of the dropping resistor is $R = \frac{E_s - E_r}{I}$. The answer will be in ohms.

Notice that the zener diode appears to be wired backwards in this circuit. It's quite correct, however. The zener action occurs when the inverse voltage capability of a diode is exceeded, and its junction breaks down. Any junction diode will behave like a zener under those conditions, but zener diodes do it better. For what it is worth, any junction diode will always break down at the same voltage, but this voltage varies widely from one diode to another, even among the devices of the same type number. If you can determine the breakdown point of a given non-zener diode, it can be used as a zener at that voltage.

Zener diodes have been covered quite thoroughly in the November, 1962 issue of 73, as well as in the whole spectrum of electronic publications, from the most esoteric engineering journals to the most elementary of hobbyists' magazines. The writer, therefore, chooses to make only a few plain-text statements contrasting them to gas regulators. First of all, zeners are available in a staggering assortment of voltages and power ratings, from about 3 volts to several hundred volts, with power dissipations ranging from precision reference cells rated at a few milliwatts to big, woolly monsters of 100 watts or more. Gas tubes, on the other hand, can be had only in four or five standard voltages, with a maximum dynamic current range of 35 milliamps.

The biggest zener diode ever encountered by the author was a 60 volt, 50 watt unit, and it was only about one eighth of the size of an OA2, which is a gas tube in a seven pin miniature envelope. Furthermore, that big zener required only a single ¼" hole for mounting. Texas Instruments, among others makes a series of 400 milliwatt zeners that are smaller than half-watt resistors, and they're reasonably priced at less than three dollars each. Gas regulators, in this writer's opinion, come away a poor second to zeners in regard to physical size, electrical characteristics circuit simplicity, and general utility.

While it is entirely feasible to install a 10 volt, 10 watt zener diode in a supply and get a

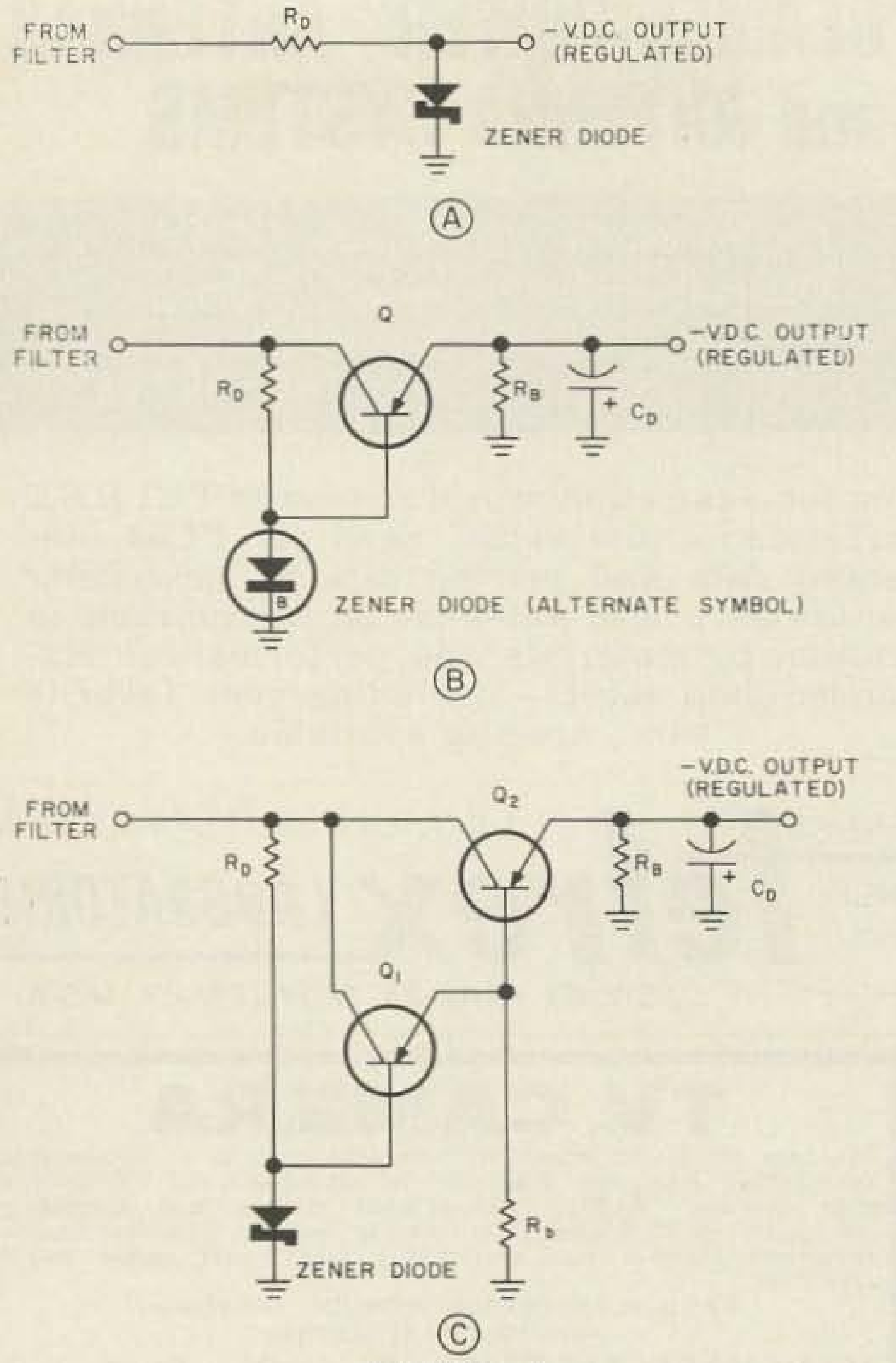


FIGURE 5

10 volt output that will stay in regulation out to one amp, the cost of that 10 watter may knock your wallet out of regulation. Figure 5B shows a series regulator circuit that will multiply the current rating of an inexpensive, low power zener by a factor equal to the beta of the power transistor, Q. The transistor itself need not break you bank, either. It can be one of the less-than-a-dollar variety offered by most of the major mail-order electronics supply houses. These units are generally culls from the production lines of the Big Names, and they have usually been rejected for high collector to emitter leakage or for low beta. In this application, both faults can be tolerated. High leakage normally engenders temperature instability in a transistor amplifier and increases the possibility of thermal runaway, but in this circuit the transistor is connected as an emitter follower, and thermal runaway is therefore impossible.

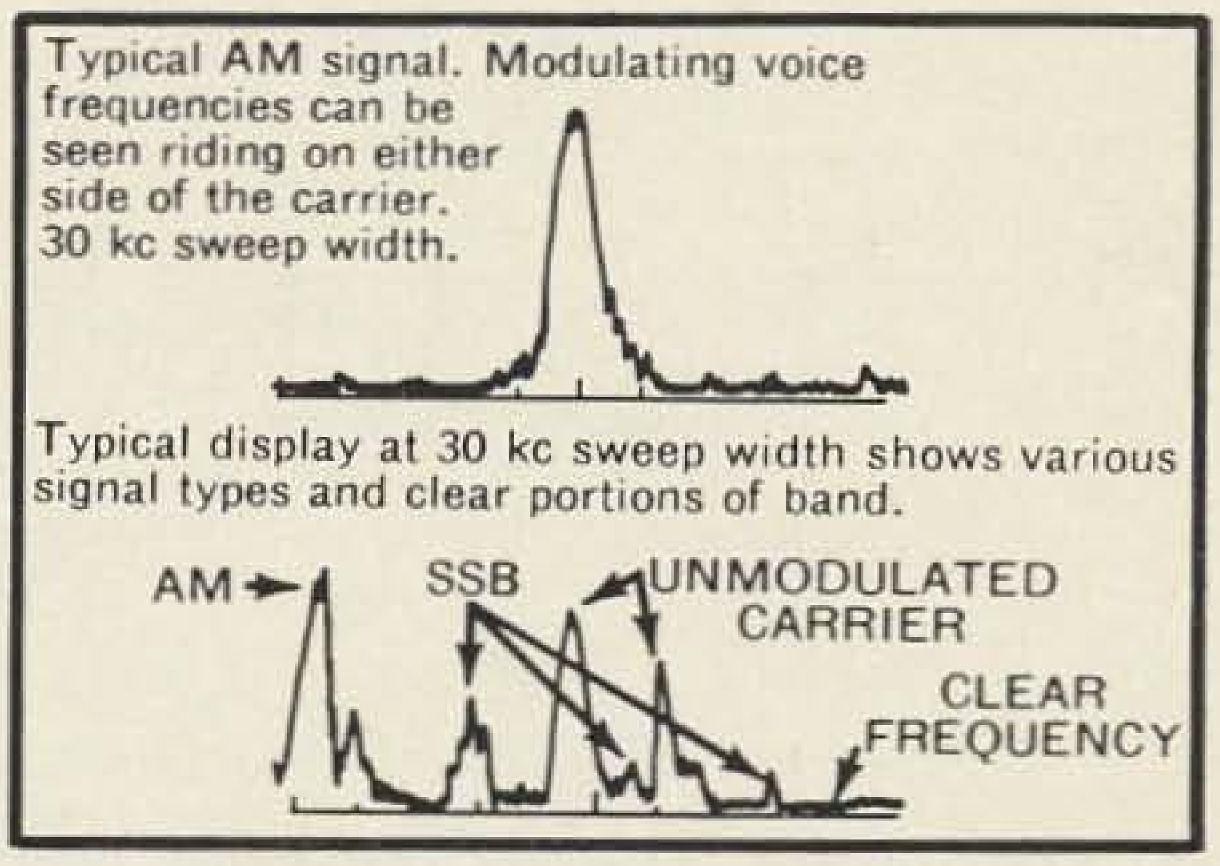
Low beta can be compensated for by using a second transistor in a Darlington configuration, as shown in Figure 5C. Q1 can be any unit that is capable of handling the base current for the power transistor, Q2. The base current is equal to the current flowing between the collector and the emmitter, divided by beta. In the case of Q2, the collector to emitter current is the sum of the currents drawn by the external load and by the bleeder resistor, R_B. Q1's beta needn't be anything to write home about, so Q1 can be bargain basement special, too. Beta for the combination will be the product of the betas of the two individual transistors. For example, if Q1 is a medium power unit from the cutrate bin at the corner drug store, with a beta of 25, and the power transistor, Q2, is a mail-order mongrel with a beta of 10, the compound beta will be 250.

The extra resistor, R_b, is a ballast resistor which helps to minimize any effects of transistor leakage. Its value isn't critical; it can fall between 1K and 10K, with higher leakages taking values toward the low end. As mentioned before, R_B is a bleeder resistor, which should be chosen to draw perhaps 5% of the supply's maximum output current. The capacitor, C_D, is intended mainly for decoupling the circuits powered by the supply, and its value ought to be at least 50 microfarads.

In addition to extending the current capability of a low power zener diode, this type of regulator circuit provides two other advantages: it reduces ripple, and it lowers the output impedance of the supply. Since the flow of current through a transistor is independent of the collector supply voltage and is determined mainly by its base current, variation of the collector voltage, caused by ripple, will not induce any variation in the current flowing through the device, as long as the ripple low point doesn't dip below the voltage level at the emitter. Any hum that does appear in the output will be a result of ripple being present at the base of the transistor and of collector to emitter leakage. Obviously, in a supply with electronic regulation of this sort, filter requirements can be less rigid. The filter circuit need only be heavy enough to do a really good job on the base supply for the series regulator, and the transistor itself will do the rest.

The other bonus, lowered output impedance, owes to the fact that the output impedance of an emitter follower is approximately equal to the impedance of the base circuit divided by the beta of the transistor. Referring again to Figure 5C and applying the values of beta given previously, the output impedance of the regulator would come close to the impedance of the zener diode (about 20 ohms) divided by the compound beta of the Darlington connected transistors; this was 250 in the example. The resulting output impedance is in the neighborhood of 80 milliohms. Looking back through the emitter of Q2, R_D would appear to be in shunt with the zener, and R_b would appear to be in shunt with Q1. Since the resistance of each is several hundred ohms, their

WATCH IT!... WITH THE



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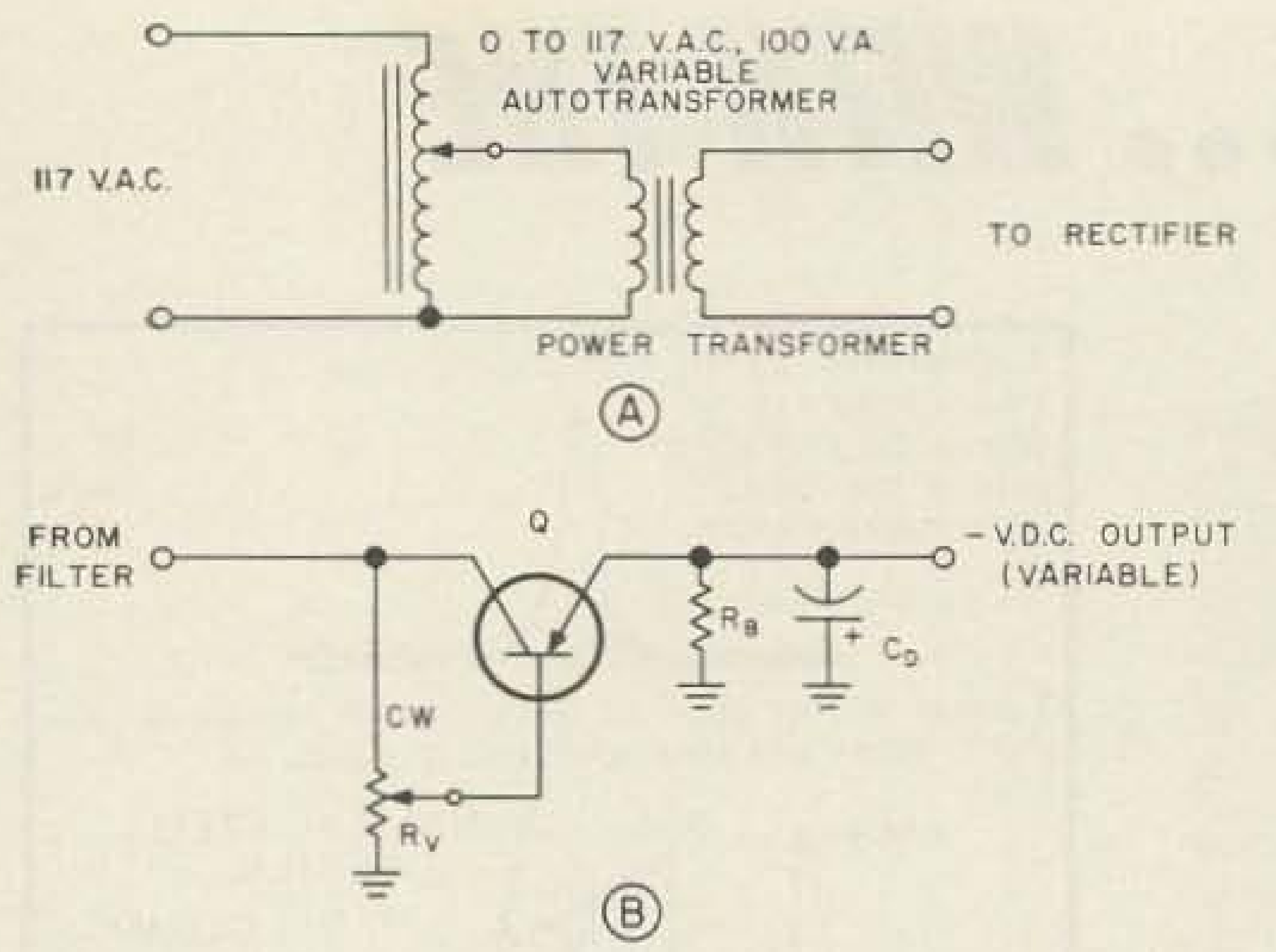

FIGURE 6

net contribution toward lowering the overall output impedance is small. Thus it can be seen that the use of seires regulator is a most convenient method for keeping down the output impedance of a power supply. In high current supplies (half an amp or more) their use is practically mandatory. In general, series regulators pay their own way, and then some.

There are many ways to control a series regulator in addition to simply referring it to a fixed voltage, as has been done here. There are error sensing shunt amplifiers, zener referenced differential comparators, and even AC-coupled hum amplifiers which feed the ripple back out of phase and make it possible to eliminate normal filter circuitry altogeather. The author does not wish to slight the more technically competent readers, but he desires only to impart working knowledge of the basic techniques in semiconductor supplies. Adequate coverage of the more exotic methods of making a supply sit up and talk would take far more space than your writer feels inclined to fill. In any case, outside of laboratory use and other critical applications, their value in garden variety, general purpose power supplies seems doubtful.

The final aspect of this dissertation is variable voltage outputs, such as would be useful in general purpose bench supplies. Probably the simplest solution for this is to operate a fixed voltage supply from a variable autotransformer inserted between the line and the primary of the power transformer, as shown in Figure 6A. Light duty variable autotransformers can be obtained for as little as three dollars from surplus outlets. This method should not be employed if the supply has a zener diode or other reference element in it, however.

Figure 6B illustrates a kind of series regulator that is controlled by a pot, R_v, instead of a zener. Strictly speaking, it's not a regulator at all, because it has no fixed reference. It's really a sort of step-down resistance transformer (imagine that!). It makes the pot look like a much lower resistance than it actually is, exactly the same way as the series regulator divides down the impedance of the zener diode in its base circuit. The pot is used to establish the output voltage, but only the transistor's base current is drawn through it. The load current is drawn through the transistor itself. If the resistance of the pot is such that at least fifteen or twently times the base current is drawn through it, the regulation of the supply can be made surprisingly good for a circuit with no standard of reference. This little jewel, by the way, can be strapped across a battery pack to yield a variable voltage output without the necessity of dumping great gobs of battery-sapping current down a low resistance divider.

Neither the variable autotransformer approach nor the series transistor method can be considered as capable of producing truly stiff variable voltage sources. Figure 7 shows a basic circuit which gives a variable voltage output that can be regulated to better than 1% at any point in its range. It is quite similar to the circuit of Figure 6B, except that the pot is supplied from a zener diode stabilized source. In choosing values for the dropping resistor and the pot, be careful to insure that the voltage at point "Z", which will be determined by the divider action of R_D and R_v alone, is higher than the zener voltage. If it isn't, the zener won't be driven into conduction, and the output voltage won't be regulated. If the voltage at point "Z" is greater than the zener's break-down potential, it will be pulled down to the regulated level when the zener goes into conduction, and everything will be fine and dandy. The regulation of this circuit can be held to very tight limits if a high beta power transistor, or a Darlington hook-up, is used. This will reduce voltage variations at the arm of the pot, caused by the base reflecting changes in the load current which is flowing through the transistor. The higher the beta of a transistor, the less its base will be affected by changes in its collector to emitter current. Running the zener well up into its current range will allow the use of relatively low values of resistance for R_D, which in turn will permit lower re-

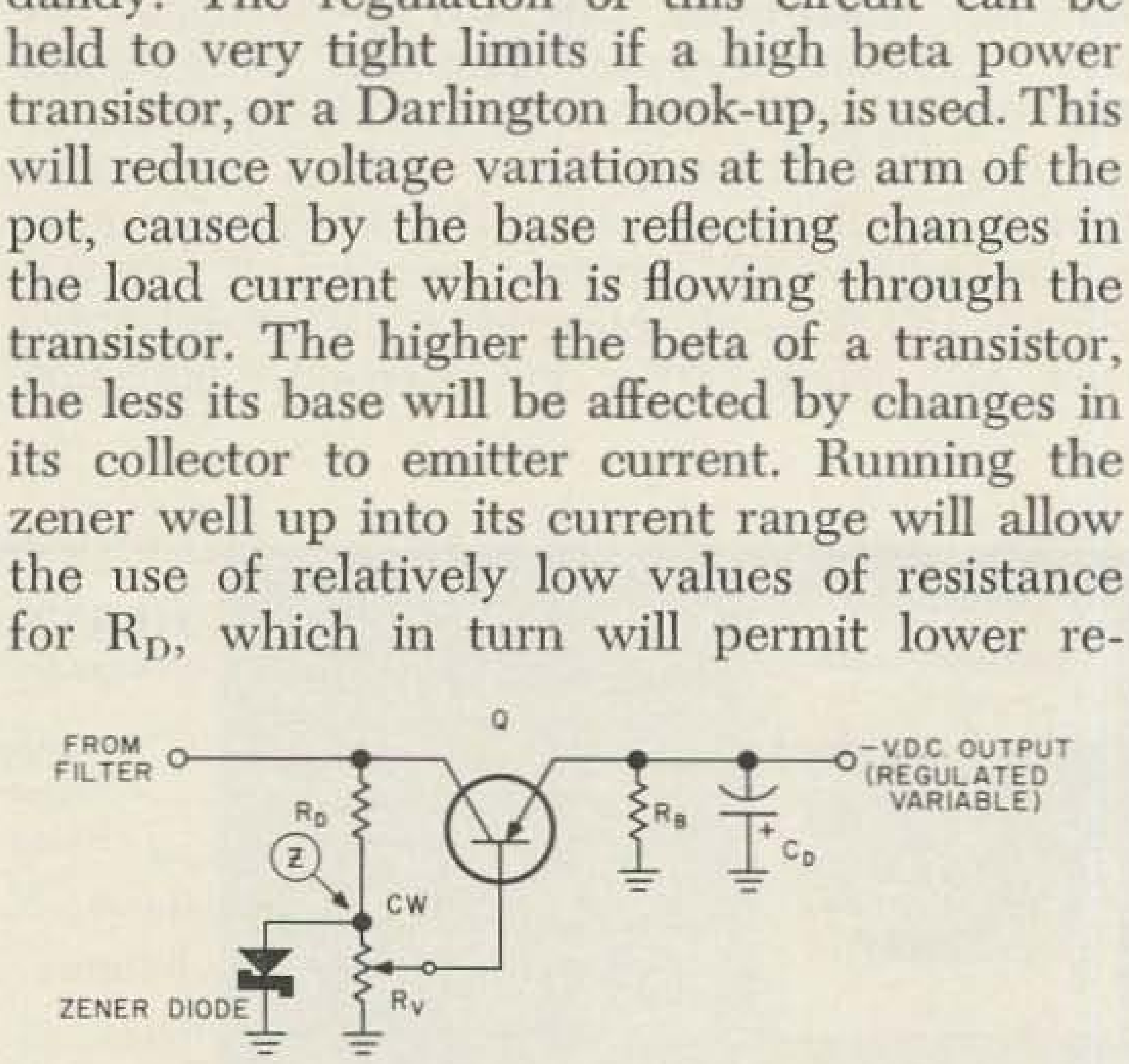

FIGURE 7

sistances for the pot. This will further minimize any changes at the base of the series transistor.

Needless to say, you should be careful not to exceed the power ratings of the transistor or the zener diode. The maximum permissible zener current can be determined by dividing the power rating of the diode by its operating voltage. If its dissipation is stated in milliwatts, your answer will come out in milliamps; if its power is given in watts, the answer will be in amperes. Multiplying the voltage being dropped across the series transistor by the current being drawn through it will yield the power being dissipated in it. It can be seen that the lower the voltage output, the less current can be safely drawn through the transistor without exceeding its power rating, because the lower the output voltage is, the more voltage is being dropped across the transistor. Something else to consider is a transistor's power handling capability goes down as its case temperature goes up. Therefore, if you want to get the most out of the series transistor, mount it on a "cold plate", otherwise known as a heat sink. This can be a six inch square of ⅛ inch aluminum plate which is electrically insulated from the chassis. This is necessary because the collector terminal of a power transistor is its case. The transistor can be mounted on the chassis itself, if a mica gasket is used between the case and the chassis, and the mounting screws are insulated with fiber "shoulder" washers.

This just about wraps up the de-lux, economy-sized tour through the realm of transistor power supplies. An apparent omission, fusing, should be cleared up before everybody goes home, though. Fuses should be selected with the thought of protecting only the power transformer and the rectifiers in the event of a catastrophic short. Attempts to fuse a series regulator will not bear much fruit, because in the presence of a massive overload, the power transistor will beat the fuse to the punch. An exception to this might be when a 15 amp house-tilter is being protected by a ¼ amp, fast-blast fuse in series, but this is rather like driving thumb tacks with a sledge hammer. If reasonable caution is exercised when making connections to the supply, and when poking about in circuits powered by it, no fears need be harbored. Trial circuits can be fired up initially through a low value series resistor and an ammeter to make sure that there are no shorts due to wiring errors or design miscalculations. Once this has been done, the series resistor can be removed, and you can proceed with setting up the circuit, or whatever else it was that you had in mind.

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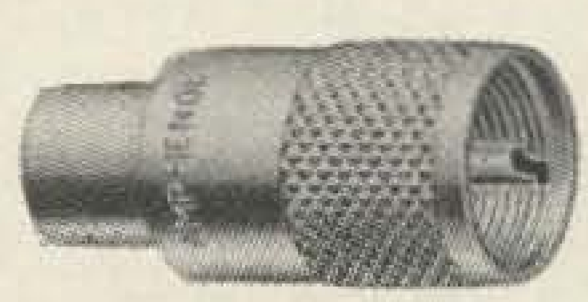

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All of this is not to say that series regulators can't be protected; they can be. The usual practice, in many kinds of expensive transistorized gear and in laboratory supplies, consists of a circuit which senses the dropping voltage caused by an impending short and shuts down the whole works until the short is cleared. Most guard circuits of this type can close a supply down inside of a few microseconds, once they're triggered fuses, by comparison, take practically forever to blow. Forever, in this instance, is often a tenth of a second, or even longer. The guard circuits should be classed as exotic extras that are beyond the scope of this article. They can be tricky, and may of them require fancy components not readily obtainable by most amateurs or hobbyists. The author recommends caution as a reasonable and inexpensive substitute.

In summing up this whole business, a low voltage, high current dc supply (or two) operated from the ac line is a handy item to have around the shack. Among other uses, it can run all that transistorized gear that you've been building lately, so that the batteries will be fresher when you have to use it away from the power line. If the said equipments require various voltages, build several regulators and run them all in parallel across the output of the supply. This will give "plug-in" convenience at the bench for the different pieces of gear. Another point to consider is that batteries wither and die, even when they're just sitting there and taking up space on the shelf. Ac operated power supplies have an infinite shelf life. Break the battery habit. Build yourself a couple of soothing, line-operated power supplies and feel relaxed, they're milder, much milder.

. . . Kidder

Letters

Dear Wayne,

I fully agree with the proposals of the IoAR to assist for the increase of ham activity and the number of hams in other parts of the world. I also agree with the proposal to keep the concerned authorities in other countries well informed about our hobby, its service to the society, etc. Our cause will more effectively be served by doing extensive public relations all over the world, rather than just trying to increase the standard of American hams.

In India, with a population of 430 millions, we have about 340 licensed hams out of which only 25% are active on the bands. Our low standard of living makes hamming a very costly affair even for the average enthusiast. This is not helped by import restrictions which make for a high cost of components. When this is the case in a country like India, it should be much worse in the countries of Africa, the Middle East and South East Asia.

G. V. Sulu VU2GV
Bangalore, India

Sir:

In the February issue of 73 the article by J. R. Fisk WA6BSO on the portion of soil treatment he should have listed common rock salt first in the order of importance of various chemicals.

There's nothing wrong in digging the basin right near and around the grounding rod. The same dimensions can be used 1 foot deep 1½ foot around the rod. Add 5 lbs of common rock salt and 12 quarts of water. More water would be beneficial.

Corrosion caused by chemical action on electrodes is not serious. Rods in the ground for about 5 years have been removed with little or no corrosion observed. In one case, chemicals inclusive of copper, iron and ammonium sulphate as well as sodium chloride were used for copper, galvanized iron, and plain iron electrodes. Corrosion due to electrolytic action would be more serious if the grounds were required to discharge direct current.

Treating the soil at the rod is more effective.

Joseph D. Gagne W1ZVF

The Ever-useful T-Pad

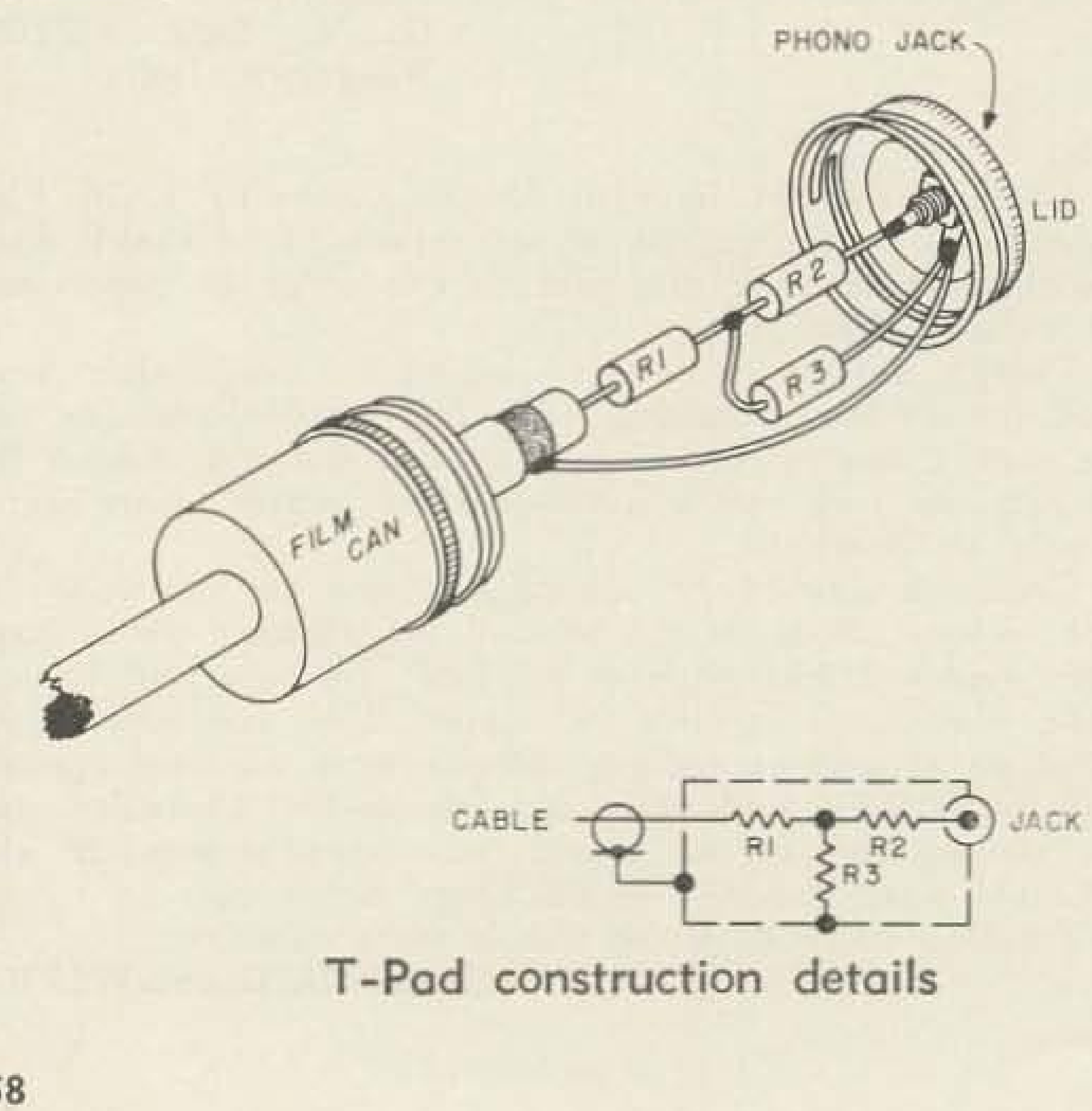
Jim Kyle K5JKX
1236 N.E. 44th St.
Oklahoma City, Okla.

Most of us have transmitters; let's hope that an equal number of us have receivers also. Antennas and microphones are usual station accessories, with a few determined diehards here and there clinging to the trusty old key. But how many of us have much in the way of test equipment?

Now and then somebody pops up with a VOM, and occasionally you can even find an operator who uses a scope. But the kind of special-purpose test gear you find in a well-equipped laboratory is almost always absent in the ham shack.

Which is more or less as it should be, since we're hams, not laboratory technicians. But with the present trends toward VHF, at least some specialized test gear is necessary. Otherwise, the regular station equipment can't be tuned for maximum performance.

One of the simplest such items is a noise generator, for getting the VHF receiver in perfect tune. This gadget has been described many times before, so we won't repeat it again —but we do have something which transforms the usual noise-generator lashup from a so-so item to an instrument capable of laboratory accuracy.



T-Pad construction details

Before going into detail, let's look at the normal method of using a noise generator: you connect the generator to the antenna input, tie the converter to the receiver, turn the avc off, connect a voltmeter to the detector load resistor in the receiver (or put an ac voltmeter across the speaker leads), and measure the voltage produced by just noise. Then you turn on the generator and adjust it for a 3 db (1.4 times the voltage) increase in output; the object is to achieve the 3 db increase with the minimum amount of current flowing in the noise generator.

However, this technique of using the noise generator is pretty sloppy, since it assumes that the receiver's detector is absolutely linear for small signals—and this assumption is almost always incorrect.

A far better technique is to hook things up just as before, except now you place three T-pads in the line between converter and receiver. The T-pads on each end of the string serve merely to clamp the line impedance at 50 ohms, but the one in the center is built for precisely 3 db loss.

Now take the 3 db pad out and take your reading as before with the noise generator off; you don't have to turn off avc or hook up a voltmeter. The receiver's S-meter can be used instead, since we're not measuring anything with the meter itself. It merely serves as an indicator so we can come back to the same point.

Then replace the 3 db pad in the line, turn on the generator, and crank it up until you get the same meter reading as before. Since you now have 3 db of added loss between converter and receiver you must have increased the noise power output of the converter by that same 3 db, and you could care less about the linearity of the detector!

This whole method is far from new, but previous descriptions of it have left something

to be desired in the way of telling how to build the T-pad. The gadget is so simple that it must have seemed obvious to previous writers—but it does have its tricky points too.

For instance, since a T-pad consists merely of 3 resistors, it is pretty easy to just wire them up by their leads. But they are hanging in the receiver antenna lead, and present-day receivers are rather sensitive. If you happen to find a 20-meter signal, it's going to foul up your measurements!

One of the quickest ways to sidestep this problem is to shield the pad against all outside influences—but how do you shield anything so tiny?

The answer here is to use discarded 35-mm film cans, which all photographers who shoot 35-mm cameras have in abundance. The Kodak kind seem to work best. This type has a threaded cap, with a flat spot in its center just right for drilling a ¼ inch hole to take a single-hole-mounting phono jack. At the other end, a ⅜ inch hole can be punched and lined with a rubber grommet for coax cable to enter.

Next step is to place the jack in the hole in the lid, with its solder lug on the inside (be sure to clean the paint so that a good electrical contact will result). The T-pad can be assembled as shown in the drawing with shortest possible leads, and supported by its lead connecting to the jack. Thread a short length of RG-58 through the grommetted hole, and connect its center conductor to the other lead of the pad; the shield and shunt lead of the pad connect to the solder lug of the jack.

All that's left is to wire-brush the threads on the film can for good contact, and screw the lid down tight. Presto, a shielded T-pad. A phono connector should be put on the free end of the cable.

You can make up a whole bunch of these in various loss values, and get virtually any amount of loss you want by stringing them together. And this has a whole lot more use than just using with a noise generator . . .

For instance, when you want to test an antenna, arrange for a steady signal, strong enough to register on your S-meter with the back of the antenna pointed at it. Then swing the antenna in small steps, and bring the S-meter back to the same reading by inserting additional loss between converter and receiver with the T-pads. The difference between this and S-meter indications may amaze you.

Or if you are called upon to measure the difference in signal strength between two stations, the same approach can be used. Note the S-meter reading of the weaker, then knock the stronger one back to the same reading by putting T-pads in the converter-to-receiver line. Read the db off the pads and add them up.

You can even use this in place of an S-meter if you really want to know the signal-to-noise ratio of an incoming signal with accuracy; take a reading on noise, then knock the signal back to the same point. Total up the db, and there's your answer.

Though resistance values in the pad must be precise for absolute accuracy, the pad has an inherent tolerance of small errors and you should have better than 2 percent accuracy if you use 5-percent resistors. Specifically, a 10-percent error in the resistance value of any one arm produces less than ¾ db error in the pad loss, and less than 4 percent error in impedance. Using 5-percent resistors would, of course, cut these error limits in half.

If you want to follow the approach of using a string of these pads for all purposes in the shack, it's best to make them up on a "binary" approach since this gives you the maximum number of db values with the minimum number of parts. A basic assortment might be two 1 db pads, and one each of 2 db, 4 db, 8 db, 16 db, and 32 db. Using them in series in various combinations, you can get any whole number of db from 0 to 64, which pretty well covers the range of values you may ever need. For an example, to get 50 db you would use the 32 db pad, the 16, and the 2. For 60 db, you would use the 32, the 16, the 8, and the 4.

If the ability to increase loss in 1 db steps seems a bit exotic to you in view of the fact that 3 db is only half an S-unit, then you can use a binary progression in 3 db steps; this takes one 3 db pad, one 6 db, one 12 db, and one 24 db. The range is from 0 to 45 db, 3 db at a time.

For clamping a line's impedance, it's a good idea to use at least a 3 db pad and a 6 db unit might be even better. The lower-loss pads

pads may not have the ability to swamp out impedance variations on their other sides.

About all that's left to make this complete is a chart of resistance values for various loss figures. Here it is; all are for use with a 50 ohm line; to use at any other impedance, multiply these values by the ratio of the new impedance to 50 ohms:

LOSS AMOUNT	R1, R2	R3
1 db	2.7	430
2 db	5.6	220
3 db	8.2	150
4 db	11	100
6 db	16	68
8 db	22	47
12 db	30	27
16 db	36	16
24 db	43	6.2
32 db	47	2.2

. . . K5JKX

Letters

Dear Wayne;

Double saw-bucks being something less plentiful than 5 meter amendments to RM-499, I decided to hold off a month and see how you made out. Three hundred twenty-eight isn't exactly a landslide, and, despite the illustrious names on our Board of Directors, I was not convinced that you would make it.

Then came CQ for May, and that editorial! How long has Cliff been pouring his vitriol into Zero Bias? Thinking back, I can't remember an editorial with his characteristic touch.

I am not, per se, a champion for the underdog, although, if there is "reasonable doubt" in each direction, I will tend to favor the persecuted. I consider this a vicious attack, without basis of fact; its only effect, as far as I am concerned, is to cause me to enclose my check for ten dollars, with my best wishes for success in your endeavor.

H. E. Eddy W2SHZ
Oneonta, New York

Dear Wayne:

I received my shiney gold IoAR card today. This puts me in an awful delemma. Shall I flash it to all my friends, and be shunned as an ego-maniac? Or should I keep it buried in my wallets inner recesses, causing the gnawing pain and emotional anguish that those who have rare stamps or tape recordings of talking porpoises must bear. (People just don't understand dept.)

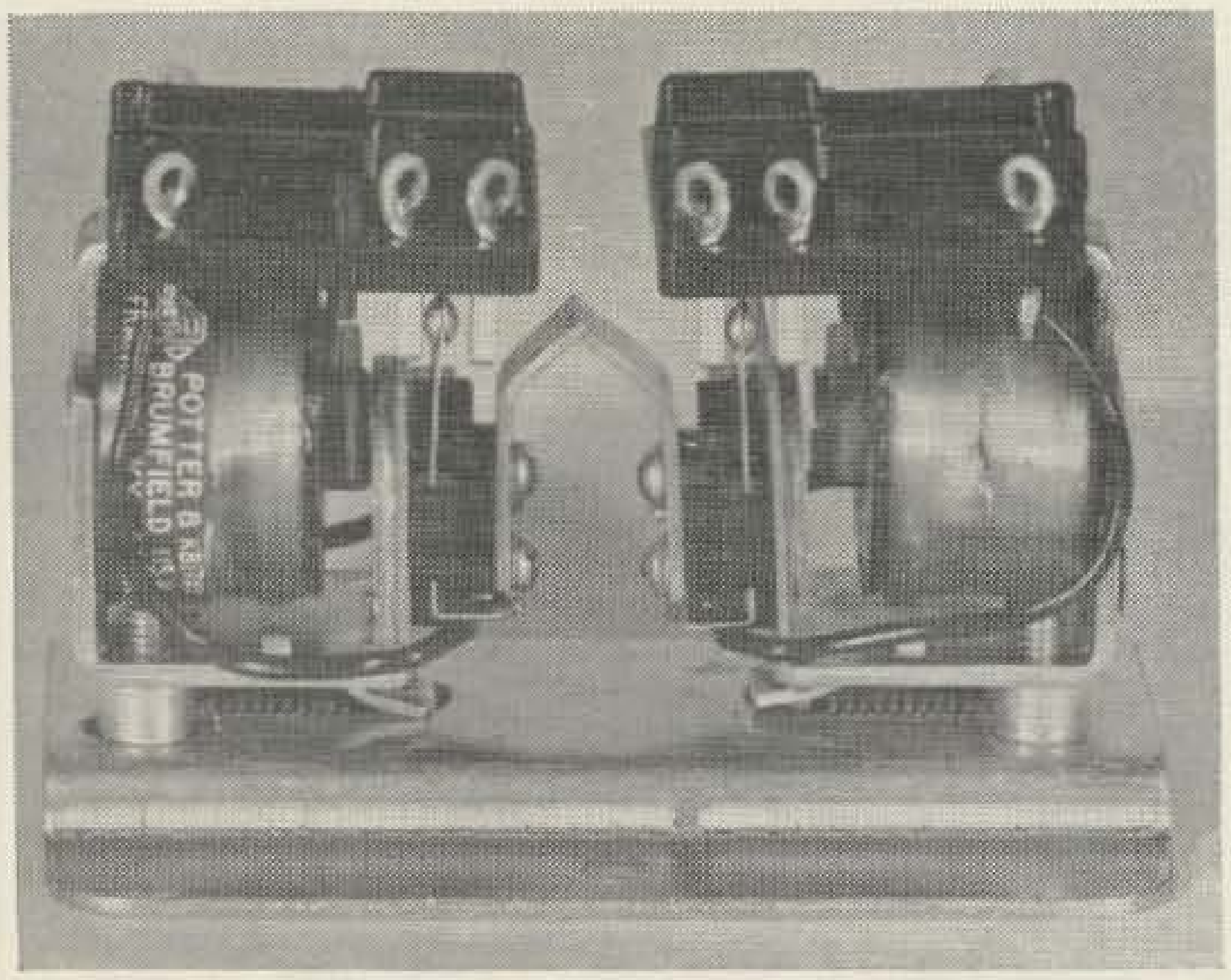
One possible solution might be the forming of local IoAR ham clubs with burly SS men types standing at the doors demanding to see you card as you enter. (This possibly smacks too much of Wagerian festivals at Bayreuth in the latter 30's tho.)

It's a pity that it isn't one of those "badly printed, poorley written, fortunately almost total illegible" types of lithographic art that puts a good feeling in a fellows heart for carefully hiding it in a safe, dark, out-of-the-way place.

I guess this is just a cross that the members must bear. On the other hand, if every ham in the country had one, our problems would be solved!

My profound congratulations and support on your jumping into the Santa Barbara and Denver court battles. This is the kind of action I expected from the IoAR! I'm tickled that it kicked the ARRL into some action.—I don't think it will hurt them a bit to have a standard to aspire to.

Terry F. Staudt, WØWUZ
Loveland, Colorado



Symmetrical latching relay.

Ronald L. Ives
2075 Harvard St.
Palo Alto, Calif.

Controlling Symmetrical Latching Relays

Although they were invented more than 20 years ago, and have been commercially available at reasonable prices for more than a decade, symmetrical latching relays seem to be unknown to a large part of the amateur fraternity, as well as to many industrial electronic engineers.

The symmetrical latching relay consists of two mechanically identical relays, with a mechanical linkage so arranged that when one armature is down, the other rises by spring tension and locks it in place. Henceforth, until the other coil is energized, the armatures retain their relative position. In happy consequence, current is drawn only momentarily, resulting in a great saving in power, and a substantial reduction in heating.

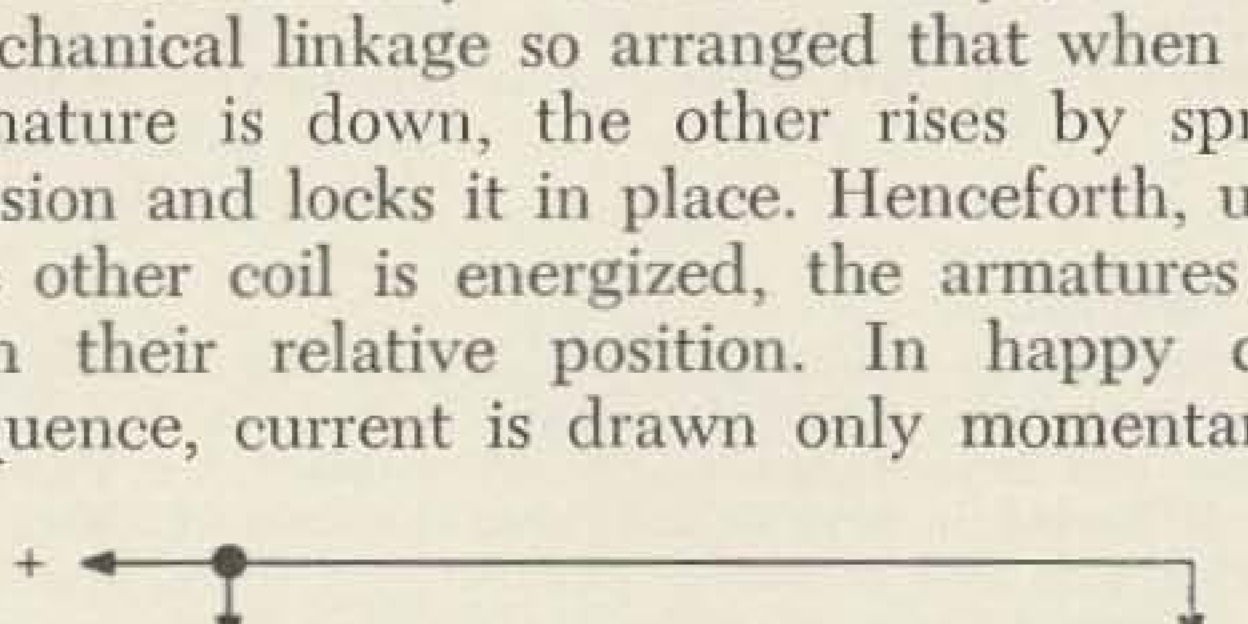


Fig. 1. Push-button control of symmetrical latching relay.

The appearance of a modern symmetrical latching relay is shown, the specific relay shown being a Potter and Brumfield type KB-17-AY, with 115 volt ac coils. Similar relays are produced by a number of other manufacturers; and most of them are available in a variety of voltages, both ac and dc. Standard contact arrangements are 4 and 6 pole, double throw. Most of them have contacts rated at 5 amps resistive.

Because of the mechanical holding feature, these relays are quite insensitive to vibration; and, as the contact interchanges in the two halves are sequent, not simultaneous, these relays can be wired as self-limiters so that they shut themselves off immediately the desired contact transfer has been performed.

Push-Button Control

The simplest controlling method for symmetrical latching relays is by means of two push-buttons, as in Fig. 1. When button "a" is depressed, coil A is energized, its armature is pulled down, and the armature of coil B rises shortly (about 0.1 sec.) thereafter, locking armature of A in "down" position. Reverse action takes place when button "b" is depressed.

The somewhat unconventional push-button connection here shown is to prevent trouble when both push buttons are depressed simul

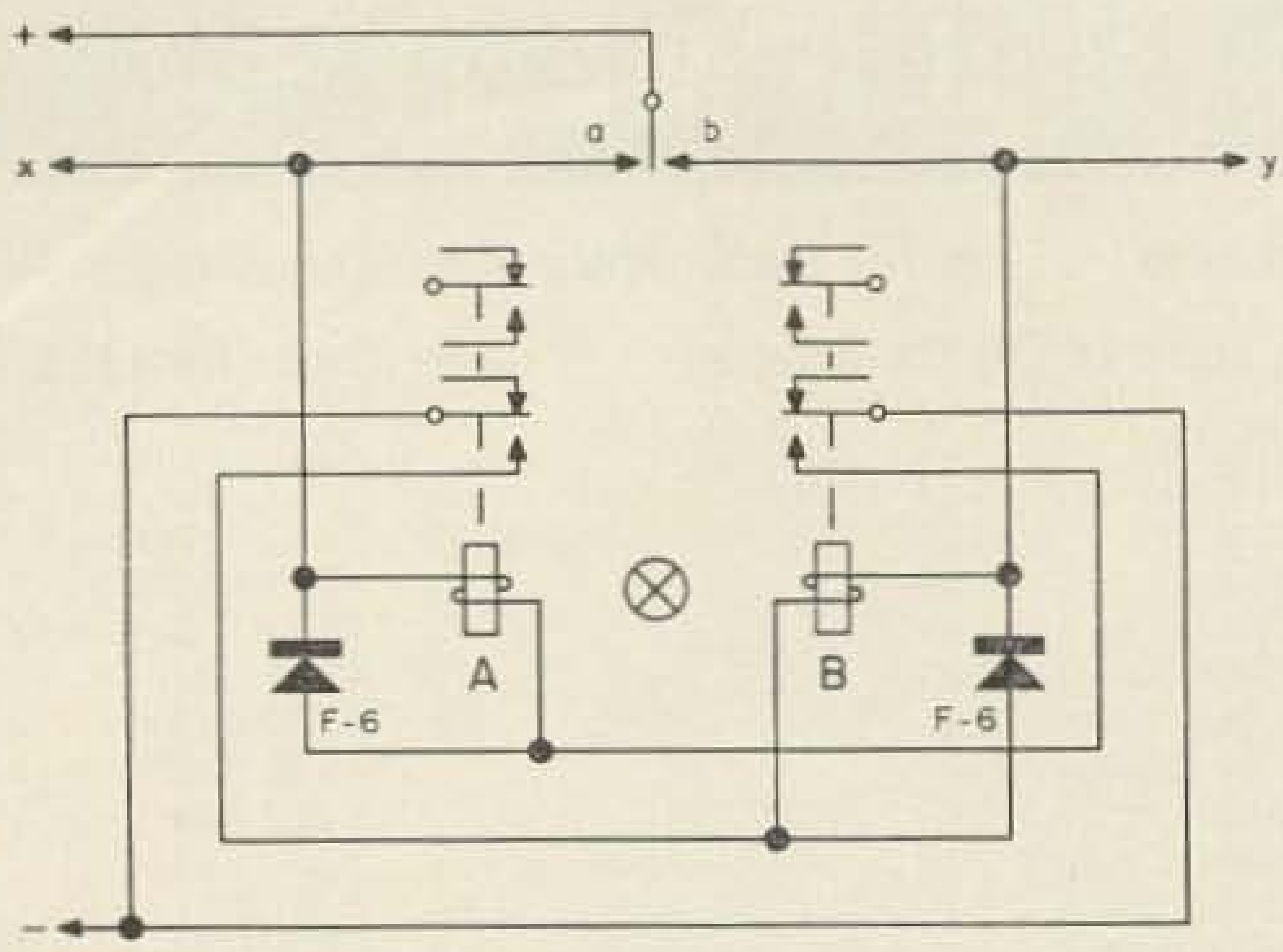


FIGURE 2

Fig. 2. Self-limiting connection.

taneously. As here shown, when this is done, nothing happens.

Circuit shown is for dc operation, the reversed diodes across the coils being spark suppressors. For ac operation, replace them with silicon or selenium "contact protectors" (made by I. T. and T. and Sarkes-Tarzian).

Self-Limiting Connection

For controlling a symmetrical latching relay with a spdt toggle switch, or similar contactor, while limiting current flow to that necessary for relay operation, the self-limiting connection is ideal. One form of this is shown in Fig. 2. A number of alternate circuits, most of them quite obvious, are possible.

In this circuit, let us assume that the switch is in "b" position. Armature of coil B will be down, and locked in place, but coil B will not conduct as its return through the armature contacts controlled by coil A is open.

When the switch is thrown to "a" position, coil A is immediately energized, the armature pulls down, arnd the armature of coil B rises shortly thereafter, locking A armature in down position, and opening the return of coil A, so that it conducts no more current. Subsequent switching to position "b" causes a mirror reversal of this action.

Other loads within its current capacity can be controlled by the switch, a convenient pair of connecting points being x and y (Fig. 2). Note that the self-limiting connection leaves a set of contacts available on each side of the relay (if it is 4pdt). Each set can carry an independent load, but they should not be paralleled to increase current capacity, as they operate sequentially, not simultaneously.

AC operation is entirely practicable here if the diodes are replaced by other suitable fly-back absorbers. Be sure that the voltage is reasonably correct (within about 10 percent). In an emergency, ac latching relays can be operated on dc, using either protective series resistors, or an 80 percent reduction in applied voltage.

Single-Pole Switch Operation

Until recently, operation of a latching relay from a single pole single throw switch required an auxiliary relay, which either drew current continuously when the switch was in ON position, or required somewhat costly and complicated auxiliary equipment, such as a capacitative limiter. With the introduction of inexpensive and dependable medium-power audio transistors, the problem is greatly simplified, and current drain in the ON position can now be limited to the hold-off leakage of the transistor plus the bias resistor drain– usually a matter of less than on milliampere per applied volt.

A representative circuit for the operation of a symmetrical latching relay with a single pole single throw control switch is shown in Fig. 3. This is the simplest of a family of circuits derived for the purpose, and also the least expensive to build.

Assuming, for initial condition, that the switch is open, and armature B is down. No current is drawn from the line, as armature A is up.

When the switch is closed, coil A is energized through the armature contacts controlled by coil B; and a strong positive bias is applied to the base of the transistor, cutting it off. Armature of coil A pulls down. Armature of coil B is released, locking A armature in down position, and opening the supply circuit to coil A. When A armature pulls down, the

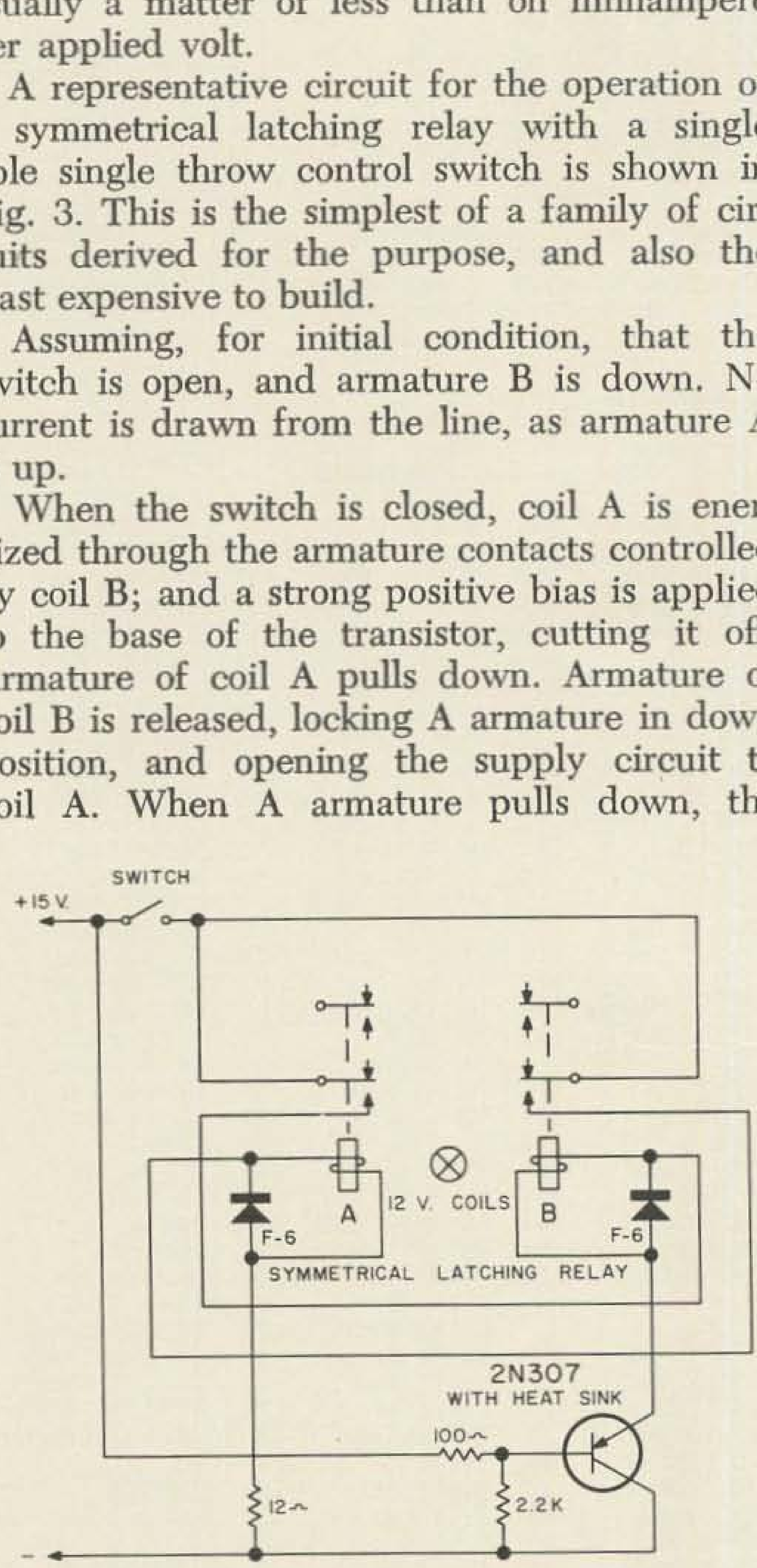


FIGURE 3

Fig. 3. Circuit for single-pole single-thro switch operation of symmetrical latching re lay.

upper end of coil B is connected to supply +, but the coil cannot conduct, as its return through the cut-off transistor is open. Because the transistor responds to energization more than fifteen times as fast as the relay, there can be no ambiguity of action, "schizophrenia," or "buzzering" here. So long as the switch remains closed, armature A remains locked down, coil B is nonconductive, and current drain is that through the transistor base network.

When the switch is opened, cut-off bias is immediately withdrawn from the transistor, and coil B, energized through A armature contacts, immediately conducts. B armature pulls down, A armature releases and locks it in place, and also opens the supply to coil B. No current flows in this position thereafter.

Performance and Service File

Standard symmetrical latching relays, in continuous commercial service, have a service life of several million operations, with only routine maintenance. In ICAS service their expectable life is so great that the relay will almost surely still be good when the equipment in which it is installed has become obsolete.

Needed maintenance is slight, and consists of blowing the dust out periodically, wiping the contacts with a soft cloth about once every six months, and oiling the armature hinges *lightly* from time to time with a good grade of clock oil.

. . . Ives

Letter

My dear Wayne:

Enclosed is a year renewal to 73 Magazine and $10.00 or the IOAR and dont you pocket of the latter is per the thot instilled in my dirty little mind by CQ nagazine in the last issue which arrived 2 days before 73 lid. I never before realized what a "scoundrel" you really ire until I read the Zero Bias page this month. From hat it should be rated at about 5 times cutoff instead of ero. But I always have been a bit of a non-conformist so or that reason I love a scoundrel such as you are. Keep ip the good work but be careful and don't get too bitter vith the other side or you could defeat your own ends. So ar you have done a wonderful job.

I enjoyed my fone conversation with you a couple of nonths ago even if during the time I was dropping uarters in the slot you said it was not worth it. You vere not in a position to judge as it was my money.

Clifford van Ciel W6AVZ
Idria, California

IoAR News

(Continued from page 7)

technically upgrade the average amateur. I honestly believe they will feature a spark transmitter with a low-pass filter any issue now—while recommending a new license be required with a grandfather clause to operate this mess.

The sweat, blood and guts of Ross Hull, Grote Reber, Sam Harris, Frank Jones, W2UK/KH6UK, W6NLZ, W9ZHL ,W9WOK, W8KAY, W2AZL and many others—through invention, development and operation of VHF-UHF equipment and communication circuits during the past few years—opened this spectrum of frequencies for all.

Amateurs were actively using frequencies above 300 mc when the NAM thought the magnetron was some new Japanese toy. Amateurs were communicating with each other on VHF when George Southworth was still hiding his waveguide experiments under piles of old telephones to keep from being fired at Bell Labs.

Amateurs can keep their VHF-UHF bands! It is going to take a lot of work and a lot more money.

We have several advantages over our less fortunate dc band brethern. At least for the moment, most UHF-VHF frequencies and the pirates that want them, are under US jurisdiction and policed by the same FCC as you and I.

The amateur must have a voice in every committee and agency that can change the rules and regulations.

Some time ago, a few of us gave up waiting for someone else to start actively promoting amateur radio. We can use your help. The *Institute of Amateur Radio* is a group of the angriest 500 amateurs ever banded together in an all-out effort to expand amateur radio. This expansion can only come in the higher frequencies, and this is why the technicians can do the job. The technicians opened 6 into the band it is today. Before you gentlemen showed everyone how, 6 was deader in the peak of a sun-spot cycle than 10 is now. *You* must open the other bands.

The IoAR is an *action committee* whose prime purpose is to expand the rights, privileges and operating frequencies of all amateurs. As a member, you can contribute an active part in this program. In ARRL, each director tries to represent a whole geographic area of amateurs. In the IoAR, each member represents one or more directors. We have a Washington office. We are actively promoting amateur radio at many levels of agency and committee. We will use brass knuckles, political influence, a well-placed foot on certain individuals' posteriors, or any other quasi-legal action to improve the amateur's image and rights. We have no fancy code of ethics. We *do* have documented evidence of invention, improvisation, development, and prior operation by amateurs on these coveted VHF-UHF bands. We are going to be heard by these various committees or know—and publicize—the reason why we weren't.

The IoAR was formed to see that every person in any position that has influence on the amateurs status is going to be well-informed and aware of the facts, i.e., that amateurs can continue to lead in communication development *only* if given the room and opportunity to expand, and that we have always been able to do many things that were economically unfeasible by commercial or government contract.

With your help, the IoAR will re-establish the amateur's rights in our UHF-VHF bands again. Together, we can get rid of those idiotic sub-band restrictions that keep you from using the low end of 6 and 2. IoAR dues are $10 a year—and we can't even throw in the Old Ladies Journal of Antique Wireless (QST) because every cent goes toward publicizing amateur radio. There are no Chiefs—everyone is an Indian. How well the IoAR does depends on each individual member. A technician can help amateur radio more in the next few months than an ARRL director can in a lifetime. How about helping! The IoAR is not in competition with ARRL. Most of us are ARRL members in good standing—but we won't hold it against you if you aren't. But I'll tell you this. If they continue to act like a home for retired maiden ladies, the IoAR will put rings in their noses and lead them into the cold hard facts of life in a competitive world. I think you are just the guy that can help us.

Bill Ashby K2TKN
Director IoAR
Box 97
Pluckemin, N. J.

Institute Report

The Interim Directors of the Institute of Amateur Radio hafe been preparing by-laws of the Institute for submission to the members, a process which has been taking a great deal of their time

The Directors accepted the resignation of Bil Leonard W2SKE as an Interim Director. Leonard had been inactive in Institute affairs.

(Turn to page 73)

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ARRL's Motives: A Closer Look

Now that they're "official," the current re-exam proposals of the American Radio Relay League can be read loud and clear—and their message is one of discrimination, undesirable change in government policies and protection of "The Old Guard."

ARRL has petitioned the Federal Communications Commission to remove all General and Conditional Class licensees from the choice High Frequency (HF) radio-telephone bands, pending a re-examination of operators in these classes.

In the past several months ARRL's position has vacillated, indicating that frustration may have been running rampant within the League. But modified versions of rash license proposals by League directors have now been supported by ARRL's "front office," and the petition has been introduced to FCC (see November *QST*). ARRL proposes the loss to General and Conditional operators of the 20-meter phone band beginning July of 1965, the 40- and 15-meter phone bands beginning July of 1966 and the 75-meter phone band beginning July of 1967.

This across-the-board cut is far more radical than a more commonly accepted method of reducing QRM: attrition licensing, whereby initial licensing requirements may be elevated. Apparently no one in ARRL has considered this accepted and time-tested method in view of the League's panic to drastically decimate HF phone band participation.

The League's *stated* purpose is to "provide additional self-training goals and thus to strengthen the position of the amateur radio service in both domestic and international affairs. ARRL would reinstate the Advanced Class licensing category. Those already holding Advanced Class licenses (old Class A) would continue to operate on the HF phone bands without interruption.

The laudable *stated* purpose contrasts markedly with ARRL's purposes in the past, as shown by a few examples from recent radio regulatory history.

In 1949 the League opposed the FCC's attempt to commit amateur radio operators to a "basis and purpose," as witness the frantic editorial "It Seems to Us" in QST, June 1949. The ARRL was jolted when it discovered that the FCC had a mind to formulate on its own—Docket No. 9295, April 1949—a reorganization of amateur service in the U.S. with a newly-added "Part 12.0, Basis & Purpose."

We quote from the editorial the ARRL's expressed feelings toward the new governing principles: "We have such new things as an initial declaration of purposes for the amateur service; the introduction of what may be termed apparatus specifications in our regulations (which the League has always opposed in principle)." This attitude seems to contrast strangely with current *great concern* of the ARRL over "international considerations."

ARRL fought in 1949 for a "grandfather clause" for old-timers. The League felt that the so called grandfathers should have more operating privileges, mainly due to longevity more than anything else. The proposal was shot down by FCC. It now appears that ARRL has a long memory.

The 1963 proposal looks like the same old "grandfather clause" suggestion under a different guise.

There is no known proposals by the ARRL for re-examination of the small remaining class of amateur radio operators who will be permitted to continue on the best HF phone bands. Ironically, the lack of proposals concerning this "elite" reflects a conflict with the stated intent of the ARRL program:

> " . . . Should not sit idly by and risk the loss of our frequencies," and "should join together in a common effort to preserve and improve amateur radio."

Should the many—General and Conditional Class operatiors—"join together in a common effort" to preserve the bands for a few—the Amateur Extra and Advanced Class Operator?

Nor has it been proven that General and Conditional operators abuse the bands any more or any less than do Advanced and Amateur Extra Class operators.

Today a vast number of radio amateurs are in the General and Conditional classes, set up by FCC (not at the suggestion of ARRL) in 1949. This large body of radio amateurs would suffer greatly by the ARRL's proposed preferential treatment for Amateur Extra and Advanced classes. The segregation of the General and Conditional classes from HF phone privileges, if consummated, would be one of the boldest discriminatory actions of recent years.

Perhaps 9% or so of the General and Conditional class operators would immediately return to all the HF phone bands after promulgation of ARRL-proposed regulations. What about the other 91%? They will be faced, first of all, with an "accelerated depreciation" of their popular "name-brand" radio-telephone transmitters while attempting to requalify themselves. Perhaps coincidentally, they will be "scrambling" to buy future editions of the ARRL license manuals in order to bone-up for their re-examination.

Some may discover difficulty in their attempt to recover the once-obtained phone operating privileges. Some will not be able to swallow their bitter personal feelings and animosities and will not attempt to participate again in amateur radio.

The ARRL petition ignores the current commendable efforts of the FCC to upgrade gradually the technical portions of examinations in Novice, Technician, Conditional and General classes. Doesn't FCC get any credit for this program?

No sensible radio amateur is against any reasonable approach leading to the improvement of on-the-air operating techniques, nor does he oppose any reasonable attempt to preserve the world-wide amateur radio frequency segments. But the current proposals of the ARRL are unreasonable. They contrast distinctly with the intelligent and conservative approach that has won admiration for ARRL in the past.

ARRL blames "development and availability of highly complex and efficient manufactured equipment, particularly single sideband suppressed carrier radio-telephone transmitters, receivers and transceivers" for raising a question as to whether amateur radio's "basis and purpose" are being fulfilled.*

Today we are operating amateur radio channels within a highly technological and complex electronics environment. We can never hope to recapture the colorful era of "ham radio" and its BCI prior to the last great war. That's history!

ARRL is further concerned that General and Conditional operators cannot build or repair this equipment for the most part and that these HAMS "lack an understanding" of it. The League claims there has been little incentive for many amateurs, once licensed, to increase their technical knowledge and proficiency.

(EDITOR'S NOTE: Remember, they opposed the original statement of "basis and purpose.")

So they propose to give these classes more incentive by forcing them to participate in the available CW portions and the unpopular (because of the sun spot cycle) 10-meter phone band?

Obviously ARRL thought some incentive existed earlier. Their publication of help-along license manuals and many successive editions updating the technical portions that characterize the timely upgrading of the FCC examinations, including those of the General Class license, were recognized to be extremely valuable. The manuals were particularly appealing to the non-technical strata, that is, many of the same group of general types that the ARRL now seeks to eliminate from the phone bands. These helpful manuals provided a "gateway to amateur radio" for the herd that was to be raised through the ranks from the Novice and other classes.

The ARRL courted membership by invitational advertising, through the stimulative booster campaigns at affiliated club levels, through publication of the enhancing "Basics for Beginners" and many other fine articles.

Among these attractions are the delectable displays of colorful advertisements—selling the very same items of equipment to which the League now so strenuously objects.

ARRL's petition—speaking of commercial factors—would have serious domestic economic implications. Sales of new equipment will without doubt decline noticeably. Used equipment markets will feel an even more drastic pinch. FCC, in its evaluation of public policy, is faced with consideration of the economic factors.

The League role as representative of amateur radio operators should be examined in connection with the current petition. ARRL claims membership of "more than 80,000 amateurs licensed by the Commission." FCC licenses 250,000 amateurs currently.

ARRL would be hard-pressed to pretend to that all their membership supports the petition. This leaves a fraction of the 250,000 as supporters of the ARRL proposal.

On the other side of the representation coin, who speaks for amateur radio operators in international negotiations? A number of recent *QST* articles have referred to the performance of ARRL officers as "members of the official delegations to the actual conference sessions," of Internatinational Telecommunications Union conventions. On close scrutiny it appears, however, that ARRL participates more in the capacity of a "private operating agency" in support of the real representative of the U.S. amateur radio operators: *FCC*

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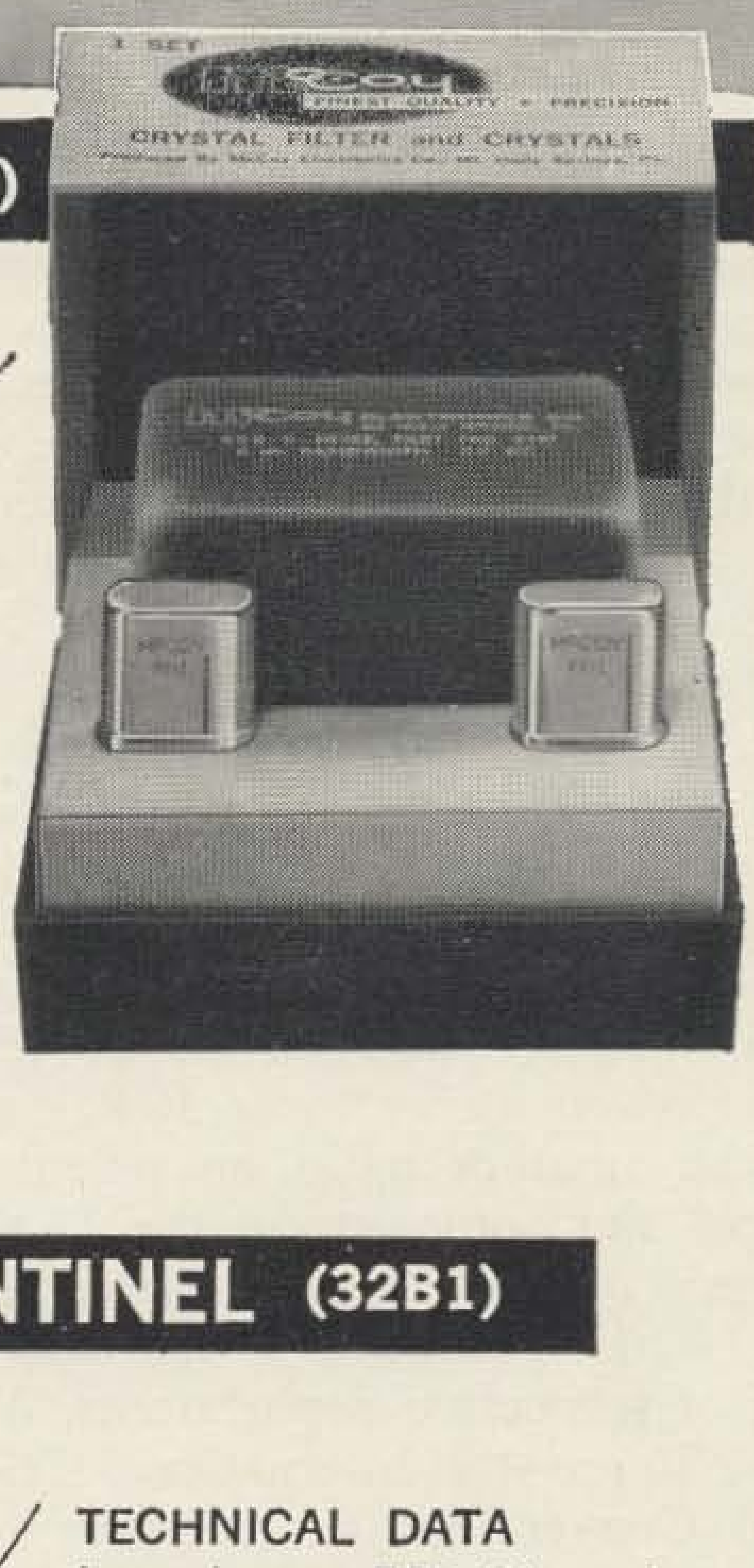
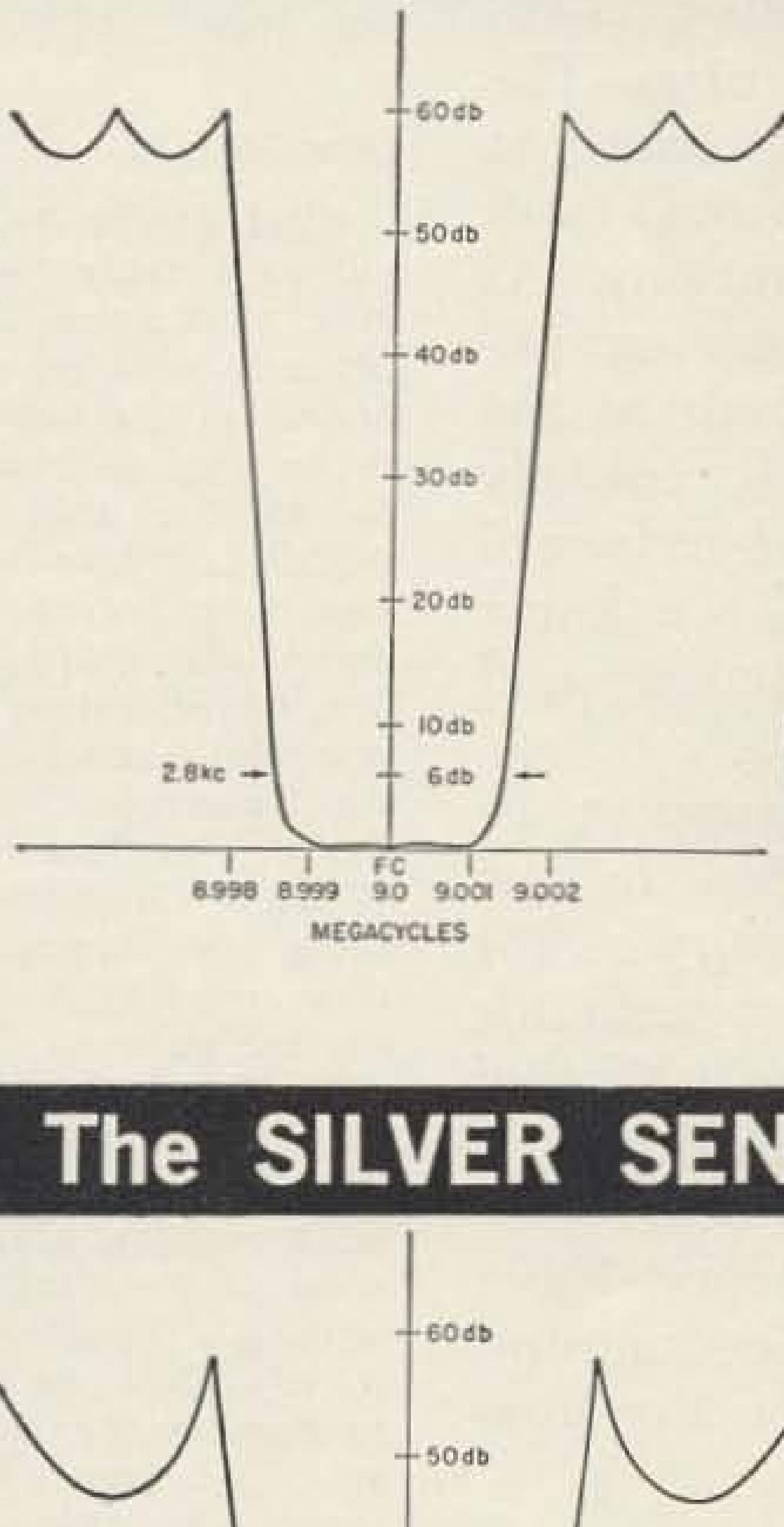
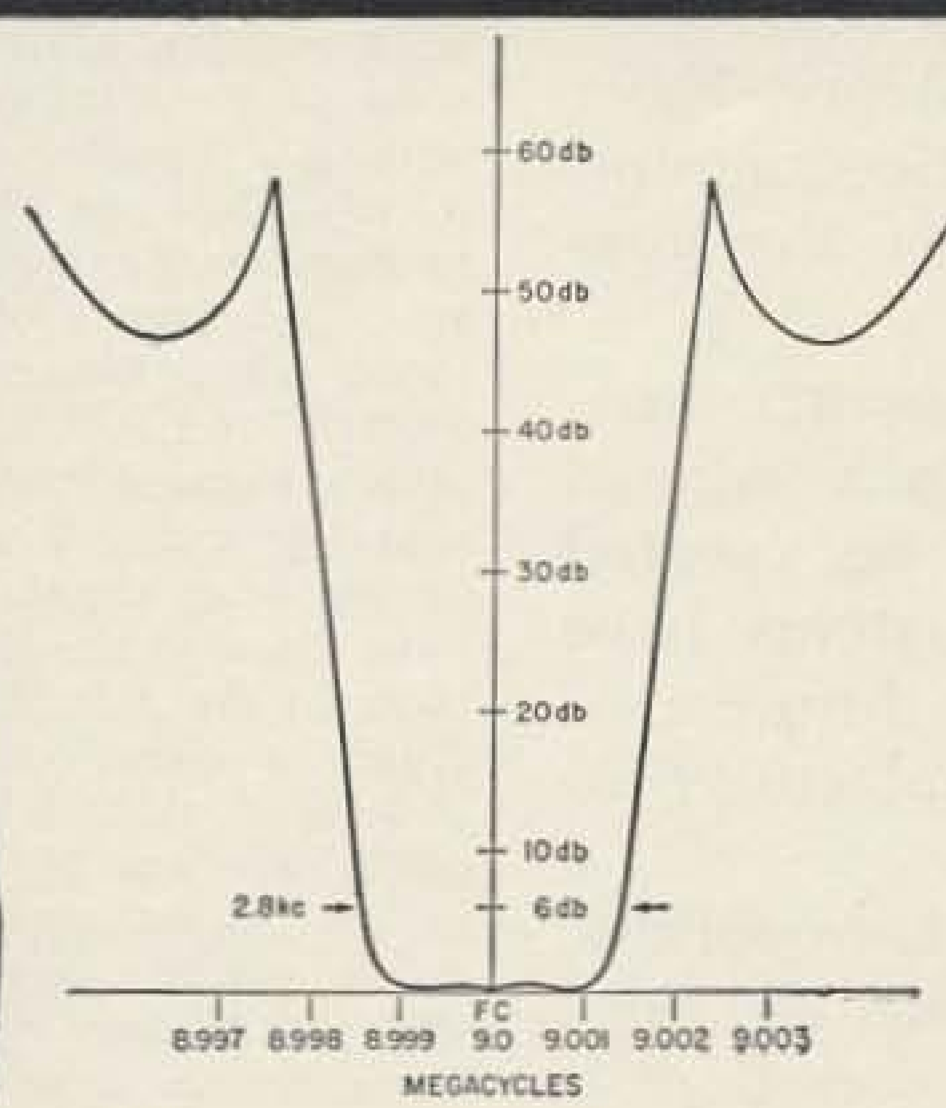


TECHNICAL DATA
Impedance: 640 Ohms in and out (unbalanced to ground)
Unwanted Side Band Rejection: Greater than 55db
Passband Ripple: ± .5db
Shape factor: 6 to 20db 1.15 to 1
Shape factor: 6 to 50db 1.44 to 1
Package Size: 2 7/16" x 1 19/32" x 1"
Price: $42.95 Each



The SILVER SENTINEL (32B1)



TECHNICAL DATA
Impedance: 560 Ohms in and out
Unwanted Side Band Rejection: Greater than 40db
Passband Ripple: ± .5db
Shape factor: 6 to 20db 1.21 to 1
Shape factor: 6 to 50db 1.56 to 1
Package Size: 1 3/4" x 1 1/4" x 1"
Price: $32.95 Each

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This is not to ridicule ARRL's gallant actions (assisting the FCC) to preserve the amateur bands. It is merely to appreciate ARRL's tendency to overstate their role.

Regarding these international considerations—on the basis of ARRL's position—the FCC appears to be somewhat nearer to the amateur operator at home and abroad. This federal agency, with its official monitoring role, would appear to be closer to the actual problems than ARRL, with the latter's representative structure and minority membership status.

In addition, there is unlikely to be any measurable effect upon the retention of international amateur bands by heavy QRM or by some yokel's insistence on repeating "73's" (best regardses) for the thirteenth time. The real threat to international amateur bands is far above this level and stems from tariff and international political considerations. As long as the U.S. is the strongest nation politically and economically, and as long as the U.S. supports its own HAMS, it is unlikely that the "threatened" international bands will be usurped. (For the experts: Yes, we know there have been two plenipotentiaries and only one U.S. vote.)

The U.S. has every reason to support its amateur radio operators. In addition to the FCC's proven (as witness 1949) support for enlarging amateur radio, an ardent benefactor has been the entourage of the Department of Defense's military and civilian technical advisors. This Pentagon entourage attend—on behalf of respective departments, Army, Navy and Air Force—the International Telecommunications Conventions as members of the government delegations.

The Department of Defense supports amateur radio for reasons of its own. In a national emergency, amateur bands could be vacated with the least practical delay. Amateurs have demonstrated their availability for future mobilization of manpower for national emergency.

Amateur operators who agree or, hopefully, disagree, with the ARRL petition can still have a voice in any policy decision that is made by the FCC. Here is how:

(1) Watch for 73 Magazine for the publication of FCC's "Notice of Proposed Rule Making." Note the Docket Number.

(2) Prepare a brief, concise rebuttal covering your major objections and/or recommendations. Refer directly to the FCC's "Notice of Proposed Rule Making" by the indicated Docket Number (if a rule if formulated).

(3) Limit your rebuttal to no more than two double-spaced typewritten pages. Present in fourteen (14) typewritten copies (this is standard FCC procedure). Carbon copies will do if they are easy to read.

(4) Mail to the Federal Communications Commission, ATTENTION: Chief, Amateur and Citizen Radio Division, Washington 25, D.C.

Watch for the notice and make your objections. There's no excuse for griping on the *remaining* General Class phone bands.

. . . W9AIY

Letter

Dear Wayne,

First I wish to say that 73 Magazine certainly fills the bill as a truly "ham" magazine. It's articles are written in a most refreshing manner, while at the same time its editor is man enough to be frank, outright, and above all, honest in his beliefs. Wayne, could you please inform me as to what in blue blazes Herbert and John are trying to do to the spirit and morale of the members of the A.R.R.L.? I've had my ticket about two years, and in that time became a member of A.R.R.L. for a one year period and dropped from its ranks for another year. After due consideration I thought, "Oh well, maybe I'm the one who is wrong, perhaps I should breakdown and rejoin the 'happy folk' up at Newington." Rejoin I did. Regret I do. The June 64 issue of QST carries an article by William Orr, W6SAI which if not the most insulting thing ever directed to the general ranks of amateur operators certainly deserves credit for using a lot of words to confuse an issue.

William tries to say in so many words that a vote on RM-499 is not called for. I guess that would be cricket in their book. William goes on to say that the letters written in opposition show poor spelling of words, and a poor show of the "radio amateur's attempt to communicate by writing." Thank you William, thank you A.R.R.L. With friends like you the amateur body needs no enemy. To further justify their bumblings he points out that there are "two breeds of cats" in amateur radio. The first are those who, through the blessing of the "Great White Father" (A.R.R.L.), are at once placed ahead of the others because they held their license for a period of 10 years or more. The not so desirable type who really isn't an amateur (again according to William) are those who have been licensed in the past decade. (But William, I thought the A.R.R.L. was "by and for the amateur" ! ! !) Again a sugar-coated pill is forced upon by us by the statement that RM-499 will better amateur radio as a public service. My, my, William, tell all of the operators in the recent earthquake in Alaska that they really are below par in capabilities. (Of course, while going about their duties they were so busy you will have to excuse their ignorance in these matters that only the Boys in Connecticut know about.) Let us face one fact and that is: if enough nations vote for a slash in amateur band coverage no matter how well educated in radio theory we be, the slash will come. Another thing: if we read our governments' rules and regulations it is they who set most of the requirements to become an amateur. If the government itself sets standards what can be the reasoning of a group of individuals who try to set up their own? (What say William?)

Wayne, I guess I've gone a bit far out but at least I feel that my words do not fall on deaf ears. Here is a promise that I am making in earnest, that in a very short time I will be numbered among the members of the IoAR

Mike Francioli WB2BQ(

(Institute Report from page 66)

Founding members now should all hafe received the special Founding Member gold certificate, the special laminated gold membership card, a supply of Founding Member stickers for their QSL's, two status reports on current activities of the Institute, two official information reports to be broadcast and background information on the reasons for the Institute.

The Interim Directors are looking for help in setting up the Institute organizaion and ask that you drop a line to the Institute of Amateur Radio, 5219 7th Road, South Arlington, Virginia if you have some time to help with this.

The Institute now has five men working in Washington toward establishing a lobby for ham radio. A founding Membership in the Institute is $10. Send your name, call, address and $10 to the Institute of Amateur Radio, Peterborough, N. H.

Working New Countries on Two Meters

The European Side

After many years of intensive experiments, ,enna Suominen OH1NL and Bill Conkel V6DNG finally succeeded to make the first-ver moon-bounce contact both ways on 144 nc.

When they started the experiments a couple f years ago, the specialists considered it as a seless waste of time and impossible to do. n a meeting of well-known European VHF-nen the fact that moon-bounce contact on 44 mc would be impossible, was proved by vater-proof" mathematics. The factors were ne present amateur technics and the maximum owers allowed for amateur use; these were onsidered too inadequate.

However, Bill and Lenna started where the thers had stopped. They concentrated them-lves in the signal-to-noise ratio. I.e., they ent "below the surface." The positive tests uring several months proved that they are n the right track, and finally, on April 11th,

1964 they made it two-way. Earlier both of them had heard signals from each other, but not in the way that they could have been also confirmed both ways. On April 11th this was possible, and a duly two-way contact was written in 144 mc history. This contact is the first moon-bounce contact on 144 mc, and also represents new world record on two meters.

The work behind the final QSO was tremendous. Two years, and over 70 experiments plus innumerable amount of working hours for building the equipment. Dr. Karl Lickfeldt, DL3FM, the chairman of the IARU Region I VHF Committee, in his letter of congratulations to OH1NL said: "Only few radio amateurs will understand what you have done, but I understand—while realizing the happening—that you have really nicely done what some others have been trying hard on 1296 mc." (To clear this, the moon-bounce on 1296 mc is considered easier than that on 2 meters.)

W6DNG used 1 kw power, rebuilt 75A4, converter input 416B and antenna stacked, several-elements yagi-system. OH1NL used a

OH1NL

power input of 800 watts (special permission from the Finnish authorities) and 24-elements stacked, net-reflector antenna and home-built nuvistorized receiver. This contact reminded especially the old timers of the contact which S-2ND and PR-YSA in 1925, on August 29th, made on 43 meters as the first Finland-USA contact. The pioneering work still is in the mands of amateurs, only the technics and bands have changed.

The OH1NL-W6DNG moon-bounce QSO was made on April 11th 1964 between 1500-1600 GMT. OH1NL is located in a village named Nakkila, approximately 20 miles southwest from the city of Pori on the west coast of Finland. The experiment, which finally succeeded, was the 73rd. Before this Bill W6DNG had changed his antenna many times, the "record" antenna being 59th during these tests. OH1NL used a 24-element 21 db antenna (12 dipoles parallel-coupled) with a net reflector, the area of which is approximately 25 square meters (over 250 sq. ft.), with bazooka-feeding and preamplifier. This antenna can be both tilted and rotated both ways. The best time for the contact was to be found from the "Nautical Calendar" giving the positions of the moon. The equipment itself used by OH1NL is very typical amateur equipment as to the look of them. The shack merely is VERY amateur-like when you visit it. But this shows that the results are not made by fine looks, they are made by means of high skill and experience. Nothing seems to be impossible for radio amateurs, even though things often are proved mpossible by means of theory before the results show otherwise.

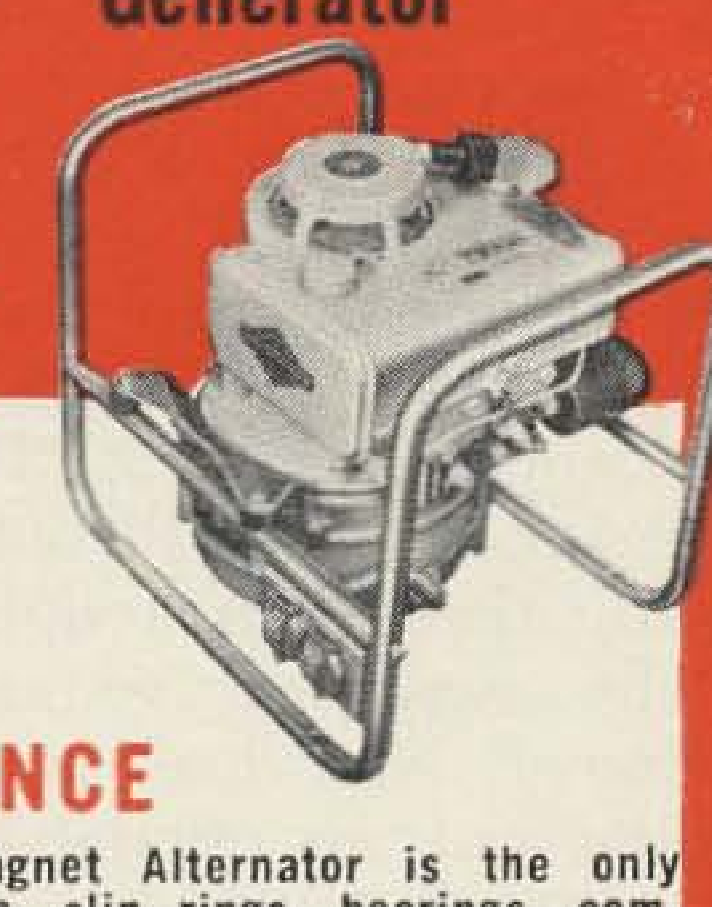
Hats off to Lenna and Bill!!

The American Side

Bill Conkel W6DNG
4608 La Cara
Long Beach, California 90815

A few years ago the Army bounced a signal ack from the Moon. Then the Collins company bounced a signal back. This got me terested enough to start working on the proj-t. The success of W4AO and W3GKP in 956 spurred me on.

I started out with a kilowatt input (about 0 watts out) into four ten element yagis rizontally polarized. The receiver was a 7A converter into a 75A2 with a very nar-



row filter. I did get some echos back from the moon on the eastern horizon, but I couldn't seem to find anyone else to bounce to. Most fellows thought I was nuts . . . so I got back an echo, big deal!

Ned Conklin K1HMU got interested in moonbounce and set up quite a station. We kept skeds through the summer of 1961 and had several close calls. On September 14th we almost made it. This was a real heartbreaker. We got all but one piece of the info across that ARRL requires before you can officially say that you've made contact. By the next summer Ned had an even bigger antenna going and our regular contacts were frequently nearly acceptable for credit . . . but never complete.

It was about this time that OH1NL and I began to correspond and set up skeds. We tried it from two to twelve nights or days a month . . . sometimes getting nothing and sometimes exchanging signals which almost added up to a QSO.

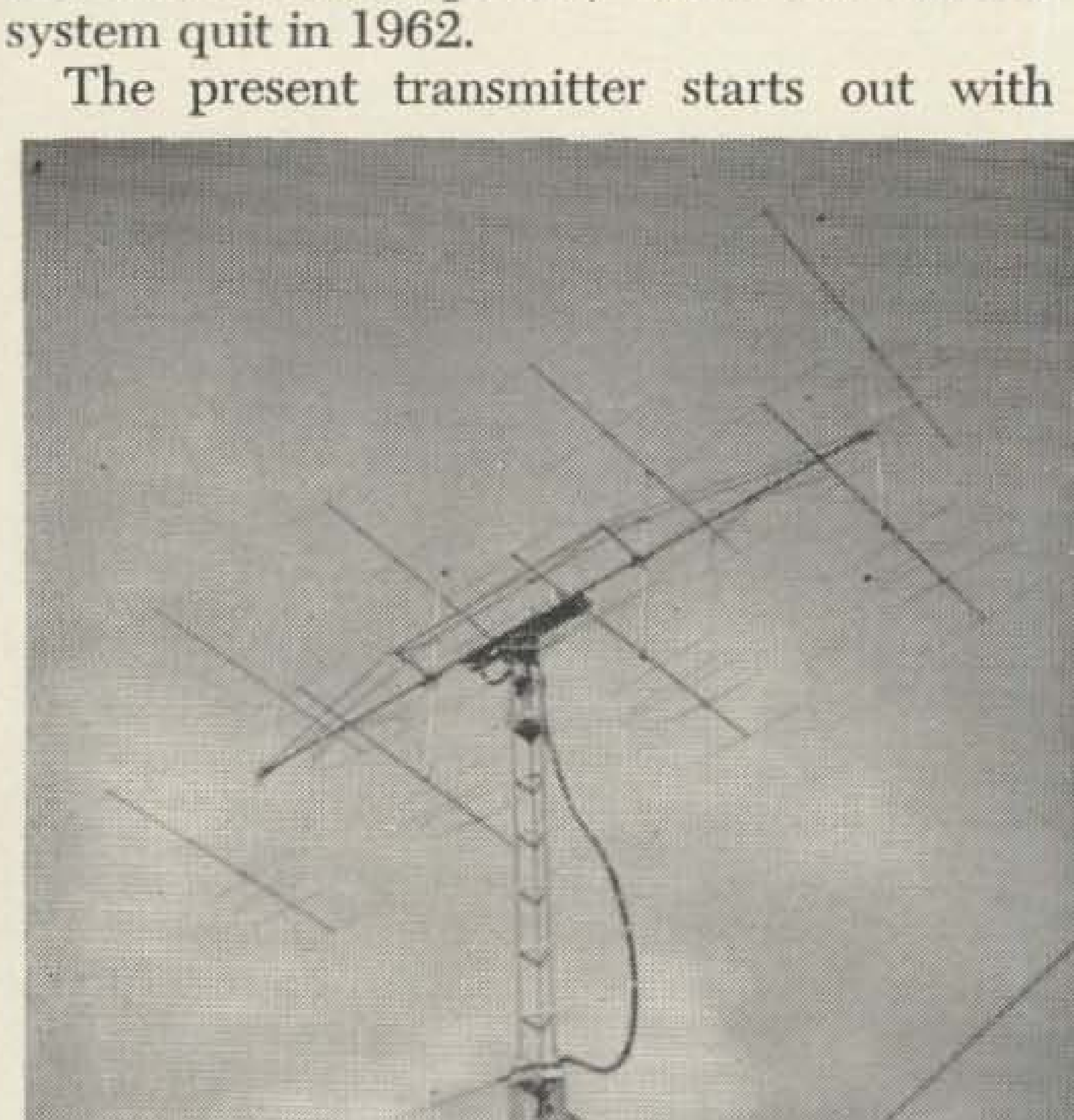
All this time I had been gradually improving my equipment and bringing it up to the best possible. Until last December all three of us had been using circular polarization. I got the bug to try horizontal again since I could build a much higher gain antenna this way and it would have less wind resistance. I wrote to Lenna OH1NL and he agreed to change over to horizontal. Circular polarization would seem to have benefits for moonbounce, but the added weight and wind resistance are against it . . . as well as the fact that horizontal is better for meteor scatter work and for general contacts with other stations.

On April 11th this year Lenna and I did make a valid two meter earth-moon-earth QSO.

I suppose that the futility of trying to work any distance on two meters from the Los Angeles basin (mountains all around except for ocean) may have had something to do with my looking to the moon for some DX. There is just no way to work long distances from here except by moon or meteor scatter.

Apparently everyone but me knew that there was no way to beat that 251 db attenuation in the earth-moon-earth path using amateur equipment. That's kind of like the bumble bee not being able to fly because it is aerodynamically incorrect. Antenna #59 (my 59th two meter antenna since 1952) consisted of eight seven element short yagis, two high and four wide, with 300 open wire phasing lines. The feed line is RG-17A/U. It has been aimed optically since the automatic system quit in 1962.

The present transmitter starts out with a



highly stabilized 8 mc oscillator which hasn't turned off for over two years. It doesn't drift. A 5894 buffer drives the PP GG 4X250B's. The receiver starts out with a 416B preamplifier into a nuvistor converter into a 75A4 using a 500 cycle filter and an 80 cycle audio filter. I've got a feedback circuit for noise cancelling built in, but that's another story.

This is a lot of trouble to go to just to work a new country, I'll admit. However, if you get the bug to give it a try remember that your major effort should be in the antenna. Don't pay too much attention to advertised gain figures on yagis. I've tried and tried and I've yet to see a yagi of any length that measures over 13 db gain and some of the stacking that goes on adds a few db at times, and loses 'em in others. Circular antennas are very difficult to stack and the gain is hard to measure in either plane. All in all I don't recommend that you rush out and buy a bunch of antennas unless you can measure their gain as you set them up and tune them.

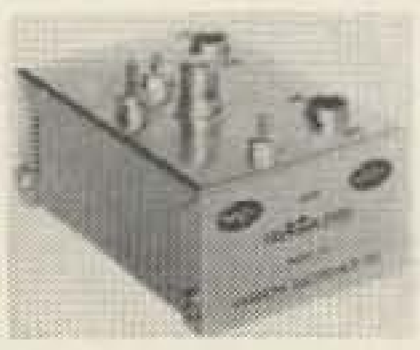
The receiver must get right down to Johnson noise and have AFC or some kind of phase lock because you can't tune around for signals that are this weak. You have to know the frequency the other fellow is on and hope that doppler shift and other influences don't take the signal out of the notch.

Let me know when you're fired up and ready for a try . . . OK? . . . W6DNG

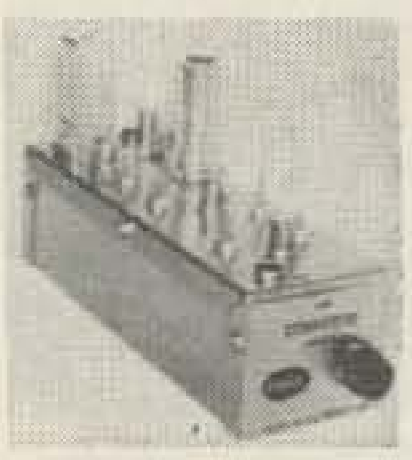
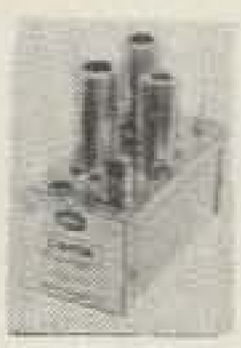
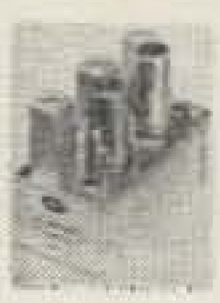
VHF Buyer's Guide

AMECO

American Electronics Company
178 Herricks Road
Mineola, New York

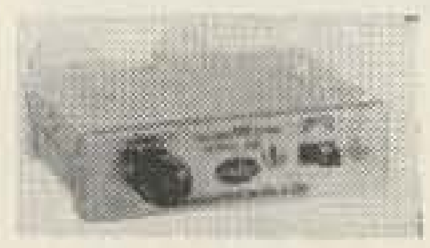



Preamplifier Model PCL (left) for all bands 80-6 meters. Nuvistors give 20 db gain. Nuvistor preamplifier for 50, 144 or 220 mc (right) Model PV. Both require power from receiver or from PS-1 power supply. PV ... $13.95. PCL ... $24.95.

Converter (left) for one band 50-144-220 mc, two nuvistors, one 6J6. Any i-f output. No power built in. PS-1 power supply separate unit. Converters (right) for 6 or 2. Use tubes. 6ES8-6U8A-6J6. Output 7-11 mc or 14-18 mc. CN .. $44.95. CN Kit . $31.95. PS-1 $11.50. PS-1 Kit $10.50. CB6 .. $27.50. CB6 Kit .. $19.95. CB2 .. $33.95. CB2 Kit .. $23.95. CSB .. $9.95 CSB Selector box.

Model CLB (left) 6 meter mobile converter, 12 volts dc power. Model CMA (right), all band converter, 1700 kc-54 mc and 108-174 mc. 3¾" x 6" x 6¾". Requires crystal ($3.50). Uses internal battery. Transistorized. PS-2 power supply provides 12 vdc for CLB from 115 vac. CLB .. $24.95. CMA .. $64.95. PS-2 .. $8.50.

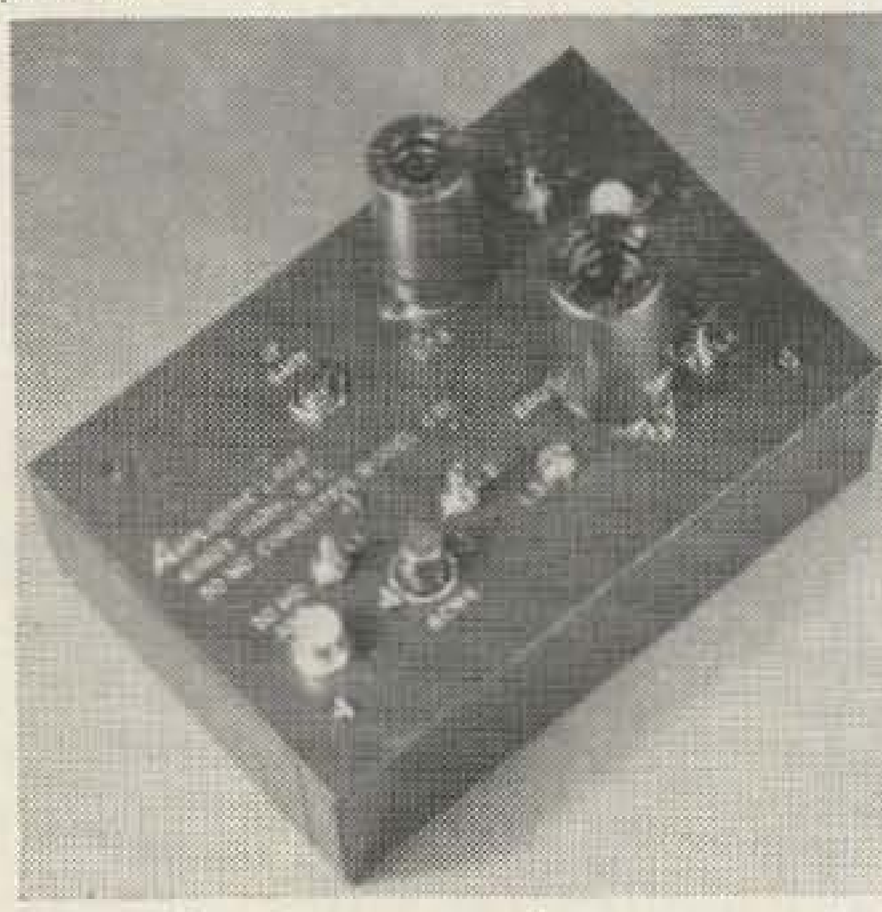
Model CHT, transistorized, built in battery or car battery through BS-9 adapter. CHT converts 2 meters to broadcast band. Can cover from 108-174 mc. Mode ICLT same as CHT except converts any ham band from 2-54 mc down to the broadcast band or any other i-f output. Model SNL squelch & noice limiter, 6 or 12 vdc. SNLT all transistor. CLT or CHT .. $35.95. BS19 .. $2.95. SNL .. $17.75. SNLT .. $19.95

TX-62 6 and 2 meter bandswitching transmitter. 75 input on AM and CW, with built in modulator and solid state power supply. Broadband circuits except in final. Uses 8 mc crystals or external VFO. 11½" x 9½" x 6". $149.95.

Amplidyne Labs

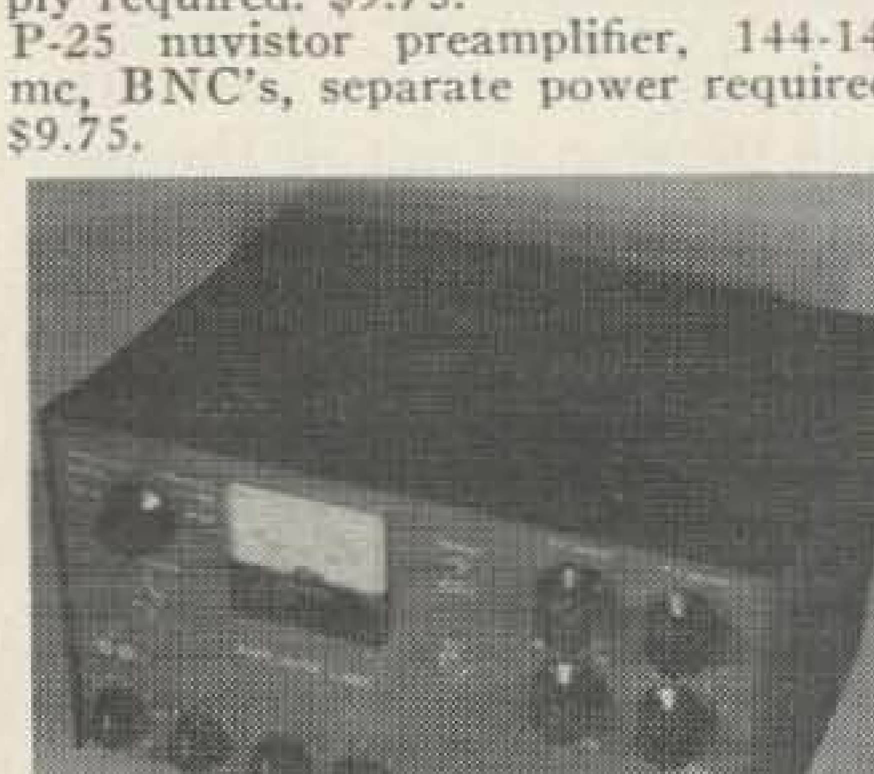
Amplidyne Laboratories
Box 673
Kings Park, L. I., N. Y.


C-23 two meter nuvistor converter. Two 6CW4's in grounded grid rf amplifier, 6J6 crystal oscillator, 6BQ7 mixer-*if* amplifier. Requires separate power supply or voltage from receiver. Output 14-18 mc. Special outputs $1 extra. BNC connectors. 4" x 6" x 2". $34.25. PS-4 Matching power supply $9.75 (right). C-14 1¼ meter nuvistor converter. Identical to the C-23 except input 220-225 mc and price $42.50.



C-61 six meter nuvistor converter. One 6CW4 grounded grid rf amplifier, 6BQ7 mixer and oscillator, 6C4 *if* amplifier. PS-4 matching supply. 14-18 mc output. BNC connectors. 4 x 6 x 2. $28.50.

P-62 Nuvistor preamplifier, 50-54 mc BNC connectors, separate power supply required. $9.75.
P-25 nuvistor preamplifier, 144-148 mc, BNC's, separate power required. $9.75.



Model 621 six and two meter transmitter. 60 watts to GE 8150, 6L6's plate mod. Xtals or external VFO. Built in dummy load, separate loading controls, spotting button, metering of all stages including rf output using external meter (not supplied). $229.50.

126 nuvistor three band converter, 6-2-1¼ meters, built in power supply, 2-6CW4's, 6DJ8, 6J6. BNC connectors, four *if* outputs (7, 14, 26, 30.5 mc) available. $94.50.
Model 221 (right) is an adapter for the 621 transmitter and puts 18 watts on 220 mc. 6360 output. Uses 55 mc output, power supply, modulator and metering of 621. $72.50.

Iodel 221 220 mc adapter for the ıodel 621 transmitter, which supplies modulation, power and 55 mc rive. 15w AM input, 18 watts CW) a 6360. 4 x 5 x 10. $72.50.

Clegg

juires-Sanders, Inc.
'5 Watchung Avenue
'atchung, N. J.

:gg 22'er two meter transceiver. ıal conversion receiver with crys- lattice filter, Nuvistor RF stage, effective noise limiter. Transmitter ; broadband exciter stages, 18 tt high level modulated 2E26 final, ;h to talk and provisions to switch ernal final and VFO. Built in id state power supply for 115 vac l 12 vdc. $239.50.

Clegg Apollo 700 six meter linear amplifier. 700 watts PEP with 10 watts of drive. Push pull 8236's. Automatic control with Venus transceiver. Three meters. Built in solid state power supply. 15 x 7 x 10½.

Clegg Model 372 Lo-Pass filter. 50 ohm impedence. Less than, .5db insertion loss to 50.7 mc. More than 28 db attenuation at 55 mc, over 40 db on any TV channel over 68 mc. Am power rating with VSWR of less than 2:1, 120 watts below 51 mc, 240 watts below 30 mc. Adjustable notch tunable from 55 to 68 mc.

Clegg Interceptor B six and two meter receiver. Tunes 50-54 mc with built in converter for 144-148 mc. Flywheel dial, entire dial tunes one mc at a time. Nuvistor rf stages. Crystal lattice filter for selectivity. Designed for low cross-talk. 15" w, 9" h, 9" d. 32 lbs. $473. Allbander converter for 3-22 & 27-31 mc.

Clegg 99'er six meter transceiver. Double conversion receiver, S-meter, spotting switch. Transmitter crystal controlled (or external VFO), 8 watts to 7558 final, plate modulated. Receiver covers 50-52 mc for good bandspread. AC power supply built in. S-meter switches for transmitter tuning. 10" w, 6" h, 8" d. 14 lbs. $179.95.

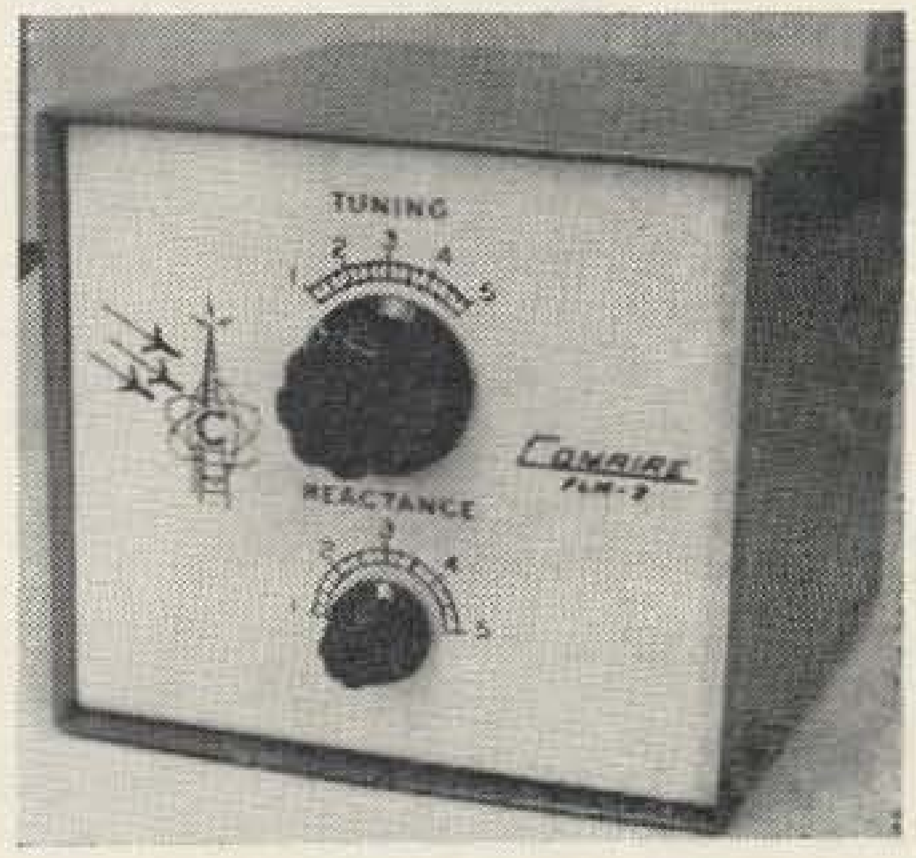
Clegg Thor, six meter transceiver. Receiver has crystal lattice filter for selectivity, BFO, tunes 50-52 mc, external speaker (not supplied). Designed for low cross modulation, images, *if* leakthrough. Transmitter is VFO in receiver frequency or crystal controlled. 60 watts on AM or CW to a 6883 final. Separate (but included) power supply and modulator uses two 6CU6's in Class B. S-meter switches for transmitter tuning automatically. Variable BFO injection for SSB detection and spotting. ANL. 12" w, 6" h, 8½" d. 15 lbs. Power unit 12" w, 6½" h, 8½" d. 27 lbs. $349.95. 12 vdc transistorized supply $119.95.

Clegg Venus VI, SSB transceiver for six meters. Receiver tunes 50-50.5 mc (or any other 500 kc band if specified), crystal lattice filter for selectivity, nuvistor front end. Transmitter 85 watts AM, SSB, CW to 6883 final. Tuning dial: 1 kc per division. Receiver may be offset from transmitter frequency by plus or minus 1 kc. Requires separate power supply. $495. AC power supply $110, 12 vdc supply $120.

Clegg Zeus six and two meter transmitter. 185 watts AM or CW on both bands to a 7034. 811A's class B plate modulation, 18 db speech clipping with automatic modulation control. Crystal oscillator or built in ultra-stable VFO. Flywheel tuning dial. Power supply and modulator in separate unit with interconnecting cable. $695.

Comaire

Comaire Electronics
Box 126
Ellsworth, Michigan

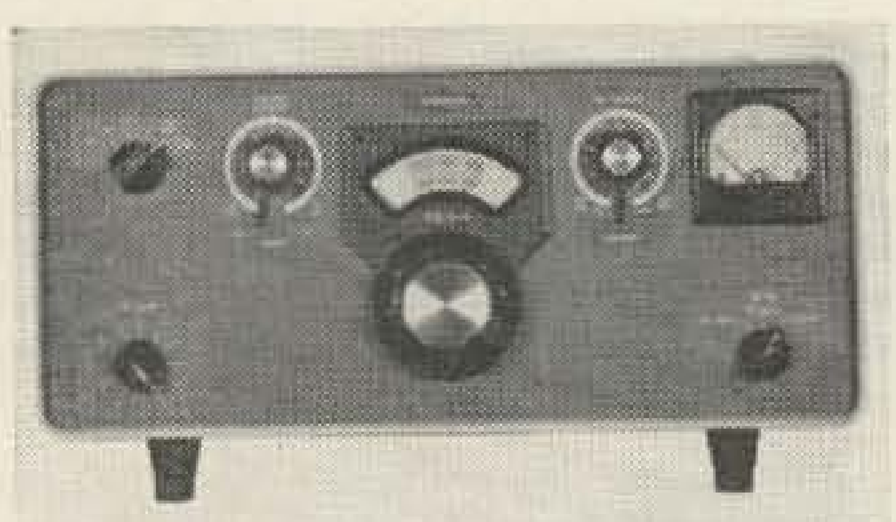


FLM-2 two meter line matching unit to match transmitter to feedline. FLM-6, same thing only for **six** meters. $19.95.

LM-6N2 Line matcher. Combination six and two meter antenna tuner with built in SWR power meter. 500 watts. 7½" x 6" x 7". 8 lbs. Tuners are completely separate. $59.75.

Collins

Collins Radio Co.
Cedar Rapids, Iowa



The 62S-1 converts a 14 mc AM, CW, SSB, or RTTY signal to 6 or 2 meters. N.F. 4 db and power input 160 watts. High voltage is taken from the present exciter. Size: 7¾ h, 14¾ w, 13 d. Weight: 25 lbs. Price: $895.00.

Electronics Specialists

Electronic Specialists Laboratories
301 South Ayer Street
Harvard, Illinois

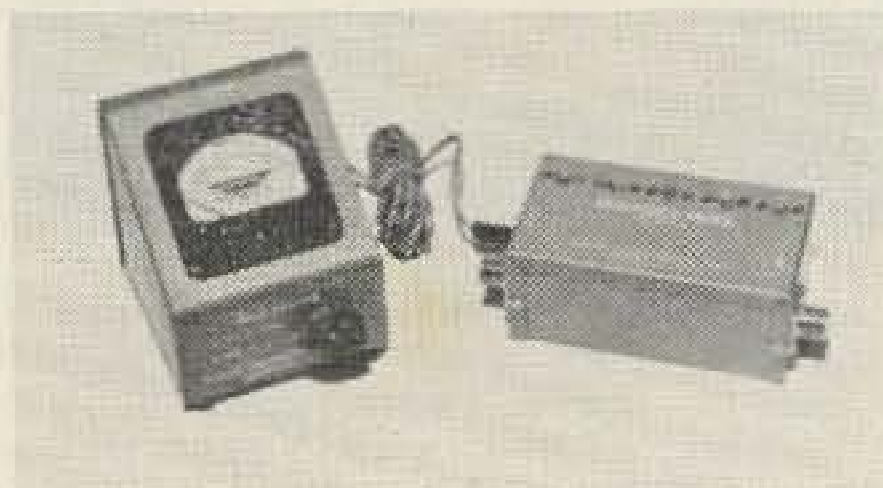
The ESL nuvistor pre-amp is available in models for 50-54, 144-160, and 220-225 mc. Size: 2 w, 1⅝ h, 1⅝ d. Price: wired $8.95, kit $5.95. All nuvistor converters $56.95 with power supply, $44.95 without.

Fulton

Fulton Electronics
Manteca, California
Two meter transmitter for use with crystal mike. Two watts output, complete with modulator and three tubes. $25.00. Six meter transmitter. Similar to above, four watts output. $25.00. Two and six meter super-regen receivers with audio stages. Two or six meter transceiver with AC power supply. $78.00.

Gavin

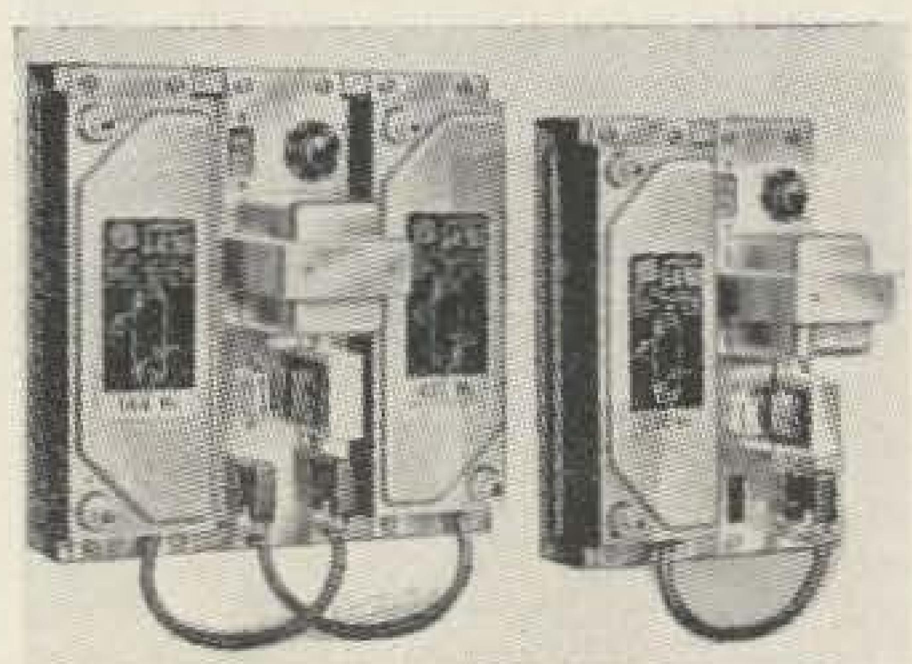
Gavin Instruments
Depot Square and Division Streets
Sommerville, N. J.
BP-144 tunable band-pass filter for 2 meters. Pass band 2 mc., rejection 35 db 5 mc from center frequency (adjustable from 144 to 148 mc), insertion loss less than 1 db., power 190 w plate input. 52 ohms, UHF connectors, 4 x 2¼ x 2¼. $11.85.



The Maverick is a 5 section tunable 6 meter filter with rejection of unwanted signals greater than 35 db., insertion loss less than 1 db. 400 watts plate input. 50 ohms impedance, UHF connectors 5 x 3 x 2. $16.95. Maverick II has identical rf circuitry but includes power measuring meter in 2 ranges, 0-50w and 0-400w. $34.95.

GELOSO

American Geloso Electronics
251 Park Avenue South
New York 10, N. Y.



Model 4/160 6 meter nuvistor converter. 3 db noise figure, 4 mc band pass, 70 db image rejection. *If* 26-30 mc. $109.95.

Model 4/161 2 meter nuvistor converter. 3 db noise figure. Similar to 4/160. *If* 26-30 mc. $109.95.

Model 4/162 220 mc nuvistor converter. 5 db noise figure. Similar to 4/160. $109.95.

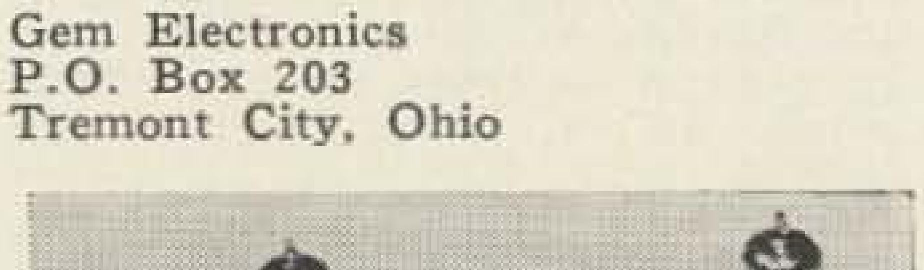
Model 4/163 432 mc nuvistor converter. 5-6 db noise figure. Similar to 4/160. $139.95.

Power supply for above converters. 4/159. 110-220 v, 50-60 c. $29.95.

4/103 Geloso 2 meter VFO. Drives 832 or 2E26. $29.95.

Gem

Gem Electronics
P.O. Box 203
Tremont City, Ohio



6 meter transmitter-exciter. 5 watts. Uses 8 mc xtals. 1 6AU8. 2½ x 4. $6.50 less tube. XT.

Modulator for above. 1 12AX7 and 1 6AQ5. Carbon or xtal mike $5.00 less tubes. MA.

Cascode nuvistor pre-amp, uses 2 6CW4. 20 db gain. 6 meter and 2 meter. 2½ x 2. PA-C. $4.50 less tubes.

2 meter nuvistor preamp. Up to 30 db gain. Uses 1 6CW4. 2PA. $4.00 less tube.

6 meter nuvistor convertor. Uses 4 6CW4. *If* BC to 14 mc. 2½ x 4. $7.50 less tubes and xtal. 6MC-N.

2 meter nuvistor convertor. Uses 4 6CW4. *If* 6 to 14 mc. 2½ x 4. $7.50 less tubes and xtal. 2MC-N.

2 meter convertor. 1 6CW4 and 1 6U8. *if* 6 to 50 mc. 2½ x 4. $7.50 less tubes and xtals. 2MC-X.

2 meter super-regen receiver. 6CW4 and 6U8. 2½ x 4. $6.50 less tubes. 2-SR.

Hallicrafters

Hallicrafters
Chicago 24, Illinois

HA-2 and HA-6 transverters. Converts ten meter transmitters and receivers to six or two meters. 5894 final for 120 watts input, can be driven by any 10M exciter from 10-100 watts. Requires separate (P-26) power supply. 8"H, 17"W, 9"D. $349.50.

Heath

Heath Company
Benton Harbor, Michigan

The VHF-1 Seneca is a 6 and meter transmitter kit with 140 wat CW and 120 watt AM input t 2-6146's. VFO, 4 crystal socket carrier control modulation, banc switching, power supplies include Size: 10⅛ h, 16⅝ w, 10 d. Weigh 50 lbs. Price: $179.95.

The HW-10 and HW-20 are 6 and 2 meter transceiver kits, respectively. 6 meter Shawnee covers 49.8-54 mc, 2 meter Pawnee 143.3-148.2 mc. Both feature built-in supply for 6, 12 or 120 volts. 10 watt 6360 final, push-to-talk microphone, VFO or crystals, internal speaker, 15 kc selectivity, double conversion, squelch, BFO, AVC. Size: 6 h, 12 w, 10 d. Weight: 34 lbs. Price: $199.95.

The HW-29A and HW-30, the Sixer and Twoer, are 6 and 2 meter transceiver kits. Crystal controlled transmitters, 5 watts input to a 6CL6, tunable superregenerative receiver, with microphone, less crystal and mobile power supply, built-in ac supply. Weight: 8 lbs. Price: $44.95, GP-11 mobile power supply kit $16.88.

The HA-20 is a 6 meter linear amplifier kit to match the HX-30. 2.5-10 watts drive, 125 watts PEP SSB, 75 watts AM, push-pull 6146's, forced air cooling, self-contained power supply. Size: 10⅛ h, 16⅝ w, 10 d. Weight: 43 lbs. Price: $99.95.

The HX-30 is a 6 meter SSB transmitter kit with 20 watts input on SSB, AM and CW. Phasing SSB, VOX, anti-trip, VFO, grid block keying. Size: 10⅛ h, 16⅝ w, 10 d. Weight: 50 lbs. Price: $189.95.

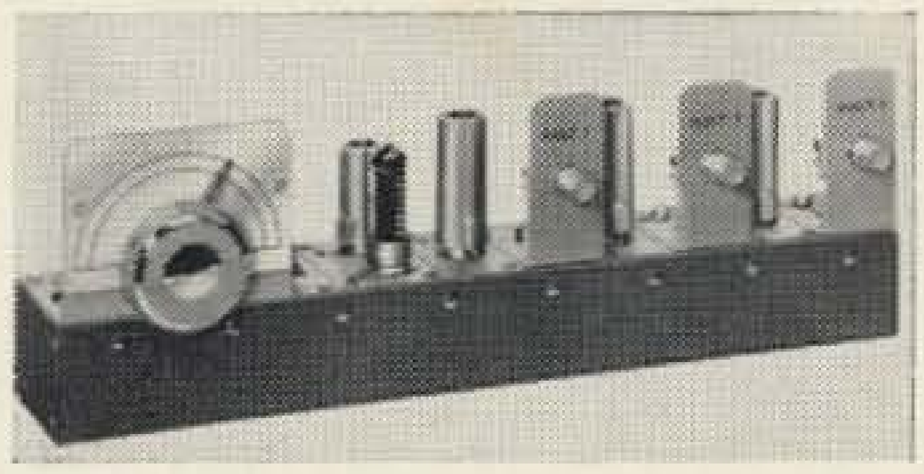
HiTronics

HiTronics Inc.
716 Evanston
Kansas City 33, Mo.

6CN Converter for 6 meters. 3 nuvistors, 2.5 db noise figure, built in low pass filter. Built in power supply. Standard *if* 28-32 mc, others available on order. 4 x 5¼ x 4. Price $35.00.

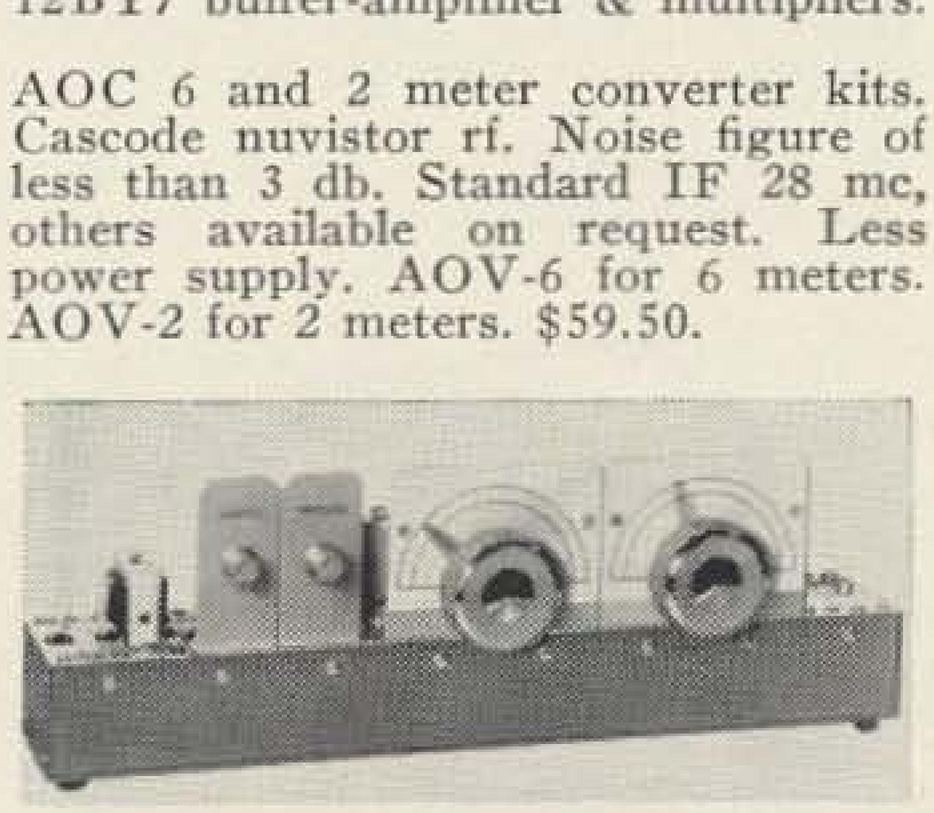
International Crystal

International Crystal Manufacturing Company, Inc.
18 North Lee
Oklahoma City, Okla.



AOF VFO kit. 8-9 mc VFO for six and two meter transmitters. ½ watt output. AOF-89 includes VFO and buffer $22. AOF-90 includes multiplier for six meter output $29. AOF-91 includes multiplier for 6/2M output $36. 6BH6 osc., OB-2 VR, 12BY7 buffer-amplifier & multipliers.

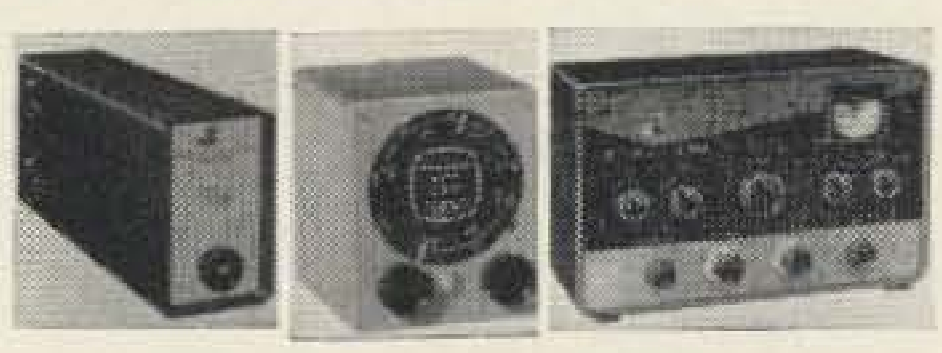
AOC 6 and 2 meter converter kits. Cascode nuvistor rf. Noise figure of less than 3 db. Standard IF 28 mc, others available on request. Less power supply. AOV-6 for 6 meters. AOV-2 for 2 meters. $59.50.



AOR receiver kits. Superhet circuit with regenerative second detector. Nuvistor rf amplifier. Additional Add-On-Circuits may be used to expand these basic receivers. AOR46 six meter; AOR47 two meter are $66.50. All AOR receivers include power supply and 4" speaker.

Johnson

E. F. Johnson Company
Waseca, Minnesota



The 6N2 Converter (left) converts 6 and 2 meter signals to 1 of 4 *ifs:* 26-30 mc, 28-30 mc, 14-18 mc, 30.5-34.5 mc. Bandswitching and self contained power supply. Size: 5 h, 2¾ w, 12 d. Weight: 2 lbs. Price: Kit, $59.95; Wired, $89.95.

The 6N2 VFO replaces 8 to 9 mc crystals in any 6 or 2 meter transmitter. Includes a VR tube but requires external power. Size: 4 w, 5 h, 4½ d. Weight: 2 lbs. Price: Kit, $34.95; Wired, $54.95.

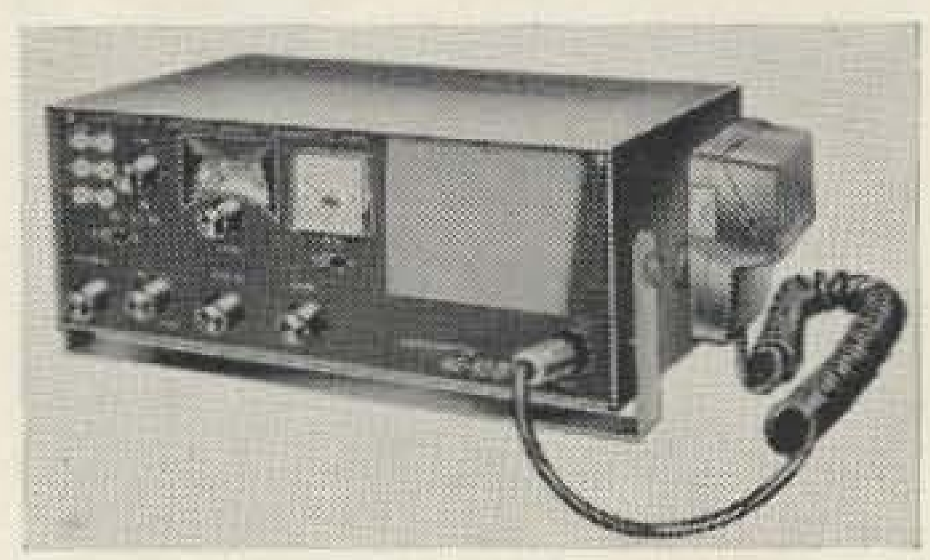
The 6N2 is a bandswitching transmitter for 6 and 2 meters. Requires an external power supply and modulator. 150 watts input CW, 100 watts AM to 5894. TVI suppression. may be driven by any 8-9 mc VFO or crystal. Size: 8⅜ h, 13⅛ w, 8½ d. Weight: 10 lbs. Price: Kit, $149.50; Wired, $194.50.

The 6N2 Thunderbolt amplifies a 5 watt input signal to 1200 watts PEP SSB, 1000 watts CW, or 700 watts AM. Silver plated tank circuits, 2-7034 final amplifiers, self contained power supply. Size: 21 w, 11⅝ h, 16½ d. Weight: 120 lbs. Price: $549.50 wired only.

Lafayette

Lafayette Radio
111 Jericho Turnpike
Syosset, L. I., N. Y.

HE-89 6 and 2 meter VFO. Built in power supply. 8-9 mc output. 6¼ x 4½ x 4. $29.95.



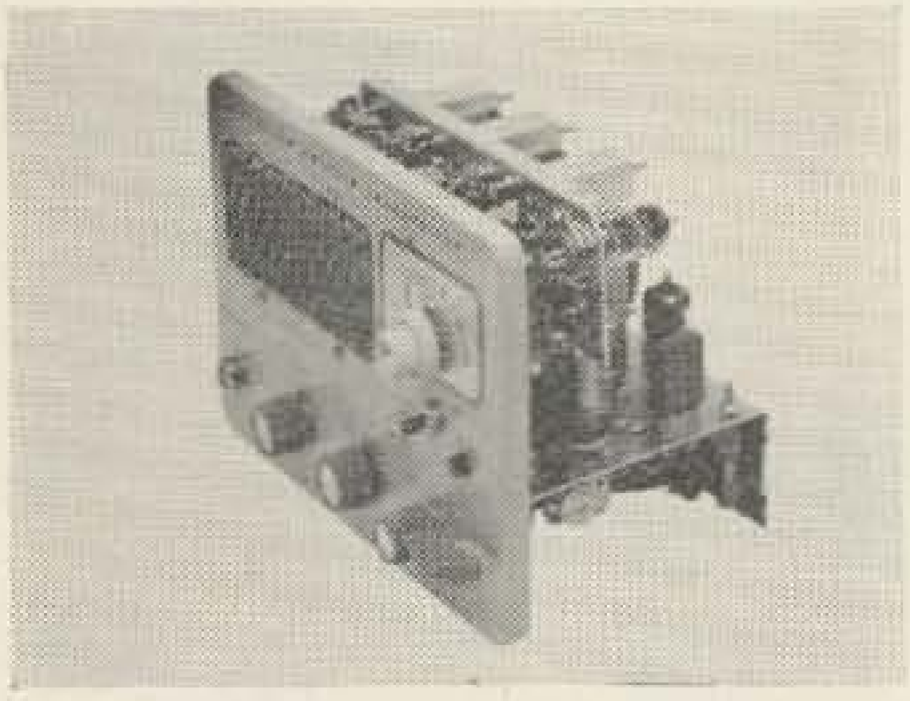
The HE-45-B a 6 meter transceiver with 14 watts input to a 2E26 final. Built-in 12 and 115 volt supplies and speaker. Pi-network, external VFO input, S-meter, spotting swtich, noise limiter, superhet receiver. Size: 5 h, 12 w, 8½ d. Weight: 15 lbs. Price: $119.95.

The HE-61A (left) is a 6 meter VFO with 8-9 mc output for use with most 6M transmitters and transceivers. 2 tubes, power cable, crystal plug, less power supply. Size: 3¾ w, 4¾ h, 4¼ d. Weight: 3 lbs. Price: $19.95.

The HE-56 (right) and HE-71 are 6 and 2 meter converters, respectively, converting 50-54 mc and 144-148 mc to 7-11 mc. 2 tubes in HE-56, 3 in HE-71, self-contained power supply. Size: 7⅝ h, 3½ w, 5⅝ d. Weight: 6 lbs. Price: HE-56, $29.95; HE-71, $32.95.

Lawrence

Lawrence Engineering Co.
36 Lawrence Road
Hamden 18, Conn.



Twoer modification kit. Fits in case of Heath Twoer with no changes in power supply, no cable changes. Makes Twoer a superhet with increased selectivity and sensitivity and no receiver radiation. $33.90.

Sixer modification kit. Similar to above, but for 6 meters. $34.85.

National

National Radio Co.
Melrose, Mass.

The VFO-62 is a 8-9 mc vfo for use with any 6 or 2 meter transmitter. Self powered, crystal socket, bandswitching, spotting switch. Size: 5¼ h, 6½ w, 5½ d. Weight: 6 lbs. Price: $49.95.

Olson

Olson Radio
260 S. Forge Street
Akron, Ohio
Olson 6 Meter transceiver, 100% modulated 15 watts input, double-conversion receiver with crystal controlled first oscillator. .5 mcirovolt sensitivity. Tunable BFO, Built in power supplies for 117 v and 12 v includes push to talk mike, 4½ x 12½ x 7. $139.98.

Parks

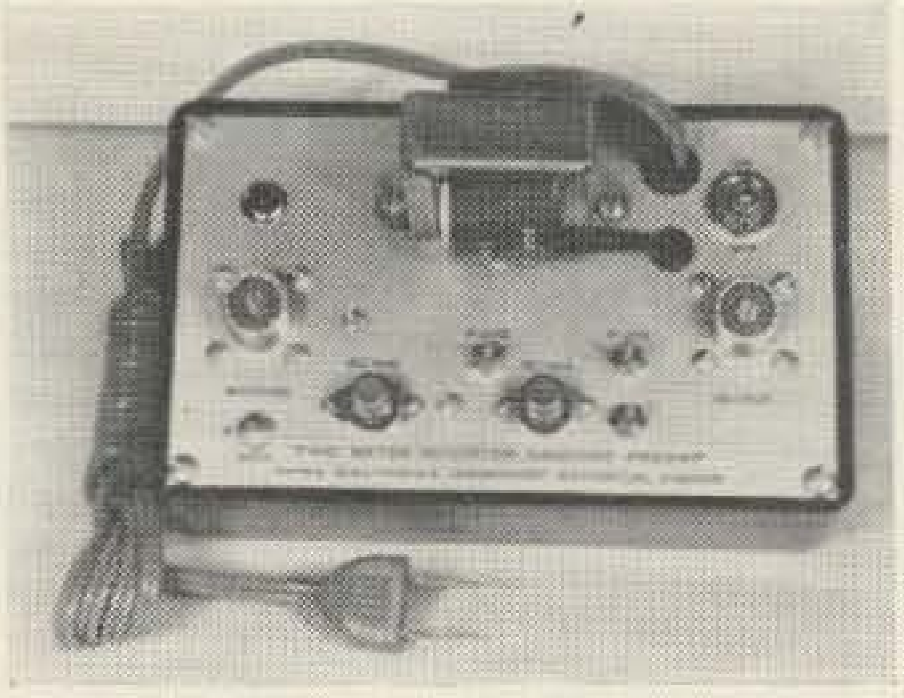
Parks Electronic Laboratory
Route 2, Box 35
Beaverton, Oregon

The Model 50-1 6 meter converter uses a 6CW4 and 6U8A to give output on 7-11, 10-14, 14-18, 26-30, 27-31, 28-32, or 30.5-34.5 mc. 1.5 mc bandwidth, self-contained power supply, choice of connectors. Price: $34.50.

The 144-1 is a cascode nuvistorized 2 meter converter with possible *if*s of 7-11, 10-14, 14-18, 22-26, 24-28, 26-30, 27-31, 28-32, 30.5-34.5 or 50-54 mc. 4 mc bandwidth, choice of connectors, 3 db noise figure, power supply included. Price: $54.95.

220 mc nuvistor converter. Similar to 2 meter converter. $54.95.

432 mc nuvistor converter. Similar to 2 mc converter. $54.95.



The 144-1P 2 meter preamplifier uses 2 nuvistors to give a 2.5 db noise figure. Built-in power supply, 4 mc bandwidth, UHF connectors. Price: $25.00.

220 mc nuvistor preamp similar to 2 meter preamp. $25.00.

432 mc nuvistor preamp similar to 2 meter preamp. $25.00.

P & H

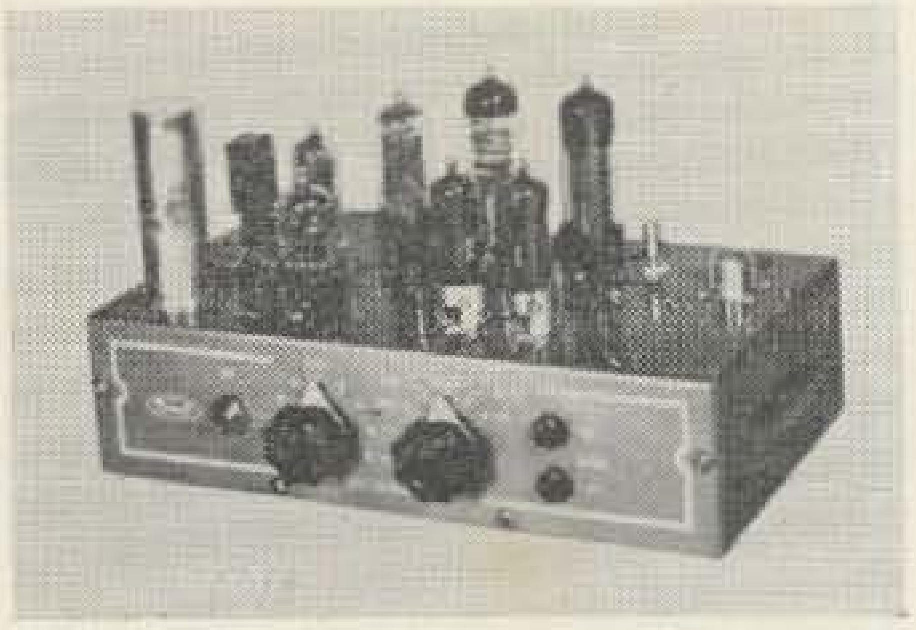
P & H Electronics, Inc.
424 Columbia Street
Lafayette, Indiana

2-150 transmitting converter. Converts 20 meter output of any exciter (AM-SSB, etc) to two meters. 7854 final, 175 watts PEP on SSB, 165 watts CW, 90 watts linear AM. Built in power supply. 9" x 15" x 10½", 45 lbs. 10-100 watts drive required. Well metered. $329.95.

6-150 transmitting converter. Almost the same as the 2-150 except converts 20 meters to six meters, final 8117. Price $299.95.

Tecraft

The Equipment Crafters
Box 84
South Hackensack, N. J.



The Criterion converters are available for 50-54, 144-148 and 220-225 mc. Outputs available from 6-50 mc, built-in power supply, 2 tubes, 2 nuvistors, 4 mc flat bandpass. Price: $54.95.
The Tecraft transmitters are available for 50, 114 and 220 mc. All include one crystal and have 6360 final at 20-25 watts input. Plate modulation, less power supply. Price: $65.95, power supply $39.95.

Utica

Utica Communications Corp.
2917 W. Irving Park Road
Chicago 18, Illinois

The Utica 650 is a 6 meter transceiver with VFO included. It features 22 watts input to a 2E26, 3 kc selectivity, dual conversion, spotting switch, S-meter, adjustable BFO, built in power supplies for 12 and 120 volts. ANL, push to talk, microphone, ac power cord. Price: $189.95. 12 vdc power cord $3.95.

Vanguard

Vanguard Electronic Labs
190-48 99th Avenue
Hollis 23, N. Y.
6 meter 150 mw 4 channel transis torized transmitter with AM modu lator. Includes transistors and 50.! mc xtal. Requires 12 volts at 35 ma $14.95.

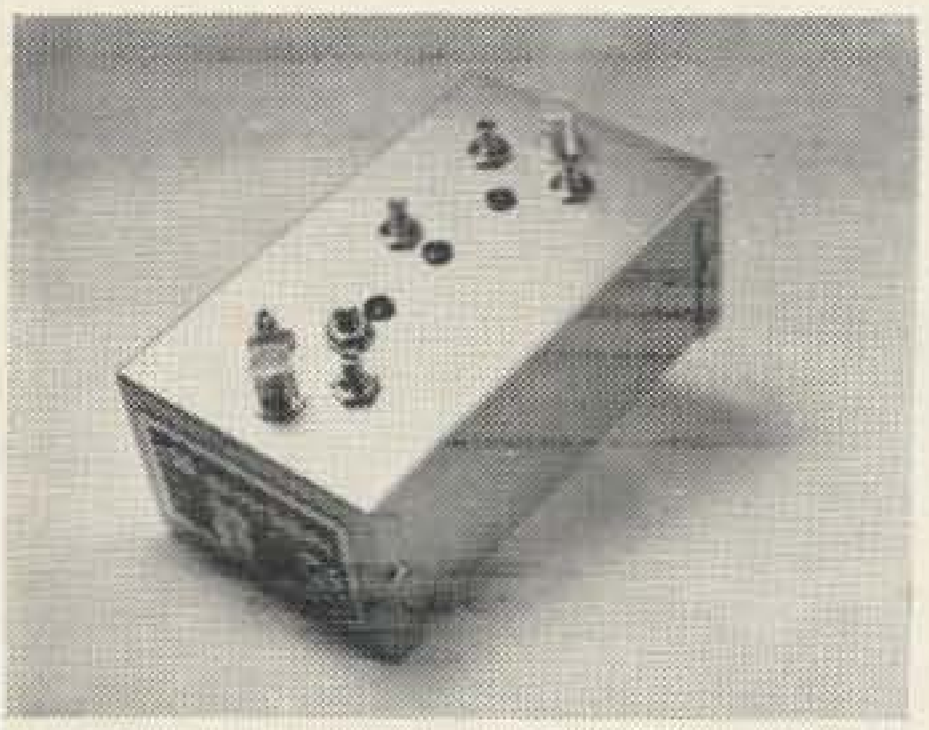
Transistor converters. 3 VHF trans istors, crystal included. 3 x 2¼ x 2 Tuned rf state with better tha 1 microvolt sensitivity. 12 v DC 300-B 50-51 mc, *if* .6-1.6 mc $10.9 300-C 50-54 mc, *if* 14-18 mc $10.9 300-D 144-148 mc, *if* 50-54 m $12.95. 300-E 144-145 mc, *if* .6-1. mc $12.95. 300-F 144-146 mc, 28-30 mc $12.95. 300-X 1 input an 1 output frequency between .6 an 160 mc $14.95.

Mark 3 transceiver covers 49.5-54.5 mc. Crystal controlled 200 mw transmitter. Includes whip antenna, handset. 6½ x 11 x 3¼. Wt. 4½ lb. $69.98.

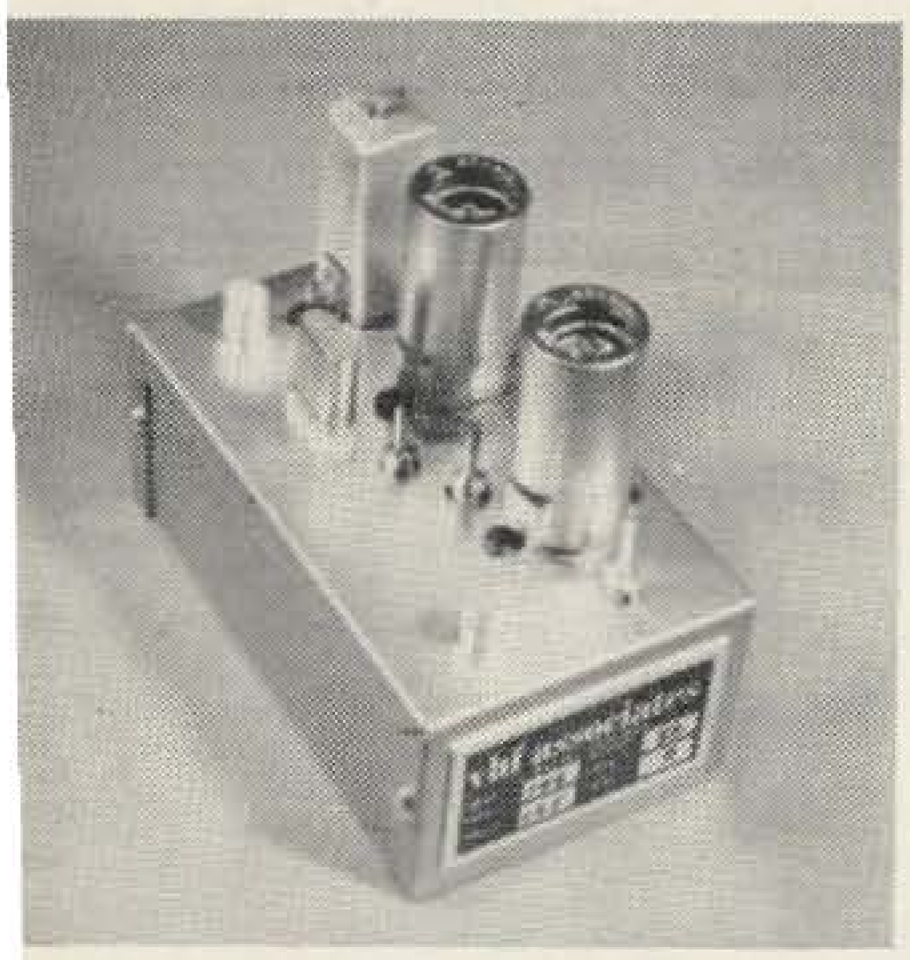
Vanguard nuvistor converter uses a 6CW4 pre-amp and 6U8A converter. 2.5 db noise figure. Output on 14-18 mc or .6-1.6 mc. $10.00.

VHF Associates

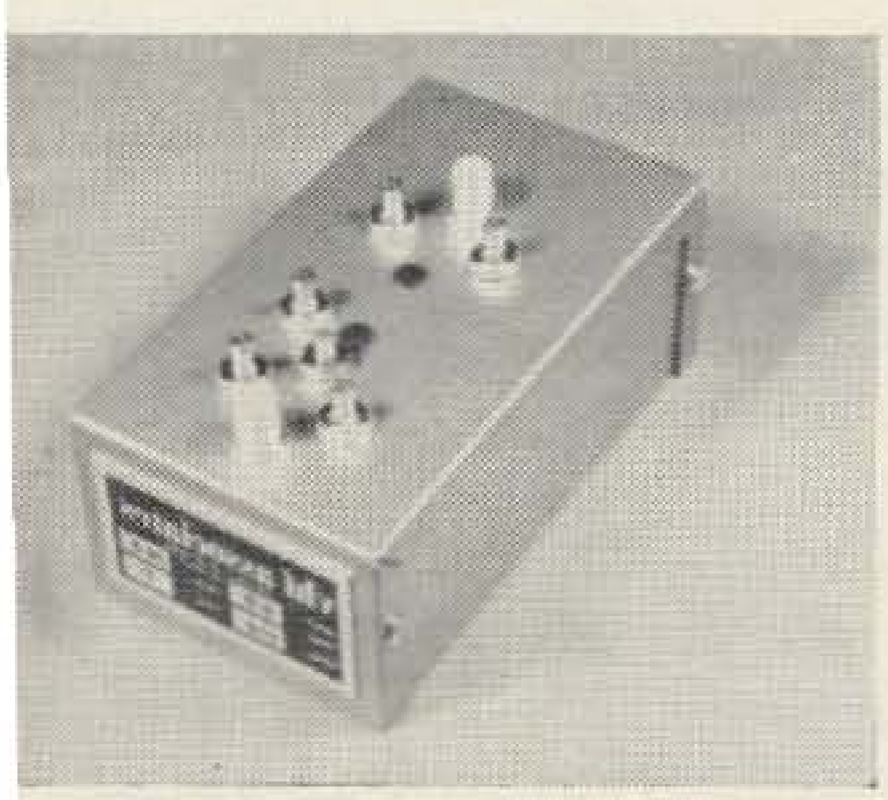
VHF Associates
P.O. Box 6401
Denver, Colorado
VHF-UHF Frequency Doubler 2132. Driven by up to 20 watts PEP AM or 20 watts carrier FM or CW. on 216 mc. Output 12 watts PEP AM or 12 watts carrier FM or CW. No power supply required. 50 ohms impedence, BNC connectors. 3 x 5¼ x 2¾. $54.95 wired and tested, $49.95 in kit form.



VHF-UHF Frequency tripler 1432. Same specifications as above except input is 144 mc.



Iodel No. 145 2 meter converter. ' 50 to 54 mc. Noise figure better ian 5 db. Gain more than 25 db. .equires 100 to 150 vdc and 6.3 v. x 5¼ x 2¾ in. Price $22.95.



Model 514 Varactor Tripler from 48 to 148 mc. Drive requirements: up to 20 watts RF. Output: 12 watts PEP on AM, 12 watts carrier on FM or CW. No primary power required. Size 3 x 5¼ x 2¾ in. $54.95.

Model 4314 (2 meter output) and 4322 (1¼ meter output) nuvistor converters for the 432-436 mc band. Noise figure 6 db., gain 18 db. use 2 6CW4 and a 6J6. Power required, 100 to 150 vdc and 6.3 v. Size 3 x 5¼ x 2¾. $44.95.

Whippany

Whippany Laboratories
1275 Bloomfield Ave.
West Caldwell, N. J.

The Li'l Lulu 6 meter transmitter has VFO coverage, 50-54 mc with tracked multiplier and final stages. Extensive shielding and built in low-pass filter. Built in 115 and 12 volt power supplies, push to talk switchable AM or CW, accepts crystal or carbon mike. 5 watts output on phone, 5⅜ x 8 x 11⅜. Weight 16½ lbs. Price. $225.00.

WRL

World Radio Laboratories
3415 West Broadway
Council Bluffs, Iowa

TechCeiver TC6-A 6 meter transceiver. Superhet receiver with rf stage, crystal controlled plate modulated 1 watt transmitter with push-to-talk. 10 tube sections (6 tubes) and 2 diodes. Speaker included, 5 x 9¼ x 6. Weight 5¼ lbs. Price: $39.95 less power supply. AC supply, $15.95. 12 volt DC supply, $29.95.

Antennas for VHF

Antenna Specialists
12435 Euclid Avenue
Cleveland 6, Ohio
6 and 2 meter verticals for mobile use. 6 and 2 meter coaxial and ground planes. Combination 6 and 2 meter coaxial antenna for mobile use.

Cush Craft
621 Hayward Street
Manchester, N. H.
Yagis for 6, 2, 220, and 432 with stacking kits available for duals and quads. Dual 6 and 2 meter yagi. 6, 2 and combination 6 and 2 meter halos. 16, 32 and 64 element colinear arrays for 2, 220 and 432. Ground planes. Squalo for 6. Big Wheels for 2, 220 and 432. Twist for tracking satellites. Zipper portable beams for 6 and 2.

Finney Company
34 West Interstate
Bedford, Ohio
Combination 6 and 2 meter beams with stacking kits available. 6, 2 and 220 yagis.

Gain, Inc. (Importers)
1209 West 74th Street
Chicago 36, Illinois
Skeleton Slot J-Beams for 6, 2, 220 and 432 with stacking harness and add-on kits.

Hy-Gain Antenna Products Corp.
N.E. Highway 6 at Stevens Creek
Lincoln, Nebraska
Yagis for 6, 2, 220 and 432 with stacking harnesses. Standard and center mount halos for 6 and 2. Ground planes for 6 and 2. Jay-Pole Stacks for 2. Duo-Bander beam for 6 and 2. Log Periodic for 6 and 2. Duo-Band ground plane for 6 and 2. Discone for 50 mc through 500 mc. Verticals for 6 and 2 for mobile use.

Hi-Par Products Company
Fitchburg, Mass.
Saturn 6 Horizontally Polarized Antenna for 6. Lunenburg 2 meter Halo. 6 meter Broadband Ring Antenna for Fixed Installations. Yagis for 6 and 2. Hilltopper Portable Beams for 6 and 2.

Lafayette Radio Corporation
111 Jericho Turnpike
Syosset, L. I., N. Y.
6 meter ground plane. 6 meter verticals for mobile use.

Medicom
Box 632
Soulsbyville, California
Flex-A-Ray for 2, 220 and 432.

Master Mobile Mounts
4125 W. Jefferson Blvd.
Los Angeles, Cal.
2 meter J. 2 meter cloverleaf. 2 meter twin six beam. 6 meter beam. 1½ wave colinear ground plane for 2. Verticals for mobile use. Ground planes.

Mosley Electronics
4610 N. Lindbergh Blvd.
Bridgeton, Missouri
2 meter Scotch-Master beam with stacking kits. 6 meter Scotch-Master beams.

New-Tronics
3455 Vega Avenue
Cleveland 13, Ohio
Conveya 6.

continued

Oklahoma Center VHF Club
c/o Bob's Amateur Electronics
1139 N. May Ave.
Oklahoma City, Okla.
Vertical J for 6.

Super-Q Products
3363 Verner Rd.
Kent, Ohio
6 meter beam.

Telrex Laboratories
Asbury Park, N. J.
Yagis for 6, 2, 220 and 432.
6 meter Spiralray.

World Radio Labs
3415 West Broadway
Council Bluffs, Iowa
6 meter colinear ground plane. 6 meter beam.

Addendum

Gonset

Gonset Inc.
801 South Main Street
Burbank, California

Gonset Sidewinder. Two meter transceiver, SSB, AM, CW, mobile or fixed, PTT, two speed tuning dial, tunes 1 mc, bandswitches for each of the four mc, receiver transistorized for compactness and low drain, transmitter transistorized except mixer, driver and final. Crystal lattice filter. S-meter. 20 watts PEP to 6360 final, 6 watts AM. Transistorized power supply fastens to rear of transceiver. Draws .05 amps at 12.6 vdc in receive position, 1 amp for transmitter standby, 8 amps during transmit. Power supply operates from 12 vdc or 117 vac. 8¾" w, 4¾" h, transceiver 7" d, power supply 5½" d. Weight 19 lbs. Sidewinder: $349.95. Power supply kit $39.95, wired $49.95.

Disclaimer

We've tried hard to get everything right in this section, but it is always possible for us to get a price or a model number wrong, or even to leave out units which obviously should have been included. Injured manufacturers should let us know so we can do better next time.

A Ham's Eye View of the Alaskan Earthquake

Les Haye KL7CKQ
Box 946
Anchorage, Alaska

I had just arrived home from the office a short time before the earthquake struck our area. From the immediate violence of the shake, I realized that we were in for massive damage in the Anchorage area.

For the duration of the earthquate, I had my hands full trying to remove one granddaughter from the danger area where pictures and mirrors were falling from the wall, while my daughter-in-law, René, was trying to calm my wife, Margaret, who was almost hysterical over all of her nice dishes flying from the cupboards and crashing to bits on the floor. The other granddaughter was fairly safe on a bed in the bedroom. I remember thinking at the time that I hoped we were not sitting on top of a volcano which was about to erupt. Some of the neighbors told me that their chief concern was whether my 52'unguyed tower would come crashing down. The beam was slightly damaged but the tower came through unscathed.

My amateur radio station KL7CKQ sustained a considerable beating around but seemed to be in an operable condition; however, we had no elecericity, gas, heat or water so the big transmitter was temporarily unusable. I proceeded with immediate installation of the 2-meter (CD coverage) mobile transmitting and receiving facilities into my car. This posed a minor problem due to the use of an exchange battery which did not have the proper battery connections. This was overcome by cutting the battery clips from my battery charger and "haywiring" them to the battery. My son, Jim, KL7EKD, had a difficult time locating my mobile antenna in the jumbled mess the earthquake had made of my storage building. However, it was found i usable condition and placed into service.

Upon getting the "two meter" apparatus into operation, I checked into the CD net from the car and was advised that they had no immediate need for my mobile services. At this time, Dan Wright, KL7ENT, having been forced from his home by the shake, had placed his mobile high-frequency transmitter into his car and arrived at my place. We made immediate preparation to get on the high frequency amateur bands from his car. Wiring torn loose in his automobile by the severity of the earthquake was hastily repaired and Station KL7ENT, operating mobile on a whip antenna, went on the air. Immediate contact was made on 75 meters with Horace's W7AG in Suquamish, Washington, and Horace relayed to our relatives that all the respective families here were all right and the homes damaged but safe. Horace, an old friend of Dan's was monitoring on the frequency commonly used by Dan and him to establish nightly contact via amateur radio. Horace said it was with extreme relief that he heard Dan calling him and realized that he was OK. Almost continuous contact was maintained throughout the period from 8:45 on the evening of the quake continuing for several days.

While Dan set up contact with Horace, I cut the cable lacing on my big transmitter and removed the various antenna lead in cables for the fixed antennas and made provisions to hook these antennas to the mobile transmitter and receiver in Dan's car. These large perma-nent antennas would give better signal strength nd coverage. We then set about the almost nsurmountable task of providing some of the irst communications between the disaster area ınd the outside world. This was about 8:45 on the evening of the calamity. While Dan operated the "mobile portable fixed" station, set about coordinating between the CD facilities with the transmitter in my car, running in-ormation between my car and my house, and o Dan in the mobile station. By this time, my on, Jim, was busy hunting gasoline to keep Dan's car running since all the service stations vere out of commission. Gasoline was donated y Ken Stocker. Other good samaritan neigh-ors moved in to make fuel available to pro-ide the motive power for the mobile station.

About this time one broadcast radio station ad gotten into operation and we were receiv-g information on my portable transistor radio. he operation of the broadcast station was a odsend to us since we were able to com-unicate with them by telephone which for-nately was undamaged and operational on e Fairfax Exchange all through the emergency. Many messages from Fairbanks and the 48 states were relayed directly to the radio station to avoid the disruption of the CD net. Dan operated throughout the night handling incoming and outgiong traffic until about 4:30 A.M. when the 75 meter band "went out." Dan was so fatigued and hoarse from his all-night vigil that he sounded more like a big bullfrog than anything else. We tried unsuccessfully to sleep until 6:30 A.M. at which time we switched to 20 meters and my Telrex tribander and prepared for the grueling task of continuing the emergency communications to the outside on the 20 meter amateur frequencies. Again Dan bore the brunt of the constant talking with some assistance from me, KL7CKQ, Andy, KL7ARY, and Frank, W5GEG. I continued with the leg work between the phone, broadcast station, and the mobile radio station, trying to keep abreast of the stream of incoming and outgoing messages.

Nearly all the messages throughout this period were damaged and welfare information between Anchorage, Fairbanks, and the "South 48." As an example, an appeal went out for bread via the broadcasting station which was being received at Fairbanks. Almost immediately we handled the incoming answer to the appeal with the information that the bakery in Fairbanks had received the message and 700 loaves would be in by plane in the early morning. Messages of this type became almost routine.

Other traffic from the outside included a multitude of offers of aid, personnel, and supplies ranging from blood, plasma, and medical supplies, to heavy machinery with operators, as well as telephone facility supplies with trained personnel and offers of money and food. These were all placed into the proper channels with answers back to the originating stations as soon as possible.

Since communications was of vital importance, in answer to a query by the Postal Inspector at San Francisco as to damage to facilities here, the Postal authorities were contacted through the broadcasting station. The Postmaster called me almost immediately and we were able to relay back through our station that all post office personnel were OK with minor damage to the Post Office facilities. This meant that mail could be worked. We were able to answer queries from the airlines and inform them that the International Airport was closed to jet traffic which was being accepted by the Elmendorf Air Force Base facilities. At about 2 AM we handled an urgent request for generators and dynamite from

Seward. This report, as well as a rundown of damage to the railroad terminal, dock, and tank facilities, was immediately placed into the hands of the proper authorities.

This has been a cross section only of our first operations since there were such a multitude of messages worked throughout this time that it would be impossible to tabulate them here. However, we should note the fact that candles and flashlights supplied the only lighting available with no heat or drinking water. This compounded the difficulties but the situation was alleviated to a certain degree by the welcome advent of a portable gasoline stove supplied by Andy, KL7ARY, and coffee made from melted snow.

At about noon on Saturdaay we started to get electricity back. When this would occur we would change the antenna to the big KL7CKQ transmitter and handle the traffic through that facility since we could run much higher power. The power would fail occasionally and an immediate transition would be made back to mobile KL7ENT with a negligible time lag. This went on throughout the day with a nighttime transition to the mobile station when the 20 meter band failed and forced us back on to 75 meters.

As soon as possible we had the radio broadcasting stations begin giving broadcasts that we were in a position to start handling outgoing welfare messages to the outside. An immediate landslide of messages hit us with the streets in front of 3215 Lois Drive and 915 Engle Street lined on both sides with automobiles, and many people coming to the house on foot. It must have been a tremendous emotional release to the frantic public to know that contact could be made with their worried relatives, many of them sick and ailing.

Mrs. Marjory Cook, my daughter-in-law, René, and my wife, Margaret, were pressed into service to copy messages and feed them to the operator of KL7CKQ or KL7ENT as fast as they were written. All messages were worked as soon as possible with priority given to emergency messages. We were running as many as 100 messages behind at times, but handling as many as 219 per day. These messages were the telephone collect type with the instructions to the receiving station, who was given from 5 to 25 messages, that he step to the telephone and phone them through while we were giving the next station from 5 to 25 messages. By this type of operation we were able to deliver at least 98% of the messages with no time lag.

With the restoration of power, Dan, KL7ENT, had returned to his damaged home and placed his big station into operation. This doubled our traffic handling capacities with liaison between the two stations provided by separate 2-meter station facilities. The story of his operations from this point on would fill another volume.

I think at this time it would be interesting to give a little cross-section of the sometimes pathetic, sometimes urgent, and sometimes humorous situations encountered. The overall morale of the people we met, many homeless and confused, was terrific. There was little evidence of panic. Talk would sometimes turn to reconstruction of their battered businesses or homes with the greatest concern being given to getting word to relatives.

As an example of the varied messages handled, one lady came to us and asked if we could possibly help her since her brother and some friends had chartered an airplane and were waiting for clearance from the authorities here to come after her body. She flatly stated, "I am not a body." We assured her that we could and would help her and asked where the message was to go. Needless to say we received a shock when she said, "Paris, France." This slight difficulty was resolved when we learned she had a relative in an outside state. We gave them the telephoned information, requesting them to send a cable with the welcome news to her waiting relatives in France.

Another similar situation involved an ailing father in Lebanon. This was complicated by the fact that the party did not have the relative in the states. The difficulty was quickly resolved by my Net Control Station K7VJJ, Keith, who stepped to the telephone and sent the necessary cable to Lebanon at his own expense. A check was dispatched from the joyous relative to Keith for the amount of the cable.

We also had a sort of a humorous inciden of a continuing nature. We had several querie from a large cheese factory wanting to donat 1000 lbs. of cheese. For about three days th Red Cross was constantly queried for shippin instructions. Under the pressure at that head quarters the answer failed to get back to u until we finally elicited the information th they did not want the cheese. This informatio was sent back to the people at the factor They asked us to give the donation to anyon who could use it. The American Legion w contacted. They eagerly accepted and shippin instructions were provided to the factory.

In another instance we had information th a lady was in a hospital in California wi shock, and information was obtained that h daughter and family were safe. This inform tion was dispatched to her via telephone. I can't give more than a small cross section of the messages handled, however, I would like to give a few sidelights on the operation.

One of our very faithful contacts in California who had been pushing messages for all he was worth, came back on a transmission and said to me, "Les, all of these messages say the same thing (we are safe, etc.). They don't seem to be very important to me." I went back to him and said, "Lloyd, if I received one of these messages it would be the most joyour and important message in the world to me." Lloyd came back and said, "I hadn't thought of that, shoot me some more messages."

I believe that it is proper at this time to say that the radio amateurs throughout the world reacted to this emergency in a wonderful way. Frequencies and bands were cleared for the outgoing traffic with many stations policing the frequencies being utilized for emergency or disaster traffic. Very little interference was encountered, and thus the transmission of these thousands of messages was possible. I can't praise all the fellows enough foh the teriffic way they moved in to ease the burden here during those dark days.

There were constant queries from stations throughout the states, but since we could not handle incoming messages as all phones were limited to emergency calls, all such questions were necessarily turned down and believe me, it was heart breaking to have to take such a course. However, had we not done this we would have been completely snowed under with traffic for which there were no answers.

To help alleviate this constant desire for nformation, I asked the girls who were taking nessages to make notes of all information comng through on the radio regarding damage, asualties and general conditions in the state, s fast as they were made public. I would then ake a brief break and read these accumulated eports to the thousands of amateur stations ionitoring our transmissions. It was pointed ut at the time that we did not know how ccurate the information was but were offering since this was all the information we would ave for some time. We thus answered thounds of unasked questions with a minimum me delay. We were told later that such transissions did a tremendous job to allay the ars of a nation who temporarily had no other urce of information. I fact we were told that ews media constantly monitored our transissions with dissemination through news faities as fast as it was received.

There were constant offers of cash for our services by those taking advantage of them and they seemed a little surprised when we said *No Charge*. We had to explain that these stations were licensed by the FCC as amateur activities and that the service now being rendered was a working example of the public service offered at any time by the members of a closely knit fraternity.

I would like to extend my special appreciation at this time to John Meyers, K7DPH who came in and spelled me on the transmitter through the many long hours. He gave his time and energy unstintingly to keep KL7CKQ on the air and the traffic moving.

I would like to thank all the people who came in and offered to help even though they themselves needed help.

I would like to especially thank Sgt. Gilstrap of the 2868 GEEIA Squadron, Elmendorf AFB, who made his way to my home to offer his assistance in the station operation as soon as the roads became passable.

I now want to offer my heartfelt thanks to those many amateur operators who patiently stood by on the frequency we were using to be ready to handle the traffic as fast as possible. It is only through such cooperation that it was possible to handle such a massive bulk of messages.

This is the behind the scenes story of those continuing radio announcements you received on your broadcast radios telling you to take your welfare messages to Station KL7CKQ at 3215 Lois Drive or to Station KL7ENT at 915 Eagle Street.

(W2NSD from page 4)

new breed of ARRL director. The responsibility is entirely up to the ARRL members to get good men into the directors' chairs. Have you anyone in your club or in your town that would make a good director? Someone who has been keeping up with current amateur events, a fellow who is intelligent and dedicated to our hobby? He also has to have been an ARRL member continuously for four years and have a General or better class license . . . no Conditionals or Technicians no matter *who* they are. Once you have a good man in mind you have to sell him on wanting the job. Then you have to send a nominating petition into headquarters with ten signatures of current ARRL members. I'll have more info on this next month for you.

Elections this year are for the Central, Hudson, New England, Northwestern, Roanoke, Rocky Mountain, South Western and We

Gulf divisions. Please fellows, we *must* have some good directors elected this year. Let's not get stuck with chaps who are out only for personal prestige.

WA2USA

As of this writing WA2USA has been put off the air as a result of the industry of ARRL errand boy Dannals who, with his cohort Stan Zak, is planning to run for Director next year. We understand that Dannals, Kahn and Booth requested permission from the officials in charge of the Venezuelan pavilion to have the ARRL take over WA2USA. This was an obvious way out of the hot spot ARRL was in due to the rising complaints about their "hidden" station K2US and growing dismay over the commercialism of their tie-in with "Drink Coca-Cola." It is particularly unfortunate that the good of amateur radio has become so completely submerged.

Salaries

Are there any other members of ARRL besides myself that would like to know something specific about headquarters salaries? Who are we paying how much? How much is

(Turn to page 90)

73 Products and Publications

6UP Magazine. The only fullfledged monthly devoted to VHF. Invaluable to the Technician and the VHF/UHF DX'er and experimenter. Activity reports on all band openings. Wide band FM news. Six meter news. Two meter news . . . 220, 432, 1296 . . . etc. Construction articles, antennas, etc. K5JKX editor. **$2 per year.** Don't miss a single copy of this interesting magazine.

ATV Bulletin. The Amateur Television Experimenter is the only publication devoted to ham-TV. Circuits, operating news, conversions of surplus gear, ads for TV gear, discussions. WØKYQ editor. **$2 per year,** published bimonthly.

Back Issues of 73. All back issues of 73 are available for **50c each** except June 1962 and January 1961, which are unavailable, and Oct-Nov-Dec 1960 issues, which are $1 each. We'll *pay* $1 for a January 1961 or swap for it.

Binders. Bright red leather gold stamped with 73 and year. Specify 1960-1, 1962, 1963, 1964. **$3.00 each.**

Bound Volumes. Only a few left. 1960-1, 1962, 1963. A very few. Beautiful red leather. **$15 each.**

WØKYQ editor. **$2 per year,** published bi-
Impedance Bridge. Full scale construction prints for the bridge described in the August 1961 issue of 73. Comes complete with a reprint of the article. Watch out General Radio! $1.00

SSB Transceiver Schematic—W6BUV. Giant size schematic of the transceiver that appeared in the November 1961 issue of 73. Complete with extra November issue. $1.00

73 Inc

Peterborough, N. H.

(W2NSD from page 89)

the General Manager getting with his new improved raise? How much will Budlong get in retirement with his new raise? Aren't we members entitled to know where our money is going?

Publicity

The May 30th Post has a fine article on how hams have formed a communications network to link eye banks around the country. There have been quite a few local articles on this network in newspapers too. This is the sort of public service that makes ham radio worth its salt. All of us owe a vote of congratulations to the eye bank net.

Progress

One of the great areas for pioneer work in ham radio is in the VHF's. We've had two major historical events just recently in this field. On April 11th W6DNG contacted OH1NL on two meters via moonbounce (nearly 5000 miles away). The signals were S2 and S3, but they *were* signals. These fellows didn't have very spectacular stations either, using persistence over about two years to make up for a lack of antenna elements or a big dish.

Sam Harris W1FZJ (W1BU) was getting echos back on two meters about six years ago, but he was unable to get anyone else to set up and try to work him. He decided that he might be able to do better on 1296 and, sure enough, Eimac set up a station in California, provided him with a transmitter, and the record was made. I'll bet he'll be back up on two meters before long now.

Not that Sam has been taking it easy since his 1296 record. On May 19th he fired up on 432 mc and worked KP4BPZ in Arecibo Puerto Rico, a distance of about 1650 miles Sam was running his usual kilowatt and feeding his 28 foot dish. The dish was lying on the ground tilted up against a pole so he could run out and swing it to follow the moon Contact was made with signals running between 20 and 40 db above the noise. Another record.

It must be admitted that most of the work on this contact was being done down in Arecibo where Gordon was using the 1000 foot dish built right into a depression in the mountains for his antenna. This gave him a gain of about 56 db. When you figure that my little 336 element beam can have about 28 db at the very best you can see that the 1000 foot dish *is* advantageous.

Due to the location of the big dish the moon comes into range only about two hours a day for about two weeks each month. Most of this time is spent in scientific observations. On occasion Gordon finishes up some tests early and has a few minutes to tune up on 432 and see what he can work. He is planning on being on 432 for the entire two hour period for the June 13th day of the ARRL VHF party so we may see the distance record broken again in a few days. On the 14th he will fire up on two meters and see what can be done there.

If you've followed my writing much you probably know that this has bugged me considerably. I'm in the process of getting rather well set up on two meters. Unfortunately my monster antenna is aimed at the horizon and not at the moon. We could hit the moon at its setting time, but it would swing through the width of the beam pretty fast. This means that if we're going to try mooning it we'll have to start over and hook up a whole new antenna just for that. I don't know if we're going to be able to do that or not.

432 is probably my answer. We have a 192 element Cushcraft beam for that band on hand and it isn't too big to swing around on a polar axis. That still leaves me with a need for a good converter and a final amplifier. Neither of these seem to be made these days and I don't have the time to cook them up... what'll I do? My best bet is to write about the fellows who are able to build gear for these bands and make the contacts and not try to do it myself. This will leave some time for putting out 73 and working on the Institute.

In view of the events of late this special VHF issue is rather timely. One thing I'm trying to get across is that most of the gear for these bands can be built up very simply. We're starting a series of articles by K1CLL in this issue . . . they will go on for a long time to come. Bill Hoisington (ex-W2BAV) has been around the VHF's for a long time now and is nothing short of a wizard. He builds most of his gear on copper clad laminate which he picks up surplus from Meshna. The other main building material is flashing copper . . . soft copper which you can buy at a plumbing store. Nothing Bill ever builds costs much. He uses the least expensive tubes he can find, with the 2C39 being just about the highest price one in his repertoire.

The other day Bill was sort of at loose ends and asked for a suggestion for something to build. "How about some linears for the Sixer and Twoer?" I asked. A couple days later he drove up with working models which gave a solid 25 watts output and were so simple to make that everyone here gaped in disbelief. The only power supply was a 500 volt TV job . . . no bias required. The on-the-air reports were wonderful. We can't have everything in one issue so these little marvels will be along in a couple months for you. Bill got quite a laugh at the Swampscott Convention when he attended a lecture by a VHF Expert who started right off telling everyone that Class B linears were much too inefficient and were no good.

The VHF's can be a lot of fun and it needn't be expensive to get there. You have to make your choice . . . monthly payments for new equipment or monthly repairs on old . . . or else you can follow Bill with the tin snips and soldering iron. You probably won't be nutty enough to buy a mountain to hold up your antennas, and it isn't really necessary. Though I've done a lot of mountain and building topping down through the years, I've also done a fair job of working DX right from the old homestead in Brooklyn. I used a 24 element beam (four six element yagis) with 500 watts and worked sixteen states and all the way out to Chicago on two meters.

Now, with a nice mountain shack, I hardly know which way to turn. Six, two, 220, and 432 all beckon. There's moonbounce, TV, WBFM, aurora, SSB, and even RTTY.

The next time you get frustrated by the QRM on 75 meters you might give some thought to wide open spaces up above ten meters. Actually the W.O.S. start around 15 meters most of the time these days, but it isn't until you get up to six meters that you run into large concentrations of regular inhabitants together with W.O.S.

Activity on six and two varies between the use of simple gear with simple antennas for short range rag chews to monster stations for moonbounce, meteor bounce, aurora bounce, and brute force no bounce. Operations take place from home, mobile and from mountain tops. I've run the gamut down through the years. Back in 1946 I helped open two meters with the first 522 on the band. In 1947 I was lugging it to the tops of mountains. By 1948 I had it on top of the News Building in New York. The only signal that was outdoing me then was W2BAV, Bill Hoisington up in Rye, New York who had a fire tower on top of a mountain. All this two meter stuff did not keep me from working quite a bit of DX. The next time you are up visiting the CQ office you can look through my 20 year QST collection there and find where I've marked each mention of W2NSD in the DX column.

There's a note on the cover of each issue telling which page to turn to.

Even today I get as much kick out of six and two as I do out of working something rare on twenty. I've accumulated quite a bit of gear down through the years. My two meter rig is powered by the power supplies and modulator from the old pre-war National 600 transmitter which I picked up in 1947 and recently siliconized. The exciter is an old 522 driving a Gonset linear. The final was $30 surplus. The big event is the antenna and location.

Way up on the side of Mount Monadnock, the highest peak in southern New Hampshire, is a six room house. Surrounding this house are three towers, the largest 120′. On this 120′ KTV tower is the biggest two meter antenna you've ever seen . . . 288 elements! This is made up on three 96 element beams, one over the other. The 96's are in fact plain little old 64 element colinear beams with two directors in front of each set of colinear ele-nents. In this way we get the advantages of he colinear beam and the added gain of the agi. Clever idea by Cushcraft. The 288 was wung in place last October, but the feed-ines had never been connected. This May, vhen the snow melted enough to get to the ouse we found that the beam was quite in-act, despite a rigorous winter and extremely igh winds.

Naturally we're anxious to see how the eam works. We first used a little six element agi on a pole and found that we could work asily 150 miles with the band closed. Then e got a 96 element beam on top of the tower nd found that we could hear every Twoer in lew York and New Jersey and got reports of 0 db over 9. This blew over two days before ie September DX contest last year, proving iat 2″ hardened steel pipe is not enough for beam of this size. Almost every station we ork from the mountain is in the same south-esterly direction so we decided to use the wer to hold the beam instead of a pipe and forget rotating it. Actually, in practice, we ill be able to rotate the beam about 120° if becomes important. To take care of the casional station off our major beam we're ing to swing a 48 element beam to the top the tower on a Ham-M rotator. This will be etty interesting when we get it perking.

Next Month

We're putting together a special transistor ue for you. Receivers, transmitters, convert-, transceivers . . . wait'll you see the collec-n. . . . Wayne

INDEX TO ADVERTISERS

To aid you in finding ads which are not running in this issue we have listed the last ad run by each company in 73.

Propagation Chart

EASTERN UNITED STATES TO:

GMT -	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	14	14	7	7	7	7	7	14	14	14	14	14
ARGENTINA	14	14	7	7	7	7	14	14	14	14*	21	14*
AUSTRALIA	14	14	14	7	7	7	7	7	7	7	14	14
CANAL ZONE	14	14	7*	7	7	7	14	14	14	14	14	14*
ENGLAND	7*	7	7	7	7	7*	14	14	14	14	14	14
HAWAII	14	14	14	7	7	7	7	7	14	14	14	14
INDIA	7*	7*	7	7	7	7	14	14	14	14	14	14
JAPAN	14	14	7	7	7	7	7*	7	7	7	14	14
MEXICO	14	14	7*	7	7	7	7*	14	14	14	14	14
PHILIPPINES	14	14	7	7	7	7	7	7*	7*	7	7	14
PUERTO RICO	14	7*	7	7	7	7	14	14	14	14	14	14
SOUTH AFRICA	7	7	7	7	7	14	14	14	14	14	14	7
U. S. S. R.	7	7	7	7	7	7	14	14	14	14	14	14
WEST COAST	14	14	14	7	7	7	7	7*	14	14	14	14

Good: 1-5, 12-15, 23-31

Fair: 11, 16-20, 22

Poor: 6-10, 21

Es: 1-5, 12-15, 27-31

(High MUF and/or freak conditions)

CENTRAL UNITED STATES TO:

ALASKA	14	14	14	7*	7	7	7	7	7*	14	14	14
ARGENTINA	14	14	14	7	7	7	14	14	14	14	14*	14*
AUSTRALIA	14	14	14	14	7*	7	7	7	7	7	14	14
CANAL ZONE	14*	14	14	7*	7	7	14	14	14	14	14*	14*
ENGLAND	7*	7	7	7	7	7	7*	14	14	14	14	14
HAWAII	14	14	14	14	7	7	7	7	14	14	14	14
INDIA	14	14	7	7	7	7	7	14	14	14	14	14
JAPAN	14	14	14	7	7	7	7	7*	7	7	14	14
MEXICO	14	14	7*	7	7	7	7	7	7*	14	14	14
PHILIPPINES	14	14	14	7*	7	7	7	7	7*	7*	7	14
PUERTO RICO	14	14	7*	7	7	7	14	14	14	14	14	14
SOUTH AFRICA	7	7	7	7	7	7	14	14	14	14	14	7
U. S. S. R.	7	7	7	7	7	7	7*	14	14	14	14	7*

J. H. Nelson

WESTERN UNITED STATES TO:

ALASKA	7*	14	14	14	7	7	7	7	7	7	7	7
ARGENTINA	14	14	14	7	7	7	7	14	14	14	14*	14*
AUSTRALIA	14	14*	14*	14	14	7	7	7	7	7	14	14
CANAL ZONE	14*	14	14	7*	7	7	7	14	14	14	14	14
ENGLAND	7*	7	7	7	7	7	7	7*	14	14	14	14
HAWAII	14	14*	14*	14	14	7	7	7	14	14	14	14
INDIA	14	14	14	14	7	7	7	14	14	14	14	14
JAPAN	14	14	14	14	14	7	7	7	7	7	14	14
MEXICO	14	14	14	7	7	7	7	7*	14	14	14	14
PHILIPPINES	14	14	14	14	14	7	7	7	7*	7*	7	14
PUERTO RICO	14	14	14	7	7	7	7	14	14	14	14	14
SOUTH AFRICA	7	7	7	7	7	7	7	14	14	14	14	7
U. S. S. R.	7	7	7*	7	7	7	7	14	14	14	14	14
EAST COAST	14	14	14	7	7	7	7	7*	14	14	14	14

* Means next higher frequency may be useful. . .

COMPARE

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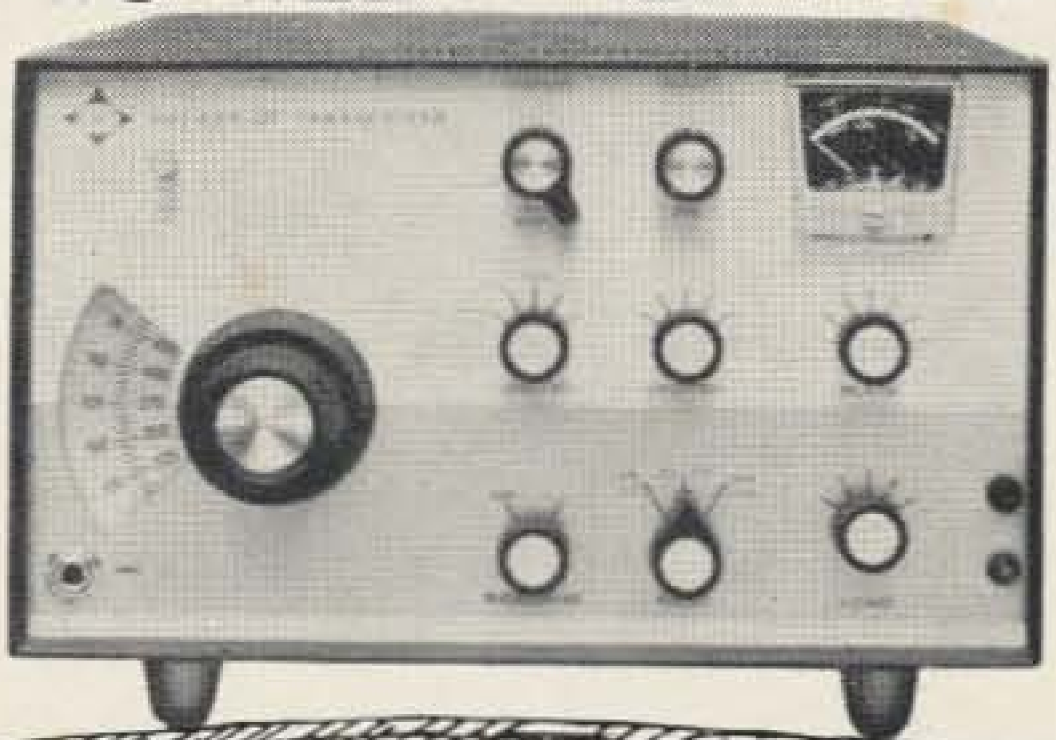

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Name ________ Call ________

Address ________

City ________ State ________

The Institute of Amateur Radio

what • why • who • etc

WHY IS THERE A NEED FOR THE INSTITUTE OF AMATEUR RADIO?

1. Amateur radio has no representation in Washington.

a. Other users of radio frequencies have organizations in Washington to help protect their frequencies and privileges. See 73 April 64, page 18, for details. We, who have been constant losers, more than any other group, should be strongly represented. We've tried doing without; can we learn?

b. Other hobbies have organizations in Washington to keep in touch with the government, and protect the prlileges of the members against restrictive legislation and promote positive legislation. Good examples of this are the Aircraft Owners and Pilots Association, and the National Rifle Association. AOPA, being on the spot, was able to get legislation through Congress quickly, when they wanted alien pilots to be able to use their plane radios while in the U.S. Look how many years we've been trying to get reciprocal licensing.

c. The Institute of Amateur Radio will be centered in Washington, D.C. Four of the nine interim directors of the Institute are in the Washington area, and they are proceeding with the bulk of the organizational work from there.

d. One of the IoAR interim directors is an official representative and is in touch with the Senate, representatives of the administration, etc. The voice of amateur radio is being heard where it counts.

2. Nothing is being done to keep our government behind us.

a. We had very little support at the 1959 Geneva Conference. U.S. Delegates, representing the various users of radio frequencies, admitted that amateur radio was at the bottom of the list.

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3. Coordinators
4. 73 Staff
5. Temporary secretary: Wayne Green

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2. A representative in Washington. Harry Longerich W2GQY/4.

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MEMBERSHIP APPLICATION

Date ______________

GENERAL INFORMATION

Name ____

Address ____

City ______________________ State ________ Zip ______

Age ______________

TECHNICAL INFORMATION

Amateur Call ______________ Class of License ______

How long have you had this Call? ____________________

What are your primary fields of interest in amateur radio?

Frequency Bands of most interest to you?

What type of operation do you prefer: ( ) Phone ( ) CW
( ) TV ( ) VHF ( ) RTTY ( ) Contests ( ) Other (list)

Please list any professional and/or amateur radio societies of which you are a member.

IoAR Membership Fee (one year) $10

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