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73 magazine
for radio amateurs

#142 JULY 1972

FEATURES

STAFF

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73 Magazine is published monthly by 73, Inc., Peterborough, New Hampshire 03458. Subscription rates are $6 for one year in North America and U.S. Zip Code areas overseas. $7 per year elsewhere. Two years $11 in U.S. and $12 overseas. Three years $15, and $16 overseas. Second class postage paid at Peterborough NH and at additional mailing offices. Printed at Menasha, Wisconsin 54952 U.S.A. Entire contents copyright 1972 by 73 Inc., Peterborough NH 03458. Phone: 603-924-3873.

Don't forget to join Lin and Wayne for the European trip in September (page 60). Make note of the proposed DXpedition to Bajo Nuevo (page 112). Will we see you at Expo in July (page 70)? Will you forget to send in the readers service request (page 128)? And wait until you see the coming Rig of the Month contest starting soon in 73! Heh! Articles needed: IC construction projects, SSTV, RTTY, FM, etc. One last message for this month: 220 MHz, use it or lose it.

NEVER SAY DIE

...de W2NSD/1

EDITORIAL BY WAYNE GREEN

Ham Jamming

The service nets on 40m have been having troubles with jamming . . . catcalls . . . music . . . the works. Hopefully, all involved will recognize there is much to be said on both sides of this controversy, although the situation may look black to one side and white to the other.

The net ops feel they are spending a lot of their time and money providing a valuable public service and that this should not only be appreciated by other amateurs, but they should get some cooperation, to boot. The nets are, in fact, providing valuable services in many instances and, if all amateurs would cooperate, could be of tremendous value as a public service and as a proof of the value of amateur radio.

On the other side are ops who are indignant that any group has the audacity to "own" a frequency. The frequencies are free and open to anyone and they get madder than hell when a net opens up and demands they move off the net "frequency." Then again, there are also those ops who feel that anything organized should be destroyed. If anyone is doing good or being helpful, they should be stopped. In the past these people have broken the noses off statues, burnt books, shredded paintings and smashed babies in front of their mothers . . . they are still at work, even in the hambands, making life miserable for as many people as possible.

What is the answer? Or better, what are some answers? May I suggest some possible avenues for the service nets. High on the list I would put PR. PR on the air . . . courtesy above and beyond the bounds of reason. PR in the media . . . see that the editors of ham magazines and club bulletins get info on services rendered by the nets. As an editor I can affirm that this PR has been sadly absent in the past. With only a little effort and organization any or all of the nets could have had considerable coverage in 73 . . . and probably the other magazines as well . . . perhaps even with monthly columns. PR is the name of the game.

The recent appeal to the chairman of the FCC for help in fighting the jamming of one of the nets did not seem to fall on receptive ears within the FCC . . . and seemed ill advised to me. One of the basic benefits of the amateur service has been our boasted ability to be self-policing . . . so when we run into a problem we make a big stink and put the pressure on the head of the FCC for help. Nuts.

Is it really impossible for us to be self-policing? Must we turn to the FCC to police our bands and solve our problems .,. . recognizing that there is more than a little possibility that our problems are to some degree self-generated? Are the net members really impotent to help themselves? Have they no possible way to organize a system for locating jammers and quieting them? I think all of us recognize that this is ridiculous on the face of it.

If we find that our nets are being jammed we have to do something about it. The techniques for locating a jamming station are not all that difficult for us. Direction finding is simple. Not only is it simple, it is fun. Once the offending amateurs have been located there are several ways of handling the situation. I do not think that brute force should be called for except as a last resort . . . cutting of feedlines, pins in coax, bloody noses should be avoided.

There is no reason why illegal acts should be necessary to stop jamming. The great percentage of jammers will stop their nonsense once they have been uncovered. The few remaining bad guys should listen to reason if visited by a committee.

Isn't that better . . . and more satisfying . . . than asking the FCC field engineers to spend the incredible amounts of time it takes them to chase down our jammers? Let's do it ourselves.

Repeating Non-Amateur Stations

The regs are clear on this. . .it is illegal. Yes, I know that some of the two meter repeaters are set up with tone coding which connects them to the time signals from CHU. I don't see the harm in this. . .and I certainly appreciate the utility of it. I spend a lot of my time within range of a two meter transceiver and a lot of it out of range of a short wave receiver.

By now everyone must be familiar with the time signals from CHU. . .on 3333 and 7335 kHz complete with ticks every second and voice announcements every minute.

Another popular public service that is being toned on by some repeater groups is the Weather Bureau broadcasts on 162.40 or 162.55 MHz, depending on where you are located. There are over 60 of these stations around the country and they play tapes of the weather report continuously. . .and most of them update it every half hour or so.

Perhaps we should give some thought to proposing an official change of the regulations to permit short rebroadcasts of public services such as these.

New 73 Staffer

Keith Lamonica W7DXX has joined the 73 staff in the position of Managing Editor. Keith has been quite active in FM, having set up repeaters recently in Oregon and Tennessee. He is also quite interested in DXing and will be working hard to organize some 73 DXpeditions. Say, would it be possible to have a "DXpedition of the Month?" Let's see, Bajo Nuevo in November – maybe Serrana Bank in December – Cayman Islands in January – Grenada in February – and on around the rarer Caribbean islands. Hmmm?

Keith is hopelessly addicted to amateur radio. In the short while he has been with 73 he has gotten one repeater on the air and is almost up to DXCC from Peterborough. He's got several more repeaters in the works, together with a lot of interesting repeater functions, so the amateurs in northern New England will have some advantages over those elsewhere, being able to down link.

Why the FCC Hassles Hams

A recent rash of harassments of hams by the Michigan FCC Engineer in Charge, who seemed to have nothing better to do with his government financed time than to demand log books from FMers, made me wonder why he wasn't devoting some of his time to trying to clean up the CB problem which is really miserable in his particular area.

A letter from an amateur who works in broadcasting and who has asked not to be identified explains the situation. He talked with a pair of FCC field engineers and they said that they could care less what happens on 2m FM. . .that if anything illegal was going on they depended upon amateurs to take care of it and, at worst, if reported to the FCC, they would look into it. They also do not check CB. They do check the broadcast stations in great detail, running audio proof of performance; they checked wo-way commercial users for fre-uency and proper operation. But hey just don't check the CB band ecause if they do catch a violator it ist means more work for them. With ie broadcast and business band they re dealing with intelligent and respec-ible people when they issue a cita-on. With CB they are dealing, more ften than not, with idiots. To make ieir job easier they just don't mess ith CBers.

This makes sense, even if it is bviously unfair. Perhaps the FCC eeds a staff of field engineers just to heck up on CBers?

tandard Repeater

Standard Communications has been 'orking hard to firm up the design on repeater package for a complete two ieter repeater station. In early May iey announced that production had arted on the first run of the units nd that the first deliveries were :heduled for early July, parts sup-liers willing. The basic units are the tandard model 803 commercial VHF ansceiver boards and the transmitter ıns ten watts output. There is a mike ck for a regular Standard micro-hone and a speaker jack for an 8Ω ›eaker.

The whole package will sell for 595! At that price the number of vo meter repeaters may start zoom-g. That is mighty attractive for a ›mpletely solid state unit. Many of ie Progress Line repeaters may iange to solid state – it does hold romise of needing a lot less main-nance. It is a bore to get to the top your mountain through six feet of iow to put in a new pair of 6146's hen the old ones go soft.

Will the new repeaters sell? Well, ie day they were announced by :andard there were at least three rush ·ders placed.

ew FM Transmitters

A letter arrived the other day from iternational Signal – the same com-any that makes the fine Clegg equip-ent. It seems they were considering aking some little transmitters avail-ıle to the amateur market and won-ered what the reaction to them ould be. The reaction of the others ho received the mailing must have ›en about like mine . . . I sent in a ieck immediately for a bunch of em.

The little rigs arrived in due course ıd they are fascinating. They are ›mplete with crystal and micro-ione. All you have to do is connect to an 8-volt battery and antenna ıd you are on two meter FM – or six eters – or even ten meters. There e three different models.

The transmitters are quite well built. They use an 8 MHz crystal oscillator, run the rf through two triplers and a doubler, a buffer and a power amplifier – with an output of 0.1 watt. The mike is a small flat job with high impedance output and feeds into an amplifier, limiter and Darlington amplifier to the phase modulator.

The whole rig is 2½ x 3 x 1 in. and is built on excellent PC board. With that small size you could easily install this in many of the receivers to make a transceiver . . . in a hat for conven-tions . . . in a little tiny repeater pack-age which would make it possible to have a repeater in your car . . . etc. The mind boggles.

The two meter transmitters will be selling for about $33! Line forms to the right . . . of me.

Equipment for 220 MHz

The Tempo 220 transceiver is scheduled for deliveries starting in July. This $220 AM-FM transceiver should be exceedingly popular. A re-cent poll in the midwest showed that about 80% of the active two meter group are planning on going on 220 as soon as equipment is generally avail-able.

The Clegg 21 is scheduled to be available about the same time. This unit has some very interesting fea-tures, such as using one crystal for both transmit and receive. It will be priced under $300 according to pre-sent plans.

The Drake 220 unit will hopefully be arriving from Japan in reasonable quantities this summer and help a lot more fellows get on the air. The price is not firm on this one.

Surplus fans may be interested in the Comco 278 transmitter-receiver on sale by Fair Radio for $40. This is probably an AM job, but certainly can be converted easily for the new FM repeater service. It is tubes, and runs from 6, 12 or 24 volts. It looks like fun. It might be made into a low cost repeater.

Tell Our Advertisers You Saw It in 73

Unused Citizens' Band?

The Electronic Industries Associa-tion proposal for taking the amateur 220 band and turning it into a new citizens band is even more curious when you look into the use that has been made of the 460 MHz citizens band. Here the rules are quite similar to those proposed for the desired 220 band, yet activity is negligible in this band. Most of the very few users of the 460 band seem to be businesses which could easily be moved to busi-ness bands.

A chap I know has a repeater set up in the 460 band, licensed by his wife. He has the channel virtually to him-self, even though he lives in a major city. He says there are a couple of other licensees for the channels he is using, but only one has any activity at all – a police department at a local university.

Perhaps interested amateurs should bring this situation to the attention of the EIA and some of the congressmen that are getting to pressure the FCC to shove through the 220 band steal from amateur radio.

Looking for Work?

If you would rather work for a ham magazine than anything else, you might think about the possibilities of coming to New Hampshire and work-ing for 73. We are growing and ex-panding and are looking for licensed amateurs to fill several positions. We have a spot opening as an advertising assistant. This would pay on the order of $75 a week or so. We can use some help in the art department with laying out pages and doing finishing paste-up. This starts about the same rate. A good typist for setting our type on the IBM Composer would be worth a bit more as a starter.

The pay is not great, to be sure, but think of the fringe benefits – the gear we get to play with here – the repeat-ers we can set up – extra good deals on personal equipment – even the possibility of getting to go on a trip now and then.

If you are interested please drop us a line with your resume and tell us about your ham background.

. . .Wayne

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A MODERN VHF FREQUENCY COUNTER

Peter A. Stark K2OAW
196 Forest Drive
Mt. Kisco NY 10549

Part 2 of 3 parts

Two months ago we started describing our frequency counter design, showed how to use it, and gave a complete parts list. This month we will provide the complete logic and schematic diagrams, and describe how it works, and next month we will have the printed circuit board layout, parts layout drawings, and construction and operation information.

Figures 3 through 18 show the diagrams of the various parts of the counter. To see how these parts fit together, refer back to Fig. 2, the block diagram, in last month's article.

0–20 MHz Input Circuit (Fig. 3)

This circuit is one of the most tricky circuits in the counter, since it must convert a variety of input signals, large and small, simple and complex, into digital pulse signals of just the right voltage and speed to operate the counter. This job is considerably simplified by a Schmitt trigger IC, an SN7413N, designed just to interface TTL digital logic to the outside world.

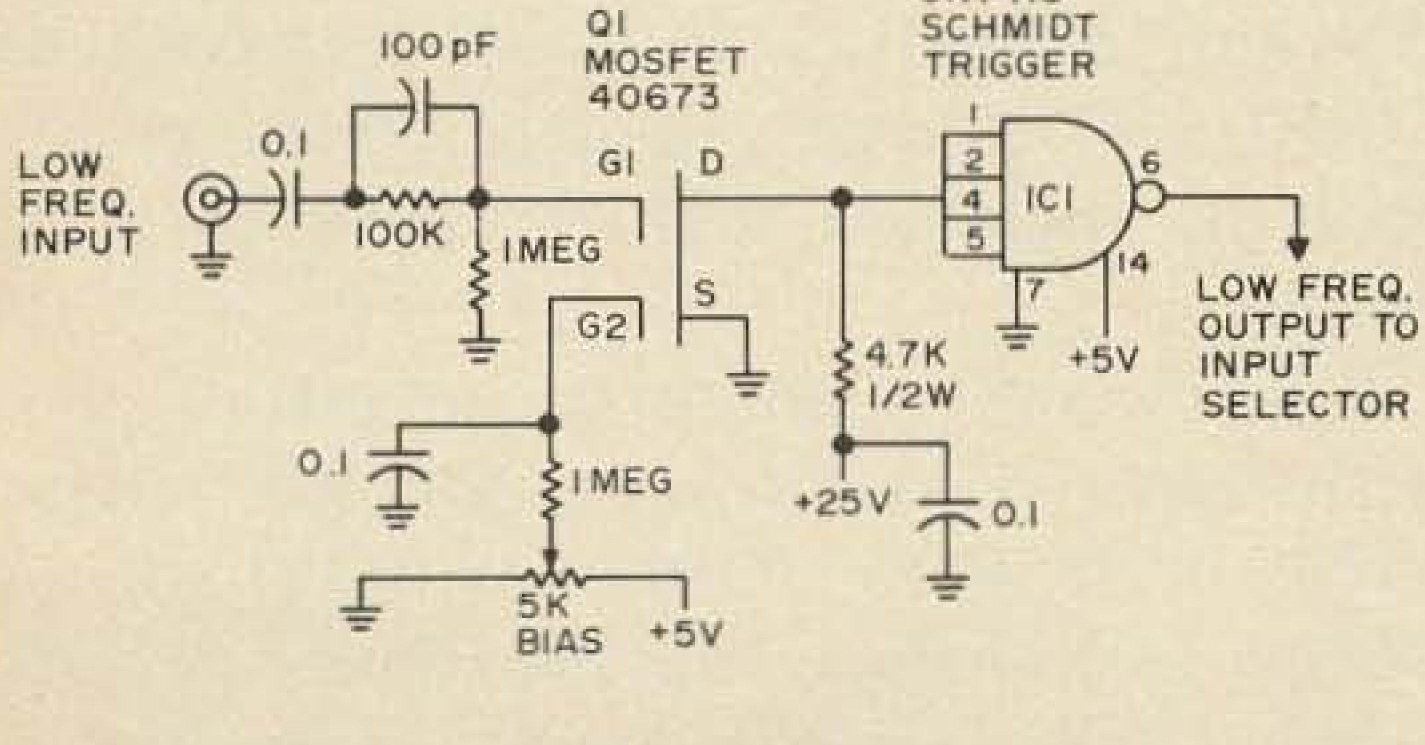

Fig. 3. 0–20 MHz (low frequency) input circuit.

The low frequency input circuit starts off with Q1, a 40673 RCA dual-gate-protected MOSFET transistor which provides high input impedance and a useful amount of gain at a very low price. The input signal from the HI-LO input switch is applied to Gate G1 through a 100K current limiting resistor. Because of the diode-protected gates, the 100K resistor allows inputs up to 50V without damage to the FET.

The 5K bias potentiometer varies the bias voltage to gate G2 to allow the Schmitt trigger, IC1, to operate in the middle of its range. The pot should be adjusted so the voltage on the FET drain is about +1.3V with no signal.

The 0.1 μF dc blocking capacitor reduces response below about 20 Hz. For operation below this frequency the capacitor could be bypassed, but it performs a valuable function of preventing external dc voltages from changing the bias on Q1.

VHF Pre-scaler (Fig. 4)

The VHF pre-scaler accepts input signals from the low rf range up through about 200 MHz – depending on the IC's you get – and divides the input frequency by 10. This is done by two special-purpose – and expensive – IC's.

IC2 is a high-frequency amplifier which allows the use of quite low voltages. It is not really needed. In fact, to get the scaler to work at 300 MHz and slightly above, it shouldn't even be used, since it limits the high frequency response. But it is very useful at lower frequencies, below about 180 MHz, and it provides a good buffer for the really

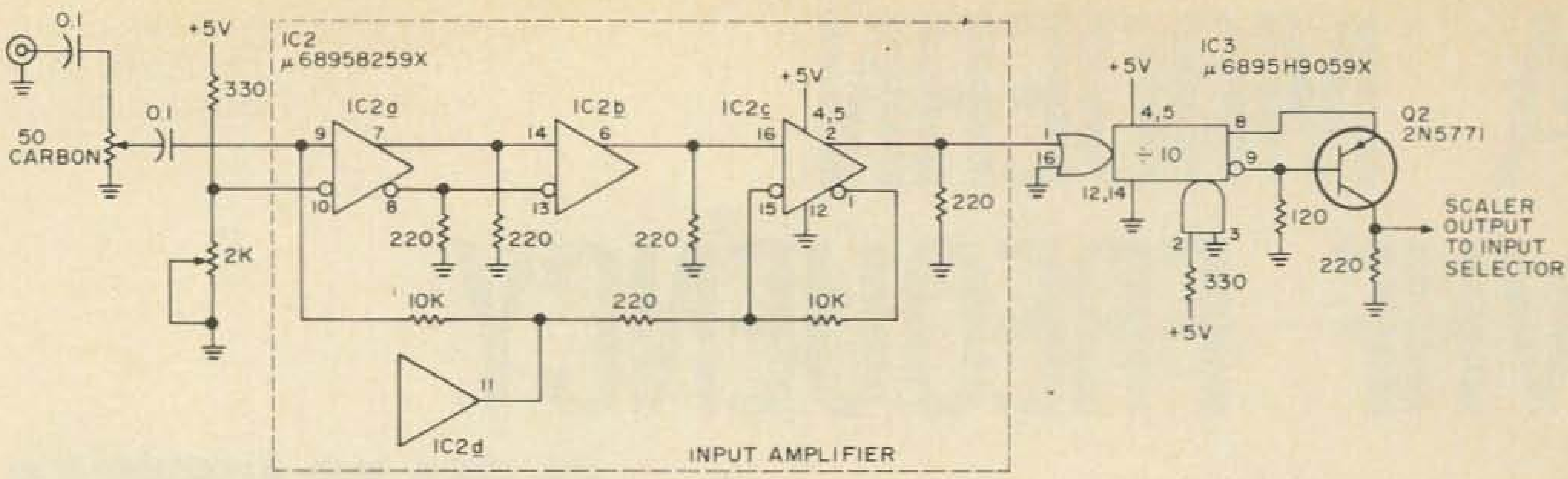

Fig. 4. VHF Prescaler. NOTE: to extend scaler range to 300 MHz (with some loss of sensitivity) eliminate all parts in dashed box, and jumper pins 2, 9, and 10 at IC2 socket.

expensive IC3 against burnout due to high input voltages.

IC3 is a special VHF prescaler IC made by Fairchild just for this use. It replaces four separate IC's used in some scalers, and even at $16 is actually cheaper than the four IC's it replaces. This particular IC is rated to work up to about 320 MHz, and some samples may work even higher than that.

These two IC's are ECL (emitter-coupled -logic) IC's, which need special interfacing with the rest of the counter, which uses TTL IC's because of their much lower cost. This is done by Q2, a level shifter and amplifier stage.

Input Selector (Fig. 5)

At first glance, the input selector may seem a little overdesigned. Sure enough, it could be replaced by a simple SPDT switch to select the output of either the low frequency input circuit or the VHF prescaler and feed it to the counters. But to avoid problems, that switch would have to be mounted right on the p.c. board, near the circuitry connected to it, and away from the input leads to prevent the possibility of feedback oscillations. To avoid the whole problem of shielding the leads and switch,

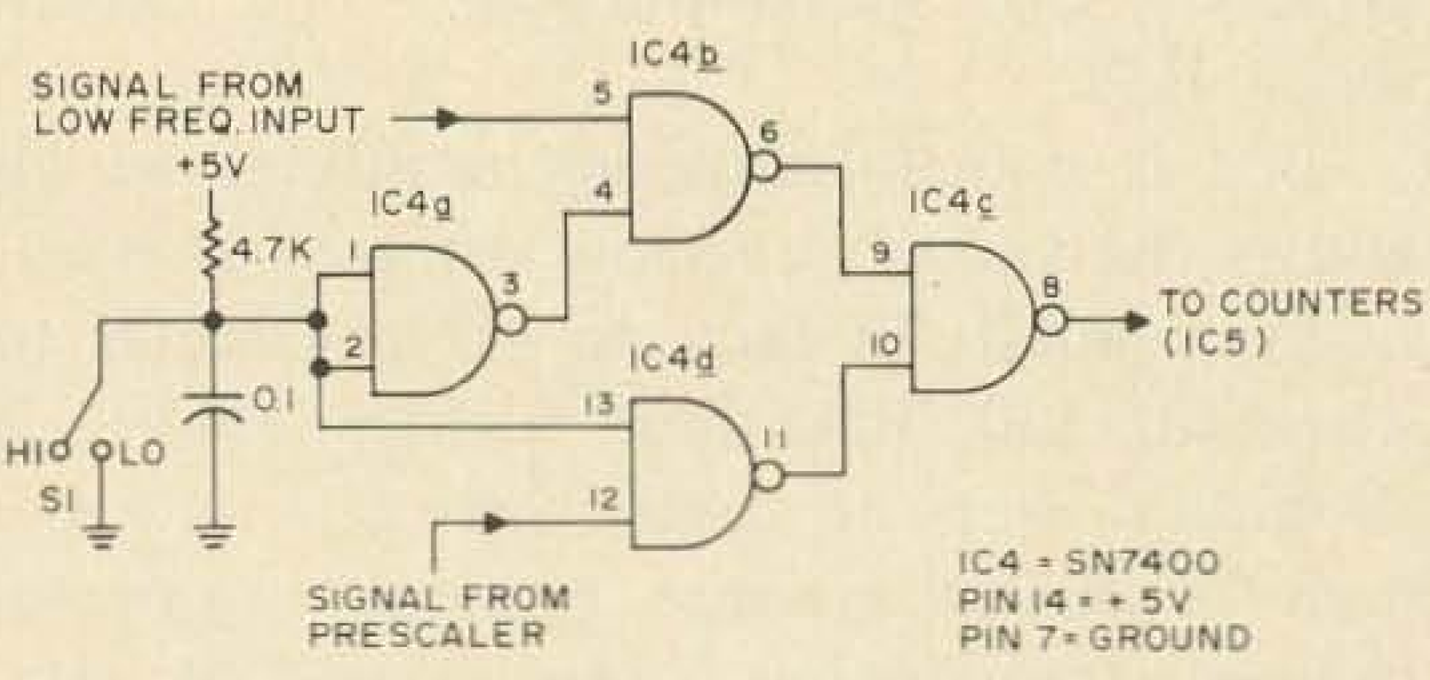

Fig. 5. Input selector.

we simply add IC4, a quad 2-input *nand* gate IC costing less than 40¢, which does the actual switching. Now a simple SPST contact on the HI-LO switch controls a small dc voltage, which energizes *either* gate IC4*b* or gate IC4*d*. A commercial counter would probably solve this problem by using a two-deck rotary switch with five inches of shaft separating the two decks, with the front deck switching the inputs between the two input circuits, and the rear deck, neatly positioned just above the circuit board, controlling the outputs. But for our purposes using IC4 is a lot more practical unless you have a switch factory next door.

Incidentally, we are going to use this trick one more time later, in the time base selector, where an SPST switch and two 40¢ IC's do the work of a DPDT switch, five coax leads, and a lot of headaches.

Counters, Latches, Decoders and Overflow (Fig. 6)

Now we come to the heart of the counter, where the actual counting is done. This circuit is divided into five almost identical stages, one for each digit displayed, plus three extra flip-flops. Most of the work is done by three types of MSI IC's. The five SN7490 IC's (IC6, IC9, IC12, IC15, and IC18) are decimal counters which count, digit by digit, the actual number of input cycles.

As soon as a count is completed, it is transferred into the five SN7475 latches (IC7, IC10, IC13, IC16, and IC19) when a strobe pulse arrives from the control circuits. These latches act as temporary memories to allow nonflickering display of the count even while the counters are reset back to

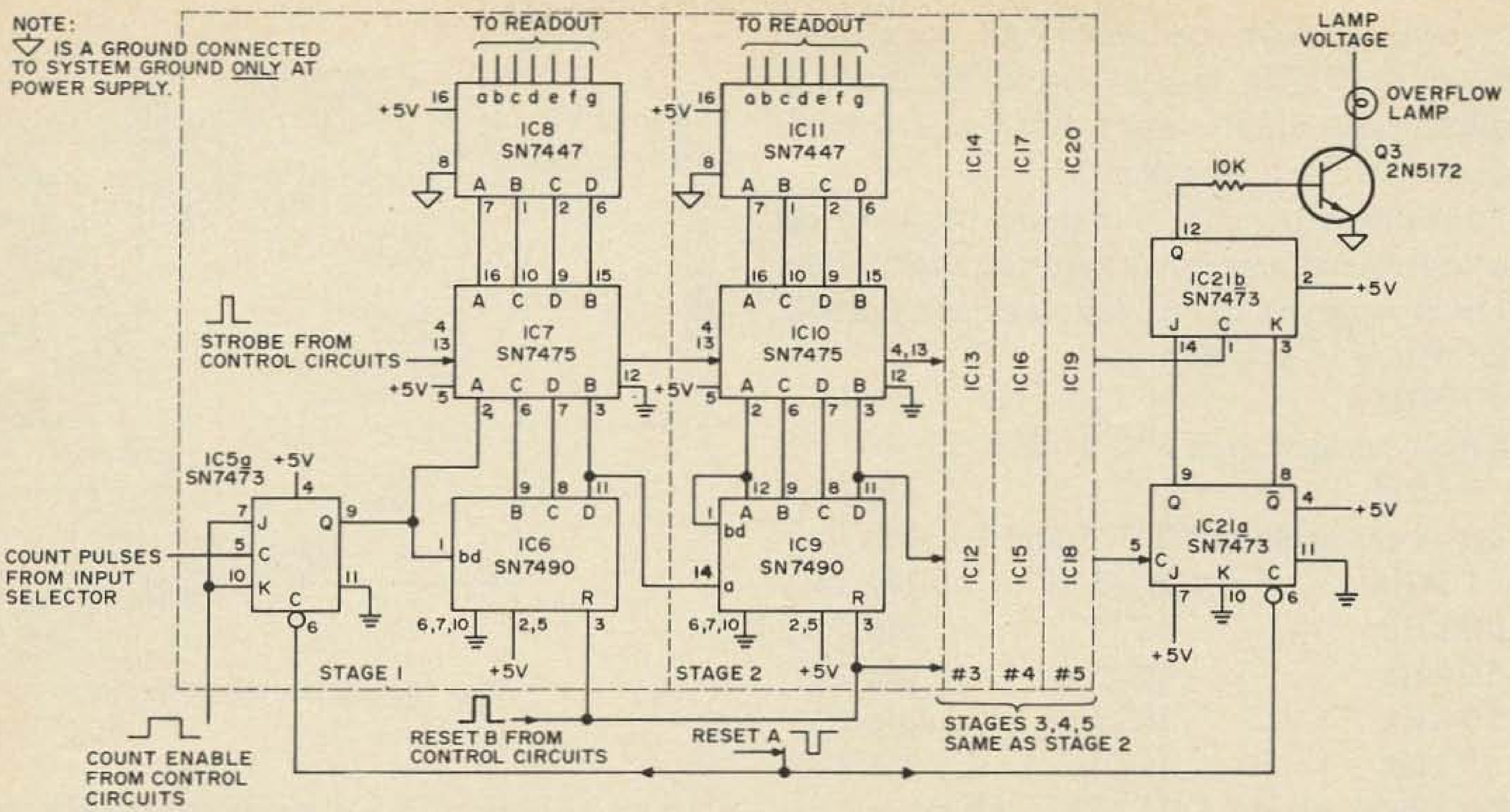

Fig. 6. Counters, latches, decoders, and overflow.

zero by a pulse on the reset B line, and then take the next count.

The BCD (binary-coded-decimal) digit from each latch is connected to the SN7447 decoders (IC8, IC11, IC14, IC17, and IC20), which translate the BCD code into the seven-segment code needed by the readouts.

The five stages of the circuit are the same except for stage 1. Part of IC6 (using pins 12 and 14) is instead replaced by an external flip-flop, IC5a. This is done because we need a foolproof way of enabling and disabling the counter for a 1-second (or 1 millisecond) intervals without disturbing the count or adding extra pulses. This is done by the Count Enable signal applied to the J and K inputs of IC5.

IC21 keeps track of any overflow from the last decade counter, IC18. If the number of cycles counted during the time period exceeds 99,999, IC18 sends a pulse to pin 5 of IC21*a* which turns on. IC21*b* acts as a one-bit latch which then remembers this condition, and lights the overflow light through Q3.

IC5 and IC21 are reset by the Reset A pulse when the counters start on a new count.

10 MHz Crystal Oscillator (Fig. 7)

The basic time reference for the counter is an AT-cut series-resonant 10 MHz crystal in a simple circuit using four gates from an SN7400 IC. Although a 2 MHz or even 100 kHz crystal could be substituted (with the saving of one or two SN7490 IC's in the time chain divider), it appears that 10 MHz crystals are more stable and need less temperature compensation. Besides, the 10 MHz crystal provides a better signal for zero-beating against 10 MHz WWV.

Time Chain Dividers (Fig. 8)

The 10 MHz signal is divided down to 1 kHz, 10 Hz, and 1 Hz by seven identical

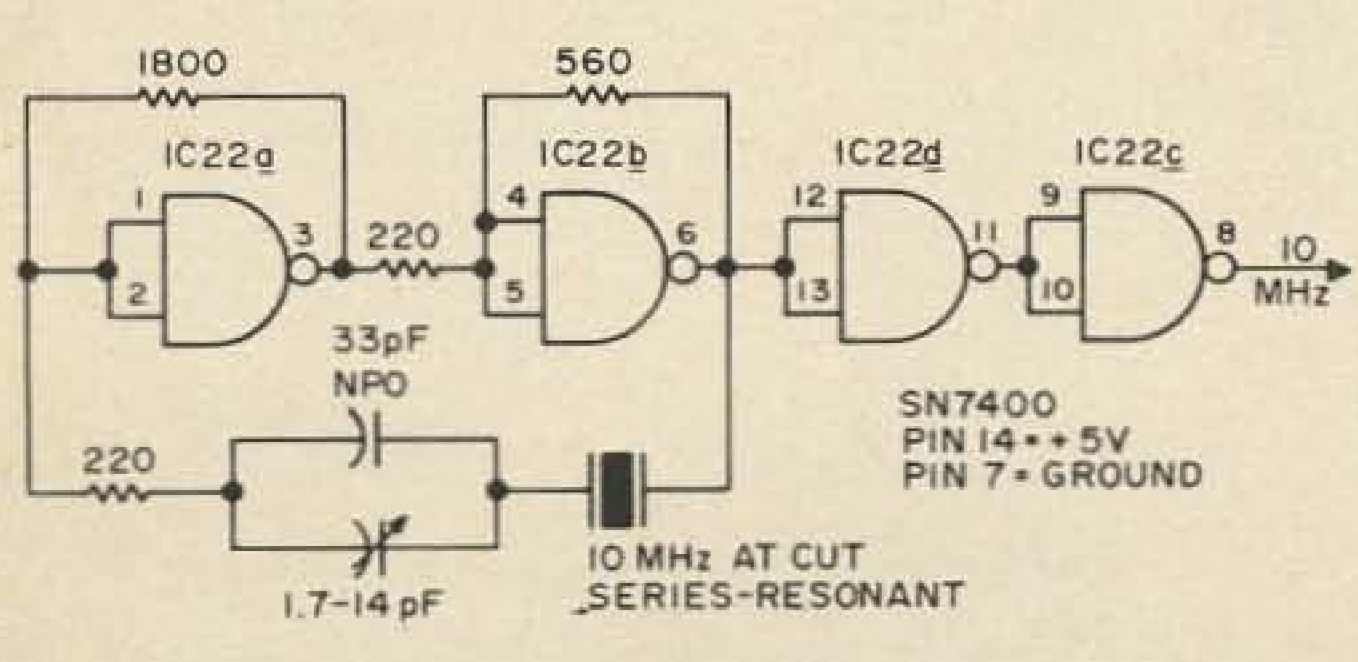

Fig. 7. 10 MHz crystal oscillator.

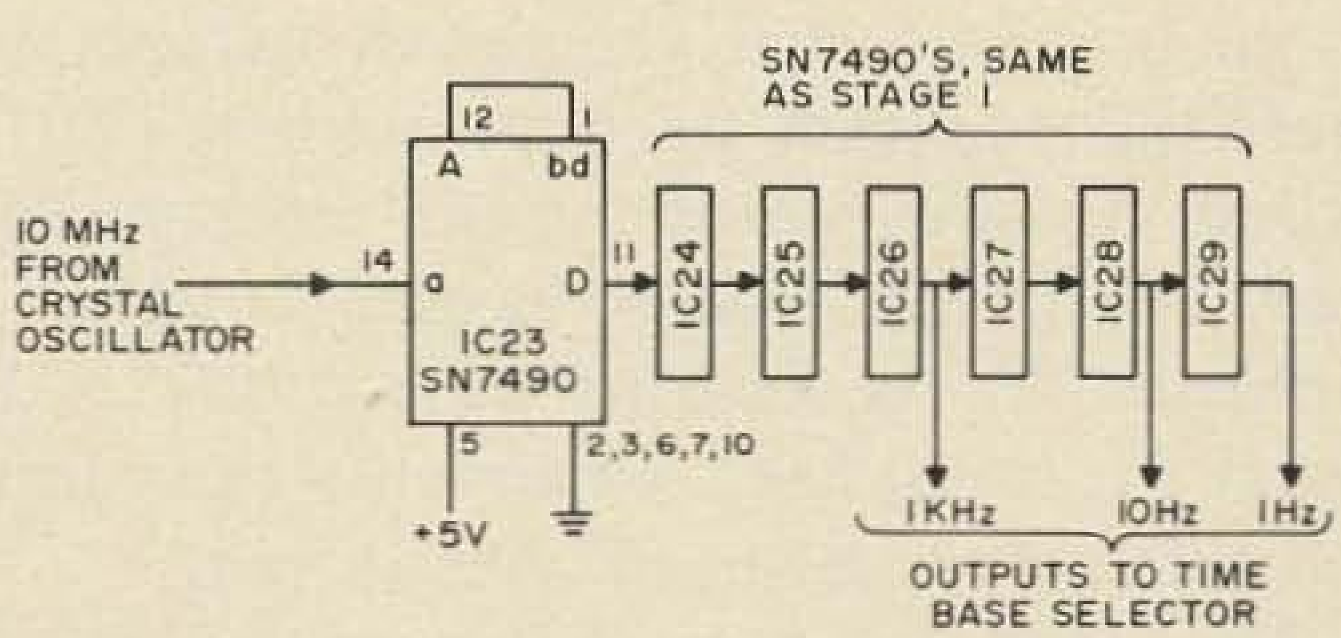

Fig. 8. Time chain dividers.

SN7490 decade counters. As mentioned above a 1 MHz crystal could be used, in which case simply omit IC23 and jumper pins 11 to 14 in its place.

Incidentally, this is a good place to get accurate frequency markers for calibration; here is a partial list of frequencies available, and where to get them:

10 MHz	IC23	pin 14
(Zero-beat against WWV, 10 MHz)		
5 MHz	IC23	pin 12
(Zero-beat against WWV, 5 and 15 MHz)		
1 MHz	IC23	pin 11
100 kHz	IC24	pin 11
50 kHz	IC25	pin 12
10 kHz	IC25	pin 11
5 kHz	IC26	pin 12
(Zero-beat against CHU, 7335 kHz)		

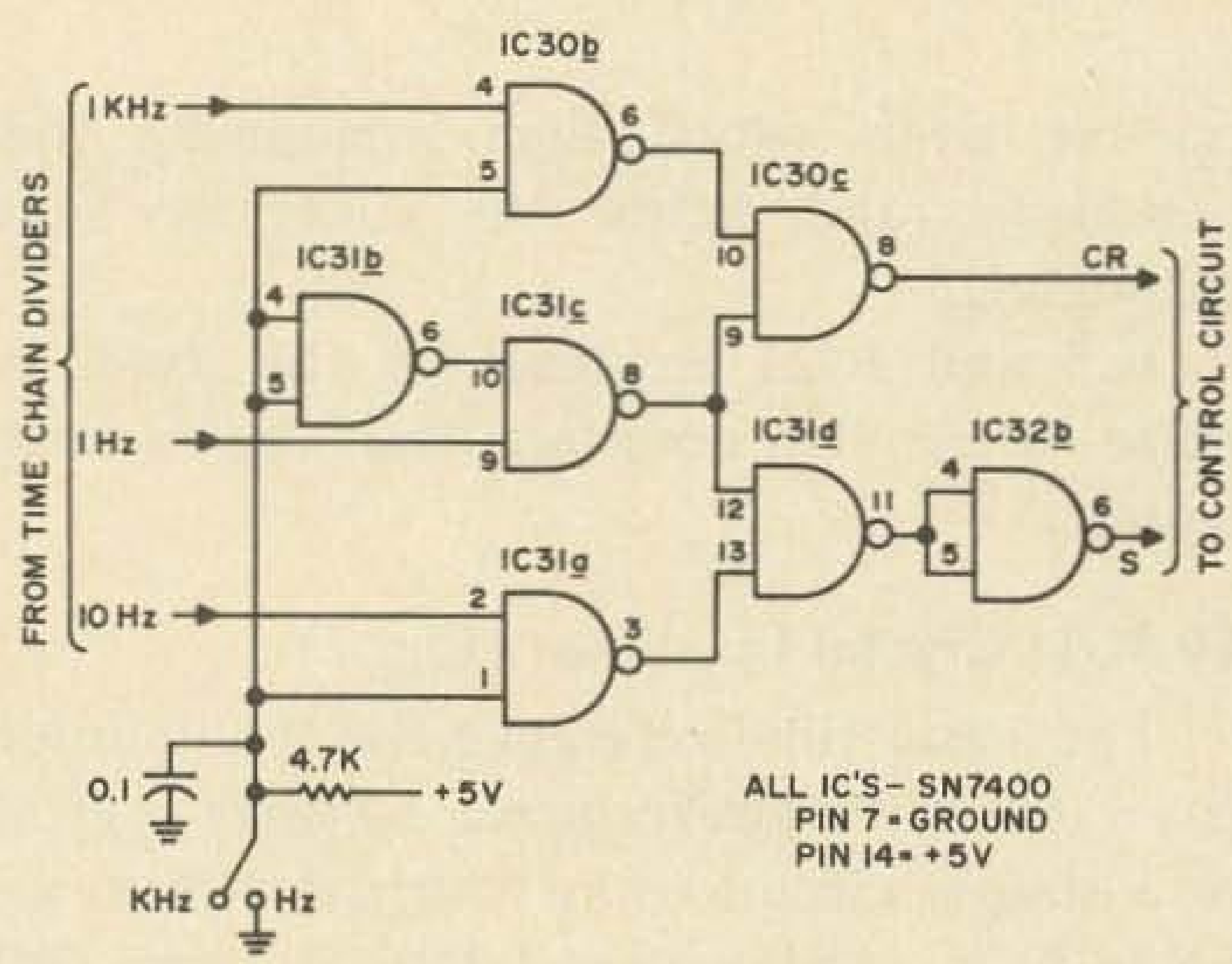

Fig. 9. Time base selector.

Time Base Selector (Fig. 9)

The time base selector receives 1 kHz, 10 Hz, and 1 Hz square waves from the time chain dividers, and sends two signals, depending on the position of the Hz-kHz switch, as follows, to the control circuits:

Switch Position	CR Output	S Output
Hz	1 Hz	1 Hz
kHz	1 kHz	10 Hz

As mentioned earlier, the switching function could just as well be done with a DPDT switch, but this would require more wiring, coax cable, and even so might cause some problems. At the expense of two IC's (IC30 and IC31, about 80¢), we simplify the wiring and eliminate some headaches as well.

The CR signal at 1 Hz or 1 kHz is eventually used to enable and reset the counter, while the S signal is eventually used to strobe data into the latches.

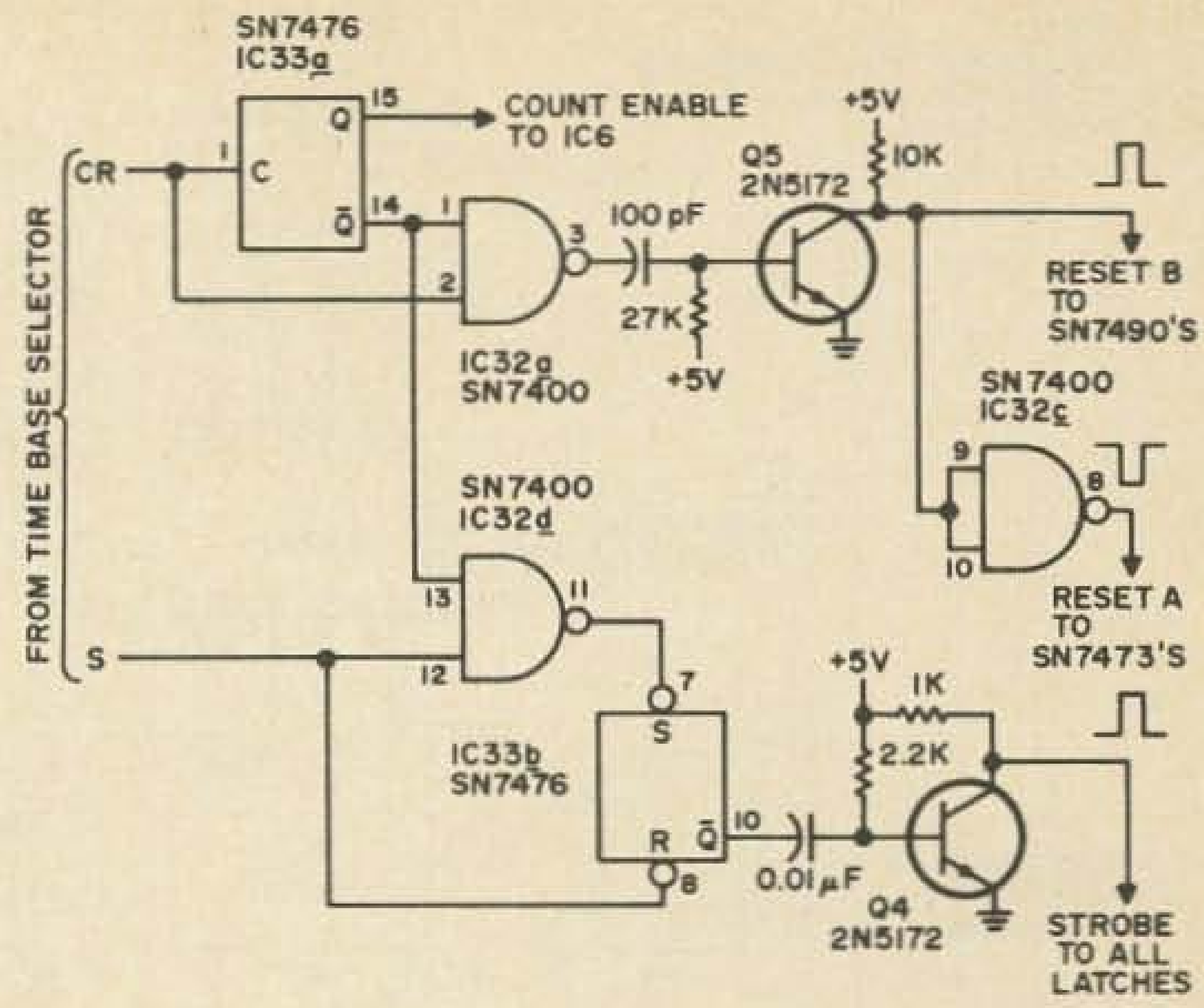

Fig. 10. Control circuits.

Control Circuits (Fig. 10)

The control circuits receive the CR and S outputs from the time base selector, and generate the count enable, resets, and strobe signals for the counters and latches.

The best way to understand the operation of this part of the counter is to look at the waveforms generated. Figure 11 shows the various signals which exist when the Hz–kHz switch is in the Hz position (they are slightly idealized – they don't always look quite so neat).

In the Hz position, the CR and S inputs are both 1 Hz square waves, though they are

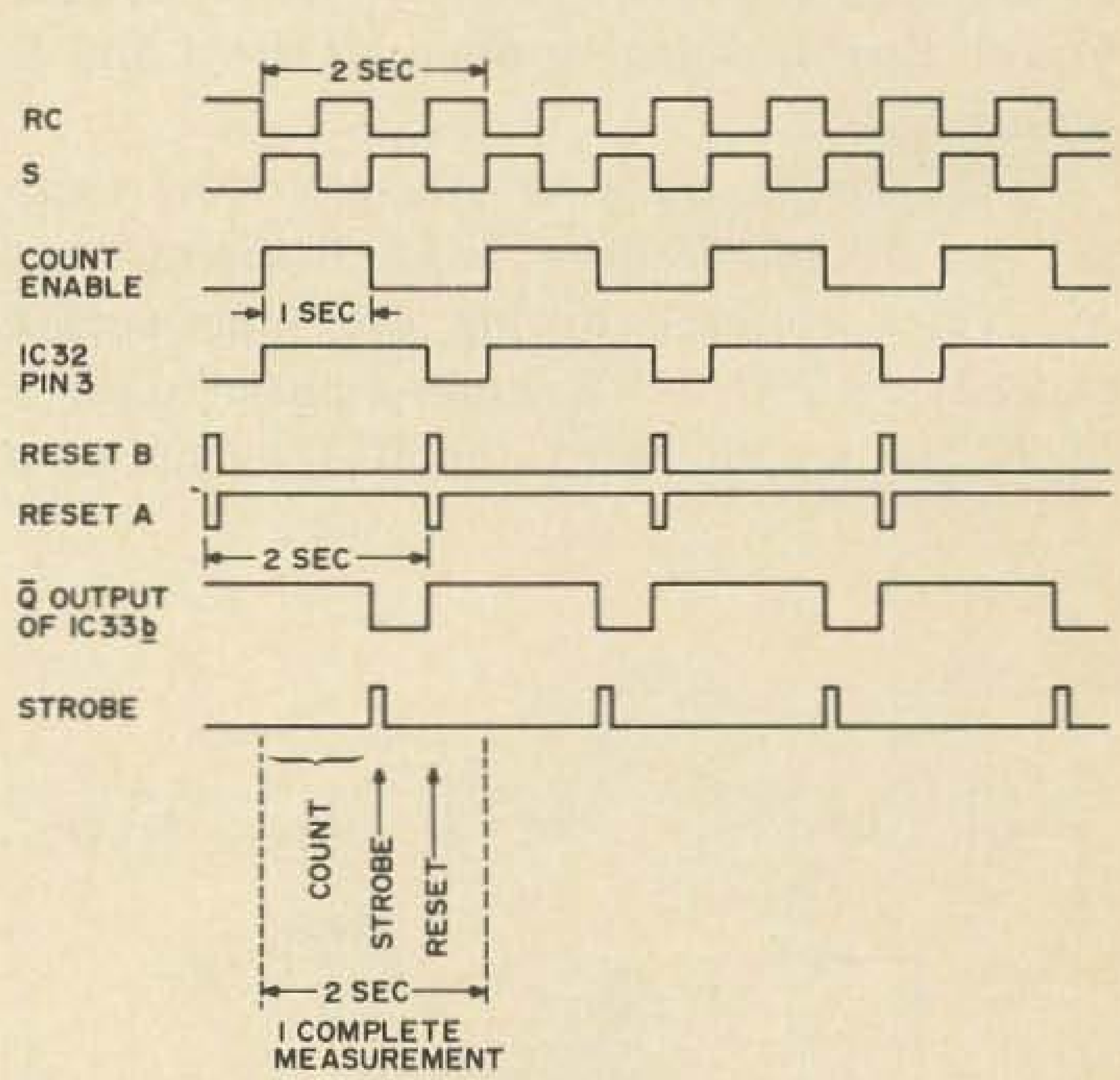

Fig. 11. Control circuit waveforms in the Hz measurement position.

out of phase. The count enable flip-flop, IC33*a*, flips back and forth at a rate of one cycle every 2 seconds. One complete measurement takes 2 seconds, as shown. First, the count enable signal goes plus for one second, during which time the counters count the input cycles. At the end of the first second, the count enable signal returns to zero, and a short positive strobe pulse strobes the counter outputs into the latches. A half-second later the reset A and reset B pulses reset the decimal counters and overflow flip-flop, in preparation for the next count.

In other words, although the actual count interval takes only one second, a complete measurement takes two seconds, and the decimal readout is updated only once every two seconds.

As shown in Fig. 12, the control circuits work quite differently when the Hz–kHz switch is in the kHz position. The count enable flip-flop, IC33*a*, flips back and forth and goes through a complete cycle in two milliseconds. The counters count the input frequency for one millisecond, then the count enable signal returns to zero, and the counters stop. One-half millisecond later the counters are reset back to zero, in preparation for the next count. In other words, the counters take 500 complete counts per second, each cycle of counting taking a total of two milliseconds.

But the big difference is in the strobe pulse. Instead of coming every two milli-

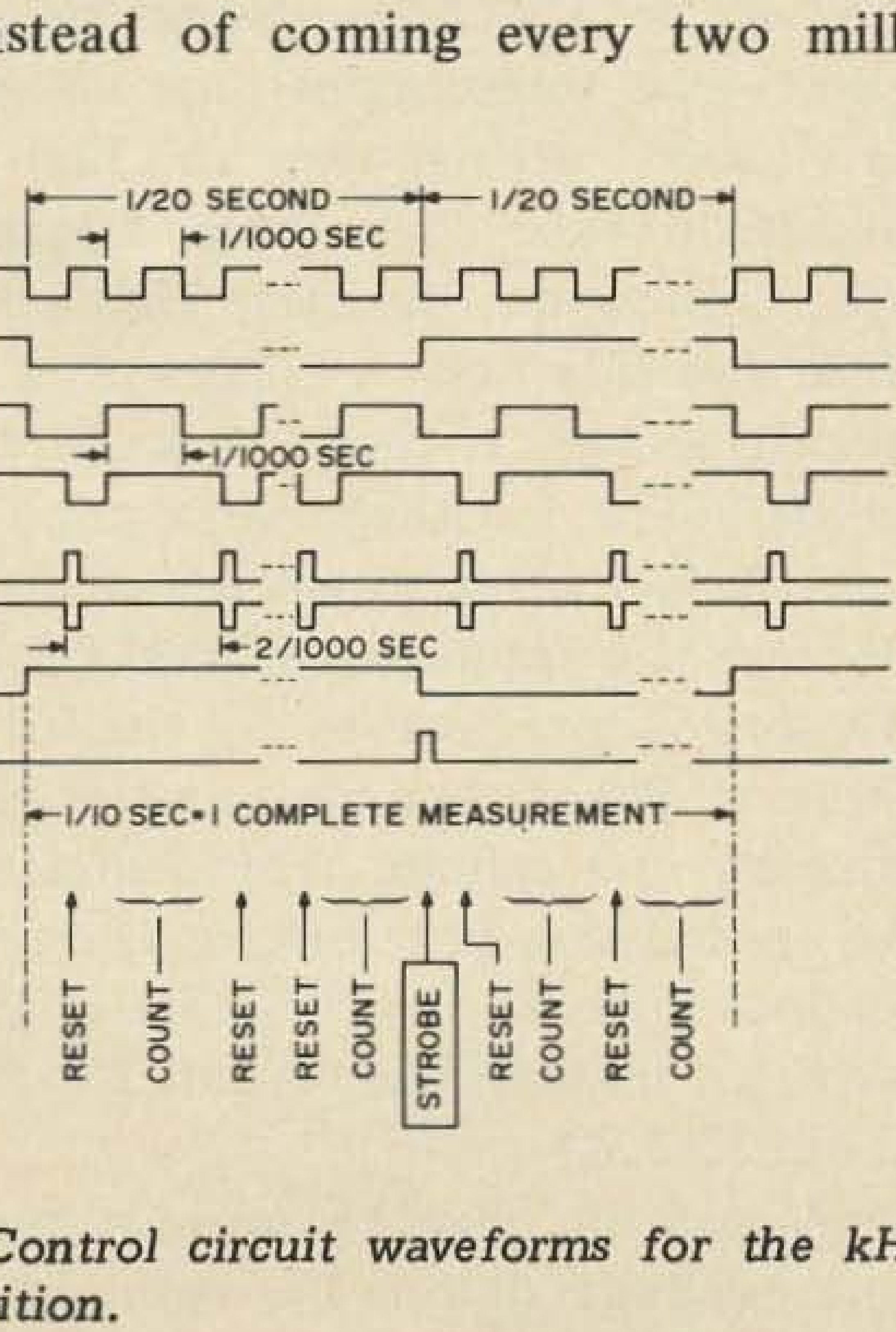

Fig. 12. Control circuit waveforms for the kHz switch position.

seconds, strobe pulses come only 1/10 second apart, ten per second. Thus, even though the counters take 500 counts a second, only every fiftieth count is actually displayed. A complete measurement therefore takes a tenth of a second.

This is done intentionally, to make sure that the display flickers at a 10 Hz rate if the frequency is changing. This is important when seven-segment readouts are used. Suppose the frequency is changing very quickly. As it changes, all seven elements in each readout will be turned on, in different combinations. If this happens very fast, it appears that all the segments are lit – the readout contains all 8's. For instance, suppose that the frequency measured is 16,999,500 Hz. In the kHz position, the display will read either 16999 or 17000. If it alternates very quickly between the two readings, then all seven segments in the rightmost four readouts will be lit, and the readout will look like 18888. The control circuits purposely slow down the readout strobe rate to make sure that the readout flickers between the two values at a noticeable rate.

Types of Readout Devices

Several different readout devices can be used with this counter, depending on your desires and the condition of your wallet.

The pc board is designed tor the SN7447 BCD-to-seven-segment decoders and the RCA DR-2010 Numitron indicator tubes. The interconnections between these two units are shown in Fig. 13. The Numitron tube is a 9-pin miniature glass tube with seven thin lamp filaments, viewed from the side, which plugs into a 9-pin p.c. mount socket. It *could* be soldered directly to the board, but that's not a good idea since one of the seven filaments may burn out. Because the readout is viewed from the side, it's entirely practical to put the tube right on the p.c. board, and mount the board horizontally in a cabinet. The decimal digits are 0.6 in. tall and quite bright. The price of one readout tube is about $4.50 at the time of writing, making the total for five tubes about $22.50.

A slightly cheaper seven-segment miniature readout device has been advertised in

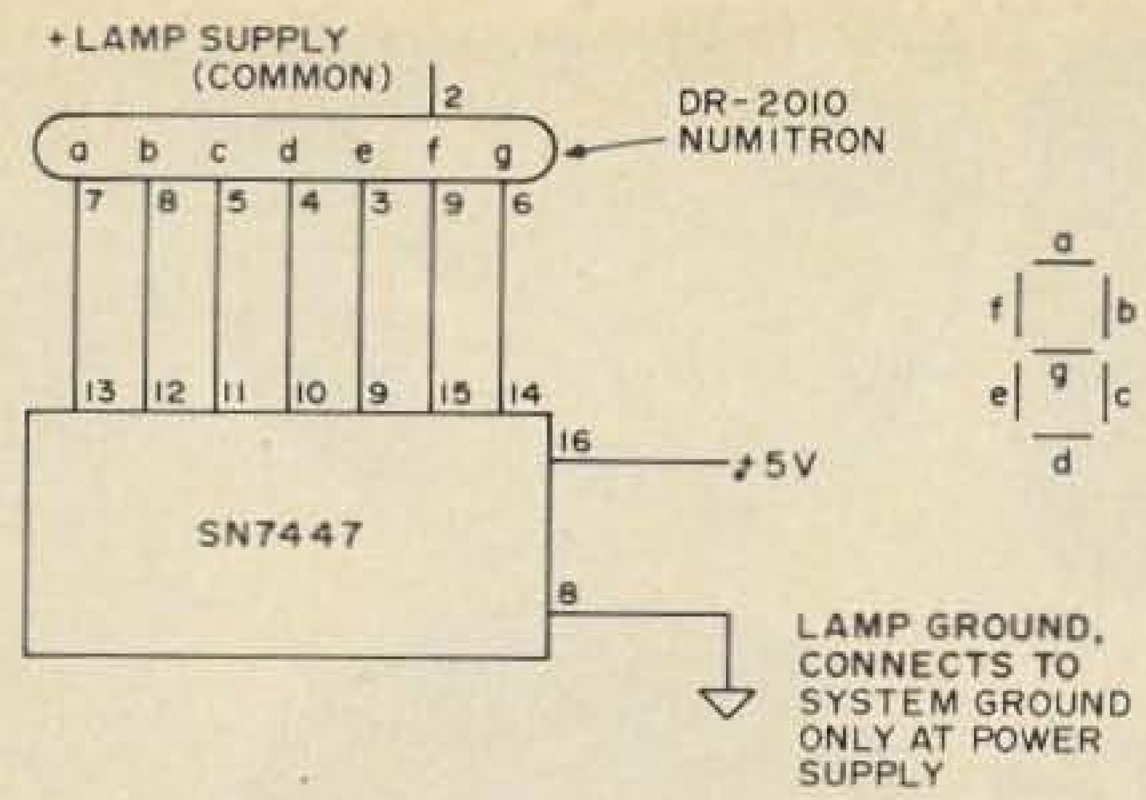

Fig. 13. Connecting the RCA Numitron (DR-2010) readout.

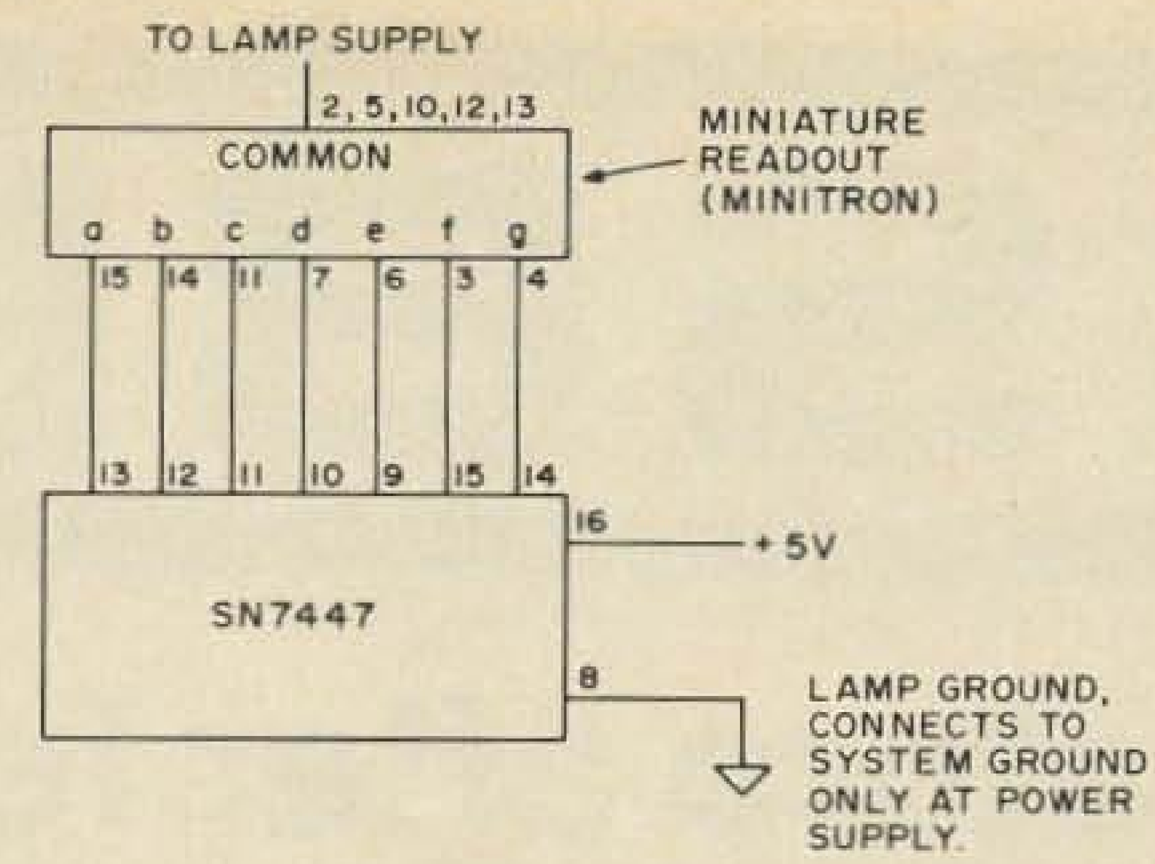

Fig. 14. Connecting the 16-pin miniature incandescent readout.

several ham magazines under various names. It works on the same principle as the Numitron, but is mounted in a tiny 16-pin package similar to a 16-pin I.C., with the numbers only 0.36 in. high. At the time of writing its price is about $3.70, or about $18.50 for a set of five. It can be connected to the SN7447 decoder as shown in Fig. 14.

Both of these readouts have one slight problem. At an applied voltage of 5V, the current per segment in the Numitron is 25 mA, and about 8 mA in the smaller readout, while the SN7447 decoder IC is rated to deliver up to 20 mA. But the surge current into an incandescent lamp filament when first turned on is about 12 times the rated current – the Numitron takes about 300 mA surge, while the miniature type takes about 100 mA. Both of these values can overload the SN7447.

One way to avoid this problem is to use the SN7447A decoder, which is rated for somewhat more current than the SN7447. Another is to use less than 5V. Some people suggest that the lamp voltage be taken from an unregulated 3–4V. An excellent choice is a full-wave rectified, but unfiltered, 3.15V (see Fig. 17 for power supply connections).

Another problem is associated with the high surge currents. The lamp voltage and the ground connection for the SN7447 must go directly to the power supply, separate from the normal power leads for the rest of the unit.

A really elegant, though more expensive method is to use a light-emitting-diode seven segment readout such as Monsanto's MAN-1, or -3, the Litronix 10A, or some of the Hewlett-Packard units. At the time of writing the minimum cost in unit quantities is about $8.50 each ($42.50 for a set of five), but many people feel that by the time this article appears the LED price may be close to the incandescent readouts.

The MAN-3 has a number height of about 0.1 in. while the MAN-1 and Litronix 10A are about 0.3 in. Figure 15 shows the connections from the SN7447 to the MAN-1 or 10A. Both LEDs are mounted in a miniature 14-pin package similar to a 14-pin IC.

Both the LED readout and the miniature incandescent readout are IC-like packages which have to be viewed from *above*. This means that it's not practical to mount them

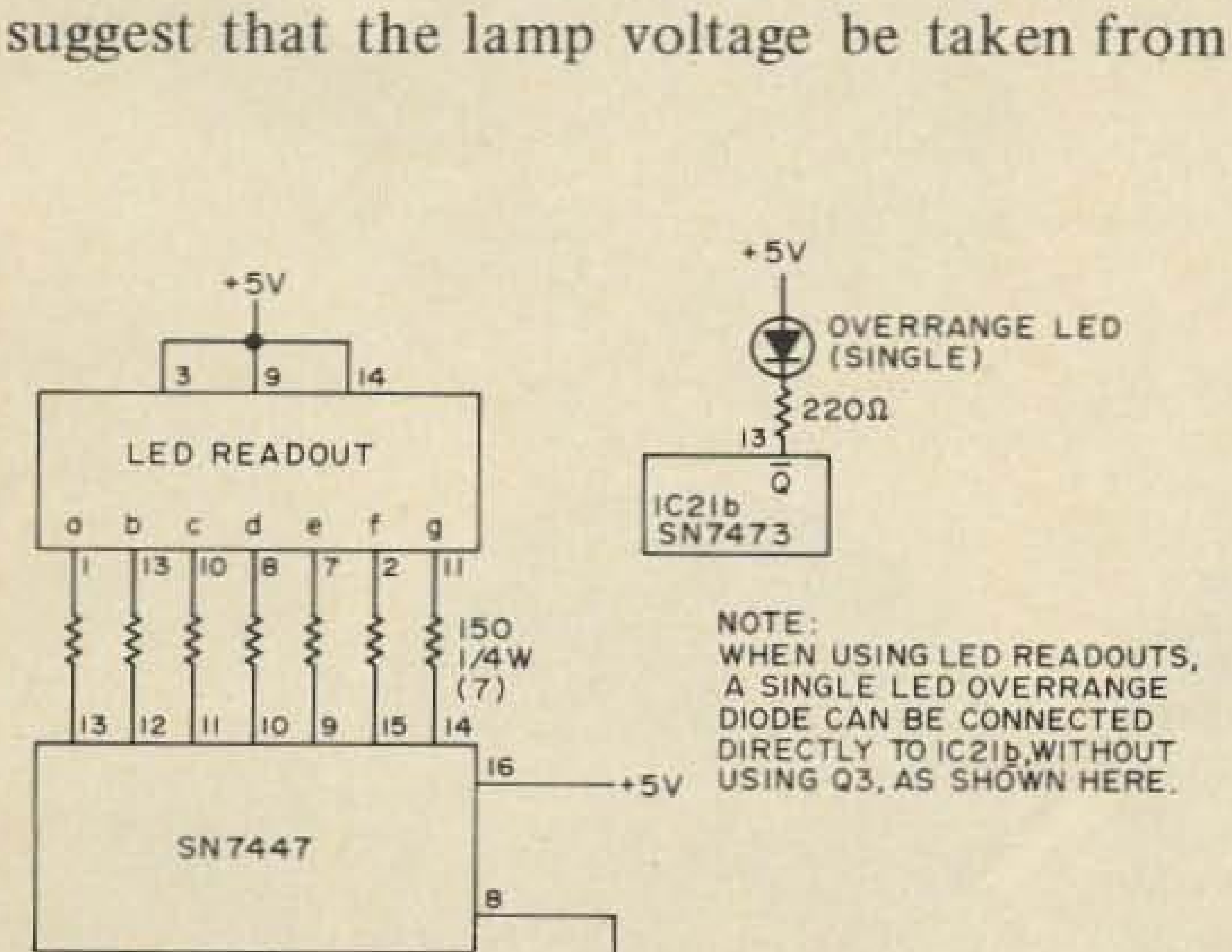

Fig. 15. Connecting the MAN-1, 10A, and LED-700 LED readouts.

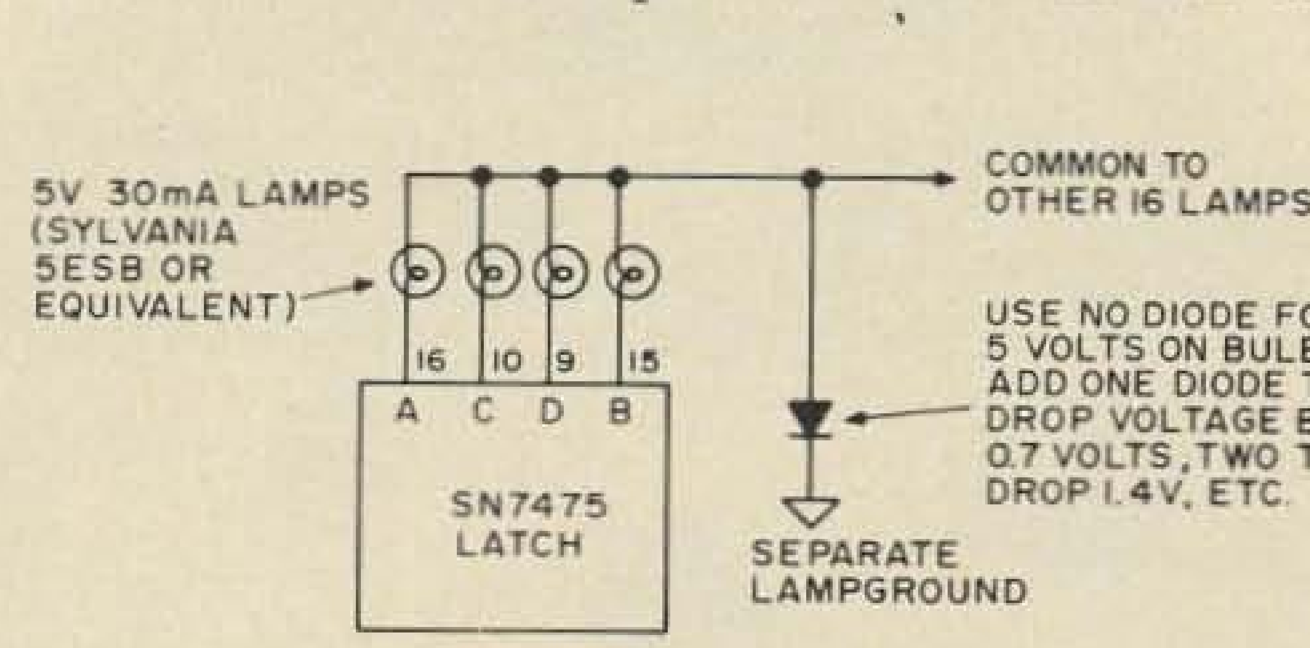

Fig. 16. Connecting four lamps to SN7475 latch, to reduce cost.

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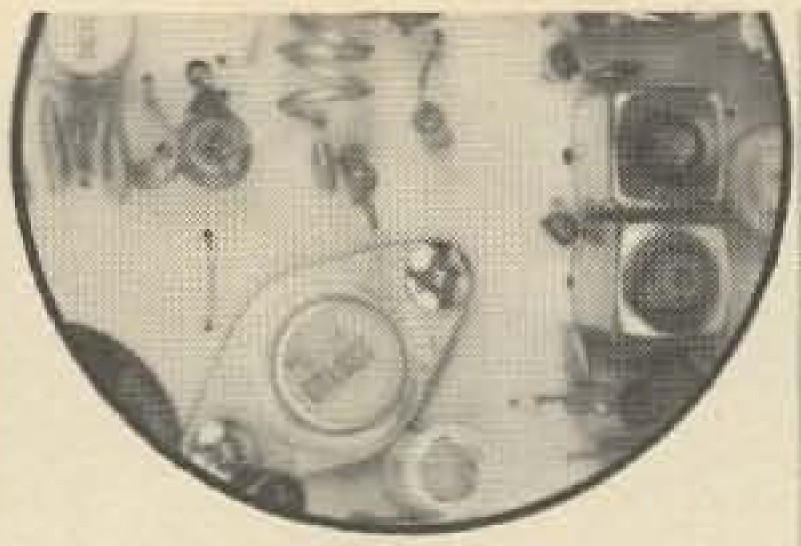

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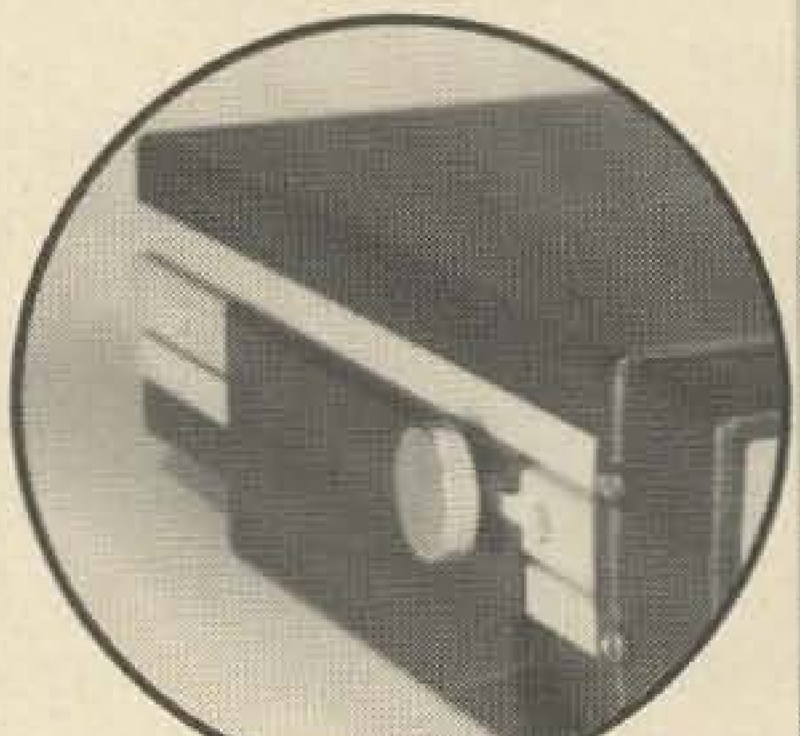

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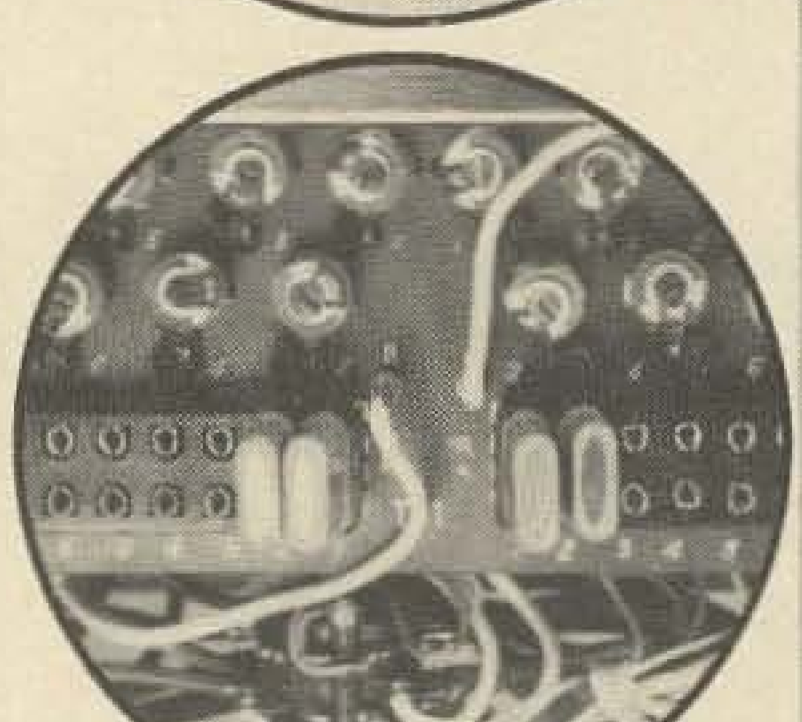

Two sets of crystals are supplied. Transmit and receive crystals have individual trimmers for exact frequency centering

Beautifully constructed, book size, the SB-450 has 12 channel capability, delivers 5 watts FM output. It's all solid-state — no warmup — low drain from 12V car battery (operates on 115VAC for base station use with available accessory supply). Two sets of crystals are supplied for repeater and simplex operation.

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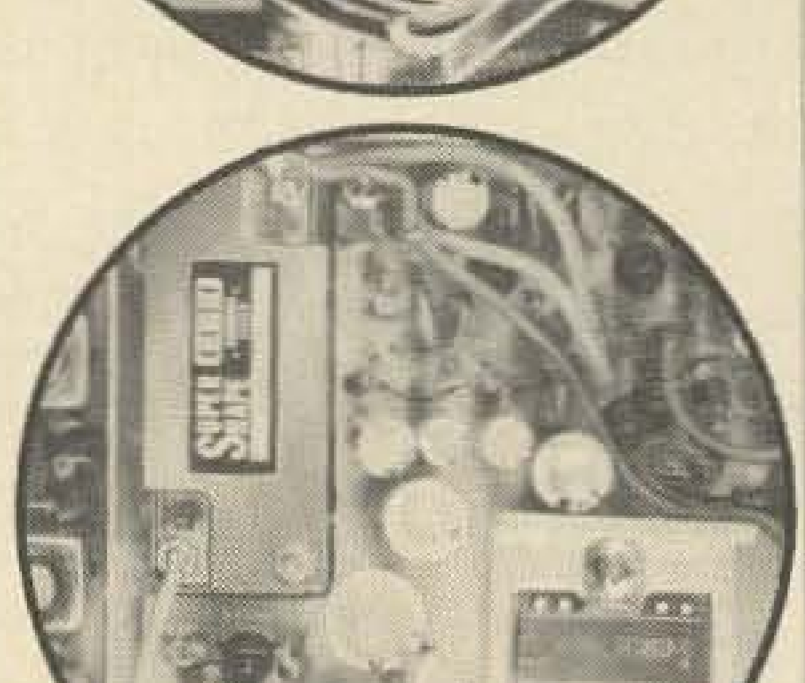

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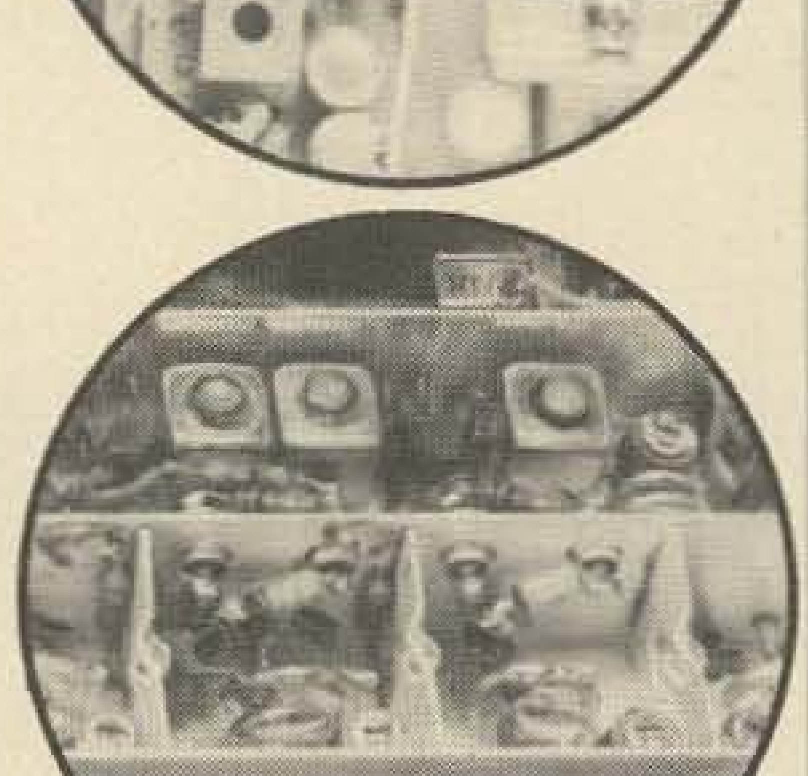

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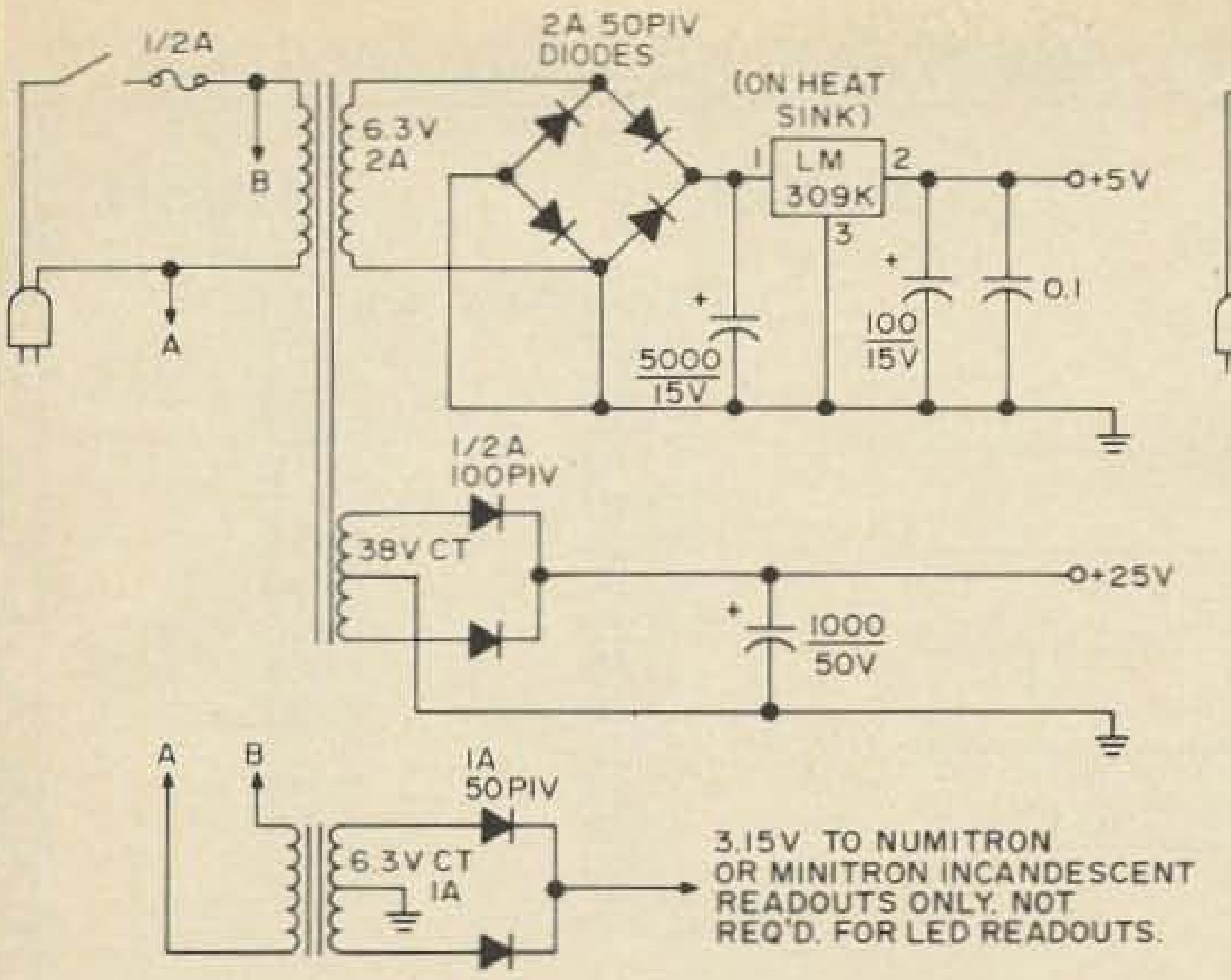

Fig. 17. Power supply.

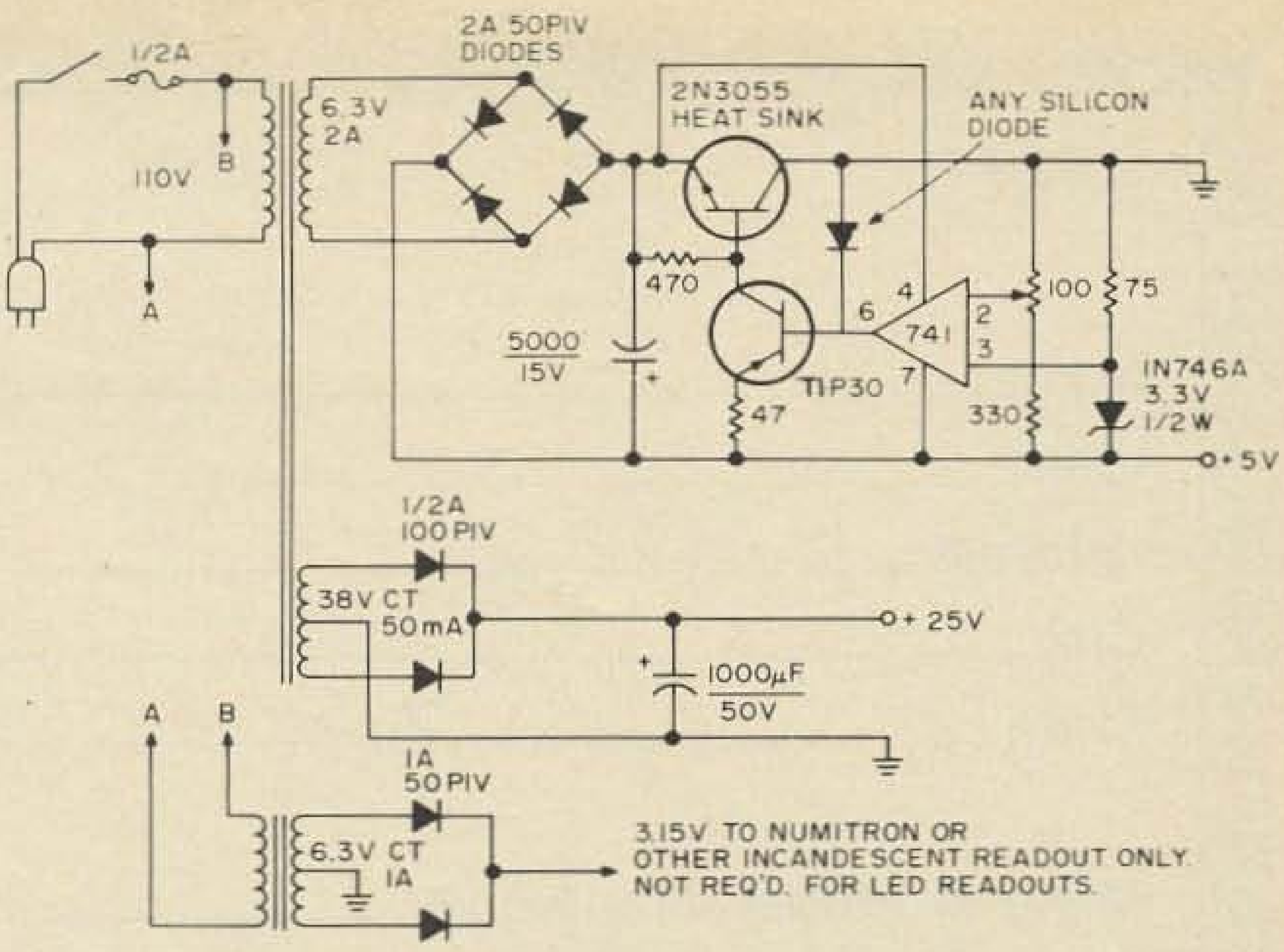

Fig. 18. Alternate power supply.

on the same board as the rest of the counter unless you like to look down from above. The best way to mount them is on a small etched or perforated board which stands up vertically right in front of the main p.c. board.

Power Supply (Figs. 17 and 18)

A good power supply is a very important part of any digital system. It must be well filtered and well regulated, since integrated circuits are very sensitive to noise on the power lines. Most important, the power supply voltage to the IC's should be between +4.75 and +5.25V, and must not go above 5.5V or so to avoid damage to them.

The counter needs +5V at ±5% regulation at about 1.5A, +25V at about 10 mA for the FET input amplifier, and a lamp voltage of about 3V and roughly 1A if incandescent readouts are used (LED readouts work directly off the +5V supply).

The simplest +5V power supply uses an LM-309K 5V regulator IC, available from a number of sources at a low price. Shown in Fig. 17, all it has is a bridge rectifier, three filter capacitors, and the regulator. Figure 18 shows an alternate design, which is capable of somewhat more current output and therefore runs cooler. This design happens to be the one used in our prototype, since it is current limiting and short-circuit proof.

In our units, the +25V supply uses a 38V center-tapped transformer winding and a simple full-wave rectifier. Since only about 10 mA of current is required, a 1000 μF filter capacitor is enough filtering. Since 38V transformers are not that common, you may use a 16V bell transformer in a bridge rectifier circuit to give the same output voltage; the p.c. board has room for the extra two diodes in the bridge. In fact, any transformer that will provide 20–30V of dc will work. Regulation is not too important.

If you use the Numitron or Minitron incandescent readouts, the 3V lamp voltage comes from a separate 6.3V center-tapped filament transformer, as shown in Figs. 17 and 18. The two rectifier diodes mount on the main p.c. board. If you use the LED readouts, the transformer and diodes are not needed.

Since the TTL IC's are not only sensitive to noise, but generate sharp spikes on the 5V power line as well, adequate filtering is very important. In addition to a hefty power supply filter capacitor, there are small 0.1 and 0.01 μF disk capacitors scattered around the p.c. board, bypassing the +5V line to ground. These are essential to eliminate the voltage spikes as close to the IC's as possible. In fact, the two IC's in the VHF prescaler have 0.01 μF disk capacitors soldered directly under them, on the copper side of the board, connected right on the two power supply pins, just to keep out noise and prevent problems.

In the third part of this article, we will show you how the p.c. board is laid out, where to place the parts, and how to hook the whole thing up.

...K2OAW

Note:
Circuit boards and parts for the complete counter are available through Circuit Specialists, Box 3047, Scottsdale AZ 85251. Ed.

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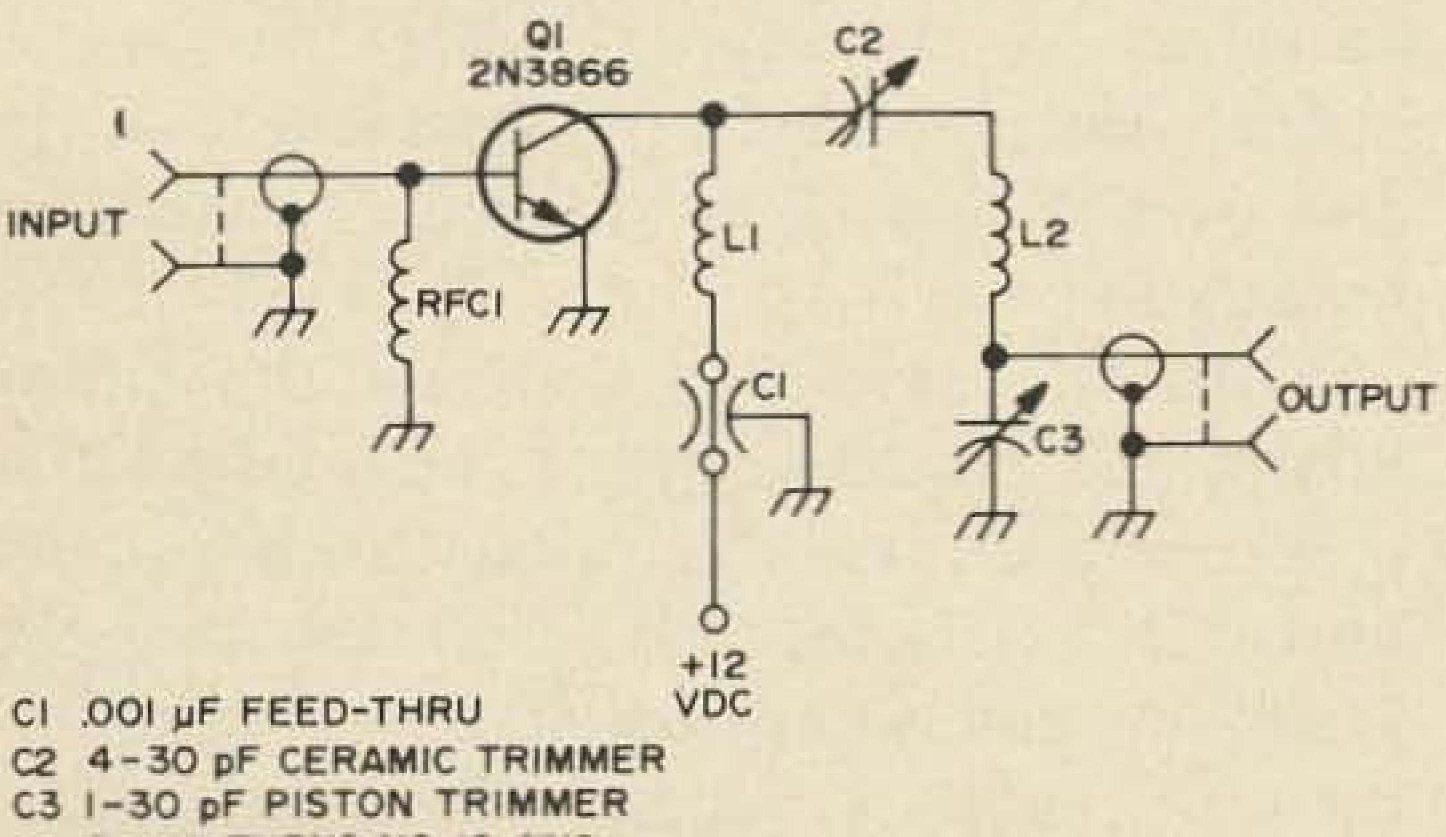
EXPERIMENTAL SOLID STATE VHF AMPLIFIER

A couple of articles in the amateur literature have outlined the merits and characteristics of some of the relatively new power transistors for VHF power amplification.[1,2] The article by Franson is extremely valuable; it describes characteristics and typical circuits with a good section on impedance matching between stages and to the output load.

After careful reading of some of the published information, a 2N3866 transistor was obtained. This type was selected mainly because of its low cost and 1W output rating. A watt of output at 2 meters puts a solid state transmitter in pretty much the same class as the little transceivers so popular for local contacts on the band.

While the circuit designs have been worked out on paper, not much has been shown on the practical construction methods required to obtain maximum efficiency in a power amplifier stage. A quick check in breadboard fashion showed that the 2N3866 would indeed provide considerable power gain at 144 MHz, and seemed to be quite stable in operation. For the preliminary test, the transistor was mounted inside a small minibox with the emitter lead soldered directly to a ground terminal bolted to the chassis, and the other two transistor leads soldered to standoff terminals close to the transistor body. Input and output jacks were mounted on each end as well as a feedthrough capacitor on the top of the box for the application of B-plus. This arrangement provided a check on the circuit, but the power output obtainable was well below what the data sheet indicated it should be.

Both articles mentioned point out the necessity of using the shortest possible leads in the construction of this type amplifier, and indicate the construction which should be used for maximum efficiency at VHF. It



C1 .001 µF FEED-THRU
C2 4-30 pF CERAMIC TRIMMER
C3 1-30 pF PISTON TRIMMER
L1 2-1/2 TURNS NO. 16 AWG, 3/8 in. DIA., 3/8 in. LONG.
L2 3-1/2 TURNS NO. 16 AWG, 3/8 in. DIA., 1/2 in. LONG.
RFC1-24 TURNS 28 AWG ENAMEL ON 1/2W RESISTOR

Fig. 1A. Schematic diagram.

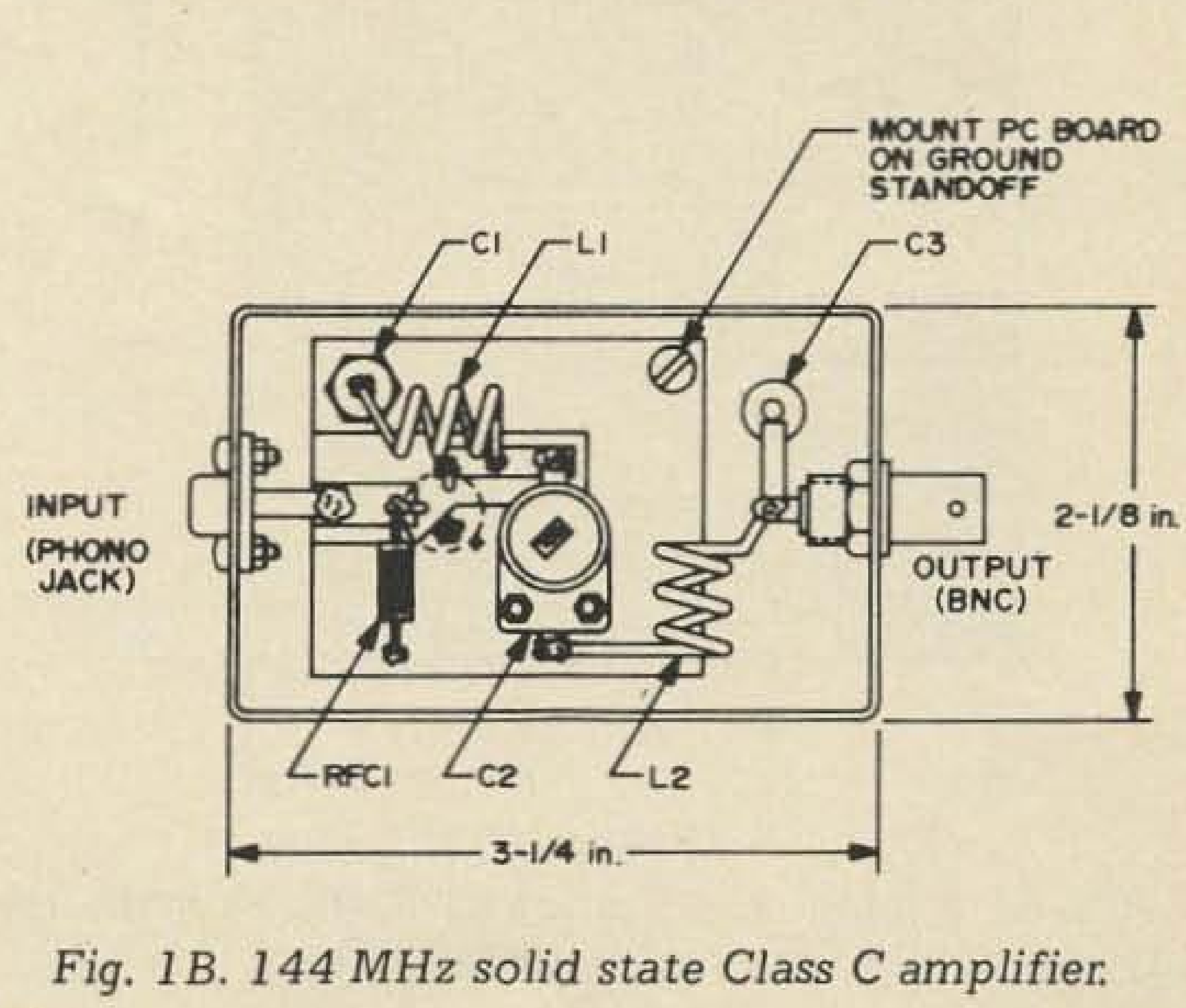


Fig. 1B. 144 MHz solid state Class C amplifier.

was obvious that the breadboard amplifier did not meet these requirements, especially in regard to grounding the emitter lead by as direct a path as possible. The emitter lead was probably somewhat over an inch in length after passing through the solder lug to the chassis ground. Also, the tank coils and rf choke in the base circuit were not mounted as they should have been.

With these inefficiencies in mind, the circuit board pattern shown in Fig. 2

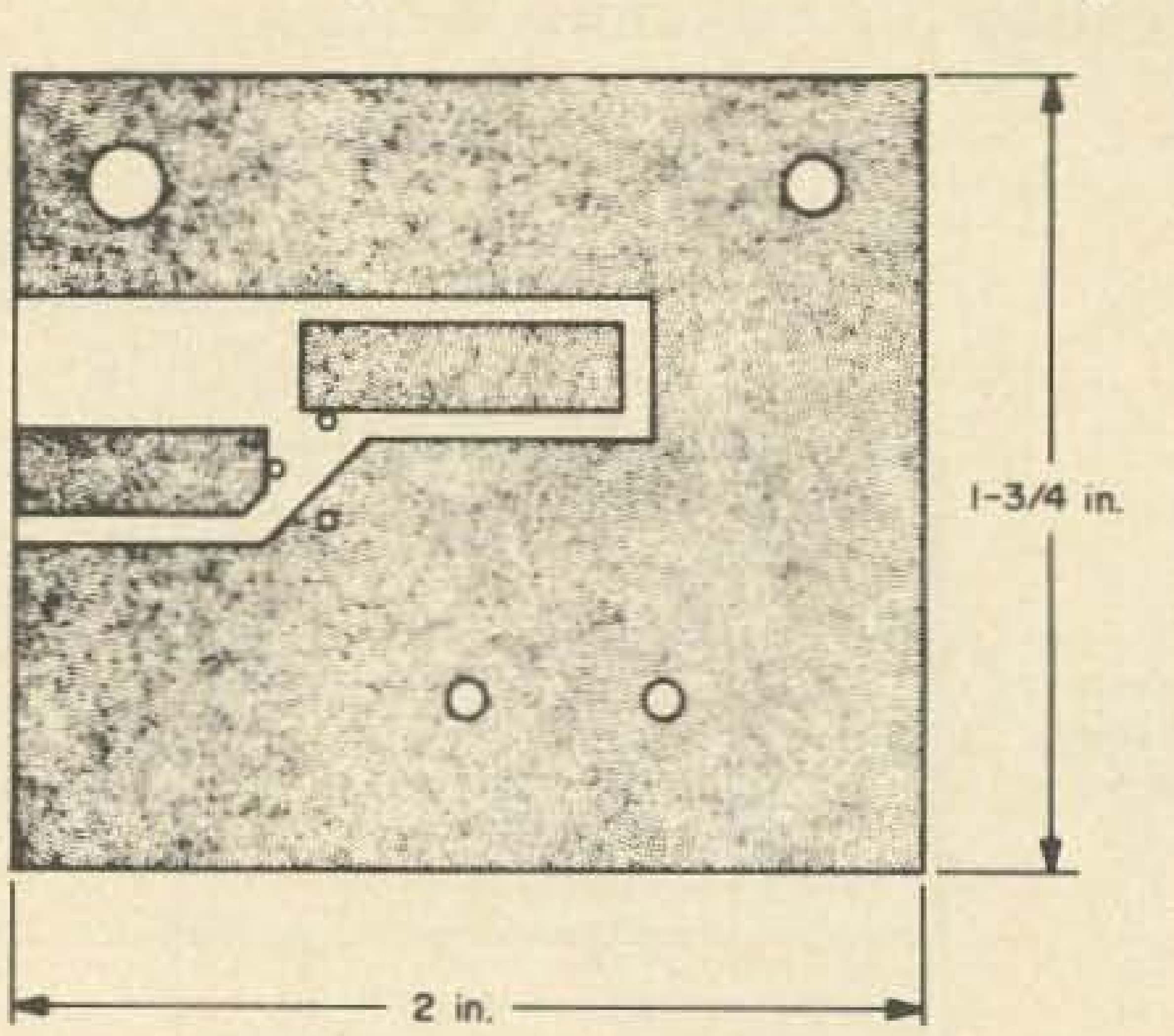


Fig. 2. VHF amplifier PC layout.
40% of original size (shoot at 250% to make this layout 2.775 times larger than shown).

evolved. The copper clad board provides a good ground plane for the amplifier, and soldering the transistor directly to the board provides the shortest possible leads, especially for the emitter termination. The wide strips of copper at the collector and base connections give low inductance connections at these points, another consideration mentioned in both articles.

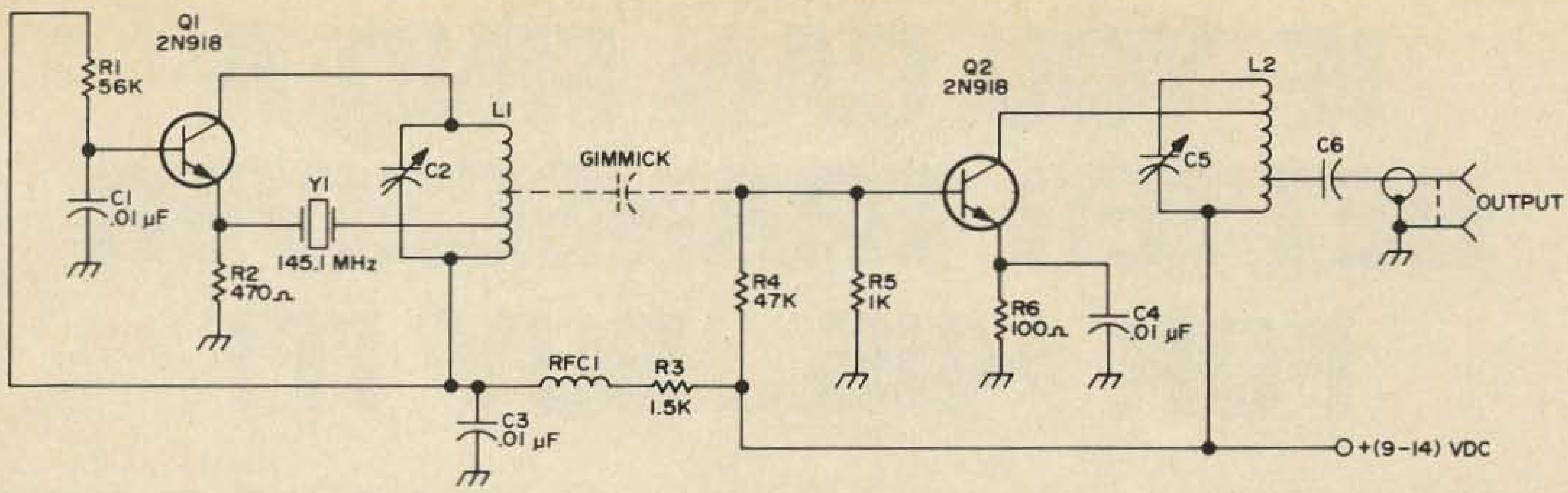
As shown in the top view of the assembly (Fig. 1B) the input jack is soldered directly to the base connection on the circuit board and also serves as a support for the board on this end. The other end of the board is supported on a grounded standoff. It was thought best to use just one standoff between the circuit board ground pattern and the main minibox chassis ground, although the effects of ground loops with a more rigid multiple point mounting were not investigated. At any rate, the construction method shown is plenty rigid, even for mobile applications in amateur service.

C2 is soldered directly to the collector strip on the circuit board eliminating a lead at this point, and L2 goes between the other side of C2 and the output port. The output loading capacitor, C3, is a piston trimmer with one side bolted directly to chassis ground. A flat strip of 1/8 in. copper was used for the short connection from the high side of C3 to the output.

The amplifier circuit was the same as the one in Fig. 4A in the article by Franson. This particular circuit is a good choice to obtain an impedance match between the collector and the 50Ω output desired, since the impedance level at the collector is pretty much set by the supply voltage and power output level, in this case somewhere in the area of 12V and 1W of output. The circuit is repeated in Fig. 1A.

With the amplifier built on the circuit board, and mounted inside the minibox, the power output available immediately jumped up to 1W or more. Best of all, the amplifier tuned up and acted just like one might on the low frequency bands.

In order to run the transistor at the relatively "high" level necessary for a watt of output, some sort of heatsink for the transistor should be provided. A flat plate of



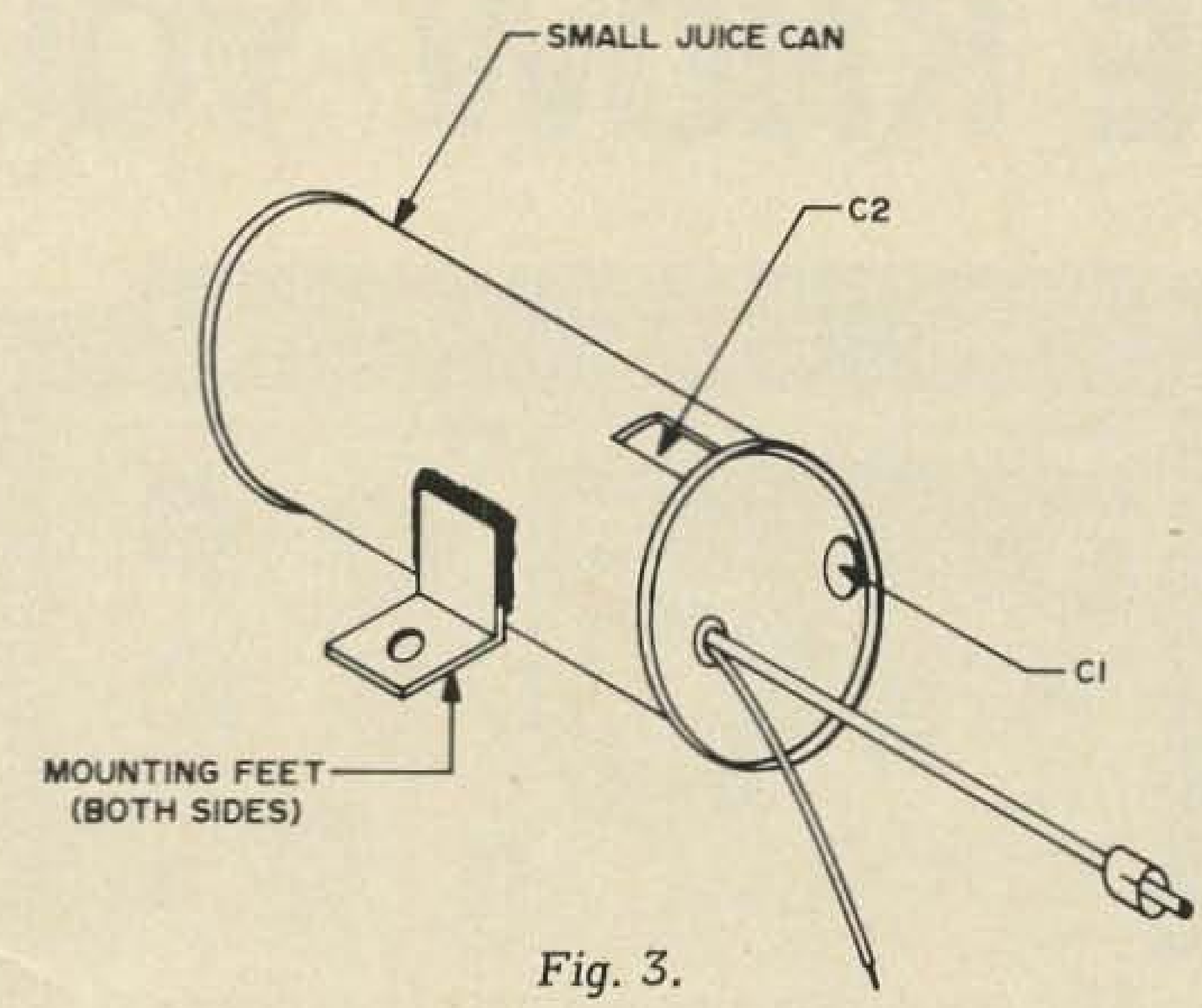


Fig. 3.

aluminum was tried by reaming a hole to fit over the transistor body and bolting it directly to the circuit board. However, this arrangement added so much capacity from collector to ground that the circuit failed to work with the heatsink in place.

As a result, a small heatsink clip was fashioned from scrap metal to slip over the transistor in much the same manner as the commercial clips available. This radiator provides enough cooling for normal power levels. The output flattens out above a watt anyway, so there is no advantage in pushing the stage any further than a couple of watts of dc input. Actually, the transistor ratings indicate that it could probably be operated at this level without a heatsink, although the clip is insurance well worth the effort.

As it turns out, actual checking of amplifier performance is simple with this type of construction, and in many amateur applications the source of a signal to drive the stage may be more difficult to obtain. For quick checks the output from a small two-meter transmitter could be used with a suitable attenuator to knock down the power to the few milliwatts required.

As a matter of interest, the circuit of a little 144 MHz signal source is shown in Fig. 3. This was built up on a small piece of vectorboard and mounted inside a small frozen orange juice can. It provides a very convenient signal source with a few milliwatts of output, which is just right to drive something like the 2N3866. The critical part of the signal generator, of course, is the 145 MHz overtone crystal.

The test amplifier shown not only provides a convenient and efficient way of checking transistor performance, but it can be used as an integral part of a small two-meter transmitter. With a crystal oscillator like that in Fig. 3 and a small modulator, the 2N3866 amplifier provides a simple little transmitter with results equivalent to some of the small commercial two-meter rigs. The applications for mobile and portable work are obvious.

. . .W9ZTK

References.

1. David F. Becker, "More Power on 144 MHz with Transistors" *QST* August 1969.
2. Paul Franson, "How to Use RF Power Transistors" *Ham Radio* January 1970.

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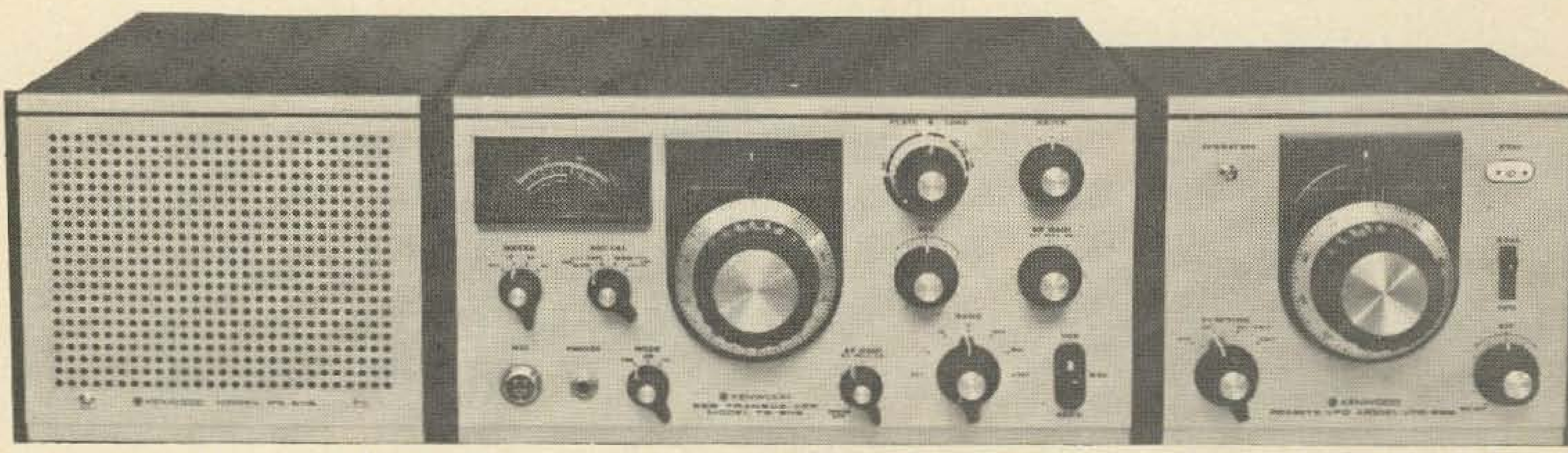

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28.5 - 29.1 mHz
29.1 - 29.7 mHz
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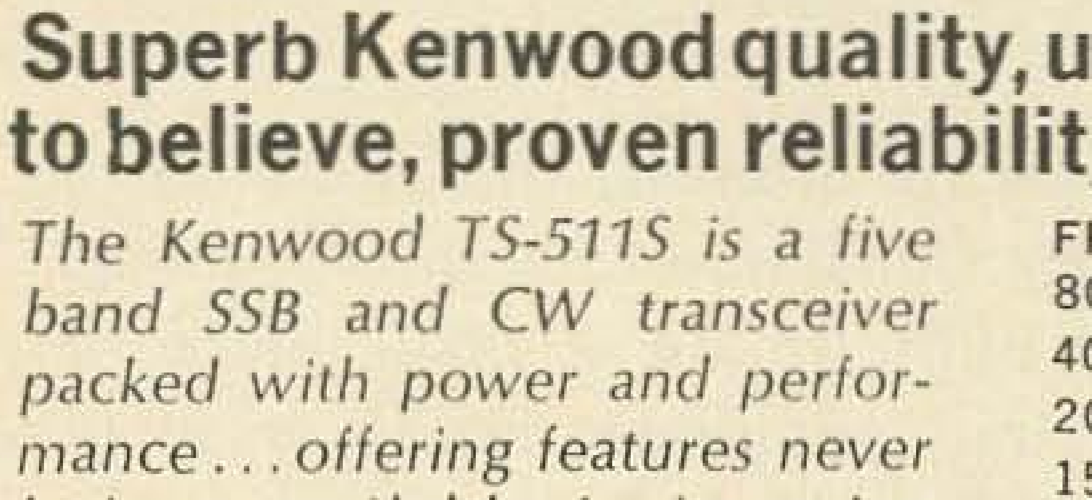

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THE PHASE-LOCK LOOP

PART ONE

Reprinted from Amateur Radio, *Journal of the Wireless Institute of Australia.*

This is the first of two articles written with a view to acquainting amateurs with the principles of the phase-lock loop. Applications of the phase-lock loop are outlined and the use of a phase-lock loop as an optimum FM discriminator is discussed.

The basic phase-lock loop is shown in block diagram form in Fig. 1. It comprises three basic components:

(1) A phase detector (Fig. 2),

(2) A low pass filter (Fig. 3),

(3) A voltage controlled oscillator (VCO) (Fig. 4).

The phase of a periodic input signal and that of the VCO is compared by the phase detector; output of the phase detector is a measure of the phase difference between its two inputs. This difference voltage is then filtered by the loop filter and applied to the VCO. Control voltage on the VCO changes the frequency in a direction that reduces the phase difference between the input signal and the VCO.

When the loop is "locked" the control voltage is such that the frequency of the VCO is exactly equal to the average frequency of the input signal.

Suppose now that the input signal carries information in its phase or frequency; this signal is inevitably corrupted by additive noise. Suppose also that the VCO is the "local oscillator" in some form of receiver. The task of such a phase- lock "receiver" is to reproduce the original signal while removing as much of the noise as possible. If the "local oscillator" could be locked to the input signal and made insensitive to the random noise on this signal, then the input signal could be reconstructed.

The input to the loop is a noisy signal, whereas the output of the VCO is a cleaned-up version of the input. To suppress noise, the error output signal from the phase detector is averaged over some length of time by the loop filter, and the averaged error is then used to control the frequency of the oscillator. It is reasonable, therefore, to consider the loop as a kind of filter that passes signals and rejects noise.

Two important characteristics of the filter are that the bandwidth can be very small

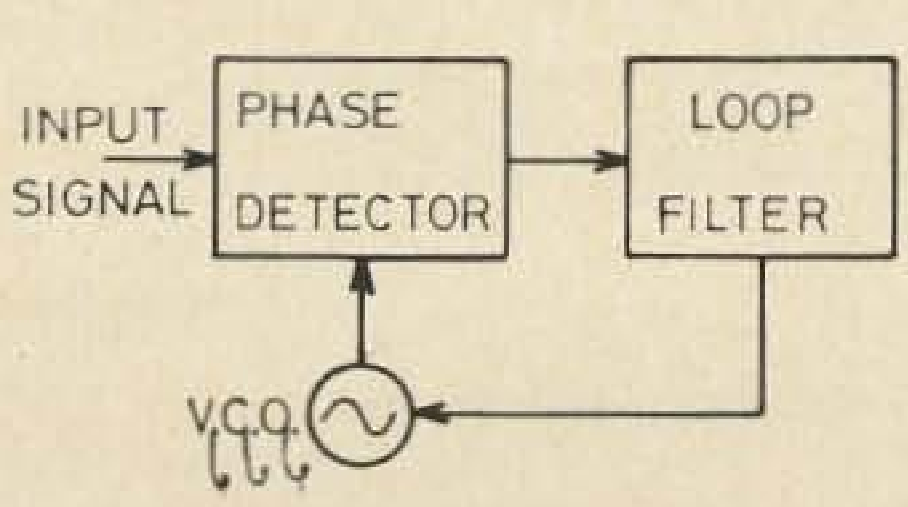

Fig. 1. Basic phase lock loop.

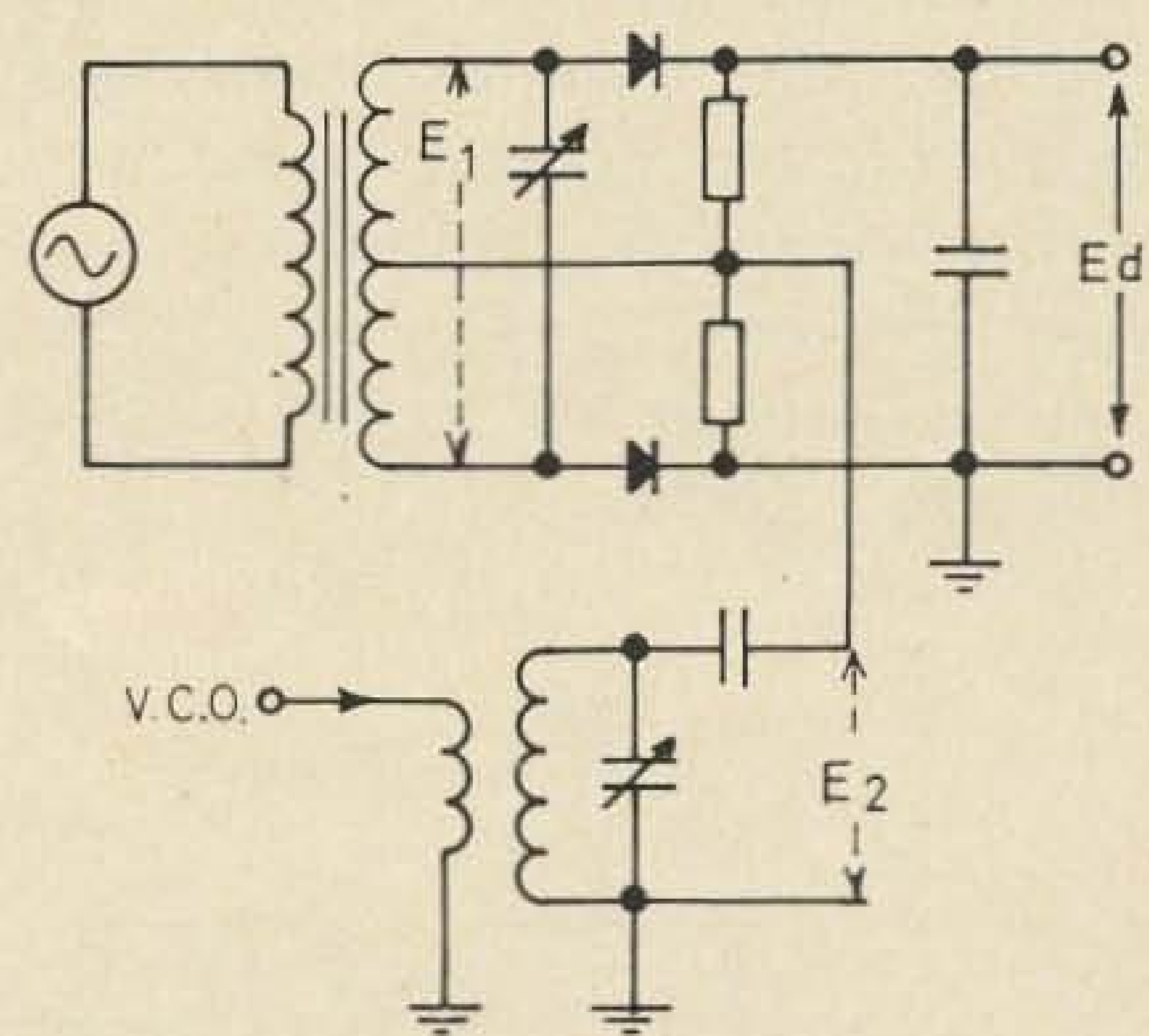

Fig. 2. Typical phase detector. If the signal input is Er sin $(2\pi ft)$ and the VCO is E2 cos $(2\pi ft + o)$ then the output of the detector is $Ed \approx 2E2 \sin\theta$ or for small θ, $Ed \propto E2\,\theta$ for $E2 > E1$, i.e. the output voltage is proportional to the phase difference between the signal input and the VCO.

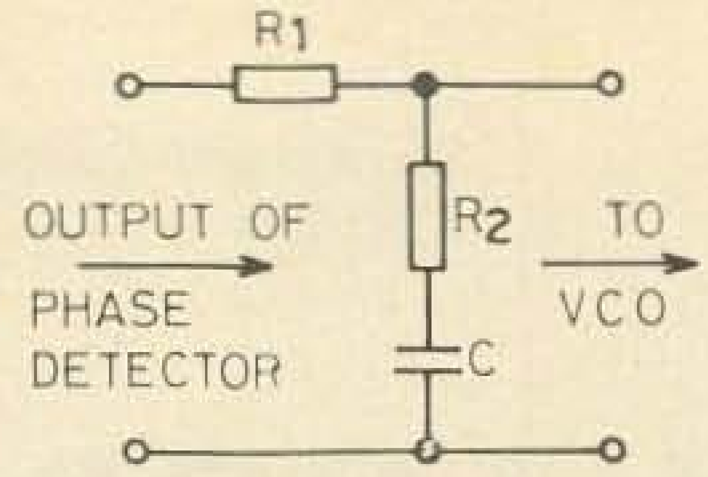

Fig. 3. Typical low pass filter. The transfer function of this filter is

$$H(S) = \frac{S\,C\,R2 + 1}{S\,C\,(R1 + R2)} + 1$$

where S is the complex variable.

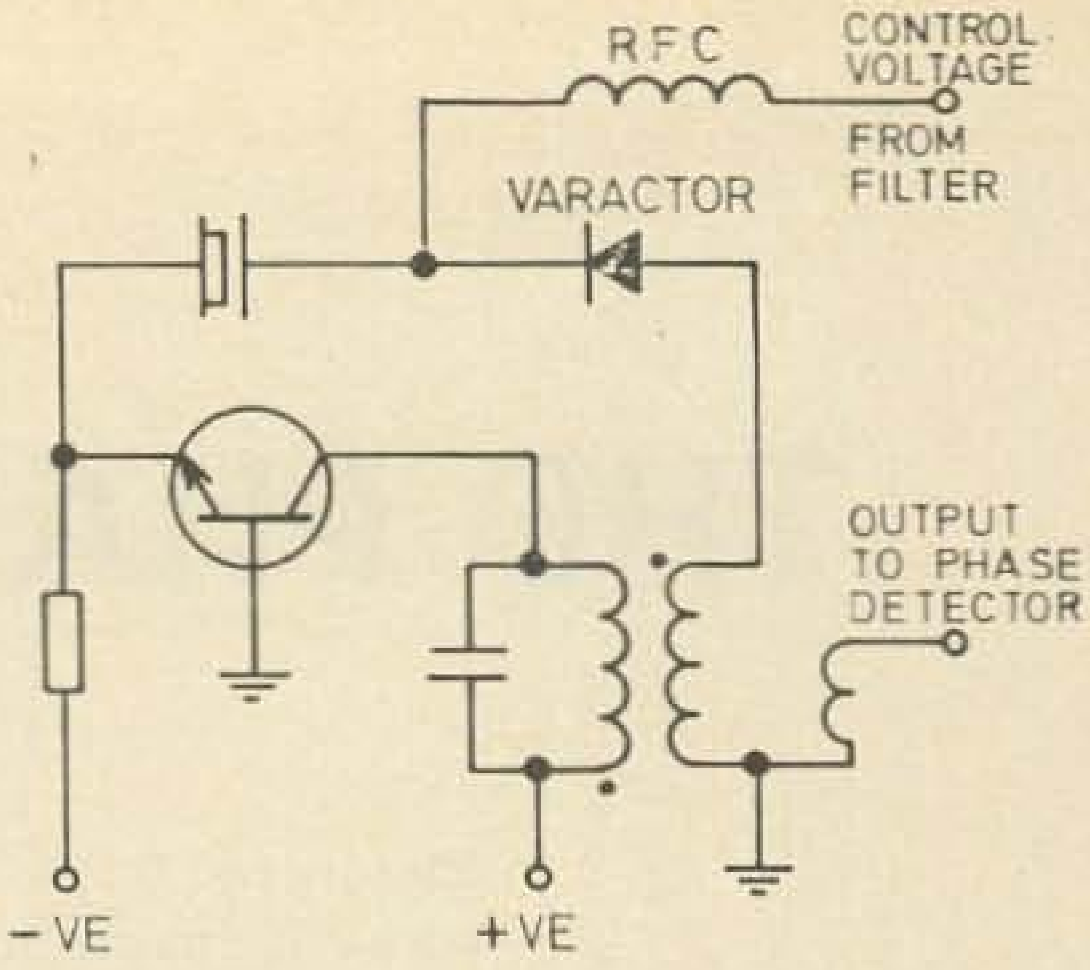

Fig. 4. Typical voltage controlled oscillator.

and the filter automatically tracks the signal frequency. Narrow bandwidth is capable of rejecting large amounts of noise; it is not at all unusual for a phase-lock loop to recover a signal deeply embedded in noise.

One application of the phase-lock loop is as the local oscillator in a synchronous or homodyne receiver. In essence this receiver consists of nothing but a local oscillator, a mixer, and an audio amplifier. To operate, the oscillator has to be adjusted to exactly the same frequency as the carrier of the incoming signal which is then converted to an intermediate frequency of zero Hz. Output of the mixer contains demodulated information that is carried as sidebands by the signal. Correct tuning of the local oscillator is essential to synchronous reception; any frequency error whatsoever will hopelessly garble the information. Furthermore, phase of the local oscillator must agree, very closely, with the received carrier phase. In other words. the local oscillator must be phase-locked to the incoming signal.

Another common application arises in television receivers. The flywheel synchronisers in present-day TV receivers are really phase-locked loops.

Space use of phase-lock began with the first American (Russian?) artificial satellites. These carried 10 mW. CW transmitters; received signals were correspondingly weak. Furthermore, Doppler shift made the exact frequency uncertain. At the 108 MHz frequency used, the Doppler shift could range over a ±3 kHz interval. Hence an ordinary fixed-tuned receiver would require at least a 6 kHz bandwidth for a signal that could be contained in something like a 6 Hz bandwidth. This entails a noise penalty (noise is directly proportional to bandwidth) of 1,000 times, i.e. 30 dB. Such penalties are intolerable and that is why narrow-band phase-locked tracking receivers are used.

Noise can be rejected by a narrow-band filter, but if the filter is fixed, the signal will almost never be within the passband. For a narrow filter to be usable it must be capable of tracking the signal. A phase-locked loop is capable of providing both the narrow bandwidth and tracking that are needed. Current applications of phase-lock include:

(1) Perfect afc (automatic frequency control) of receivers;

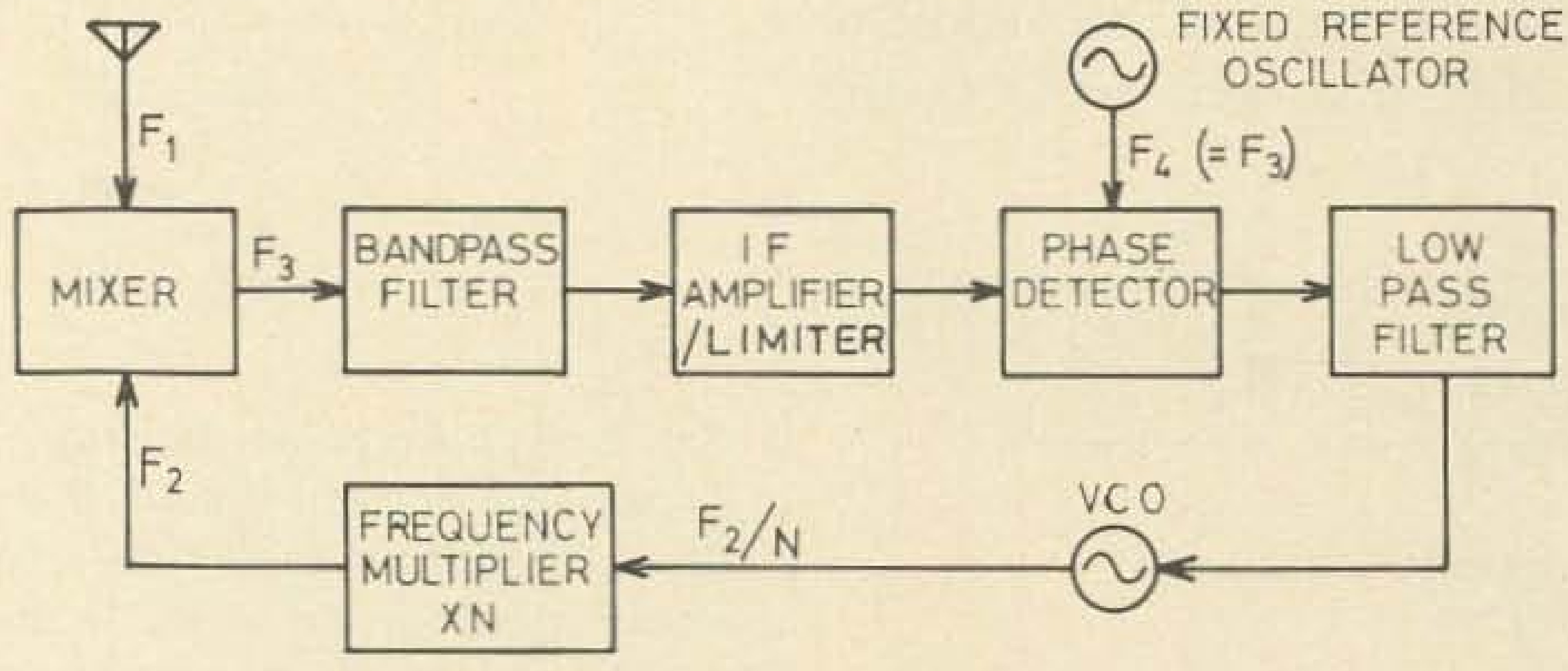

Fig. 5. Basic phase-lock receiver.

(2) P.c.m. telemetry bit synchronisation;
(3) Frequency multipliers and dividers;
(4) Coherent transponders;
(5) Noisy oscillators can be enclosed in a loop and locked to a clean signal; if the loop has wide bandwidth, the oscillator tracks out its own noise and the output is greatly cleaned up.
(6) A phase-locked loop can be used as a frequency demodulator; in which service it gives superior performance to conventional discriminators.

A simplified diagram of a superheterodyne phase-lock receiver is shown in Fig. 5. The principal difference between this and a conventional receiver is that the local oscillator tracks the input signal, allowing a much narrower i-f bandwidth. The smallness of the bandwidth is limited only by error and stability considerations.

Consider now the output of the phase detector; this is proportional to the phase difference between the i-f signal and that of the local reference oscillator. As the input signal varies in frequency when modulated, so the output of the phase detector will vary in sympathy with the modulation in order that the VCO track with the incoming signal to keep the frequency and phase of the i-f signal correct. Thus this voltage from the phase detector is a demodulated version of the FM signal. Direct use of the phase-detector output is unsatisfactory since it would be very noisy and unfiltered. Normally the demodulated signal is taken from the loop low-pass filter.

A simpler method for using a phase-lock loop as an FM demodulator is shown in Fig. 6; performance is of course not as good as a fully fledged phase-lock receiver, but practical advantages are obvious.

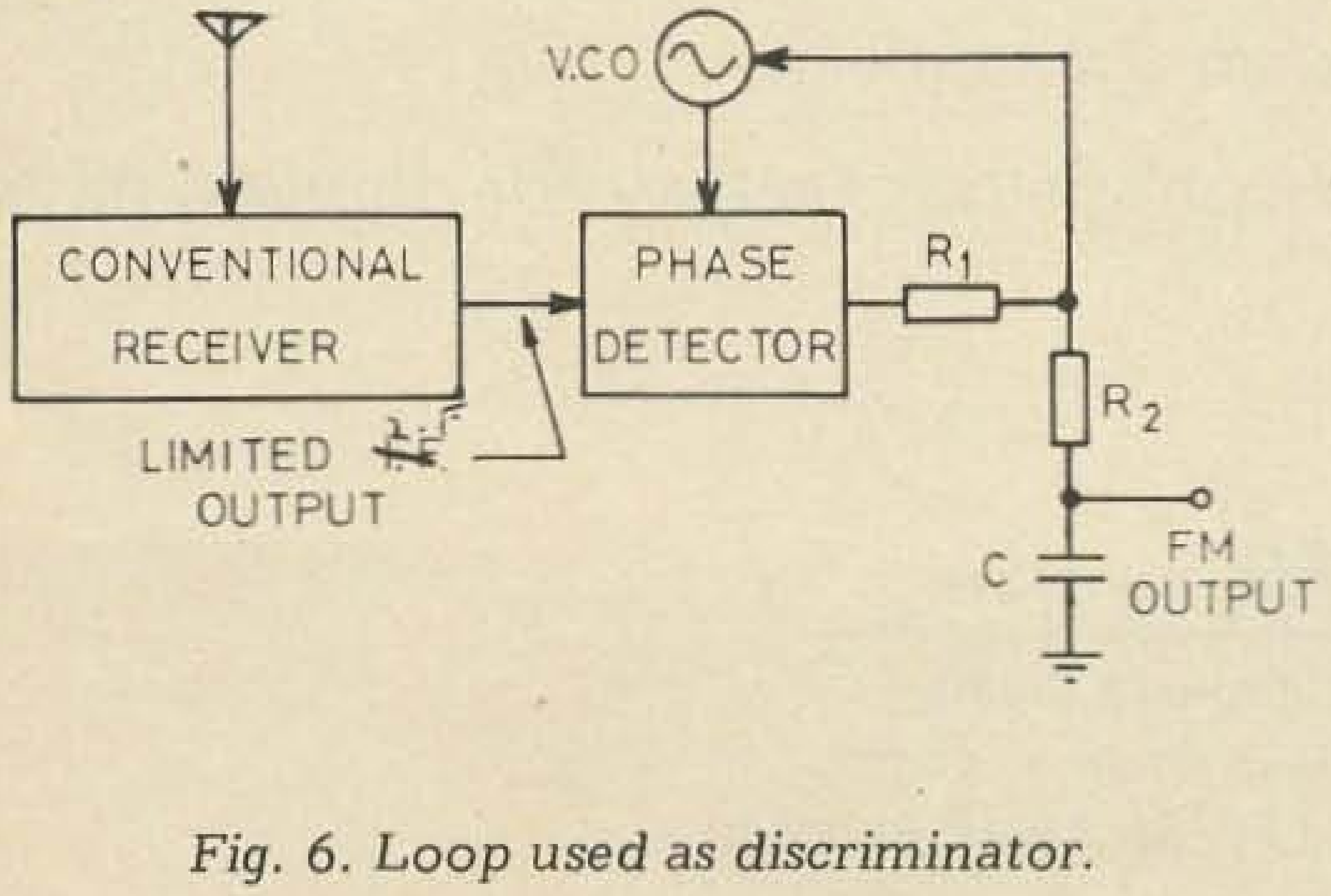

Fig. 6. Loop used as discriminator.

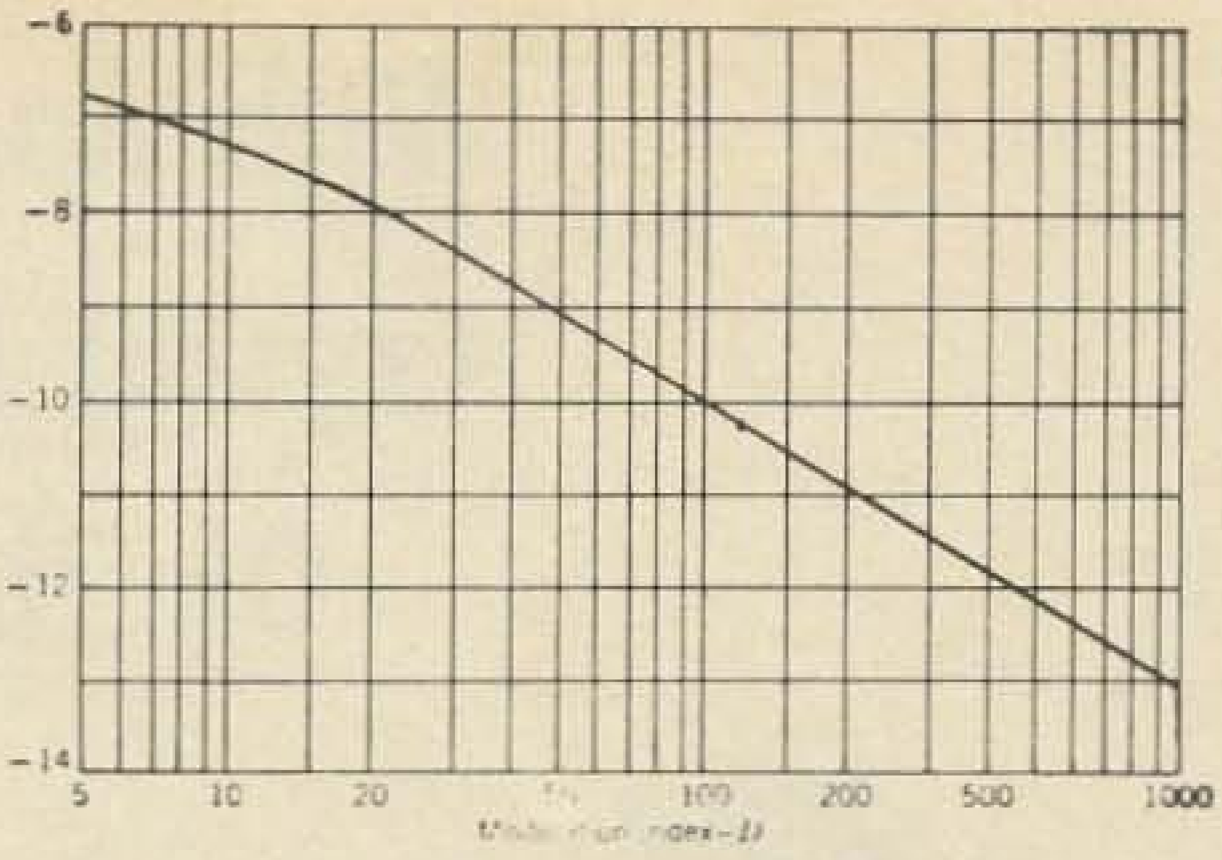

Fig. 7. Threshold for Random Modulation (Ref. 1).

The threshold of a conventional discriminator is considered to be +10fN SNR (signal-to-noise ratio) at the input to the limiter, whereas the threshold SNR for the phase-lock loop demodulator is indicated in Fig. 7.

Conclusions

The following conclusions may be drawn regarding discriminators:

(1) At high input SNR's there is no appreciable difference between phase-locked and conventional types.
(2) A phase-locked loop will have a lower threshold than the +10 dB of a conventional discriminator.
(3) The improvement that can be gained depends on the modulation of the input signal.
(4) For best results , the loop should be specifically designed for the modulation actually present.
(5) Premodulating filtering can provide better performance..

Next month, in the second article on this subject, a practical FM demodulator using an IC will be discussed. This is of the "add on" variety as in Fig. 6.

. . . VK4ZFD

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VHF CONVERTERS
A Building Block Approach

Dual insulated gate MOSFETS have taken a lot of the drudgery and black magic out of VHF front-end design. Using these devices, it is possible to construct stable, high-gain, low-noise rf amps and quiet, "birdie" free mixers using a few basic circuits without the use of exotic test equipment or hours of fiddling with temperamental adjustments.

Dual insulated gate MOSFETS offer inherent advantages not found in any other device. They handle strong signals and show cross-modulation characteristics as good as those of a well-designed pentode

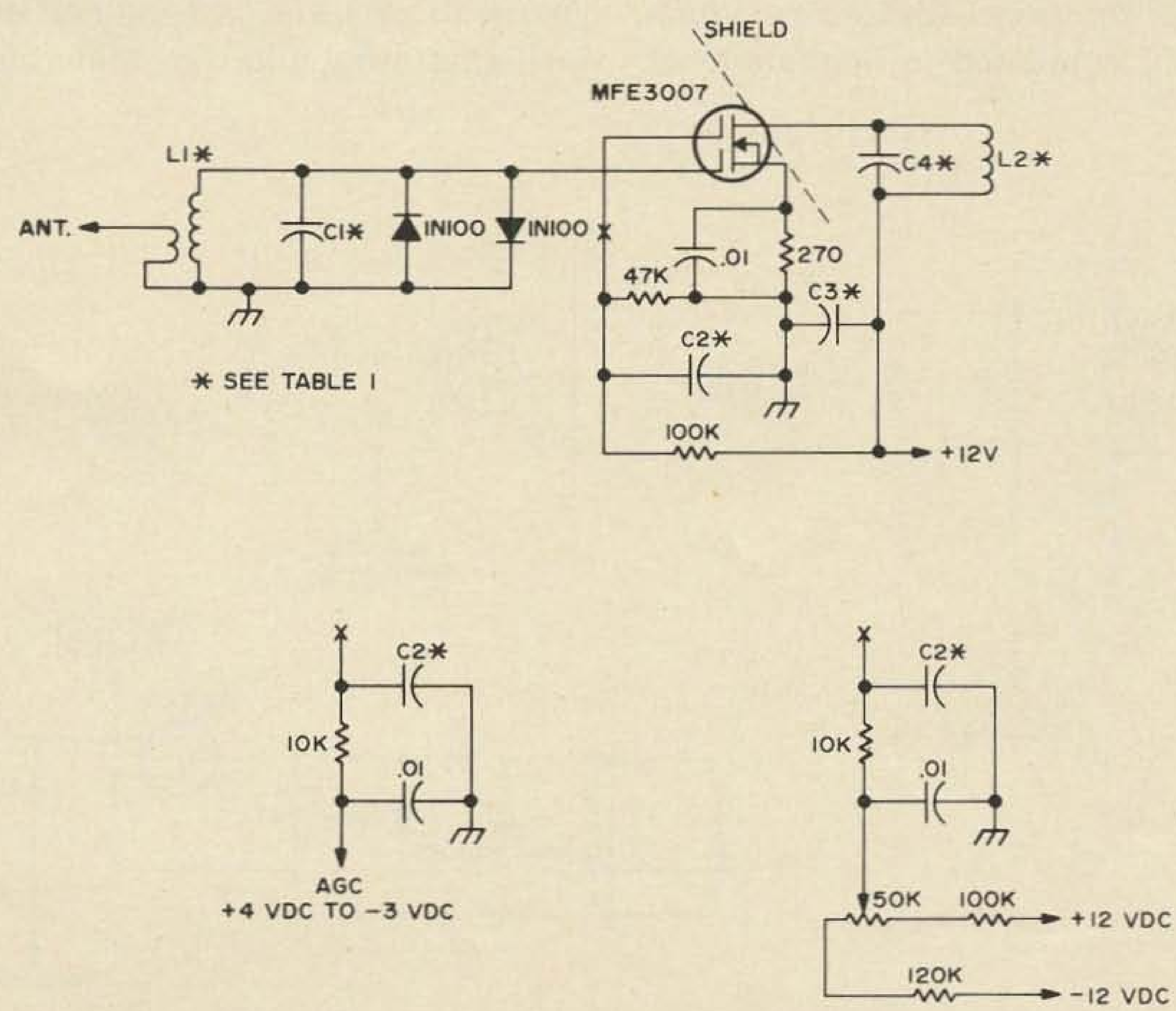

Fig. 1. RF amplifier.

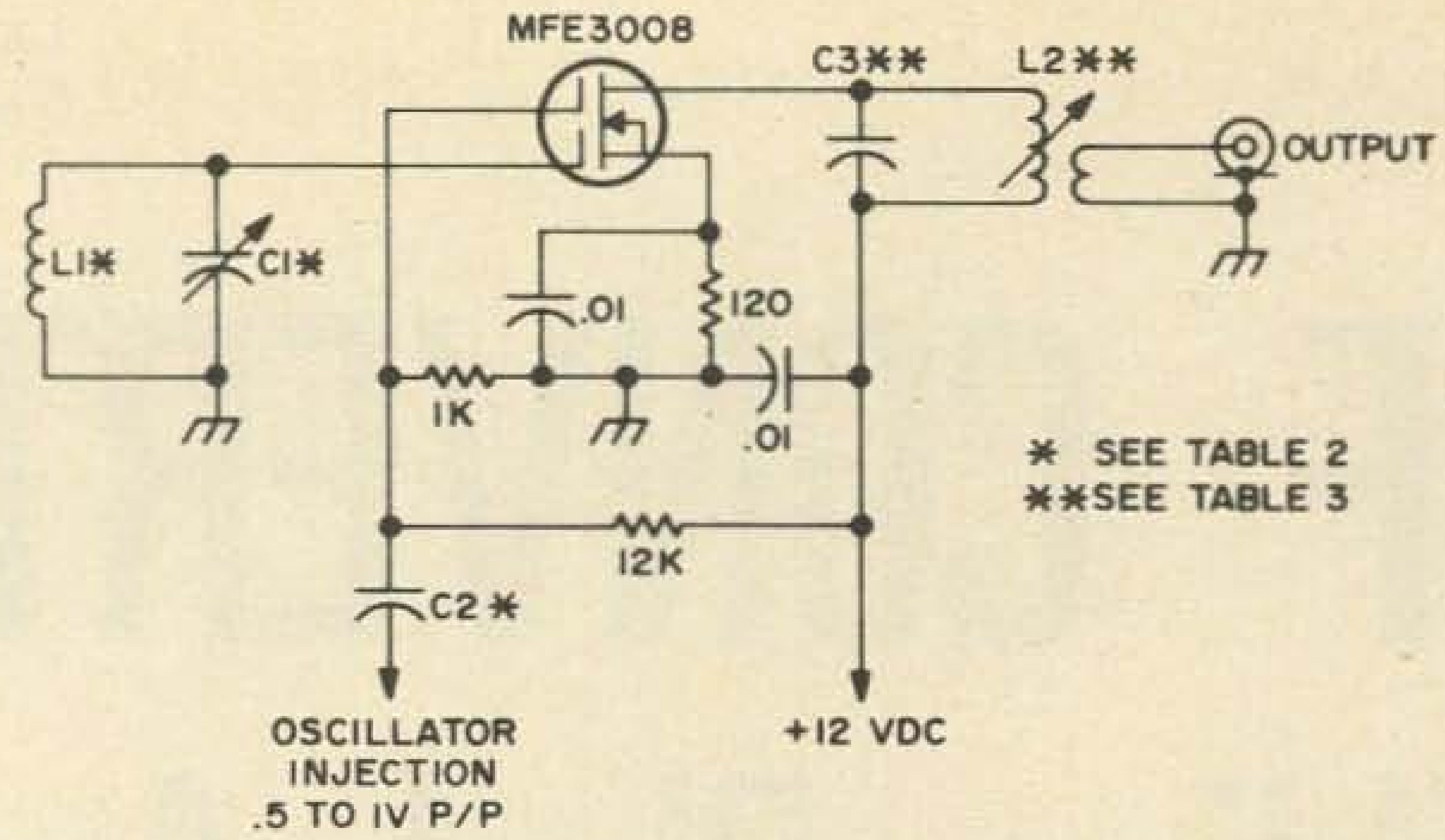

Fig. 2. Mixer.

tube stage, yet they provide noise figures and gains which cannot be excelled with anything but a parametric amplifier. They are quite stable and predictable. They have very low input and output capacitances, and are high-impedance devices, permitting comparatively easy design of tuned circuits well into the VHF range. They are relatively uniform device-to-device of the same designation, and maintain their characteristics over a broad range of frequencies. If desired, agc is easy to apply, though it will not, of course, normally be used in VHF front ends.

Because of all these advantages which are so happily combined in one family of devices, it is possible to use a building-block method for designing VHF converters and rf amps up to 432 MHz. Only the frequency-dependent components have to be changed in building over a wide range of frequencies. This has never been possible with other devices.

MOSFETS do, however, have certain limitations because of their extreme susceptibility to gate shorts caused by excessive rf voltages or static charges. Therefore, in handling and installation, it is important to circumspectly observe some precautions.

I have read of many elaborate safeguards to be taken in handling MOSFETS, including grounding the soldering gun tip

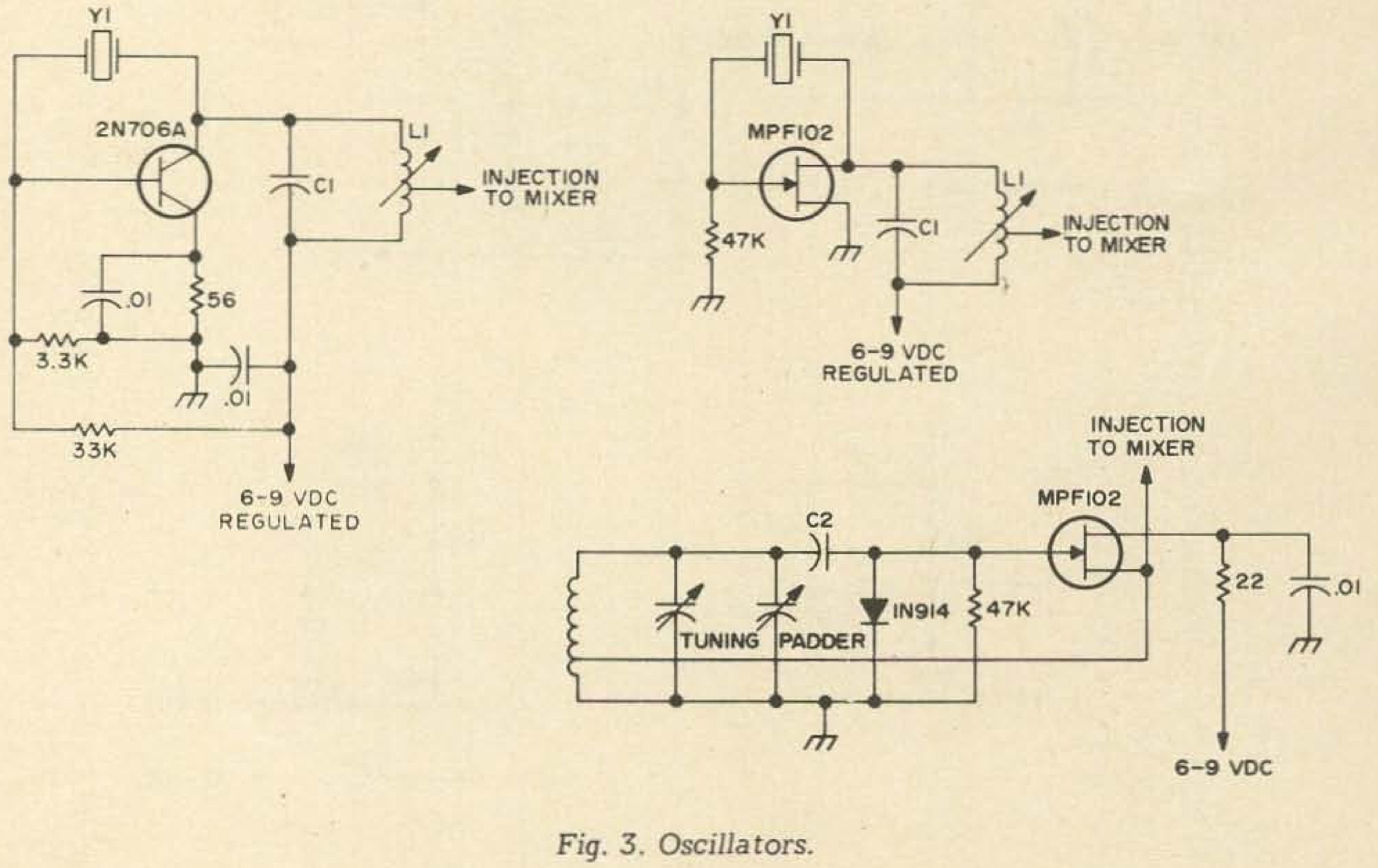

Fig. 3. Oscillators.

before soldering them in. I definitely prefer to use sockets, and with a little forethought this is possible in just about any VHF design. The use of sockets eliminates many potential hazards to the delicate MOSFET gates. NEVER INSERT OR REMOVE A MOSFET WHILE ANY VOLTAGES AT ALL APPEAR ON THE SOCKET TERMINALS!!!! Once a MOSFET is installed in a circuit, the problem of static charge damage is pretty well taken care of. But while preparing the device for installation, caution must be excercised. Even minute discharges such as those from your fingers on a dry day are dangerous. The method I use to avoid problems is so simple that it seems to have been overlooked. At least, I have never heard of it elsewhere: I use water.

Have a pan of water close by when you prepare to install a MOSFET. Before removing the packing short, immerse your hands, the MOSFET, and all tools which will contact it in the water. Since the MOSFET is hermetically sealed, it won't be damaged. Then remove the short, trim and form the leads, and insert it in the socket. Be sure you keep everything wet until it's finally installed. I guarantee you'll avoid any shorted-gate problems if you use this method.

Precautions must also be taken in the circuitry and mechanical design of equipment using MOSFETS which will be located in a strong rf field, as in a typical amateur installation. It is advisable to use *two* good relays in series between the transmitter output and the converter input to provide the greatest possible isolation from the transmitter. In the transmit position, the converter input can be shorted to ground by the extra relay. Back-to-back diodes (1N100s are fine) should be connected across the input gate of the first rf amp to limit the rf voltage appearing there to about 0.7V peak-to-peak. In addition, the lead from the input coil to the input gate and the lead from the input connector to the coil should be kept as short as possible to minimize any stray coupling. The entire converter should be carefully *sealed* to rf to keep everything out of the converter except what comes through the antenna input connector; and all stages

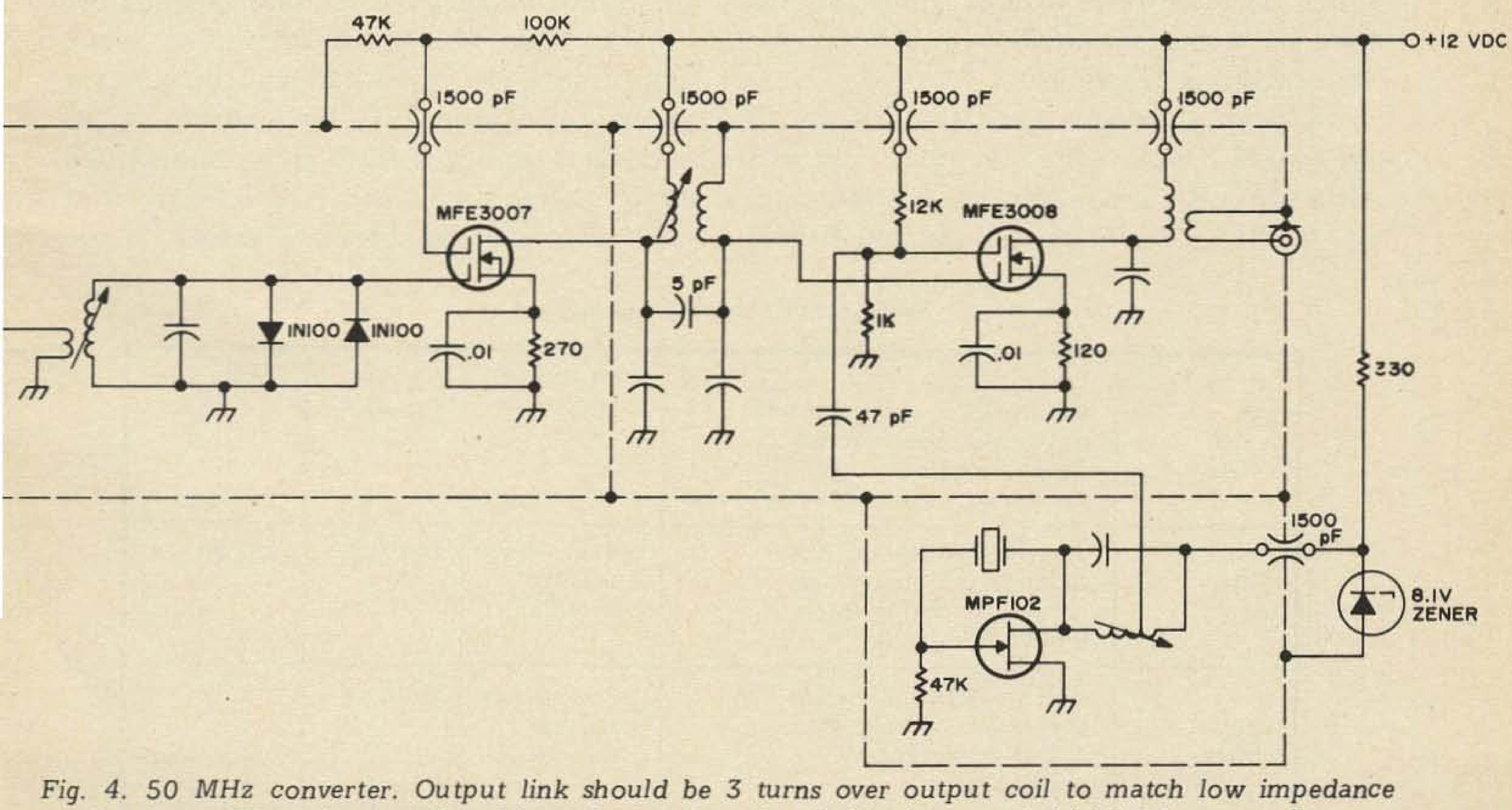

Fig. 4. 50 MHz converter. Output link should be 3 turns over output coil to match low impedance receiver input. Note the use of feedthrough capacitors for all dc voltages and shielding between all stages. Tuned circuit values will be found in Tables I–IV. Output coil of oscillator is tapped for injection voltage. It should run between 2 and 4 turns from cold end for .5 to 1 V peak-to-peak, but this will vary somewhat from crystal to crystal.

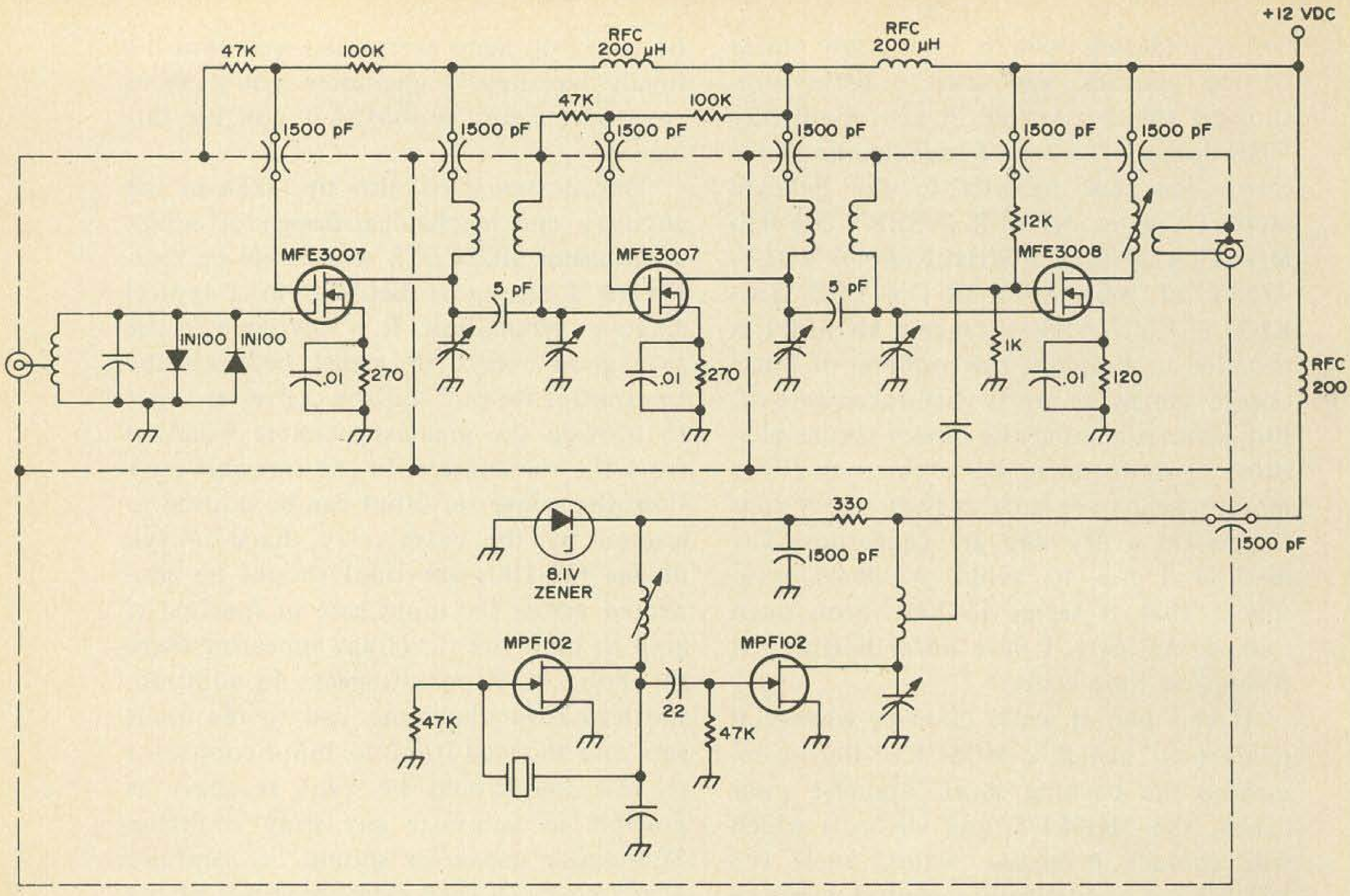

Fig. 5. Schematic of a converter for 144 or 220 MHz illustrates the use of the MPF102 JFET as a multiplier. Note that it is necessary to tap down on the coil to achieve proper injection voltage. Tuned circuit values will be found in Tables I–IV.

should be carefully sealed from one another. The converter diagrams illustrate the kind of layout required as well as the use of feedthrough capacitors.

Mixers shown use the Motorola MFE3008, while the rf amps use the MFE3007. RCA manufactures a wide range of MOSFETS which can be substituted directly for these devices, but I have found the Motorola MOSFETS easier to come by.

The basic rf amplifier building block will usually be used straight through at maximum gain in VHF installations. However, gain control options are shown. To apply them, break the lead in Gate 2 at "X" and add the circuitry shown in the

TABLE I: Rf stage components

Freq.	L1, L2	C1, C4	C2, C3	Typ. gain
50 MHz	8 turns #22, close wound on ¼" slug tuned form. Three turn link over L1 for input.	10 pF	1500 pF	24 dB
144 MHz	4 turns #20 tinned, 5/6" diameter, ½" long. Tap L1 1 turn from ground end for input.	8 pF plastic tubular trimmer	1000 pF	20 dB
220 MHz	4 turns #20 tinned, 5/6" diameter, ¾" long. Tap 1 turn from ground end for input.	8 pF plastic tubular trimmer	1000 pF	18 dB
432 MHz	#12 wire, 2½" long. Tap L1 at 1", L2 at 1 ¾". (See Fig. 9)	3 pF plastic tubular trimmer	500 pF	12 dB

TABLE II: mixer stage components, input frequency dependent

Freq.	L1, C1	C2	Conv. gain
50 MHz	Same as L1, C1 Table I, but without taps.	47 pF	15 dB
144 MHz	Same as above.	30 pF	12 dB
220 MHz	Same as above.	22 pF	9 dB
432 MHz	Same as above.	6.8 pF	6 dB

TABLE III: Mixer components i-f frequency dependent

i-f	L2	C3	Remarks
10 MHz	14 turns #22, close wound on 3/8" slug-tuned form	180 pF	Ok for 50 MHz, too low for higher bands.
14 MHz	9 turns #22, close wound on 3/8" slug-tuned form	120 pF	Ok for 50, barely acceptable for 144 MHz, too low for higher bands.
28 MHz	6 turns #22, close wound on 3/8" slug-tuned form	18 pF	Ok for 50, 144 and 220 MHz, acceptable for 432 only if necessary
30	6 turns #22, close wound on 3/8" slug-tuned form	15 pF	Same as 28 MHz i-f remarks.
50 MHz	8 turns #22, close wound on ¼" slug-tuned form; 3 turn output link	10 pF	Ok for 432 and 220 MHz, too high for lower bands.

TABLE IV: Oscillator components for preferred i-f frequencies

BAND MHz	IF MHz	XTAL MHz	OSC. TANK L	OSC. TANK C	MULTIPLIER TANK L	MULT. TANK C	MULT. OUT. MHz
50	10	40	10 t. #22 on ¼"	12			
50	14	36	Same as above	15			
144	28	38.66667	Same as above	12	6 t. #20 tinned, 5/16" d., ½" long	10 pF trim	116
144	30	38	Same as above	"	Same as above	Same	114
220	28	64	6 t. #28 on ¼"	6.8	4 t. #16 tinned, 3/8" d., 5/8" long	Same	192
220	30	63.3333	Same as above	"	Same as above	Same	190
432	50	63.66667	Same as above	"	Same as above	Same	191
					Same as L1 for 432, Table I.	Same	382

NOTE: Output taps for oscillator and multiplier coils are approximately 25% up from cold end.

TABLE V: Components for VHF vfo (ranges are approximate)

RANGE MHz	L	TUNING C	PADDING C
30 - 50	8 t. #22 on ¼" slug-tuned form	20 pF	20 pF trimmer
50 - 70	6 t. #22 on ¼" slug-tuned forrn	10 pF	20 pF timmer
80 - 100	5 turns #14 tinned, ¼" diameter, 3/8" long	20 pF	15 pF trimmer
100 - 130	Same as above	10 pF	10 pF trimmer
160 - 200	5 turns #14 tinned, ¼" diameter, 5/8" long	10 pF	3 pF trimmer

All source taps are 20—25% up from ground end.

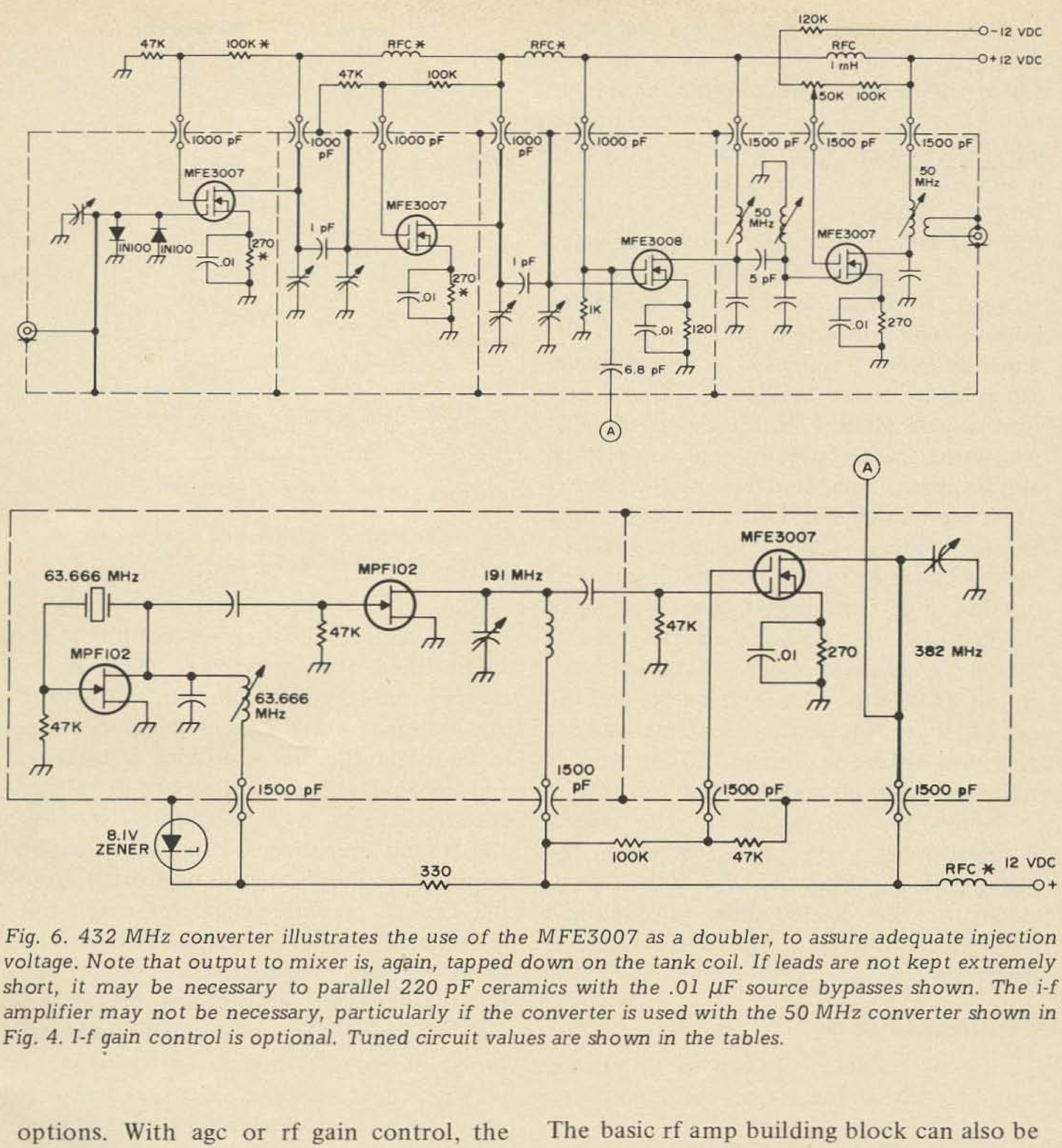

Fig. 6. 432 MHz converter illustrates the use of the MFE3007 as a doubler, to assure adequate injection voltage. Note that output to mixer is, again, tapped down on the tank coil. If leads are not kept extremely short, it may be necessary to parallel 220 pF ceramics with the .01 μF source bypasses shown. The i-f amplifier may not be necessary, particularly if the converter is used with the 50 MHz converter shown in Fig. 4. I-f gain control is optional. Tuned circuit values are shown in the tables.

options. With agc or rf gain control, the basic rf amp makes a fine i-f amp for use at low frequencies, or following a converter. Frequency dependent parts are marked with an asterisk, and values are broken down in Table I. RF stages can easily be cascaded by coupling L2 of the first stage to L1 of the second stage using 2 or 3 turn links or twisted wire "gimmick" capacitors. One stage gives more than adequate gain at 6m and below, but from 2m up, two stages are advisable for optimum performance. The basic rf amp building block can also be used as a multiplier in oscillator chains, though for economy and simplicity, the MPF 102 is preferred. Typical noise figure is under 3 dB. Approximate gain figures will be found in Table I.

Components marked with a single asterisk are dependent on the input frequency, and those marked with a double asterisk are dependent on the i-f frequency. For values, refer to Tables II and III respectively. Approximate conversion gain will be found in Table II.

*RFCs are #28 closewound over 47K ½W resistors, 8 to 10 turns. Noise figure can be improved by increasing source resistance and decreasing 100K resistor to keep G2 to source voltage at approximately 4V. Maximum possible source resistance is 750Ω. There will be some compromise in gain, and the noise figure can only be decreased by 1 dB at best, so it generally is not worthwhile.

There are several possibilities for basic oscillator building blocks. There is one factor which must be taken into consideration which is often ignored: the level of the injection voltage. With MOSFET mixers, it is advisable to keep the heterodyne voltage between .5 and 1V peak-to-peak. A voltage this low will not maximize conversion gain, but it will insure minimum spurious responses. Even at .5V, there is still more than enough conversion gain – 6 to 15 dB, depending on frequency. Although it is possible to design oscillators using single- or dual-gate MOSFETs, there is nothing to be gained from the additional complexity and expense, compared to a well-designed JFET or bipolar oscillator. Of the circuits shown in Fig. 3, I have found the JFET to be the easier of the two crystal controlled circuits to get working. It seems a bit more predictable and stable than the bipolar model. A pleasant surprise was the very simple JFET vfo. It is rock stable, and the output is very clean. It is recommended for any use where a tunable front end is required, up to about 220 MHz.

Note that the output of the crystal oscillators has to be tapped down on the tank coil to keep the injection voltage down to the desired level. Component values for a variety of i-fs will be found in Table IV

Construction Notes

Use of a shield between the input and output coils of the rf amps is imperative.

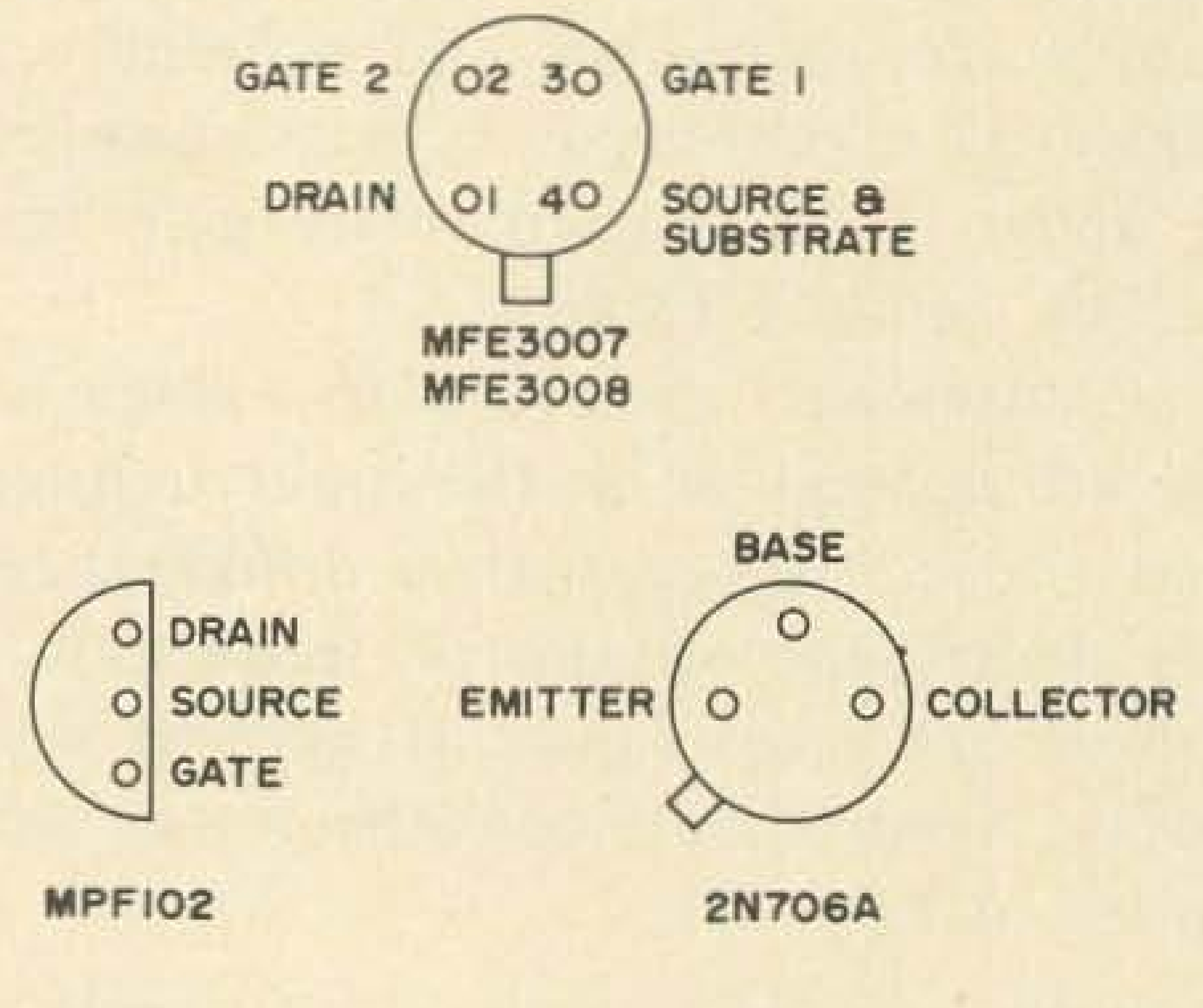

Fig. 7. Base diagrams of transistors referred to in schematics and text (bottom views).

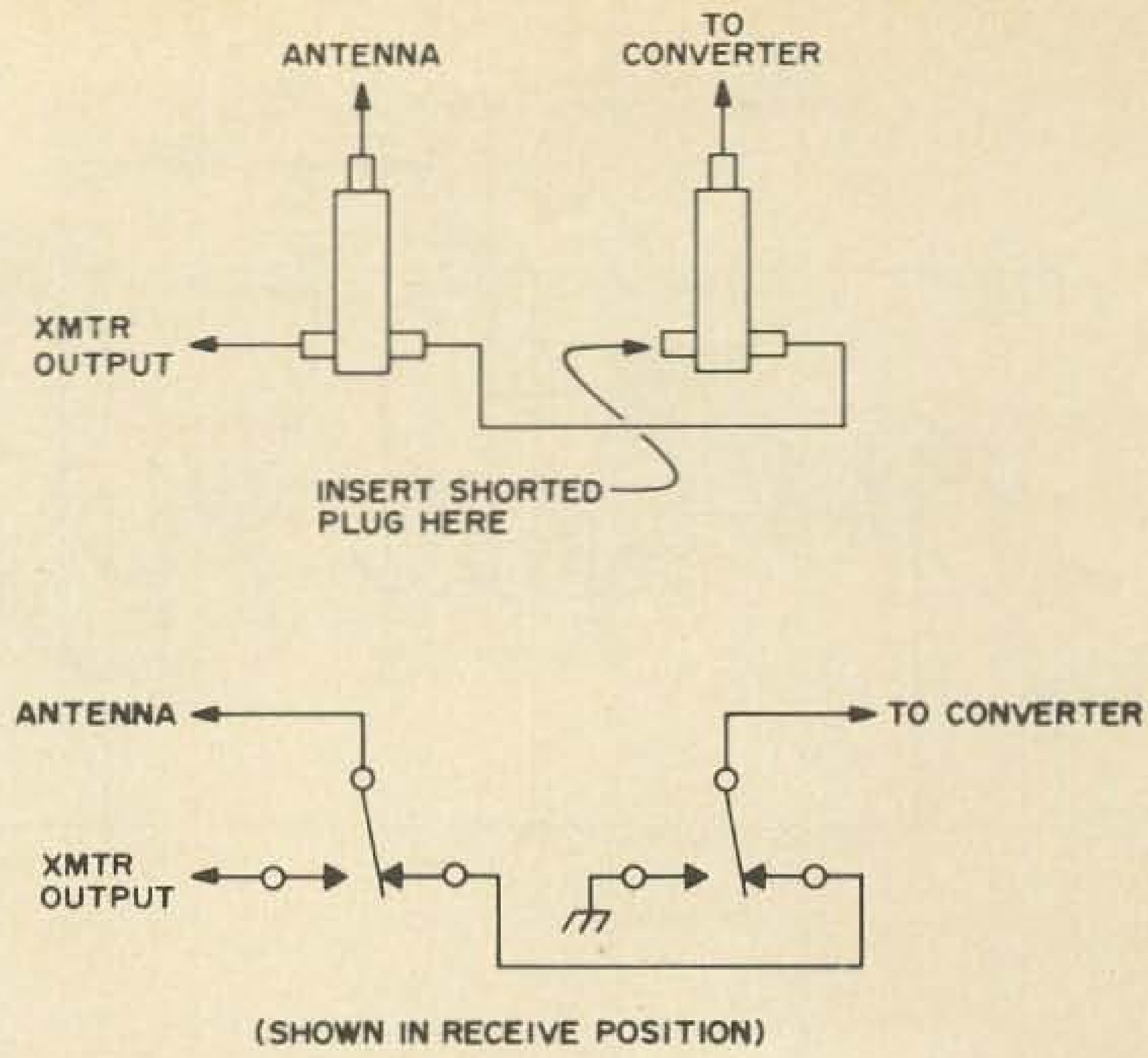

Fig. 8. Method of connecting antenna relays in series to protect MOSFET front end.

Feedtrhough capacitors are definitely recommended for everything going in or coming out (except, of course, for the signal connections). They will help eliminate another potential source of rf leakage, and instability. See the diagrams of various convertors, Figs. 4–8. Mechanical stability and sound shielding techniques must be observed to derive maximum benefit from the circuits presented here. Printed circuit techniques are not recommended because of rf leakage potential. Use copper clad board as a chassis, and enclose the bottom with an appropriate off-the-shelf chassis, in time-honored VHF homebrew tradition.

With these building blocks, and reasonable care, any moderately experienced homebrewer can put together converters which will truly approach state-of-the-art performance. The only empirical fiddling which will be necessary will be that required to maximize the signal-to-noise ratio in the first tuned circuit. Right now, I should warn you that some of my tuned circuit values are computed, while others are proven in performance. They should be right on the money, but if you have to do a little trimming here and there to get things to peak up, don't be upset with me. A few hours spent working with these building block circuits will pay off in unexcelled VHF reception.

. .W8RHR■

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$15 T-POWER SUPPLY

Interest in amateur mobile communications has recently been stimulated with the increasing availability of retired commercial FM equipment. For many years the workhorse of the mobile power supply has been the mechanical vibrator. Semiconductors that are capable of handling the same task with increased efficiency and dependability are available commercially. All preliminary design goals were exceeded in operation of this solid state vibrator replacement.

The necessary prerequisites were:

- Simple design with low construction cost
- Minimal modification of existing equipment
- Operational dependability regardless of ambient temperature extremes
- Reduction of conventional T-power noise on transmitted signal

Although direct application is made to the General Electric 30 Watt Progress Line, with no circuit changes the same device may be used with comparable vibrator powered equipment.

Construction

The basic circuit is a two transistor push-pull inverter (Fig. 1).

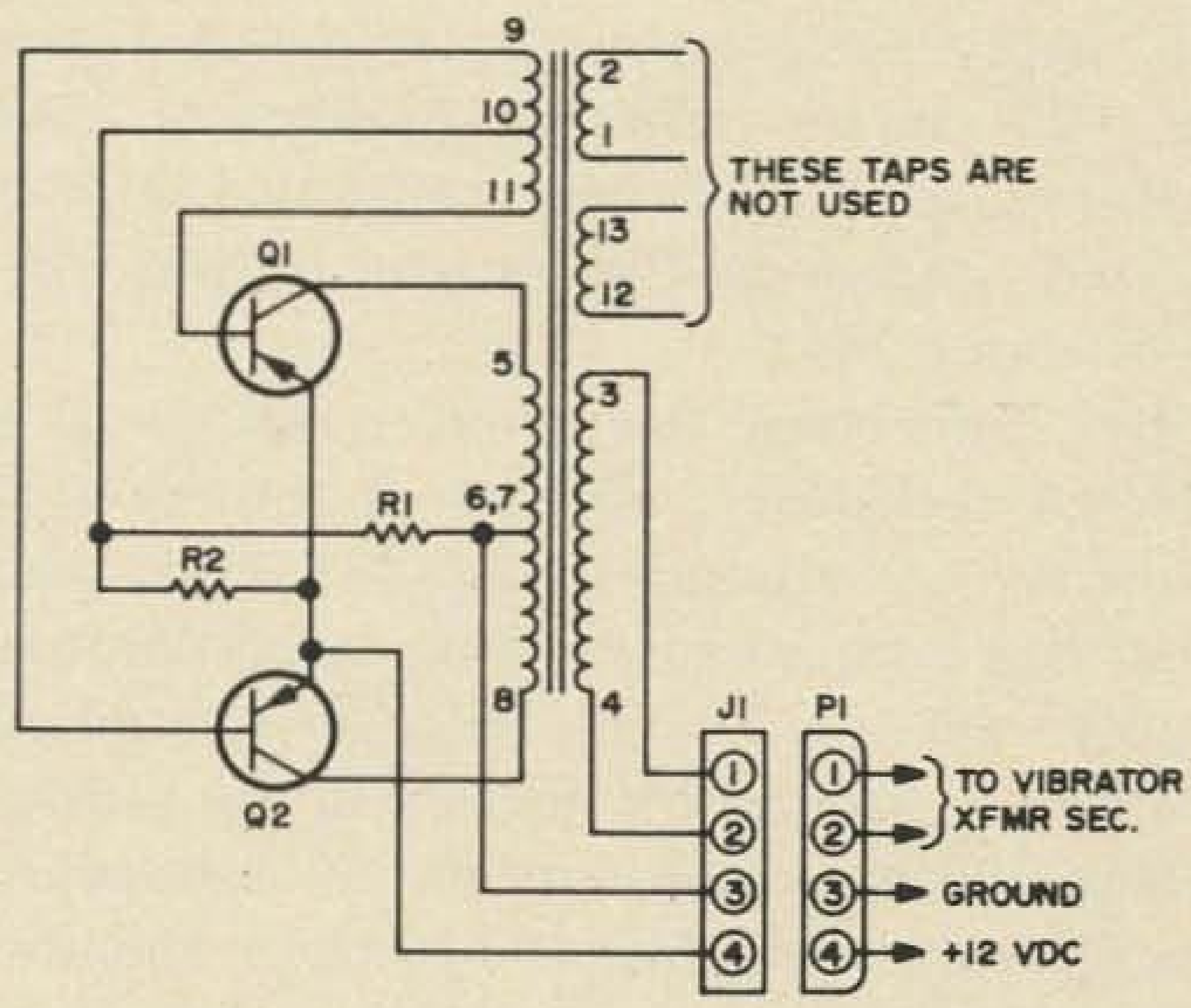


Fig. 1. Schematic diagram of T-power. R1 @ 200Ω, 10W; R2 = 10Ω, 10W; Q1, Q2 = Motorola HEP 233; T1 = Toroid T-2, $2.95 Tower Communications[1]; P1 = Cinch-Jones 4-terminal connector.

Any toroid with a suitable feedback winding for the transistors in use and a secondary section capable of 250V at 70W may be used for (T1). (R1) the starting resistor will supply a minimum of 0.6V on the feedback winding centertap for a supply voltage of 12.6V. This will insure dependable transistor starting with the low ambient temperatures that are encountered in mobile operation.

The Motorola HEP 233 power transistor's maximum ratings include a 30% safety margin on the collector-to-base voltage (Vcb) and collector current (IC) parameters. The HEP 231 power transistor may be used with increased savings in construction cost. However, this transistor should not be used in circuits requiring input power in excess of 70W. (Q1) and (Q2) are mounted on heatsinks and it is imperative that the TO-36 transistor case, the transistor's collector, be insulated from the chassis. A HEP 455 mounting kit provides insulation and maintains adequate heat transfer properties from the transistor to the heatsink.

The heatsinks are mounted on a 5x3x2 in. aluminum minibox. A chassis mounted 4-conductor Cinch-Jones receptacle provides input power for the inverter and transfers output voltage from the toroid secondary to the mobile power supply. The toroid transformer and associated components are mounted within the minibox. Several drops of epoxy cement secure the toroid to the

[1] *Tower Communications, 1220--22 Villa St., Racine WI 53403.*

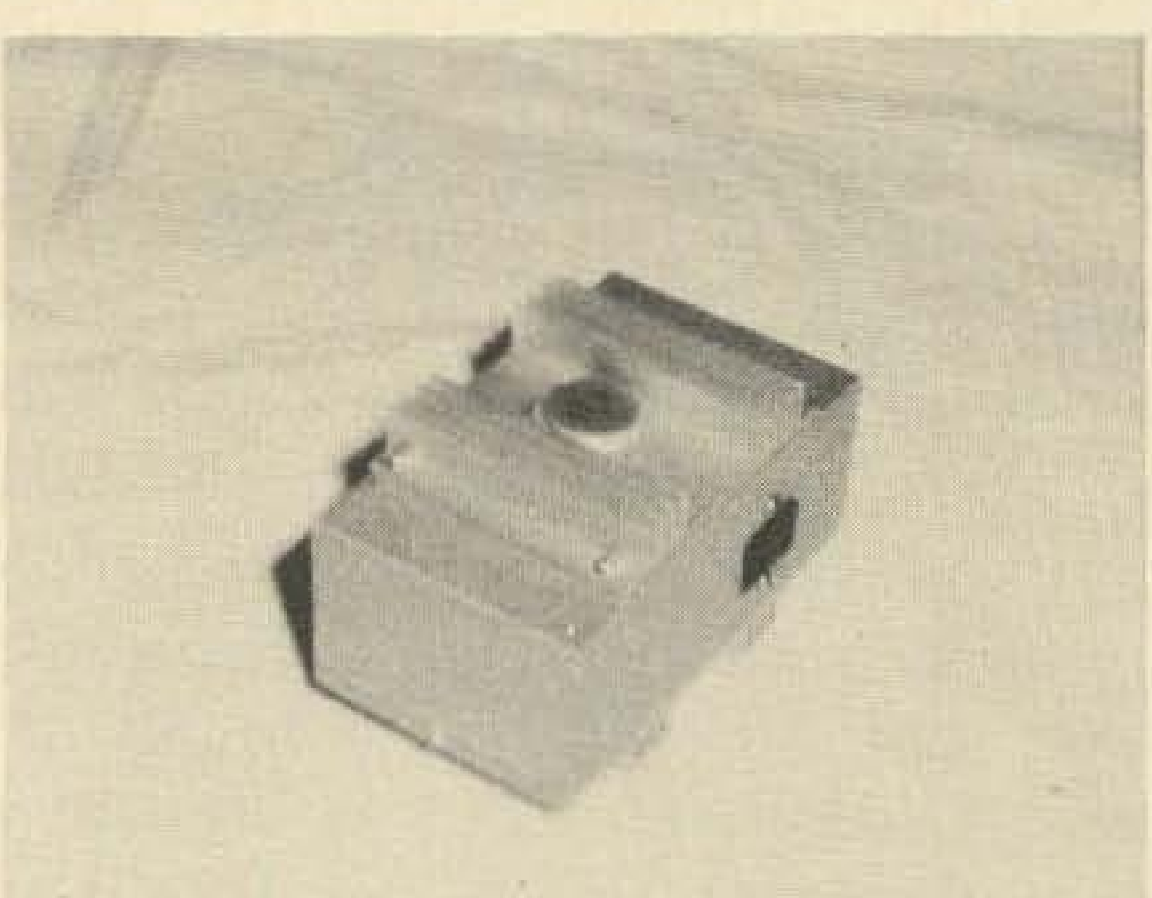
chassis. Any method may be used to secure the transformer provided the securing elements are of non-metallic composition. All connections to the individual transformer terminals are made with the assistance of a diagram supplied by Tower Communications with each purchase. Insulated 16-gage wire or larger is recommended for all connections.

Addition to Mobile Power Supply

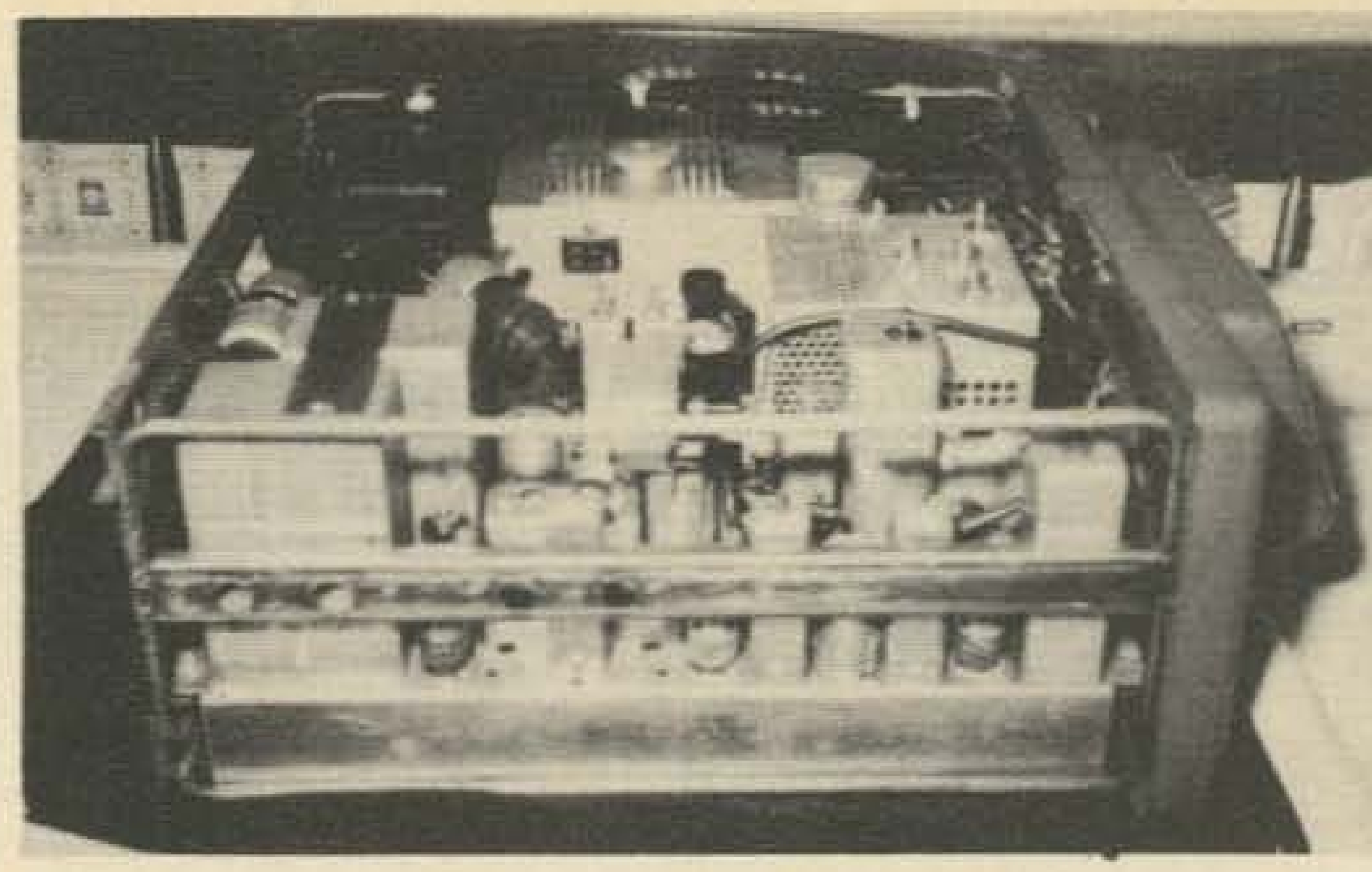
An ohmmeter is used to test the vibrator equipment prior to attachment to the mobile supply. Resistance measurements across the 12V input terminals indicate a 10Ω forward and 50Ω reverse resistance. Under no-load conditions, the inverter output voltage is about 285V.

By connecting the inverter output to a selected secondary winding of the vibrator transformer, existing relay functions and rectifying components of the original mobile supply are used. The desired secondary winding is located by measuring the output voltage from combinations of secondary transformer taps while the receiver operates from the vibrator supply. The combination, which develops 250V under receive load conditions, will function as an input terminal for the inverter output. The (BLACK-RED) and (RED-GREEN) windings are used with the General Electric Progresss Line 30 Watt vibrator supply.

The 12V inverter input voltage is obtained from an appropriate terminal on the battery input socket. Terminals 4 and 1 at connector (J501) are used with the General Electric power supply. The inverter unit may be mounted on the front panel of the transceiver basket or on the power supply chassis. The final modification prior to



Top view of unit shows large heat dissipation area provided by heatsink.



T-power unit fits snugly between power transformer and relay on Progress Line power supply strip.

operation is removal of the vibrator from its socket.

Summary

Installation of the T-powered vibrator replacement requires that the transmitter be retuned. Units using this power supply modification experience an input power increase of about 30%. Thus a heavy duty replacement for the final amplifier tube is recommended (i.e. 8298A or 6146W for the 6146A). Receiver B+ decreases about 10%. This slight loss extends the life of audio output tubes such as the 6AQ5 and does not impair receiver operation.

Examination of an unmodulated transmitter signal indicates little or no discernible audio distortion such as "T-power whine." The "whine" is filtered by choking action in the secondary winding of the vibrator transformer.

A significant improvement in the ambient noise figure of the receiver is noted with the T-power. Increased audio clarity on weak signal reception is very noticeable.

The T-power circuit described has been in use at my mobile station for over six months. Dependable service and improved equipment operation make this circuit a mandatory addition to any mobile installation.

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References

General Electric Progress Line Manual 144-174 MHz, 12V, Transistor Powered Mobile Combination FT-36 and MT-36.

Radio Corporation of America, *Power Circuits DC to Microwave*, 1969, pp. 162–199.

Tower Communications, data sheet supplied with toroid transformer T-2.

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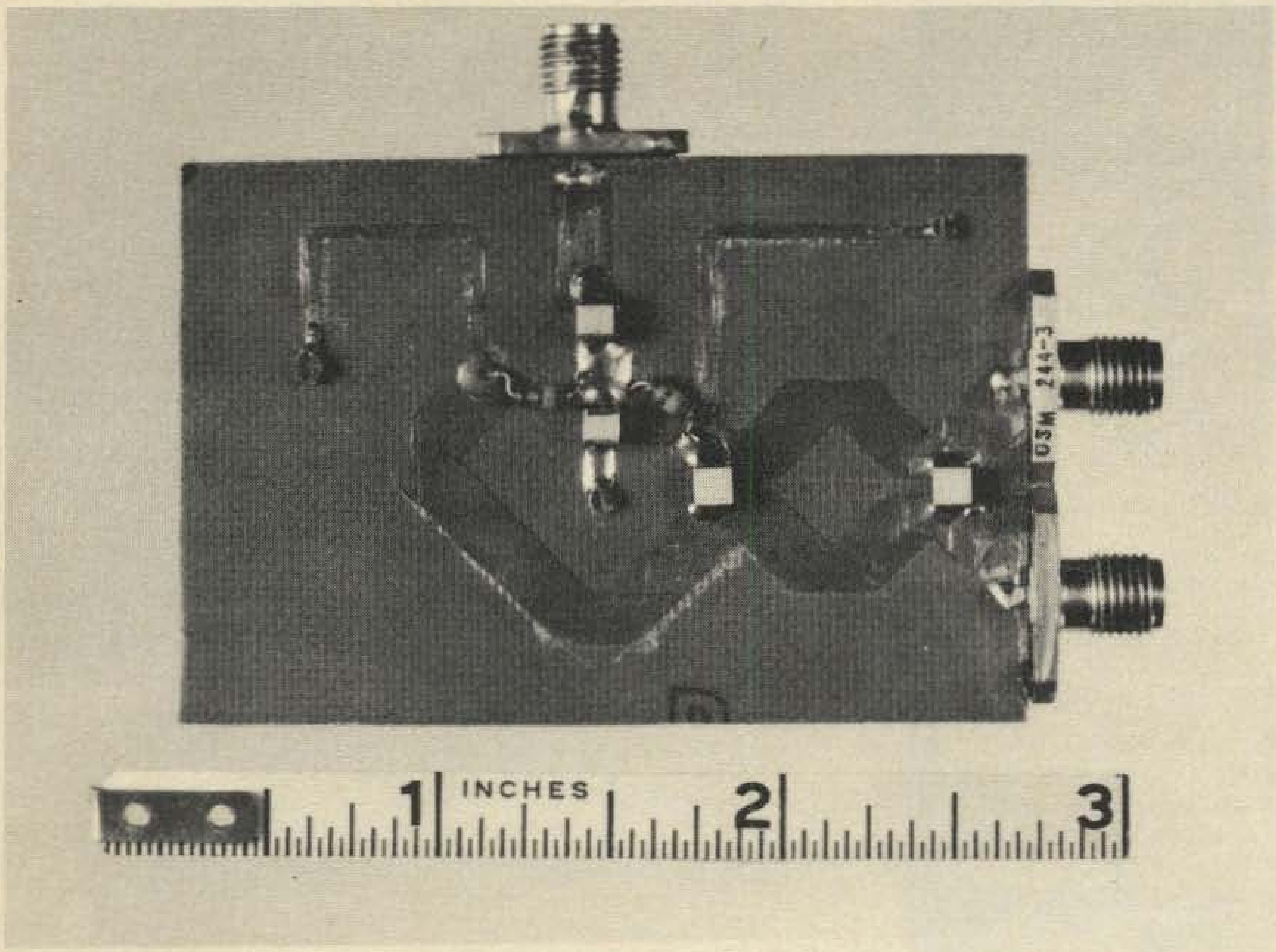

EASY-TO-MAKE 1296 MHz MIXER yielding a 6.5 dB noise figure

Microwaves are for the birds. You have to go out of the way with equipment to accomplish what is eaqual to a 10¢ phone call. That is how I thought about it for years. But then I saw microwave walkie-talkies with built-in spiral antennas for Astronauts – that turned me on. Microwaves are great for space as you know. Low power communications are made over long distances and small physical antennas with high gain can be used. The future of these frequencies looks bright in every way. There are hams in the Arctic, airplanes, ships and soon I'll bet in space. And you cannot call for 10¢ to Mars. Besides, every ham cannot buy microwave equipment from the shelf.

So I needed a mixer to start with. The ones I had seen so far did not appeal to me. You could hang a diode on an antenna with a local oscillator and have a mixer, but it should be at its best. To be just that, you need the following:

1. Low noise microwave diodes
2. Good impedance match
3. Get the signal to the diodes and not into the oscillator circuit.
4. Get the local oscillator signal to the diodes and out of the antenna.

To accomplish these points I used:

1. Microwave Associates MA 4882 Schottky Barrier Diodes
2. L4, L5 are a bit shorter than a quarter

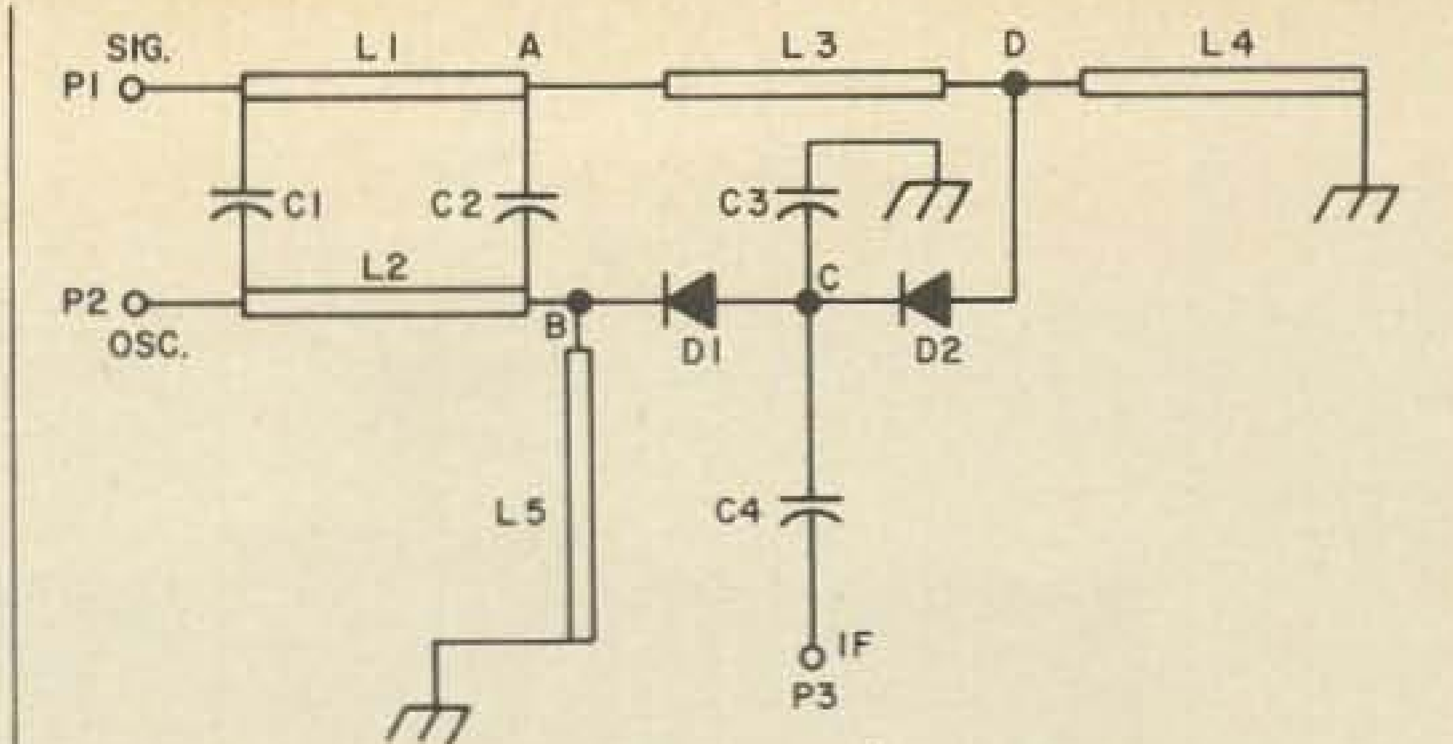

Fig. 1. Schematic. L1 – λ/8 50Ω micro strip line .176" wide, .755" long; L2 – λ/8 50Ω micro strip line, .176' wide, .755" long; L3 – λ/4 50Ω micro strip line .176" wide, 1.51" long: L4,5 – λ/4 micro strip line .050" wide 1.170" long; C1, C2 – 2.3 pF ± 0.1 pF Pellets 0.1" x 0.1"; D1, D2 – MA 4882 Microwave Associates; C3 15 – pF Pellet C4 – 100 pF. Dimension only good for a board with a dielectric constant of 2.5, two sides copper, 0.062" thick. The shape of L1, L2 is such that minimum coupling occurs. Capacitors from American Technical Ceramics, 1 Norden Lane, Huntington Station N.Y. 11746 were used. Order numbers are: C1, C2 – ATC 100 B2R3CP; C3 – ATC 100 B 150MP; C4 – ATC 100 B101MP.

wave, so besides the dc return path they are slightly capacitive to cancel out inductance

3. L1, L2, C1, C2 is a 3 dB 90° coupler. Power coming in Port 1 will be split between A and B with 90° phase difference. It is theoretically possible to have over 40 dB isolation between P1 and P2.

Through the λ/4 line of L3, 90° phase shift is added and any signal coming in will be split and 180° out of phase between D and B. So signal oscillator and dc should be balanced out at point C leaving only the difference at Port 3. C3 will ground any remaining signal and oscillator rf after mixing. C4 is a dc block for the i-f.

The coupler alone, (see Fig. 2) was made first to measure its performance. In the final mixer version it is hard to do that, especially after the diodes are in. They will multiply any signal and reflect these harmonics. Then I went to Fig. 3, soldered the components in and was surprised how well it worked. Watch for the distance of C1, C2 (see Fig. 3). As a substrate, double copper clad teflon fiberglass was used. To follow dimensions of Fig. 3 it must be 0.062" thick with a dielectric

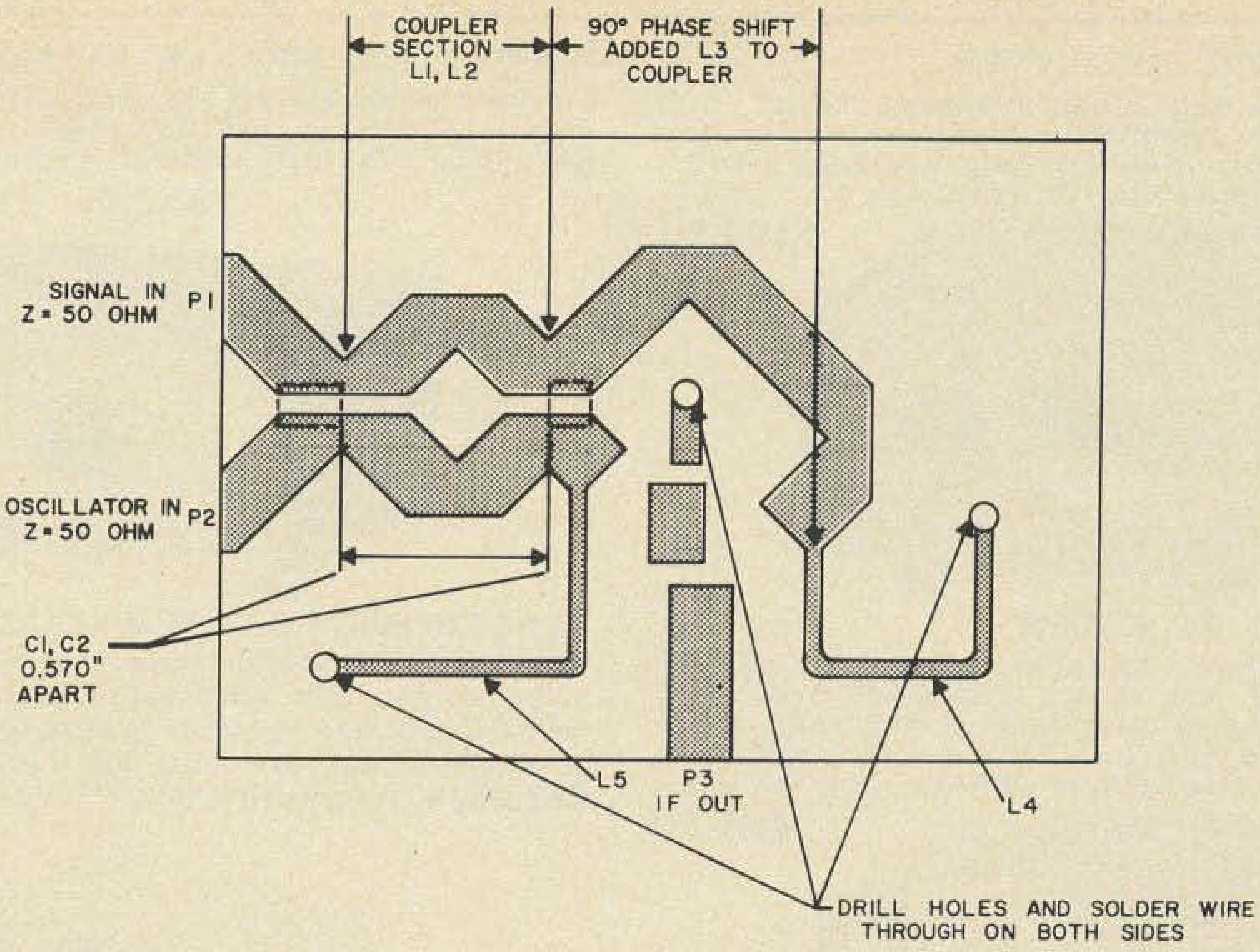

Fig. 3. Printed circuit board layout.

constant of 2.5, such as for teflon fiberglass. Photo etching would have been perfect, but not feasible, so both sides of the board were taped. The back side of the copper is needed as a ground plane. Then a drawing as in Fig. 3 was glued over it and cut out with a razor blade; the paper and tape where no copper should be was peeled off. After etching I drilled the three ground holes, stuck wire through and soldered it on both sides. As connectors I used OSM 244-3 with the mount soldered to the bottom foil.

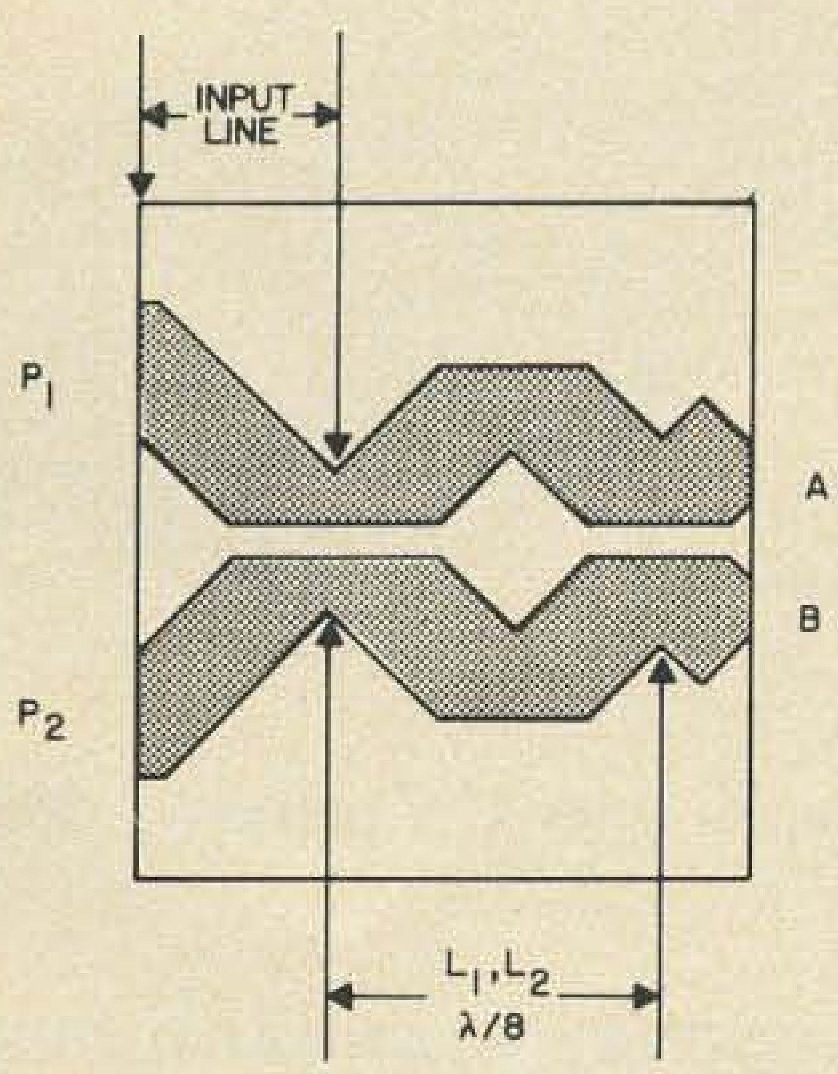

Fig. 2A. Board layout.

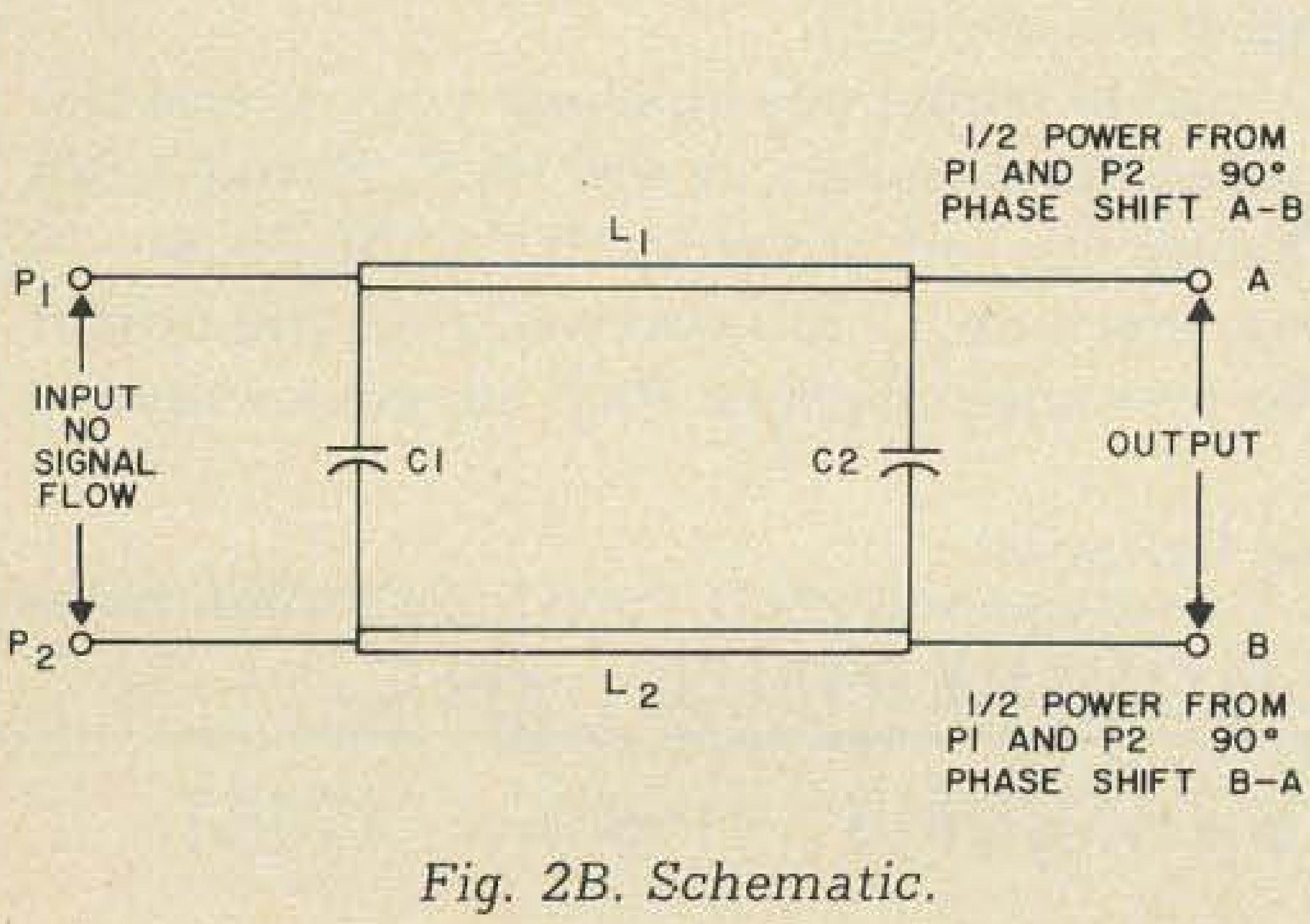

Fig. 2B. Schematic.

If you are not familiar with micro strip let's talk about it first, since the whole layout is based on it. It is similar to coaxial transmission line. Let's take L1, Fig. 2 – it consists of a .176" wide .755" long strip and a ground plane on the other side with a dielectric of 2.5 in between. The result is a $\lambda/8$ long 50Ω line. If it is made wider or the dielectric constant is higher the characteristic impedance will go down. Most of the electrical fields are contained between strip and gound plane. L1 and L2 are shaped in such a way that minimum coupling occurs.

Being fairly accurate with dimensions, this mixer should work very well. The lowest noise figure I got was with 2.8 mW local oscillator signal 60 MHz below 1296 MHz. An H-P noise meter with an i-f noise figure of 2.5 dB was used for the measurements, so that the actual mixer noise is even below 6.5 dB. Commercially available mixers with that noise figure will typically cost about $100.

I'd like to thank Raymond Camisa and Wheeler Laboratories for helping me complete the mixer. . . .WB2YVY

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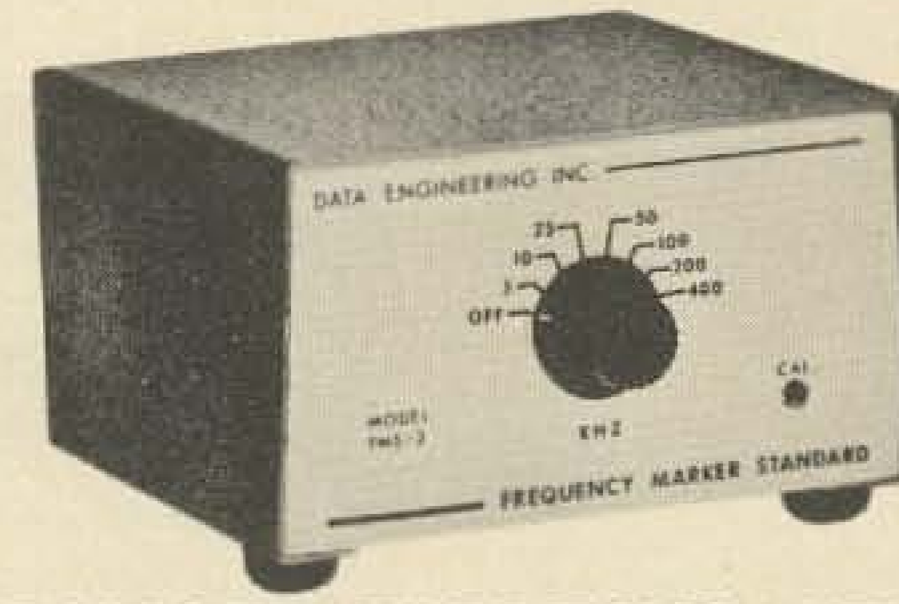

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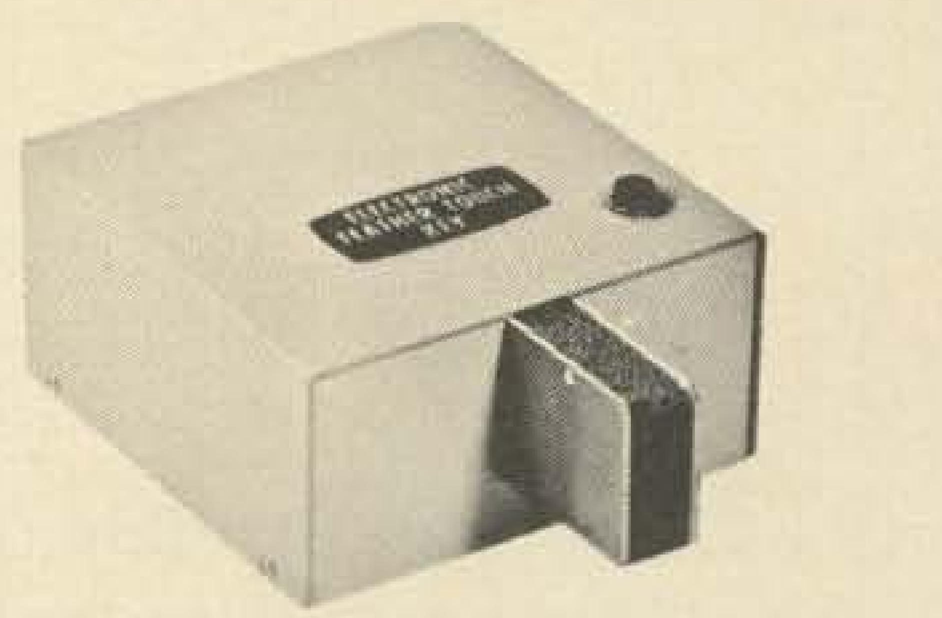

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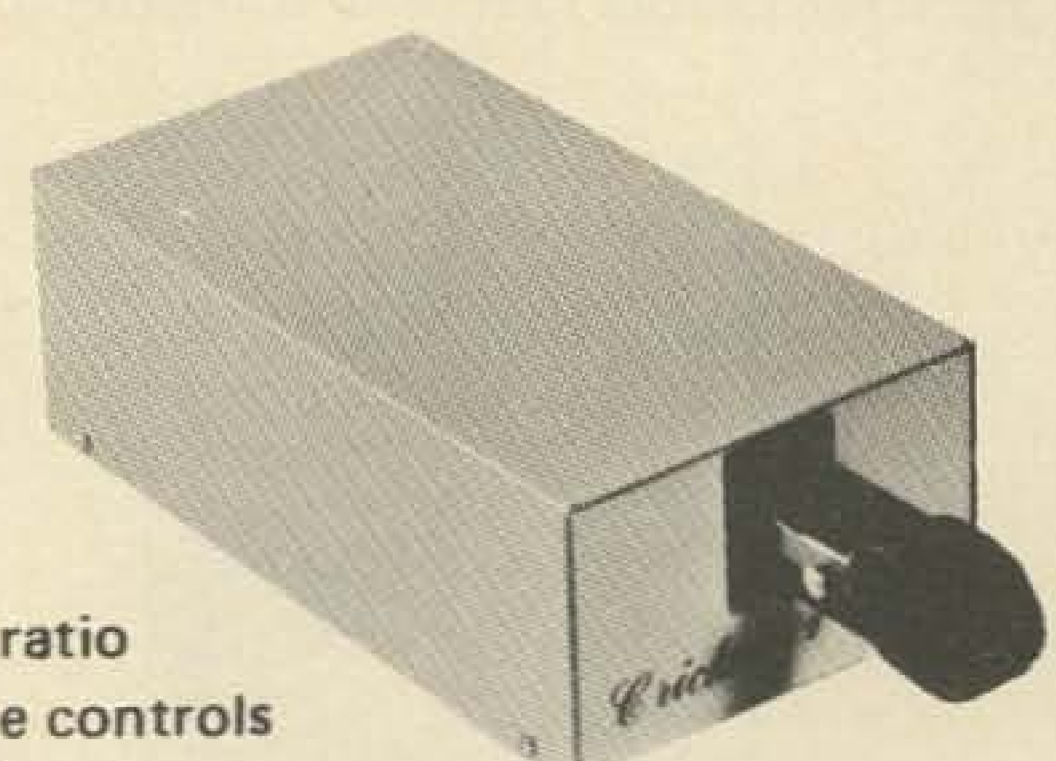

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VHF REPEATERS IN EUROPE

A status report with some vacation planning tips.

The rapid growth of repeaters in Europe and the fact that temporary operating licenses can be obtained by U.S. amateurs in many European countries opens the way for the U S. amateur visiting Europe to enjoy VHF FM operation. The advantages of such operation as compared to carrying along HF gear are many. First of all, the equipment itself that is required is relatively simple. Any number of the commercially available or home-built transceivers that are battery operated and deliver 1–2 watts output will fit in a suitcase and will suffice for most repeater operation. Antenna requirements are simple and a simple whip antenna can be used or a portable beam be made of wire elements for indoor use which also will easily slip into a suitcase. But, the greatest advantage of VHF FM operation in Europe is probably the contact that it allows with local amateurs. As in the U.S., the operators that use most repeaters in any given city pretty well get to know each other through repeated QSO's and the QSO's tend to get somewhat "stale" at times. A new station and particularly one speaking English and using a special temporary call sign will usually find a special welcome on a repeater channel that is far more pleasant than that experienced on HF (more on operating habits and courtesy later). Last, but not least, one may be able to operate 2 meter FM in Europe although one has less than a General Class license and therefore could normally not secure a reciprocal license.

Licensing

The material in this article is mainly directed at the amateur visiting Germany, Austria or Switzerland since the repeater possibilities are the most developed in these countries. All repeaters in these countries are also available to any amateur to use (private repeaters are basically not allowed). Germany, particularly, has a large and developing repeater network throughout the country. Many other countries plan repeater networks, such as England, but do not have repeaters yet in operation because of technical approval and details that remain unresolved with their administrations. The latter is unfortunate for the visitor since 2 meters as such is a popular band in England and a number of beacon transmitters are in operation. As a matter of interest, there are some 60 VHF beacons operating in Europe including 40 on the 2 meter band and 11 on the 432 MHz band. However, before any operation can be undertaken one must, of course, secure the necessary temporary operating license on the basis of one's U.S. operators license. Given below are the addresses to write to in order to secure the necessary application forms. A photostat of one's U S. license is required and a small fee of a few dollars. Be sure to fill out the application form as directed and also to take care of the licensing arrangements a few months ahead of time. In most cases the amateurs who handle the details of securing the reciprocal licenses from the necessary authorities in their countries do so on a volunteer basis and one should attempt to help them as much as possible. Try to remit the necessary fees in the amount required in their currency rather than sending a simple personal dollar check which requires that they go through an extra effort to have the currency converted. The service that is provided is usually very fast and efficient. For instance, the last time I applied for a temporary license in Germany, it took only about 2 weeks to complete the whole transaction. A license was received authenticated by the necessary Post Department authorities (a branch of the Post Office Department acts as the equivalent of the FCC in almost all European countries) and it was complete with a detailed booklet, in English, which explained the operating regulations, power limits, etc. Be sure to indicate that operation only on VHF will be undertaken if one has only a Novice or Technician Class license.

For Germany write to:

Deutscher Amateur Radio Club
International Affairs
Muehlenstr. 27
5601 Doenberg /Wuppertal, Germany

For Austria write to:

OVSV Dachverband
Attn: OE1WN
P.O. Box 999
1014 Vienna 1, Austria

For Switzerland write to:
Generaldirektion der PTT
Sektion Allgemeine Radioangelegenheiten
3000 Berne, Switzerland

Equipment to Use

This section covers the frequency channels in use but a word about the FM equipment in use in Europe might first be in order. In general, one will find that 2 meter FM has generally gone down the same equipment development phases in Europe as in the U.S. Much of the initial 2 meter FM work, particularly mobile, was done using FM equipment converted from commercial surplus. Instead of names like Motorola or GE, many amateurs will report that they are using Siemens, Telefunken or Storno equipment. The power levels in use tend to be somewhat lower than in the U.S. with mobile installations rarely exceeding the 25 watt output level. Repeater installations also tend to be low-powered and often the Postal authorities limit the repeater power levels to 15 watts output. Today, the amateur sales market in Europe is in full bloom with Japanese made equipment. Almost all of the brands sold in the States (and some not yet sold in the States) are available, although sometimes under different brand names depending upon which company has picked up the distribution rights from the original Japanese manufacturer. For instance, the Drake TR-22 is sold under the original manufacturer's name as the Trio TR-2200. The Tempo line is sold under the Yaesu or Sommerkamp labels, etc. But the imported equipment is basically the same as that sold in the mp labels, etc. But the imported equipment is basically the same as that sold in the U.S. although it may be a bit confusing at first when one describes his station in a QSO and finds that in spite of different names, the equipment is the same.

A price comparison for imported equipment of a similar nature in Europe and the U.S. is difficult because of the accessory items that are sold in some cases as part of the equipment and in other cases as extras. German distributors tend to market the Japanese equipment exactly as it is packaged for use on the Japanese market. That is, with a few standard Japanese channel crystals installed (useless in both Europe and the U.S.) and with the original Japanese equipment manual perhaps supplemented by a very brief translation of the most important circuit features. For this reason, one may find Japanese equipment costing a few dollars less in Europe, but the difference is not significant.[1]

Nonetheless, one may want to consider purchasing some VHF equipment in Europe. There are the advantages that one doesn't have to worry about transporting the equipment and going through customs. The equipment can also be ordered with crystals installed and tuned up for use on the main European repeater channels. One may also be able to work out a purchase-repurchase arrangement with an equipment dealer, since the FM equipment market is strong for both new and used gear, so one would in effect be renting the gear. One would have to work out these arrangements on an individual basis. The place to start would be to write for a brochure on the VHF FM equipment available to some of the larger dealers in amateur equipment, such as:

Hannes Bauer Company
P.O. Box 2387
Bamberg, Germany

or

Richter Company
Grabben Strasse 9
Hannover, Germany

Both of these companies also provide full-size catalogs of all of their amateur gear, but the cost of each catalog is $2.50.

Tone signaling is not yet used on most repeaters, except in Switzerland. If it is used (indicated in next section), a standard tone frequency of 1750 Hz is used. Only one or two repeaters, such as the Berlin one, use complicated entry signals which generally would not be useful for the visiting amateur to provide for. The definite trend on 2 meters is towards repeater entry via a 1750 Hz tone, although for the next year or so

[1]These radios are often redesigned in order to meet FCC specifications for emission. Tests at the 73 labs have confirmed that the difference is substantial – Ed.

one will be able to use most repeaters without any tone entry. If one already has a tone generator built into a 2 meter FM transceiver, it would be a good idea to reset it for 1750 Hz if its present frequency is much more than 50 Hz removed from this frequency.

Repeater Channels in Use

The installation of repeaters in Europe is growing rapidly and in some countries, particularly Germany, one can find a repeater to enter from practically any corner of the country. This rapid growth of repeaters has brought with it the usual problems of channel spacing and overlaps in coverage so repeater frequencies are subject to change. Nonetheless, the repeater frequencies shown here should certainly be useful throughout 1972.

As one reviews and studies the development of 2 meter FM repeater installations in various countries of the world, a rather sad picture emerges about amateur radio. Repeater channels in most countries were chosen on the basis of the channel spacings common for commercial surplus FM equipment. But for a hobby that is supposed to be as "international" as amateur radio and with all the international cooperation that is supposed to exist among the amateur organizations, one would think that as 2 meter FM enters its second generation that some order would be agreed upon for at least the main repeater frequencies. Instead, if one looks at the Japanese FM channels, the U.S. channels and the European channels, they are all different and what is perhaps worse, the planning that goes on for future repeater channels will keep them all different. Even the so-called "calling frequencies" in each country are different. This is all in spite of the fact that aside from some small exceptions, the first 2 MHz of the 2 meter band is designated for amateur usage in Regions I, II and III of the world by the ITU.

Germany

Germany has two major calling frequencies designated. One is 145.000 MHz and the other 145.150 MHz. Unfortunately, the latter frequency corresponds to one of the repeater frequencies and if one wanted to equip a transceiver for a simplex channel, 145.000 MHz would be the better and more common choice. However, a calling frequency channel is not necessary and for a low-powered transceiver may prove fairly useless. After all, if one is using a 1 watt transceiver with a simple whip antenna only slightly above ground level or in a city hotel room, one might as well walk the short distance covered via a direct channel.

Repeaters cannot be freely put into operation in Germany and a great effort has been made to develop an overall frequency plan for repeaters. Basically, a special permit is required from the German equivalent of the FCC to erect a repeater and this permit will not be granted unless the German Amateur Radio Club (equivalent of ARRL) first approves the repeater proposal as being compatible within the existing system. Repeaters can have a maximum power output of 15 watts and a deviation of ±5 kHz. Vertical polarization is used and the repeater identifies itself at least every ten minutes by F2. At the present time, a tone signal is not used to open most repeaters, but the definite trend is to use a 1750 Hz tone to open the repeater. At the moment, there are four repeater channels designated:

Channel	Transmit to Enter	Receive On
1	144.150	145.750
2	144.200	145.800
3	144.250	145.850
4	144.300	145.700

These channels with 50 kHz spacing were arranged on the basis of the 50 kHz channel spacing formerly used by commercial FM gear. A plan has been started by the German Radio Club to convert to 25 kHz channel spacing and to create 3 more standard repeater channel. If one is planning on visiting specific cities, one can search out the channels necessary. For general travel, it is obvious that equipping a transceiver for the new channels 2, 4 and 6 will provide the broadest coverage. There are two repeaters that operate on non-standard frequencies, probably because of their partial coverage into East Germany so East German stations can also be contacted. One is the Berlin repeater DLØSB (transmit on 145.150, receive on 145.600). A tone sending the number 6 opens the relay. The other is the Elm mountain repeater (transmit on 144.800, receive on 145.900). The following are the standard channels and repeater locations in Germany:

Channel	Transmit to Enter	Receive On
2	144.150	145.750
3	144.175	145.775
4	144.200	145.800
5	144.225	145.825
6	144.250	145.850
7	144.275	145.725
8	144.300	145.700

Channel	Call Sign	Location	Licensee
2	DBØWF	Berlin (radio tower)	DL7OG
2	–	Cham	DC6YC
2	DBØXA	Coburg	DJ7WH
2	DBØWW	Duisburg	DC6WR
2	–	Feldberg (Rhein – Main)	DC8VC
2	DBØXH	Hamburg	DL6FX
2	DBØWH	Hannover	DJ1UY
2	DBØZF	Kaiserstuhl (Freiburg)	DJ8PK
2	–	Kassel	DJ1XJ
2	DBØWK	Konstanz	DK1MW
2	DBØWL	Lahr (later channel 6)	DL9QD
2	DBØZM	Munich-City (later channel 6)	DK5MZ
2	DBØZN	Nuerberg	DK2YV2
2	DBØZØ	Osnabrueck	DJ7ZS
2	DBØWR	Stuttgart	DK4SU
2	DBØWB	Winterberg (Au/Inn)	DC1MT
3	–	Bad Koenig	DL2WN
3	–	Bocksberg (Harz)	DJ3JW
3	DBØWG	Goeppingen	DJ4LY
4	DBØWA	Aachen	DL6IM
4	DBØXB	Baederstrasse (Baltic Sea)	DK6HD
4	–	Bamberg	DC1NY
4	–	Bentheim-Lingen	–
4	DBØWC	Bremerhaven	DC8FD
4	–	Darmstadt	DC6FG
4	–	Deggendorf	DJ3SF
4	DBØWD	Deisier	DJ6JC
4	DBØZR	Dortmund	DJ4VR
4	DBØXR	Dreilaendereck (Loerrach)	DJ4Q4
4	DBØZZ	Grab*	DL8XY
4	DBØXG	Greding	DL8ZY
4	–	Hersefeld	DK2RH
4	DBØYK	Homberg-Kaiserslautern	DC8DY
4	–	Koblenz	DK4PW
4	–	Leer/Ostfriesland	DJ9ZW
4	–	Lindau-Northeim (Hannover)	DL9AD
4	DBØZL	Luechow/Elbe	DC8XT
4	DBØWS	Siegen	DL8KV
4	DBØWX	Triberg	DJ8MY
4	DBØZW	Weiden	DJ9HO
5	–	Hoher Meissner	DC6EE
5	DBØWN	Ochsenwang	DJ2GO
6	–	Andernach-Mayen	DJ5GU
6	DBØZA	Aschberg (Rendsburg)	DC8C8
6	–	Bremen	DC6CA
6	DBØWT	Detmold	DK3RC
6	DBØWE	Essen	DJ1HT
6	DBØWS	Goslar-Steinberg	DJ4JI
6	DBØZH	Heidelberg	DL1LS
6	DBØYH	Hoechenschwand (Black Forest)	DJ9ZK
6	DBØWV	Hoechsten	DJ3CH
6	–	Koeln-Bergheim	DJ3RD
6	–	Knuell	DL8MC
6	DBØXS	Merzig/Saar	DK1MG
6	DBØWM	Muenster/Westf.	DC6EH
6	DBØZB	Ochsenkopf	DJ7EW
6	DBØWZ	Wuerzburg	DK2DT
7	DBØZU	Zugspitze (currently ch.6)	DJ9HJ
8	DBØXA	Altenwalde	DJ9CR
8	–	Kalmit	DL8UX
8	DBØYY	Ludwigsburg (later channel 3)	DJ4XO

*5 second tone to enter.

Austria

Austria has generally followed the same philosophy in developing a 2 meter repeater network as in Germany. The Austrian system is not as yet developed as the German one but progress is being made. Many Austrian amateurs who live near the German borders using the German repeaters, along with the relatively low amateur population may account for the lack of development of a repeater network in Austria. The channels used in Austria are the same as those used in Germany so refer to the German channel frequency listing for the following Austrian repeaters:

Channel	Call Sign	Location
1	OE5XGL	Altmuenster
2	OE5XUL	St. Johann
2	OE7XTI	Innsbruck

The above repeaters are in operation presently. In addition two other repeaters, one in the OE3 and one in the OE6 sector of Austria, should be in operation later in the year. No details are available on these latter repeaters as yet but they will most likely use the same channel as the above repeaters.

Switzerland

2 meter repeaters are not allowed by the postal authorities in Switzerland but they are allowed in the 432 MHz band. Amateurs there have therefore turned to developing a network of 432 MHz repeaters. Two standard channels are used:

Channel	Transmit to Enter	Receive On
1	431.050	438.920
2	431.200	438.800

The repeaters in use are:

Channel	Canton	Entry Tone Frequency
1	Zuerich	1160 Hz
1	Luzern	1595
1	Fribourg	1290
2	Luzern	1160
2	Solothurn	1160
2	Appenzell	1595

The tone call is necessary to open the repeaters. The repeater frequencies are compatible with the 432 MHz repeaters in Germany although there are only two such/latter repeaters in use, one in Frankfurt using channel 1 and one in Giessen using channel 2.

Operating Habits

As was mentioned before, foreigners will find a nice welcome on VHF FM but the way to start is not by breaking up a QSO that is taking place. Take the time to listen first to see what the operating practices are like. Most amateurs will try to keep their QSC's over repeaters relatively short and will particularly try to give preference to mobile stations calling in. Even in spite of the language problem, it is relatively easy to learn to recognize when the repeater is free. Then a short QRZ in English can be called. Often, one will fine many stations eager to have a QSO in English and perhaps sometimes too many. If one finds too many stations lining up for a QSO it would be a good idea to go QRT for a while rather than monopolize the repeater. After all, it is their repeater. Most stations will be glad to exchange QSL cards if desired although one sometimes hears the comment that repeater QSO's aren't really direct QSO's and therefore don't deserve QSL's. Phone-patching is not done so don't bother to ask for it.

Antennas

Taking a small transceiver along on a vacation trip can generate some antenna problems. A simple whip antenna such as that built into some transceivers will work fine in a good high QTH but normally supplementing it with a better antenna will prove worthwhile. One of the simplest antennas to use is a folded dipole cut to frequency much like an indoor FM dipole. A small balun of the type used for broadband FM-TB 300 Ω to 75Ω conversion will handle 1 – 2 watts and can be mounted at the transceiver so twinlead can be used to the folded dipole which is also constructed from twinlead. The advantage to this type of antenna is that it can be moved around in a room for the best results while the transceiver remains stationary. The antenna can be fastened to a window with tape. The dimensions for such an antenna for 2 meters are shown in Fig. 1A. If one wants to get just a bit more elaborate, a portable beam can be constructed using the rods formed from metal clothes hangers and a few banana jacks and plugs. By choosing the antenna

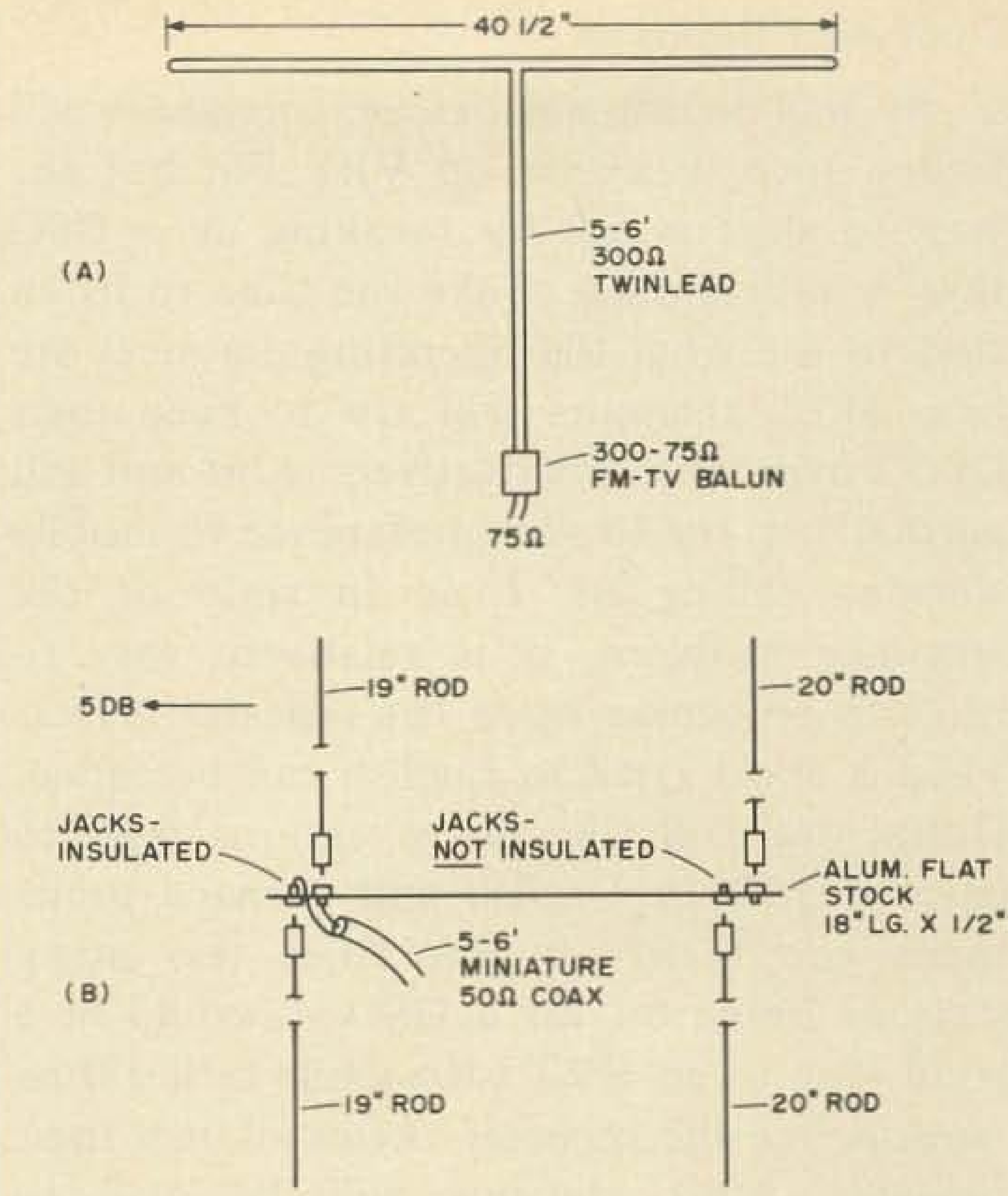


Fig. 1. Two simple antennas for 2 meters.

dimensions properly, as shown in Fig. 1B, the driven element will directly match a coaxial cable feed. The whole antenna just plugs together in a matter of seconds and can be easily transported. In use it can be supported from a piece of furniture, taped on a window, etc. The 5 dB of gain provided will easily make the difference at times between being able to activate a repeater and not being able to do so, as I have often experienced when using a TR-22 and the antenna inside a room. Use miniature coaxial cable to feed the antenna such as RG174 or RG178. The difference in attenuation between these cables and RG58 or RG59 for lengths of 5 - 6 feet at 2 meters is not significant and the miniature cables can be handled conveniently like hook-up wire.

... W2EEY

Glen E. Zook K9STH
818 Brentwood Lane
Richardson TX 75080

LOW COST THICK FILM RF PREAMP

This article presents a low cost rf preamplifier most economically expressed in thick film technology. Input and output impedances are 50Ω to match conventional transmission lines. The tuned circuits are preset during manufacture but may be repeaked when the preamp is installed. The entire unit is injection molded to produce a waterproof, virtually indestructible product.

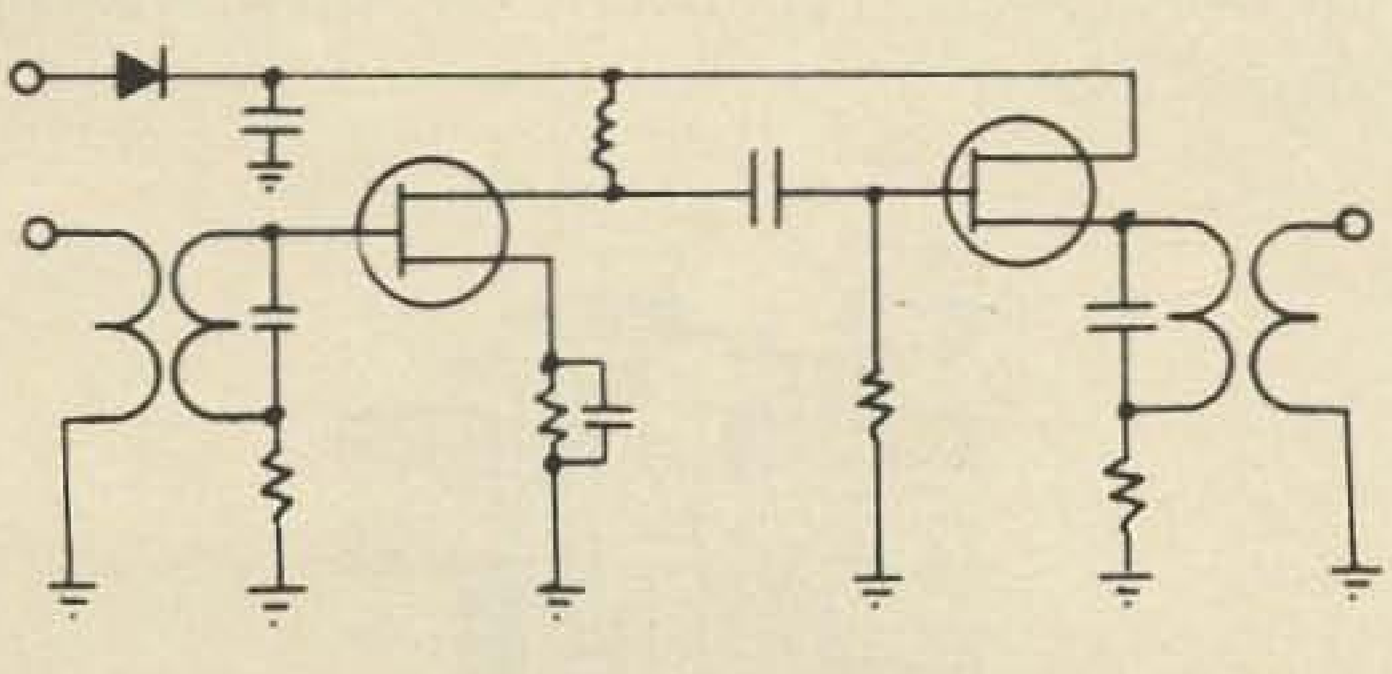
The basic preamp circuit may be referred to as a "handbook circuit." It consists of a 2N5245 N channel FET as the rf amplifier with a second 2N5245 as a source-follower. The purpose of the source-follower is to isolate the rf amplifier from the remainder of the receiver circuitry and thus prevent oscillation. Chip resistors and capacitors have been utilized with discrete transistors. Later improvements will include chip semiconductors.

The original design utilized fixed inductance and close tolerance NPO capacitors. However, this method was not conducive to high volume production. Also, such a system allowed no compensation for outside circuit parameters. Thus, the revised design incorporates slug tuned coils.

It was originally planned to make the unit field serviceable. However, most field service stations are not equipped to handle hybrid circuit repairs. Also, the low initial cost of the hybrid circuit makes replacement rather than repair more economical. The final design consists of an injection molded package with provisions for alignment of the slug tuned coils. The rf input, rf output and power cables are all internally connected before molding. The injection molding produces a waterproof, virtually physically indestructible package.

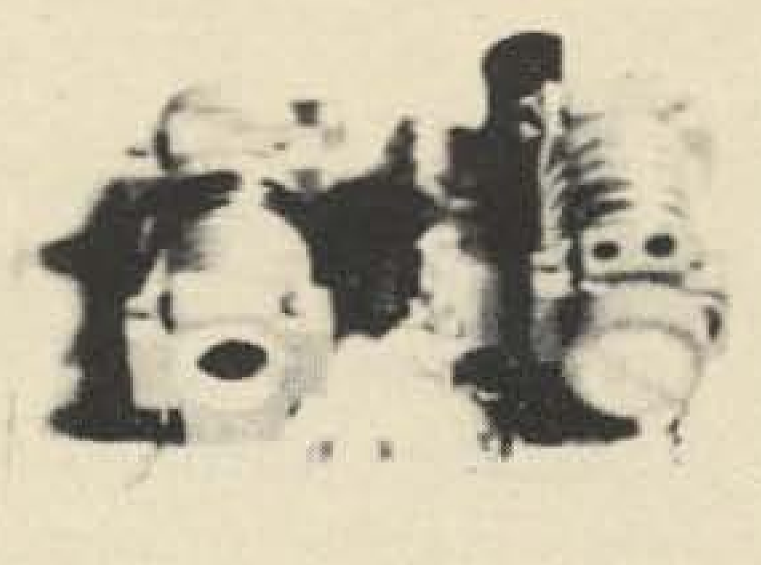
Protective Circuitry

The amount of protective circuitry depends upon the application. All units incorporate reverse polarity protection in the



1. Basic Schematic

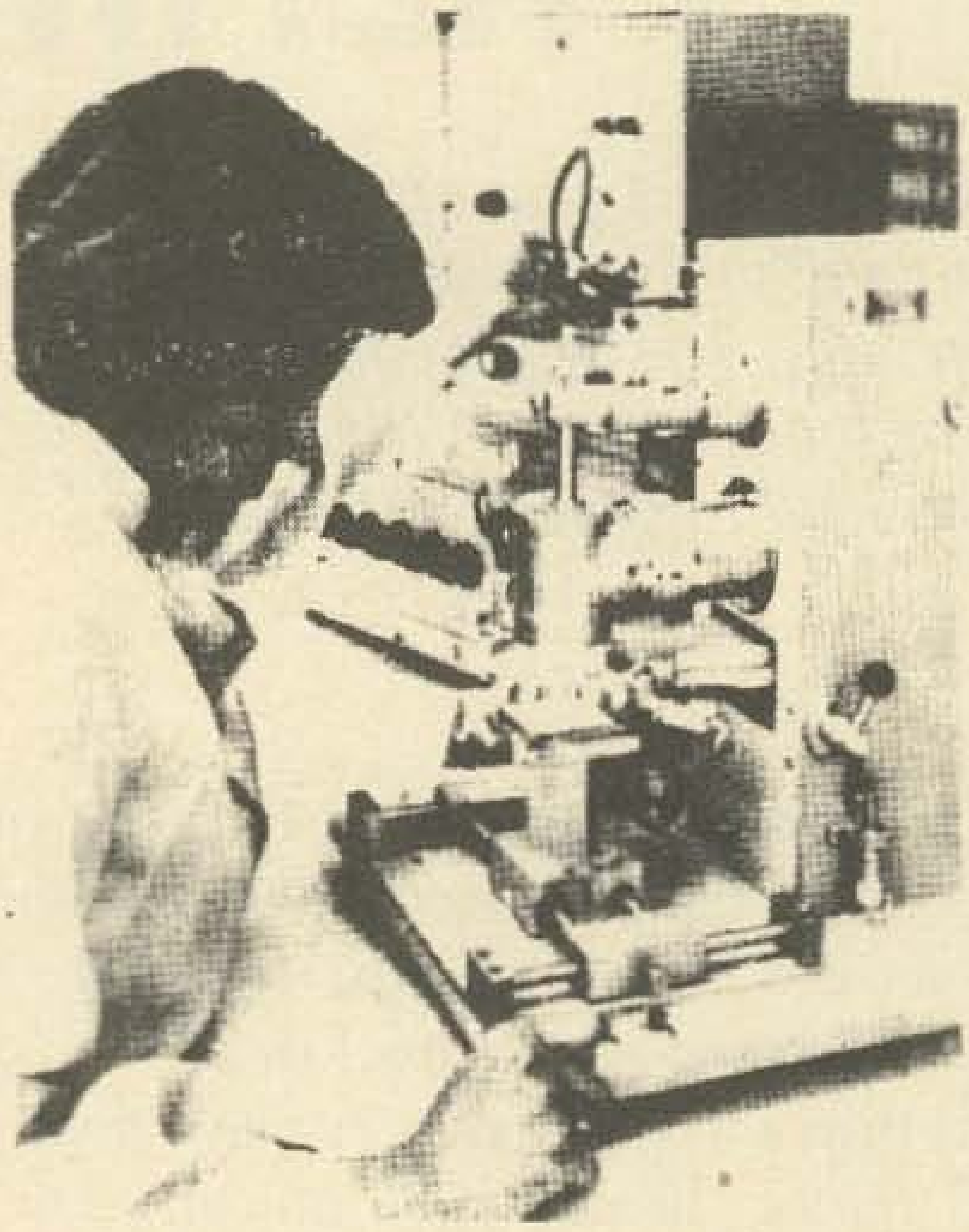
Fig. 1. Basic schematic.



Interior view of preamp.

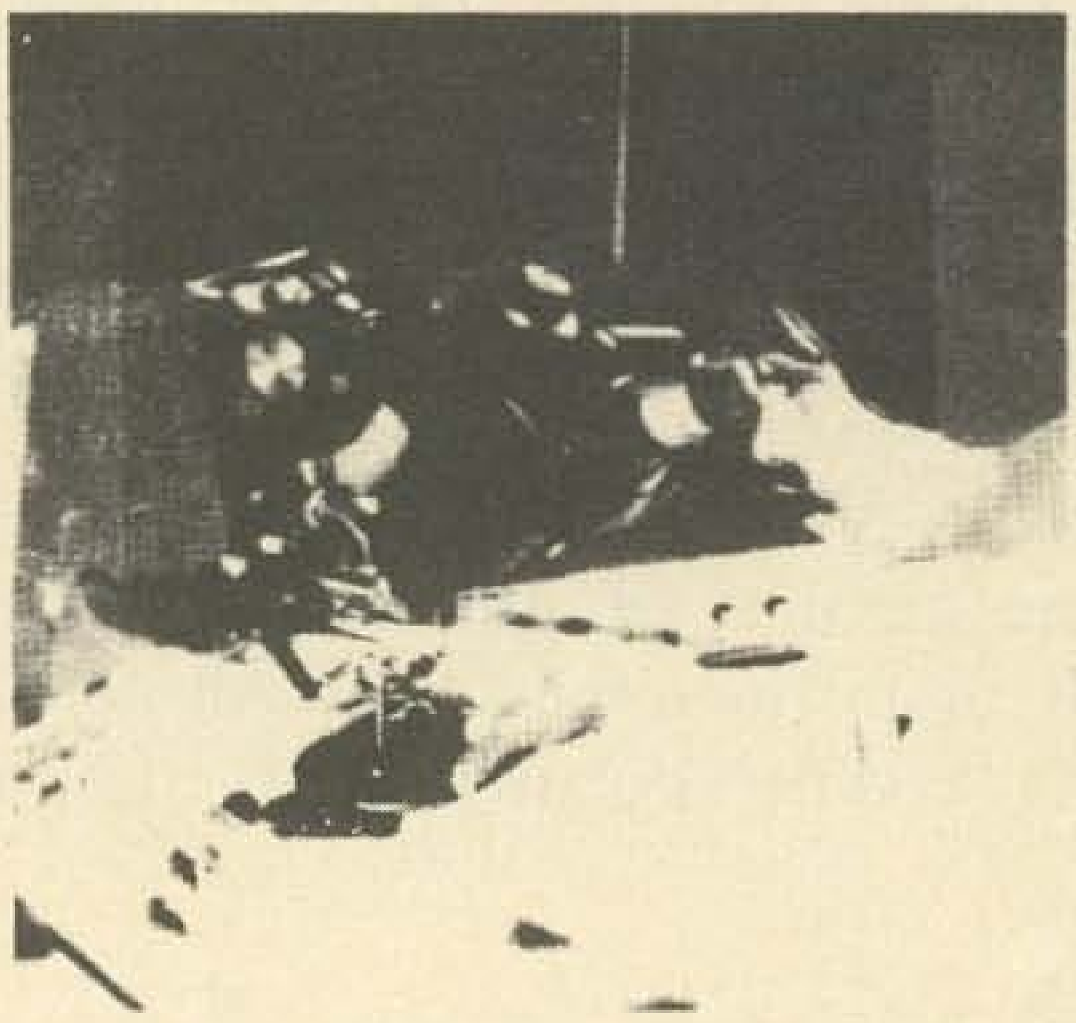
form of a silicon diode (1N4001). In applications involving medium and high power transmitters in close proximity to the preamp, germanium diodes are placed across the input to protect the field effect transistors. In low power applications such as CB where power output is restricted to 3.5W or less, the diode protection of the FET's is not needed. For special applications, the entire circuit may be shielded.

This hybrid concept may be expanded to include thick film rf preamps for other services. These include low band FM (25–50 MHz), 6 meter amateur (50–54 MHz), special single channel television requirements (54–88 MHz and 172–220 MHz), FM broadcast (88–108 MHz), aircraft (108–132 MHz), high band FM and 2m amateur (132–172 MHz). Other possibilities include UHF FM communications (450–470 MHz), industrial radio control (72-76 MHz), and other VHF and UHF radio services.



Assembly operations.

Fabrication area.



Applications

The hybrid preamp was originally designed for use in CB equipment (27 MHz). The original application is as an "add-on" accessory to the receiver portion of the unit. Other applications include incorporation of the hybrid circuit as the receiver "front end" in new design equipment and in receivers for radio controlled equipment.

Construction

The construction begins with a 0.015 in. ceramic substrate. On this is screened a paladium-gold conductor pattern. The substrate is then fired at 900C. After firing, the substrate is inspected and passed to the assembly department. Assembly begins with the soldering of the chip components, progresses through mounting of the discrete active components, and finally to the mounting of the rf coils and external connection leads. The unit is then visually inspected.

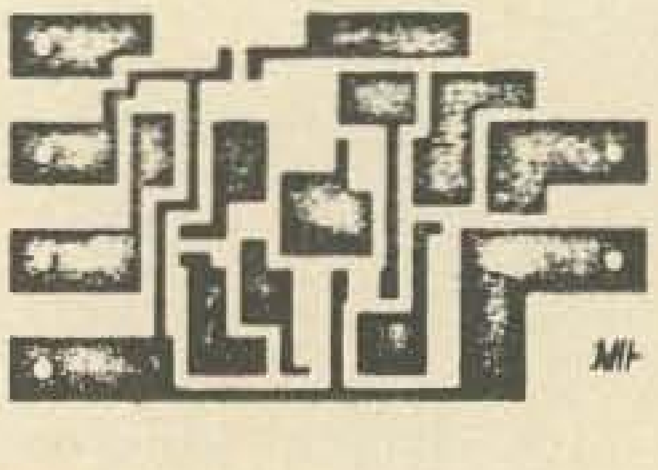


Fig. 2. Substrate conductor pattern.

Initial Testing

After completion of assembly, the unit is given an initial electrical test and rf alignment. This stage consists of the application of the required 12V dc to the unit and checking for dc parameters including excessive current and open circuits. The initial rf alignment is as follows: A signal at the desired frequency is applied to the input of the hybrid circuit through a 50Ω pad. The output of the hybrid is connected through a second 50Ω pad to an indicator. Power is then applied and the slug tuned coils peaked. The total gain of the preamp is measured and if within specifications, it proceeds to the next stage, encapsulation. If the hybrid circuit fails, it is sent to a repair station for troubleshooting. After repair it again is visually inspected and undergoes a second complete electrical and rf test.

Encapsulation

The final manufacturing stage consists of encapsulating the entire circuit through injection molding techniques. Teflon rods are inserted into the slug tuned coils to form holes in the encapsulation material to allow alignment after the unit is installed. After encapsulation, only the three cables (rf in, rf out, and power) and the holes for alignment are visible.

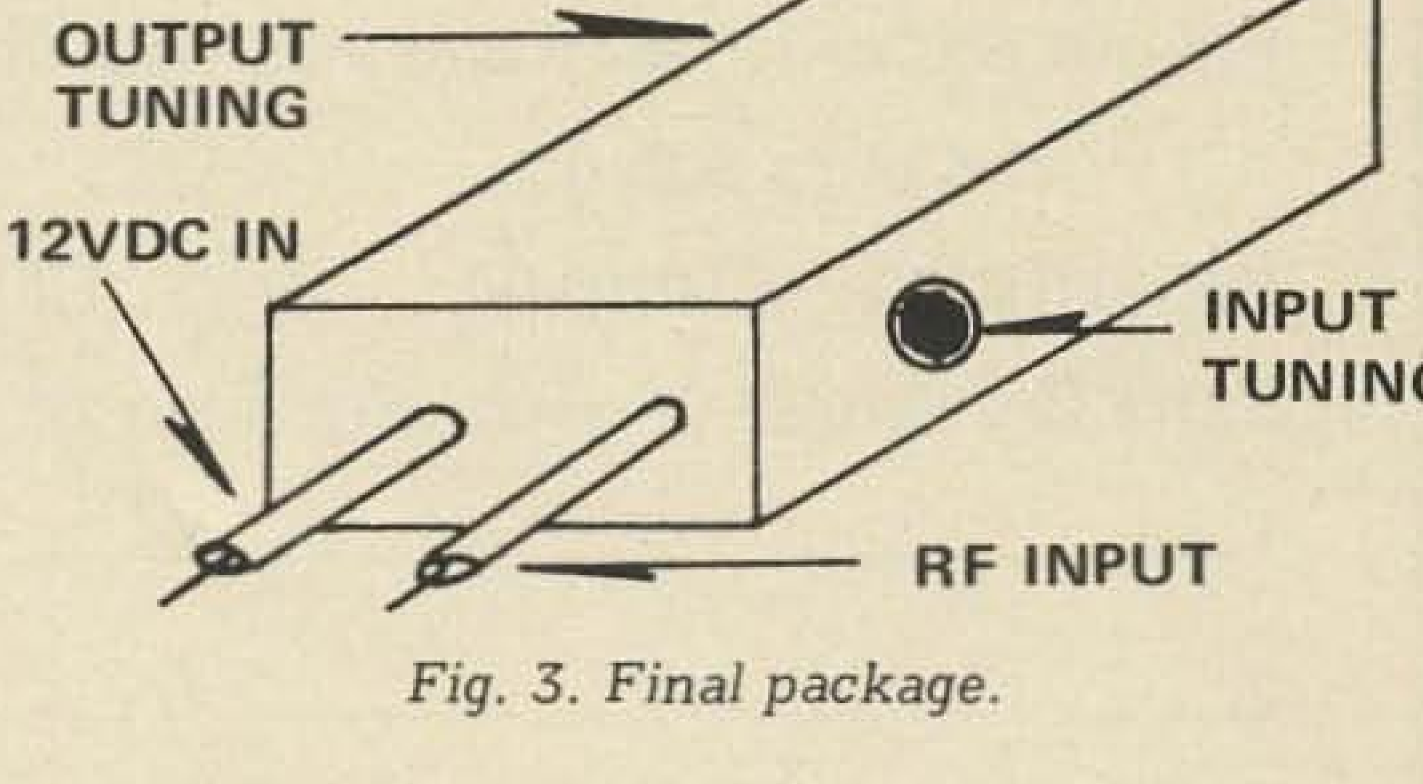


Fig. 3. Final package.

Final Testing

After encapsulation the unit is given a final electrical and rf test. Because of the encapsulation material, it is necessary to slightly realign the tuned circuits. If the unit is rejected, it must be discarded. Accepted units are labeled and serially numbered.

. . .K9STH

PICTURE PAGE

ABOUT 8,000,000 CONTEST POINTS

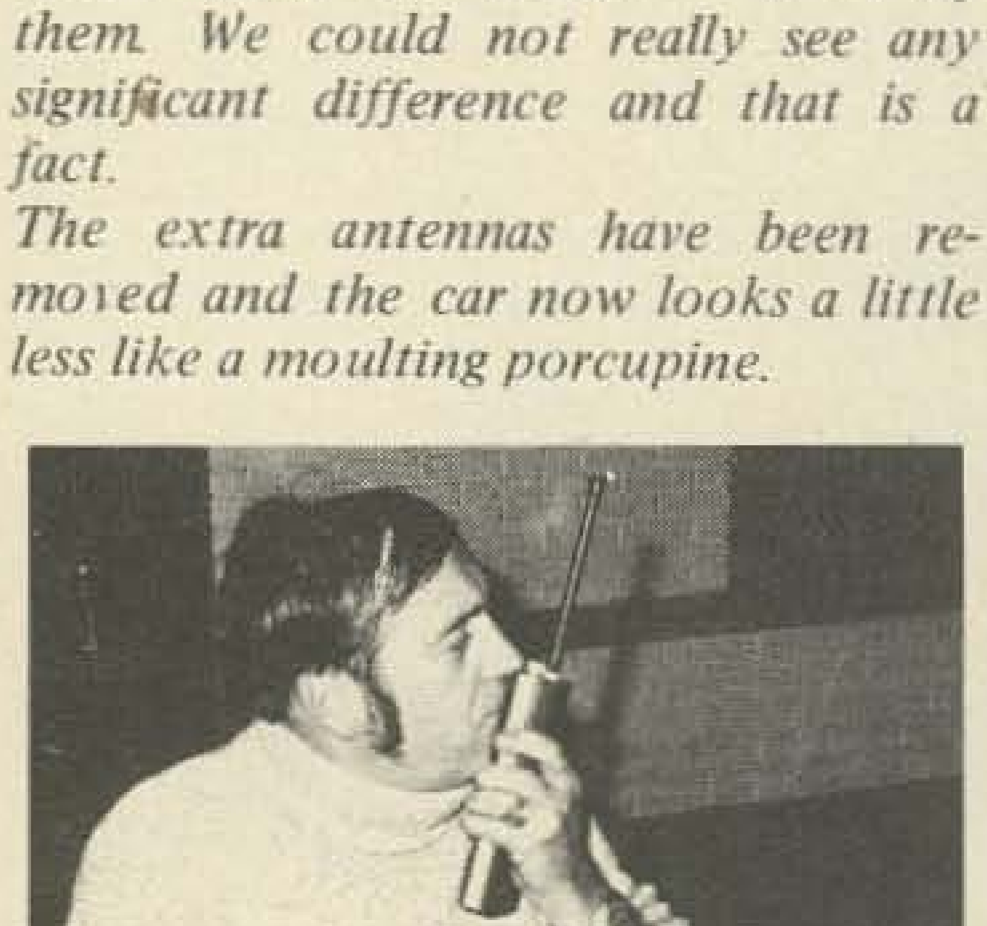
On a recent visit to Washington Wayne visited the Potomac Valley Radio Club and snapped this candid picture. These are the big guns of the east coast – they were adding up their cumulative score for the DX contest and it staggered the mind. Was it 8 million, 12 million or 15 million points? Whatever it was, they sure must have beat out their perennial rivals up in Philadelphia. This group has worked everything there is to work – they must be very happy.

WHICH ANTENNA WORKS BEST?

The gain figures used in advertising can sometimes be confusing. Here is the W2NSD/1 Datsun 24Z with two magnetic mount 5/8 wave whips and a bumper mount 5/8 wave. Some bad things have been said about the magnetic mounts so we decided to check it out and see what difference there was between them and a substantial bumper mounted antenna.

You can't just switch from one antenna to another because the "picket fence" phenomenon causes the signals to go up and down by several S-units every time you move a few inches. This means we had to drive around and try to find average figures – peak figures – etc. After a lot of driving and antenna switching, there was little doubt as to which antenna worked far better than the others – none of them. We could not really see any significant difference and that is a fact.

The extra antennas have been removed and the car now looks a little less like a moulting porcupine.



Jean Shepherd K2ORS, at the recent FM Symposium run by 73 Magazine, talks from one table to another over the din using an rf boost. After the dinner Shep gave a performance which resulted in laughing fits for a good part of the audience – three hernias and one double hernia. Two representatives of a national amateur organization were there – one smiled – briefly.

SHEP PR DEPT.

Jean Sheperd's America will be back on PBS television starting July 6th at 8PM on Thursdays. Don't miss this interesting series by one of our old time amateurs K2ORS. It won't hurt to drop a letter to your local PBS station telling them that you want to see this series – they are very responsive to such letters.

MOUNTING THE RIG

What do you do when you succumb to buying a car which turns out not to have any reasonable place under the dash to mount the FM rig? Here is the cockpit of the Datsun 240Z which has one of those molded paperboard dashboards with just no place to hang a rig.

The bracket for the 826 was mounted on the transmission hump and the rig slides into place easily, It takes but a minute to remove it for crystal changes and it is out of the way of the leg. There is room for a second 826 on the right hand side of the hump, if you need to go for 24 channels in your area and have the loot. The power amplifier – TPL – 120 watts – is under the seat – also out of the way.

The next step is a touchtone pad and tone burst unit which will go in place of the pencils on top of the hump. The hand mike will eventually be replaced by one fastened to the sun visor and a push-on push-off switch will operate the rig – thus making driving a little safer. Even as handy as the mike is, it would be better not to have to use one hand for it.

AT DAYTON

Don Payne K4ID. Perhaps you've noticed the growing ads in 73 by Payne Radio. Don has been bringing the Signal One transceiver to the attention of amateurs through his ads. . .and selling this incrediple new unit.

Fred Deeg K6AEH, president of the Palisades Amateur Radio Club (last we heard) and sales manager of Standard Communications. Fred is an avid two meter FMer and has had a lot to do with the most used Los Angeles repeater, the PARC WA6ZDI station. Fred is deeply involved with the soon-to-be-announced Standard repeater package.

Tom Litty K6RAD shows his new 220 transceiver (marketed under the Tempo name by Henry, but made by TPL Communications in Hawthorne, California). This unit is both an FM crystal controlled transceiver and an AM tunable receiver with transmitter vfo! The price is expected to be in the neighborhood of $220, which is sure to be a very popular neighborhood. Looking on are Gene Hastings W1VRK and Eli Nannis W1HKG, the two powers behind the Boston and Swampscott conventions.

Dave Ingram K4TWF, who writes the SSTV news in 73. Dave is one of the more prolific writers on the subject and has been responsible for a good deal of the interest that has grown in this fascinating new aspect of amateur radio.

AMSAT NEWS

Michael Frye WB8LBP
640 Deauville Dr.
Dayton OH 45429

Receiving A O-C Signals

Very soon, AMSAT in cooperation with NASA will launch its sixth satellite, AMSAT–OSCAR–C. A-O-C will be a real step ahead for amateur radio. It will enable hams from all over the world to participate in some of the rarest DX ever.

Most hams are already aware of this. However, very few still understand completely how to get the most use out of A-O-C. The first thing the average ham asks is, "What type of equipment do I need," and "where do I aim my antenna" etc. This column is designed to give the straight details plus a little help to the person just starting.

Transmitter

The first step is putting out a good signal on two meters. The satellite receives signals between 145.9 MHz and 146.0 MHz. It will accept any mode appearing within this band and repeat it. CW or SSB are recommended because they utilize A-O-C in the most efficient way. As far as power goes, 100 W of effective radiated power (erp) is just right. Any signal stronger than that will overload the receiver or increase the gain, thus reducing A-O-C sensitivity.

Finding such a transmitter, if you do not already have one, is not really as hard as it sounds. First if you are a do-it-yourselfer, you can assemble a neat little rig that puts out about ten watts on two meters, then use a 10 dB antenna to bring the signal up to full strength. Second you could convert any of a number of surplus 2m rigs to CW by keying the carrier. In other words, this does not have to be an expensive endeavor.

Receiving

Most good amateur receivers capable of receiving 29.45 MHz will be fine for receiving signals from A-O-C. Receiver sensitivity and selectivity should be fairly good; however, since there is a high level of man-made and galactic noise on ten meters an extremely good front end is not required.

Antennas

The antenna that you use will probably be the most critical item you will need. Because it will determine the effectiveness of your station, the ten meter receiving antenna is the most important. Some form of directive array is recommended. A height of 50 feet off the ground is probably the all around best. Antennas mounted higher, thus having a low angle of radiation, will be best for DX work since the satellite will be near your horizon. For local contacts the lower antenna will pay off because of its high take-off angle.

For the 2 meter antenna a simple dipole will do, or a directive array depending on the transmitter's erp. If a beam is used it has to be aimed in the general direction of the satellite. A good idea is to mount it at a fixed elevation angle of 30°, since this will afford the broadest take-off angle. Again for the DX hunter the antenna should be mounted normally since this will aim the boom at the horizon for low angle shots.

Since A-O-C will last for about a year, this column will continue to inform on techniques and latest happenings in the mission. For all those interested in receiving additional data such as an A-O-C telemetry chart individual system explanations, and command functions. Please send SASE to me and I will send you a free copy.

FLASH!

Just before press time, we learned that A-O-C will not be launched in July as scheduled. The new launch date is still unclear, but it is expected to be in the late fall or early winter. Keep reading *73* for details of all OSCAR flights.

SOCIAL EVENTS and CONTESTS

The South Milwaukee Amateur Radio Club will hold its third annual Southeastern Wisconsin SWAP-FEST on July 15th at Shephard Park (American Legion Post 434), 9327 So. Shephard Ave., Oak Creek, Wisconsin. The activities will start at 7:00 A.M. and run until 5:00 or later. There is plenty of parking and a picnic area. Admission is $1.00 per person. Bring your friends and whatever goodies you have to swap or sell. For more information write to A.R.S. WB9EQA, William N. LeCourt, 1900 West Kimberly Ave., Milwaukee, Wisconsin 53221.

* * *

Model Rocketeers will hold an on-the-air convention on July 15 at 1800 GMT on 3,992 and 14,300 – each give or take a little. The Ludlow (MA) Amateur Radio Club is sponsoring the convention, and net control will be WA1NIC.

TWO RIVERS HAMFEST

The Two Rivers Amateur Radio Club of McKeesport will hold its annual Hamfest on July 16, 1972, at the Clairton Sportsmans Club off Rt 51, near Pittsburgh, Pa. For flier write WA3MWM C. Thomas, 7022 Blackhawk, Pittsburgh PA 15218.

* * *

The annual Indiana Radio Club Council Picnic and Hamfest will be held on July 9 at the Lafayette Fairgrounds. There will be a flea-market for the hams and fun and games for the rest of the family. Trailer parking is available. Indiana's Ham-of-the-Year award as well as other operating awards will be made. Tickets are available from any IRCC club, or by mail, or at the gate. Advance tickets are $1.50 each by mail from W9YIP, 477 Robinson, West Lafayette, Ind. Orders should be mailed by July 4. Enclose payment and SASE. Tickets at the gate will be $2.00. There will be advanced and grand prizes as well as other prizes.

* * *

The Annual Wyoming Hamfest will be held July 15th and 16th 1972 at the Holiday Inn, Thermopolis, Wyoming. There will be prizes, a banquet Saturday night, Swapfest, Technical talks, Ragchews, Representatives from MARS, etc. Talkin on 3920 and 2 meters. Golfing, swimming and picture taking of the buffalo that roam at will in the State Park. The Hamfest is sponsored by Mildred and Joe Ernst of Thermopolis.

* * *

ONTARS, the Ontario Amateur Radio Service, sponsored by R.S.O. Inc., operates daily, all year, from 7AM to 6PM local time on or about 3775 KHz. It is a public service net for the express purpose of handling traffic, but check-ins from stations without traffic are most welcome.

A cordial invitation is extended to our American amateur friends to avail themselves of this service. ONTARS net control will recognize check-ins from all modes – SSB, AM and CW. For US amateurs operating mobile in Ontario this is an easy way to obtain traffic information, directions, etc. and meet new friends.

ONTARS will be looking for those W and K calls.

* * *

The first annual picnic of the Northwest Amateur Monitoring Service (NAMS) will be held Sunday, 16 July 1972 at Lewis & Clark State Park about 10 miles south of Chehalis, Washington, on old Highway 99.

NAMS will be one year and one day old on the day of the picnic. Overnight camping is available at Lewis & Clark State Park, with 40 spaces available. Bring wood for campfires, and bring food – it's a pot luck picnic, begins at 1 PM.

1972 County Hunters Contest July 29–30, 1972

The CW County Hunters Net invites all amateurs to participate in the 1972 CW County Hunters Contest. All mobile and portable operation in less active counties is welcomed and encouraged.

Contest period: 0000 GMT July 29 to 2400 GMT July 30.

General Call: CQ CH: Exchange – QSO number. Category (portable or mobile), RST, State (province or country) and county (U.S. stations). Scoring: QSO's with fixed stations are 1 point, QSO's with portable or mobile stations are 3 points. Multiply the number of QSO points times the number of U.S. counties worked.

Logs must show category, date/time in GMT, station worked, exchanges, band, QSO points, location and claimed score. All entries with 100 or more QSO's MUST include a check sheet of counties worked or be disqualified. Logs must be postmarked by Sept. 1, 1972 and sent to CW County Hunters Net c/o James E. Hoffman K1ZFQ 42 Gresham St., Milford CT 06460.

* * *

The Dade County Amateur Radio Public Service Corps will operate Special Events Stations from the National Political Conventions, Miami Beach, Florida during July and August. Tentative planning: Formal traffic – Schedules and traffic nets. Contact frequencies 7072 14072 CW, 7272 14317 SSB. Station hours – 10:00 AM – 10:00 PM EDT, 1400Z – 0200Z. Calls/Dates – WD4USA, Democratic, July 10-13, WR4USA, Republican, August 21-24. QSL Info (SASE) to: Special Event Station (call), PO Box 501, Miami Springs, FL 33166.

* * *

The Quebec's amateur radio association, R.A.Q.I., will be holding its annual convention at the Cite des Jeunes in Vaudreuil Que. on June the 30th, 1st and 2nd of July. All amateurs of course are welcome and we will have french and english talks on technical subjects. Also, door prizes will be given during the convention, including 2 main prizes which will be awarded at Sundays's banquet.

* * *

The largest meeting of radio and electronic enthusiasts in the midwest is scheduled for Radio Expo '72 at the Lake County Illinois Fairgrounds on July 8 & 9. There will be technical talks, meetings, flea market, and something for the whole family. Advance tickets are only $1.50 ($2 at the door) from Radio Expo '72, Box WA9ORC, 230 East Ontario St. Chicago IL 60611.

* * *

The Columbus, Ohio Amateur Radio Association has been granted use of the special event call sign WJ4ULY. The club will be broadcasting both phone and CW from Independence KY on July 4. Only US stations will be worked on 40 and 80, DX stations will be worked on 20, 15, and 10. There will be Novice stations active also QSL via W8TO; enclose SASE.

* * *

The Wabash Valley Amateur Radio Association will hold the 26th Annual Hamfest, The VHF Picnic, on Sunday, July 30, 1972, at Turkey Run State Park near Marshall, Indiana. Registration is $1.50 each with no advance registration. There will be prizes, Bingo games for the XYL, big flea market and plenty of good fellowship. Talk in will be on 52.525 and 146.94.

DX FOOTNOTES

(The following letter, all of it, was written on an airline place mat — Ed.)

I arrived (I'm here in Dr. 9VINR Charan's office, & he keeps bringing in patients, & I just get up & leave when he comes in) here Thursday fr Bangkok, as my time was up that was stamped on my passport. Had been issued the call of HS1AGO while there. Worked many sta with HS call and 9Y4VV Nazir dn in Trinidad, but we never hrd 1 Stateside call. Nazir gave me a 5–9 report. Doc just handed me yr letter of Oct. 71. I'd left the States bk in Nov. Flyin to Lima Peru on my way to visit XS4AA Basil, but stayed in Peru for 3 days visiting hams. Then flu over to Sao Paulo & eyeballed with Brasilian hams, then flu up to Rio where I met & visited many hams in Rio. After 4 days, took off & flu 4280 mi NS to Johannesburg, then drove 130 with Basil to his QTH in Kroonstad. While there for 2 weeks, I wire-brushed & painted his 70' tower.Then contacted K6UJS the night B-4 I left for Cape Town, or ZS1Land, who had my XYL on the LL as a SWL telling him where I was goin. Next day I hitched rides down to C.T. & stayed with many hams in the area ZS1UP was one of them, John, whose son Willie's picture was in the South African paper a week after I was there right on the front page in his plane, upside down flyin over CapeTown.

After meeting many members of my Mormon Church at the services there in CapeTown, I went to the BOAC office & instead of routing me bk to SF via London, she sent me to Nairobi where I met Robby 5Z4ERR & several others & also goin on a small Safari to hunt (but I didn't do any hunting) just went along for the ride in their LandRover & took a few pictures) No room on this paper to elaborate abt my thrilling experiences while there in Kenya. However, after meeting many of the local 5Z4 boys, I caught a plane to Bombay via Uganda & Kuwait. Upon landing at Bombay I had a hotel res at a lovely hotel (paid for by BOAC) because I wanted 24 hrs to contact any VU2 hams, which I managed to do. I met Ali VU2ST & his ham son, who drove me clean across dark Bombay at night (without lights) to his QTH where I met Ali & other both on the air & with the ol eyeball. By this time, it was abt time to catch my flight to Bangkok which was very much appreciated, as we were served a delicious American dinner (after eating stuff I wasn't used to eating) bk there in Bombay.

Well the first thing I noticed after bein in Bangkok a few hrs, was everywhere you looked there, beautiful women . . . all over the place, everywhere.

My visa for my visit to Thailand was up Jan. 28th, we (meaning me) left the 27th (didn't take the XYL B-cause, all she wanted to see was Japan).

Flu into Singapore at 1530, plenty of time to call & make contact with Charan 9VINR, whom I'd QSO'd previously. Said he'd find a place for me. I'd contacted Ruspy DU7ER fr Bangkok on the SEANet with Baddy 4S7PB in Celon as NC & told Ruspy (with my HS1AGO call, that I wd B comin dn to eyeball with Doc Charan in Singapore in a week & if he shud also happen to contact any Victor Sugar stas to B sure & tell them that K6OnlyPrettyGirls (many hams know me by my call) wd B visiting HongKong on his way bk to his QTH there in San Francisco.

So Wayne, I'm sending you this letter to help you better realize just how wonderful a trip I had visiting the many ham friends that we've contacted in past years. I forgot to mention, Thursday evening (when we got in fr Bangkok, we just happened to hit it right because that nite, 9V1NR & I HS1AGO (K6OPG) attended the semi-annual meeting of the Singapore Amateur Radio Club, & I got to eyeball many hams I'd QSO'd with, & also I was lucky enough to see the picture I've been trying to see for a long time, bk in the States, Radio Amateurs of the World.

Now, just as soon as the good doctor (who's sitting in his office, filling out dozens of QSL cards, which I think is very commendable) is ready, we're goin dn two a place called Johore Bahru, which is here in Malaysia, to visit some of his friends.

I'm sorry that after QSO'ing Bud 9V1OI many times, he's not here, but up somewhere in Vietnam waters operating MM fr his dredge with the call of W7RMT. Charan & I were drivin to his office, & he said to me, see that nice beam up there on the top of an apt building, well that's Bud's 9V1OI's QTH he left behind.

Many tnx agn Wayne & 73s fr Singapore;

Kenny K6OPG

* * *

Following are instructions for obtaining reciprocal operating privileges in Suriname: Because of an agreement between the USA and Suriname, there are no objections against the issuance of licenses to holders of a valid FCC license, during their stay in this country. Applications must be addressed to: The Governor of Suriname. Through. The Minister of Public Works and Traffic, Kleine Waterstraat 8, Paramaribo, Suriname.

With this application an official stamp of Sf 0.30 must be placed and payment of legal charges of Sf 6.00 and an administration fee of Sf 1.00 are due. In order to meet the requirements, send the application and an amount of U.S. $5.00 3 months before the date of arrival to: The Government Telegraph and Telephone Service, Bureel Radio Controle, Keizerstraat, Postbus 1839, Paramaribo, Suriname. The change will be handed to you upon your arrival. Complete and sign the information form that is returned to you and forward it also to The Government Telegraph and Telephone Service.

The license fee per annum is SF 10.00, payable when you are here. Once in Suriname, contact the Government Telegraph and Telephone Service and you will receive further information.

* * *

The *Mobile News* reports that Portugal has signed reciprocal licensing agreements with the following countries: Belgium, Canada, France, Germany, Holland, Morocco, Switzerland, the U.K., and the U.S.

Here is a list of addresses to which to write when requesting licensing information in the Caribbean:

BARBADOS
Ministry of Communications,
Works & Housing,
Government Headquarters,
St. Michael, Barbados

JAMAICA
The Postmaster General
The General Post Office
Kingston, Jamaica

ANTIGUA
The Posmaster
General Post Office
Antigua, Leeward Islands

GRENADA
Ministry of Communications & Works
St. Georges
Grenada, Windward Islands

MONTSERRAT
The Postmaster,
The General Post Office
Montserrat, Leeward Islands

ST. LUCIA
Ministry of Communications & Works
St. Lucia, Windward Islands.

ST. KITTS, NEVIS, ANGUILLA
The Administrator
St. Kitts, Leeward Islands
(Note. There are at present certain administrative difficulties in this

group which may present some problems in obtaining licenses in Anguilla.)

TURKS & CAICOS
The Administrator's Office
Turks & Caicos Islands

BRITISH HONDURAS
The Postmaster General
Belize, British Honduras

* * *

DX LETTERS

Amateur operation here in Germany has been a pleasure I never thought it could be back home. Of course, we have our shared bands with commercial services, lots of QRM (some of it intentional) and certain restrictions, but you don't need a KW to work in DXer's Heaven. One thing we do lack is a Third Party Agreement between the U.S. and Germany – no phone patches are allowed.

We would like to hear more Stateside stations calling Europe on 80 meters. Although our band stops at 3800 kHz, the portion traditionally reserved for working DX is 3790–3800, and you don't have to be an Advanced or Extra to work us. If you can work split frequency, you *can* work us. Just give a listen in our DX portion. We usually indicate what frequency we're listening on, but we do listen all over the band, including the General portion.

On 20 meters, we'd work a lot more of you in the Central and Western states if you'd beam the long path over New Zealand. The south polar route works beautifully! Try around 1400 GMT.

Harry K5HML/DL4HW
APO New York 09053

Enclosed are two prints showing the "Ham Quadri" antenna installed on the *Lady Mary*. Mary, WA6VIB, is still located at Manzanillo, Mexico, but is leaving for Acapulco soon.

Bob Wilkinson WA6RFB

THE TRAVELING HAM

Joe Kasser G3ZCZ/W8

This column is a forum on information and ideas enabling the traveling ham, be he tourist or commercial traveler, to take his ham rig with him and to successfully operate from overseas. The advent of solid state VHF FM and low power subminiature HF equipment has made portable ham stations an everyday occurrence.

The USA now has reciprocal licensing agreements with many countries. Some of these countries, especially in Europe, have a VHF phone (144 MHz and up) class of license that does not require a Morse code test. Thus American Technician class operators should be able to obtain reciprocal permits. These are well worth acquiring because there is a high level of VHF activity in Europe.

Consider the two meter band: in Europe the international two meter (mobile) calling frequency is 145.0 MHz. It is used by both AM and FM stations, but mostly by FM. There is also an international SSB frequency centering on 145.410 MHz. Europe is in Region One of the IARU and as such the two meter band only covers 144–146 MHz. Squeezed into those 2 MHz one finds AM, CW, FM, SSB, repeaters and beacon stations. The band is voluntarily divided: CW operators utilize the bottom 150 kHz, the beacons, although at present all over the band, will soon move up to the top end and occupy the top 50 kHz. The phone operators have the rest using AM, FM and SSB. Many cross mode contacts take place.

There is no six meter band in Europe, but the United Kingdom, Eire, Iceland and Gibraltar have a four meter band at 70 MHz. In the summer, sporadic E skip conditions occur, allowing DX contacts across the continent. This band was a popular mobile band in the UK, until the Class B (VHF Phone Only) license allowed two meter operation without a Morse code test (but with the same technical exam as the Class A (All Band) license. Two meters has become the prime mobile band and has resulted in the establishment of simplex channels for mobile use. For example, 144.48 MHz is a popular channel in London, England.

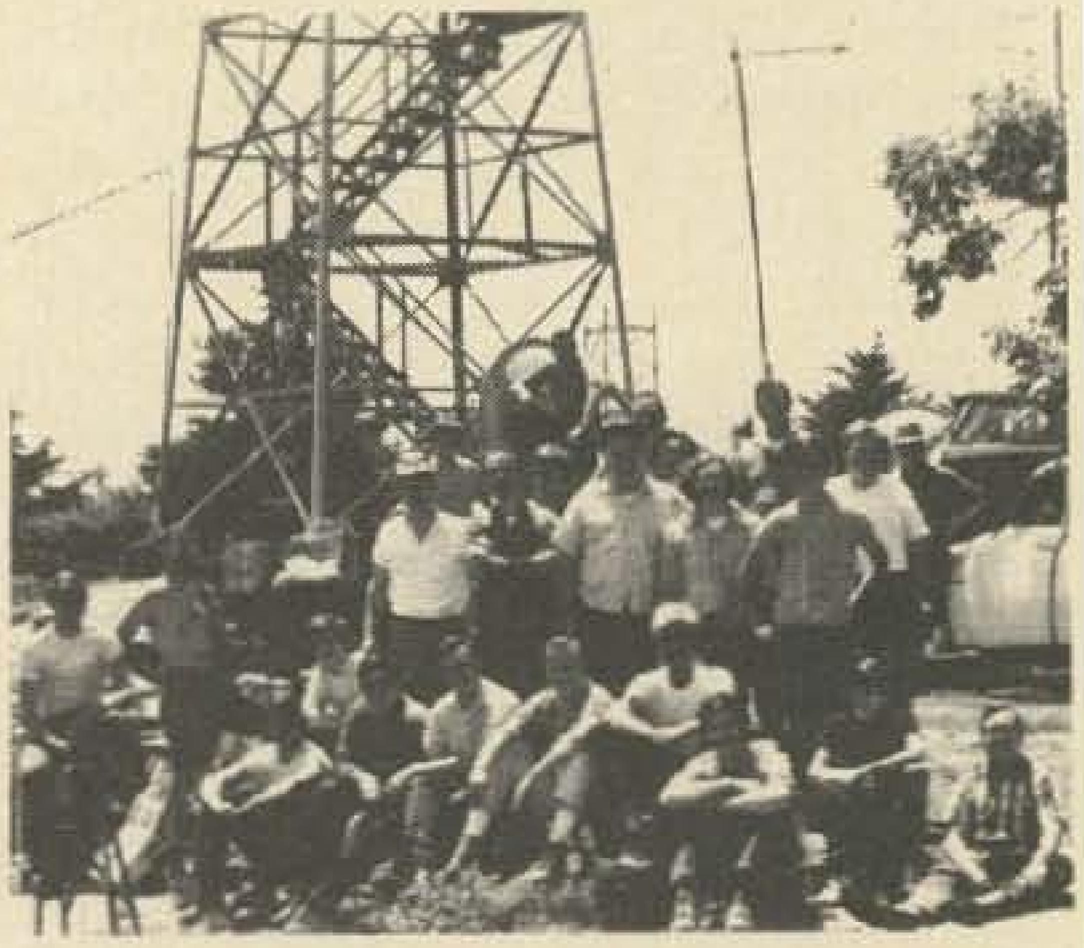
With the many high-rise hotels, tall buildings and hills dotted all over European cities, the use of a TR-22 or similar hand-held rig results in many contacts. If you think there is no one to talk with, boy are you wrong! The strange accent usually starts a pile-up. Standing near the museums overlooking the base of the Eifel Tower in Paris I had numerous QSO's one winter evening a few months ago both over the air and with curious courting couples at the site. (I would have been up in the Tower except for the fact that it was closed.) Language was no problem, I couldn't even begin to use my French since they all insisted on using English. So with a few words of English, a few words of French and lots of enthusiasm, we managed to communicate.

Next time you go to Europe, take a VHF hand unit with you (get a reciprocal permit first) and have fun. The QSL's are interesting too and make fine souvenirs. How many hams do you know who have QSL cards from G8's, FL's, and DC6's.

Next month I'll write about HF operation, but in the meantime if you have any tips, experiences or ideas to pass along, please do.

Log of W7DXX/1 20 SSB

JX2HK is quite active from Jan Mayen on 14.210. OY9LV is trying split frequency operation. Ole often transmits around 14.220 while listening around 14.300. Thanks to Jim for a very good DXpedition to Market Reef with OJØSUF. QSL via OHØMA . . .EP2TW, ALF via GI3HXV. UH5ØD and UG5ØA are special call signs for Russia, a 50th anniversary celebration. 9N1MM, AF5FX, KS6DY, CN8CJ, OD5BV, MP4BBW SVØWZZ, DL8NU/OHØ, WA2BVU/4X (QSL via W2DYN) are quite active stations and easily worked (they're good operators). Carlton Ross, W9ABA, of Ross and White, operates each Feb. from Grand Cayman Island under the call ZF1BR. QSL via W9ABA. That YI2AZ who appears once in a while on 20 appears to be a pirate.



Here's the whole gang that set up and operated W1DC this last June for the VHF Contest. They operated from Pack Monadnock Mountain in Peterborough, N.H. and put out one whale of a signal on all the VHF and UHF bands.

50 MHz BAND

Bill Turner WAØABI
5 Chestnut Court
St. Peters MO 63376

The skip season is here and if the first two weeks of May are any indication, this should be a dandy year. The band opened nearly every day and in all directions. Reports from various parts of the country confirm local observations that the buildup started in late February. WA5RBI reports Feb. 20th to have been hot from Enid, Oklahoma – the band opened for two hours to Ohio, Pennsylvania, West Virginia and Kentucky. Bob reports another opening March 4th, but with deep QSB, the same general area was involved with the addition of identifiable signals from Georgia, Louisiana, Texas, Illinois and Wisconsin. March 6th brought another opening, this time from the south and southwest. Stations worked included XE1PY, WA7BBM, WA7JEI and multiple 5's. Total elapsed time was an hour and a half starting at 0153Z. On the 8th of March the test pattern and audio of XHY-TV were received on channel 3 and another unidentified Mexican TV station on channel 2 with perfect picture and sound. "Started tuning 6 meters and found the following, 2340Z LU6ACL on AM . . .fair audio, XE3 on CW from Yucatan. At 0012 XE1JP, George, then worked WA5UMP, Jim from Russellville, Ark. on backscatter. On March 9th heard WA1JEX – worked him with the beam South (185°) with 5 x 6 signals both ways. By the way, XE1PY reports 37 straight days of openings there. Also he and Alfredo, LU3EX, have been logging and triangulating a steady carrier on 49.97 MHz. According to their figures . . .from the Northwest of Africa."

Bob, W4GDS, reports having worked XE1PY on backscatter at 2000Z on the 29th of March. Rusty had at the time been working South America for some two hours. Before the band closed at 2127 Bob had worked LU8DIN, LU3EX, LU2DEK, CX1AAX and CE4CP, all with S9 plus signals. I think I'll move South.

Both WB9JFT and WB4VLH report having worked Len, VE4QL. WØGNS noted 'stronger than horseradish" with his groundplane. Better get the beam back up Mac! Others noted as being very active in the past few months include Jack, WA5UUD, New Orleans and Joyce, WB5CUL, working her first skip. I wonder why most 6 meter YL's/XYL's are from the South?

The Itchycoo Park VHF Amateur Radio Society has announced the scores of participants in their 2nd annual "Worldwide VHF Activity." Highest overall score was the 600 points compiled by WA1NNW, who made 60 contacts, all on 6 meters. Other 6 meter leaders were WA3LKO with 250 points and 50 contacts and WA3PNW with 204 points and 51 contacts. Congratulations are due this group not only for sponsoring this "activity" but also for recognizing that a "contest" in which the sole aim is the exchange of callsign, section and signal report is of little value to the participant and a great detriment to normal operation on the band. The 1973 version of this activity is scheduled for 3 PM local time March 10, to 10 PM March 11, 1973. Full details will be published well in advance.

Six meters is looked down upon by many "higher class" licensees as the hangout of incompetents who are unable to pass the General Class exam and it must be admitted that there are those among us who leave something to be desired. But, is this not true of amateurs as a whole rather than Technicians alone? In Websters a technician is defined as "a specialist in the technical details of a subject or occupation" and a little research will disclose that this is exactly the case. Much of the blame for these opinions must rest on the publications which form the communication links between hams. So long as the modulated oscillator/rogen receiver articles are featured and the handbook tells the casual reader that the normal range of a well equipped station is 75 to 100 miles the situation will remain status quo. Anyone who has tried to sell AM equipment long ago discovered that there is no market for it, the average station runs 200 to 1000 watts of SSB and is capable of communication over distances of at least 300 miles. Is it not time too for the only national amateur radio organization to amend its structure to allow the holding of office by the 40% of the total ham population now excluded by the "General Class or above" clause? . . .WAØABI

SSTV SCENE

Dayton was once again a slow scan haven this year and I'm sure if you missed the '72 convention you will want to mark the '73 convention on your calendar. W9NTP and WB8DQT had some interesting gear on display and an "original" copy of the slow scan handbook. WØLMD had his integrated circuit half-cycle smapling monitor on display, and described it in detail during the TV Forum. K4JPE had a storage tube monitor that drew quite a crowd. (The pictures on these tubes get brighter instead of dimmer after being scanned.) There was some very good color fast scan gear and, of course, plenty of W6MXV and Robot units, plus individual booths for each. in what manufacturers designate a P7 Phospur tube. RCA excells in long persistance with in what manufacturers designate a P7 Phospur rube, RCA excells in long persistence with most tubes capable of holding an image 10 to 15 seconds, however, it was noted that some SSTV'ers had bought P7 cathode ray tubes that wouldn't hold an image long enough to view half a picture! Obviously the trend is toward RCA tubes for monitors, and moving the "short persistance P7's" into flying spot scanners.

How about a U.S. sponsored slow scan contest? Wayne and I have discussed the possibilities and we see no reason why this shouldn't be a real blast. This wouldn't be a contest to compete with CQ Electronica of Italy's slow scan contest, but rather in addition to their contest. Certificates to the winners would be no problem, and by the time the contest is on we may be able to come up with a trophy for the overall winner. First thoughts were for a 12 hour period contest late this fall. Since it is already August, we will need to hustle for a contest in, say November or December – what's your thoughts? It would be *your* contest – if you would like to see another slow scan blow-out drop me a card with your suggestion on a date and time. The cards are a must to prove the validity of the contest.

A lot of SSTV'ers have written asking where they might find 931 Photomultiplier tubes. A source may indeed be difficult to locate, for often distributors and surplus houses are rather high ($14.00 each) on them. Have you tried duplicating machine companies? Many stencil cutting machines use one or two 931's and usually these are pulled out when their sensitivity drops slightly (they only apply 650 volts on them, and have no sensitivity adjustment) so they are ideal for flying spot scanners. Another place to try is the local junk yards – some autos use these in their automatic head light dimmer, and they can be purchased for 50¢ to $1.00. If you get two that don't match in sensitivity, try separate 3 meg pots in series with the -900 volt supply to them so you can apply a variable voltage to each one – this way you can balance their sensitivity. A "collar" made of heavy paper, sized to fit over the glass of the 931 and a 1/4 x 1" slit for light to reach the 931 grid cut in it can be used to control both sensitivity and picture shading – moving the slotted collar around will shade sides of the pictures. Naturally, moving the slit to the extreme sides will cut out all output. Happy hunting for 931's. . . .K4TWJ

Microwaves

FREQUENCY BAND DESIGNATORS

Paul Schmidt, W9IDP comments on the microwave band designators listed in the May "72 issue of *73* as follows: *"On page 12 Jim Weir has listed. . .the OLD designators. The Department of Defense has. . .issued. . .new designators. (He) should have known that the new designators are official, and are being used in MIL-SPECS and MIL-STD's."*

Paul, I did know that the DOD had issued these new band designators, just as I know that Hewlett Packard had issued their own band designators, and the ITT Handbook had chosen still a third set of letter designators. The question, then, is: what constitutes the "official" nature of a band designation? Taking a rather pragmatic approach to the problem, I say that the *usage* governs the correctness or incorrectness of a symbol. Now, taking any of the wave trade magazines, including the most prestigious of them, you will be hard pressed to find a single reference to the new designators. However, references to "S" band telemetry (2290 MHz) and "X" band waveguide (10 GHz) are quite prevalent.

I do *not* on the other hand, disagree with you. I think the adoption of this system would only be second to the adoption of the metric system in helping the microwaver in his work. It is, in short, the best system of designators ever designed for microwave work. With your kind permission, I will repeat my designators, and alongside them your new system of designation. Perhaps order will come of this chaos yet.

OLD

LETTER	FREQUENCY
P	200–400MHz
L	400–1500 MHz
S	1.5–40 GHz
C	4.0–6.0 "
X	6–12 "
K	12–36 "
Q	36–46 "
V	46–56 "
W	56–100 "

NEW

DESIGNATOR	FREQUENCY
A	0–250 MHz
B	250–500 "
C	.5–1 GHz
D	1–2 "
E	2–3 "
F	3–4 "
G	4–6 "
H	6–8 "
I	8–10 "
J	10–20 "
K	20–40 "
L	40–60 "

The problem I see arising in the transition period, between the time the old symbols fade away and the new ones replace them, is one of letter confusion. For example, if I told you I had 20 watts at C-band, you wouldn't know whether I had made a breakthrough at 5 GHz, or had something that was fairly common at 500 MHz. Do you see the problem? The same problem arises when speaking of K and L bands. Both systems use K and L so I feel that we must be rather careful in the use of this new system.

Jim Weir WB6BHI
P.O. Box 23233
San Diego CA 92123

READER REVIEW

KENWOOD TS-511S TRANSCEIVER

I get equipment "jitters" every couple of years of so and when that time came around recently I was determined to purchase an uncompromising transceiver; usable with good effectiveness on both CW and SSB – *and* be satisfied with it for more than a couple of years. After four months of operation, it appears I made a good choice.

Advertising in 73 affected my decision. I ordered my rig sight unseen, since my dealer in Muskegon did not have a unit on display. I waited four long weeks for delivery due to the West Coast dock strike. I paid the whole wad – full rig price, sales tax, surtax, and shipping. The Kenwood line is fair traded by most of its dealers. While awaiting the arrival of my TS-511S, I became aware that Allied Radio of Chicago had just discontinued marketing a transceiver quite similar in physical appearance, but closer examination showed the Allied unit used more tubes, used 6146 finals (lower PEP) had the CW filter standard, but lacked a noise blanketer. Later, I also noted the Allied units manual was much more complete in circuit and trouble shooting detail than the Kenwood TS-511S. Both units are definiately manufactured by Trio of Japan.

I received the unit two days before New Years – and on New Years Day, it quit; that is, the unit no longer dipped out (resonated). Replacing the finals did not correct the problem. After a few minutes checking, I noticed a loose gear drive on the end of the band change shaft which engaged a gear driven rotary switch in the tank circuit. A dual set screw gear had worked loose, caused by changing bands, and was not changing the rotary tank circuit taps. Since this may happen in other units, I wrote Henry Radio and advised them of the problem. With the unit's cover off, I could readily see the excellent construction techniques used. All circuits are on isolated boards, subdivided by section (i-f, audio, etc.). The TS-511S performs superbly, with only minor quirks. I highly recommend the 500 Hertz CW filter option. This option, with the rig's RIT feature allows an almost separate" transmitter and receiver type quality operation. Even the occasional CW op will want the filter – it is much better than audio restriction type filters. The unit's S meter pins on almost all signals 80–20 meters, when adjusted per instructions. The receiver did not swamp or overload under most signal conditions. The slow/fast agc circuits handled signals properly, and allows operator choice when conditions or modes change. The dial linearity is very good from band edge to edge. Once you get used to 1 kHz readout, you'll never accept less accuracy. The bands are covered in 600 kHz segments and conveniently cover many MARS frequencies without the modifications necessary on other rigs. There *is* a carrier frequency jump from upper to lower SSB, and to CW (with the filter), but in most cases this is no problem. The noise blanketer is effective for impulse type noise such as automobile ignitions, however it is only fairly effective on some car ignitions. Fortunately, I don't live near an expressway.

The transmitter tuneup is typically quick and easy, of the better transceivers available today. One can either tune up by the maximum rf out method or the conventional load and plate tune method. The meter checks the four vital functions on transmit and is an S-meter on receive. 6LQ6's are used as finals. Tune-up key-down is kept to a bare minimum as with all sweep tube rigs. A screen grid on-off switch is provided for improved final neutralizing when necessary. Audio reports are good, and the alc circuitry works well under properly adjusted microphone level conditions. A cooling fan is standard equipment for the finals. Actually, the rig is highly transistorized, and hardly gets warm even over extended periods.

In summary, I'm glad I purchased the Kenwood, and I plan to hang onto it. Parts and service are available from Henry Radio directly, as most of the dealers handling the Kenwood line are qualified to give technical advice and do minor repairs, but do not stock the parts or circuit boards. American manufacturers should wake up to the fact that the Japanese equipment now has a firm foothold in America in terms of price, quality, state-of-the-art designs, and service. My advice – consider the Kenwood. It's a gem.

David Alan Linderman WA8IKP
Grand Rapids MI

Joseph M. Plesich W8DYF
RD 1
Irondale OH 49932

Your Ham Club - Interesting? Or Boring!

How are things going at your ham club meetings these days? You say things have been dragging a little? The fellows are tired of having the same old program every week? If this is the situation at your club, now's the time to do something about it while the fellows are still showing up at the meetings.

Let's start by making sure that the club members are reminded to attend the meetings. Your club secretary can send post cards to them, meeting announcements can be sent to the local newspapers and radio stations, and they can also be reminded over your local VHF net, if you have one. If you don't have one, why not start one? Local nets are a big help in holding clubs together. One suggestion made by a club secretary whose club meets bi-monthly, is to mimeograph a sheet of paper with the dates of all the meetings and net nights of the current year, and to distribute it to all the members so they can tack it on the wall of their shacks.

Now that everyone knows on what night your club meets, how do you keep their interest and how do you get them to keep coming to meetings? Perhaps part of the answer lies in a well-organized meeting.

One successful club has their meetings divided into the following three activities.

1. Business meeting – thisportion of the meeting should be long enough to take care of the business and short enough to keep everyone from becoming bored. Your president should have a big gavel and use it. Without at least some semblance of order, nothing will be accomplished. However, don't be too strict. Remember, ham radio is a hobby, and the fellows do come to the meetings to enjoy themselves.

2. Coffee and doughnut break – this isn't absolutely necessary but it is always welcome. You know how everyone likes to raid the refrigerator during the commercial. Try to buy your own coffee maker. It will come in handy for other activities such as a field day, mobile outings and picnics. Also, to keep from drawing upon the club dues for refreshments, keep a "kitty" next to the coffee maker and let the fellows "feed her" according to the dictates of their consciences.
3. The planning activity – this is by far the

most important part of the meeting. Let's start at the beginning: First, an activities committee and chairman should be selected and be responsible for all meeting programs. The chairman should be a dynamic, vigorous person with a forceful, but pleasing, personality. Choose him carefully, for he might well be the most important member of your club!

Below is a list of some suggested club activities. Once you get to thinking about it, you'll be able to add several more to the list.

1. Try a field trip to the electronics department of one of your local industries.

2. Movies are always welcome. Get a list of movies and film strips from QST, your local library, and your local phone company.

3. Have a demonstration. This could be an artificial respiration demonstration by a member of your fire department or Red Cross chapter, or the display of a piece of gear constructed by a member of the club.

4. Construction projects. This can be anything on which the club decides, from UHF gear to a coil loaded bobby-pin vertical for 80 meters.

5. A question-and-answer forum. Get three or four of your "brains" to sit on a panel and let them solve problems tossed at them by club members. It will be a lively evening!

6. Speakers from business and industry. Another idea is to have the members talk about their pet interests, such as DX, traffic handling, etc.

7. Have a joint meeting, picnic, or dinner with another club. If you are really objective in your thinking, you might even do this with a CB club!

8. Mobile hunts. About February, a committee should be appointed to decide the ground rules for your summer mobile hunts. This should include bands operated, area covered, gear used, and prizes. Mimeographed maps of the area to be covered during the hunt are nice to have, as well as picnics after the hunt.

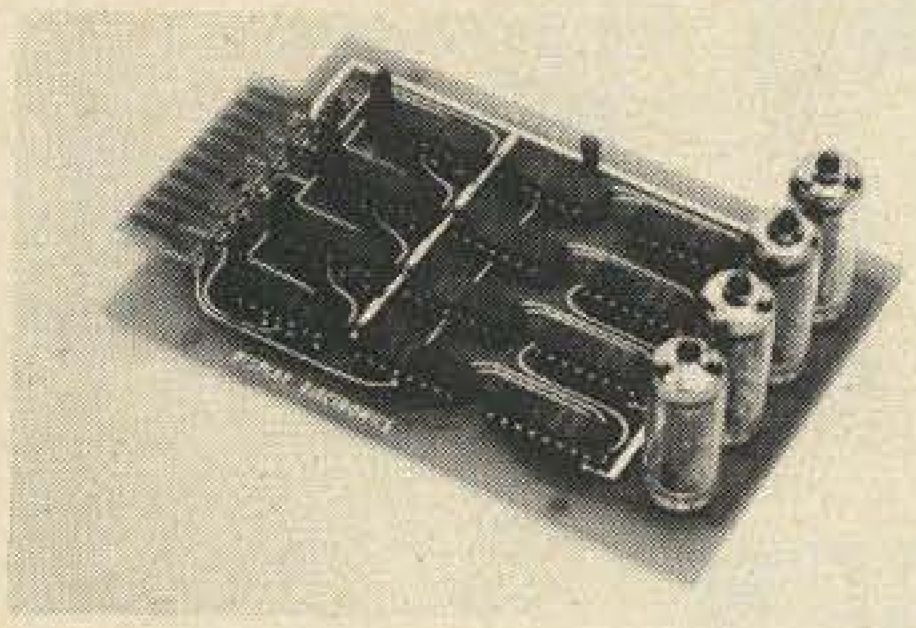
9. Contests. Who can work the most countries from one meeting to the next? How many stations can a club member work in an hour? Who can work the greatest distance with the least amount of power? Keep thinking – you'll come up with many more ideas.

10. Have an auction. It is plenty of work but it can be lots of fun as well as a profitable venture for the club. Careful planning and lots of publicity is the secret of success here. Try to get a good auctioneer. He should be witty, comical, bubbling over with personality, and have plenty of gab.

One way to cut the club in on the profits is for the club to take 5–10% of the price of the piece of gear that is being auctioned. It is a dandy way to add to the club treasury once or twice a year.

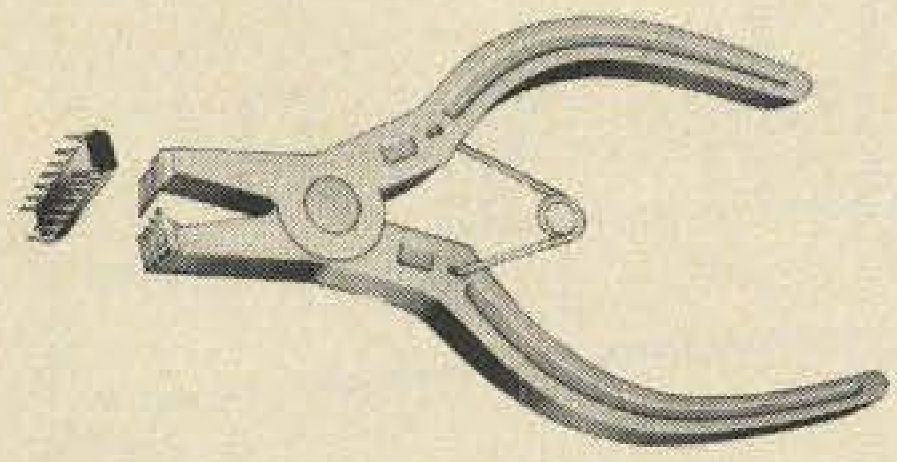
Well, that's about it, fellows. Try to put a little life into your club and you'll watch it grow and prosper. Also, you'll have lots of fun doing it.

. . .W8DYF



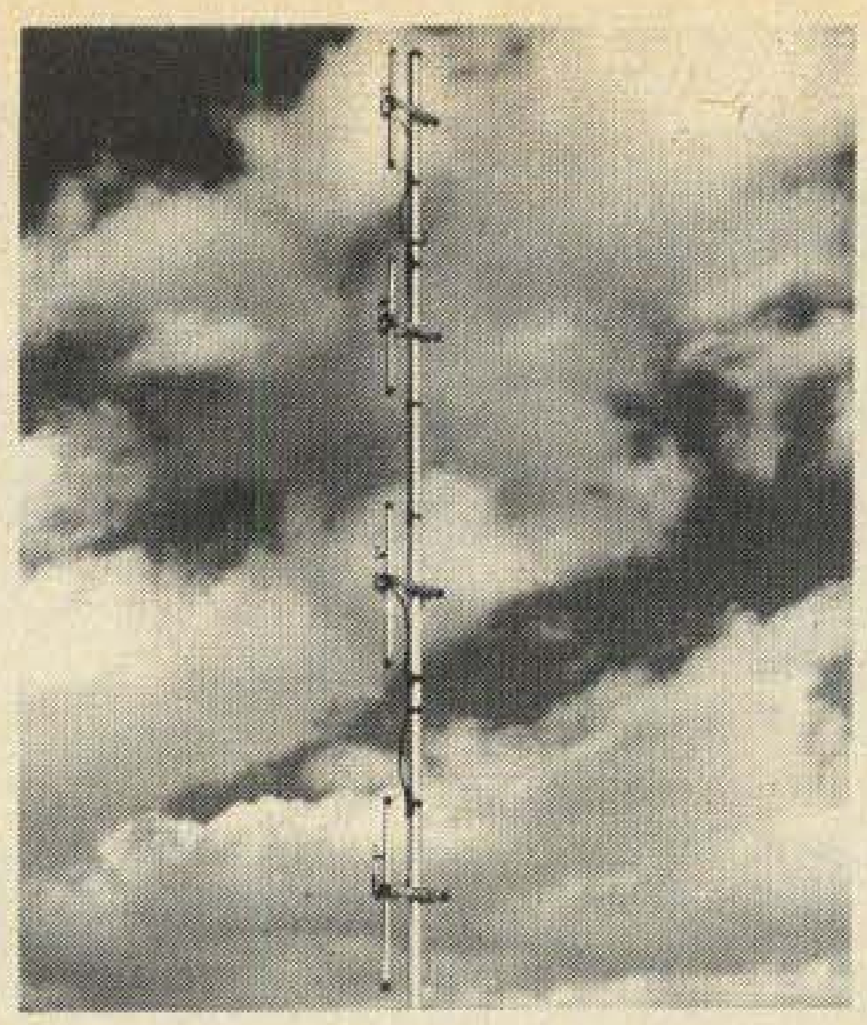
CM COUNTER AND DISPLAY MODULE

The new Series CM Counter and Display Modules, provides a convenient reasonably priced solution to a variety of counting and display requirements. Modules in the series are available in several different numbers of digits with each digit including a decade upcounter, memory latch, decoder-driver and readout tube. Since the incandescent readout tube operates from 5V dc it eliminates the need for an additional power supply. Each character is nearly 1/2 inch high and will provide an attractive, high contrast display when viewed through the polarizing filter accompanying the module. The 7400 series TTL integrated circuits and readout are assembled on a G-10 fiberglass printed circuit board. Connections to the module may be made through the rodium plated edge connector or directly to terminals. The module features zero blanking and a lamp test control. Each module is thoroughly inspected and tested before shipment. A complete schematic and instruction sheet is included with each unit. Write to *Display Electronics, P.O. Box 1044, Littleton, Colorado 80120.*



NEW TOOL

Experimenters will delight at this new integrated circuit inserter/extractor. No more will you need to keep a bottle of iodine on the bench. The Starnetics unit operates like a pair of pliers with a spring loaded handle so that you do not squeeze the DIP into a squashed spider. Metal teeth also act as a heat sink while soldering. And to prevent waste, leads on old ICs can be straightened. This is certainly a universal device for the home builder. It costs less than twenty dollars from *Starnetics, 10039 Riverside Dr., No. Hollywood CA 91602*

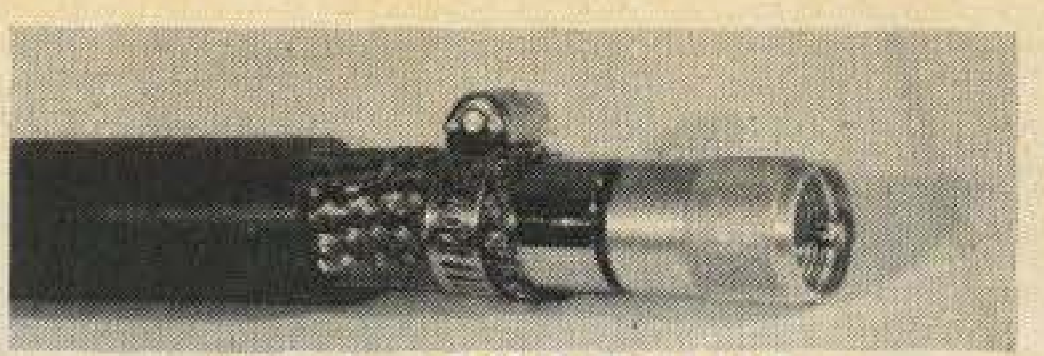


REPEATER BUILDERS NOTE

Cush Craft announces the addition of two new models to their Four Pole antenna design. The Four Pole is a series of four stacked dipoles for amateur FM applications. Four Poles are supplied with the dipoles mounting booms harness and all hardware. Center support mast is not supplied which allows the user to custom select a mast for his installation or to tower mount the antenna. Gain figures for the antennas show 6 dB omnidirectional and 9 dB semidirectional pattern. Available for the 144, 220 and 435 MHz amateur bands. For more information, write to *Cush Craft, 621 Hayward St., Manchester NH 03103.*

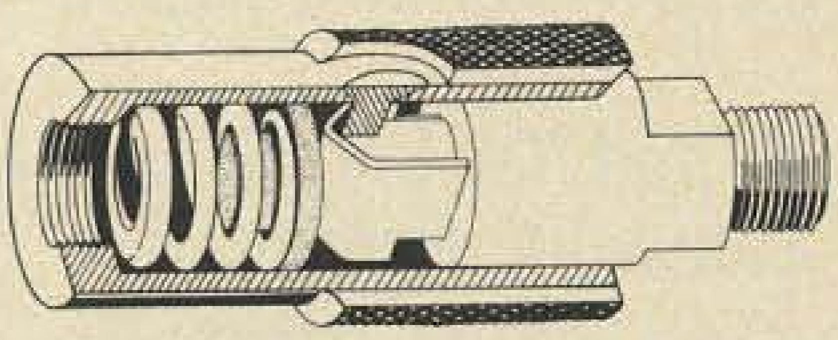
PORTABLE MONITOR RECEIVERS

Now you can listen to the repeaters wherever you go. Tune them in with the Hallicrafters portable monitor receivers. These radios feature continuous tuning over the 27–49 MHz or 144–175 MHz ranges. They have adjustable squelch controls that eliminate background hiss. The rf stage lets you hear the weaker signals and the tuned i-f stages let you separate stations on nearby frequencies. Each of these radios has a nine transistor complement and provides all the sensitivity and audio that the average repeater monitorer wants. Price of these units is under forty dollars. For more information, write to the *Hallicrafters Company, 600 Hicks Rd., Rolling Meadows IL 60008.*



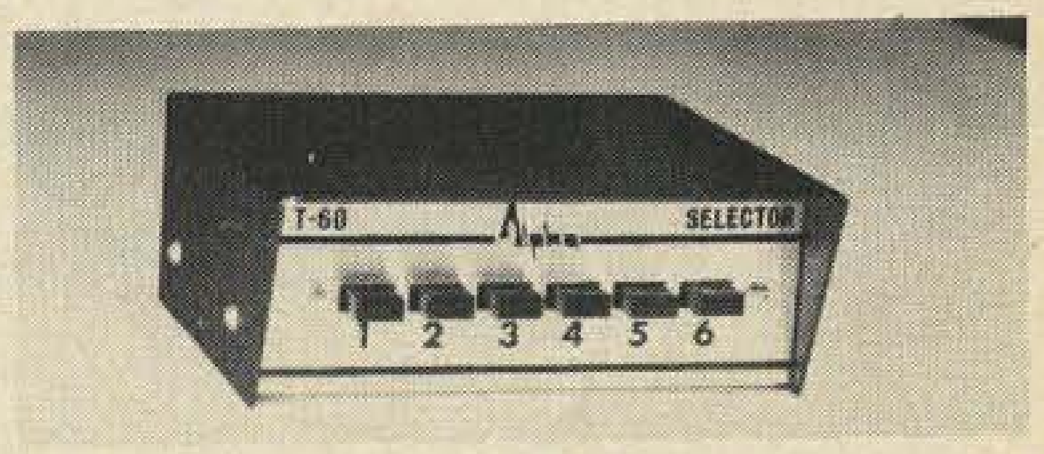
COAX CONNECTOR

At last! A low priced connector for RG-17/U coaxial cable. RG-17/U coax is a low loss and flexible cable suitable for amateur use. It is also inexpensive when compared with alumium hard line and other low loss transmission lines. This connector enables the RG-17/U to be connected directly to an SO-239 receptacle without an adapter. The connector may be used at frequencies up to 550 MHz with negligible insertion loss. In addition, no special tools are required for a solderless installation that is completed in minutes. For more information write *Wayne Smith Products, P.O. Box 46521, Bedford, Ohio 44146.*



QUICK ANTENNA DISCONNECT

NEW-TRONICS CORPORATION announces the first available 100% stainless steel Quick Disconnect for instant press and twist removal of a mobile antenna from its mount. Lifetime performance is assured in this heavy duty assembly with special encapsulated design and stainless steel spring for freedom from sand, dirt or ice jam-ups. The Model QD-1 will accommodate small, medium or large antennas with 3/8"-24 base. For additional details write: *NEW-TRONICS CORPORATION, Sales Department, 15800 Commerce Park Drive, Brookpark OH 44142.*



NEW TONE ENCODER

Repeater users who frequent tone-entry repeaters should consider the new Alpha Electronics MT-60 tone encoder with six selectable tone frequencies. Each tone is completely adjustable from 20 Hz to 300 Hz, and the tones can be continuous or pulsed. The beauty of this unit is that it also is a tone decoder. Several hams can have a selective calling system so that only the desired station can break the squelch. Different combinations of encode and decode functions can be made. The tones are determined by plug-in modules. Write to*Alpha Electronic Services, 8431 Monroe Ave., Stanton CA 90680.*

The 2-Meter FM Rig The Experts Praise

GLADDING 25™

6 CHANNELS/2 METER/TRANSCEIVER/25 WATTS

Power is the keyword when discussing Gladding 25™, the two meter transceiver the experts recommend.

Gladding 25 is so similar to our marine gear (we're the leader in AM and FM marine communications) we are able to take advantage of the tremendous buying power and production efficiencies our huge volume gives us. The result is remarkably low priced. A Gladding 25™ has the power, price and the features amateurs want most, with unmatched quality.

• 25 Watts output • 0.3 micro volt uv sensitivity for 12 db SINAD • Dynamic microphone for unmatched audio • Six separately switchable transmit and receive channels • Crystal supplied for 149.94 simplex and repeater capability on 146.34/146.76 and 147.34/146.94 mHz • 12 volt mobile unit has matching accessary AC power supply • Vacuum tube driver and final for reliability and economy • 8 pole crystal lattice filter • Solid state receiver • Transistor sockets • Glass epoxy printed circuit boards • Quick disconnect power plugs • Mobile mounting brackets • One watt output capability for short range communications.

$249.95
for mobile unit

$299.95
with accessory AC power supply

Write for complete information.

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DIVISION OF GLADDING CORPORATION
P.O. Box 800, Biscayne Annex, Miami, Florida 33152

Ed Webb W4FQM/1
Technical Editor

The HEATH IB-102 PRESCALER

With the greatly increased activity on 6 and 2m FM the average ham is in dire need of a means for frequency measurement above 30 MHz. The Heath Company had a nice 15 MHz counter (the IB-101) well within the normal ham's equipment budget. But a method or device was needed to allow their 15 MHz counter to measure to better than 150 MHz. To fill this need Heath introduced the IB-102 prescaler. This unit will take a 150 MHz signal and divide it by 10 and thus allow the counter to read it as a 15 MHz signal.

The Heath IB-102 prescaler is enclosed in the same attractive case as their counter. The unit is all solid state of course, using both FET and bipolar transistors plus TTL integrated circuits. With Heath's excellent instructions and assembly manual the kit goes together in four or five evenings of work.

The 50Ω input to the IB-102 is fed to a broad band amplifier. This amplifier in turn feeds an IC that functions both as a trigger circuit and as a level translator to get the input signal to the proper TTL switching levels. The output of the trigger circuit is fed to a second IC that provides a divide by 2 function. The divide by 2 stage is followed by an IC divide by 5 stage for a total division of 10. An additional IC decode (divide by 10) stage can be switched in to give a divide by 100 as well as a divide by 10 function. The output from the various divide stages is fed to an output buffer amplifierThis gives the proper impedance transformation from the relatively low impedance used in the ICs to a high impedance output that will match the high impedance input of a frequency counter. Provisions are also made to operate the scaler "straight-through" when the divide by 1 function is selected.

The Heath IB-102 offers several important features not found on any of the other prescalers offered on the ham market.

First: It has an input level meter so that you know that the prescaler has an adequate input signal level for proper operation. No more do you have to adjust the input coupling to the prescaler and see if your counter reading changes. The meter tells you the whole story.

Second: The IB-102 has an input sensitivity control on the front panel so you can adjust the input broadband amplifier gain to keep the input level meter in the green area. There is even an input test button on the front panel. If you push it (with a signal applied to the prescaler) and the input meter stays the same, you have enough input gain. If the meter level changes you need to adjust the input gain control or provide more input to the prescaler.

Third: The IB-102 is the only prescaler to have a divide by 100 function. This doesn't mean much to you if you have a 15MHz counter and thus can use the divide by 10 function to read 2 meter signals. BUT if you are one of those who has one of those surplus 2 MHz or 10 MHz counters from MARS, the divide by 100 function saves the day – you too can read 2 meter signals. True, you lose a significant figure on the right and thus only read to the nearest 100 Hz with a 1 second gate time. But on most of those counters you also have a 10 second gate time. By using 10 second, you regain your lost digit and read to the nearest 10 Hz!

The input sensitivity for 2 meter work is excellent. A 90° right angle BNC connector was put on the input jack. A little 19 inch whip antenna was fitted to a male BNC connector and that in turn was plugged in the right angle connector. Now the prescaler was all set with a 1/4 wave 2 meter vertical antenna. No trouble was encountered in getting the input meter "in the green" and good counter readings from a 2W hand-held 2 meter transceiver across the room. Even mobiles pulling up in the driveway 15 feet away could be read.

Once again the Heath Company has seen the ham's need and has zeroed in on the problem. Result: a new product that exactly fills the need and is less than $100. That's a hard act to follow. The IB-102 is a most satisfactory piece of test gear and should be a companion to the counter in your lab. It lets you accurately measure frequencies that you could only guess about before. With the IB-102 available, there's no excuse for being off frequency whether it be on FM or moonbounce or one of the MARS VHF channels. ...W4FQM/1

MARS

From your response to earlier MARS articles, two things are ob-vious: If you are already a MARS member, this column is old-hat–you are familiar with the operation, the meetings, the awards, etc. If you are a non-member, such news items are of no great interest–more importantly, you want to know what MARS mem-bership could mean to you. Therefore, in the future, I will concentrate on the MARS story, its purposes, plans and aims, and how you can broaden your horizons and profit greatly as a result of your membership.

Consider, if you will, an organiza-tion of thousands of dedicated hams, all using the same procedure, the same format, the same phonetics for a given letter of the alphabet–and all bound together by a common interest, mili-tary communications. Generally, hams are a friendly lot, by nature of their hobby. MARS membership embel-lishes this friendship–members be-come close friends through their asso-ciation day after day on MARS fre-quencies, constantly adding the newer members to their own individual circle of friends and acquaintances. Ex-ample: Third US Army MARS insti-tuted the "buddy" system several years ago. A new member is assigned a "buddy"–an older member who lives nearby–to help the neophyte get on the air, or to answer any questions concerning the MARS operation.

To reiterate, you don't become a MARS member *instead* of becoming a ham–you become a MARS member *because* you are a ham! The basic requirements are: a valid amateur radio license (yes, you can join as a Novice or Technician); at least sixteen years of age; an interest in military radio communications; equipment capable of operation on the frequen-cies to which you will be assigned–in most cases just outside the eighty or forty meter bands. To become more familiar with the MARS operation, you might like to listen to some of the Nets. Try 6997.5 kHz, 7305 kHz, 7358 kHz, 7360 kHz and 14,405 kHz in the daytime. During the early evening hours listen on 4001.5 kHz, 4010 kHz, 4015 kHz, 4020 kHz, 4025 kHz and 4030 kHz. WAR Broadcasts, consisting of approximately 200 words, are transmitted Mondays at 8 PM Eastern Time on 3347 kHz, 6997.5 kHz and 14,405 kHz at 15, 20 and 25 words per minute. Such trans-missions are good code practice opportunities.

If you are equipped to copy Tele-type, the same message is transmitted on the same frequencies on Tuesday evenings at 8 PM Eastern. Army MARS stations use the prefixes A, AA, AD or AL before their usual district number and final letters, i.e.: W4SCF is A4SCF in Army MARS. Air Force MARS stations are identified by AF prefixes, while the Navy MARS program utilizes N prefixes. A bro-chure outlining the MARS operation will be sent to those who are inter-ested. For the brochure, for MARS applications for any branch, or for any information concerning MARS, simply address:

Harry Simpson
MARS Editor
73 Magazine
Peterborough, N.H. 03458

REPEATER UPDATE

LISTENING
94 76 88 73 70 64 82. . .

NC	K4RUQ	Durham	34–94
NC	K4ITL	Raleigh	28–88
NC	K4RSH	Chapel Hill	22–82
NC	WB4QEP	Danville	28–88
NC	K4VUG	High Point	34–94
NC	WA4OFF	Greensboro	16–76
NC	W4EVU	Salsbury	28–88
NC	WB4PPS	Roaring Gap	22–82
NC	W4PAR	Lexington	31–91
NC	WA4CQK	Mount Airy	38–98
NC	W4BFB	Charlotte	34–94
NC	W4NYR	Shelby	28–88
NC	WA4NUO	Ashville	34–94
NC	WA4BVW	Mt. Pisgah	16–76
TN	W4TEA	Knoxville	16–76
ENGLAND			
	GB3PI	London	145.15–145.75

FM REPEATERS IN ENGLAND

A "UK FM Group" has been formed to press for permission to establish FM repeaters in the UK. So far, such repeaters are not allowed by the authorities. The following are some FM channels (simplex) in com-mon use in the UK:

144.350 Calling channel, Southwest and South Wales area
144.400 Working channel for above area
144.480 Calling channel, London area
144.600 RTTY and FM working chan-nel but RTTY priority
144.800 Working channel matching above calling channel
145.000 Mobile calling channel
145.150 Calling channel (little used at present)
145.200 Working channel matching above calling channel

W2EEY

ARE YOU TAKING 2 METERS TO HAWAII?

Hawaii repeaters have been ex-panded with a view towards better coverage of the islands and better service for the visitor.

146.28/146.88 is now on Diamond Head, giving full coverage of your stay in Waikiki. This repeater, KH6EQF, is linked on 450 to KH6EQK on Mount Haleakala. With its 10,000 foot ele-vation, KH6EQK gives good coverage on 146.34/146.94 throughout the islands of Maui and Molokai, and coverage on parts of northern Oahu and western Hawaii (The Big Island). Plan on .34/.94 for your island hop-ping, but you may want .28/.88 in Waikiki unless your hotel room is high and easterly facing Haleakala, 100 miles away.

146.20/146.80 is primary Honolulu frequency, thru a new repeater at Tripler Army Hospital. There are over a hundred users on this repeater. Consider this pair if you plan an extended stay.

146.16/146.76 is a local-area fre-quency. One repeater, KH6FOX, is located at the University of Hawaii, with coverage into Waikiki. Another, KH6EQL, is located in north-central Oahu at Waialua. A third, KH6EQN, is under construction at 8,000 feet in the Hilo area on the Big Island, with plans for a link to reach the Haleakala -Diamond Head complex. These three local repeaters, all on 146.16/146.76, are lightly loaded and serve as escape routes when the big ones are busy.

There are no tone-access require-ments on Hawaii repeaters.

Hawaii amateurs welcome ham visi-tors, and hope that this explanation, more extensive than is possible in the various charts, will help you to turn up in Hawaii with the right fistfull of crystals.

New Product

100 MHz COUNTER KIT

Heath Company has introduced the IB-1101 Frequency Counter with a 1 Hz to over 100 MHz range and a list of features before now unheard of in low-cost counters. The Heathkit IB-1101 has an input circuit that will accept input levels from less than 50 mV to more than 200V, depending on frequency. The full five-digit readout can be expanded to eight-digit capabi-lity by simply using the overrange circuitry. And to make accurate read-out even easier, the decimal point is automatically placed with range selec-tion, while MHz, kHz, overrange and gating are indicated by front-panel lights. A one megohm input imped-ance and low input capacitance reduce the chance of circuit loading.

Priced at just $269.95, the IB-1101 can be assembled in 10 hours. The 26 digital ICs and five cold-cathode read-out tubes plug into individual sockets. All other components mount neatly on one double-sided circuit board. For further information write *Heath Com-pany, Benton Harbor MI 49022.*

Caveat Emptor?

Price – $2 per 25 words for non-commercial ads; $10 per 25 words for business ventures. No display ads or agency discount. Include your check with order.

Deadline for ads is the 1st of the month two months prior to publication. For example: January 1st is the deadline for the March issue which will be mailed on the 10th of February.

Type copy. Phrase and punctuate exactly as you wish it to appear. No all-capital ads.

We will be the judge of suitability of ads. Our responsibility for errors extends only to printing a correct ad in a later issue.

For $1 extra we can maintain a reply box for you.

We cannot check into each advertiser, so Caveat Emptor . . .

ATTENTION REPEATER OWNERS If you are interested in joining other repeaters via 10 meter DX inter-tie, contact Keith W7DXX/1 at 73.

SELL: HEATH HW-32A ac & dc power supply, EV 664 desk mike, Shure 414 mobile mike, HM-11 SWR bridge. No reasonable offer refused. C Novak, 110-48 72 Ave. Forest Hills, NY 11375.

NO QRN Wyoming ranch land, wild horses, antelope, deer. 10 level acres $20 down, $20 month. Mike Gauthier, K6ICS, 9418 E. Florence, Downey CA 90240.

COLLINS MECH FILTERS 455 Z 10 used $3, F 250 A 67 new $2.50. Want tuner assy. for TS-497 Sig. Gen. state condition and price. WB6IQS, PO Box 4255 Palm Springs, CA 92262.

HAMFESTERS 38th Hamfest and Picnic Sunday, August 13, 1972, Santa Fe Park, 91st and Wolf Roads, Willow Springs, Illinois, Southwest of Chicago. Exhibits for OM's and XYL's, famous Swappers Row. Information and tickets, Joseph W. Poradyla, WA9IWU, 5701 S. California Ave. Chicago IL 60629.

HEATH HW100 HPZ3A SSB/CW filters, with front panel switching. Recently factory aligned, $285. Pickup sale preferred. Dave Lambert, WA1JSD, RFD 3, Derry NH 03038 (603) 432-8194.

100 WATT RF AMPLIFIER Model AKT-7 RF Amplifier will run 100 watts input to an Amperex 5894. In like new condition, still in original military packing. Tunes 200 to 400 MHz as is, can be converted to 2 meter FM amplifier or used as 220 MHz FM Amplifier. Recent issue (1962), $20.00 shipped prepaid. Enclose SASE for copy of schematic and 4 page list of other goodies. Richard Solomon, 19 Pierce Road, Watertown, MA.02172.

FM HAMFEST Sunday August 6 Steuben Co. 4-H Fairgrounds near Angola, Ind. Large flea market, gate prizes – 1st prize an HT220. Picnic grounds, campsites ,boating, swimming, food, soft drinks available. Entertainment for SYL. No vendors fee. For more information write FWRA Box 6022 Fort Wayne, Ind. 46806.

VHF NOISE BLANKER Models available for VHF transceiver and receiver-converter systems. See advertisement in July issue 73. WESTCOM ENGINEERING Box 1020, Escondido, CA 92025

YOUR CALL LETTERS Two sets, for windshield and rear glass. Smart white letters with red outline. Easily installed pressure sensitive decals. $1.00, postage paid, anywhere. Satisfaction guaranteed. Lake Jordan Artists, Slapout AL 36092

QST MAGS OCTOBER 1916 TO PRESENT also many other mags and handbooks. Want to sell out everything. Best offer. Sase for list. W6AG 213-786-1214

INFRARED INTRUSION Detector kits. Transmitter: $24.00, Receiver: $22.00. Kits include board, board-mounted components, emitter/detector. See March Popular Electronics. H. Olson, PO Box 339, Menlo Park, CA 94025.

FOR SALE Heath SB-610 Scope. 3 months old $85. Johnson 6 N2 VFO $35. Jim Gysan 53 Lothrop St. Beverly MA 01915 (617) 922-3850.

FLASH
EUROPE ORGANIZES FM WITH 600 kHz SPLIT

Just got a telephone call from Kris Partridge, G8AUU in London. He says Region 1 had a meeting in The Hague May 15-19 and they made the big decisions for FM. As to how the decisions will affect FM in England, they have set up 33 repeater channels. There are 1 through 33 covering 145 to 146 MHz. Starting at 145.025 each channel is in 25 kHz steps to 145.825. Channels 1 through 9 are repeater inputs, channels 10 through 19 have not been allocated, and channels 20 through 33 are repeater outputs. Power is limited to 15 watts erp and the deviation in narrow band. (In England wide-band is 5 kHz and narrow band is 3 kHz.) Also, tone burst of 1750 Hz is required. The first repeater on the air will be GB3PI in London with the input on channel 6 and the output on 145.750. 145.000 is the national simplex frequency. We will have full details next month.

. . .W7DXX/1

FOR SALE: HEATHKIT compact kilowatt HA-14 linear, good condition, and homebrew power supply. $110. W2KPE 147-11 76th Ave., Flushing NY 11367.

THREE CHANNEL HANDIE-TALKIE complete with crystals for 04-64, 16-76, and 94-94. Also includes desk stand charger and nicad battery. $315 value. Brand new. First check for $250 gets the whole package. Under manufacturer's warrantee. Radio Bookshop, Peterborough, NH 03458.

CLEANING OUT SHACK garage and attic. Six new surplus 6C21 Triodes, misc. XMfr's, chokes, caps & xtals. List available. WA7OTN, 185 E. 550 N., Bountiful UT 84010.

FM IC-20 & REGENCY – 2A OWNERS Now available, 4 frequency tone burst oscillator, internally mounted. $29.50. Bob Brunkow 15112 S.E. 44th Bellevue, WA 98006. Phone: 206-747-8421.

COMPUTER SHACKSIGNS printed on computer paper, block letters by IBM-1130. Beautiful! Frame it! Call alone, or anything. 13½" x 11".2 for $1.00. WA2BCY, Lambert, 240 Garth Road, Scarsdale NY 10583.

SALE – LIKE NEW with original instruction book (3) art 13 autotune aircraft transmitters with all tubes, $50.00 each. Also: (3) new panadapters, BC 1031 with spare tubes and power cord and original tech. manual. $70.00 each. Shipping costs collect. W3RYJ, RD 4, Box 368, Reading, PA 19606.

FIGHT TVI with the R.S.O. Low Pass Filter. See p115, March 1972, *73*. Write for brochure. Taylor Communications Manufacturing Company, Box 126, Agincourt, Ontario, Canada.

WARREN, OHIO ARA's Family Hamfest, August 20. Giant fleamart, swimming, picnicking, all free. Displays, mobile checkin. Camping available. Yankeee Lake, Rt. 7 near I-80. Details: QSL W8VTD.

IRCC PICNIC/HAMFEST Try it! You'll like it! July 9, Fairgrounds, Lafayette, Advance $1.50, Gate $2.00. Order: SASE to W9YIP, 477 Robinson, West Lafayette, IN 47906.

EARLY VACATION Then tear up that ticket to Tahiti. There'll be more fun at the ARRL Hudson Division Convention, October 21-22, Hilton Motor Inn, Tarrytown, NY. Exhibits, lectures, 2 meter FM, RTTY, contests, gabfests, New York sightseeing. Fun! No charge for a suntan. For information write Dave Popkin, WA2CCF, 303 Tenafly Road, Englewood NJ 07631.

WANTED 10 meter FM base station. Contact Keith W7DXX/1 at *73* Magazine.

Center Tap a Pot With Silver Paint

After several hours of a Saturday morning were spent trying in vain to locate a 100K center tapped linear pot in local stores, it was decided to try another tack. A regular 100K linear pot and a bottle of silver conductive paint were bought. The paint is the type sold for the purpose of repairing damaged circuit boards and while not cheap, it does have a myriad of uses and will last a long time.

The rear cover of the pot was removed and a careful calculation made as to the exact center of the resistance element. (Translation: I eyeballed it and dobbed the paint in what looked like the center) The stripe of silver was continued across the phenolic to the nearest point of the brass shaft bushing which served to attach the pot to the panel. Success! It worked exactly as planned. Please note that in the example cited the center tap was to be grounded. In circuits in which the tap is above ground other arrangements would need to be made. Perhaps a notch cut in the back cover to clear a wire which could be glued to the phenolic and the conductive paint connected to the bare end.

The left over paint will be useful to put in connections on PC boards which were forgotten before etching or required by later redesign in addition to its intended purpose.

William Turner WAØABI

Eric Falkof K1NUN
Assistant Editor

VHF SPECIALISTS FM-10-50 amplfier

VHF Specialists of Vienna, Virginia, a relative newcomer to the amateur market, has introduced the new 2 meter class C amplifier for FM work. The new unit has been designated Model FM-10-50. The amplifier is somewhat unusual as it utilizes modular type of construction. This technique allows the manufacturer a large degree of flexibility in that different modules may be used to form many different amplifiers with various input and output power levels. The FM-10-50 is a two stage type of class C amplifier using Balanced Emitter Transistor in both stages. The BET type of device can withstand almost infinite VSWR and yet remain undamaged. This is an important factor should you have a broken antenna or shorted feedline. Each amplifier stage is mounted on its own small glass epoxy (G-10) printed circuit board. The two p.c. boards are then mounted side by side in the cabinet and electrically coupled together. The input amplifier or driver stage p.c. board also contains an rf sensing circuit and dc amplifier that functions as a relay drive. The relay being driven is a double type of TR relay on a DPDT form. In the receive mode the relay contacts are connected to allow the signal coming from the antenna to bypass the amplifier on their way to the transceiver. In the transmit mode when the transceiver is keyed the rf sensing circuit pulls in the TR relay thus switching the amplifier in between the transceiver and the antenna. When the transceiver mike button is released the amplifier is once again automatically bypassed for receiving.

In actual testing the FM-10-50 would respond to input power levels as low as 1W while producing 22W output at 13.6V dc. 10W in yielded 42W out and 15W input produced 54W output.

While quadrupling your transmitter power doesn't actually double your range (except in theory) it does do a lot to fill in those "not so hot spots" that you are noisy into the repeater each time you go there. It extends your "outer limits" to usable coverage area where you can put a decent signal into the repeater for as far as you can hear it pretty well full quieting.

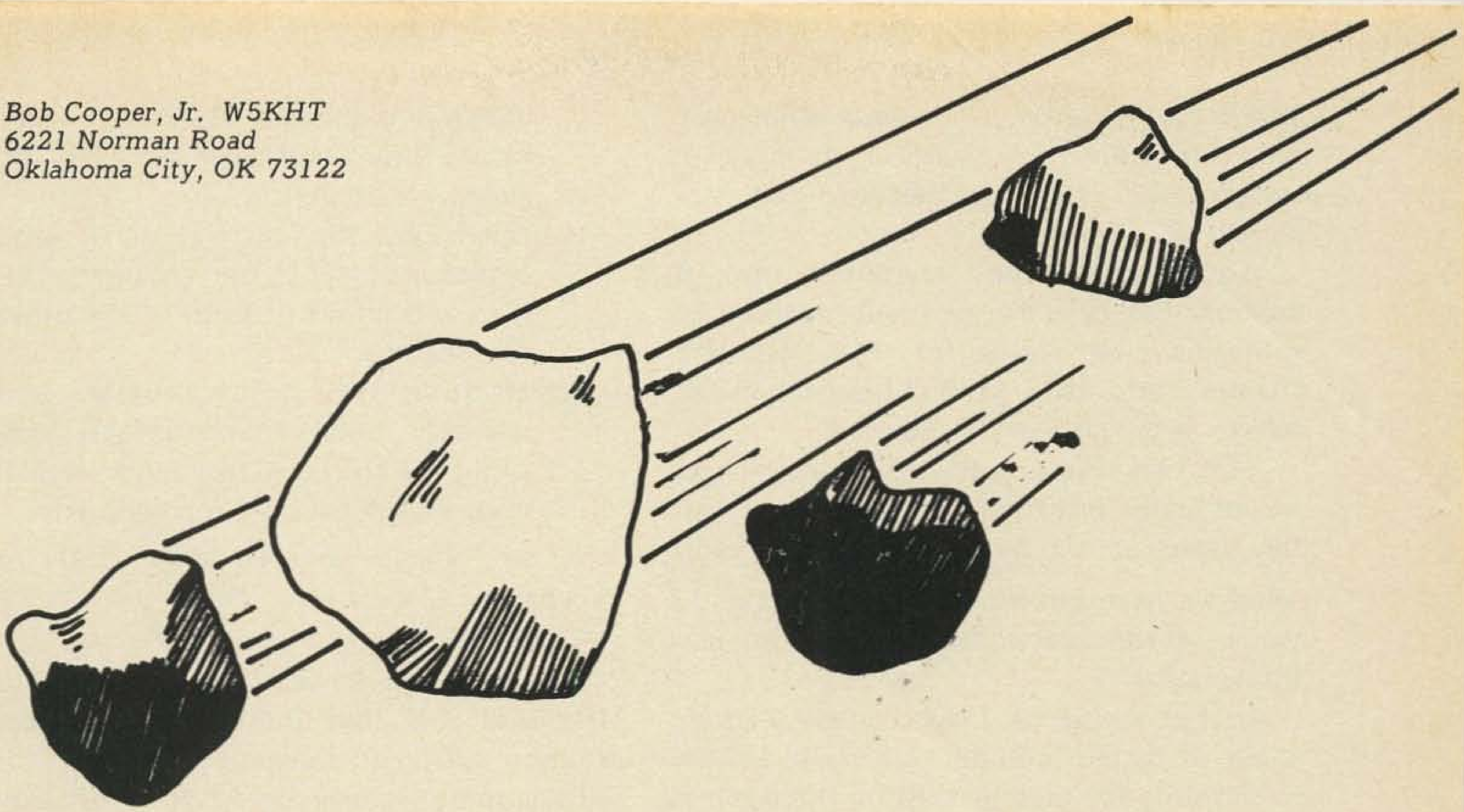
It is an interesting point to note that the VHF Specialists FM-10-50 also uses 100% all-American parts throughout. America is the unquestioned leader in rf power transistors as evidenced by the fact that all four manufacturers of 2 meter class C power amplifiers have stuck to all-American parts and active devices.

The FM-10-50 is mounted in an aluminum case with a top mounted heat sink that is common to both stages. Installation is simple: connect to 12V dc and connect to your 2 meter rig and antenna. No tune-up is required.

. . .K1NUN

VHF Specialists, P.O. Box 167, Vienna VA 22180.

Bob Cooper, Jr. W5KHT
6221 Norman Road
Oklahoma City, OK 73122



Meteor Showers:
NEW ROLE IN VHF DXING?

More frequent than you might guess, meteor showers can provide some interesting DX possibilities – but the key is in taking the proper advantage. Here are some hints and a lot of new data. . .

Nearly twenty years have passed since the first amateur use of meteors on 144 MHz, but strangely enough our apparent understanding of the mechanism is still quite cloudy, and our techniques for use of this propagation mode haven't changed much.

Basically, communication via ionized meteor columns is closely akin to sporadic E skip; only the duration is so short as to force users of this medium into a set of rigidly timed transmitting and receiving sequences if a contact is to result.

Unfortunately, the E layer of the ionosphere (extending from an average minimum height of 45 miles to an average maximum height of 85 miles above the surface of the earth) is still very much a mystery to us, in spite of various scientific studies.

Techniques Utilized

Nearly all amateur radio work with meteors above 50 MHz occurs on 144 MHz, and during periods of the year when *meteor showers* are forecast. Even within the shower periods, schedules are maintained (as a rule) only during those time slots when peak meteor activity is forecast Effectively, this precludes amateur (radio) observations during the other 99 percent of the year – periods during which we know only that meteor activity is not *forecast* to be exceptional. In effect, our current use of meteors on 2 meters skims only the top from the year's meteor crop, leaving the rest unobserved and unmeasured.

Additionally, the amateur's use of meteors has been for the sole purpose of gathering new states for 144 MHz DX chasers, and once a contact has been made, seldom is repeat work attempted.

Thus we have a built-in situation where we annually return at the same time, over the same or similar paths and reverify what we have known for as far back as 15 years, seldom attempting to seek out new information.

In the spring of 1969 I made a crude study of meteor column reflection. I chose to monitor for meteor skip on three separated frequencies, essentially over a two-octave range, utilizing commercial signal sources. Channel 7 video (175.25 MHz), FM broadcast band (93.7 MHz), and channel 2 video (55.25 MHz) were simultaneously monitored and, where practical, recorded. The monitoring system in use during the one-year period was basically as shown in Fig. 1.

The main areas of interest during this study were as follows:

(1) Determine the relative frequency of bursts encountered at each of these three (low, mid, upper) VHF regions.

(2) Determine the correlation, if any, between bursts in one frequency region and either or both of the other two regions.

(3) Measure the hourly, daily, and monthly burst *counts* (where possible) *within* each frequency region (and overall for all three regions).

Note: "Bursts" as used herein, refer to receptions of 1–2 sec. "Pings" are shorter, "superbursts" longer in duration.

Amateur experience at 50, 144, and 220 MHz indicated that the *random* meteors produce sufficent ionization for CW (or SSB) communication on 50 MHz virtually any morning of the year in the 0500–0800 period over paths of 400 to 1200 miles. At 144 MHz, CW exchanges can be demonstrated by well equipped, properly manned stations equally as often, although most of the exchanges would not qualify as a contact. Limited work at 220 MHz indicates that random morning exchanges are unlikely, but not completely ruled out. WØDRL, incidentally, has demonstrated that exchanges on 432 MHz are possible during dense shower periods, with contacts

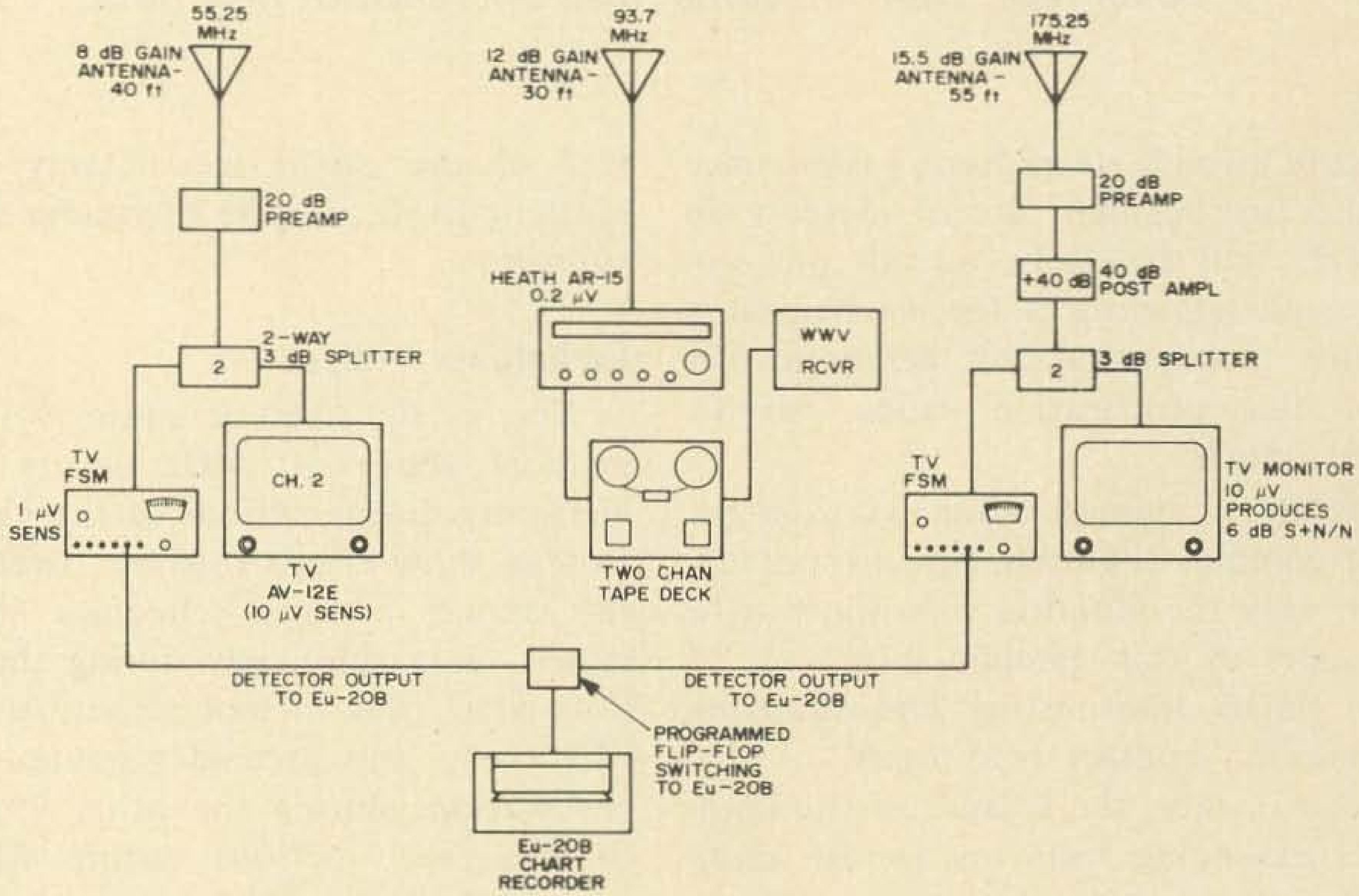


Fig. 1. Equipment set up for year-long, three-frequency monitor experiment.

sure to follow as techniques are improved.

Basic Mechanism

Space debris, consisting mostly of fine particles of dust and small rock, is scattered throughout the solar system (and probably the galaxy) in a semirandom state. If the entire solar system is measured for space debris concentration, over the billions of cubic miles contained therein, the debris would appear to be quite evenly distributed. However, if a relatively small area (such as a million square miles) is studied, a less even distribution of the debris becomes evident. And as we confine our study area to even smaller regions, *substantial* variances in the seemingly even distribution of the debris become apparent.

This bunching of debris is quite well known, manifesting itself (from our earthbound vantage point) as *regularly scheduled* meteor showers.

Not so well known is the fact that during nonshower periods the number of meteor particles swept up by the earth is also subject to considerable variation. From tables of visual observations during the 3–4 a.m. (local standard time) period, radio meteor activity in the 5–7 a.m. period can be quite accurately predicted. This has been verified by a number of observers.

This space debris which travels throughout our solar system may travel in our own *plane*, in an adjacent plane, or in a plane that is *tilted* (with respect to the earth revolving around the sun). We may encounter the same debris region each year, in our revolving about the sun, or less often than annually.

All studies of meteor debris made from the earth began as visual studies, and were therefore limited to those periods of the day when there was local darkness and clear skies. Radar returns from ionized meteor columns have evolved as a minor research program by a number of university programs, and this has helped to fill in the important time gap when the sky is not dark or clear enough for observation. (This is especially important in the summer period when daylight is longer, the peak period of the year for meteor activity.)

As the earth revolves about the sun, it is also rotating on its own axis. As Fig. 2 shows, the leading side of the earth (the side facing into the direction of the earth's travel through space and around the sun) is

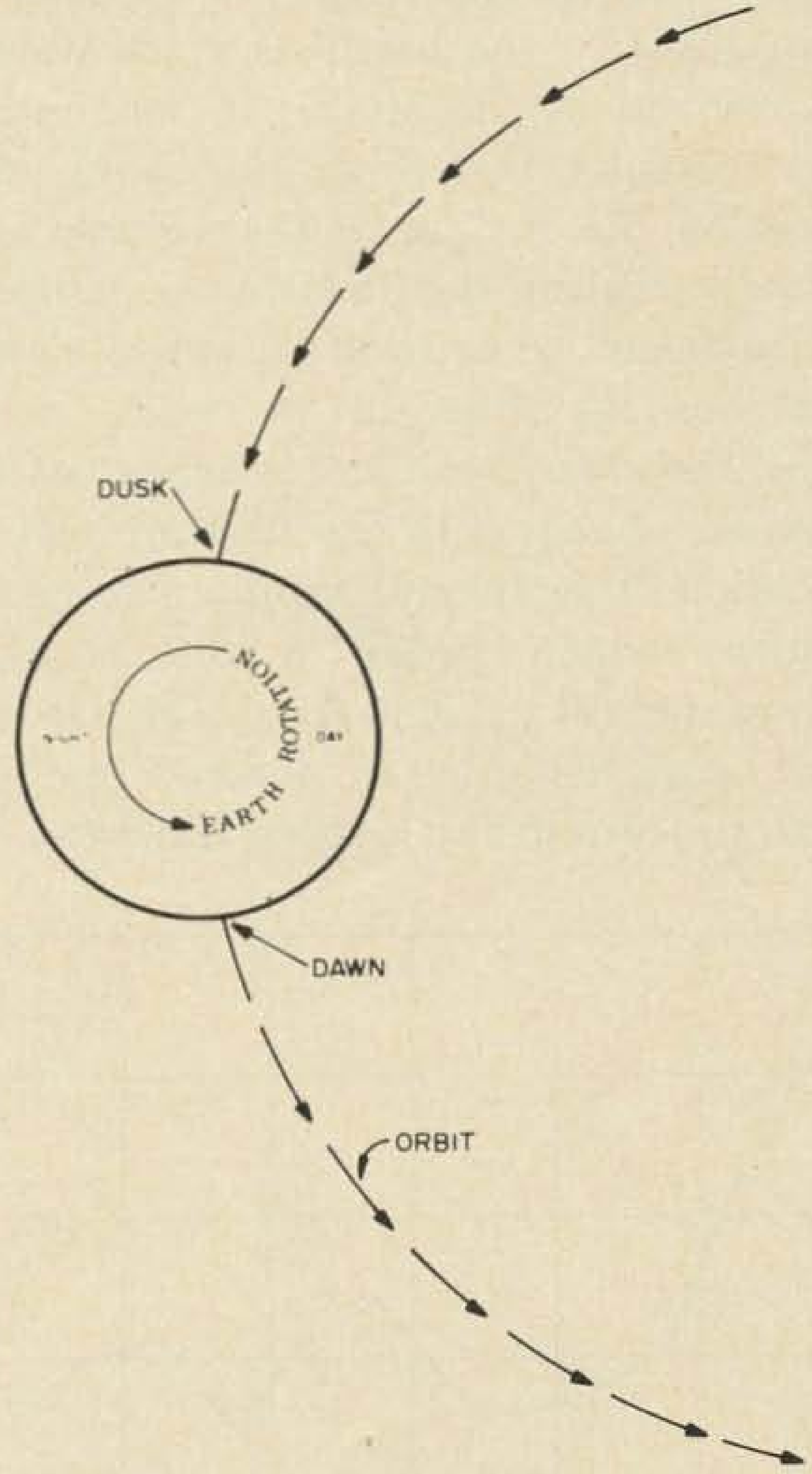


Fig. 2. Sketch shows direction of earth travel and rotation with respect to sun.

at the 6 a.m. (earth time) point. And the 6 p.m. point (the opposite side) is directly behind the earth's leading edge. As the earth travels through space, it overtakes slower-moving space debris caught ahead of it. Captured by the earth's gravitational field, the debris is pulled toward earth. At the same time, space debris moving in essentially opposite directions to the earth's movement is met head-on. The earth literally runs down much of the debris caught in its path, and unless deflected away from a true course, this debris is drawn directly into the E layer.

The density of gaseous particles in the upper layers of our ionosphere is quite well known. The density of the F layer, for example, is considerably lower than the density of the E layer.

The speed of the debris particle (which is dependent upon its original trajectory before it was caught by earth gravity) determines to a large measure the friction between the particle and the gaseous contents of the E layer. As the particle is drawn closer to the earth's surface (lower and lower in the E layer), it encounters denser gaseous materials, increasing the friction on the surface of the particle and eventually heating the particle to a temperature sufficent to cause it to ionize a trail of gaseous materials in its wake as it trajects towards the lower reaches of the ionosphere. Eventually the friction heat of the particle is sufficent to cause it to ignite or burn, which produces the familiar shooting star. Visual ignition of the particle is not required for an ionized meteor column to form in the E layer, however.

The ionized column is in actuality a *cone*, and the electron density within this conal region is sufficent to cause refraction of VHF radio signals, much in the same way the regular E and F layers refract lower-frequency signals on a regular and daily basis.

As we can see in Fig. 2, the daybreak period has a natural advantage over other periods of the day because of the relatively greater number of particles which the earth sweeps up during this period.

By the same token, the twilight period is traditionally the slowest period of the day – principally because for any debris to be caught up by the E layer in that period of the day, the debris must either be traveling in the same plane and direction, but at a *greater* speed than the earth, or be

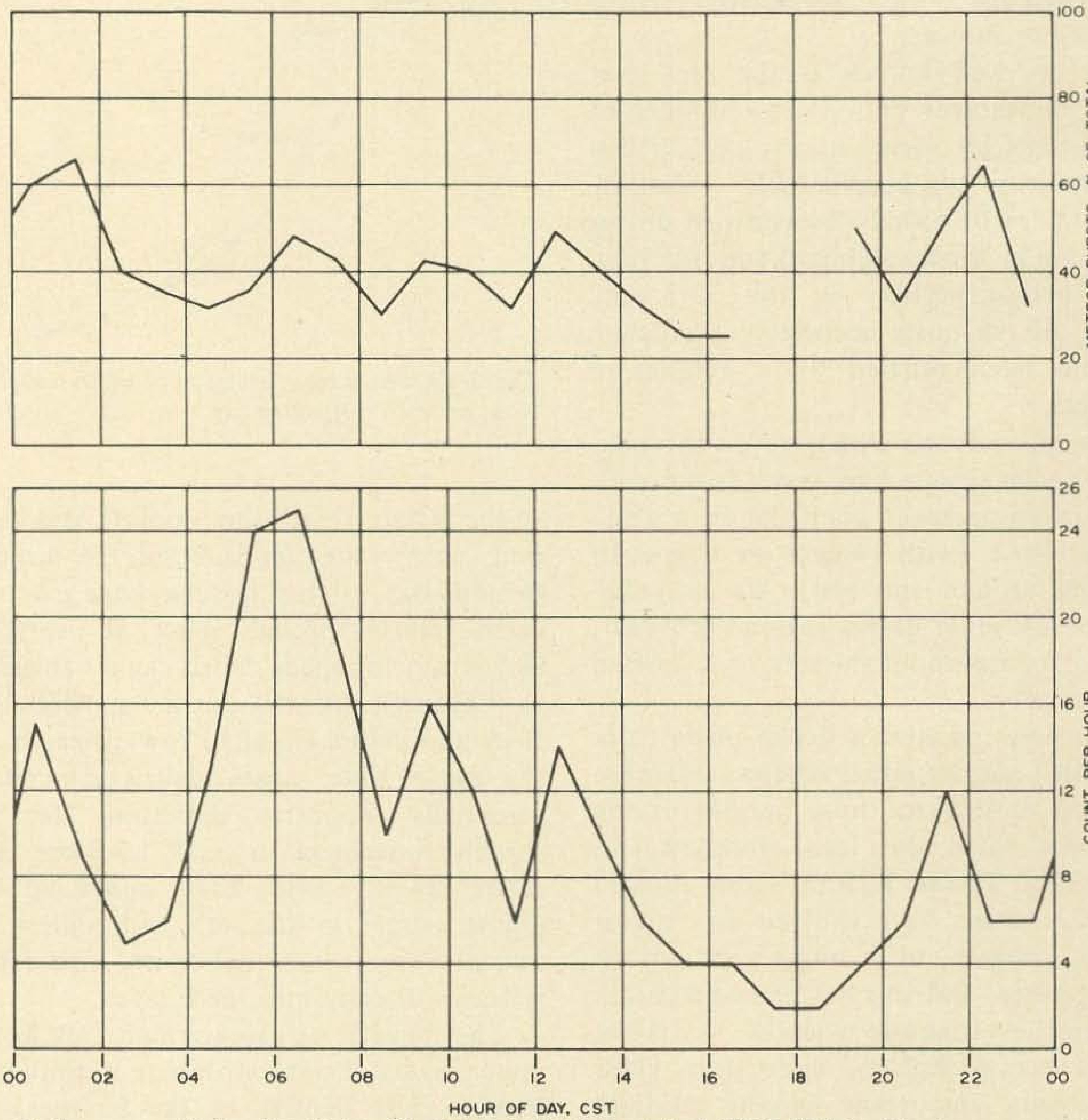


Fig. 3. Average activity, based on 41 day monitoring period (93.7 MHz). The lower portion shows average count of bursts on an hour-by-hour basis; the upper chart lists the percentage of bursts that were greater than 1 second in duration.

traveling in a plane tangent to the earth and at right angles to the earth's plane of movement, passing into the E layer from the side. This happens not very often.

In a scholarly study entitled *Meteors, Meteorites and Comets*, Smith pointed out that radar studies of VHF meteor reflections substantiate the 5–7 a.m. period, *but* noted there were unexplained increases in meteor reflection counts also around 10 a.m. and again around 10 p.m. To this I must also add that based upon my own observations and chart recordings, there are also decided subpeaks in the noon and midnight periods.

My own method of observation is simple to duplicate: The FM receiving system of 93.7 MHz is recorded on a Heath model EU-20B servo chart recorder. The presence of rf carriers (down to 0.1 μV) and their relative strength over a 20 dB range (limit of EU-20B dispersion without a dc log amp), are recorded at a standard speed of 4 in per minute. Simultaneously, a two-track audio recorder preserves the audio information (from the transmitting station) on one channel, while WWV (as a time base) is recorded on a second channel. Time marks are made on the EU-20B chart manually at the beginning and end of each recording session so that additional time marks can be added during analysis.

From the chart of Fig. 3, some conclusions are possible, with the following qualifications:

(1) 93.7 MHz was chosen as an FM reference frequency because it was not occupied in my area, and in the north, east, NE, and SE regions of the country it was well occupied by high-power FM broadcasters. •By plotting the location and coverage areas of stations on this frequency, versus other possible frequencies, it became apparent that this frequency had more territory *covered* with signal than other frequencies I could have chosen.

(2) Many of the stations operating on this frequency did not sign off until after 2 a.m. EST, and returned to the air by 5 a.m. EST, affording me nearly 24-hour coverage.

(3) FM stations on this frequency closely paralleled TV channel 2 and TV channel 7 allocations, which I was also monitoring, affording excellent opportunity for correlation within a single burst over the frequent range 55.25 to 175.25 MHz.

The observations for the 93.7 MHz measurements, in the 41 monitoring periods, were as follows: considerably higher in the 9–10 (a.m. and p.m.) period than in the 5–7 a.m. period. In other words, if a one-hour period (5–6 a.m.) produced 20 pings, 4 bursts, and a single superburst, a sampling of the 9–10 a.m. period for the same date or the 9–10 p.m. period for the evening prior indicates (typically) 5 pings, 5 bursts, and 1 superburst. (The *total* count is *lower*, but the count of *usable* bursts is *by percentage* much higher.)

The same observation can be made for the noon-to-1 p.m. midnight counterperiod. Of all periods in the day, this has proved to be the most uniform. On a day-to-day basis, the counts during these two periods are relatively unchanged (except during shower periods). The ratio of pings to bursts during both of these periods falls into a region around the 5–6 a.m. and 9–10 (a.m./ p.m.) periods.

Briefly, the additional *total count* subpeaks during the day (other than the expected 5–7 a.m. period) can probably be explained by two mechanisms:

The 12–1 periods find the earth's surface directly above the time zones shown in Fig. 4. It is probably that debris particles that escape being drawn into the 5–7 a.m. period are swept in a curved trajectory by the wake of the earth's ionosphere and are caught by the outward extension of the ionosphere (points A and B, Fig. 4). This would suggest that the majority of the particles entering the E layer in this period would follow a west-to-east trajectory, and this would enhance signals to the east (or west) of you with greater frequency than signals to the north or south of you. The bursts and superbursts almost always come (to my location in Oklahoma) from stations 70–110 degrees from me. (I did not look west during these tests.)

The 9–10 periods are less prone to explanation. Smith offered no explanation, noting only the existence of the increased radar return count.

One of the most plausible theories advanced suggests that particles swept into the 5–7 a.m. time period *at an angle* actually skip (as a flat stone thrown across smooth water) from the upper ionosphere; their speed reduced, they will *precipitate* back under the influence of gravity several time zones hence (see Fig. 4).

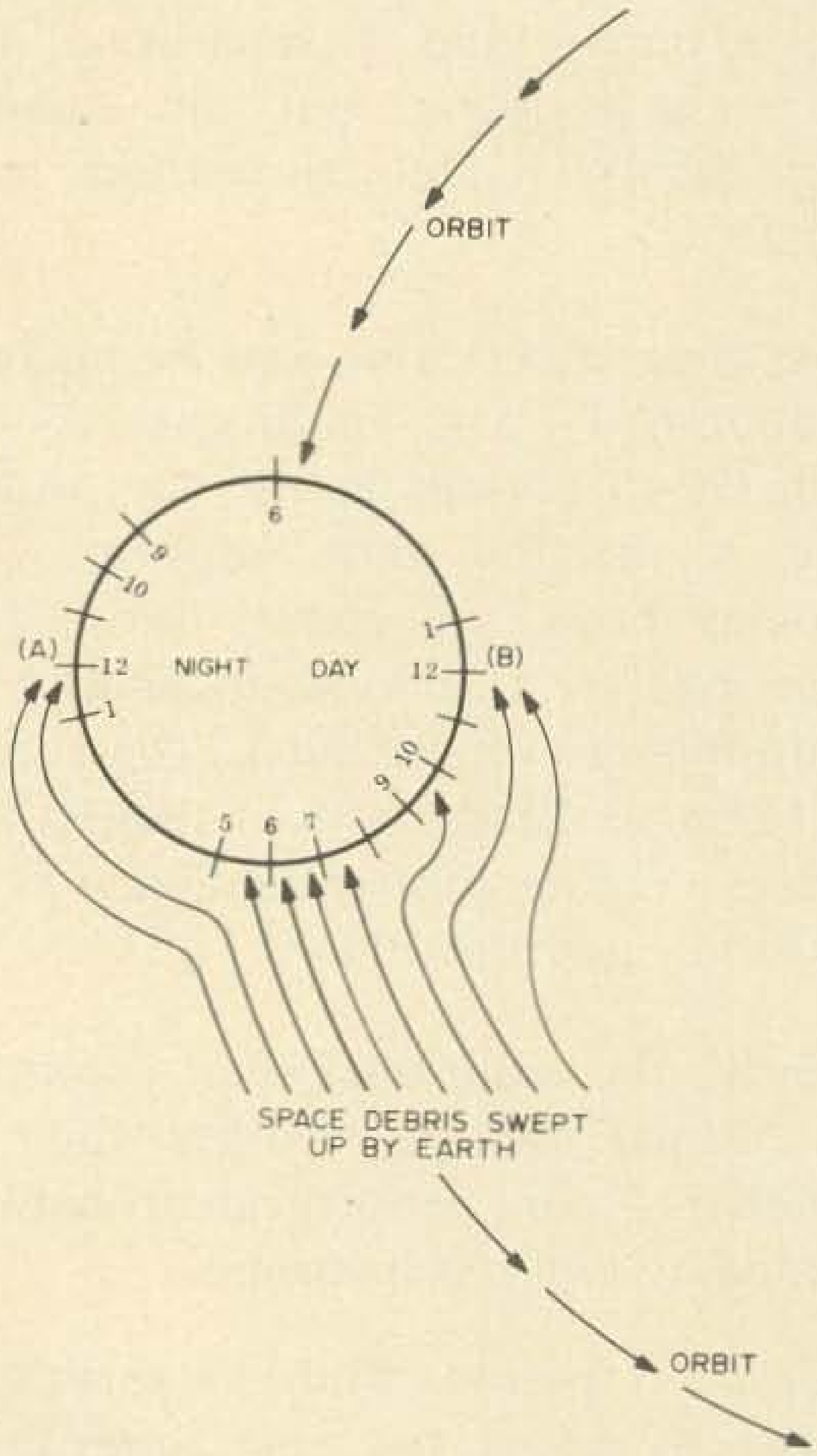


Fig. 4. Path of space debris being intercepted by the earth.

This is borne out to some extent by the observation that at least in the 9–10 a.m. period, there is good correlation on a daily basis between the average total count in the 5–7 a.m. period and the later count in the 9–10 a.m. period for the same day.

The 9–10 p.m. period is more difficult to account for; as Fig. 4 shows, it occurs at a time when the portion of the ionosphere directly over this time zone region is not favorably located for such a skip trajectory, *unless* the skipping is from the midnight period just ahead of it. If such were the case, we would expect a similar situation around 3–4 p.m. as a result of skipping from the noon period. Observations indicate that no such enhancement period exists in the 3–4 p.m. period.

In either case, there is good total-count correlation between the following periods:

(1) 5–7 a.m. and 9–10 a.m. (same date).

(2) 12–1 p.m. and 12–1 a.m. (with 12–1 a.m. time on date following the 12–1 p.m. date).

(3) 9–10 p.m. *seems* to correlate with *both* 5–7 a.m. (5–7 a.m. following) and the midnight period (immediately following); but in both cases the correlation is not good enough to be substantiated.

For directions, the 5–7 a.m. time slot is random. East–west paths propagate just as well as north–south paths.

The 12–1 periods favor basically east–west paths.

The 9–10 periods *seem* skewed in favor of SW–NE paths, in the sense that the *perpendicular* paths (NW–SE) are noticeably poor in these time slots.

Simultaneous Monitoring - 55.25, 93.7, and 175.25 MHz

With relatively similar systems on each of the three frequencies, when the same burst produced propagation on two or more frequencies at the same time, the meteor-propagated signal appeared *first* at the highest frequency affected in 90% of the cases. In other words, if there was propagation at both FM and channel 2, the burst reception appeared first on FM, and was followed by TV up to a full second later (typically just under a second). And if a burst affected all three frequencies, it *always* appeared on 175.25 MHz first, followed up to a second later by the appearance on FM and then up to a second later by the propagation of channel 2 (55.25 MHz). This was directly contrary to everything we have been led to believe about ionospheric propagation: skip that starts at the top end and works down!

As is often the case with a basic discovery about any physical phenomenon, I was being told something – something very important about the mechanics of the actual formation of an ionized meteor column and the refraction that takes place within the column.

As long as the meteorite particle remains intact its trajectory is marked by an ionized trail spreading behind it.

From the analysis of several hundred recordings of bursts, these factors become apparent:

- At 175.25 MHz, the most intense signals come at the beginning of the burst (Fig. 6), with a trailing off behind the initial peak.

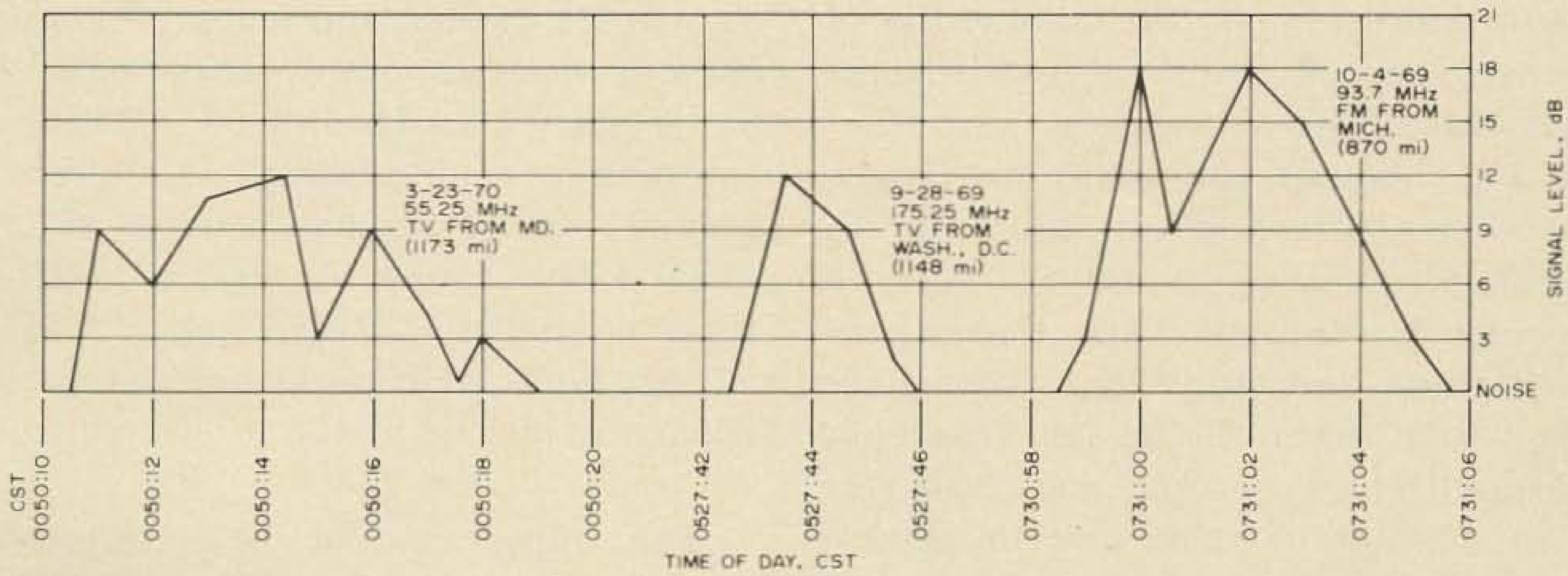


Fig. 6. These curves show the typical duration of meteoric signal reflection. Note the correlation between duration of activity and frequency of occurrence.

Let's look at the mechanics of a meteor-ionized cone formation, in Fig. 5. Here we see that the diameter of the ionized "cone" trail left behind the meteor trajectory is smallest at the particle itself, but it flares outward behind the particle much in the way a speedboat wake flares.

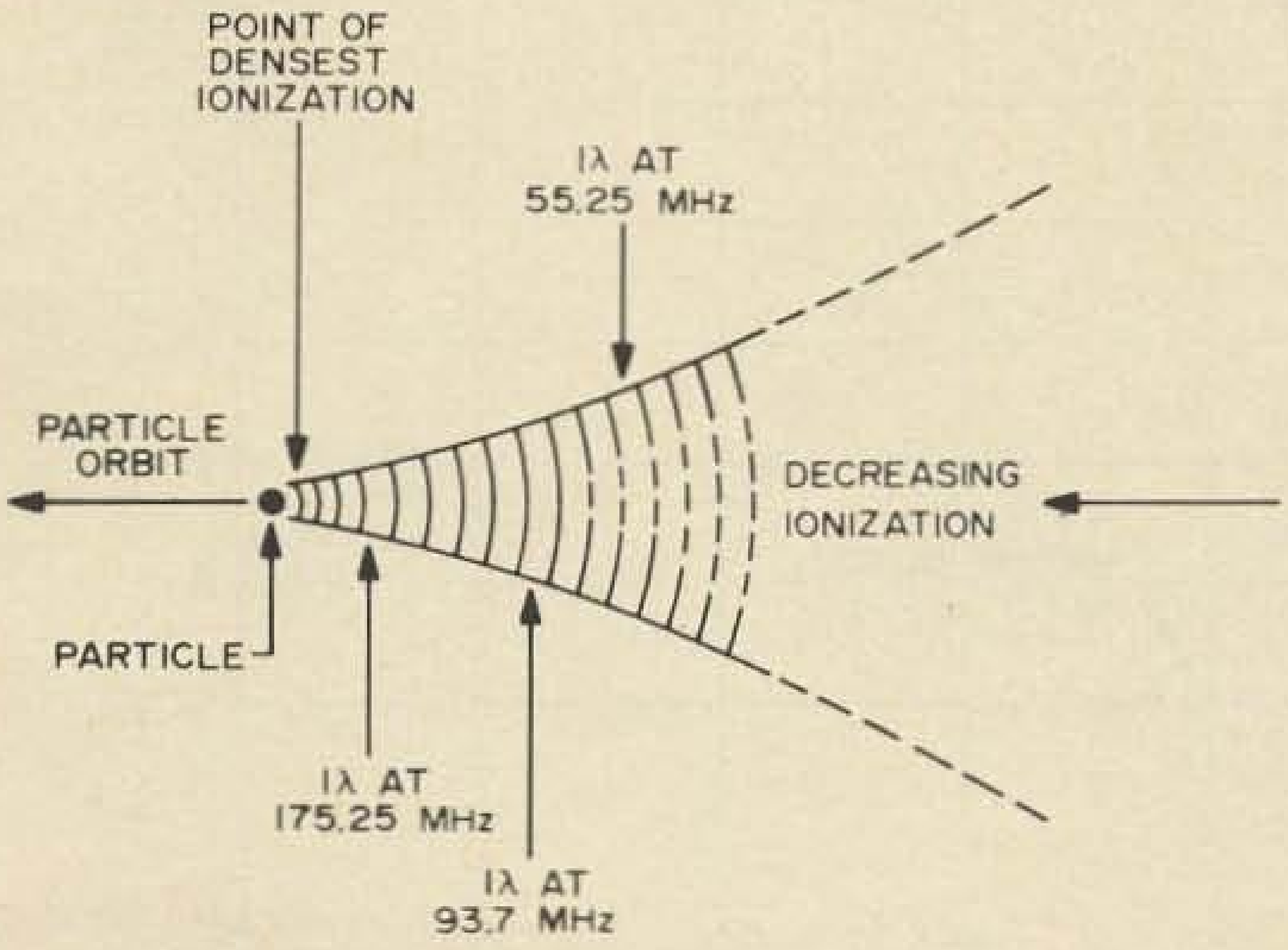


Fig. 5. Bursts are noticed on the higher frequencies first. This could be attributable to the conical makeup of the ionized trail of the meteoric particles.

- At 93.7 MHz, there is often a double-humped initial-signal peak, followed by a depression, followed by a second equally strong peak (Fig. 6).
- At 55.25 MHz, the initial peak is often not the strongest one (although the variation in patterns is greatest at this lowest of observed frequencies).

The intensity of the electron density is going to be greatest in the region *directly* behind the particles (Fig. 5). The amount of ionized material present is most concentrated at this point, dispersing over a wider area as the cone flares.

On the assumption that the density is sufficent to cause signal refraction at 175.25 MHz, refraction will begin to occur only when the 175.25 MHz signal encounters a region within the cone where the cone's flare is at least one wavelength wide (and the electron density at that point in the flare is sufficent to support 175.25 MHz propagation). Because the total *length* of the intense portion of the ionized column is generally short, this point occurs before the conic region has flared to a sufficent width to propagate the lower frequencies. And the same is true with the 55.25 MHz signal: the cone has flared to a sufficient (one wavelength) width at 93.7 MHz before it has flared to a one wavelength width at 55.25 MHz. (Note that width of the cone and length of the cone can be interchanged here with no basic change in the postulation.)

Keep in mind that maximum frequency propagated is directly related to electron density within the conic area, and that electron density is in turn a function of particle size, speed, and the level within the E layer that the particle ignites.

As Fig. 7 shows, the total burst length, for a burst affecting all three of the monitor frequencies employed here, is pretty much textbook. The highest frequency starts and stops first (lasting the shortest total time); the median frequency starts and stops second and lasts the median amount of time; and the lowest frequency starts last, lasts longest, and quits last.

For the 144 MHz meteor DX'er, this plainly suggests that a whole new school of operating techniques is in order, built around a crystal-controlled converter and a channel 7 (or 8 or 9) TV yagi, using the appearance of bursts at these frequencies as the tipoff to an "opening."

Finally, it should be reported that the frequency of bursts between 55.25, 93.7, and 175.25 MHz drops off substantially, as would be expected, as we go higher in frequency. This dropoff in total count (pings, bursts, superbursts) is about what you would expect, and is representative of both shower and nonshower periods:

From hundreds of hours of substantiative observations it appears the average meteor refraction noted at 55.25 MHz is also found up to 93.7 MHz. At some point between 93.7 and 175.25, the average-burst MUF peaks out and does not reach the highest of the three frequencies.

The author would be interested in hearing from others who have studied or would like to study other aspects of meteor propagation.

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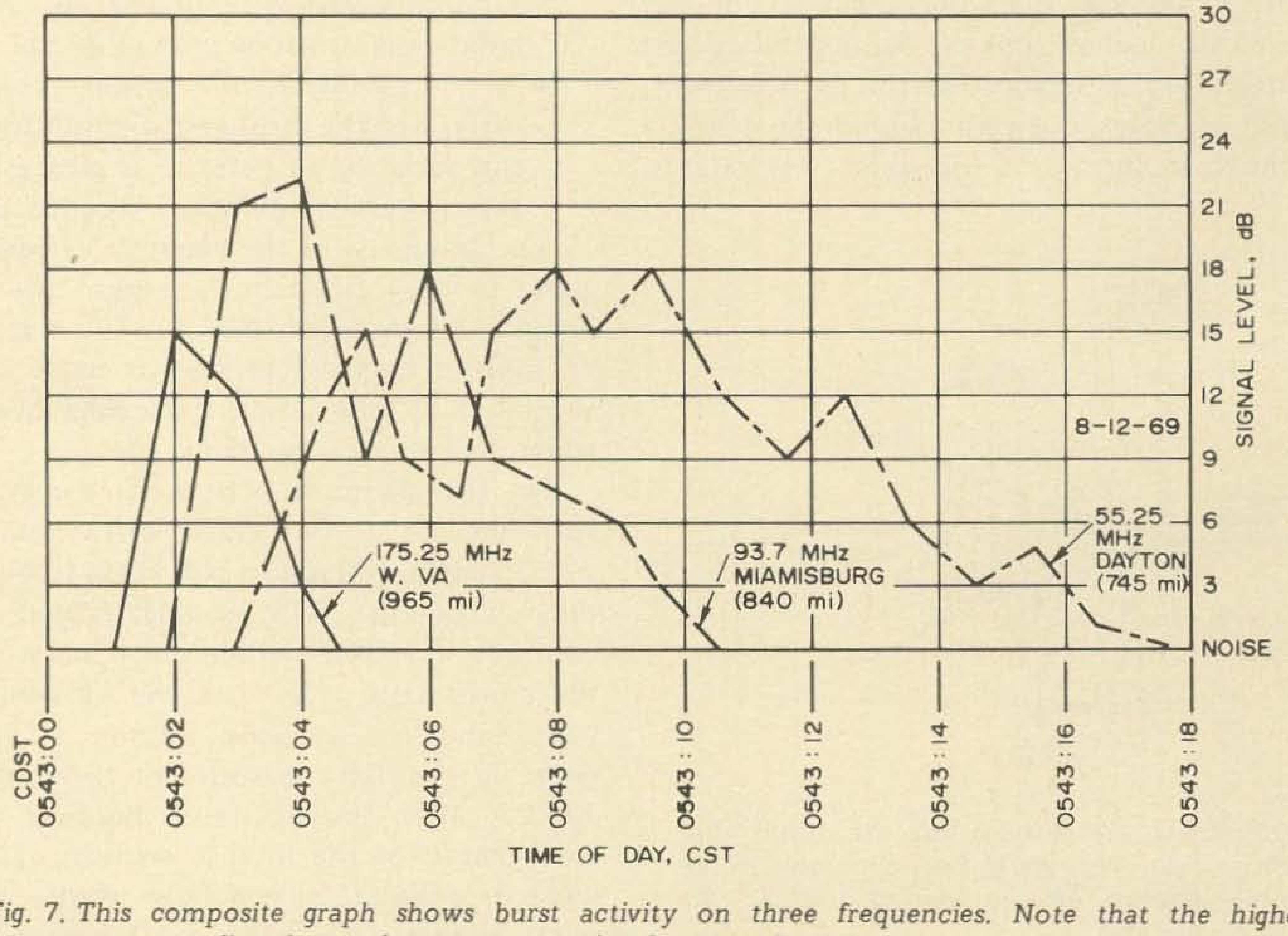

Fig. 7. This composite graph shows burst activity on three frequencies. Note that the highest frequency occurs first, lowest frequency starts last but stays longest.

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741 OP-AMP COR and TONE DECODER CIRCUITS

The integrated circuit COR and tone decoder circuits shown here are both novel. Both use the 741 type operational amplifier as a combination voltage comparator, high gain amplifier and relay driver. As shown in Fig. 1A, the operational amplifier has two input pins, one output pin, a power supply pin, and a ground pin. Some units also have two "offset-null" pins, but since these are needed only in special cases they are not shown.

The 741 type op-amp is available under different numbers from several manufacturers using different case styles as shown in Fig. 1B and Table I. Obviously the 741 op-amp and all its different versions are very popular, and it is often available for under a dollar.

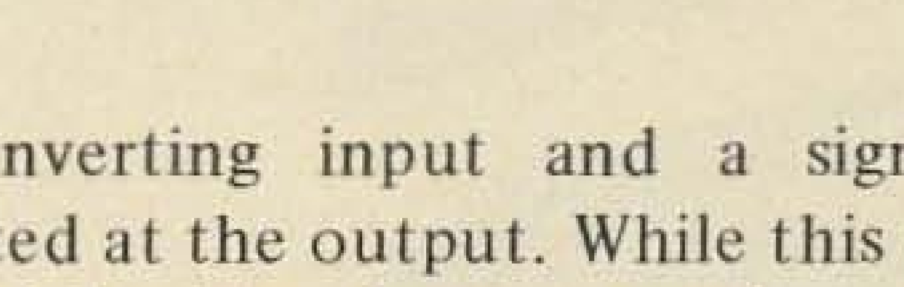
Of the two inputs, the one labeled + is also often called the non-inverting input, meaning that an input signal on this pin is amplified without being inverted (turned upside down.) The input labeled – is called the inverting input and a signal here is inverted at the output. While this description is useful when the op-amp is used as an ac amplifier, there is a better way of describing the operation at dc.

Since the two inputs have opposite effects on the output, applying the *same* input signal to both input pins will cancel out and produce *no output*. In operational amplifier lingo, this is interpreted as meaning that the output is just halfway between the positive voltage supply and the negative voltage terminal. For instance, if the IC is run at +12V, then the output will be halfway between +12V and ground, or at +6V.

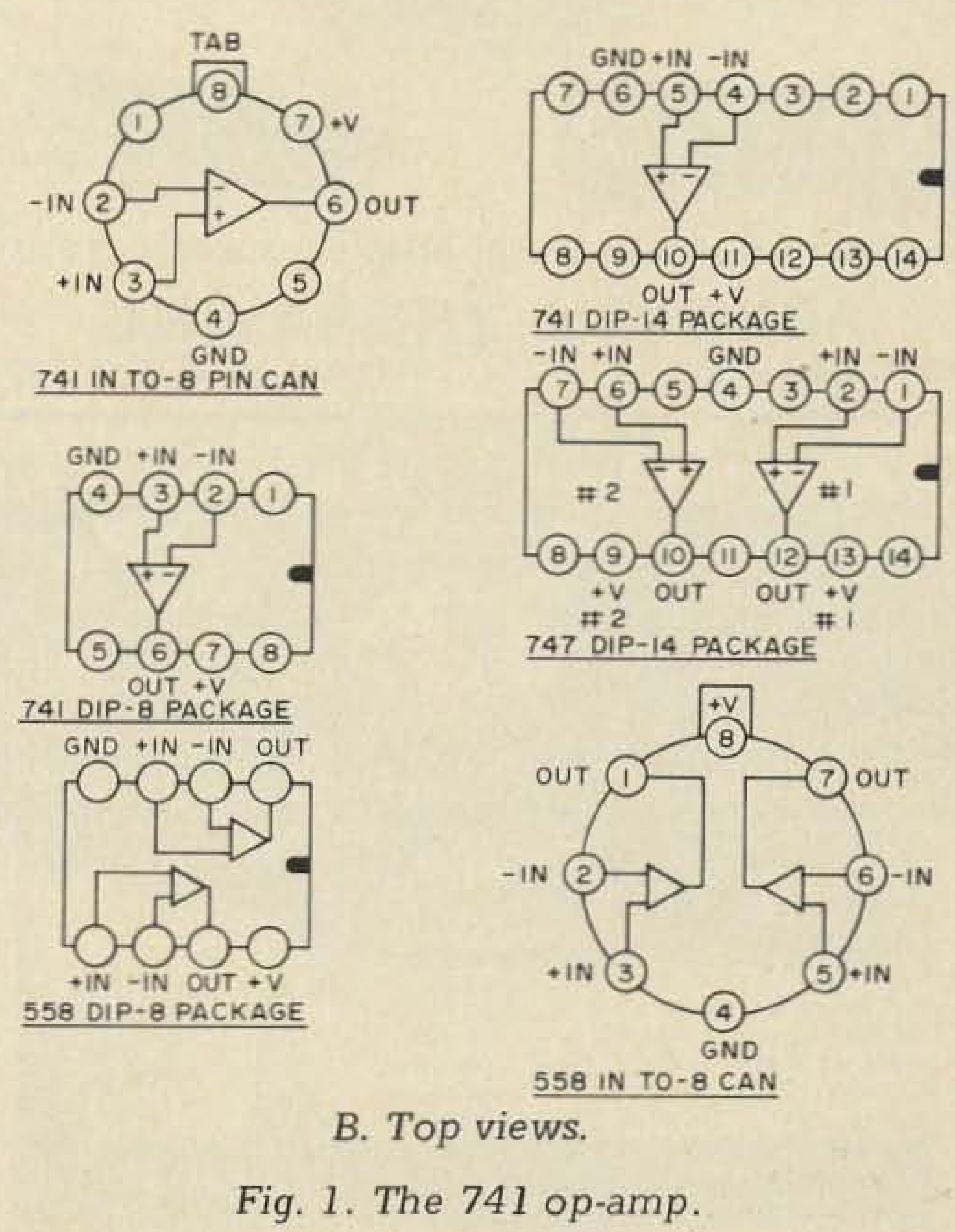
TABLE I

741 type IC Manufacturers and Numbers

Manufacturer	Number	Case & No. Pins
741 Series		
Fairchild	μ5B7741393	TO-8
Fairchild	μ6A7741393	DIP-14
Fairchild	μ9T7741393	DIP-8
Texas Instruments	SN72741J or N	DIP-14
Texas Instruments	SN72741L	TO-5
Texas Instruments	SN72741P	DIP-8
747 Series (two op-amps in one case)		
Fairchild	μ5F7747393	TO-10
Fairchild	μ7A7747393	DIP-14
Texas Instruments	SN72747J or N	DIP-14
558 Series (two op-amps in one case)		
Texas Instruments	SN72558L	TO-8
Texas Instruments	SN72558P	DIP-8
Motorola	MC1558G	TO-8
Motorola	MC1558P	DIP-8
Signetics	N5558T	TO-8
Signetics	N5558V	DIP-8



A. Basic 741 op-amp circuit.



B. Top views.

Fig. 1. The 741 op-amp.

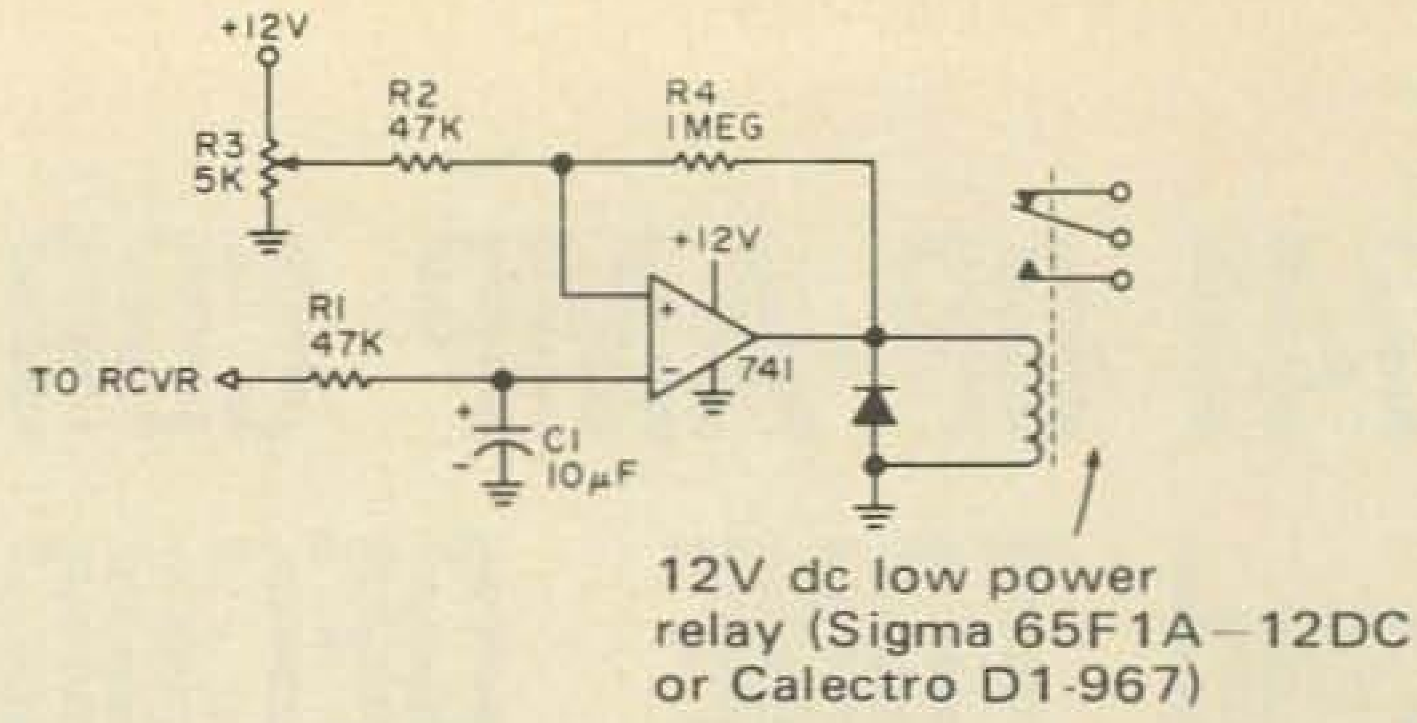


Fig. 2. A COR circuit using the 741 op-amp.

This happens only if the input to both input pins is the same, within a small amount known as the offset. If the plus input is made more positive than the minus input then the output goes more positive. Because of the high gain, only a small difference in inputs is enough to bring the output as high as it can go, within a volt or two of the positive supply voltage.

On the other hand, if the plus input is more negative than the minus input, then the output quickly swings down to within a volt or two of ground. If we connect a relay from the output to ground as in Fig. 2, we can operate that relay by slight changes in the voltages fed to the two op-amp inputs.

The circuit in Fig. 2 is a COR (Carrier Operated Relay) I devised for use with a Vanguard 2m FM receiver. There is a point in this receiver at the output of the audio amplifier which swings from its normal +9V or so down to about +8V when a station is received. I wanted to operate a relay when this voltage dropped.

I simply fed this voltage to the minus input of the op-amp through 47K resistor R1, with capacitor C1 removing any audio. At the same time, the plus input connects through another 47K resistor R2, to the wiper of R3 which provides an adjustable voltage which can be set anywhere between 0V and +12V. For our application we adjust R3 for about 8.5V.

In this application the op-amp acts as a voltage comparator, comparing the voltage from the receiver against the 8.5V reference from R3. With no received signal the receiver provides about 9V, which is higher than the 8.5V reference. Since the minus input to the op-amp is therefore more positive than the plus input, the output voltage is near ground and the relay is off.

As soon as a signal is received, the receiver voltage drops below 8.5V. The plus input is now more positive, and the output goes positive, pulling in the relay.

The circuit would operate quite well without R4, the .1 MΩ resistor from the input back to the plus input, turning on the relay when the input voltage drops below 8.5V and releasing the relay when the input voltage goes back above 8.5V. But occasionally a very weak signal will cause the input voltage to swing back and forth near 8.5V, causing the relay to pull in and out.

To prevent this relay chatter, R4 feeds back a portion of the voltage at the output back to the plus input, increasing the reference voltage fed in from R3 by about 0.2V when the relay is on, and dropping the reference by about 0.2V when the relay is off. This way the relay doesn't go on until the receiver voltage drops below 8.3V. Once on, the relay stays pulled in until the input voltage goes back up to about 8.7V. This hysteresis effect prevents relay chatter on weak signals by changing the circuit into a Schmitt trigger. The dead band can be tightened up by increasing the value of R4, or eliminated by removing R4 entirely.

Another application of the 741 op-amp, again used as a voltage comparator and relay driver, is shown in Fig. 3. Here we have an 1800 Hz tone decoder.

To see how it works, assume first there is no input signal. Resistors R1, R2, and R3 form a voltage divider between +12V and ground, and set up the basic biasing for the circuit. The voltage at the common point between R1 and R2 is about +3.3V. Since this point connects to the minus input of the op-amp through R6 and R5, it provides a

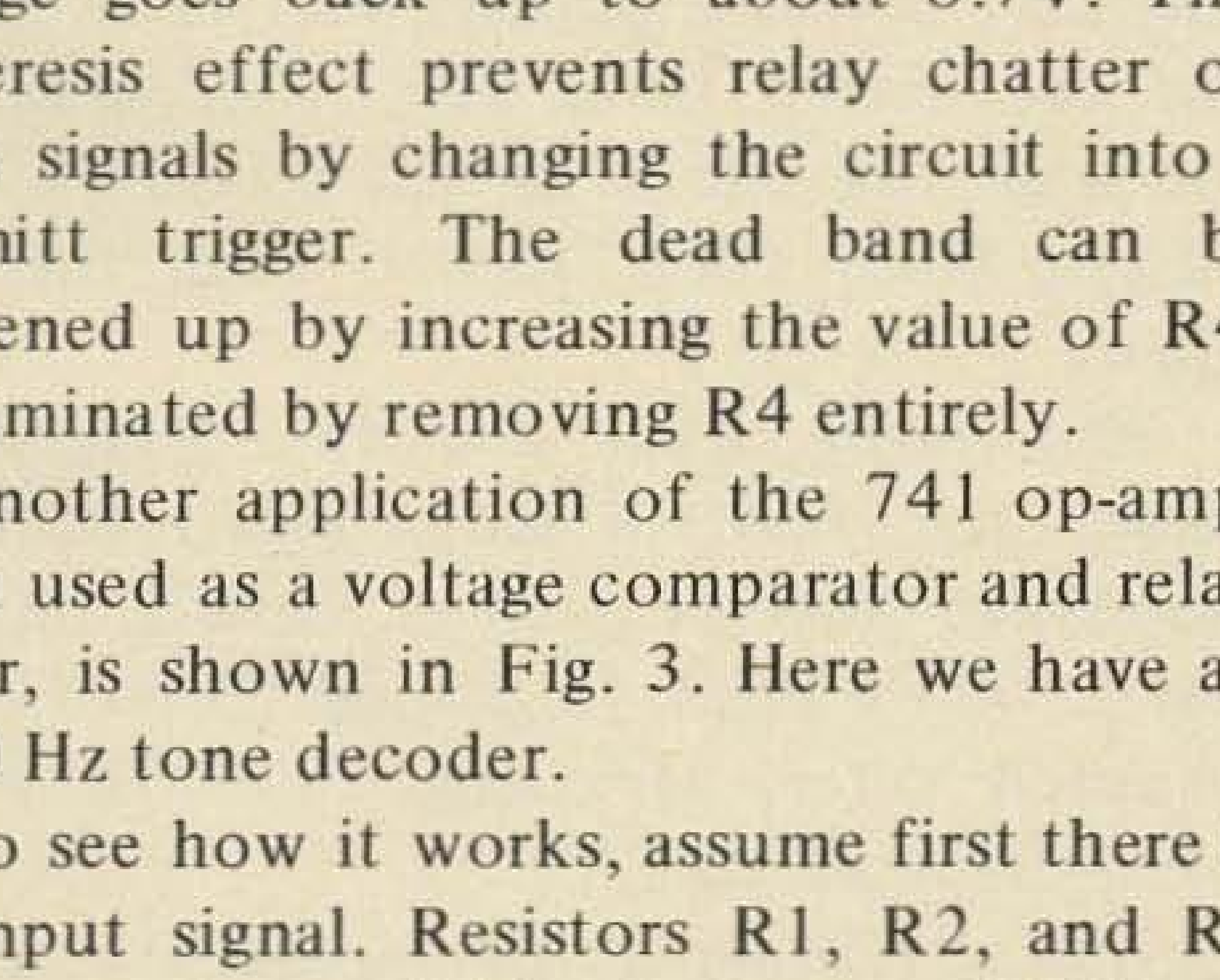


Fig. 3. 1800 Hz decoder.

positive bias to this input. At the same time the voltage at the common point between R2 and R3 is about 0.4V more negative, and this point connects to the plus input of the op-amp through R7 and R8. Since this makes the plus input more negative than the minus input, the output of the op-amp is near ground, and the relay is off (the relay can pull in only if the plus input of the op-amp becomes more positive than the minus input).

Now suppose an audio signal appears at the input terminal. This signal is fed through C1 and R4 to a series tuned circuit consisting of L1 and C2, tuned to 1800 Hz. The audio signal appearing across the *entire* tuned circuit is rectified and filtered by CR1 and C5 and applied to the minus input of the amplifier. Also, the signal across just L1 is tapped off, rectified and filtered by CR2 and C4, and applied to the plus input of the op-amp through level control R7. Both CR1 and CR2 produce positive rectified voltages, but the output from CR2 tries to turn on the amplifier and close the relay, while the output from CR1 tries to keep the relay open.

The tuned circuit does two things at the same time. First, a series tuned circuit at resonance acts as a short circuit, shorting any 1800 Hz signal to ground. Thus it acts as a notch filter, removing 1800 Hz signals from the input to CR1.

But at resonance the current through L1 is quite big, so the voltage across it is high. Thus the tuned circuit selects 1800 Hz signals and sends them to CR2. The total effect of all this is that 1800 Hz signals try to close the relay, while every other signal tries to force the relay open. The relay can only close if there is more 1800 Hz signal than everything else combined. What this really means is that the decoder can't be triggered by noise, speech or even singing – it needs pure 1800 Hz tone.

Potentiometer R7 adjusts the bandwidth, and also affects the sensitivity of the decoder. The proper way to adjust it is to set it for the required bandwidth, and add a separate gain control before the decoder to set sensitivity. Toroid and capacitor tolerances being what they are, you will probably have to try several capacitors to get the center frequency just right. My C2 capacitance actually measures closer to 0.09 μF than 0.1 μF.

As shown in Table II, the bandwidth is remarkably independent of input level, unlike many decoders which become as broad as a barn when fed with strong signals. If anything, bandwidth becomes a bit smaller at high levels.

The input impedance is about 470Ω and minimum input voltage for reliable operation is between 1 and 2V. Thus the decoder can be bridged across a 4 or 8Ω speaker line, or even across a 500Ω unbalanced line. If the available signal is too low, you can reduce the value of R4, but don't go below about 250Ω. If you need even more sensitivity, use a 3:1 or 10:1 step-up transformer – a filament transformer of the right turns ratio will do just fine.

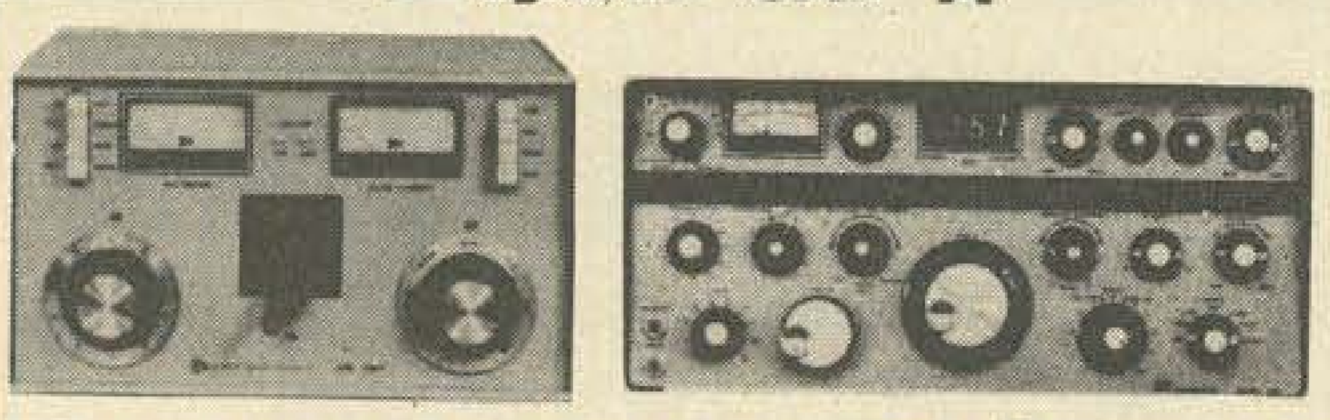
Don't forget that the decoder won't respond to a tone if it's accompanied by speech or other tones, because anything other than the desired frequency desenses the input. This is a useful feature since it means you won't get false responses to speech, noise, or even music. Under certain conditions, however, you may not want this; for example, in a Touchtone decoder where there are two simultaneous tones.

There are several ways to get around this. The best is to first separate the high Touchtone tones from the low, and thus keep the low group tones from the high group decoders and vice versa. This is the way the telephone company does it, and it works well, since it will detect only one tone in the high group and one in the low at a time.

TABLE II
Bandwidth and Level

	Bandwidth adjusted to		
	100 Hz	200 Hz	400 Hz
Minimum Input Required (rms volts)	1.2	0.8	0.6
Measured bandwidth at			
1V rms input	–	150	390
2V rms input	112	210	430
5V rms input	130	230	430
10V rms input	100	210	420

Another, and far simpler way, is to change the decoder to prevent the desensing by signals outside the passband. This is easily done by connecting the anode of CR2 to the



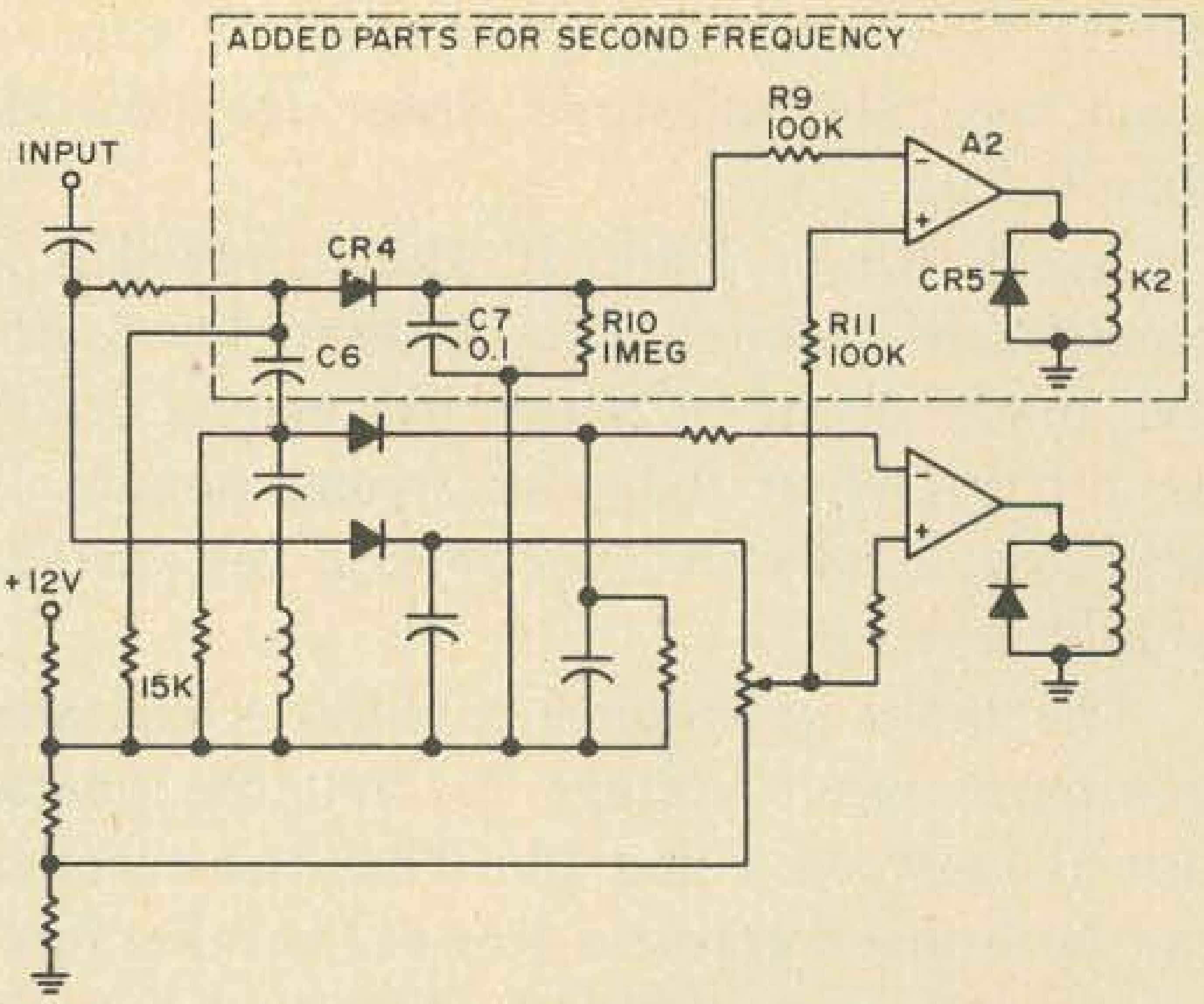


Fig. 4. Two-tone decoder using one toroid.

junction of C1 and R4, instead of to the toroid. This leads to a rather roundabout way of detecting the tone; *any* input signal will try to operate the relay, via CR2 and the plus input of the op-amp. But at the same time, every signal *outside* the passband will try to prevent operation, via CR1 and the minus input. By carefully adjusting R7, we arrange things so only signals *within* the passband succeed.

Along the same lines, Fig. 4 shows how to use *one* toroid to detect *two* tones. If you're careful you might even get more tones out of it, though I haven't tried it. All unlabeled parts in Fig. 4 are the same as in Fig. 3; only parts in the dashed box are added for the second tone.

The values of L1 and C2, in Fig. 3, are chosen to detect the *lower* of the two frequencies, and act as a notch filter at this frequency. Once this is done, C6 is chosen so that the series combination of C2 and C6 resonates with L1 at the upper frequency, to form another notch filter.

In theory, we could add as many of these additional sections as we wanted, and it would be really dandy to have a complete Touchtone decoder with just one toroid, but in practice it won't work. Every added section degrades the Q (and therefore bandwidth) of the whole system. Moreover, the frequency-determining capacitors are shared among several frequencies, and so adjustment becomes really difficult. But it's a cute scheme.

. . .K2OAW

Ralph E. Taggart WB8DQT
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Okemos MI 48864

A Simple Solid-State Flying Spot Scanner For Slow-Scan Television

A flying spot scanner is a device which uses a raster on the face of a cathode ray tube to produce high quality television pictures from either photographic slides or prints and drawings. It is usually more economical to build and easier to adjust than a vidicon camera, a factor which makes the flying spot scanner (FSS) an ideal first camera construction project for the newcomer to SSTV. The ease of operation and picture fidelity of a well designed FSS unit also makes it a valuable station accessory even when a vidicon camera is available. Using the FSS to televise most routine picture material reduces the total operating time on the SSTV camera vidicon, an important factor considering the difficulty in obtaining the special 7290 slow-scan vidicons.

The flying spot scanner which I developed to take the load from my own transistorized camera consists of three separate units:

1. The normal station SSTV monitor, which, in addition to displaying the picture output, provides both operating and deflection voltages for the FSS scanning module.

2. An SSTV test generator which supplies a signal to trigger the sweep in both the monitor and scanning module, a sub-carrier oscillator which is modulated by the scanning module output to produce the picture, and a variety of useful test outputs which are completely independent of the scanning module.

3. The scanning module which consists of a scanning CRT whose deflection plates are slaved to those of the monitor CRT, a 931 photomultiplier, and an FET dc amplifier for boosting the photomultiplier output to a suitable level for driving the test generator sub-carrier oscillator.

How it Works

Figure 1 shows a block diagram of the entire system. With no signal from the scanning module, the test generator produces a composite slow-scan signal consisting of one 30 ms vertical sync pulse of 1200 Hz repeated every eight seconds, 5 ms horizontal sync pulses of 1200 Hz at a 15 Hz rate, and a video tone (between sync pulses) of 1500 Hz. The sync pulses cause a square 120 line slow-scan raster to be produced on the monitor screen which is black due to the 1500 Hz video tone. Since the scanning module CRT has its plates slaved to the CRT in the monitor, a raster is produced on this tube as well. Since the scanning CRT is unaffected by

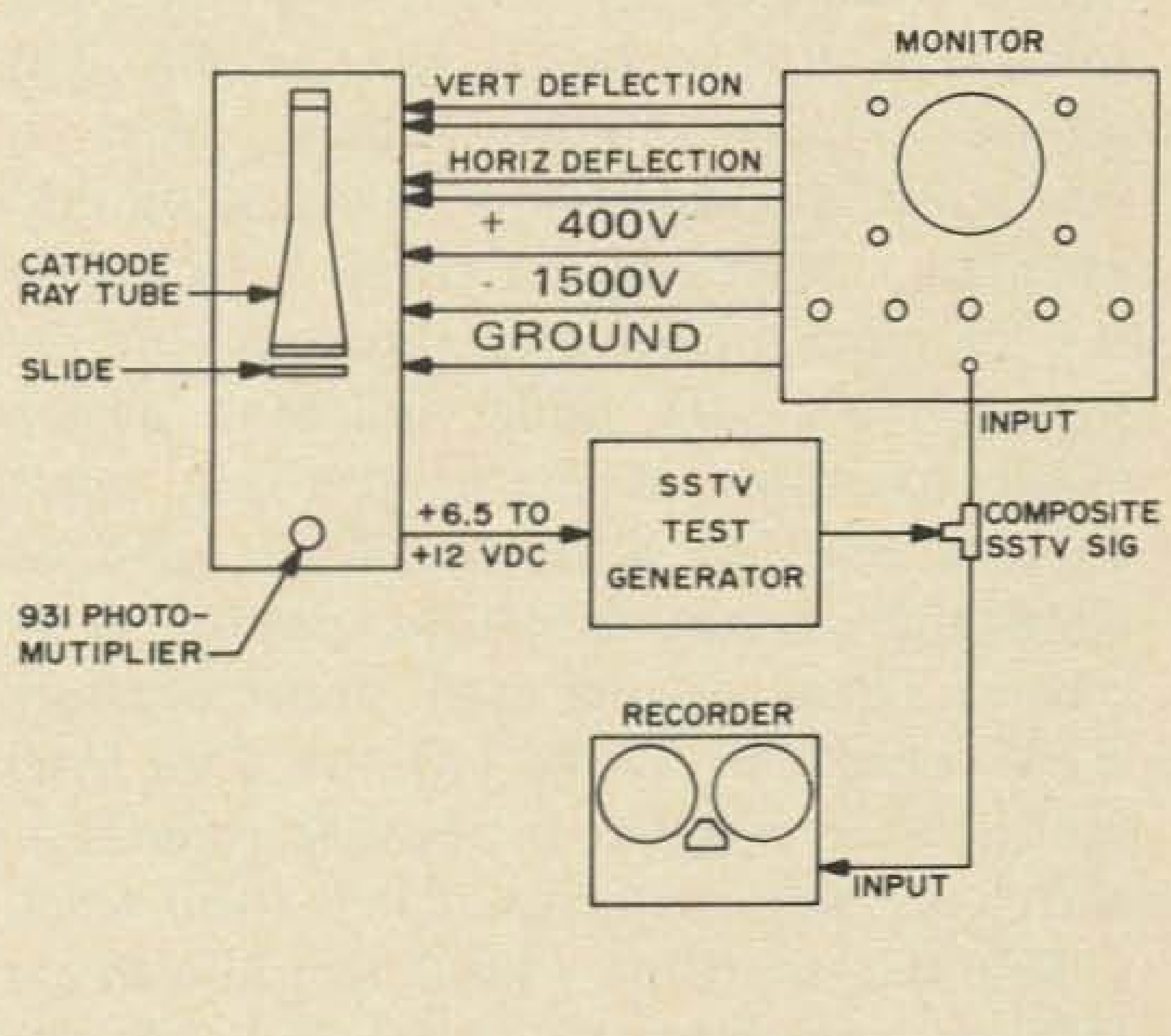

Fig. 1. Block diagram of the solid-state flying spot scanner system.

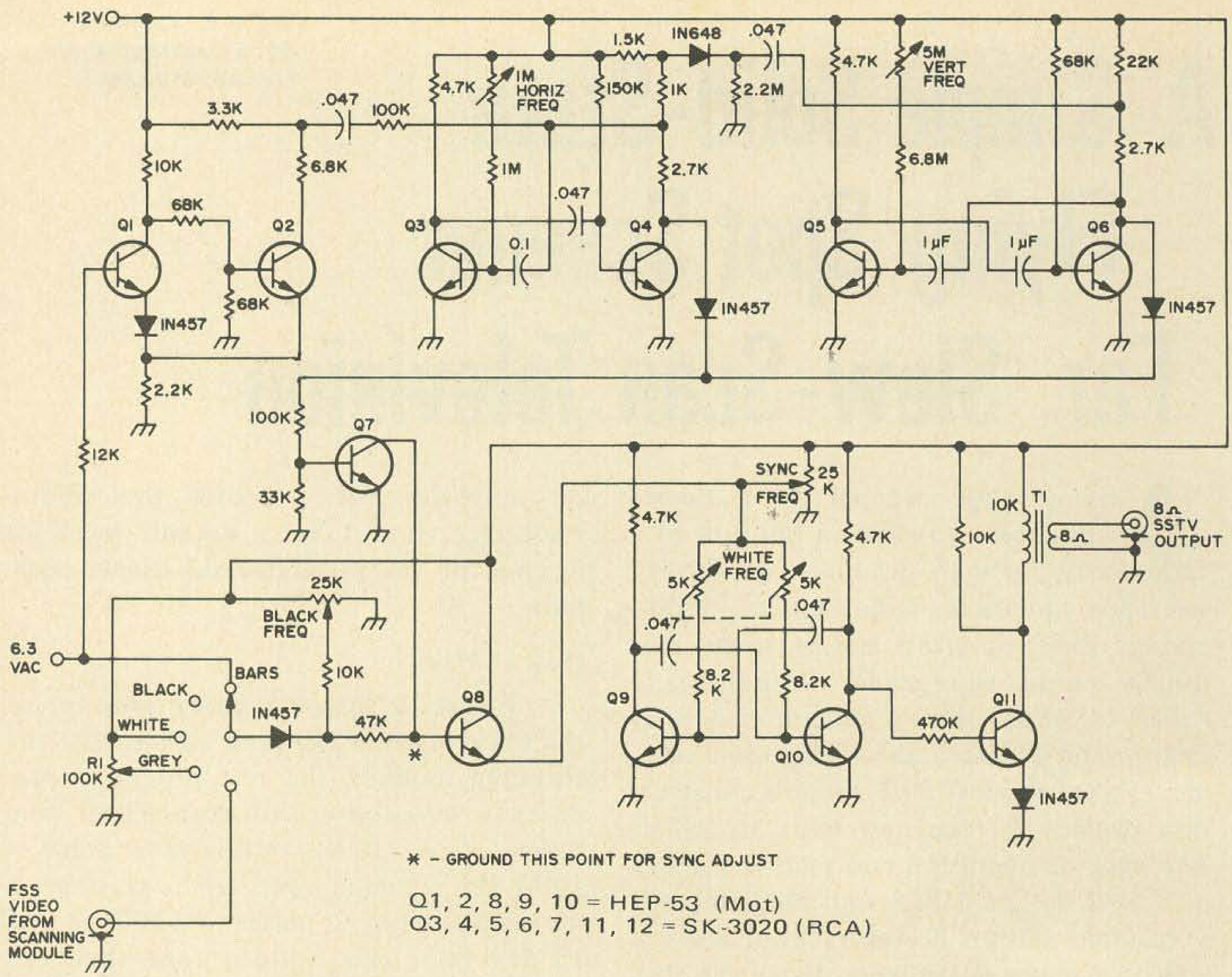

Fig. 2. The SSTV test generator circuit from a circuit described by K7YZZ[1].

the video tone, it can be independently set for a moderately bright raster. A photographic slide is placed over the face of the scanning CRT so that the light from the raster, actually a fast-moving spot of light, must pass through the slide before reaching the 931 photomultiplier tube. The 931 converts the varying light intensity to a minute voltage which is internally amplified by the photomultiplier to a level ranging from –.3V under no illumination (black portions of the picture) to –3.0V under full illumination (white portions of the picture). A single FET is used as a dc amplifier with an adjustable output threshold, producing an output signal ranging from approximately 6.5V (black) to 12.0V (white). This total range, when applied to the test generator, shifts the sub-carrier oscillator from black (1500 Hz) to white (2300 Hz) in a linear fashion, resulting in a replica of the original slide being reproduced on the monitor screen. This video information in no way affects the sync pulses, and since there is no video interconnection between the scanning CRT and the monitor, the picture will remain until the slide is removed from the scanning module CRT face. The brightness control on the scanning module CRT functions as the system contrast control and can be varied to produce the proper light level for good contrast. A T or Y connector is used at the SSTV output jack of the test generator to record the picture output for later playback. The use of the monitor to supply scanning and operating voltages for the scanning CRT and 931 photomultiplier not only reduces cost, but simplifies construction as well.

Construction

Monitor. Very little needs to be done with the monitor to fit it into the system. An auxilliary socket should be installed on the rear apron to make deflection and operating voltages avail-

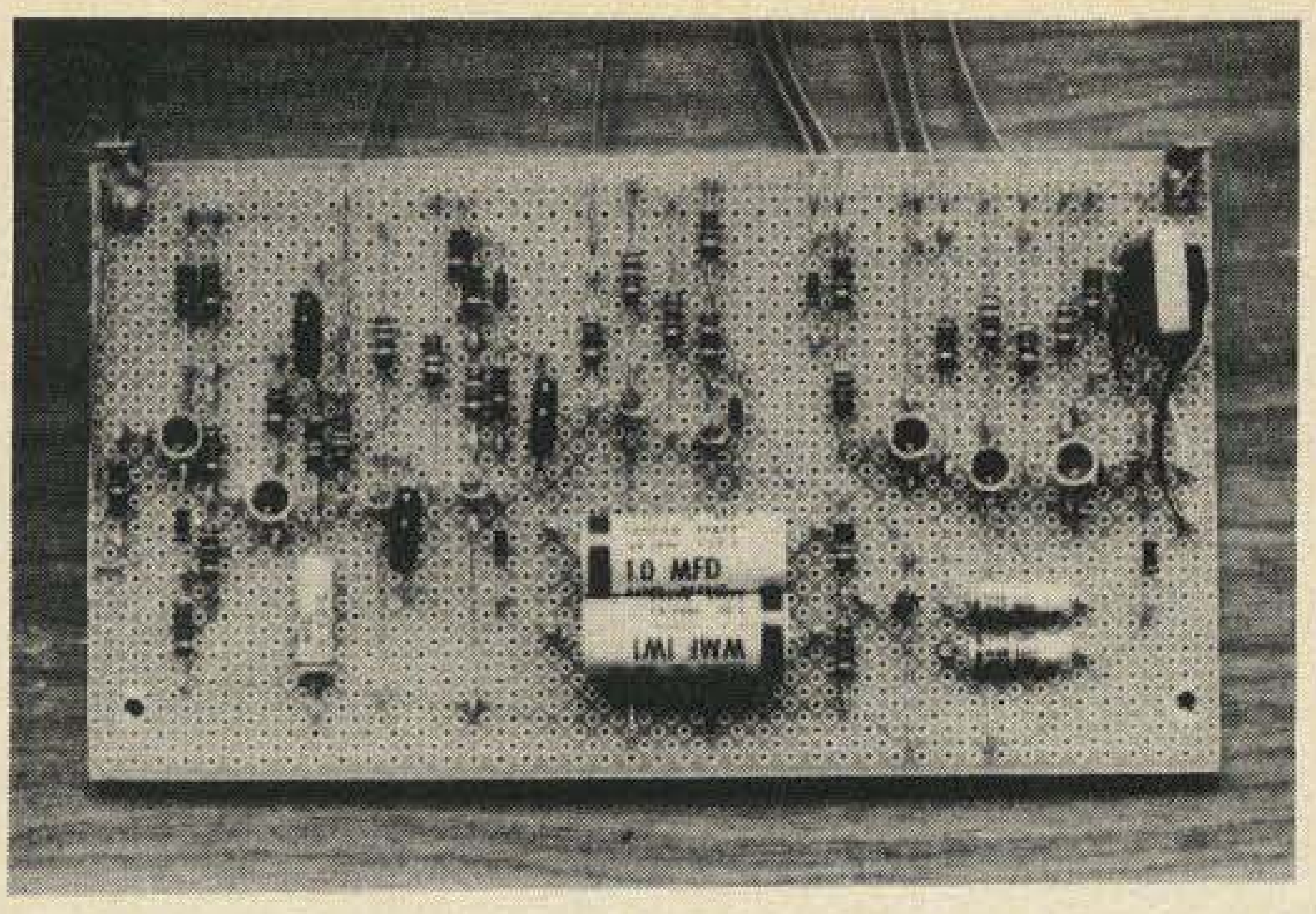

Fig. 3. Photograph of the vector circuit board layout used by the author for the SSTV test generator used in the FSS system.

able. Since the scanning unit should use a CRT that is identical with the one used in the monitor, all required voltages should be available. In my case, I used a six pin Cinch Jones socket for the vertical and horizontal deflection lines (2+2), the 400V required for the astigmatism string, and a ground line. Required high voltages, approximately −1500V and perhaps +1500V (depending on the type of CRT used) are best brought out via standard UHF coax connectors. Care should be taken that the monitor CRT display is completely linear, for the linearity of the finished picture will be governed by this factor since the two CRTs in the system are "slaved" during operation. Vertical non-linearity is the most common type and is usually caused by a faulty discharge capacitor. If necessary, a number of high-quality mylar units should be paralleled to achieve the desired capacity and discharge characteristics.

Test Generator. The heart of the entire system is a solid-state SSTV test generator developed from a circuit described by K7YZZ[1]. The changes incorporated in the circuit have been relatively minor. The transistors originally specified have been replaced by Motorola HEP and RCA SK series general replacement types. These types are usually obtained fairly easily. Some of the RC values have been changed and the "dot-bar" and "sync" test positions have been deleted, while the

FSS video position has been added. The unit was constructed in its own cabinet with an internal power supply so that it can be used independently as an SSTV signal source, if required. Figure 2 shows the schematic, while Figs. 3 and 4 show the circuit board and completed unit. The unit is certainly much larger than required and if miniaturization is your thing, it could certainly be reduced considerably in size. In addition to its function in the FSS system, the generator will also produce a black raster, white raster, a raster with a continuously variable grey level, and a stable bar pattern.

Scanning Module. This module consists of the CRT and its associated control circuits, the 931 photomultiplier, and the FET dc amplifier. A piece of cobalt glass, available in most high school chemistry labs, is positioned between the CRT and 931 to filter out the long-persistence yellow component of the P7 phosphor. Without this precaution, the amplified phototube output would continuously drive the sub-carrier oscillator to white (2300 Hz) due to the persistent yellow glow on the face of the CRT. My module is built on a 6x17x2 in. chassis. A shorter chassis could be used if mirrors were used

Fig. 4. Interior view of the completed SSTV test generator. Front panel controls (not shown) include power, function selector (S1), horizontal frequency, and the grey scale adjust (R1). The remaining pots are mounted on the chassis between the circuit board and the front panel. The rear portion of the chassis contains power supply components. The small circuit board includes bridge rectifier diodes and a zener and regulating transistor.

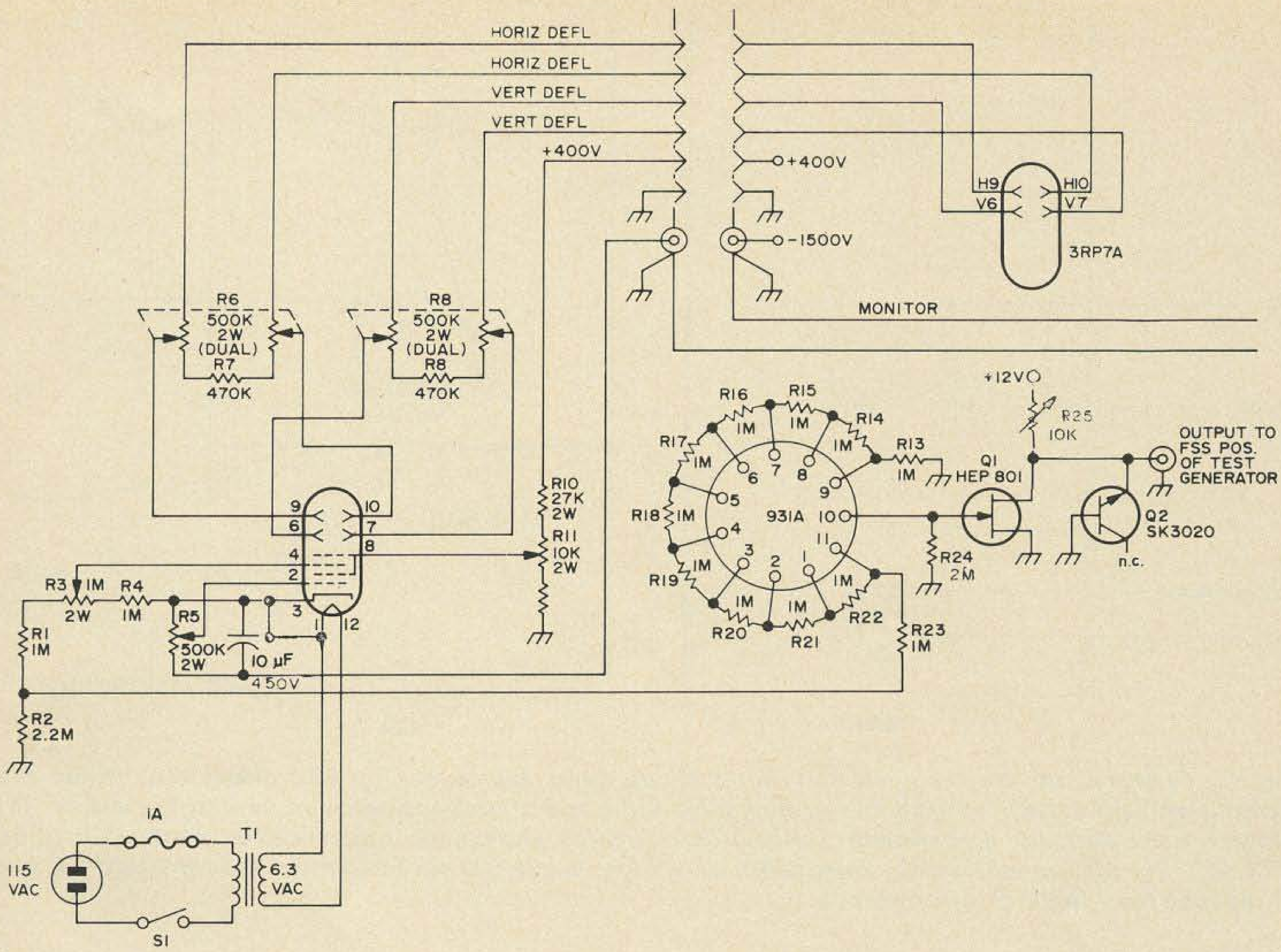

Fig. 5. Scanning module and interconnections with the monitor. The 3RP7A CRT is shown as an example only, for in actual practice the scanning CRT should be of the same type as that used in the monitor. Other CRTs will require different values in the astigmatism and brightness-focus networks and the monitor values should be duplicated. The −1500V is most easily carried via coaxial cable and suitable connectors. If a high positive accelerator voltage is required for the CRT used, it may be carried via a similar cable. Controls are: R6 – Horizontal Size; R8 – Vertical Size; R11—Astigmatism; R5 —Brightness; R3 – Focus; and R25—Dc Level Adjust. T1 is a 6.3V 1.2A filament transformer with secondary windings rated at 2 kV or better.

in the system, but the distance between the CRT face and the photomultiplier should be kept at least 4 or 5 in. if the picture definition is not to be degraded by parallax factors. The CRT should be firmly mounted and some means incorporated to keep the photographic slides pressed firmly against the tube face. Small metal clips may be used or a slide holder can be constructed and attached to the tube face. If elegance or convenience are no object, the slides can simply be taped to the CRT screen! If you plan to use the scanner in a lighted room, a black hood or box assembly can be constructed so that the CRT and the 931 form a light-tight system once the slide is in place. The top of the chassis and the inside of the hood should be painted flat black or faced with black construction paper to eliminate stray reflections.

The schematic of the scanning module and monitor interconnections, Fig. 5, show values in the brightness, focus, and astigmatism networks that are consistent with the 3RP7A used in my own monitor. If your monitor uses another tube, simply substitute equivalent networks from your own monitor circuit. In the event of such a change, be sure to modify the CRT socket connections as required. The 931 requires a negative voltage of some 600 or 700V for proper operation. Alter the relative values of the resistors following the focus pot in your own circuit so that this voltage is available.

High voltage wire should be used where appropriate and the brightness and

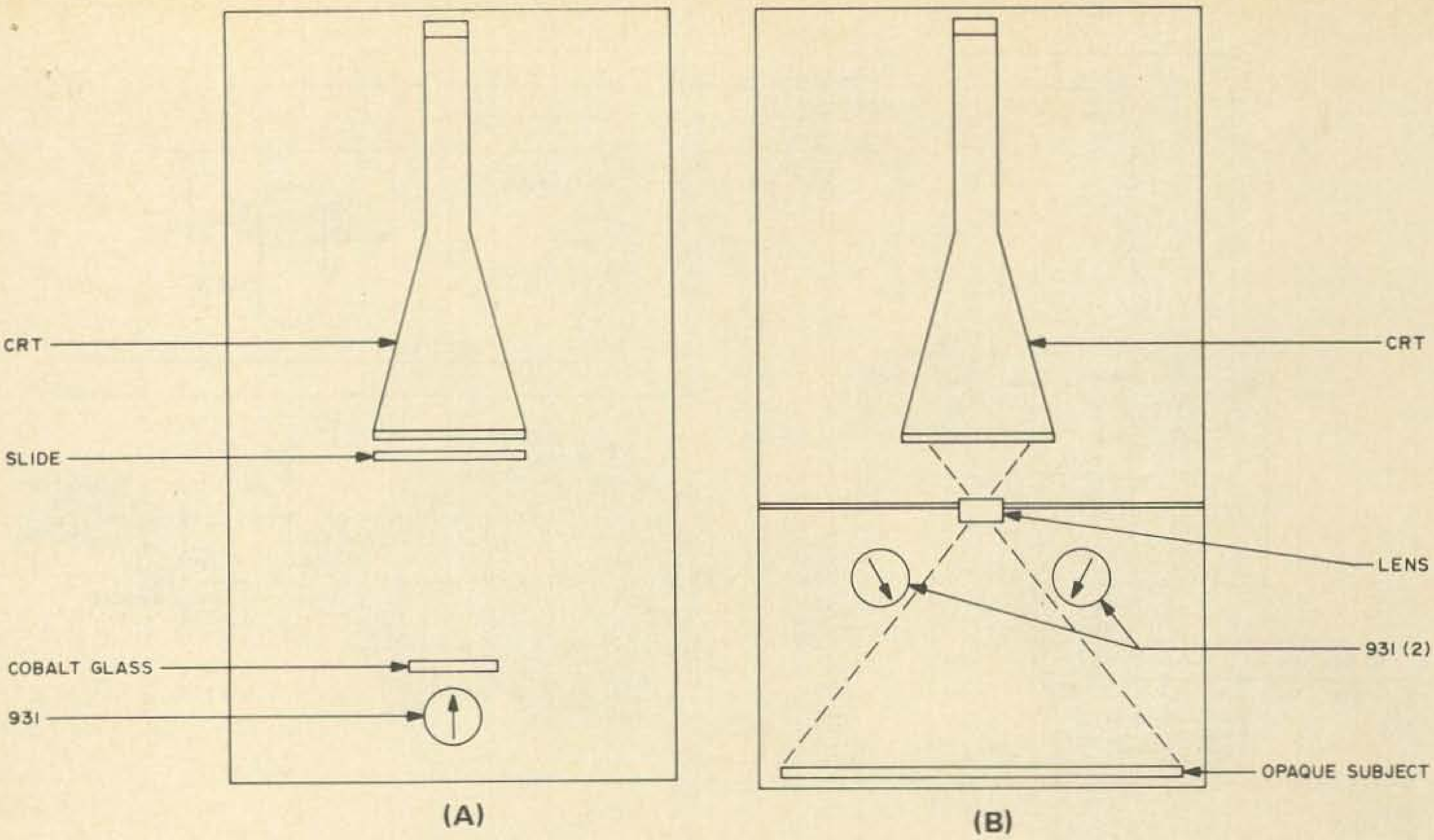

Fig. 6. Diagrams of the mechanical layout for two basic approaches to FSS design. (A) shows the transmitted light system, suitable for photographic slides and other transparencies, used by the author. (B) shows a more complex arrangement, suitable for televising photograph prints and drawings, as used by K7YZZ[2]. The arrows indicate the orientation of the key in the 931 sockets so that the light sensitive area of the tube faces in the proper direction.

focus pots should be *insulated from ground and equipped with insulated shaft extensions*. The focus, astigmatism, and dc output level can be placed anywhere that is convenient as they are rarely adjusted after initial setup. The brightness control is the system contrast control and should be placed for convenient adjustment when the scanner is in operation.

There are actually two options available in constructing the scanning unit. My own unit is built to handle photographic slides and transparencies and the general layout is diagrammed in Fig. 6a. It is also possible to set the scanner up to transmit pictures from photographic prints and drawings. The somewhat more complicated mechanical layout is diagrammed in Fig. 6b. Here a lens is used to focus an image of the scanning raster onto the photographic subject. The light *reflected* from the subject is picked up by two 931 photomultipliers. This approach was used by K7YZZ in his tube FSS circuit[2] and anyone contemplating this approach is urged to consult this article for details of mechanical layout.

Adjustment and Use

The test generator should be aligned first. The generator output should be connected to a frequency counter or some other setup for determining the frequency of the audio output. The base of Q8 should be grounded with a test lead and the sync frequency control adjusted for 1200 Hz output. Remove the

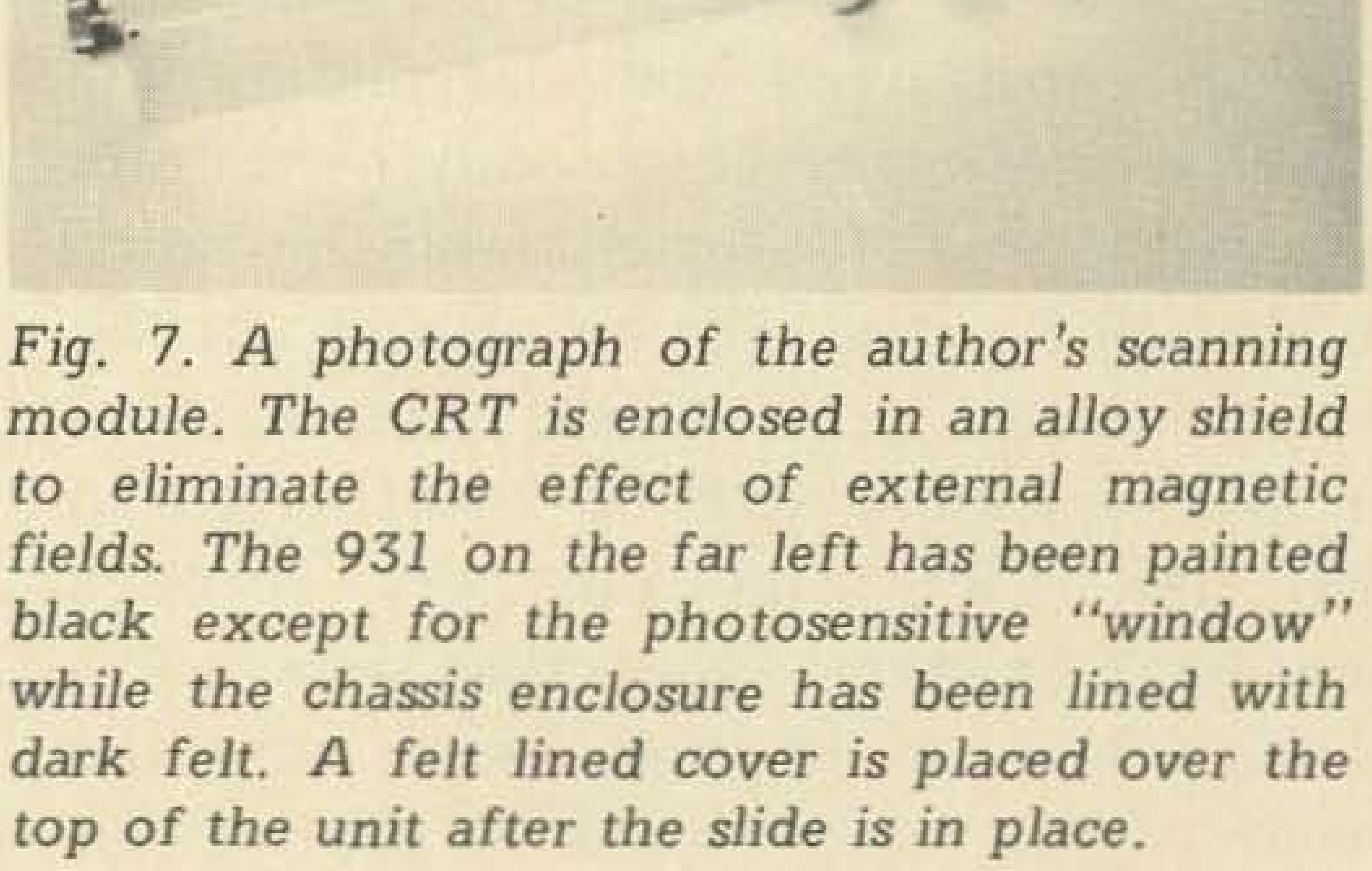

Fig. 7. A photograph of the author's scanning module. The CRT is enclosed in an alloy shield to eliminate the effect of external magnetic fields. The 931 on the far left has been painted black except for the photosensitive "window" while the chassis enclosure has been lined with dark felt. A felt lined cover is placed over the top of the unit after the slide is in place.

test lead and switch S1 to the "black" position, adjusting the black frequency control for 1500 Hz output. Switch S1 to the "white" position and adjust the white frequency control for 2300 Hz output. This series of adjustments should be repeated several times as there is some interaction between the various frequency controls. The generator should then be connected to the monitor and S1 switched to the bars position. The horizontal frequency should be adjusted for a stable display of four vertical white bars and the vertical frequency should be adjusted for an eight sec. frame time. At this point, without plugging the scanning module into the test generator, the following monitor displays should occur at each setting of S1:

BARS – four vertical white bars on a black background.

BLACK – a pure black raster.

WHITE – a pure white raster.

GREY – a raster whose intensity can be varied from black to white using R1.

FSS VIDEO – a black raster.

Turn out all of the room lights or cover the 931 photomultiplier. Plug the video line from the scanning module into the generator and apply power to the scanning unit. The dc level control should be adjusted to the point where the subcarrier output *just* begins to rise above 1500 Hz. Turning on the room lights or removing the cover on the 931 should immediately cause the raster on the monitor to go from black to white. Turn out the room lights and adjust the scanning module brightness, focus, and astigmatism controls for a moderately bright, well-focused raster. The respective size controls should be adjusted for a square raster of a size appropriate for the slides being used. Very small adjustments in centering can be made using the monitor centering controls. Put a slide in place and adjust the scanning module brightness control for the best picture contrast when viewed on the station monitor.

Photographic slides, either color or black and white, may be used directly in the system. Call signs and other printed material can be prepared on clear acetate using dry transfer lettering. "Instant" slides can be made on acetate using india ink, wax marking pencils, or many of the felt tip pens available on the market. Various portions of the slide may be cropped or enlarged, within the resolution limits of the CRT, by changing the size and position of the scanning raster. Figure 8 shows some typical output from the system. Building a system of this sort is certainly one of the easiest and least expensive ways to produce high quality SSTV pictures.

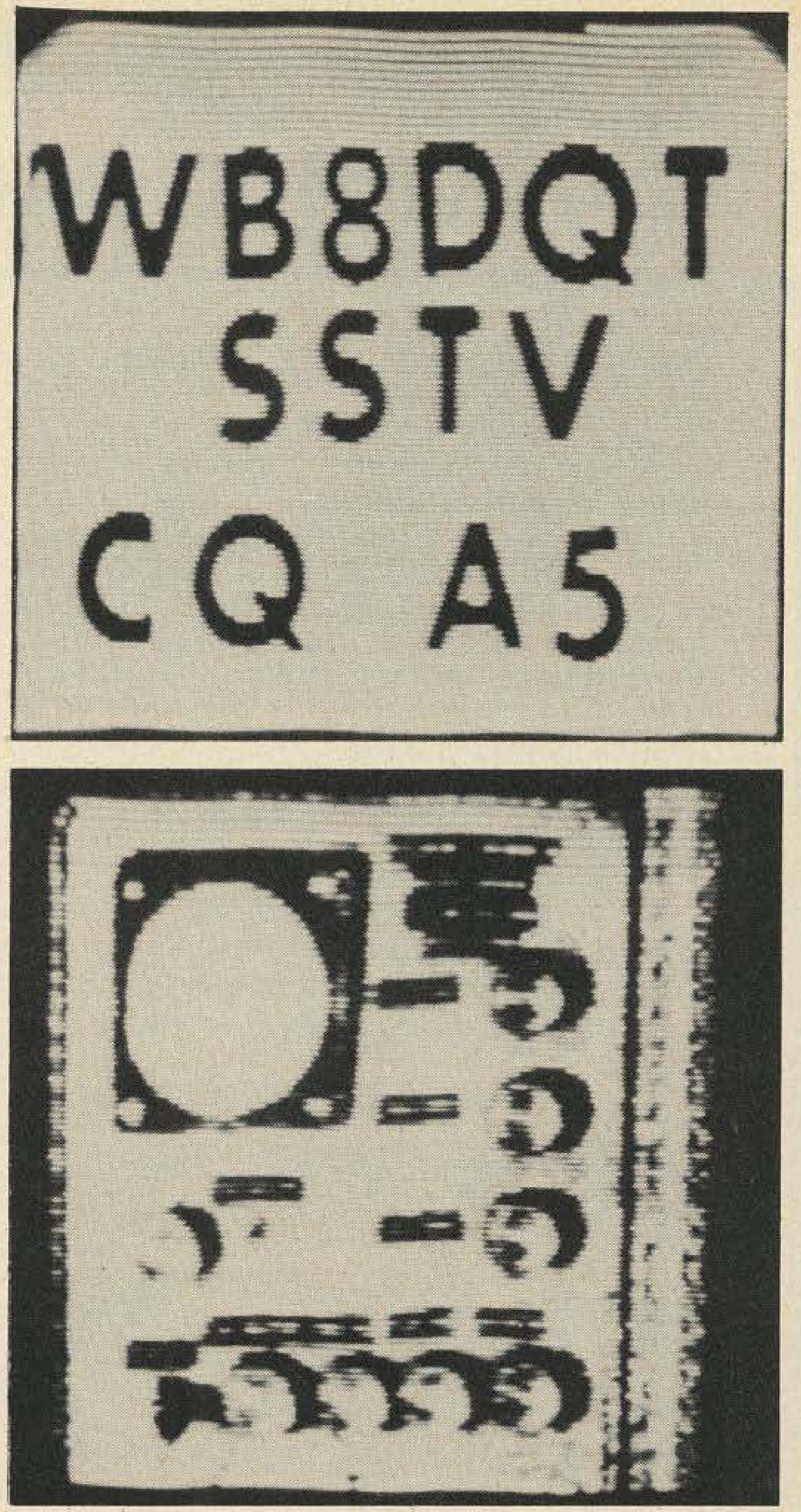

Fig. 8. Typical picture output as viewed on the author's SSTV monitor.

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References cited:
[1]Hutton, L. K7YZZ. A Slow-Scan Television Signal Generator. 73 Magazine, July 1969.
[2]Hutton, L. K7YZZ. A Slow-Scan Television Picture Generator. 73 Magazine, October 1967.

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ACTIVE FILTER DESIGN AND USE PART II

Although information concerning active network theory in the form of inductorless filters was published by Linvill in 1954, it is only since the popularity of solid-state devices and miniaturization that renewed research has shown their real potential.

In seeking a starting point for active filter design, we must consider the desired function of the network and its passive LC or RC counterpart. A basic LC low-pass filter can be used as a design prototype for any of the other filter types. Similarly, basic RC networks will be used as design prototypes for active filters. In choosing a network which we hope will produce the desired response, it is important to remember that some designs are more applicable to specific functions than others. For instance, RC ladder networks lend themselves to low and high-pass designs. The RC twin-tee notch configuration functions well as a bandstop or adjacent frequency elimination network, while RC active peaking networks provide the Q for a bandpass response. Where it is necessary to improve the performance of the single network, active sections may be cascaded, much like multiple section LC filters.

Figure 1 shows a third-order active low-pass filter with the three poles being simulated by frequency-dependent capacitors C1, C2, and C3. The resistances R1, R2, and R3 serve to vary the frequency response by altering the gain, impedance, and waveshape. The cutoff frequency f_o for this filter is given by:

$$f_o = \frac{1}{2\pi R C}$$

The RC product in the above formula incorporates the sum of the individual values of resistances and capacitances in the network. The circuit of Fig. 1 is a unity gain amplifier when operated under optimum conditions. In addition, the gain will be primarily dependent upon the value of R, which is always in series with the signal flow. Moreover, the value of R is, to a great

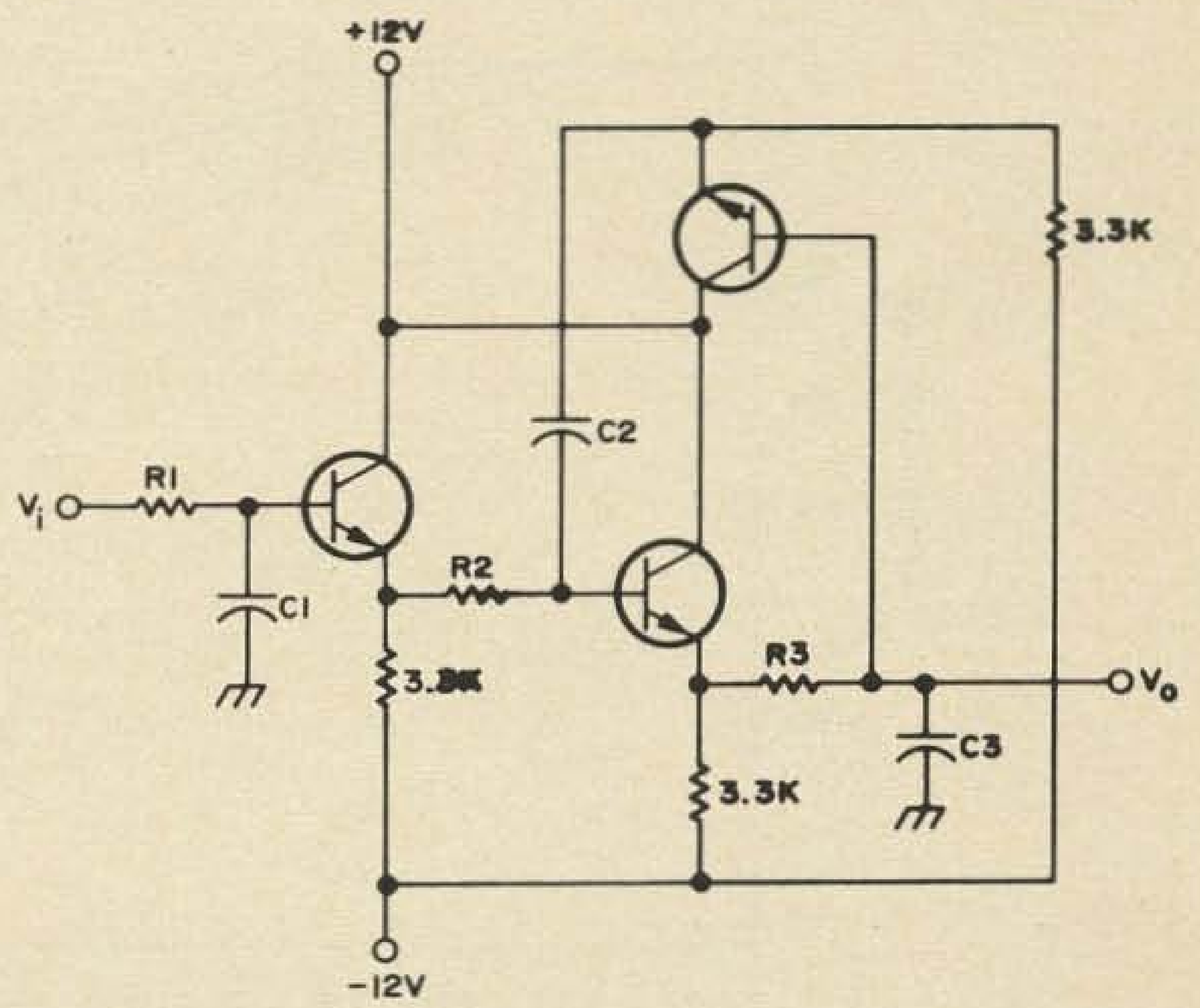

Fig. 1. Active low-pass filter.

Table I

	$C_{1,2,3}$	$R_{1,2,3,}$	Insertion Loss	f_o	-3 dB	-10 dB	-20 dB
A	.001	620	8 dB	28 kHz	100 kHz	175 kHz	220 kHz
B	.001	1 k	7 dB	17 kHz	75 kHz	140 kHz	300 kHz
C	560 pF	4.7 k	17 dB	7 kHz	50 kHz	90 kHz	160 kHz

extent, dependent on the corresponding value of C. In practical consideration, the cutoff frequency is limited by the required value of C. As the value of C is decreased, and R remains the same, the cutoff frequency is increased. The same is true for the resistor values. Consequently, there is a point where minimum capacitance requires the increase in the value of R to obtain a higher cutoff frequency. This is done at the expense of higher insertion loss or lower gain.

The value of the emitter resistors was chosen as optimum for maximum gain of the MPS 6520 transistors. Table I gives the results of trying different values of R and C in the low-pass filter circuit. Figure 2 shows the plotted frequency response for the values of Table I. From these results, it is obvious that two major areas require improvement. Of greatest importance is the lack of a sharp cutoff at the −3 dB point. We should also expect a minimum of 15 dB attenuation per octave. High insertion loss also affects the overall response, flattening the peaks and decreasing the gain. A reasonable improvement should be expected if we could design a similar filter with less insertion loss and steeper slope.

Figure 3A shows two cascaded RC networks. When this two-pole network is placed in the signal path, each section (R1C1 or R2C2) exhibits its individual frequency characteristics, which are algebraically added to produce the final filter shape response. In other words, if the network consisting of R1C1 had a rolloff around 1 kHz, and R2C2 extended this cutoff to 2 kHz, we could not expect to obtain a summed cutoff frequency of 3 kHz by cascading the two networks, but the resulting −3 dB point would be closer to 1.5 kHz. Although we may sharpen the response curve at the −3 dB point by cascading the two networks, we will have the problem of high insertion loss and minimum attenuation slope. By separating the two networks, consisting of R1C1 and

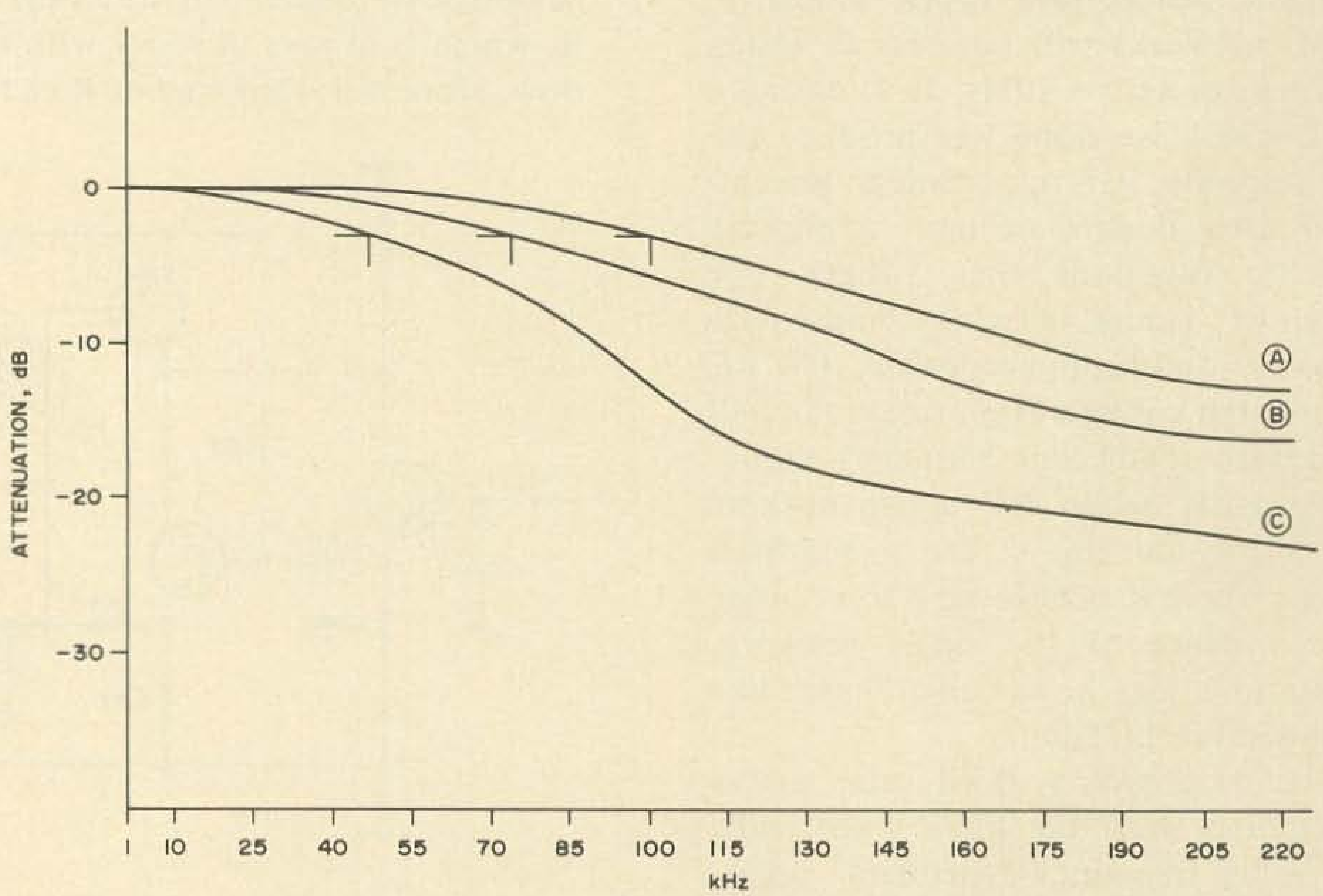

Fig. 2.

R2C2, and utilizing them as input and output circuits of an amplifier, we can lower the network insertion loss and alter the final filter response.

In Fig. 3B, the signal is fed to an amplifier (A) from which a feedback line (beta) is taken to be reinserted at the RC network. Figure 4 shows the results of variations of network component ratios and circuit design for a low-pass filter. The damping factor d is a measure of the two-pole response at the −3 dB point. Its value is dependent upon the network Q. The steeper the response curve, the greater the Q and the smaller d must be:

$$Q = \frac{1}{d}$$

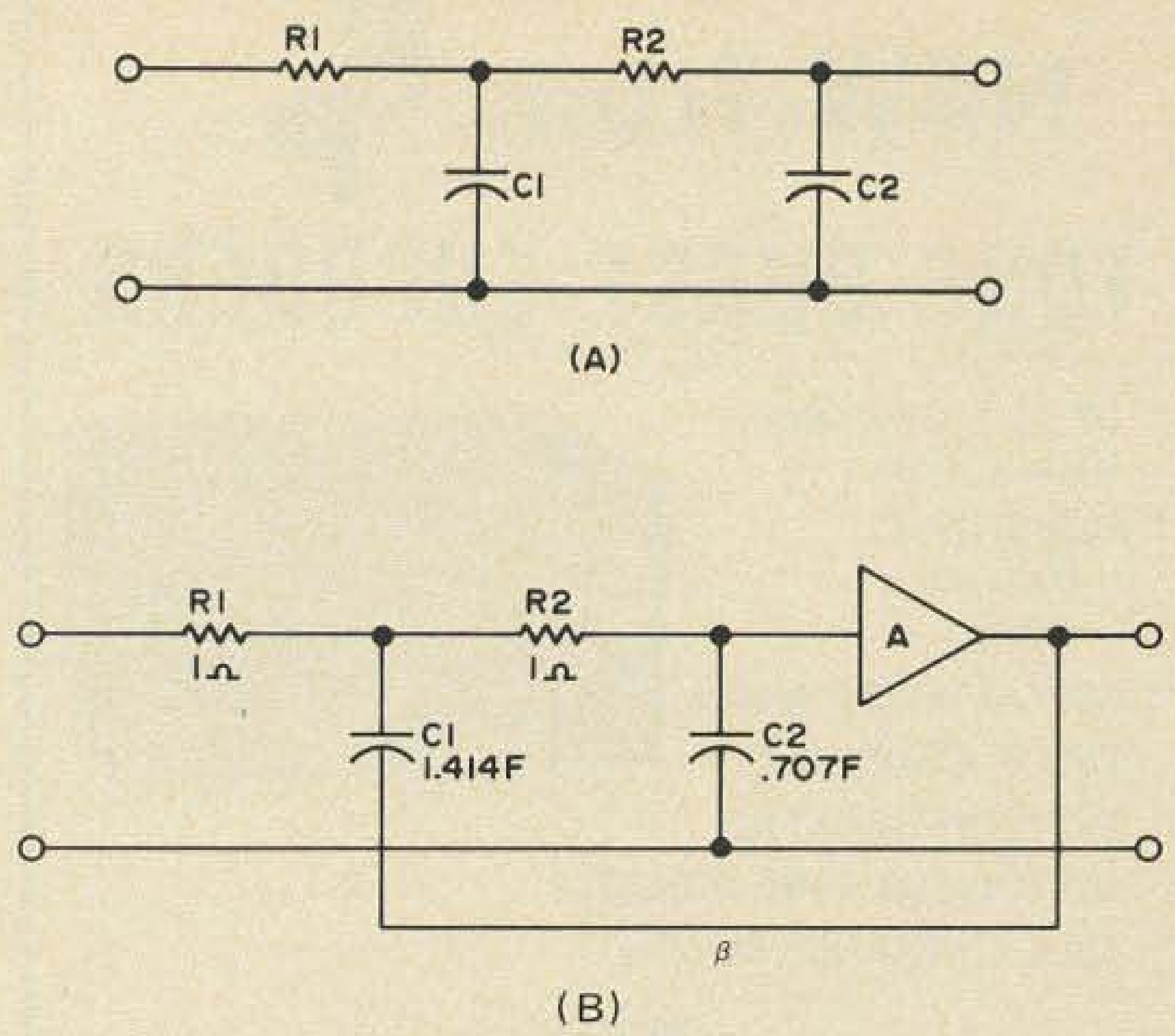

Fig. 3. Normalized lowpass filter.

Without feedback, Fig. 4 shows that the best response we can expect is where parameter d is equal to one. Such a curve would be the result of a passive RC network with a maximum gain of unity, as shown in Fig. 3A, or the active network of Fig. 1. By utilizing a feedback loop, the slope can be modified to the curves showing d equal to less than one. If an amplifier is incorporated before the feedback loop, d becomes a function of gain and feedback. In this case, the frequency characteristics take on the shape of the curve where d is equal to much less than one.

Figure 5 shows an active network which can be designed to provide any value of d for a given corner frequency ω_0. Transistor Q1 is an emitter follower stage biased for maximum gain (unity) and stable operation. The signal is direct-coupled to the emitter of Q2, and from the collector of the amplifier to the output through the emitter follower Q3. This arrangement allows transistor impedances to be matched and provides a gain (k) greater than unity, although naturally less than with a common emitter amplifier. Due to the required configuration of the filter section, the signal source appears as a constant-current generator. Therefore, the signal baselines, normally considered as zero, may be above the dc zero reference value. This possibility

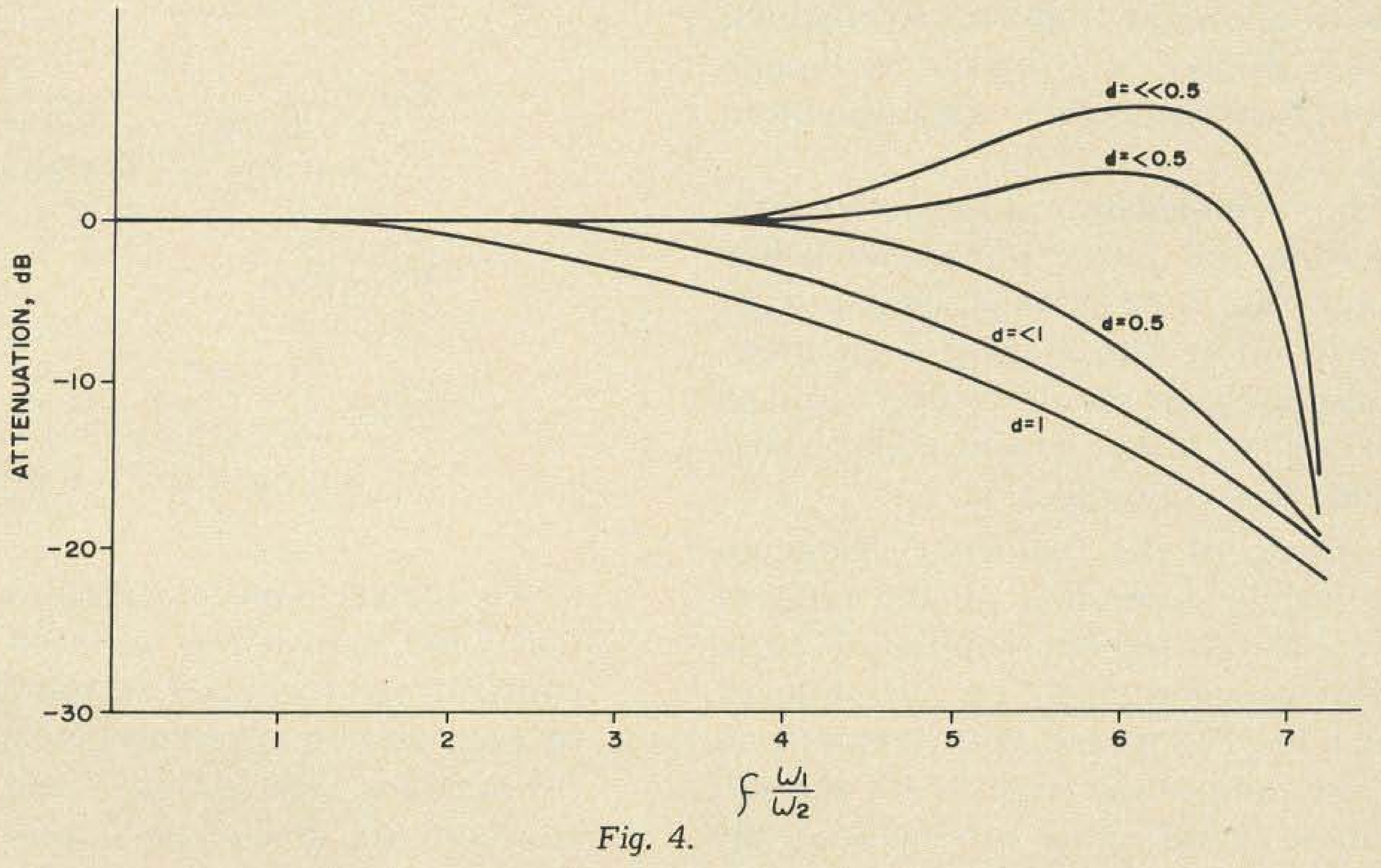

Fig. 4.

makes biasing of Q1 different from normal capacitor-coupled configurations. The base must remain positive, with respect to the emitter, for the entire swing of the input signal, regardless of where the signal baseline may be. Failure to provide correct biasing will cause clipping of the negative portion of the waveform, or when bias is too low to allow the transistor to conduct, the scope display will appear as though there is a loose connection or a ground lead missing.

The input impedance of the active filter is high while the output impedance is low (approximately 600Ω), thus lending itself to incorporation into transistor circuitry. Power supply leads should be decoupled to prevent signal loops which might cause shape distortion or oscillation.

The shape of the frequency characteristic is mainly dependent on the ratio of R1C1 to R2C2 and the amount of feedback voltage determined by the ratio of R10 to R11. The gain k of the amplifier is set by the ratio of the resistors R8 and R9. To achieve good slope attenuation, the response of the active section of the filter must be combined with that of the passive section R1C1. This requires a βk factor of greater magnitude than would be necessary for the active filter without the passive section.

In designing the RC sections, R1 and R2 should be relatively low in value for good temperature stability. The ratio of C1 to C2 can be considered to be 10 for a good starting point. By the use of impedance and frequency scaling, we can obtain values for R1C1 and R2C2. These values will not be final filter values since changing R or C may be necessary to obtain the desired response shape in conjunction with feedback and gain. Therefore, a change in R requires a change in the value of the corresponding C. In Fig. 3B, values have been assigned to the components to produce a normalized active filter network for 1 radian per second. These prototype values are for two-pole Butterworth filters. To determine the value of C, we utilize the frequency scaling formula:

$$C' = \frac{C}{2\pi f_c}$$

In this equation, C' indicates value after frequency scaling.

For a Butterworth response with a cutoff frequency of 2.5 kHz (−3 dB point), we obtain for C1:

$$C'1 = \frac{1.414}{6.28(2.5\text{x}10^3)}$$
$$= 0.09\text{x}10^{-3}\,\text{F} = 90\ \mu\text{F}$$

For C2:

$$C'2 = \frac{.707}{6.28(2.5\text{x}10^3)}$$
$$= 0.045\text{x}10^{-3}\,\text{F} = 45\ \mu\text{F}$$

To achieve convenient values of capacitance and impedance, we need only use a constant value applied to the components of each section. The constant need not be the same for each section. Using the chosen constant to divide the capacitance and

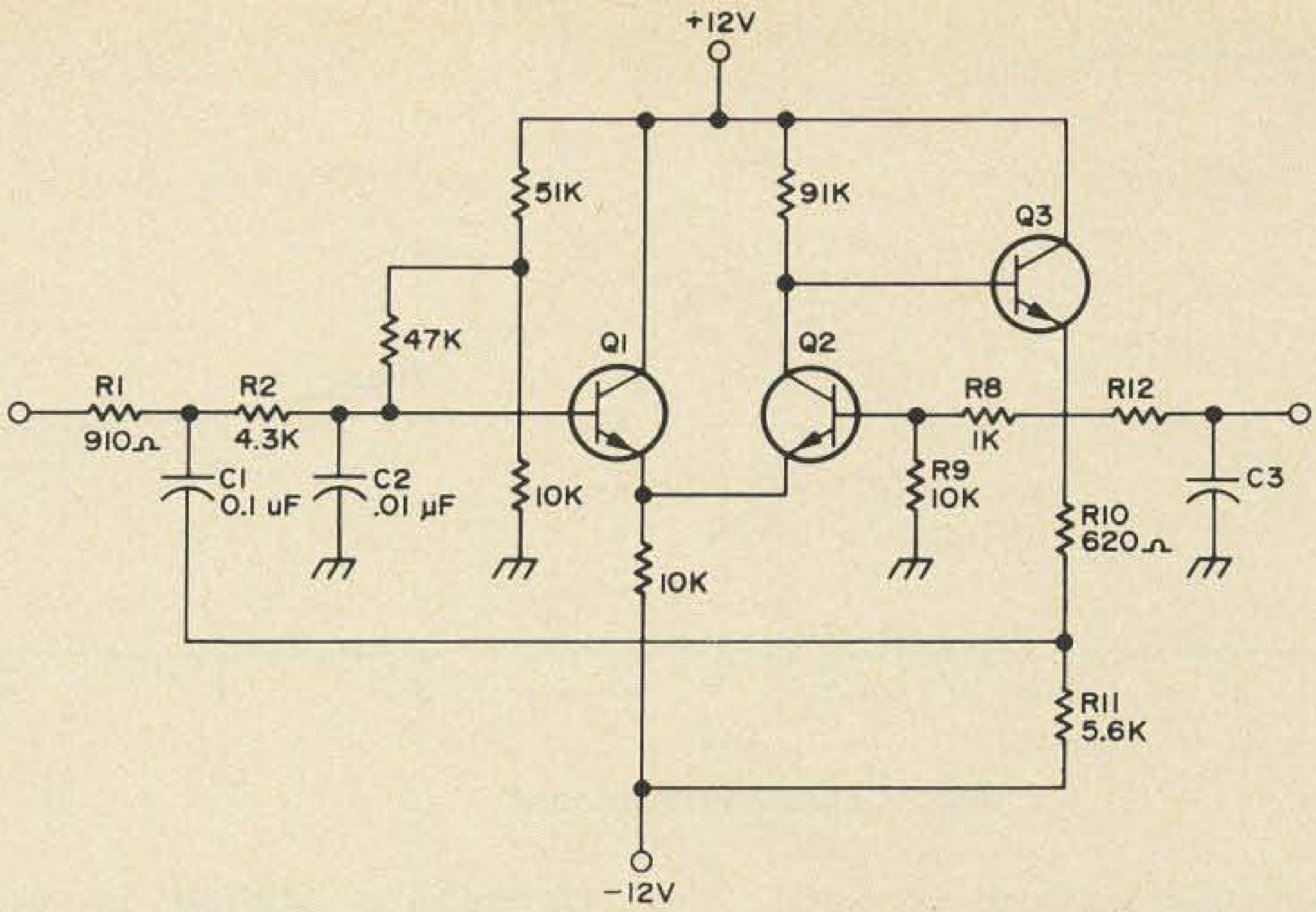

Fig. 5. Active low-pass filter.

multiply the resistance prototype values, a trial RC network is produced. Utilizing 900 as the constant for the R1C1 section, we obtain:

$$C1 = \frac{90}{900} = 0.1\ \mu F$$

$$R1 = 900(1) = 900\Omega$$

If we choose 1000 as the constant for the R2C2 section:

$$C2 = \frac{45}{1000} = 0.045\ \mu F$$

$$R2 = 1000(1) = 1\ k\Omega$$

Figure 6 shows response curves for the above computed RC values with gain varying resistors R8 and R9 having values of 1 kΩ and 10 kΩ respectively. The curves show the effect of decreasing or eliminating R10, thus increasing feedback β. From Fig. 6, the factor βk must be increased and the cutoff frequency/attenuation slope must be decreased while maintaining a passband within ±1 dB. Figure 5 shows the final design and Fig. 7 the response curve for the active low-pass filter. To obtain the 10:1 ratio of C1:C2, and decrease the cutoff frequency/attenuation slope, the values of C2 and R2 were changed to 0.01 μF and 4.3 kΩ. The passive section consisting of R12 and C3 in Fig. 5 may be utilized at very low frequencies to flatten the passband. Values for these components can be computed by the formula:

$$f_c = \frac{1}{2\pi R C}$$

At higher frequencies (above 1 kHz) the passband should be flat within ±1 dB

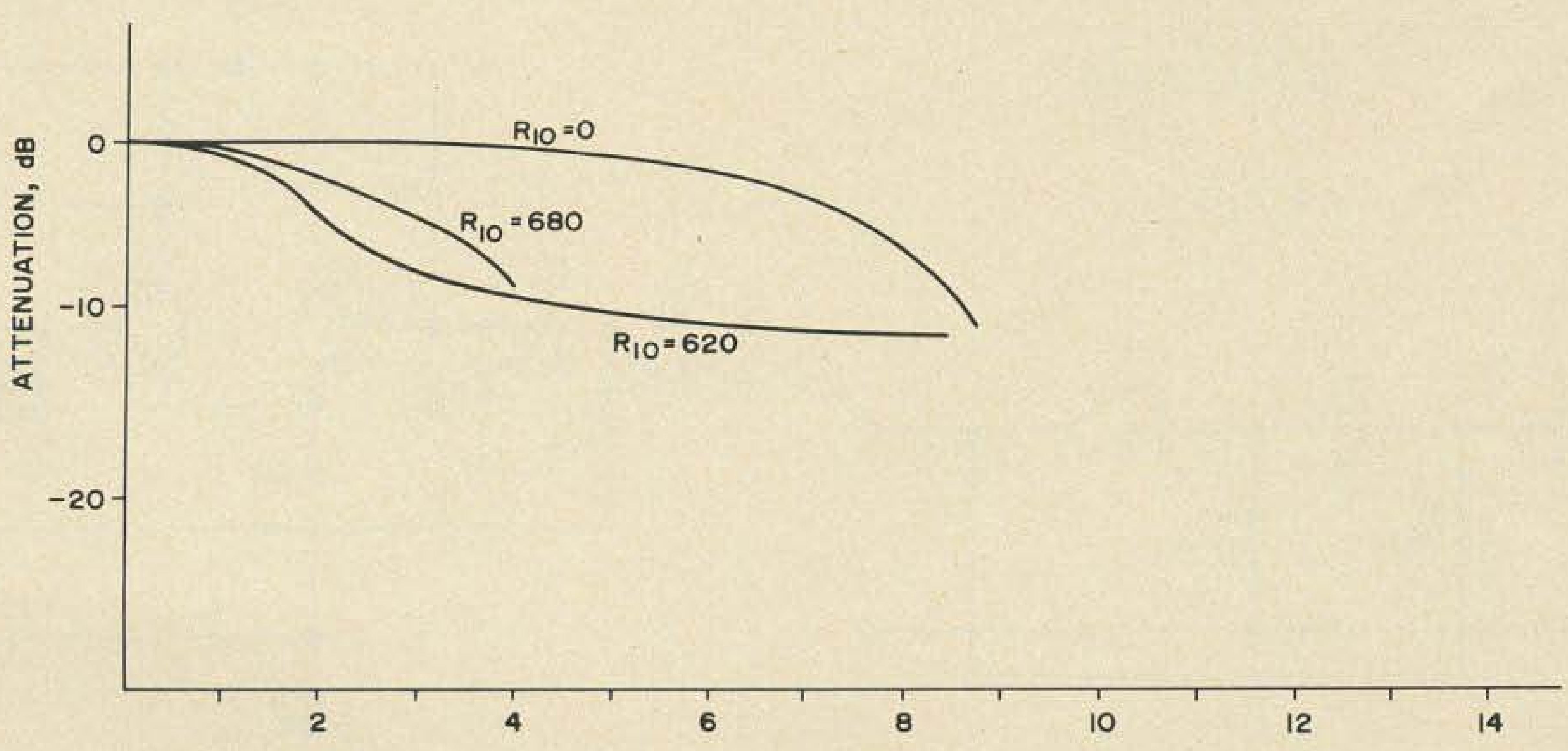

Fig. 6.

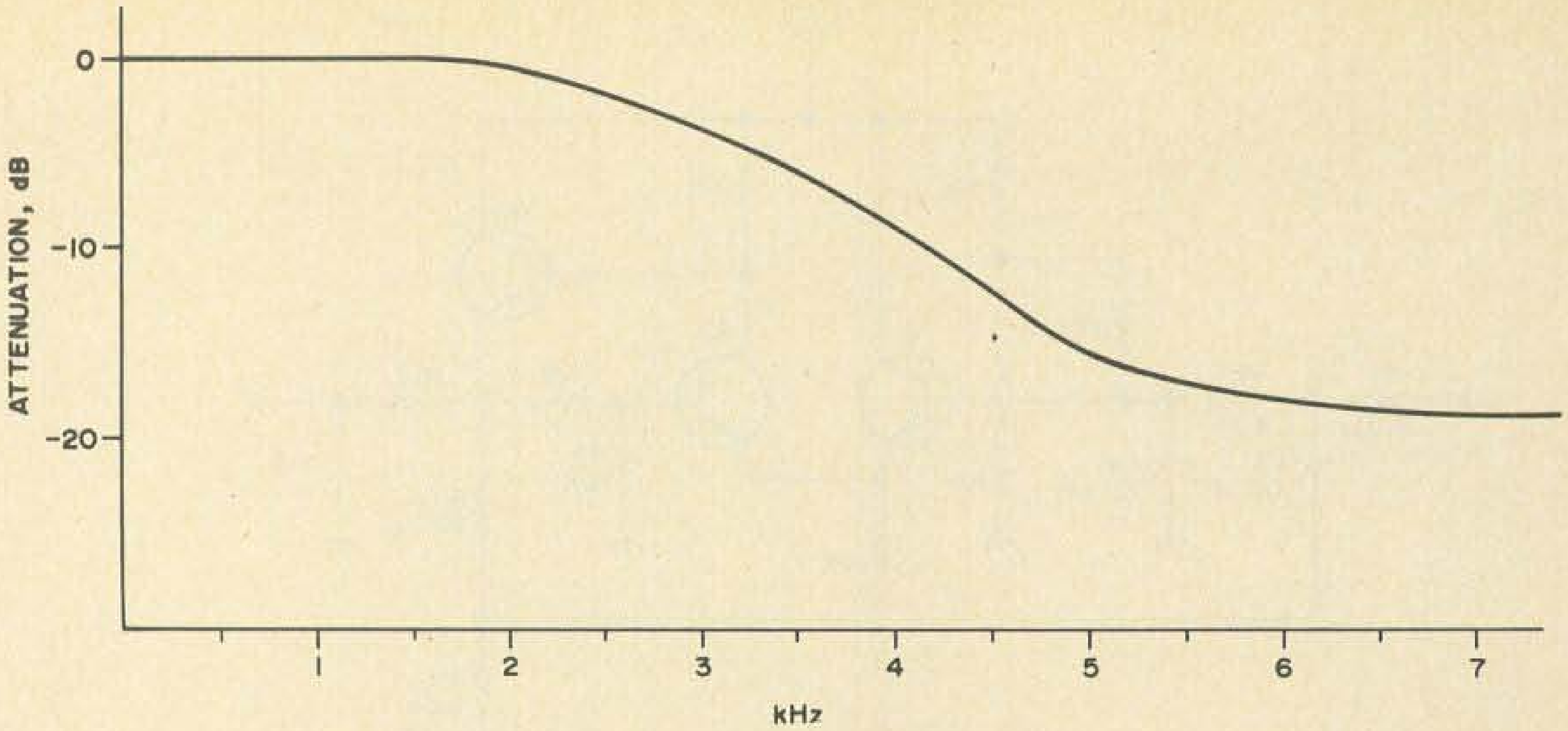

Fig. 7. Low-pass response.

without the added passive section. Consequently, the active network can exhibit gain without these components.

By changing the positions of the LC components, and finding the reciprocal values, a low-pass filter became a high-pass network. Similarly, as shown in Fig. 8, the same principle can be applied to RC active filters. The branches which originally contained capacitors are now made up of resistors with the normalized value of the reciprocal of the constant values of 1.414 and 0.707 originally assigned the capacitors in the low-pass network. In the new high-pass filter the original resistors are replaced by capacitors, also normalized for a cutoff frequency of 1 radian per second.

Frequency scaling to determine the values of C1 and C2 at a 3 dB cutoff frequency gives:

$$C'1,2 = \frac{C}{2\pi f_c}$$

$$= \frac{1}{6.28(2.5 \times 10^3)}$$

$$= 63.7\ \mu F$$

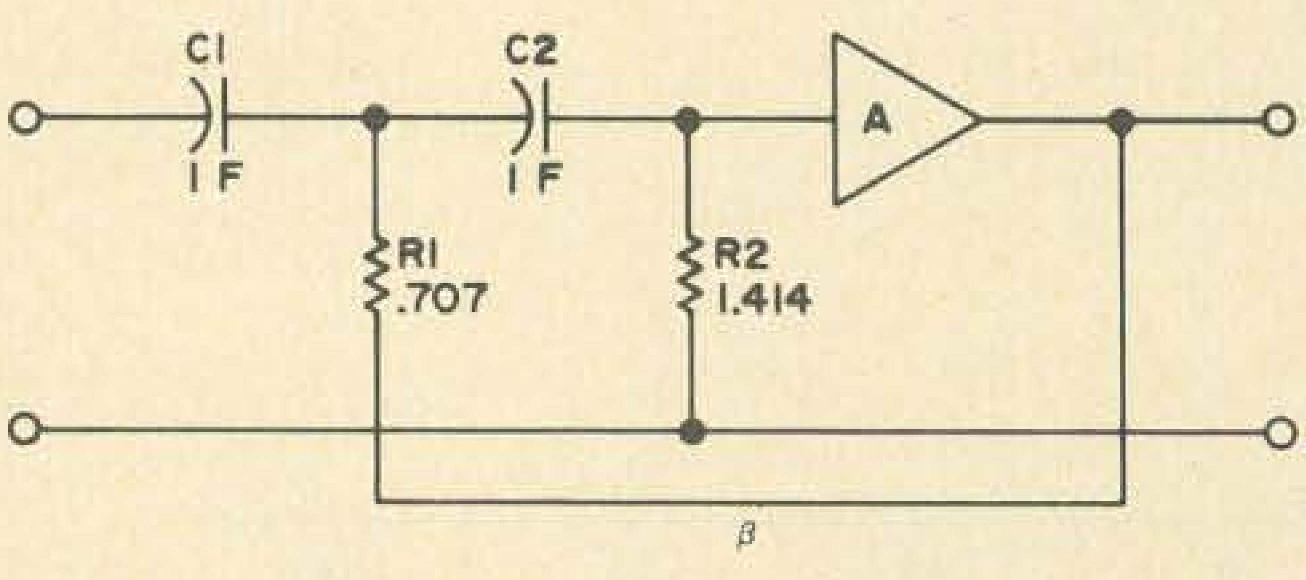

Fig. 8. Normalized high-pass filter.

Impedance scaling is similar to the low-pass procedure where the capacitor values are divided by a constant value and the resistors are multiplied by the same figure. The constant may be different for each section. If we attempt to begin with a 10:1 ratio for the parallel branches, and choose values of 100 for R1 and 10 for R2, impedance scaling provides:

$$R1 = 0.707(141.4) = 100\Omega \qquad R2 = 1.414(7.14) = 10\Omega$$

$$C1 = \frac{63.7}{141.4} = 0.45\ \mu F \qquad C2 = \frac{63.7}{7.14} = 8.92\ \mu F$$

The active high-pass network functions as a voltage amplifier, thus requiring different biasing than the low-pass filter. By utilizing R2 as a bias resistor in addition to

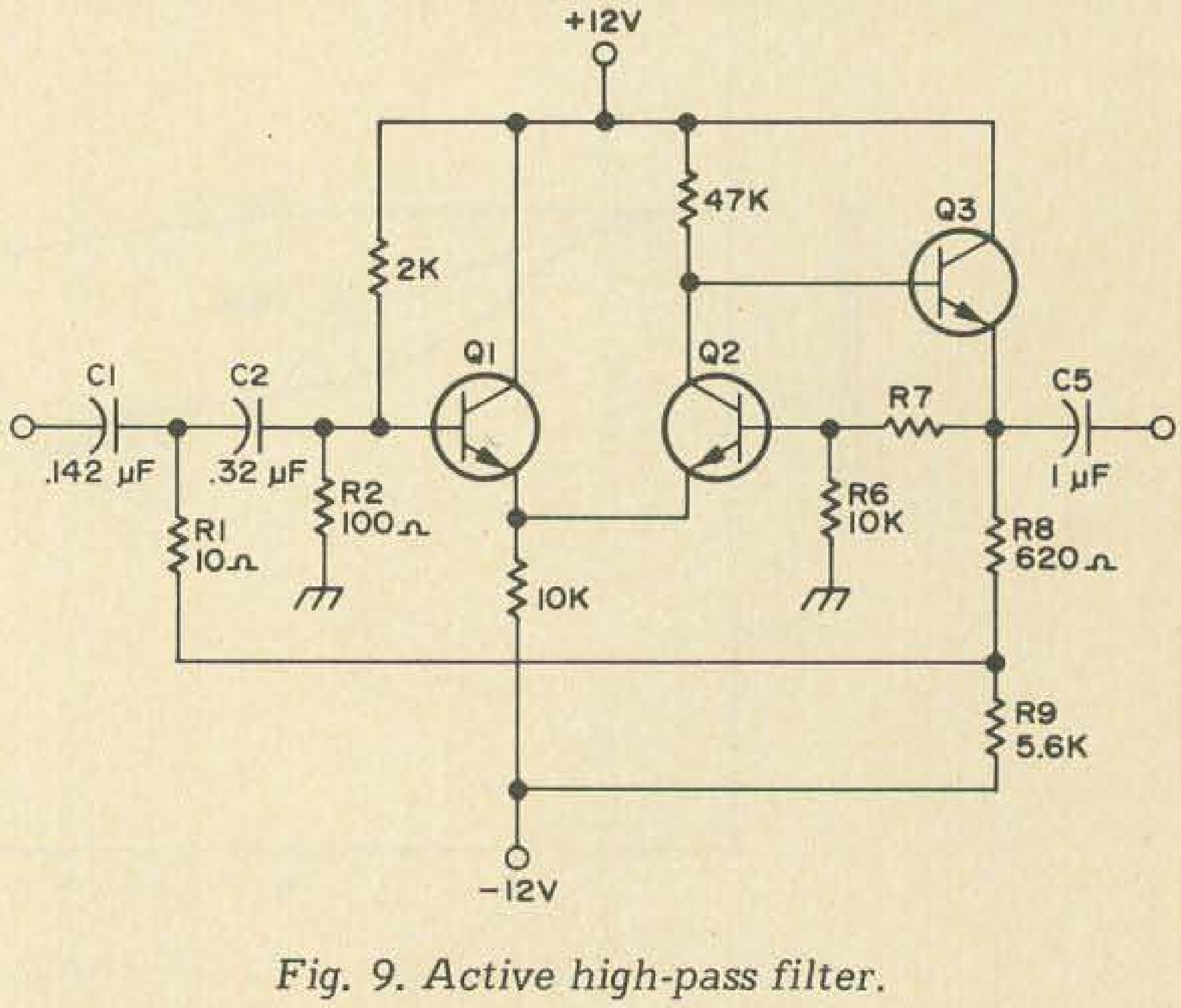

Fig. 9. Active high-pass filter.

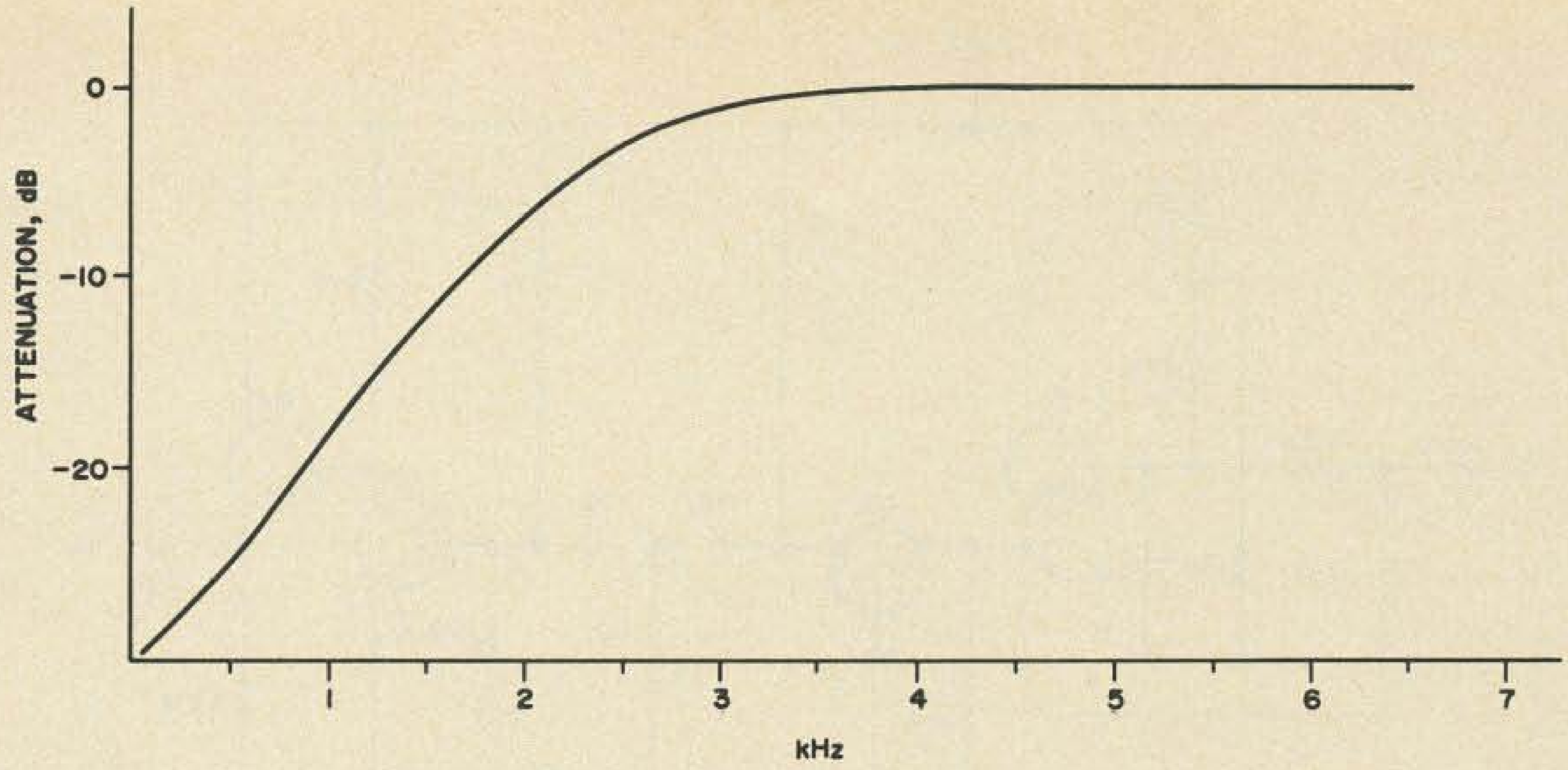

Fig. 10. High-pass response.

its function in the passive section, design is simplified. To increase the bias on Q1, R2 must be greater than 10Ω. Exchanging the positions of R1 and R2 provides the necessary base bias on Q1, maintains a 10:1 ratio in the parallel filter branches, but requires recomputation of C1 and C2:

$$R1 = 0.707(14.1) = 10\Omega \qquad R2 = 1.414(71.4) = 100\Omega$$

$$C1 = \frac{63.7}{14.1} = 4.5\ \mu F \qquad C2 = \frac{63.7}{71.4} = 0.89\ \mu F$$

As in the active low-pass filter, the ratio of R2C2 in conjunction with the feedback components R8 and R9 determine the response shape of the high-pass filter. The final values of these components, obtained by altering the ratios, is shown in Fig. 9. The response shape of the active RC high-pass filter is plotted in Fig. 10.

To obtain bandpass or bandstop responses we need only combine the characteristics of the low-pass and high-pass filters. In Fig. 11A, the combined re-

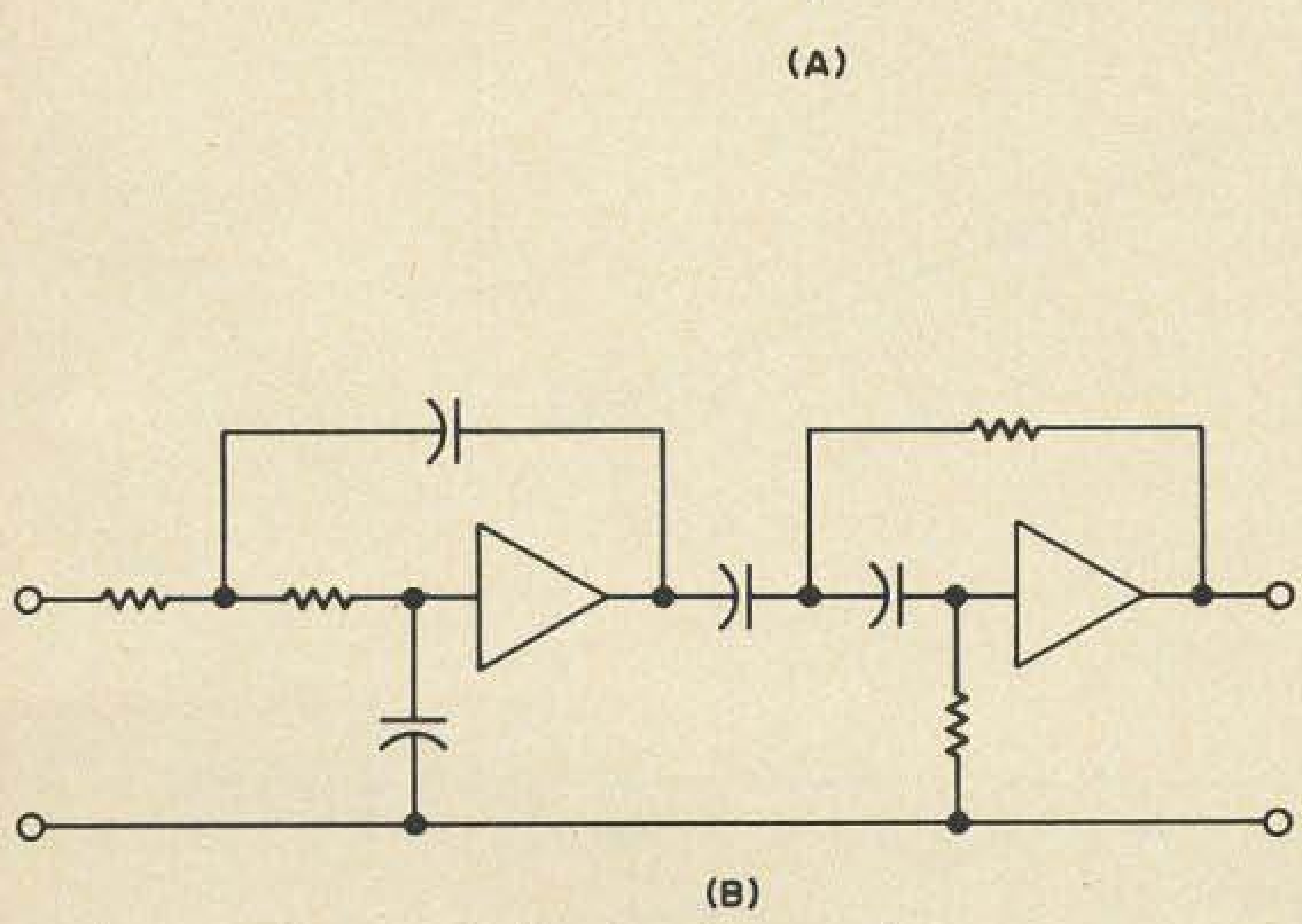

Fig. 11. Active bandpass scheme.

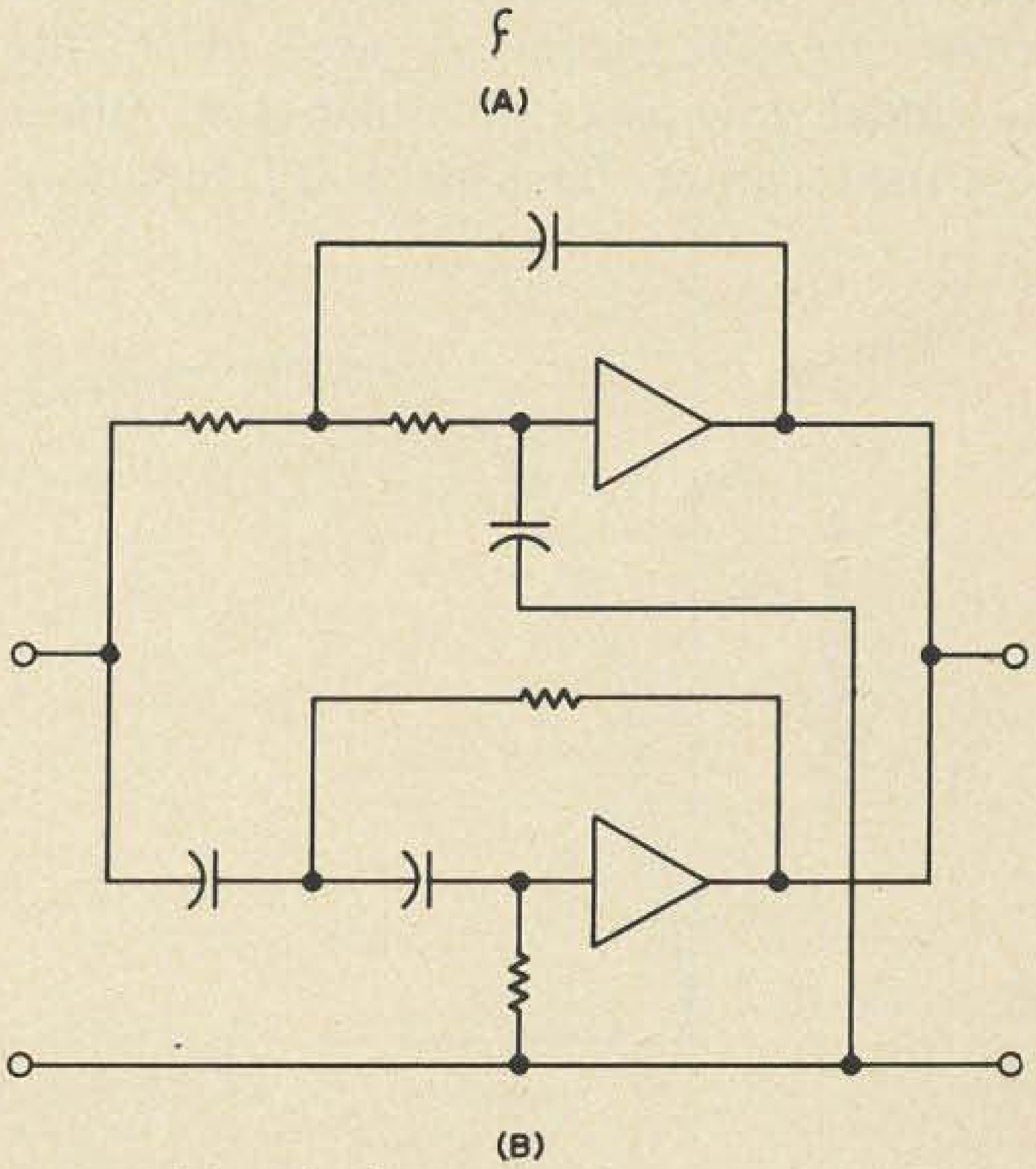

Fig. 12. Active bandstop scheme.

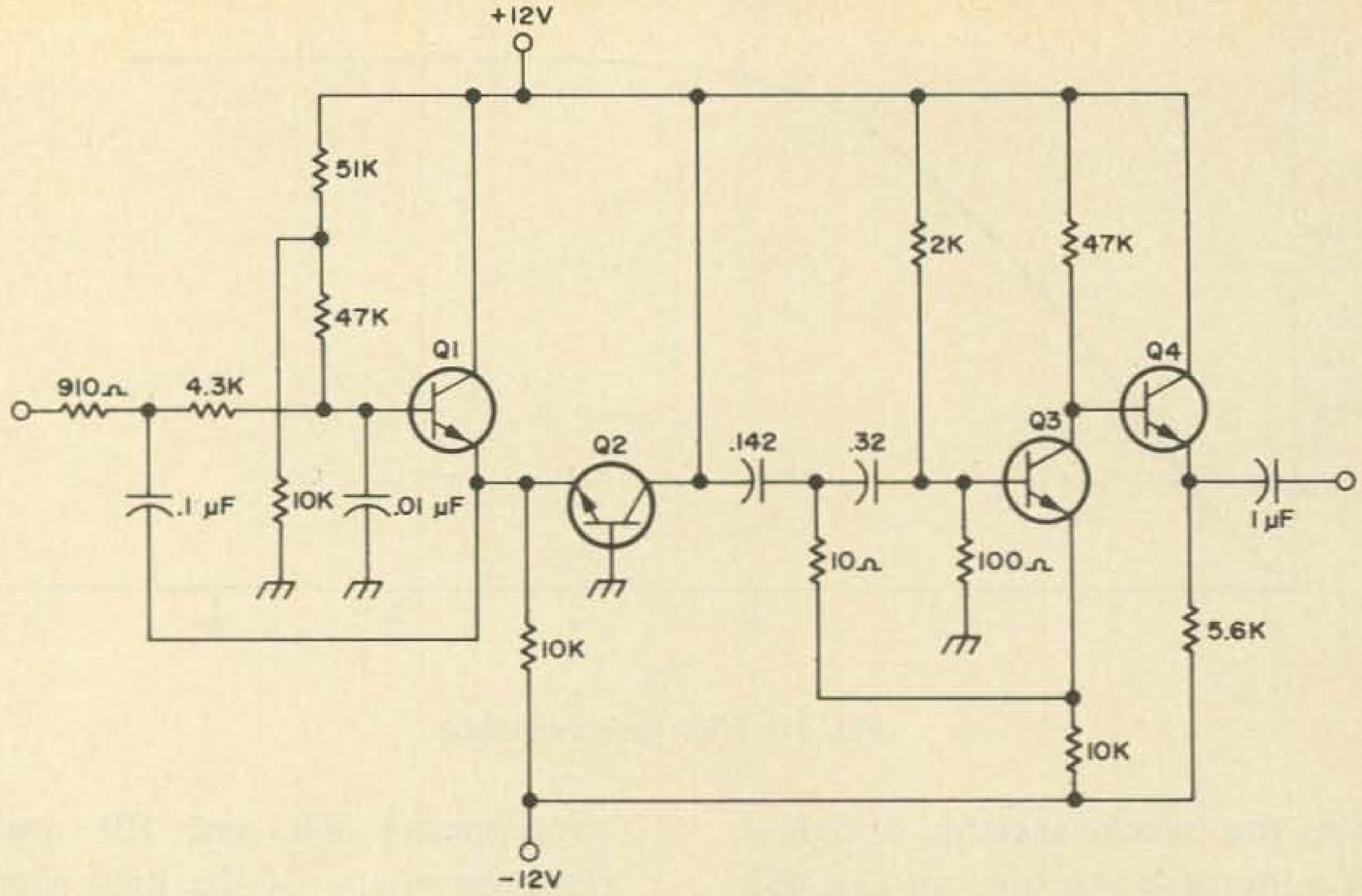

Fig. 13. Active bandpass filter.

sponses of a cascaded low-pass and high-pass filter, as shown in Fig. 11B, are displayed as simple curves superimposed one on the other to form a bandpass shape. To assure the desired response and maintain symmetry, some sort of peaking is required at f_0. This is normally a function of Q. Algebraically summing these two networks will produce a bandstop response as shown in Fig. 12. Normalized values for these prototypes are the same as given in the two previous designs.

In Fig. 13 we have cascaded a low-pass and high-pass filter to obtain a bandpass response. The passive filter component values are the same as used with the individual low-pass and high-pass filters described earlier. Transistor Q2 functions as a buffer between filter sections to preclude distortion of the response due to loading. Although the biasing values are the same as utilized on the earlier active filters, rebiasing will improve the insertion loss caused by dual series filters in a unity-gain network. Figure 14 displays the response of the network for the values given in Fig. 13. The initial response is reasonably flat for two octaves with good slopes to −15 dB.

Passive RC tee configurations have the poles of the transfer function on the negative real axis of the complex frequency plane, and they occur only once at any given point. However, zero locations are dependent upon the circuit configurations and can occur anywhere in the complex

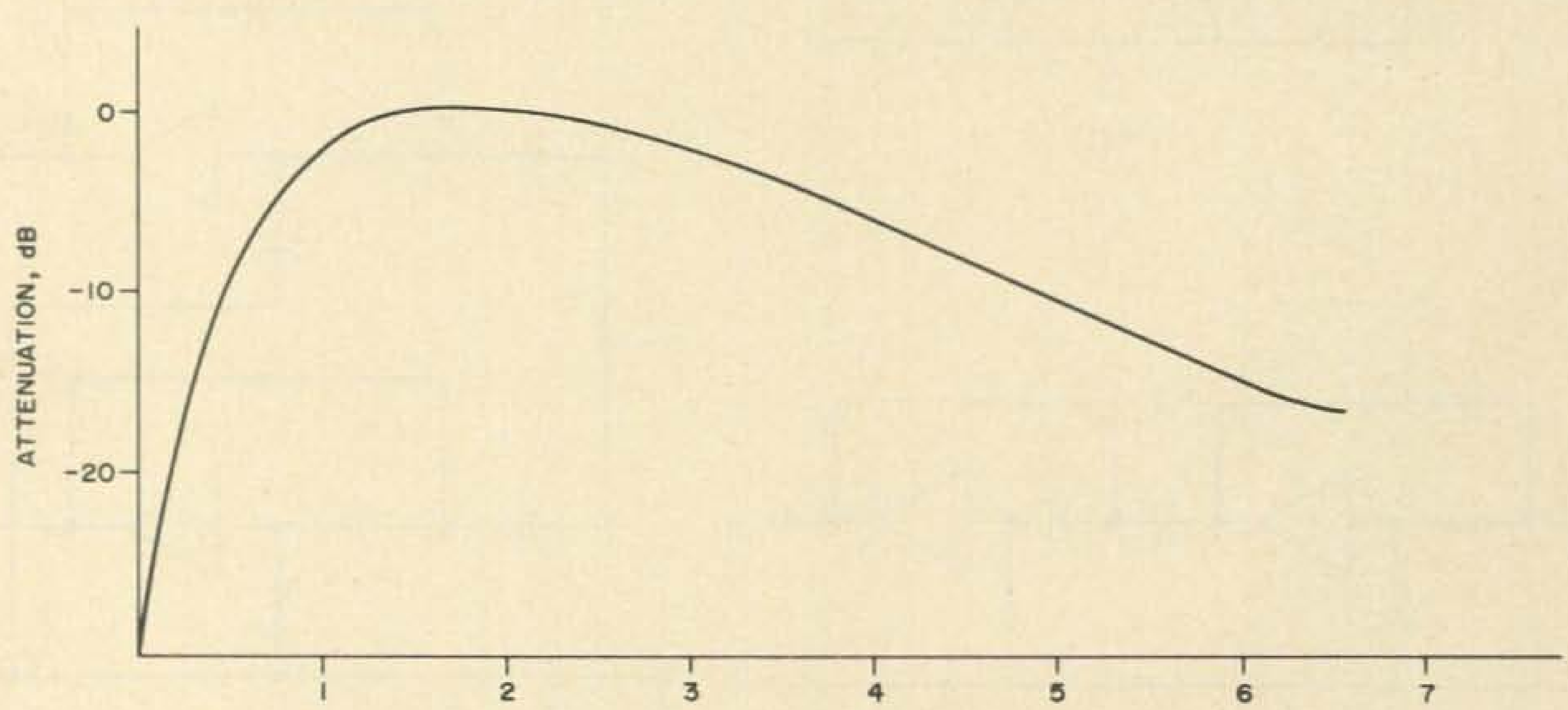

Fig. 14. Active bandpass response.

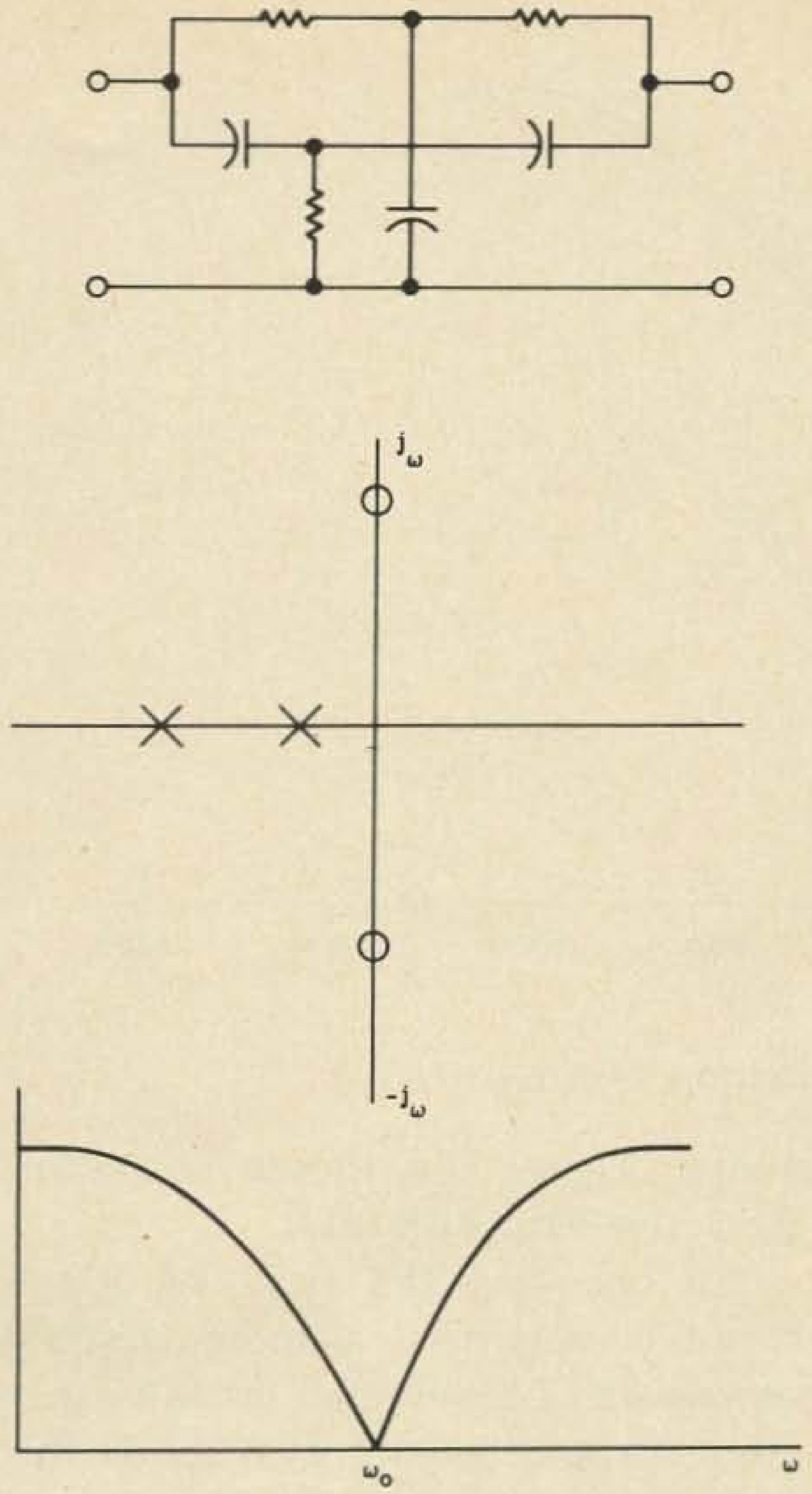

Fig. 15. Twin-tee scheme.

plane. A parallel arrangement of two tee networks and their pole-zero plot and response is shown in Fig. 15. By using the tee network with feedback, the figure of merit, or Q, can be improved by a factor of 80–100 over the value of less than 1 obtained with unity gain.

In Fig. 16, the twin-tee network has been inserted between the emitters of Q1 and Q2. This location precludes the effect of loading input or output which would produce distortion in the response. Rebiasing of the transistors may be necessary to set input signal limits and adjust gain. Operation is similar to the preceding designs in that feedback and gain are varied by R11, R12 and R9, R10, respectively. The values of the components making up the twin-tee network may vary from design to design. To retain a symmetrical response, the network must see a common input and output impedance. The ratios of R4, R5 to R6 and C2, C3 to C4 determine Q, center frequency, and in what area of the transistor curves the amplifier/filter will operate. It is therefore necessary to change the ratios to obtain the desired values of the above listed parameters, in addition to assuring operation of the network as a bandpass, bandstop, or other type of filter.

The following formula may be used to determine center frequency:

$$f_o = \frac{1}{2\pi R C}$$

In designing a bandstop network for 1200 Hz, we might choose a resistance of 1.5 kΩ giving a value of C:

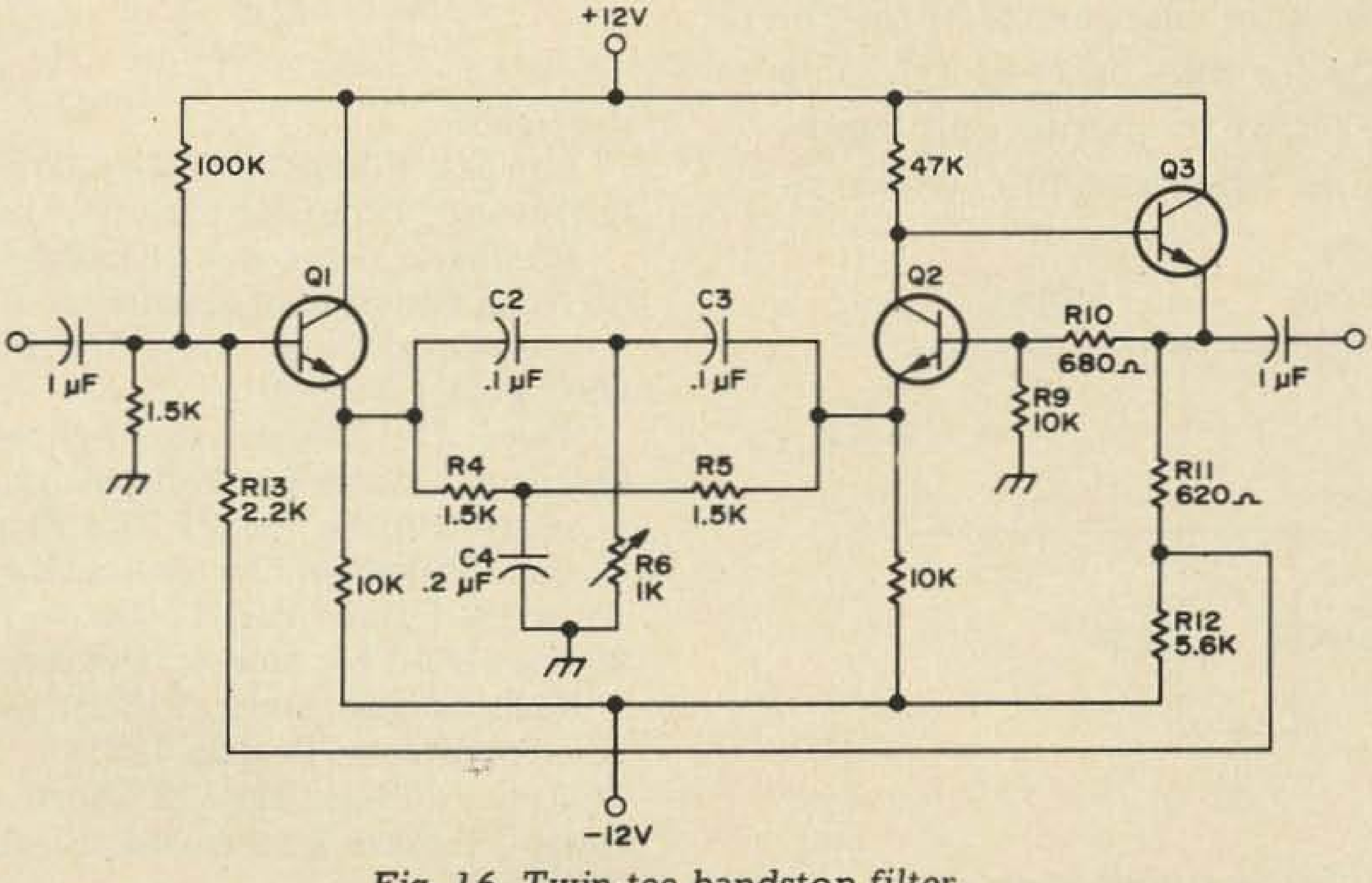

Fig. 16. Twin-tee bandstop filter.

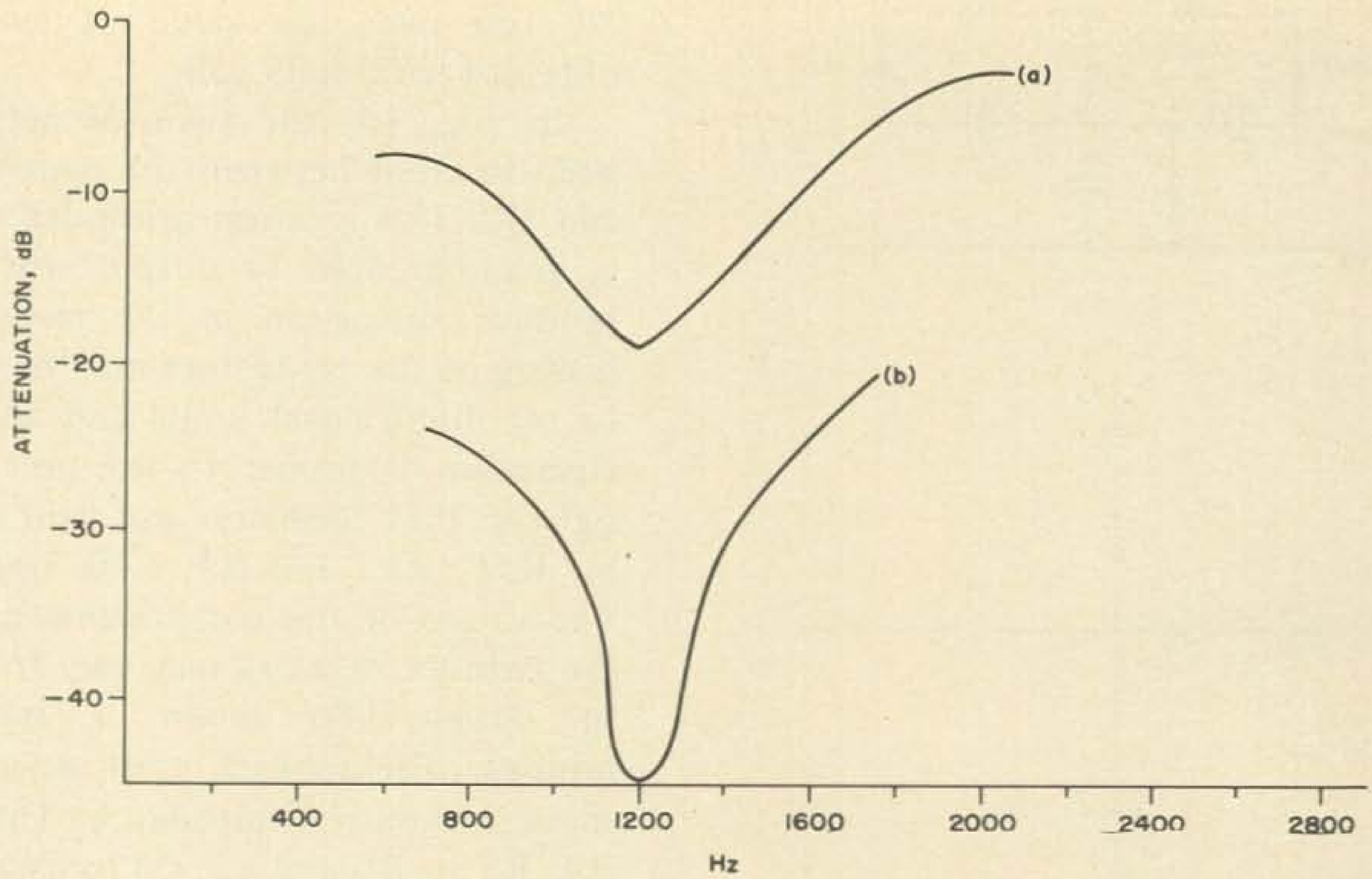

Fig. 17. Active bandstop response.

$$C = \frac{1}{12x10^2(6.28)(1.5x10^3)}$$

$$= 0.088\ \mu F$$

The vertical branches of the twin-tee network normally contain a resistance of half the value of the horizontal component and a capacitance of twice the value of the horizontal component. The tee network of Fig. 16 was breadboarded with C2 and C3 at 0.1 μF for convenience in choosing C4. R6 was made variable to allow final adjustment of the center frequency. The main feedback loop, consisting of R13, was chosen for best performance while monitoring the response on the oscilloscope. A lesser feedback loop also exists from the collector of Q3 to the base of Q1. This feedback is negative in nature and can be used to stabilize the network when required. Figure 17A shows the response for the active bandstop filter.

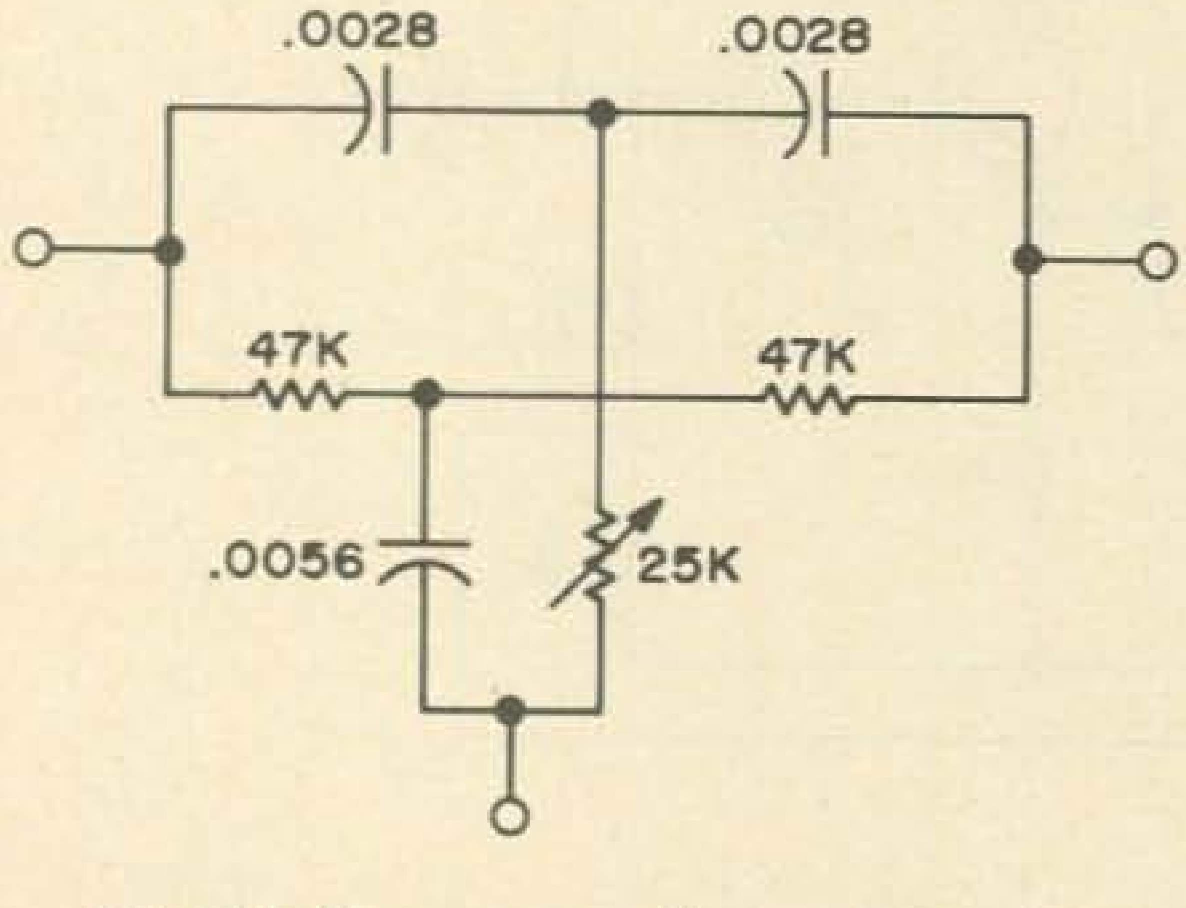

Fig. 18. Narrow bandstop network.

By changing the ratio of RC in the twin-tee network, a more desirable response can be obtained, as the expense of insertion loss. Figure 17B shows the filter response when the elements of the tee network were changed to the values given in Fig. 18. In addition, the use of less feedback (R13) tended to steepen the low frequency slope. Increased feedback flattened the slope producing the appearance of a high-pass response. Therefore, no feedback was used in the end design. Rebiasing the network would probably decrease the insertion loss.

. . . K3PUR

References:

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Synthesizing Active Filters. Sanjit K. Mitra; IEEE Spectrum; January 1969

Active Filters: Part 12 Shortcuts to Network Design. Robert R. Shepard; Electronics; August 18, 1969

PROPAGATION CHART

J.H. Nelson

Good (Open), Fair (□), Poor (O)

JULY • 1972

S	M	T	W	T	F	S
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30	31					

EASTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	14	14	7A	7	7	7	7	14	14	14	14	14
ARGENTINA	14	14	14	14	7	7	14	14	14	14	14A	14A
AUSTRALIA	14	14	14	7A	7	7	7	7	7	7	14	14
CANAL ZONE	14	14	14	7	7	7	14	14	14	14	14	14A
ENGLAND	14	7A	7A	7	7	7	14	14A	14	14	14	14
HAWAII	14	14	14	7A	7	7	7	7	14	14	14	14
INDIA	14	14	7A	7B	7B	7B	14	14	14	14	14	14
JAPAN	14	14	7A	7	7	7	7	7	7A	14	14	14
MEXICO	14	14	7A	7	7	7	7	14	14	14	14	14
PHILIPPINES	14	14	7A	7B	7B	7B	7B	7	7A	14	14	14
PUERTO RICO	14	7A	7	7	7	7	7	7A	14	14	14	14
SOUTH AFRICA	7B	7	3A	7	7B	14	14	14	14	14	14	7B
U. S. S. R.	14	7A	7	7	7	7	14	14	14	14	14	14
WEST COAST	14	14	7A	7	7	7	7	14	14	14	14	14

CENTRAL UNITED STATES TO:

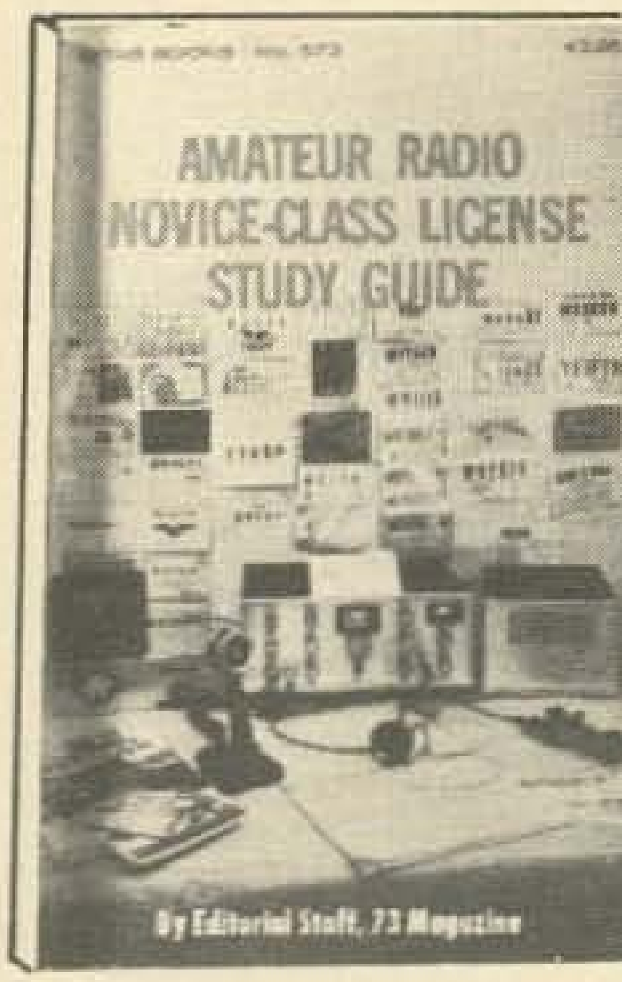
	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	14	14	14	7	7	7	7	14	14	14	14	14
ARGENTINA	14	14	14	7A	7	7	14	14	14	14	14A	14A
AUSTRALIA	14	14	14	14	7A	7	7	7	7	7	14	14
CANAL ZONE	14A	14	14	7	7	7	14	14	14	14	14	14A
ENGLAND	14	7A	7	7	7	7	7	14	14	14	14	14
HAWAII	14	14	14	14	7	7	7	7	14	14	14	14
INDIA	14	14	14	7B	7B	7B	7B	14	14	14	14	14
JAPAN	14	14	14	7	7	7	7	7	7A	14	14	14
MEXICO	14	14	7	7	7	7	7	7	7	14	14	14
PHILIPPINES	14	14	14	7B	7B	7B	7	7	7A	14	14	14
PUERTO RICO	14	14	7A	7	7	7	7A	14	14	14	14	14
SOUTH AFRICA	7B	7	3A	7	7B	7B	14	14	14	14	7A	7B
U. S. S. R.	14	14	7A	7	7	7	7	14	14	14	14	14

WESTERN UNITED STATES TO:

	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	14	14	14	7	7	7	7	7	7	7A	7A	14
ARGENTINA	14A	14	14	14	7	7	7	14	14	14	14	14A
AUSTRALIA	14	21	21	14	14	7A	7	7	7	7	14	14
CANAL ZONE	14	14	14	7	7	7	7	14	14	14	14	14
ENGLAND	14	7A	7	7	7	7	7	14	14	14	14	14
HAWAII	14	14	21	14	14	7A	7	7	7A	14	14	14
INDIA	14	14	14	7B	7B	7B	7B	14	14	14	14	14
JAPAN	14	14	14	14	7A	7	7	7	7A	14	14	14
MEXICO	14	14	14	7	7	7	7	14	14	14	14	14
PHILIPPINES	14	14	14	14	7A	7B	7	7	7A	14	14	14
PUERTO RICO	14	14	14	7	7	7	7	14	14	14	14	14
SOUTH AFRICA	7B	7	3A	7	7B	7B	7B	14	14	14	7A	7B
U. S. S. R.	14	14	7A	7	7	7	7	14	14	14	14	14
EAST COAST	14	14	7A	7	7	7	7	14	14	14	14	14

A = Next higher frequency may be useful also.
B = Difficult circuit this period.

Free Free Free Free Fr



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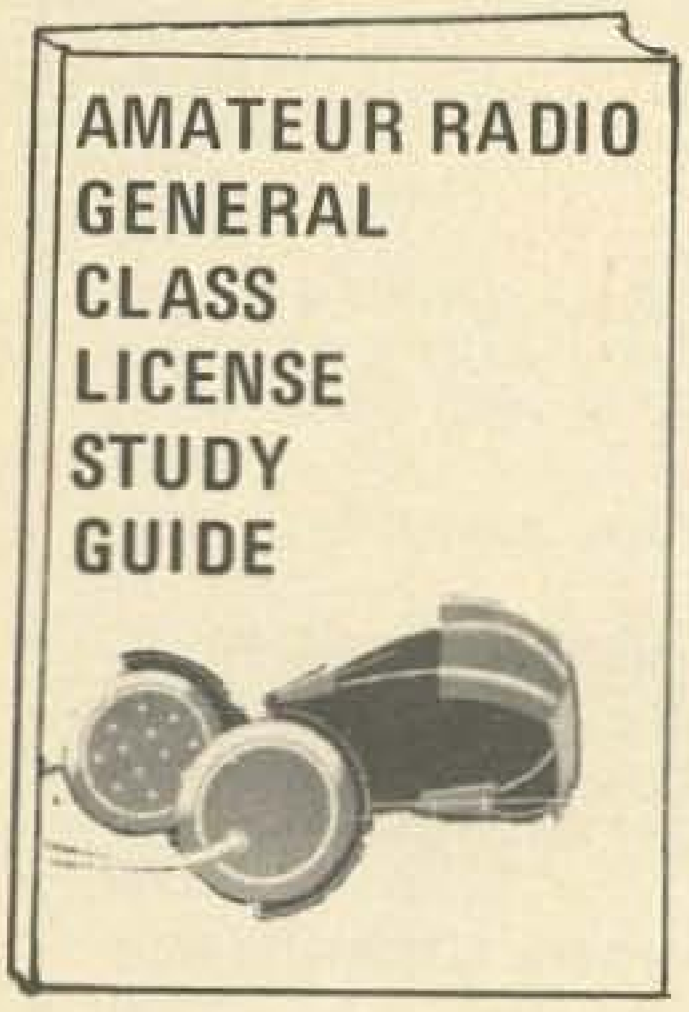

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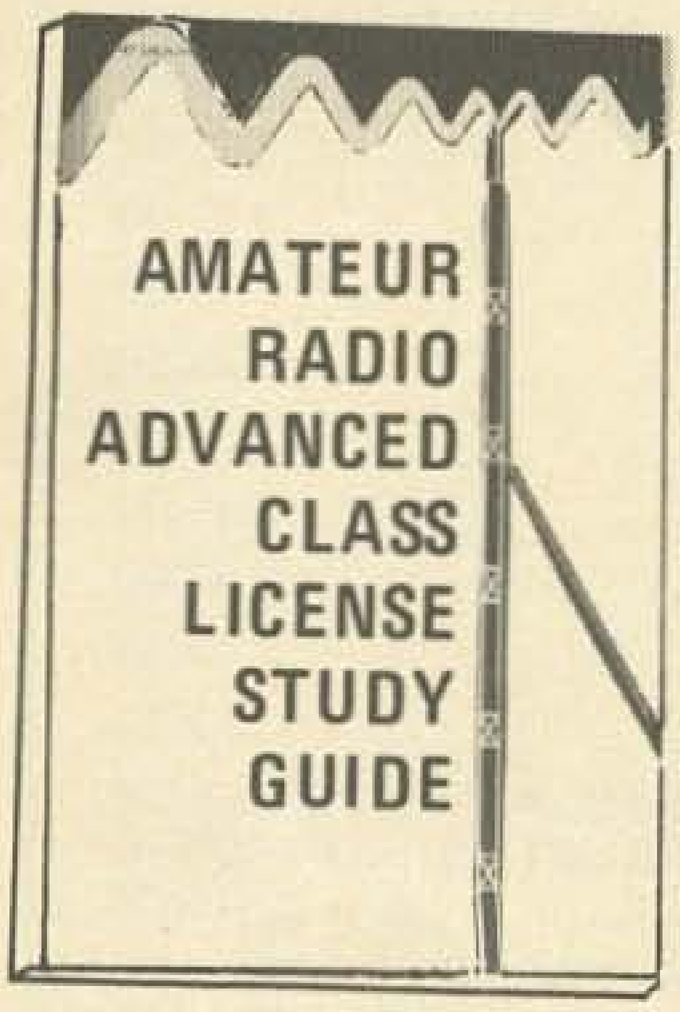

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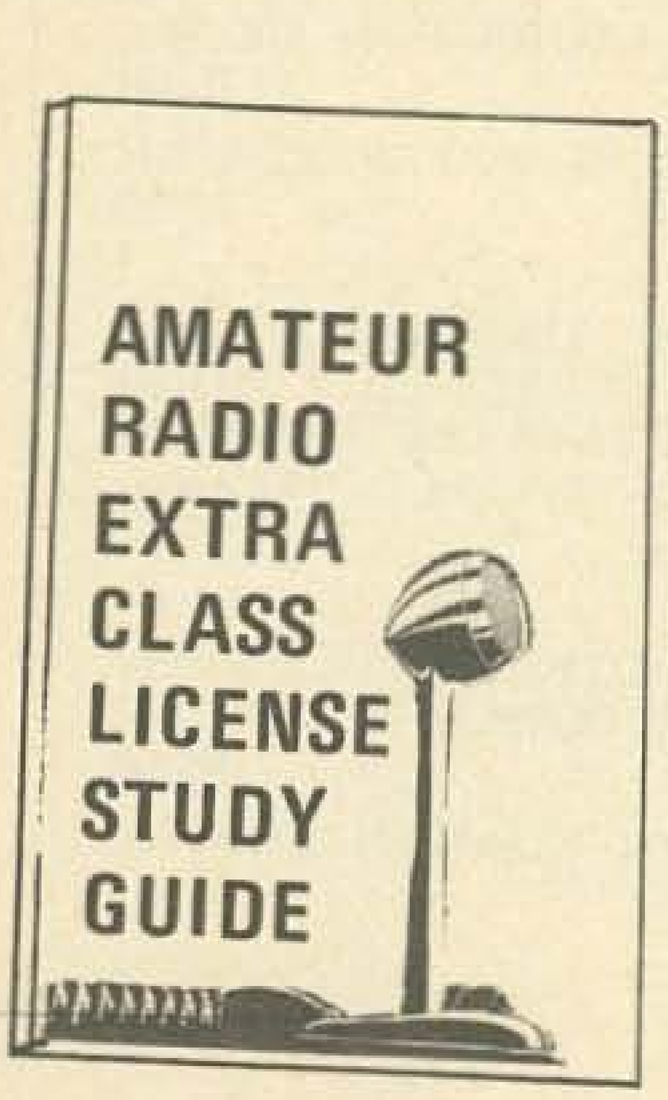

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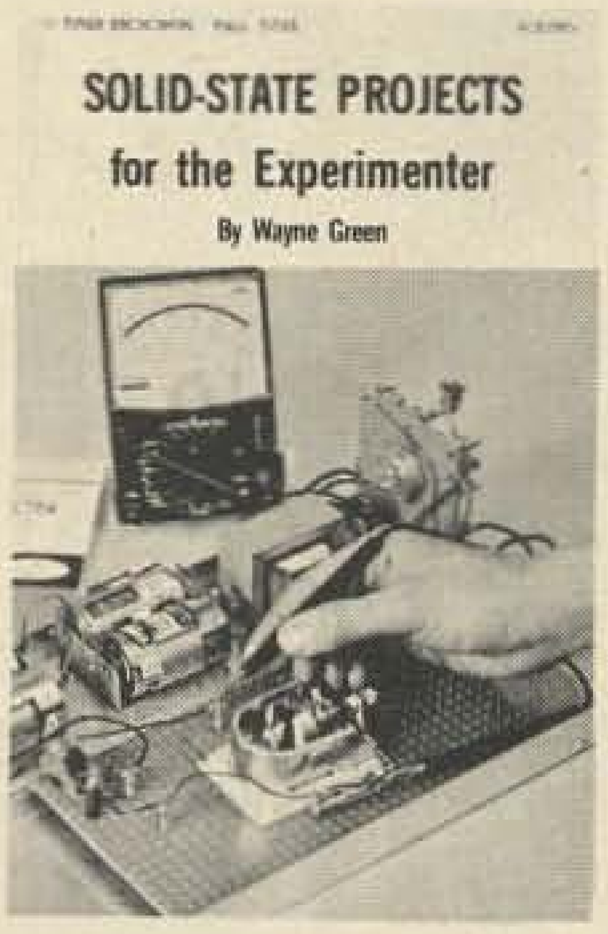

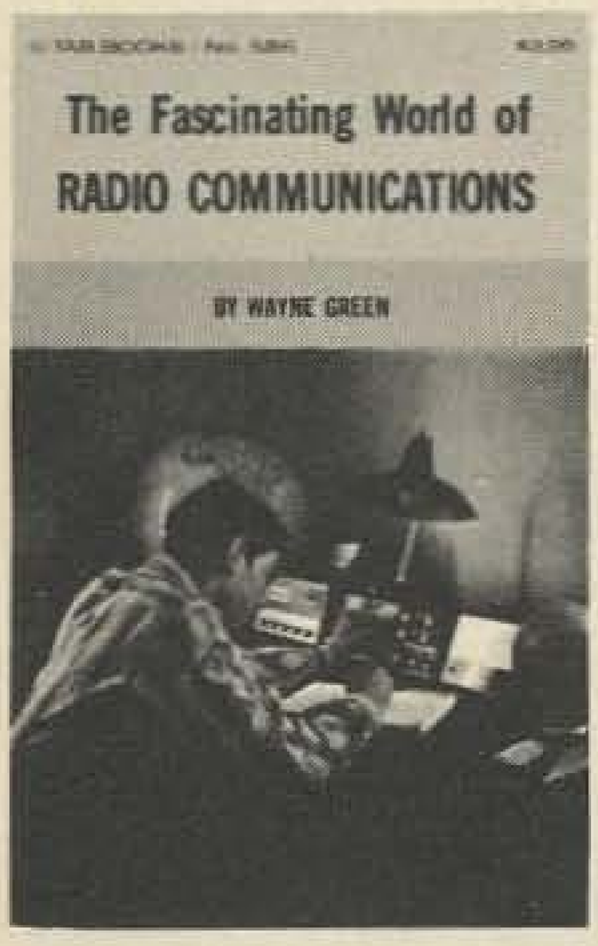

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(continued from page 128)

the Knoxville situation will improve. I mention the HXD situation because I think many repeater owners have the same problem – the 80/20 syndrome.

Many of you had the chance to work the KC4DX DXpedition on Navassa Island a couple of weeks ago. How many of you had a chance to take advantage of another first? Wayne Green, W2NSD/1 took along his slow scan gear on the DXpedition and made several SSTV contacts from Navassa with excellent pictures. Wayne will be taking his SSTV gear along with him on his upcoming trip to Jordan and several other rare spots. In fact, he will be operating SSTV/mobile. Should provide a lot of fun and a lot of new countries on SSTV. Although I have not had a lot of time to use it, I am set up for slow scan with the Robot line. I have made a few contacts and find SSTV a lot of fun.

When I proposed DX repeaters a few months ago, I had no idea the response would be so great. Basically, I proposed we have several repeaters around the country interlinked via 10 meters FM. Such a system would allow users of a local 2 meter repeater to gain access to another 2 meter repeater located in another part of the country. Or, the world, for that matter.

Although it may seem complicated at first glance, the system I propose is so uncomplicated it hurts. All that is needed is a 10 meter base station, a tonal decoder, a COR, and a "Fail safe" timer. Here is how the system would work: assume we have a 34/94 machine in California and a 34/94 machine in Florida with the DX link. Under normal conditions both repeaters are simply 34/94; the DX link is inactive. Let's say a Florida user of his local machine wished to communicate with California. He simply transmits two tones. The first tone turns on his local repeater's DX link so that any 29.680 signals heard by his machine will be sent down to him on 94. After he determines the DX frequency is not in use he transmits a second tone that turns on the California 34/94 machine's DX link. He will then hear any activity on the California 34/94 machine. Plus, of course, his own Florida 34/94. After the DX contact has been completed, a reversal of the tones will shut down the DX link.

At this point it would be a good idea to mention the "Failsafe" timer. This is simply a drop-out timer to shut down the DX link after 60 seconds of no carrier on 29.680.

I've shown how two 34/94 machines can be interconnected via ten meters. All that is needed is separate control tones for each repeater and several machines can be tied together in this manner. Obviously, there are a couple of variables, namely conditions on 10 meters. Although 10 meters is generally open all over the country during the day, there are times when the band is closed to a particular part of the country (like at night?) and inter-tie with a certain area may be difficult. But remember, many of the variables of working DX are done away with in this system. Primarily, since we are using crystal controlled frequencies and FM there is no need to tune around a band and no need to call "CQ" for a certain area. If the band is open to the part of the country you wish to make contact with you will have no problems at all. You simply transmit the tone of the repeater in that area you wish to work.

If this system is to work we will have to have some coordination, such as assigning tones and secondary 10 meter frequencies for when activity is heavy. I think the 10 meter DX links for 2 meters can be a great thing for FM. At this time several repeaters are experimenting with 10 meter DX tie ins on 29.680. I envision the day when a 2 meter operator in California can talk to another 2 meter operator in another part of the country. They could both be using small walkie-talkies. Think about this system I propose. Look into all aspects of it. I'd like to have your pro and con reactions to the idea. . . . W7DXX/1

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LETTERS

Our station here is AB8USA, Command Control Station for MARS Army in Vietnam. We've got about 25 stations over here receiving your mag each month, and it is certainly appreciated by all of them, if you can judge by the comments on the in-country net after the new issue arrives. We also get *CQ* and *QST* both of which are greeted by loud yawns on frequency.

Thanks for the article a month or two back on MARS phone patches. We were beginning to think hams had never heard of MARS for the most part. Actually, although your article implied that most stateside stations are at Army forts, there are also quite a few civilian MARS members on the air with us. For instance, AD7FTN/WA7FTN, A6VVM/W6VVM, A6PXP/W6PXP, it's really unfair to start naming them cause there are so many. The only reason they don't turn in a huge patch count is that they don't have the manpower for24 hour operation. By and large, their operating skill is as good or better than the "pros" at the Army bases.

Anyhow, keep up the fine mag, and don't skimp on the FM articles (like there was any danger of that) since I plan to get up on 2 meter when I get out of the "green machine."

Gary P Novosielski
APO San Francisco CA

We have a few 220 MHz stations going here – WA6BRC, WA6BVC, WA6IRR, WB6OPQ, WB6SUP, WB6ZOQ, WA6HIP and my own, WA6FBY. We are using the CV431A/AR transverter surplus unit, reported in the 1964 June issue of *73* as the ARC 10A.

Perhaps you can borrow a copy from a friend (or put on your scuba gear and go down in the cellar where you keep back issues. I know you store them underwater because I bought a box full).

Anyway, I got on the air for a sum total of $17.50 - how about that! Most of our thanks go to Frank W6VMY over in Saratoga for obtaining these units for us.

Bill Hahn WA6FBY
Stockton CA

On March 26, 1972, and several times since, I worked an SS station giving the call PZ1DX. I sent him a card through the Surinam bureau and received a reply from the bureau today. They state that PZ1DX is not a licensed station and the operator is a "most daring pirate." They request that I pass this information on to all SSTVers so this type of operation can be slowed down.

Jack C. Petree WB4OVX
Roanoke VA

In my opinion CW is about the only unique thing in amateur radio which still remains (since so much amateur gear is commercially made same as the CBers). In other words, if it had not been for CW, I wouldn't have been attracted to ham radio at all. After all, anyone with a good credit rating can buy radios to talk on and can make a lot of long distance telephone calls for even less money, therefore, SSB holds no particular attraction for me. At least it is not why I entered ham radio.

The cartoon on the Feb. cover was really great. I suppose it shows how *73* really feels about CW but to me its just fine. I doubt if there would be any ham radio or *73* if it were not for old guys like him.

Bill Howard WNØEQT
Des Moines IA

Amateur satellites are unique also.

CAN ANYBODY HELP?

I need your help. Twice.

1. Schematic for a link receiver model 7000. I specifically need crystal multiplier factor.

2. Schematic and/or crystal factor for an old GE model 4ER 1A3 type ER-1-A 152-162MC. Both of these pieces of gear will be used on 2 meter FM if I can find out the needed information.

Thank you for whatever help you can give.

Dean BiglerWA7IBT

MICROWAVES

Glad to see microwave feature. Keep it up. Let's get the details on these TRAPATT and IMPATT Modes into *73*. I'm interested in surplus conversions of all kinds AM –,FM, etc. I read K1CLL type articles. Interest = .1-10.5 GHz.

Herb Adams
Chula Vista CA

BONUS

I would like to point out that the Larsen Antenna works well as a ¼ wave whip on six meters. I tried it on my mobile at the suggestion of a couple of the locals. The SWR on 52.525 MHz, as measured at the transmitter, is 1.2:1.

A 12 volt antenna relay with auxiliary contacts, salvaged from an old transceiver, switches the antenna and mobile speaker from one rig to the other with the flick of switch on the dash.

Many 2 meter gain antennas will not load at all on six meters. The Larsen Antenna is not only an excellent 2 meter antenna, it is truly a "six and two" mobile antenna.

John Clough W9LPO
Madison WI

Get six for the price of two.

HAMS AS INNOVATORS

As a professional who has made his living since 1928 in marine radio and crystal servicing with ham radio to relieve boredom, a few reflections to spur amateur technology may be in order.

To this observer, the current revolution in marine and commercial radio towards VHF and maximum utilization of air space thru SSB represents a constant and growing pressure from commercial interests. This force can in time seriously threaten amateur frequencies.

It behooves inspired, adventurous hams to explore the unseen borders of technology for a new transmission medium to replace SSB. Twenty years ago a technician friend had detailed a method using vacuum tubes for voice transmission using a carrier and no sidebands. In the spectrum now occupied by one sideband it would be possible to accomodate five such carriers.

The system was too ponderous using tubes but with solid state and proliferating IC's it seems the instinctive way to do it. Lacking a proper name, it's been called True Amplitude Modulation or Carrier Power Modulation. Looking at a scope you see a carrier moving up and down transmitting intelligence, with no sidebands.

The Tiny Tim tonality of SSB begs for an innovative system to restore individuality to voice channels. Here is a tip: RF is being multiplied and divided, up and down. Why not the voice frequencies! Portions of sideband speech before entering the voice coil could, in segments, be multiplied up and divided down and reinstated into the voice channel to obtain a synthesized (and restored) quality of speech not unlike pre-SSB voices on AM.

Want to bet these projects will be solved by hams before they're uncovered in research laboratories?

F.W. Anderson W7AR
Seattle WA

Usually you are right on top pretty much on amateur affairs, but maybe not quite in regard to 160 meters. Re: "The Son of 160 M."

MORE LETTERS

The 160 band is very much alive with high power outlawed so no high power boys to contend with.

I have been back on, mostly early mornings lately, for about 8 years. I operated 160 some before WW 2. For a while I was the only really active Florida station, but that has changed in the last few years. I don't chase DX myself, but some do, with some up to around 100 countries. There is much CW and, quite a bit of the AM modes, DSB full carrier and SSB SC, also a few DSB SC. The popular SSB rig is the Drake R-4, T4X combination. (SSB is AM Right?)

I did feel as you that the manufacturers should put 160 on the rigs but maybe that would make our only medium frequency band have as much qrm as the HF bands.

The only statement that I 100% disagree with is your last sentence. 160 is *already* a "Hellova band" and *is* and *has been going*.

On another matter regarding an answer to a letter from a reader. You stated that FM wasn't available on a ham communications receiver. (This may hurt, but not too much I hope.) Read Henry Radio's advertisement for the Kenwood R-599 receiver. Not only does it have 160 but FM and 2 meter FM with the optional installed inside converter. See back cover of March 72 issue. Also in some earlier *73* magazines. (I own one.)

Harold J. Tucker K4HXW
Melbourne Beach, F L

PROJECTS

Re the "Crystal Checker," 73 November 1971 issue, page 55, I recently completed this construction project and it has worked out very well. Due to supply difficulties I had to substitute RCA SK3019 for 2N3607 transistors and 1N270 diodes for 1N914, but everything worked out okay. I also substituted a vise-like arrangement (with one metallic split jaw and one insulated jaw to replace several xtal sockets since I could not seem to get a variety of sockets). Please give us more useful construction projects like this one. (cc to author Mike Kaufman K6VCI)

Vernon Jones
Kennebunk Maine

I have been on the air since January of this year. During this time I have received your magazine and another which will remain QueSTionable. I prefer *73* over the other many times for a number of reasons, but mostly because you have some really good articles and don't waste your time with 40 pages of calls who entered contests. I also like your circuit section, but how about some more real QRP transmitters (like in microwatts).

Joseph Katz WN1PHJ
Glastonbury CT

I don't think I can bear to do without another issue of *73* Magazine. I think that the $11 for two years (check enclosed) is well worth it. The humor alone is worth that much. Anyway I heard that 1973 was going to be a big year for the magazine. Please start my subscription as soon as possible.

Jefferson W. Barstow
Hancock MI

Due to the move to UK of the Manager the BE/NL/CND/UK Forces QSL Bureau will close from 6 March 1972.

All operators and Bureaus are requested to forward all cards in the future to the *German Amateur Radio Society, Box 88 MUNICH, GERMANY*.

Thanking you for your assitance.

J.T. Worrall DL2AH/G3XBA

In regard to letter on page 6 of May issue of

In regard to letter on page 6 of May issue of *73*, I wholeheartedly agree with Ron WA1PMS and his recommendation that 146.52 be used as a simplex channel and hope others will join together in urging that this be done. It seems when anyone builds a new repeater (down in this part of the country) he wants to, and does, put it on 146.34/.94 or some other transmitting frequency with .94 as receiving.

Charlie Brown WB4OOT
Cataula GA

Thought you might be interested in comments from a Mexican ham regarding reciprocal license agreements. In a conversation in Mexico City he expressed the thought that Mexico and Mexican hams have nothing to gain and much to lose if they were to grant licenses to U.S. visitors. The loss – being mowed under by U.S. operators and with so few Mexican visitors requesting operating privileges in the U.S. it seemed rather pointless. I could think of no good argument. You have to hear it to believe how quiet the Hertz are in Mexico.

L. P. Scott WB6IKM
San Marco CA

Try working an FM repeater in NYC

Getting started on 2m FM meant that I had to buy a lot of crystals. As these are very expensive here in Sweden, I ordered them from Jan Crystals, Florida.

Unfortunately I made a big mistake! I forgot to specify the parallel capacitance. Shame on me! Of course I ended up on the wrong frequency.

As I was dying to get started I returned the crystals asking them to correct these and to return to me by Air Mail. Three weeks later I had the crystals back with correct frequencies and no extra cost.

Take my advice, ALWAYS specify the parallel capacitance. If you do not know how to figure it out, enclose the circuit diagram with your order or state the type of transceiver you are using.

Thanks JAN CRYSTALS for being so cooperative!

Eskil Persson SM5CJP
SWEDEN

After reading the article in the Oct. 1971 issue, "Back to Mother Nature the Easy Way," I was delighted.

Soon, three lengths of copper pipe were in readiness for installation. The water hose was attached, along with a valve to control the water. A stepladder was moved into place, the equipment readied, the water pressure applied.

The first results were amazing. Since the water pressure on our tap was about 90 lbs. per sq. in., an immediate fountain of mixed mud, water, plus some grass roots, ascended to a height of the operator plus about three feet. The pipe had gone down about 8 in.

Moving the lower end of the pipe to a new position, or positions, resulted in a maximum depth of about 10 inches to be reached.

The operator, wearing a garland of water, mud, and a few strands of the grass, reconsidered. By no means could the method used by WA1FHB be used in Boulder, Colo., not where we live anyway.

The clay, rocks, and boulders, underlying the thin layer of grass, is more than anything less than a diamond bit, bulldozer, or dynamite, can move.

I have been using a crowbar, post hole digger, cuss words, blisters, and whatever help can be mustered, trying to dig two holes, just three feet deep, into which I intend to put bronze screening, along with sulfate of copper crystals, to get some sort of a ground. I have a tower that needs grounding to discourage lightning from paying us a visit – indoors.

A solution to the problem has been found. Go mobile!

Ray R. Rumfelt WØMYY
Boulder CO

I make reference to your 73 circuits page in the April '72 issue wherein a crystal calibrator is described. The 1K resistors R2, R4, and R5 are not sufficient to protect the inputs of the 7400 gates from excessive voltage. This IC has an absolute maximum input voltage rating of 5.5V, which is easily exceeded due to noise or poor regulation of Vcc. This is especially likely in amateur equipment. Instead, the output of the fourth gate (pin 3) in the IC should be used as the input to pins 4, 10, and 11. The inputs to the fourth gate (pins 1 and 2) should both be grounded.

E. Douglas Jensen
St. Paul MN

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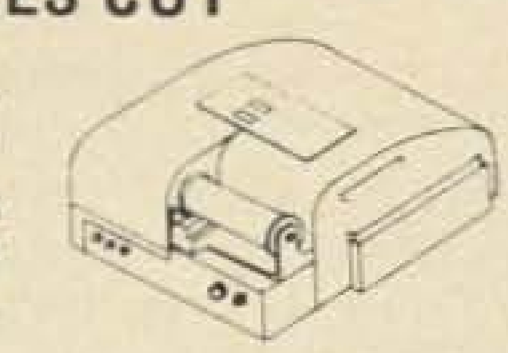

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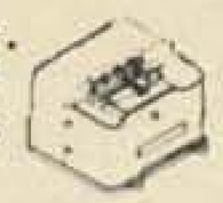

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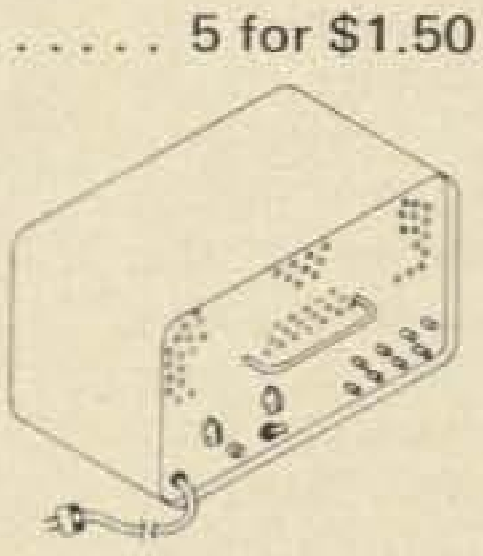

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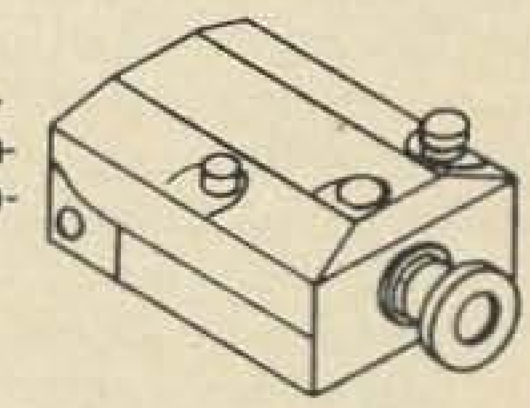

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STILL MORE...

I have frequently run across U.S. nationals enjoying the privileges of ham radio in foreign countries, yet it is not possible for an alien resident to find similar privileges here. It is true that a foreign licensed "ham" whose stay is non-permanent, can obtain a portable license, and while this is a step in the right direction it does nothing for the rest of us "furriners."

The whole world is now undergoing a revolutionary upheaval in thought. The old shibboleths and customs are under examination. Beliefs, customs and even fears that guided our social behavior in the past are being examined with honesty for a change and we have been startled to find how empty some of them are. None can deny that if an injustice exists, at the very least this society has tried to do something about it.

Well, here is another opportunity, for it is my conviction that an injustice is involved and the strange part about it is that neither harm nor benefit for anyone serves to perpetuate the injustice. It is probable that this prejudice towards foreigners exists merely because it had merit at one time and like the laws on spittoons, no one has taken the trouble to update the rules.

In this day and age it is a little difficult to imagine ham radio as a "cloak and dagger" arena, and, even if it were, I doubt that an alien resident would be more so inclined than anyone else.

Perhaps not many people realize that an FCC license is required to operate a car or truck telephone; a model airplane, car or boat; citizens band walkie-talkie; etc. I often wonder whether the poor "furriner" is entitled to operate his garage door opener.

Understanding is a thing we all cherish and, in this case, it seems like such a simple thing. All we ask is permission to apply for a license. This will harm no one but will benefit a few.

J.B. Dellis
Menlo Park CA

I would like to compliment you on your super FB General Study Guide. Thanks to it I will be sporting a WB2 call in a few weeks. I plan to get your Advanced class one in a week or two. According to the FCC official who administered the test to me I did very good on the exam. He refused to disclose the exact mark but still I am very happy to have passed. This is my second try at the exam. The first time I used the ARRL license Manual and Understanding Amateur Radio to study.

Congrats for a job well done. See you on 14 MHz as WB2KFG or as WB2DCS (it better be, I ordered QSL cards for WB2DCS). I have been told that you have a very unique QSL. Is it true? Any chance of a sample of *73* and/or your QSL?

Harry Linzer ex-WN2DCS
Malverne NY

I am writing in regards to the article on MARS in the May issue of your magazine, by Mr. Harry C. Simpson, W4SCF/A4SCF.

The article was well written and to my knowledge, this is the first time the Military Affiliate Radio System (MARS) has received such recognition in a National Amateur Radio Magazine.

Being connected with the Third US Army MARS program as the Command MARS Director, I certainly appreciate the fine publicity and would like to see more articles of this nature.

Harold E. Mulkey
MARS Director
Fort McPherson GA

How could you have committed such a dastardly act? The article appearing on page 37 of the May 1972 issue entitled, "How To Get The Stuff Into The House," written by Bill Lowenberg W2OOJ has probably done more to set back the program of amateur radio than any other single act since radio propagation was first discovered. No doubt the intention of W2OOJ was to assist those in the fraternity in the general up-dating and improvement of their stations. However, the simple act of putting into print the various specific methods used by we hams in the acquisition of equipment has placed a high percentage of us in a most disastrous position. Many of us have been using one or more of the various schemes outlined by Bill in his article for years with an extremely high degree of success. The terrible part of this whole thing is that the methods which have been exposed are some of the best in the average married amateur's repertoire not just some second rate ploys.

Normally, *73* arrives right along with the Woman's Home Companion, the Ladies Home Journal, Better Homes and Gardens and such other female trivia and is just thrown on the desk by my XYL. This month, it arrived without escort with the exception of a couple of my wife's credit card bills. That one chance in a million happened! Being not particularly interested in the bills, the XYL casually thumbed through the *73* while waiting for me to come home for lunch and found the article. It couldn't have happened at a more improper time. I was in the process of using scheme number two (page 38) to acquire a brand new SSB mobile rig with AC and DC using my old DX-40 and some junk box material on an "even trade." She was on to me in a second and ruined five weeks of careful preparation and offhand conversation, (which, incidentally, requires a better than average memory).

She now reads all of the ham ads and knows exactly what each piece of my equipment is worth on the used market, has made inquiry at the local parts house regarding my dealings and has directed the proprietor to mail any invoices for those "little minor maintenance items" necessary to the proper operation of my station directly to the house instead of to my office. She now realizes that a two meter slot beam is not necessary for the reception of Cable TV. A complete inventory of my spare parts has been effected and I have been directed to dispose of any surplus not vital to the operation of the station with any proceeds therefrom to be credited to the household operating account. Even worse, she is now using my code tapes and records and wants to keep the DX-40 for her novice rig. I have just forked over enough cash to cover a new spring outfit, complete with matching purse and shoes and we are having two perfectly good chairs recovered.

I have been through more thorough, detailed and humiliating interrogations in the past week regarding my actions over the past 19 years and 8 months than could have been devised by the most fiendish minds of the Gestapo when at their zenith. It's worse than the disclosure of the Pentagon Papers. In the future, this black mark on the record of amateur radio should be referred to as the Lowenberg Affair.

How a fine amateur and master trout fisherman like Bill Lowenberg could so conspire with *73*, to perpetuate such a dastardly act, is beyond my comprehension. I cannot cancel my subscription because I am paid in advance for two more years and the XYL thinks your publication a most excellent magazine. A pox on you all.

Garry Owen W5MDG
Roswell NM

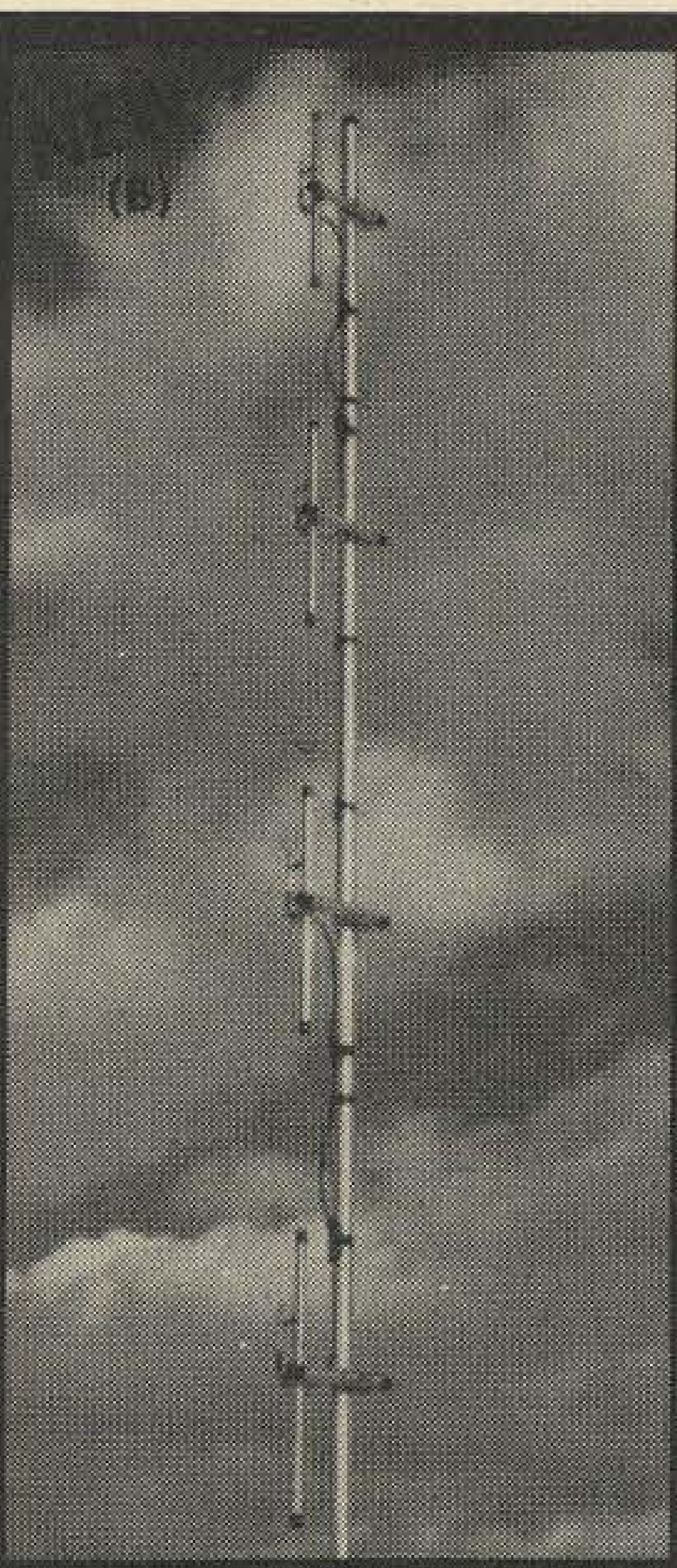
Would you kindly remind your readers that the frequencies: 53.10, 53.20, 53.30, 53.40 , and 53.50 MHz have been recognized by the FCC to be *Radio Control Frequencies* for those licensed radio amateurs who engage in remote control of model boats or airplanes.

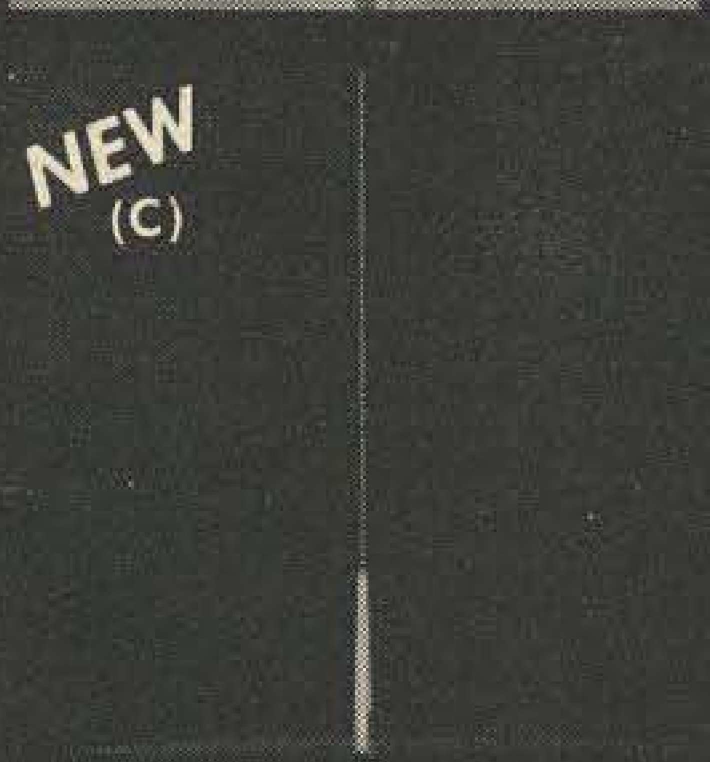
It seems that interference on these frequencies is on the increase and has, often, caused loss of control, something which can be quite a catastrophe especially in the case of model airplanes which have been caused to crash.

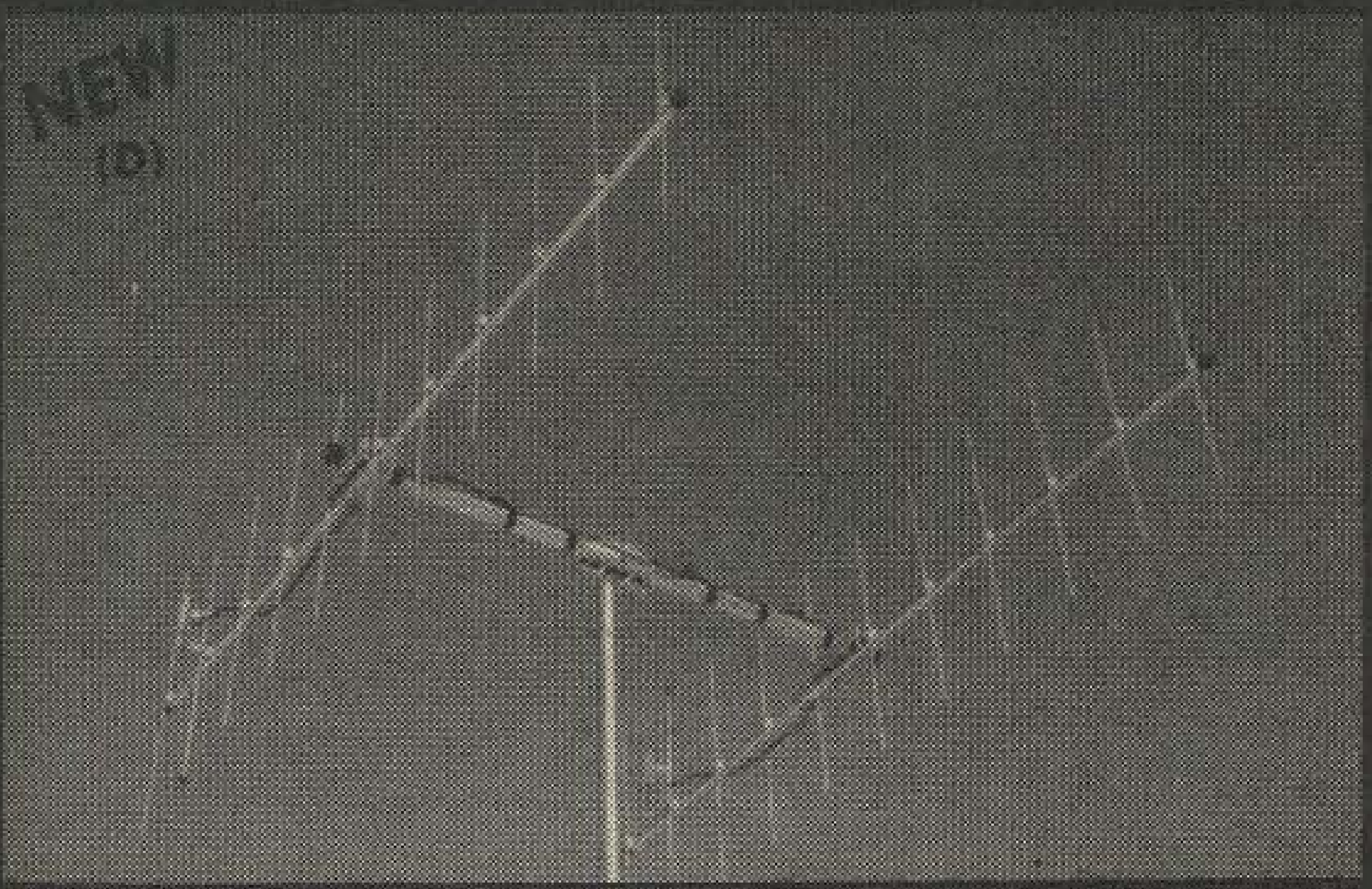
Besides the countless hours spent in building these models the cost involved ($300- $500) in these model planes make interference a very serious problem.

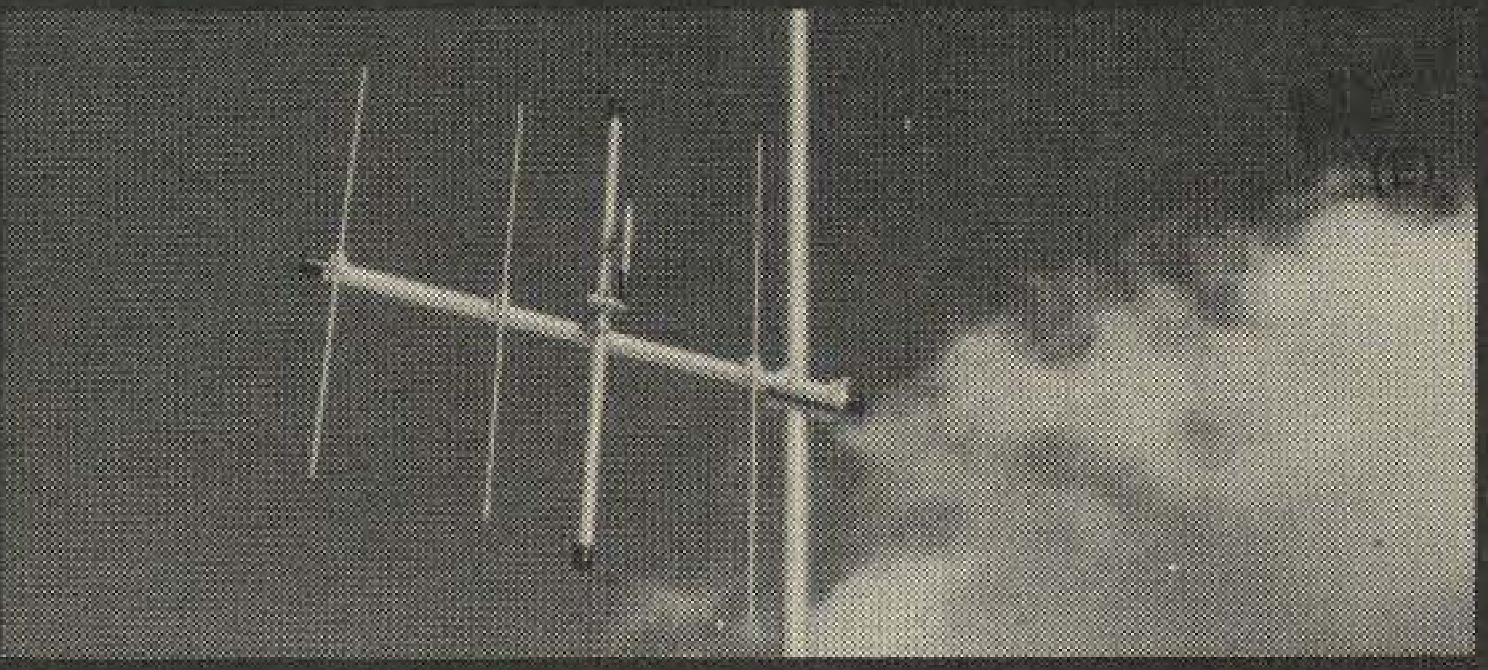
Considering all the frequencies available to hams who operate for communication purposes (CW, phone, RTTY, etc.) it seems reasonable to ask them to stay clear of the above mentioned frequencies.

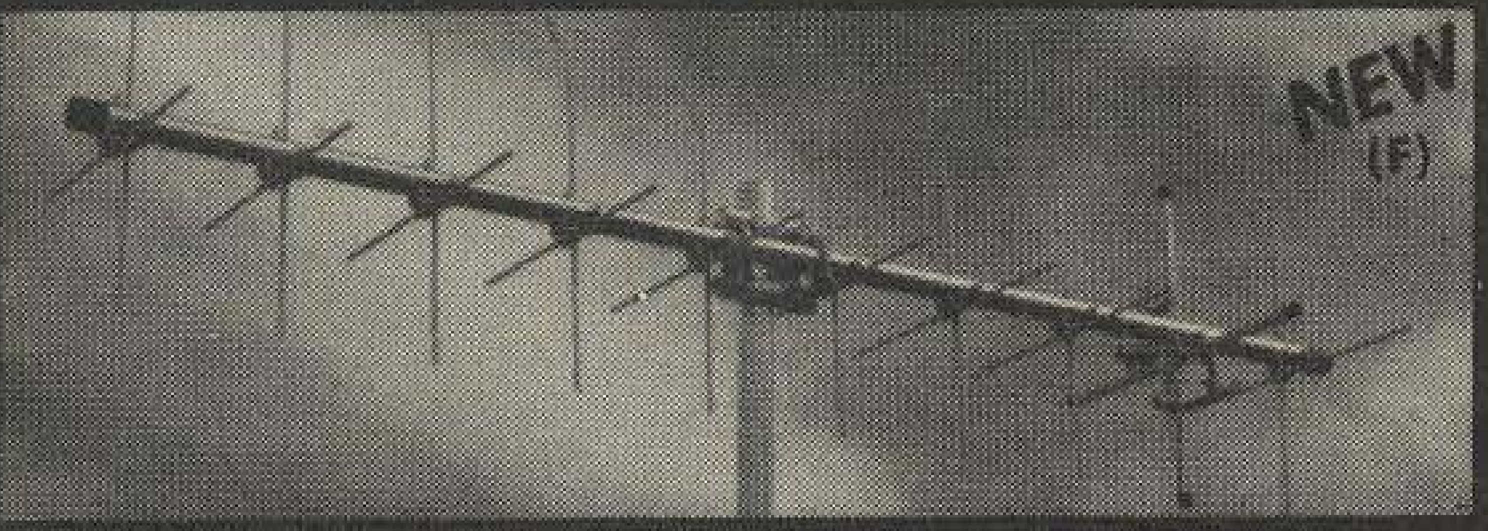
Furthermore, since it is impossible to build fancy receivers in the very











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small space available, it would be appreciated if a reasonable guard band (say 6 kHz) could be respected.

Pierre J. Catala
Needham MA

Del Wininger (January issue) is right when he says it is not likely any move to revise the symbols of the Morse code would succeed (though his reasoning is debatable—surely the real reason is that it would be expensive and inconvenient to change such a deeply entrenched language).

But the idea of everyone sending Morse as if it consists of letters rather than words is a bad one, except at the very beginning of the learning process—learning the alphabet. Once the letters have been grasped it is surely important that words should be read as words. This is the whole difference between an expert reader and a poor reader of *any* language. Once you have learned how to read, it is easier to read "been" than it is to read "b e e n" (which is the written equivalent of letters at 20 wpm and spaces equivalent to 7 wpm). Sent in Morse code at any speed above about 5 or 6 wpm, "been" has a beautiful rhythmic sound as an integrated group, and Del's method would destroy the sound of the *word* and substitute for it a jerky succession of isolated letters with little relevance to each other.

When you are reading this text, do you "search your memory after each letter appears" in each and every word? Of course you don't, or you would never get through an issue of *73* before the next one arrived.

Unfortunately too many bugs or keyers are already set to a dot speed faster than the dashes are sent, although fully auto electronic keys have made a vast improvement in the overall picture in recent years. There are not so many W6 calls sent as . — — — . . . . etc. these days, because the sender cannot cope with the dashes if he has the dots set too fast, so he slows the dots down to a speed he can handle.

The ratio of dots to dashes and spaces is fine in the code just the way we have it—all we have to do is send it properly, and if Ted McElroy could read standard code at 75 or 80 wpm there is no reason why lesser mortals can't manage 20 and 25.

There is a technical reason why Del's idea is unwise too. There are many filters in use for CW which ring enough to obscure the dots when sent at 45 wpm (which we would have to do to get a message through at a basic 12 wpm or so).

Candler had the right idea in setting down groups of words of progressively greater length for the pupil to "get the tune of." Rather than vary the ratio of character to space, Candler preserved the ratio and upped the speed. You will agree that if you can read a C at 25 and a Q at 25, you can read CQ as a group at 25, also simple groups like ES and RST and DE, then CONDX etc.

I would compromise with Del and propose that maybe we should leave a longer space at the end of each *word* but I am afraid that would bring an irate letter from someone saying "that would make it hard to read sentences as an entity."

What we should do in the ham fraternity is keep the code the way it is, but USE IT PROPERLY.

For example, if we think the other guy isn't hearing us too well, or that we might be missing some dots ourselves, *slow down* instead of repeating several times. Only this evening I heard a station sending "RST 569" four times, three of them wrongly and the last one on the dash paddle as a side swiper manual key. That is ridiculous. I am sure that if he had slowed the bug down to 15 wpm he could have sent it perfectly just once, and it would be enough.

Then how about finding something shorter than CQ for a general call? Like $\overline{AA}$ (.–.–) for example, or if traffic people find that confusing, some other unused short coupling.

And how about dropping the T9 on the CW report? On the few occasions it isn't T9 we could explain what it *is* like. What we should have instead of the tone report is a click report maybe!

Let's not revise the code. Let's just use it more sensibly.

Bob Eldridge VE7BS
Burnaby B.C.

I am very much pleased with the QRP articles of the February issue. I have been using a home brew solid state QRP transmitter for quite some time with very good results on CW. The TX consists of a vackar FET VFO with a two transistor isolation stage, one amplifier stage, all on 7 MHz followed by a two diodes doubler to 14 MHz which drives the final transistor; output is 800 mW, antenna is my regular triband TH6DXX on 30 ft height. I also tried 50 mW, 100 mW, 200 mW and 500 mW, all with fair to good results on 15 and 20 meters. However, my 800 mW always works well for me on 20m. I have worked numerous W's and also European stations. It s great fun to work QRP. In this country it is very hard to find any parts for transmitter use, so my TX is built with all sorts of odds and ends.

Otto W. Morroy PZ1AC
Paramaribo, Surinam

I always enjoy your publication. Your approach is refreshing and even old staunch ARRL men like myself appreciate it.

I'm a free lance writer/photographer. I came across the paragraph in the Feb. 72 issue regarding a small "independent territory between Norway and Sweden called Morokulien . . . an international refugee area . . ."

This is a put-on, Wayne. I was hoping I'd run into something and I could do a piece on this "small independent territory." The Royal Swedish Embassy advises: "There was never any real place called Morojulien in Scandinavia, only an imaginary spot somewhere in between where the two brother nations could meet and have fun – in Norwegian, "moro," in Swedish, "kul." This mysterious location existed only in a popular TV program enjoyed by Swedes and Norwegians some ten years ago . . . "

I suspect old Eric 5N2ABG, is trying to drum up a little publicity. Actually, there is no such place as Scandinavia. I note that the post office box combines both Norwegian and Swedish and I'll bet you a nickle to a herring that our OM Eric is associated with public relations someplace. Maybe they're trying to get some Lend-Lease or something.

Bob Foy K7ZHS
Kirland WA
Kirkland WA

Drat! Another rare one down the drain.

HOT GEAR

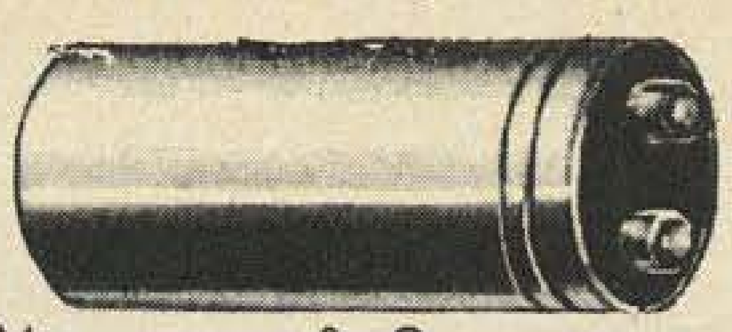
Thanks to your Hot Gear column, an honest budding amateur and the sharp eyes of another, I will be picking up my stolen HR2A soon.

W8FXX/5

List from Past Issues:

Mfr., Model, Ser. No.	Owner	Issue
Halli, SR46A, No.446100	WA1EMU	9/71
Reg., HR-2, No.04-03505	WA5BNM	11/71
Sonar, FM3601, No.1003	WB2ARM	11/71
Coll., 75A4, No.804	WØMGI	12/71
GE, Portable, No.1041218	K2AOQ	1/72
Coll., 75SE-B, No.15640	Col.St.U.	1/72
Coll, 21S3, No.12000	Col.St.U.	1/72
Coll., 516F1,No.1649	Col.St.U.	1/72
Simp. Mod-A, No.35457	W2PWG	1/72
SBE SB-33 No.103906	WA5JGU	2/72
Heath HW22A No.907-1835	W1BDX	2/72
Nat'l HR050 No.280019	WA5DQF	2/72
Halli., SR160 No.416000-108039	K9YVA	2/72
Drake TR3 No.3858	WA9EYL	2/72
Coll., KWM2A No 13815	ARRL HQ M. Godwin	2/72
Coll., 312B4 No.59920		
Coll., 30L1 No. 40084		
Coll. MPL No. 44507		
Coll. MM1 (mob. mike)		
Misco minispkr.	Sgt. Hopkins Wilm. DE Police	2/72
Swan SW174 No. 416-5	WØAXT	2/72
Reg. HR2A No.04-05896	K4GBL	2/72
Heath SB102,No.132-128107	W.Singer Woodbridge VA 703,491-2257	3/72
Yaesu FT-101 No. 107036	WA2YSW	4/72
Standard 2m FM No. 102703	W6NPV	4/72
Drake ML2 No. 20189	WB2LLR	4/72
Standard SRC-806M No. 009210	K1TLP	5/72
Aerotone 6M 355LT No. 685064	RR Police Grd.Ctrl.Trml. NYC	5/72
Standard SRC-806M, No. 102703	C. Mathias	5/72
Lafayette HA-410 No. 009210	WA2KDG	5/72
Coll., 62S1 No. 10728	MSU ARC E.Lansing MI	6/72
WRL Duo-Bndr 6010AT302	WA6FCY	6/72

COMPUTER GRADE ELECTROLYTIC CAPACITORS



MFD, BY SPRAGUE, MALLORY & SANGAMO

MFD.	VOLT	SIZE
25,000	6	2x4-1/2
66,000	6	2-9/16x4-3/4
40,000	7	2x5
15,000	10	2x4-1/2
15,500	10	2x4-1/2
74,000	10	3-1/16x5
15,000	12	2x4-1/2
11,500	18	2x4-1/2
2,300	33	2x4-1/8
3,500	52.8	2x4-1/8
3,500	55	2x4-1/2
3,100	75	2x4-1/2
3,750	75	2x4-1/2
800	99	2x4-1/8
750	165	2x4-1/8
1,250	175	2x4-1/2
500	200	2x4-1/2
300	275	2x4-1/8
250	330	2x4-1/8

PRICE $.75 EA

OIL FILLED CAPACITORS

MFD	VOLT	H	W	D	PRICE
2	1000	4	1-3/4	1	$1.25
4	2500	4-1/4	4-1/2	3-3/4	3.95
.25	3000	2-1/2	2-1/2	1-3/16	2.35
1	4000	5-1/8	3-3/4	2-1/4	4.75
.5	5000	4-1/2	3-3/4	2-1/4	2.95

PLASTIC FILM CAPACITORS

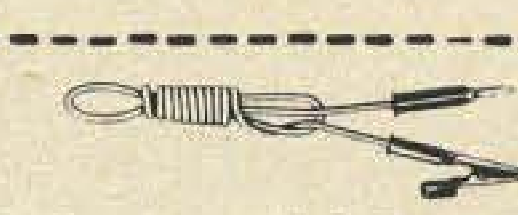
GLASSMIKE ASG-503-2M. .05 UF - 2000 VDC. 3/4" DIA x 1-3/4. AXIAL STUD $.35

GUDEMAN GC-246R202K. .002 UF - 7500 VDC. 3/4" DIA x 2". AXIAL LEADS $.70

AIR VARIABLE CAPACITOR
MFR. HAMMARLUND

5 PF TO 50 PF. GEAR REDUCTION ON SHAFT FOR THAT FINE TUNING OF YOUR VFO ETC. $.75

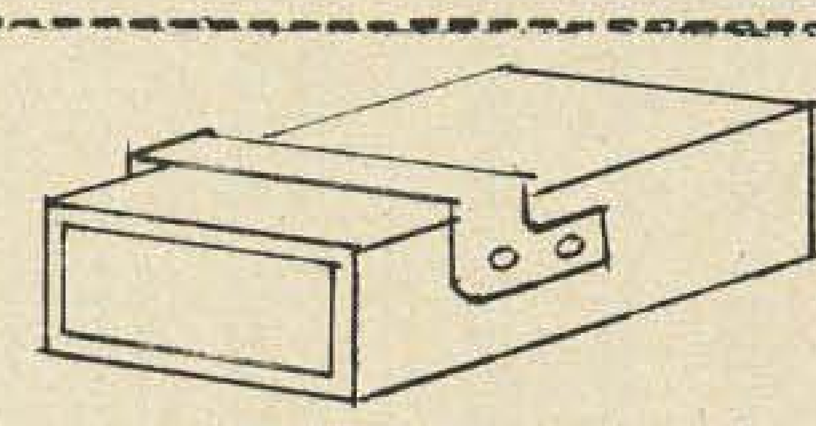
TEST LEADS



4 FT LONG, RED TEST PROD WIRE. WORKING VOLTAGE 10,000 INSULATED BANANA PLUG ONE END, MUELLER TEST CLIP OTHER $.45

ULTRA MINIATURE 2 GANG VARIABLE CAPACITOR
MFD. MONARCH

#CV-200. MAXIMUM CAPACITY, ANTENNA-148.1 UUF. OSCILLATOR-65.2 UUF. TRIMMER CAPACITOR EFFECTIVE VARIABLE CAPACITANCE-6 UUF. $.35



CB CASE & CHASSIS

22 GAUGE STEEL CASES WITH SLIDE IN CHASSIS. ORIGINALLY MADE FOR CB RADIOS. FRONT OPENING ROLLED FOR NEATER APPEARANCE. SLOTTED VENTILATION OPENINGS ON EACH SIDE(NOT SHOWN). SIZE 3-3/4"H x 8-3/4"D x 7"W. PANEL OPENING 6-1/4" x 3". MAY BE HAD WITH OR WITHOUT MOUNTING BRACKET.

WITH BRACKET $3.25
WITHOUT BRACKET $2.45

COILED CORD (MICROPHONE)
MFR. BELDEN

#8497. 3 CONDUCTOR WITH 1 CONDUCTOR SHIELDED. AWG STRANDING 23(21x36). O. D. 1/4". EXTENDS FROM 11-1/2" TO 6'. NEOPRENE JACKET. $.95

UNETCHED PRINTED CIRCUIT BOARD

THICK	SIZE	COPPER CLAD	PRICE
.0055	8x8-1/2	1 SIDE	$.32 EA
.006	8x8-1/2	2 SIDE	.32 EA
.007	10x14	2 SIDE	.80 EA
.010	11x16	2 SIDE	.88 EA
.017	12x17	2 SIDE	.99 EA
1/32	8x10	1 SIDE	.52 EA
1/8	8x10	1 SIDE	.95 EA
1/8	8x10	2 SIDE	$1.10 EA

TUNING METER
MFR. GENERAL ELECTRIC
TYPE DW-33

DIAL CALIBRATED IN 7 DIVISIONS, WHITE ON BLACK FACE. METER READS TUNE FOR MAXIMUM. MOVEMENT - 0 TO 4.2 MA. BUILT IN SOCKET FOR DIAL LIGHT. FLUSH MOUNT. 2-1/8" DIA. $.95 EA

GERMANIUM DIODE: PRV 20, FWD 50 MA 25/$1.00

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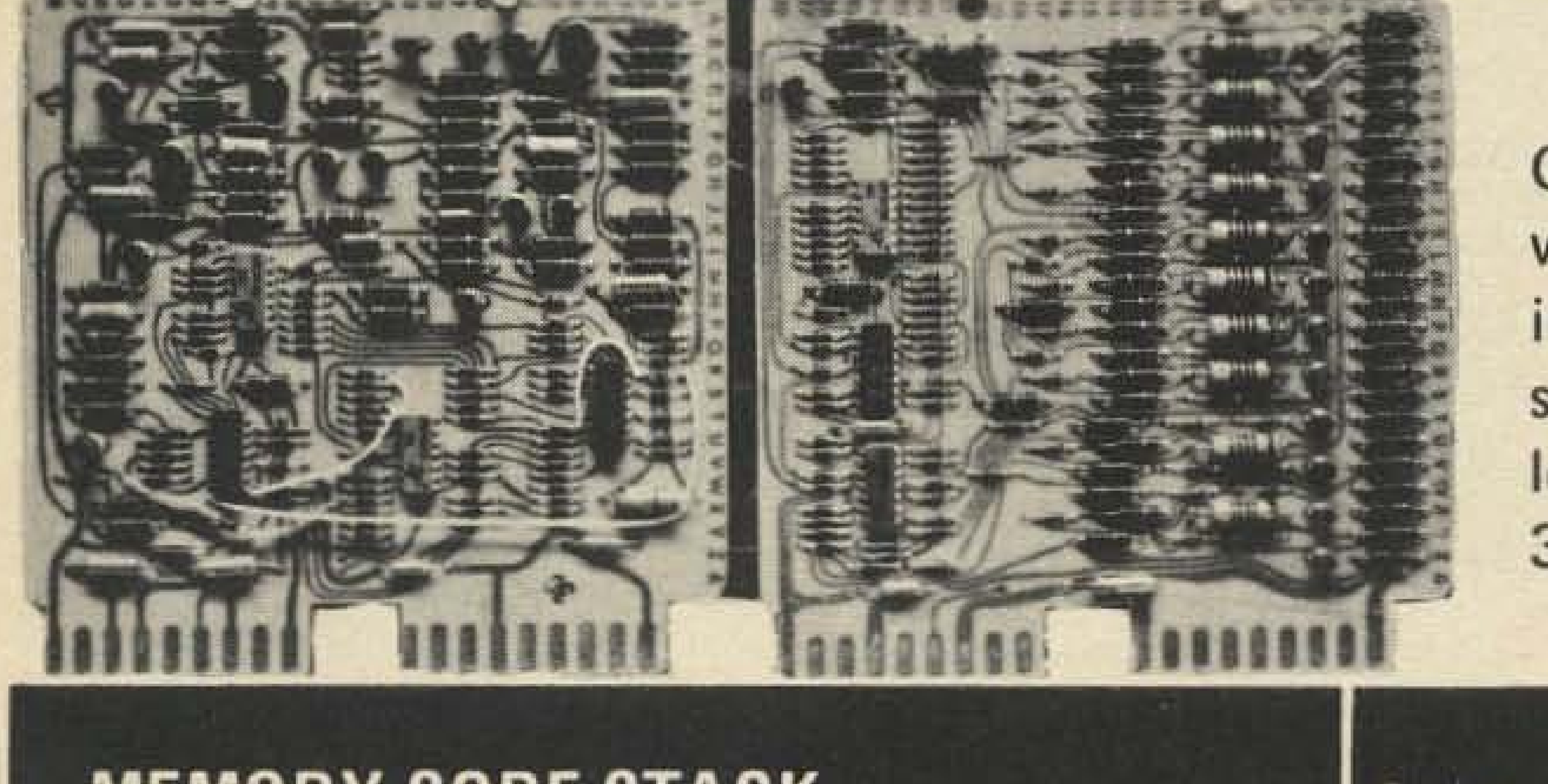

Computer boards stuffed with goodies with each and every board also including marked IC's. Typical sample shown . . . some have more, some have less.

3 boards $1.00 or . . . 20 boards $5.00

MEMORY CORE STACK

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HI POWER VARACTOR

Similar to MA 4060. Used for doublers — triplers — drivers. 20 watts input w/specs & schematics. $5

LASER DIODE 3 WATT

RCA TA-2628 w/specs $5

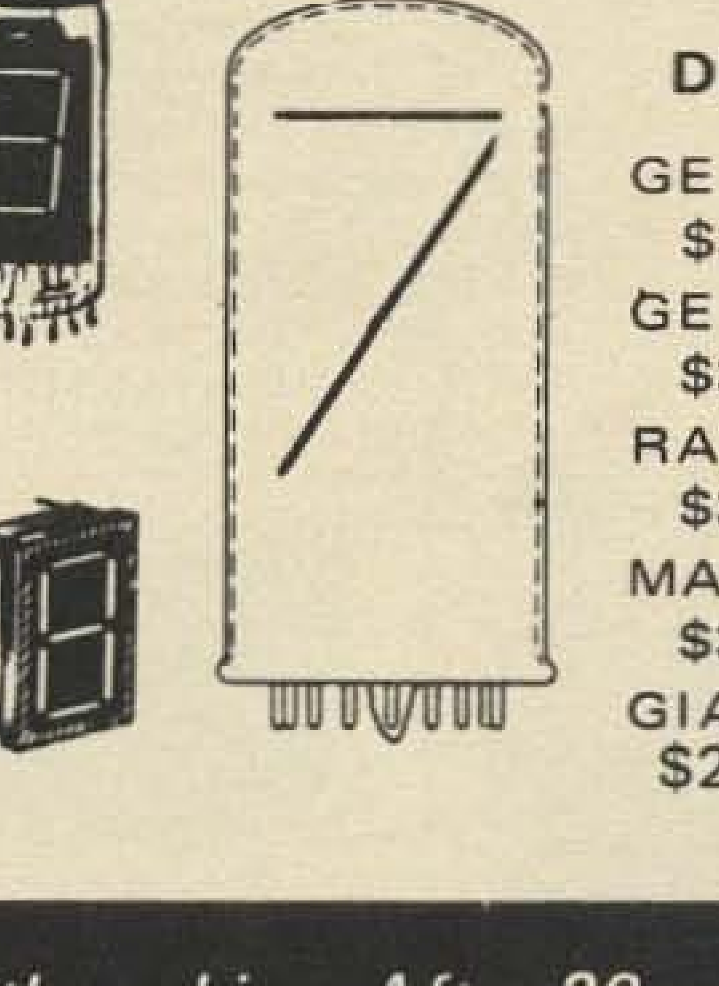
TS-323 FREQ METER $50

Navy surplus with calib. book. Similar to BC-221 except range 20–1000 MHz

1,000 µF 450V CAPS

For photo flash or linear power supplies

$1.50 each . . . . 10/$12



DIGITAL READOUTS

GE Y4075 25V Miniature
$3 ea. 10/$25

GE Y1938 24V Standard
$3 ea. 10/$25

RAY CK 1905 Standard
$3 ea. 10/$25

MAN-3 1.7V Miniature
$3.50 ea 10/$30 LED

GIANT ALPHA NUMERIC
$2.00 ea. 10/$18.00

Our newest and best catalog now available for the asking. After 20 years in the business, we know what to pick and choose for our customers and our current catalog offers you the finest of surplus bargains at the lowest prices as always. 96 pages of Super Mouth Watering exotic material to drool over.

Transistors, brand new, factory marked.

	V	MW	Fr	Type	Use	Price
2N706	25	1W	400	N-S	Sw	4/1.00
2N1517	16	83	70	P-G	VHF	4/1.00
2N1711	50	3W	70	N-S	Pwr	3/1.00
2N2152	45	170W		P-G	Pwr	1.00
2N2218A	40	3W	250	N-S	Sw	3/1.00
2N2222	60	500	250	N-S	Sw	6/1.00
2N2369A	40	1.2W	500	N-S	Sw	3/1.00
2N2907A	60	1.8W	125	P-S	Sw	3/1.00
2N3013	15	1.2W	350	N-S	Sw	3/1.00
2N3055	70	115W		N-S	Pwr	1.50
2N3663	30	200	700	S-N	Amp	50¢
MJ2250	80	20W		N-S	Pwr	75¢
MJ2254	80	25W		P-S	Pwr	75¢
2N5194	60	40W		P-S	Amp	50¢
TN-53	75	800	100	N-S		4/1.00

SILCON DIODE SPECIALS

1 Amp	1000piv	8/1.00	100/10.00
2 Amp	1000 piv	6/1.00	100/14.00
2 Amp	1200 piv	4/1.00	100/20.00
1 Amp	2000 piv	1.00	
1 Amp	3000 piv	1.25	

FULL WAVE BRIDGE MODULE

2 Amp	400 PIV	1.00
3 Amp	1200 piv	1.35

ELECTRONIC SURPLUS BARGAINS

KLEINSCHMIDT TELETYPEWRITERS

Model TT-98/FG & TT-100/FG

Capable of sending 60-100 WPM, 115v., 60 cyc. Self contained power supply, Shipping weight - 70 lbs .... **$59.50 ea.**

Model TT-117/FG same as above except no power supply. This unit used with Model TT179/FG Reperforator-Transmitter which contains the power supply for both units $49.50

OSCILLOSCOPE

A widerange, high gain, portable test unit for observation of pulses, short-period electrical disturbances, sine waves, Band width 3 cyc.-15 mc. 105/125 VAC, 50-1000 cyc. **AN/USM50 . . . $79.00**

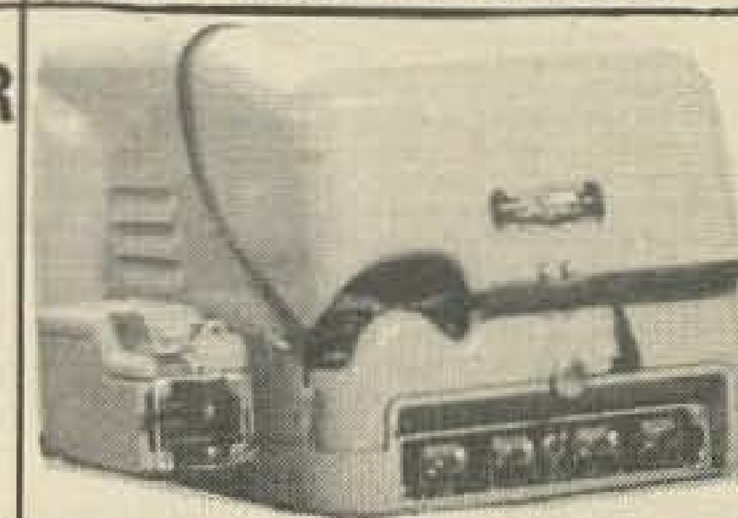
TELETYPEWRITER TABLES

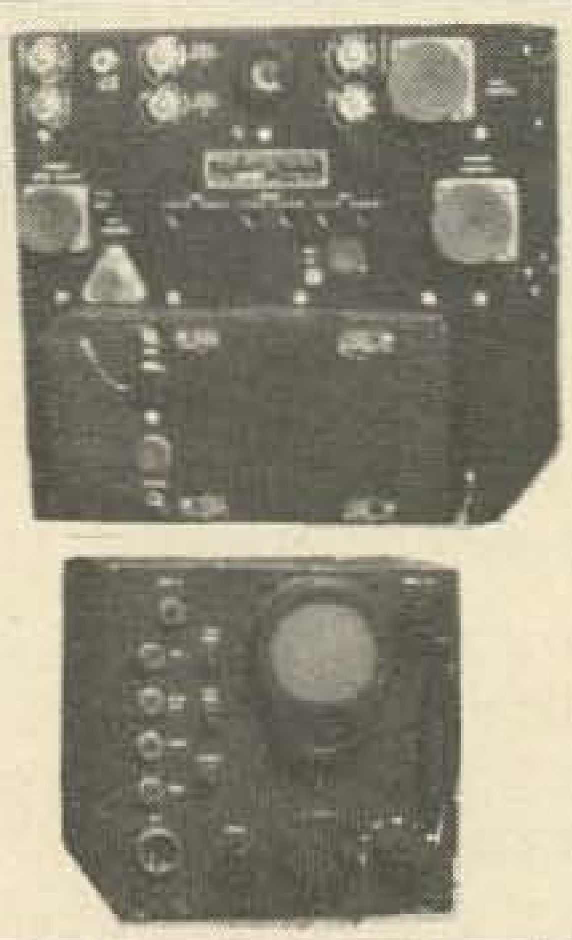
Heavy duty construction, shpg. wt. 20 lbs. for page printer, 22" x 18" x 27" ht. $15.95

REPERFORATOR-TRANSMITTER

Model TT-179/FG Mfg by Kleinschmidt

Tape printing & punching, also transmitter-distributor, 115 volts, 60 cyc. shpg. wt. 90 lbs. Used, excellent cond., (gov't cost $2,000) $59.50





AN/APN-12 RADAR SET

Consists of rec.-trans. RT11-A and ID-169 indicator. The transmitter interrogates a remote radar beacon by pulse type RF signal, pulse reply from beacon is received and displayed on the indicator to show distance and left or right heading for homing to location of remote beacon. The rec.-trans. contains 1-24 V.D.C. gear-head motor, 1-blower and tubes: 2 x 2, 2C26A, 9002, 5R4GY, 6SN7GT, 6V6, 6E5, 2-6SL7GT, 2-6AK5, 6-6AC7. Indicator contains motorized coaxial switch and tubes: 3BPL-C.R.T., 6AS6, 6AQ5, 6 x 4, 2-5726, 5-12AU7. Power reqmt. 115 V.A.C. 400 cy. and 24 V.D.C. freq. range 160-240 MHz.
Rec.-trans. shpg. wt. 50# $18.95
Indicator shpg. wt. 35# $14.95

VERTICAL ANTENNA INSULATOR

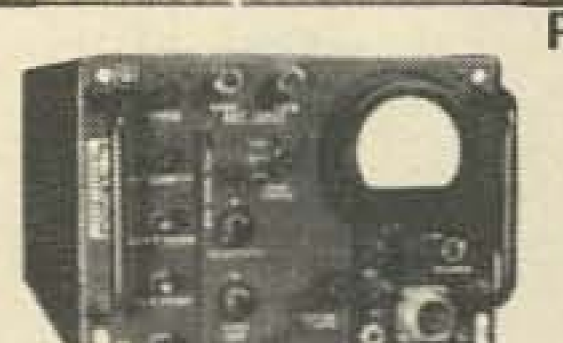
TOP - 1 3/8" o.d. - bottom 1 3/8" i.d. 16½" long - Shpg. wt. 8#$4.50 ea.

Volt and ammeters
Many types and styles

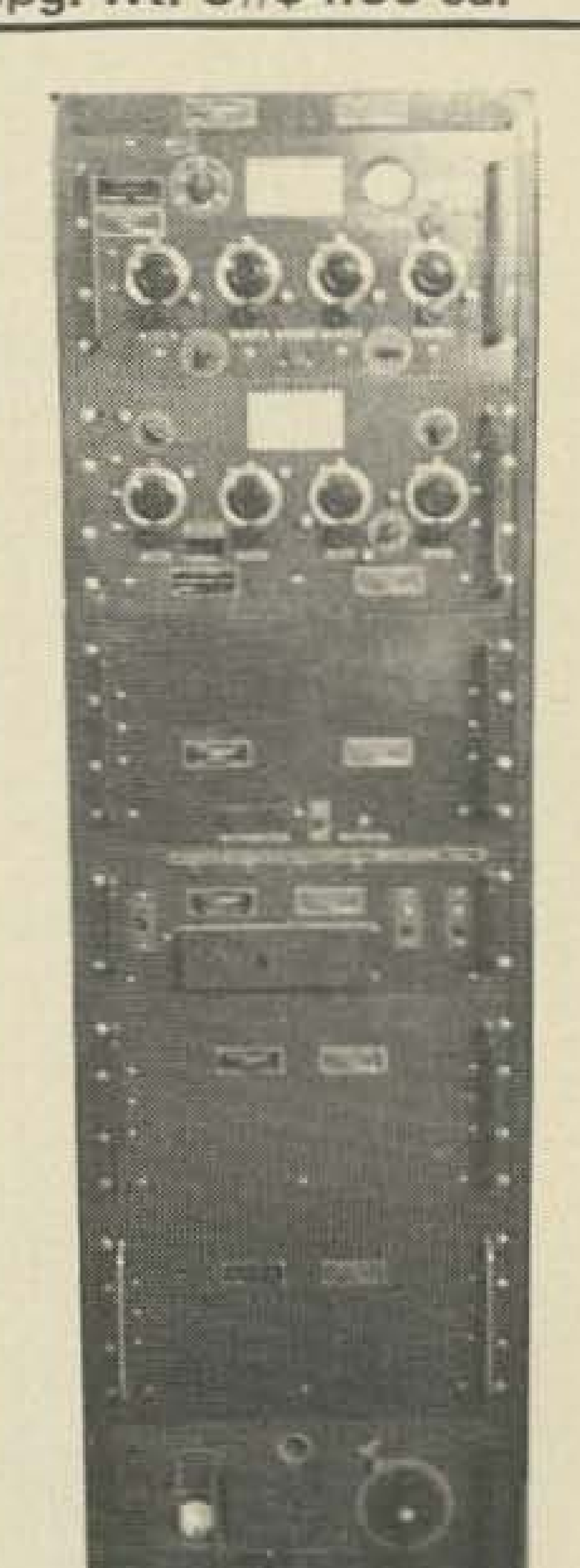
T-142/ART-13 Transmitter

This unit is ideal for HAM use on 80, 40, 20 and 10 meters. It has a power output of 100 Watts, AM, CW and MCW in a freq. range of 2-18 MHz and can be preset to the desired frequencies on any of 10 preselected channels. Complete with oscillator, 12" x 16' x 24", shpg. wt. 75# $49.50

PANORAMICRECEIVER



R356/ARR-8 290-520 MHz Tuning range in 2 bands – Directly covers 420–450 MHz Hamband, AM. Contains 5 stage, 52 MHz I F Amp, power supply module, tuner with motor driven sweep capacitor, 2 mixer sections, 2-R.F. pre-amps and tubes: 3JP1 – C.R.T., 1B3, OA2, 6AK5, 5654, 6096, 6097, 5Y3, 2-6AK6, 2-6AL5W. Power input 115V. 400 cy. Also available 70-300 MHz and 730-960 MHz. Excellent conditon. Shpg. wt. 40# $18.95



2-METERVHF BC-640 X'MITTER

50 watt - CW and AM. Freq. range 100-156 MC crystal controlled Pwr. rqmt. 100/125 60 cyc. Crated wt. 600 lbs. 6' x 22" wide. $49.50

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Fiberglass shell with retractable shaded visor. boom type carbon microphone and earphone headset. Use in car, plane, boat, motorcycle, used. $15.50

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(DIV. OF ANDY INTERNATIONAL, INC.) **F.O.B. Houston, Tex. – Payment with order**

INDEX 1971

It was our intention to print a cumulative index of the past twelve years of 73 Magazine and this is why no 1971 index had appeared in print. We have received many letters requesting an index and have decided to print the 1971 portion of the index. The twelve-year list will be published separately as soon as it is complete.

ANTENNA

BURGLAR ALARM

SEE MOBILE

CONSTRUCTION & TEST EQUIPMENT

CW

DX

EQUIPMENT REVIEWS

FAX

SEE TV

FM & REPEATERS

HELPS

HUMOR & STORIES

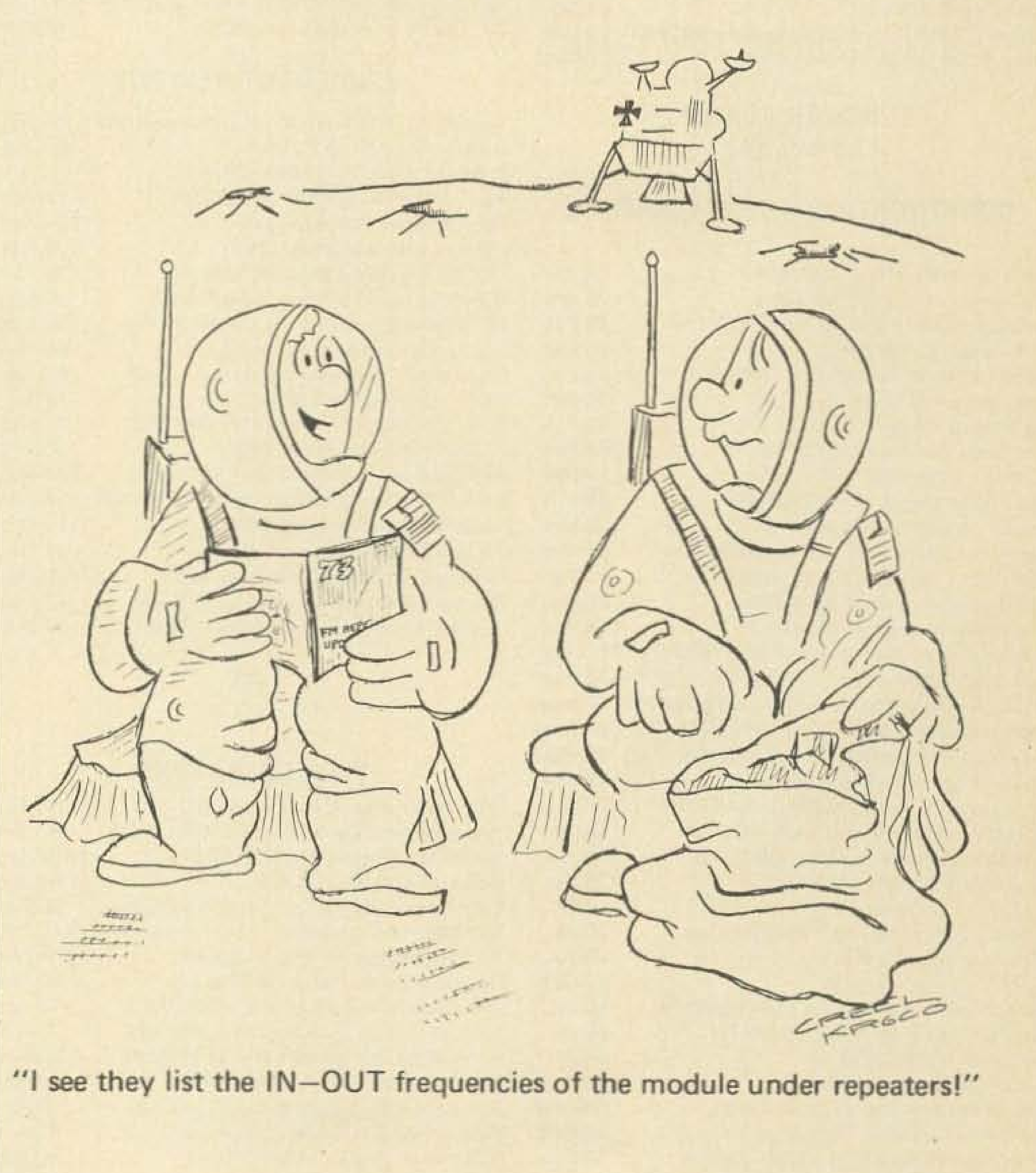
LINEAR AMPLIFIER

SEE TRANSMITTERS

MOBILE

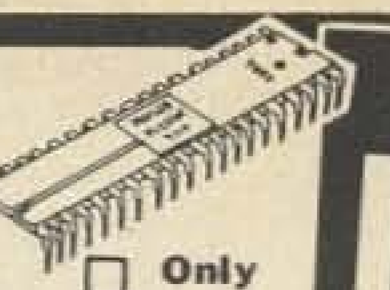
MODIFICATIONS

OPERATING



"I see they list the IN—OUT frequencies of the module under repeaters!"

12-DIGIT "CALCULATOR ON A CHIP"



Similar to Mostek 5001. Outperforms Texas 8-digit TMS1802. A 40-pin DIP. Adds, multiplies, subtracts, and divides. Use with 7-segment readouts, Nixies, and LED's. We include schematics, instructions from factory to build calculator.

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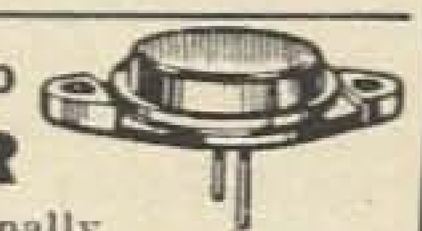

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200	☐ .95	☐ 1.25
400	☐ 1.19	☐ 1.50
600	☐ 1.35	☐ 1.75
800	☐ 1.59	☐ 1.95
1000	☐ 1.79	☐ 2.25

Code: 2 amp TO-5 case
6 Amp 1/2 x 1/2 x 3/16 sq

LOWEST PRICES ON "TRIACS"

* Two SCRs in one case! * Most complete listing!

PRV	3 amp	6 amp	10 amp	15 amp	25 amp
50	☐ $.22	☐ $.35	☐ $.45	☐ $.65	☐ $.85
100	☐ .35	☐ .52	☐ .64	☐ .85	☐ 1.05
200	☐ .65	☐ .72	☐ .88	☐ 1.25	☐ 1.45
300	☐ .79	☐ .89	☐ 1.10	☐ 1.45	☐ 1.65
400	☐ .92	☐ 1.15	☐ 1.35	☐ 1.85	☐ 1.95
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☐ SN7405N	Hex inverter, open collector	0.29
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☐ SN7420N	Dual 4 input NAND gate	0.27
☐ SN7430N	8 input NAND gate	0.27
☐ SN7440N	Dual 4 input NAND buffer	0.27
☐ SN7441N	BCD-to-decimal decoder/driver	1.15
☐ SN7442N	BCD-to-decimal decoder	1.15
☐ SN7446N	BCD-to-7-segment decoder/driver	1.55
☐ SN7447N	BCD-to-7-segment decoder/driver	1.55
☐ SN7448N	BCD-to-7-segment decoder/driver	1.45
☐ SN7472N	J-K Master slave flip flop	0.55
☐ SN7473N	Dual J-K Master slave flip flop	0.59
☐ SN7474N	Dual D triggered flip flop	0.45
☐ SN7475N	Quad Latch	1.00
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☐ SN7493N	4 Bit binary counter	1.10
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100 or more, 25% discount

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☐ 1 AMP 1000 PIV

70 WATT DRIVER AMP

Buy 3 — Take 10%

By Signetics NE540, 30 transistors, class AB of audio. 0.25% distortion. 50 to 20KHz 22V supply. With diagrams, instructions.

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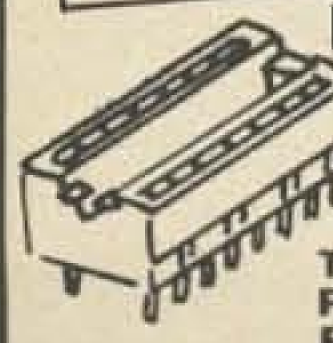
INTEGRATED CIRCUIT SOCKETS



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CATALOG ☐ 15¢

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Add 25c for handling

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☐ 2 — **711C** Dual diff. comp. (A) $1
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☐ 1 — **747C** Dual 741C, TO-5 .... $1
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☐ 1 — **741-741** Dual 741C (mini DIP) .. $1
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(A) Choose TO-5 or DIP (Dual In Line) case

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MINI -7

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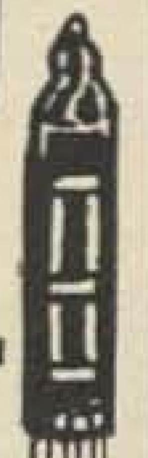

SLIM -7

☐ **MINI-7 – TUNG-SOL DT-1705E**
Tube size, 1 3/4" high x .71". Character size: .360 x .570". 10 pins. ☐ SOCKET FOR ABOVE — 50c

☐ **SLIM-7 – G.E. Y-4075**
Tube size, 1.6" x .375". Character size: .20" x .40". Nine 2" leads. ☐ SOCKET FOR ABOVE — 50c

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COUNTING SYSTEM

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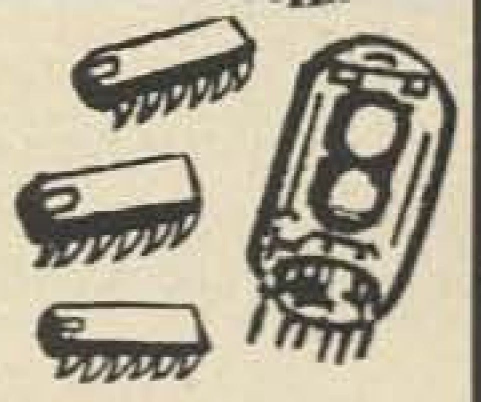

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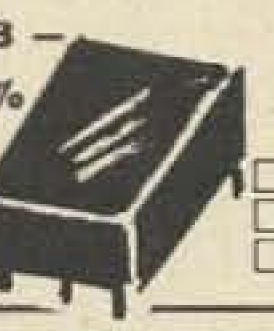

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The W7DXX/1 Column is dedicated to those of you who read 73 from the back to the front. It also gives me the chance at the last word on a particular issue.

I am trying to average an hour or two per evening on 20 SSB since I have to start my DXing anew from the new QTH in Peterborough, New Hampshire. I'm running the limit to a 3 element 20 meter beam up 75 feet and the QTH is 800 feet above average terrain. A beautiful location. It's much easier to work DX from this location than from Washington State. In fact, after just a couple of days I am halfway to the 100 countries mark.

I had a very nice 45 minute chat with Ole, OY9LV, the other night on 20 SSB. He runs low power to a dipole. However, with his mountaintop QTH on Faeros Is., he puts out a very nice signal. Ole is sending me some pictures of his shack and QTH. I'll be sure to include them in a future column. I had a small chance to appreciate what many DX stations have to go through with the stateside QRM. During our 45 minute QSO dozens of stateside stations kept breaking each time we would turn it back to each other. And then, when we finally did sign, he was mobbed by hundreds. God! I couldn't live like that. By the way, W3HNK is the QSL mananger for OY9LV.

On the subject of DX, Wayne Green and I will be operating from Bajo Nuevo (HKØ) for the November 11th week end. We have room for several more good operators. If you'd like to join us on a DXpedition to a rare tropical island, get in touch with me ASAP.

I put the *73* Magazine repeater back on the air a short time ago (WA1KGO 19-79). We have a couple of solid-state two meter repeaters on the way so we should have a couple in operation from our mountain – Pack Monadnock, Peterborough. One of them, the 19-79, will have a DX tie-in to 29.680.

You would not believe the two meter activity around the northeast. Virtually, every two meter FM frequency is occupied by at least one or two repeaters. Wayne and I took a trip to our repeater site the other evening in his mobile. He runs a 20 channel transceiver with a 100 watt amplifier. Needless to say, we had a blast. The only problem was that it would take quite a while for all the repeater tails to die out each time we transmitted.

I keep a 20 meter sked with WA4JGF, WA4QXC, W4EAL, W4LQC, and several others every Saturday morning. These fellows maintain my Knoxville Repeater (W4TEA 16-76). They tell me that they are progressing well with several new projects such as several autopatch lines to different exchanges, and the DX inter-tie to 29.680. Knoxville already has a very fine repeater (K4HXD 34-94). The repeater was put up by and is maintained by George, K4HXD (known to several of his "Group" as HIS EMINENCE). HXD is suffering the same problem most repeater owners experience. I call it the 80/20 syndrome. Namely, each repeater has 80% talkers and 20% doers. It is a sad fact but most repeater users highly praise the machine they are using until help is needed. As soon as the chips are down, or the repeater for that matter, very few people are available to help. Also, George must learn to passively monitor his repeater and not take every opportunity to "hop" on frequency and criticize repeater users. Also, he must learn to do his own thinking and not let a few do the thinking for him. I am sure when HIS EMINENCE realizes that he is in the same boat as most repeater owners,

(continued on page 112)

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