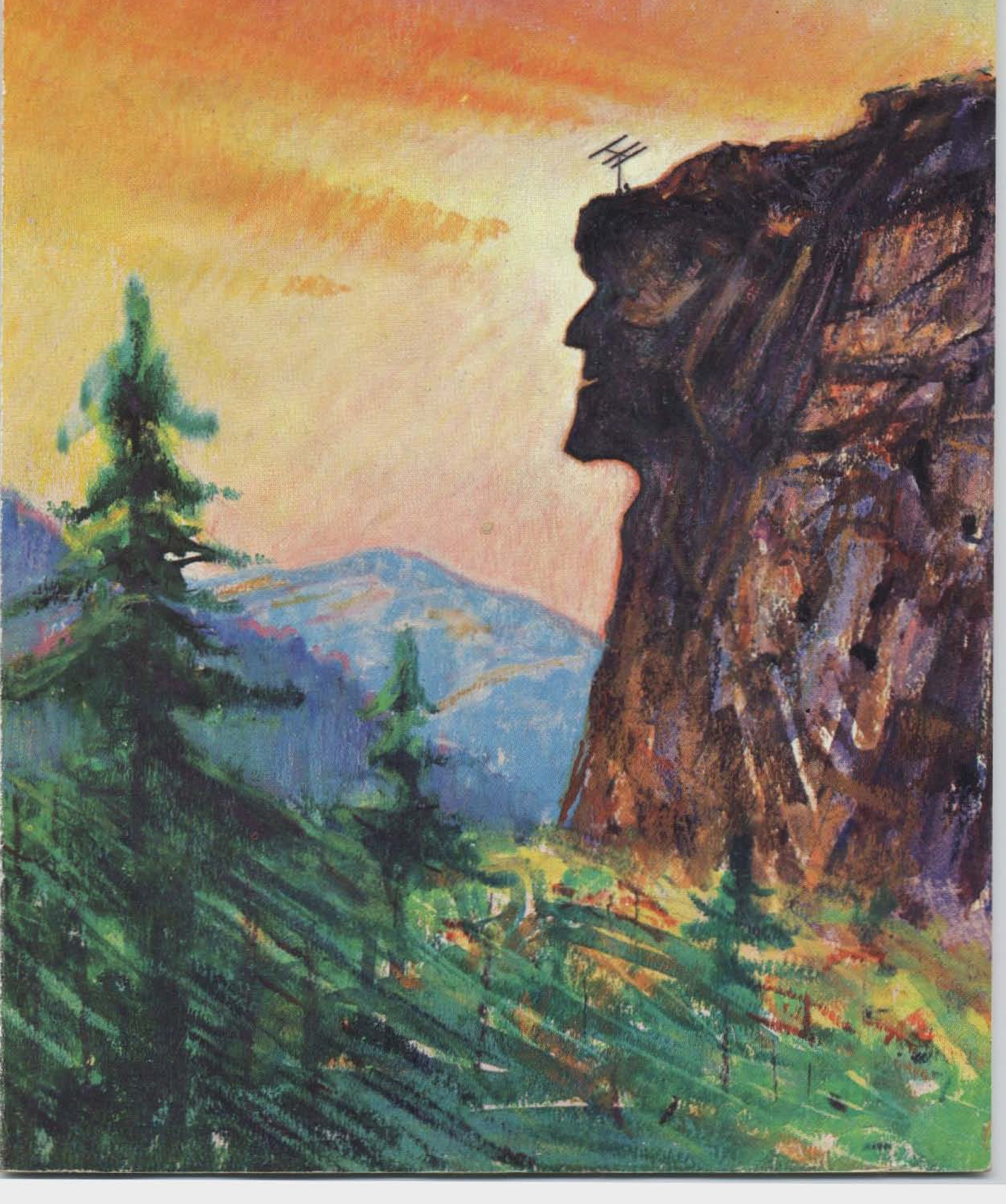
# 73

JULY 1968
73¢

## AMATEUR RADIO



*The SBX-9 Exciter-Driver and the SBA-50 Mixer-Amplifier provide the perfect combination for 50-54 MHz SSB operation. Performance, versatility and reliability are incorporated into this new SSB pair. A tremendous value at a low price!*

# International Single Sideband

## 9MHz exciter-driver

### MODEL SBX-9

SPECIFICATIONS

Exciter-Driver 9MHz . . . **$125.00**

Tubes: 6BH6 Oscillator
12AX7 Audio
7360 Bal Modulator
6BA6 RF Amplifier

Filter: Four crystal half lattice
Carrier Suppression 45db min.
Unwanted SB Atten. 40db min.

Output: Provides voltage drive for mixer such as SBA-50

Controls: Carrier Balance
Microphone Gain
Test Switch
USB-LSB Switch

Metering: RF output for balance adjust. Two sensitivity ranges available with front panel switch.

Misc: Relay included for push-to-talk operation. Crystals for upper and lower sideband included. Requires high impedance microphone. For operation on 117 vac 60 cycle power.

*Order direct from International Crystal Mfg. Co.*

## 50-54 MHz mixer-amplifier

### MODEL SBA-50

SPECIFICATIONS

Mixer-Amplifier 50-54MHz . . . **$145.00**

Tubes: 6U8A Oscillator-Mixer
12BY7A Amplifier
6360 Linear power amplifier

Drive: Requires 9MHz sideband signal from SBX-9

Output: SSB single tone 10 watts

Controls: On-Off Power
PA Grid Tune
PA Plate Tune
PA Load Tune
Metering Switch

Metering: Oscillator
9MHz Drive
Buffer Grid
PA Grid
RF Out

Crystals: Three positions, uses 3rd overtone 41-45MHz range. Crystal frequency = final frequency —9MHz

Misc: Accessory socket provided for connecting keying circuit to SBX-9. Comes with three crystals. Specify frequency when ordering. For operation on 117 vac 60 cycle power.

**INTERNATIONAL**

**CRYSTAL MFG. CO., INC.**

10 NO. LEE • OKLA. CITY, OKLA. 73102

# 73 MAGAZINE

July 1968
Vol. XLVII No. 7


| | | |
|---|---|---|
| 6 | Let's Build a Tower<br>Sturdy wooden construction | VE1TG |
| 12 | Why Not a Tilting Tower<br>With this method, why not? | W6DL |
| 16 | 40 ft Non Conducting Sky Hook<br>Making the most of a phone pole | K7VBQ |
| 21 | Burn Prevention<br>a safe place for the hot soldering iron | VE3BUE |
| 24 | The Beam Pole<br>Another phone pole idea | W7GBJ |
| 28 | Tilt that Tower<br>Using the house for leverage | W2AJW |
| 33 | Panel Gap Filler<br>Another idea to fill the holes | Ives |
| 34 | IC Audio Amplifier and Oscillator<br>ICs are here to stay | W7AKS |
| 37 | The New Tower<br>Battling the building inspector | WA2GXT |
| 39 | New 160 Meter Allocations<br>Easy to read chart to give all the information on the new rules. | Staff |
| 40 | Some Audio Thoughts<br>Versatile Modulator unit | W3KBM |
| 42 | DB<br>Wait 'till you see the illustration | WB2PAP |
| 50 | More on Xtal Etching<br>Using readily available chemical | K6GKP |
| 52 | Writing for Service Information<br>Communicating your problem | K2PTS |
| 54 | Care and Feeding of a Ham Club<br>Part I of a new series | W5NQQ |
| 60 | Photographic QSL<br>Do-it-yourself QSLs | W3RZD |
| 62 | WTW Report<br>Gus gives full listing of awards | W4BPD |
| 64 | UFO Net information | W2NSD |
| 70 | 73 Subscription Premiums<br>Lots of goodies free | Staff |
| 74 | The Anatomy of a Pile-up<br>DXing | G3BID |
| 76 | Advance Class Study Course<br>Part IV—Transmission lines and SWR | Staff |


**Effective August 1, 1968 Subscription rates will be as follows: 1 year $6.00, 2 year $11.00, 3 year $16.00. Renew now to save expenses.**

Departments


2 Editorial Liberties
4 de W2NSD/1
86 Letters
90 Caveat Emptor
96 Index to Advertisers


Wayne Green W2NSD/1
Publisher

Kayla Bloom W1EMV
Editor

Cover: Original painting of New Hampshire's "Old Man of the Mountain" by Sydney Willis.

73 Magazine is published monthly by 73, Inc., Peterborough, N.H. 03458. The phone is 603-924-3873. Subscription rate: $5.00 per year, $9.00 for two years, $13.00 for three years. Second class postage is paid at Peterborough, New Hampshire, and at additional mailing offices. Printed in Pontiac, Illinois, U.S.A. Entire contents copyright 1968 by 73, Inc. Postmasters, please send form 3579 to 73 Magazine, Peterborough, New Hampshire 03458. Engage brain before turning on transmitter.

# *Editorial Liberties*

. . . Kayla WIEMV

Last month we had so many articles in the magazine that I found it necessary to bump my own editorial in order to make room for a second page of "table of contents". This caused me deep regret because I wanted very much to press for all hams to write their congressmen to support H.R. 16764 introduced April 24, 1968 by Congressman Theodore R. Kupferman of N.Y. The bill was referred to the Committee on Interstate and Foreign Commerce and there is a possibility that it may not have seen action so far. I urge you to phone or wire your congressman immediately to support this measure which provides for licensing of foreign amateurs who have taken up permanent residence in the U.S. and intend to become citizens. We allow (through the reciprocal agreements) visitors and those foreign hams who are here working or as students to use their licenses, but the tremendous number of aliens who have filed their intent to remain have no such opportunity.

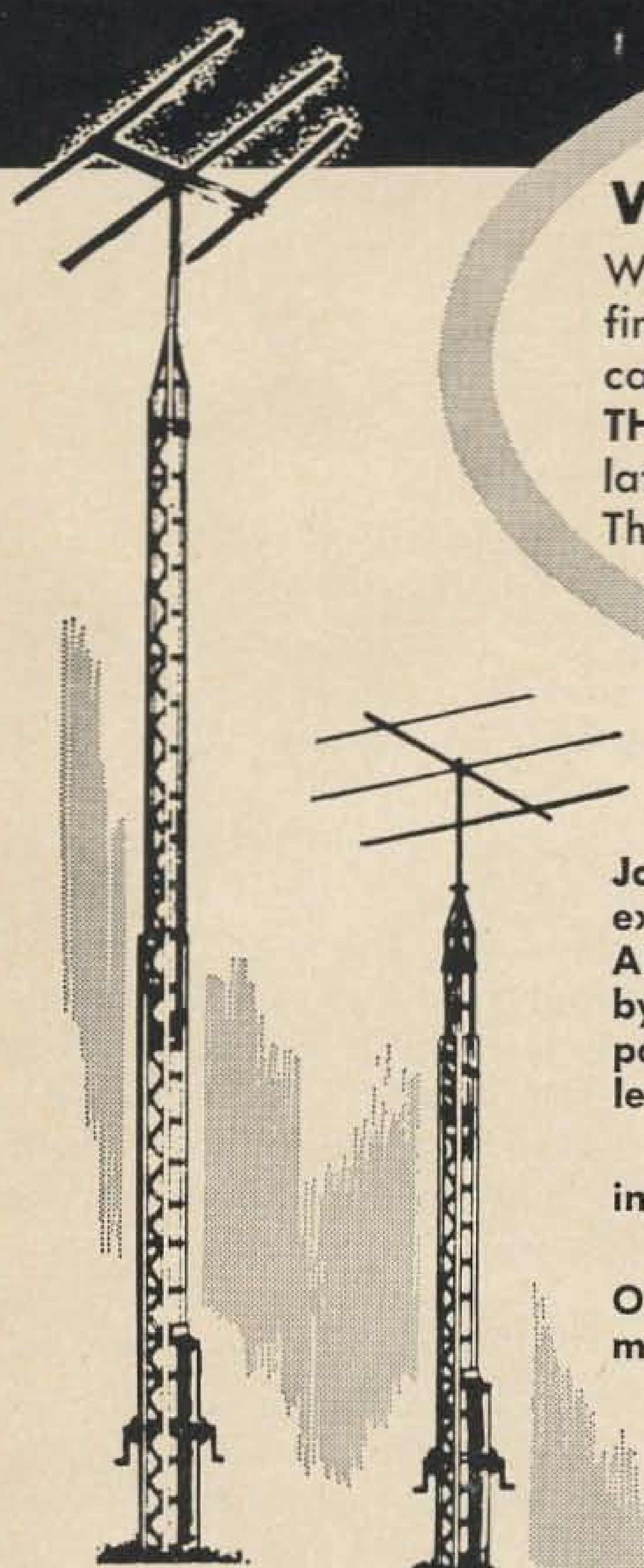
The overwhelming enthusiasm which greeted my May editorial on the 40 meter foreign broadcast intruders has caused me to ride that horse again this month. If the actions will speak as loud as the words, we should have quite a gang riding the 40 meter broadcast stations and trying to force them to move. All kinds of suggestions have been made for how to take action against the intruders ranging from "Give amateurs unlimited power on those frequencies from 6PM to 6AM local time" to "use those frequencies for a dummy load."

How about this approach? Give them QRM in any way you can, but be legal about it. We don't want any charges of malicious interference. Carry on QSOs as close to their frequency as you can manage. Then, start a campaign getting everyone you know to write to Radio Moscow and BBC, and any others you can identify saying, "I would like to listen to your broadcasts, but there is so much interference from the amateurs in the 7 Mc band that I find it hard to hear you. I wonder if you could move to a frequency above 7.3." or words to that effect. An other idea is for us to write to the Minister of Commerce in those countries telling them that We are planning a vacation and would like to visit their country but since we are amateurs, we feel they are depriving us of our rights to use our legally authorized ham bands and therefore will *not* visit their country and will urge all our friends to remain away. As you know, tourism is a big business in most countries and a pile of letters from would-be tourists who will *not* spend money in that country is an influential factor. We could probably cause a grand fight between the Minister of Commerce and the Communications department if enough letters were sent. Any other ideas? Talk is cheap, action is what is needed. Multiply your Q, sharpen up your receiver's selectivity, and get on 50-100 cycles off zero-beat from your most obnoxious foreign broadcast intruder and give it all you've got. There is nothing illegal about calling CQ even if you can't hear the station who might answer you. Soon as some manpower comes along to assist, I'm going to put up a rhombic aimed for Europe and call CQ with the full legal power. Anyone going to join me?

With this issue we are starting with full color covers for 73. Cover material has always been a problem and it is a monthly hassle to figure out what to use. We have used photos, cartoons, artwork of all kinds in the past. We now put out a call for ideas backed up with material. For this July issue we have a painting of a view of New Hampshire's "Old Man of the Mountain" with the embellishment of a beam. This was specially done to attract you to our hamfest July 6th. Full color photographs of any ham topic would be acceptable. However, since most ham shacks look pretty much the same the world over, we will eliminate them from competition. An interesting new antenna would be good, but they are hard to photograph. Naturally, you will be handsomely paid if we use your cover idea, and you will have your photo or painting returned politely if we don't.

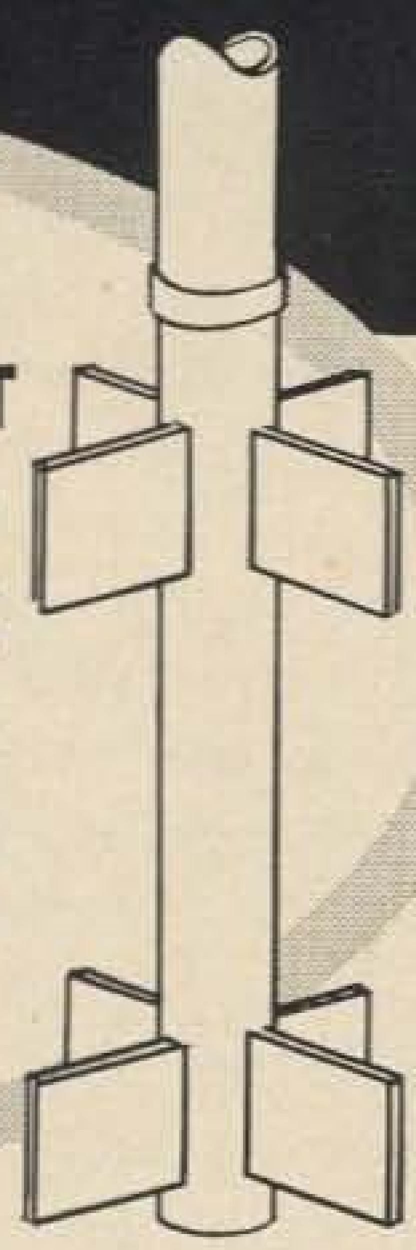
Apparently there is some misconception that your editor is also Mr. Green's wife. I would like to clarify this. Wayne and I are good (but not close) friends. I have enough troubles without having to live with him. Furthermore, he is married to a lovely girl named Lin, while I am unattached.

# INSTALL A 60 FOOT TOWER YOURSELF WITH NO CONCRETE



## E-Z WAY PRODUCTS WONDER GROUND POST

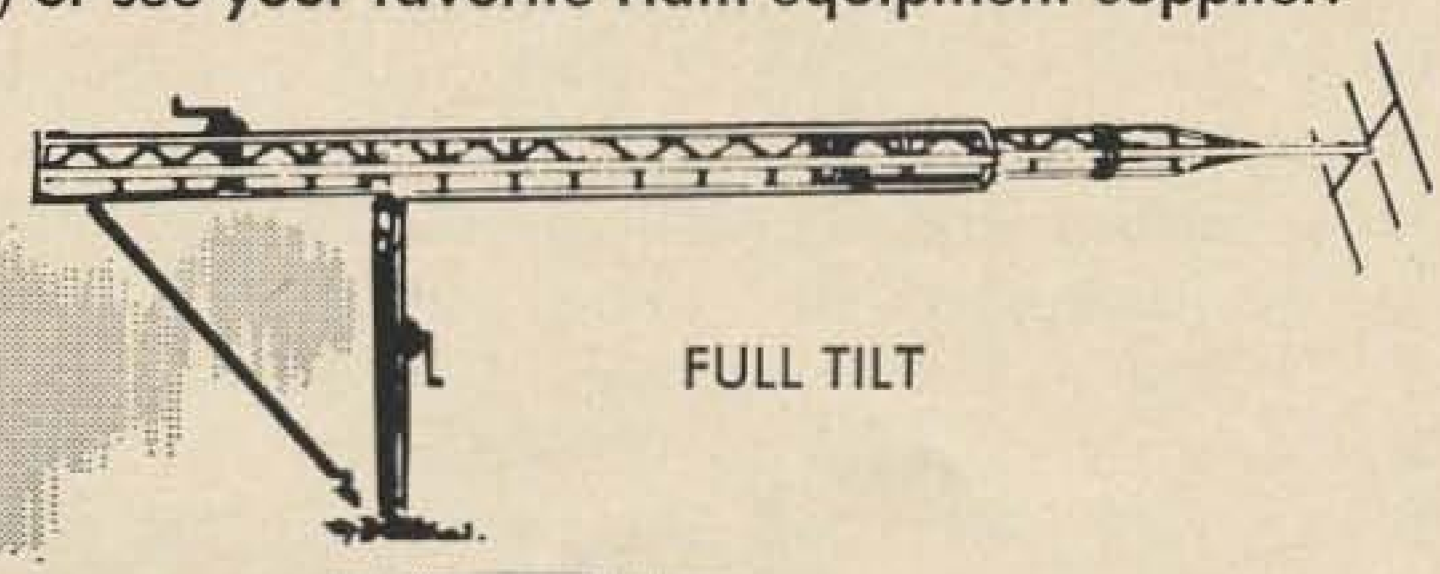
WONDER GROUND POST'S stabilizing fins insure a solid setting under practically all ground conditions **WITHOUT THE USE OF CONCRETE!** Simple installation requiring only a post hole digger. Thousands in use throughout the world for over a decade.



**Join the thousands of Hams enjoying E-Z Way Towers' exclusive advantages. The easiest Ham tower to install. Also can be raised and lowered to any desired height by one man and with equal ease tilted to horizontal position permitting access to beam and rotor at ground level.**

**Standard models from 40 to 150 feet and commercial installations to 1,000 feet.**

**More E-Z Way Towers are in use than any other kind. Order from factory (same week shipment on most models) or see your favorite Ham equipment supplier.**



FULL HEIGHT    CRANKED DOWN    FULL TILT


**E-Z WAY Products, inc.**
**P. O. Box 17196**
**TAMPA, FLORIDA 33612**

- **Engineering and Design**
- **Requirements Analysis**
- **Site Surveys and Evaluation for AM-FM-TV Broadcast, CATV, Microwave, Meteorology and Telemetry fixed or portable installations.**

**ONE OF THE WESTERN HEMISPHERE'S QUALITY TOWER SYSTEM SUPPLIERS**

**CUSTOM COMMUNICATIONS STRUCTURES**

# de W2NSD/1

Now that Don Miller and CQ magazine have joined forces, with CQ putting their reputation on the line backing Don and the validity of his expeditions, Don's reported suit against the ARRL for $550,000 takes on an added dimension, unfortunately, a court case like this can drag on for years and, win or lose, will cost the ARRL members dearly.

In addition to the suit against the ARRL, Don has also instituted a suit against 73 for $655,000. One can only guess at the reasons for such a move on his part. It is unfortunate that this whole matter has come to the courts for this will undoubtedly stifle reporting on Miller and his expeditions and will make it even more difficult if not impossible for us to get him to come up with explanations backing up his past trips.

How simple it would have been for him to just tell us that he went on such and such a ship from such and such a port on his trip to, say, Heard Island. He could tell us who was with him on the trip to back up the story and when he left, arrived, and returned and to where. He could show us a photocopy of the permission to operate from the Australian government for Heard, etc. All of this seems so simple, yet, despite my many questions, all we have is a libel suit and the prospect of having to wait years for any answers to all of our questions.

When Don visited the 73 offices about a year ago, we discussed his doing a DX column for 73 and a DX handbook. I had been looking for an author for my DX Handbook for some time and had discussed it with several well known DX'ers such as W1FH and W9IOP. I made it most clear to Don that the column and the book were possible only if all questions about the validity of his operations were cleared up to the satisfaction of the ARRL. Despite his assurances, the questions did not clear up at all . . . they continued to grow. Don was most perturbed with me when I refused to budge on this condition to his writing for 73. He is still perturbed . . . and the questions remain unanswered.

Rather than go into a long detailed discussion of the attack that Don Miller has made on me in his "article" in CQ, I would like those readers who think he may be right to consider his basic premise . . . that 73 is built on controversy and that I create controversy because it is profitable.

In fact, controversy has been one of the major factors holding back the growth of 73. My outspokenness has discouraged many advertisers from appearing in our pages. It has brought in ten letters of complaint for every letter on encouragement. Renewal after renewal form comes back to us saying that the reader is fed up with 73 because of the controversial editorials. And every editor who has worked for 73 has tried to get me to soft-pedal my columns.

From time to time I have been quiet and, just as everyone promised, the magazine has grown at a much faster pace. Then, when I felt that something had happened that everyone should know about, things would slow down again.

Neither money nor fame have been driving forces in my life. I want, more than anything else, to leave the world a little bit better than I found it. This is why the focal point of 73 has been technical and construction articles. That is why I try to report on the things that are going on in amateur radio to the best of my ability and in spite of enormous pressures to shut up.

Like most other people, I am my own worst enemy. It is all the more frustrating when you realize this, but still can't do anything about it: If I were smarter . . . if I were a better writer, just think what I might be able to do! But I'm not and I try to make up for it by working harder than other people and by being honest about what I am doing and why I am doing it.

Don was apparently quite intrigued by a little booklet I have written on "How To Make $1,000,000." Oh, I haven't done it . . . I haven't even come close . . . and I don't expect to. But that hasn't stopped me from doing a lot of thinking about the subject and figuring out some answers for those who are so inclined. If a fellow has as his goal retirement with enough income to keep him going the rest of his life, I believe I have worked out an almost foolproof system that will make this possible for him before the age of 25. My system does not include college, working for large corporations or the government. It is, in all, a rather unusual approach. The booklet is available from 73 for $1. *Turn to pg. 65*

*G. Cousins VE1TG,*
*Lower Sackville*
*Nova Scotia, Canada*

# *Let's Build a Tower*

A few years ago the urge hit me to quit messing around with the assortment of wire creations that I'd always used for radiators, and start in on rotary beam construction. Undoubtedly a lot of other hams have come to the same decision and, like me, soon realized that buying or building a beam is just part of the bargain. It has to be rotated, and it has to be mounted up in the air. The cost of a good beam can be fairly reasonable, but by the time the tower and rotator are added the whole thing begins to look like a payment on the national debt. However, all is not lost if you can convince yourself that you can take a few simple tools and build the whole affair right in your own backyard. It takes a little time and patience but the savings are well worthwhile.

I won't go into the construction of beams or quads at this time, but it seems logical to first decide what kind of antenna you're going to build and then tailor the tower to that particular design. There is also the human angle to consider. I for one like to be both safe and comfortable while I'm on top. And there is the problem of real estate; which simply means you must keep your tower and its accessories within the confines of your own property. Keeping the cost factor in mind, the tower described here was built according to these requirements:

1. Wooden construction, using only simple hand tools and a hand drill. Metal construction would be fine, but would necessitate much more in both cost of materials and more elaborate tool requirements.

2. Completely self-supporting and capable of handling the load of three stacked full size beams in winds of 100 m.p.h.

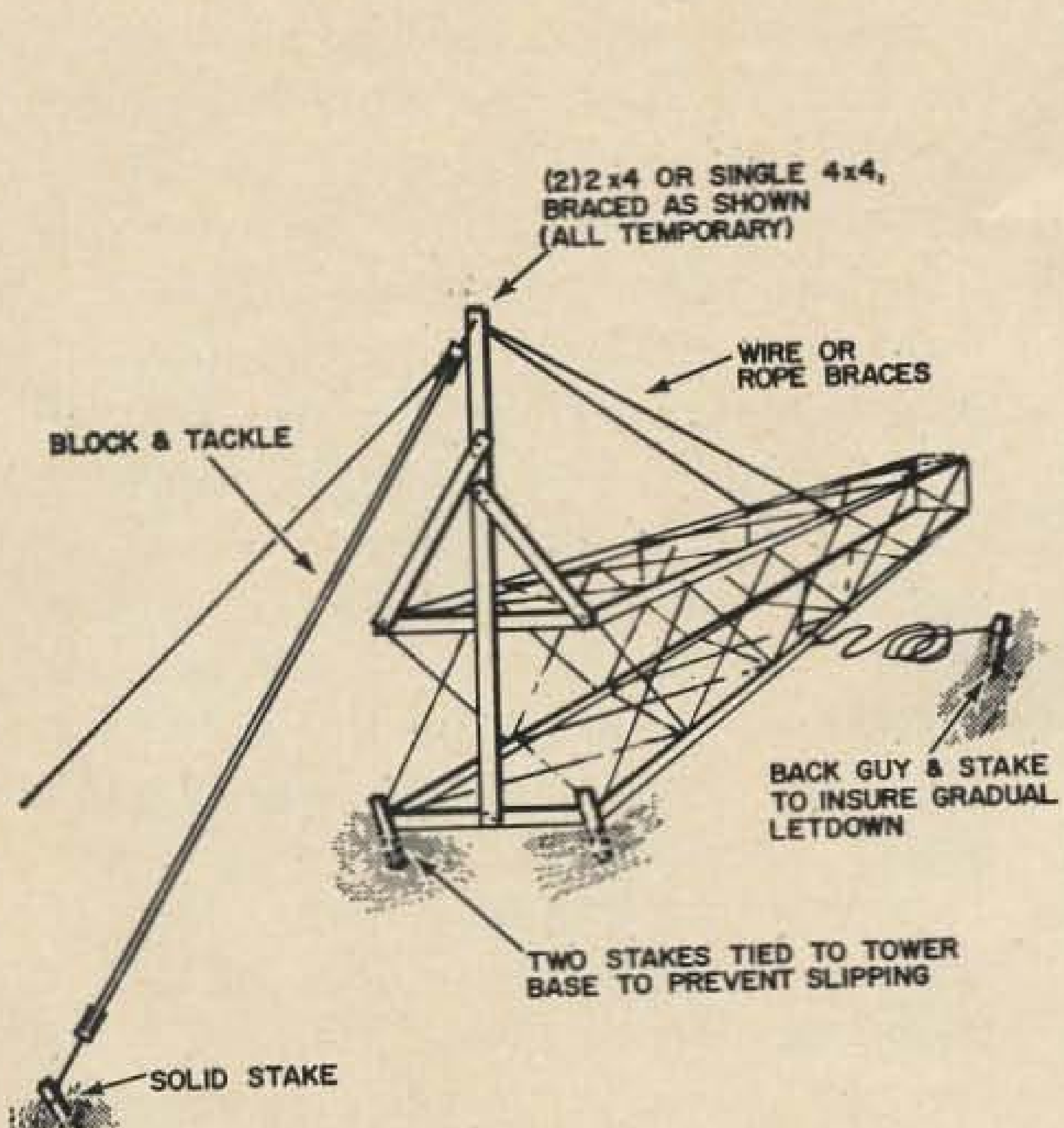
3. A wide working platform at the top, enclosed inside the tower, and with enough room for two or three men to maneuver comfortably and safely.

4. Easily built by one man and raised by four.

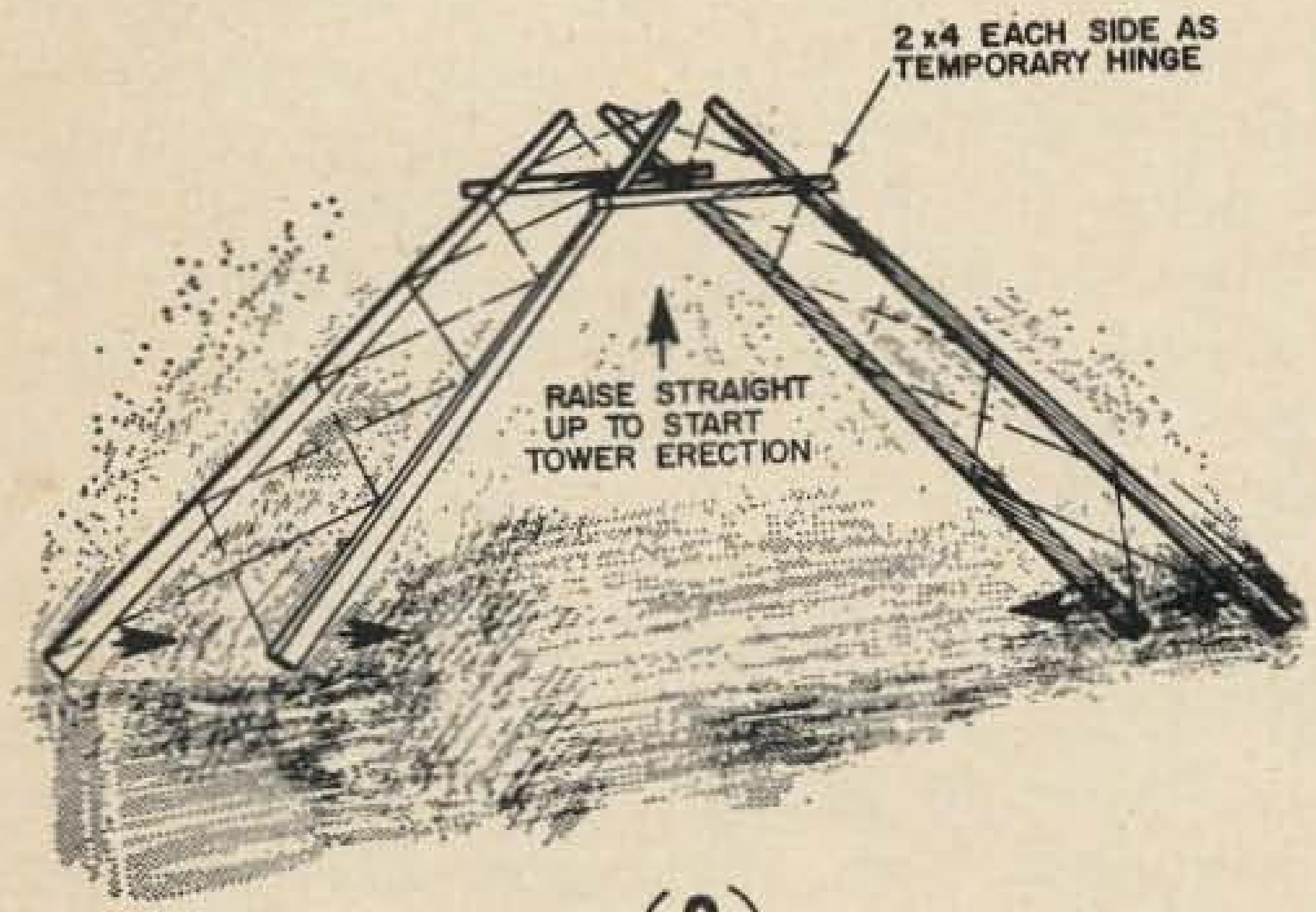
Before rushing off to buy materials, one should consider the type of lumber needed and this is pretty well dependent upon height and weight considerations. It's all very well to place a 20 meter beam at 70 feet in the air, but this is not practical unless you are going to get involved with much higher costs than are necessary. This tower of mine stood 33 feet from the ground to the top of the actual wooden frame. The rotator pipe extended two feet higher to the boom of the 20 meter beam. Therefore this beam was an approximate half-wave above ground, and its operation was perfectly satisfactory in both DX chasing and contests. Three feet over the 20 I mounted the 3-element 15, and four feet over that was the 4-element 10, making a total of 42 feet to the top of the mast. If your antenna is going to be a quad, this height will be quite satisfactory, even more so because of the quad's well known ability to perform beautifully at the lower elevations.

With due consideration for safety, the legs of the tower should be at least 2 x 4, and by referring to the overall diagram of the tower, you'll see that the lower part of each leg is actually made of two 2 x 4's with spacer blocks spiked between them. The upper leg is a single 2 x 4 which is inserted about 4 feet between the bottom two. This joint is rigidly fastened together with husky bolts. This is a good time to point out one construction feature of this tower; that is the use of bolts instead of nails. The cost is higher, and probably nails would be satisfactory if you use the newer spiral type, but I personally prefer bolts so the choice is yours. The wood sections should also be given a good coat of exterior primer and one or two coats of exterior house paint before they are assembled. Aluminum paint is also very good, and I would suggest buying it in the gallon size. It's much cheaper this way, and you'll certainly use it all!

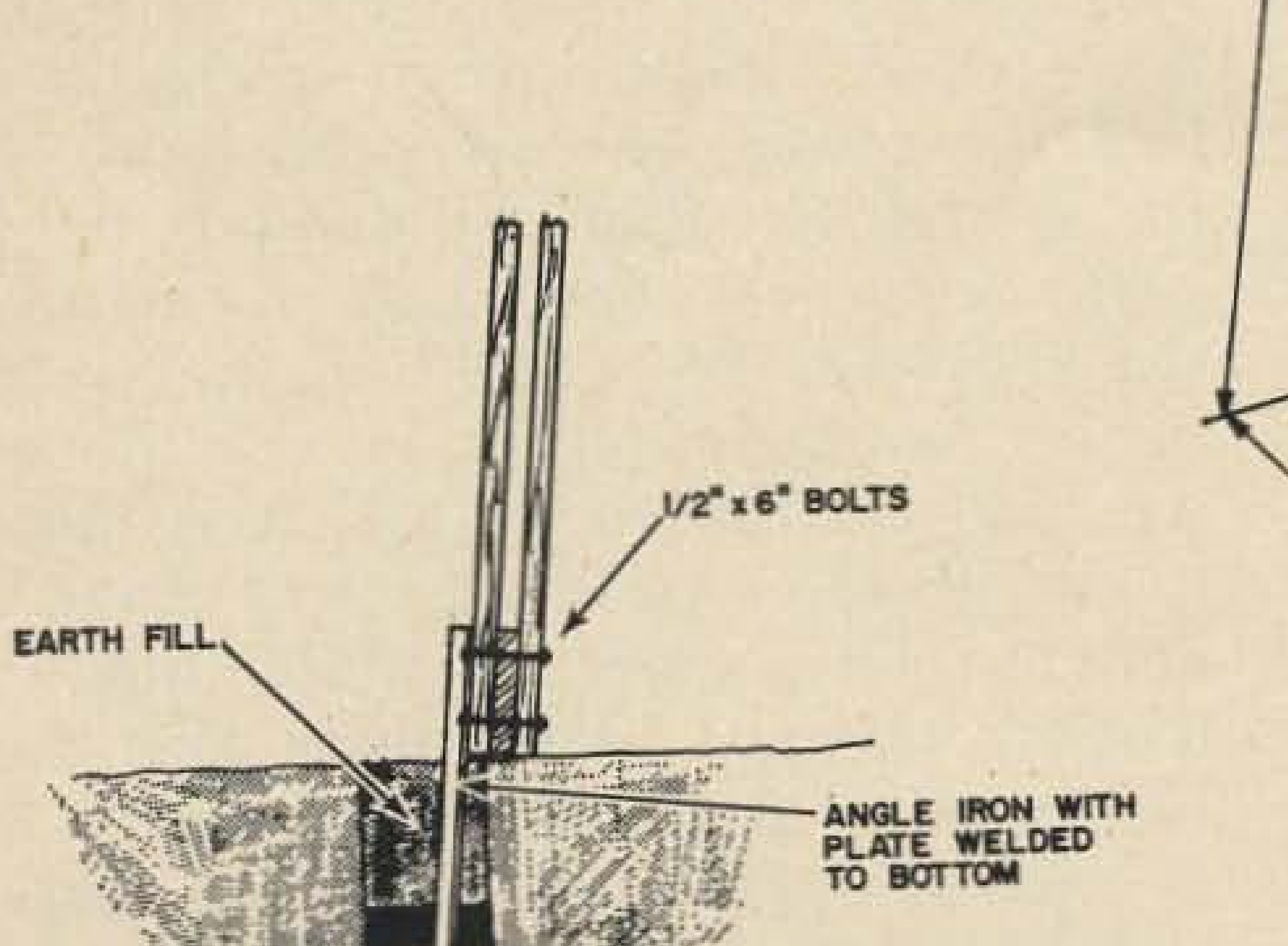
In selecting the wood, the only proper way is to go to the lumber yard and keep



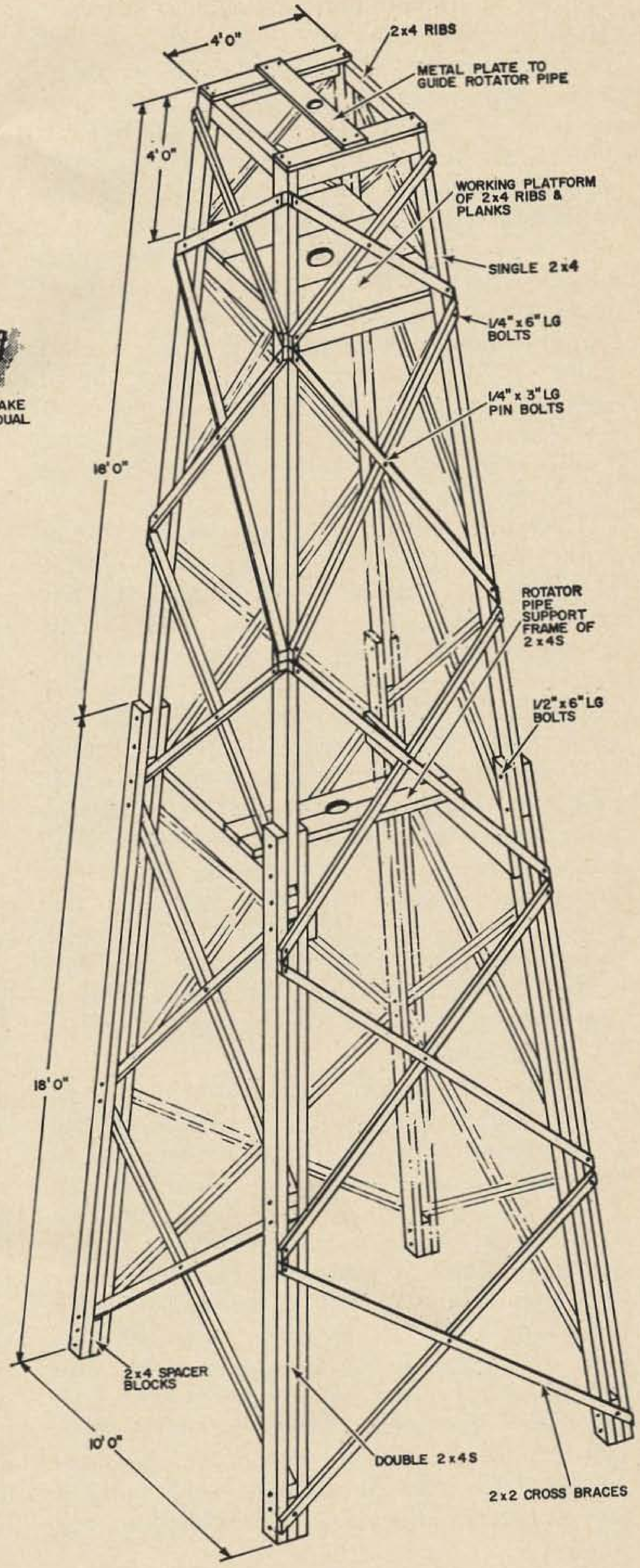

(2)




(3)




(4)




(1)

*Composite details of VE1TG Tower. See Text* digging until you find just what you want. Have a chat with the yard boss and he'll certainly assist you to find the proper materials. Buy a good grade and make sure each piece is as knot-free as possible. If you don't know much about comparative strengths, ask for advice, and then buy the strongest type available. However, if you're in a real small yard and there's not much choice, don't give up. My tower was built from plain ordinary spruce and it's been standing for six years in some of the wildest gales you'll ever see, and it hasn't shown any signs of stress up to now. However, I did take care to give it lots of paint and I also made sure I had very few knots in any of the legs and braces.

Everyone has ideas about constructing a thing like a tower, but I found it easiest to build two complete sides, each lying flat on the ground. For one thing, this makes it much easier to get the dimensions right and to end up with both sides being the same. The actual construction will be pretty clear from **Fig. 1**, with the cross braces all being made from 2 x 2 stock. You will find that this 2 x 2 will give an extremely rigid frame, but it is almost mandatory that bolts be used rather than nails. When the braces are crossed over themselves in the center, there is considerable strain placed upon the ends of each brace, and nails will almost certainly pull out of the legs. This is especially true of the shorter braces at the top of the tower.

I made the tower with a top width of 4 feet, and a base width of 10 feet, giving an approximate 3-to-1 ratio between height and base; or in other words, 16 square feet on top and 100 square feet on the bottom. This caused some of my friends to feel it would be rather "spraddle-legged" but the final appearance is very pleasing. The most important thing to remember is that this ratio makes the tower extremely stable and eliminates the need for guy wires. This one has taken hurricane winds of more than 100 m.p.h. on quite a number of occasions without any sign of damage, and without the slightest indication of becoming unsteady.

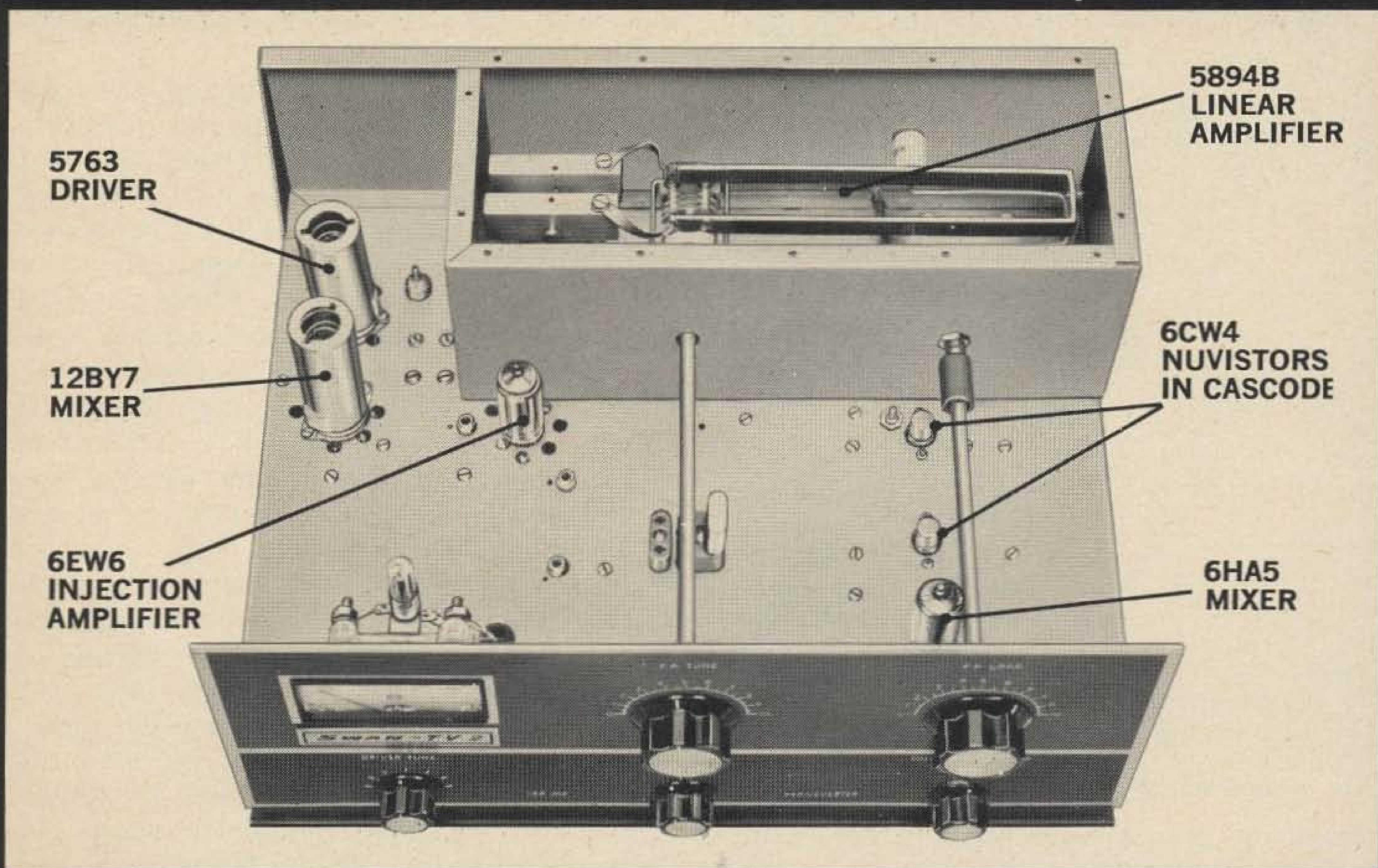
After the first two sides are finished, some thought should be given to erection before proceeding further. If yard space is very limited, it may be necessary to carry on and build the whole tower in one piece. If so, the same general methods can be used for the other sides, since all that will be required is to fit in the cross-braces. You must be careful that the dimensions are correct or the end result could be lop-sided, but by taking a little time and measuring carefully you should have no problem. The platform can be built into the tower, about 4 or 5 feet down from the top. This allows you to eventually stand safely *inside* the tower with a good solid frame all around you—quite an important feature if you're nervous about height or want to persuade some friend to come "topside" with you.

If you have built the whole tower in one piece, erection can be done quite easily. The only equipment needed is a block and tackle, a couple of pieces of 2 x 4 and a friend or two to give a helping hand. If you can get a car into position to pull straight on the tower, even the tackle can be eliminated. See **Fig. 2** for a suggested method of carrying this out. As the tower passes the "point of no return" there should be a man at the rear letting out the back rope carefully so the tower will not come down with a real bang. Probably no harm would be done, but why take chances?

The second method of completing the tower is shown in **Fig. 3**. The two completed sides are laid out end to end, and side braces of scrap wood are added to the top ends in such a way as to form a crude hinge. The braces must be fastened to the legs by means of bolts, and the bolt holes must be large enough for them to act as swivel pins. Now the center of the whole affair is raised by means of a step ladder or even just spare pieces of lumber acting as props. Now four men can grasp the legs and "walk" them inward—with the result that the tower rises smoothly until it is at the desired elevation. By marking the proper position for the four legs ahead of time, the legs can be walked in and set down in just the right place. This is the method we used for this tower and it is quite easy to do. Total erection time was about fifteen minutes. Of course when the tower is up it must be temporarily guyed as it has only two legs and is a little shaky. This condition is only of short duration if you make sure to have several pieces of the 2 x 2 cross brace material all ready at hand. As soon as the tower is vertical, go to work and install the cross braces, working from the ground up, and in the space of a few hours you can easily have at least half of the

# 2 METER SINGLE SIDEBAND

## 144-148 mc 240 WATTS P.E.P. INPUT




# THE NEW SWAN TV-2 TRANSVERTER

## A receiving and transmitting converter for the 2 meter band, designed to operate with Swan Transceivers, models 250, 350, 350-C, 400, 500, and 500C.

**SPECIFICATIONS:**

14 mc intermediate frequency is standard. Thus, when operating the Transceiver from 14 to 14.5 mc, the Transverter functions from 144 to 144.5 mc. Additional crystals may be purchased and switched in for other portions of the 2 meter band, such as 144.5-145, and 145 to 145.5 mc. Three crystal positions are available.

Alternately, the TV-2 Transverter may be ordered for an I.F. in the 21, 28 or 50 mc bands, if desired. Of course, for use with a Swan 250 six meter transceiver, the Transverter must be ordered for 50 mc. Otherwise, the standard 14 mc I.F. is recommended since bandspread and frequency readout will then be optimum. The Transverter can easily be adjusted in the field for a different I.F. range, if required.

A 5894 B Power Amplifier provides a PEP input rating of 240 watts with voice modulation. CW input rating is 180 watts, and AM input is 75 watts.

Receiver noise figure is better than 3 db, provided by a pair of 6CW4 nuvistors in cascode.

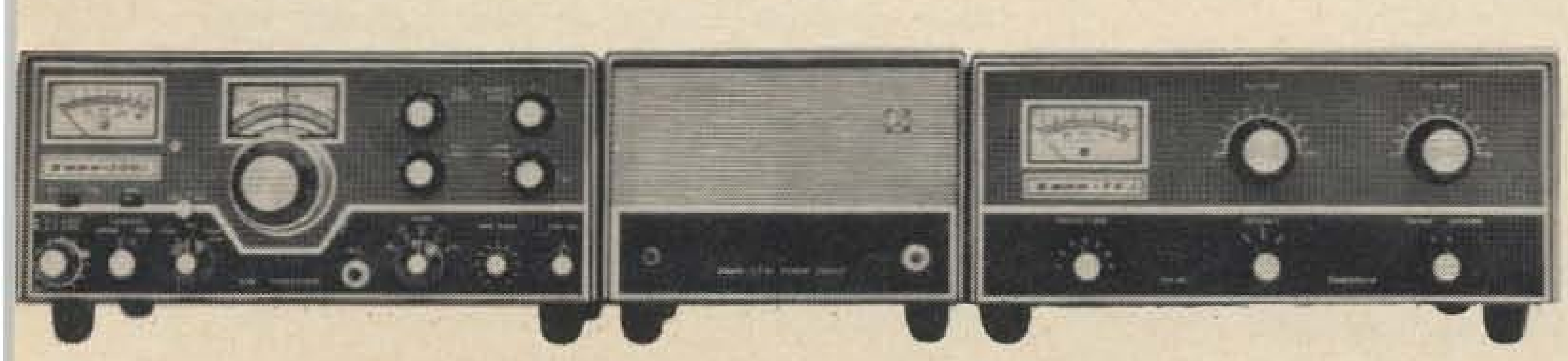
Only a Swan Transceiver and Swan AC power supply, Model 117-XC, are required. The power supply plugs into the Transverter, and the Transverter in turn plugs into the Transceiver. Internal connections automatically reduce the power input to the Transceiver to the required level.

Tube complement: 5894B Pwr. Amp., 5763 Driver, 12BY7 Transmit Mixer, 2N706 crystal osc., 6EW6 Injection Amp., 6CW4 1st rec. amp., 6CW4 2nd rec. amp. in cascode, 6HA5 rec. mixer.

The Swan TV-2 may also be operated with other transceivers when proper interconnections and voltages are provided. A separate Swan 117-XC power supply will most likely be required.

Dimensions: 13 in. wide, 5½ in. high, by 11 in. deep. Weight: 13 lbs.

**$265**

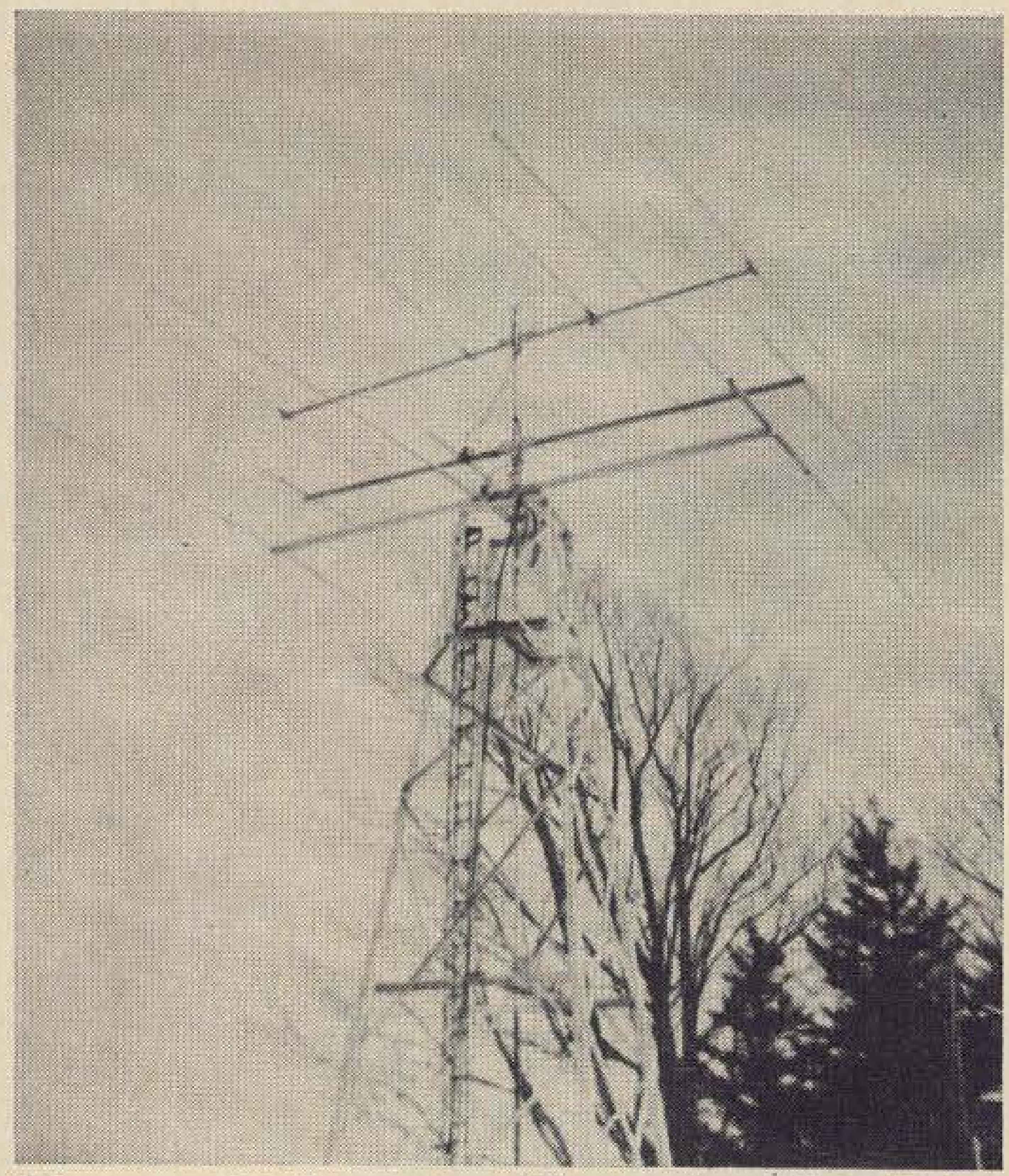


MODEL 250 ...... $325
MODEL 350C ..... 420
MODEL 500C ..... 520

MODEL 117-XC
AC POWER SUPPLY .. $105

MODEL TV-2
144 mc TRANSVERTER

**SWAN**
ELECTRONICS
Oceanside, California
A SUBSIDIARY OF CUBIC CORP.



*The completed tower with antennas installed.*

remaining braces securely in place. In fact if you can persuade the friends to stick around after the raising procedure you can probably get the whole thing finished by sundown. This is what I did, with the aid of four pals and supplemented by the XYL's sandwiches and a few gallons of good old Nova Scotia cider!

With all the bracing completed, all that remains is to build the working platform into the top. In the main diagram **Fig. 1,** you'll notice a hole is cut in this platform for the rotator pipe to pass through. About 16 feet up from the ground is another frame made from a couple of pieces of 2 x 4, also with a hole cut in it. This was necessary because I started out using a very large rotator made from a surplus D. F. antenna mount, and the thing was so big and heavy I had to leave it on the ground and run the pipe all the way up. Since the usual ham rotator won't be this big, it will normally be best to mount it up near the top and the platform can become an excellent mounting base for rotator and any extra control box which may be necessary. There is enough room to pull up a folding chair and work away in real comfort!

The metal plate shown at the very top is best made from a heavy piece of aluminum but iron will do if you give it a couple of good heavy coats of rust-proofing and paint. There should be either a sleeve or thrust bearing installed at this point but the exact type will depend upon your own rotator-pipe combination.

With your tower now completed, the footings should be considered. In my own case I found the thing so stable I used only old pieces of angle iron driven into the ground and bolted to the legs, but a better anchor can be easily made by digging the four holes and using old oil cans (from the local garage) filled with sand and capped with cement. Before filling them, make up a "T" from a couple of pieces of angle iron, bolt this to the mast leg, and let the angle iron act as a foot at the bottom of the can. Using sand is cheap and the top few inches of the can is easily capped with a bag of ready-mix concrete. Then tamp down the earth firmly over the whole affair. If this sounds pretty confusing, refer to **Fig. 4.**

One thing is still missing—an easy way to climb the thing. Well of course the easiest way is to construct a ladder and mount it on one side of the tower. Four lengths of 2 x 4 will be required and the rungs can be made from the left-over scraps of 2 x 2, or you can use short lengths of scrap pipe. My own method was to use two fifteen foot lengths of TV tower of the type that has horizontal cross braces on one side. This was mounted inside the tower and proved to be ideal for the purpose. Of course this is really a waste of money unless you happen to have the stuff already laying around so in the interests of economy I'd suggest the wooden ladder.

As a last "selling point" on the strength of this tower, after it was in use for about two years, it was taken down in one piece, loaded onto a trailer, pulled down the highway to a new QTH and put back up where it is still standing as solidly as ever. Total cost of the tower was approximately $55.00 including the paint and considering all its features of convenience, safety and load-bearing ability I think you'll find it hard to beat. . . . VE1TG

---

# RELIABILITY QUALITY VALUE

## VAN 410C
## ULL COVERAGE
## XTERNAL VFO

Model 410C Frequency Control
t is designed for full coverage
30, 40, 20, 15 and 10 meters. It
ntended for fixed station opera-
and plugs directly into Model
C. It may also be used with
del 350C. Eight ranges, 500 kc
h, 5 kc calibration.

**$115**

## UAL VFO ADAPTOR

vides for the addition of second
for separate control of trans-
and receive frequencies. Plugs
ectly into Model 500C and may
be used with Model 350C and
er Swan transceivers.

**ODEL 22 . . . . . $25**

## ARS OSCILLATOR

e crystal controlled channels
h vernier frequency control.
gs directly into Model 500C and
y also be used with Model 350C
d other Swan transceivers.

**ODEL 405X**
**ess crystals) . . $45**

**Be sure to visit**
**your Swan dealer soon.**

## SWAN 500C
## SSB-AM-CW
## TRANSCEIVER

**Five band, 520 watts for home station, mobile and portable operation.**

The new model 500C is the latest evolutionary development of a basic well proven design philosophy. It offers greater power and additional features for even more operator enjoyment. Using a pair of the new heavy duty RCA 6LQ6 tetrodes, the final amplifier operates with increased efficiency and power output on all bands. PEP input rating of the 500C is conservatively 520 watts. Actually an average pair of 6LQ6's reach a peak input of over 570 watts before flattopping!

The 500C retains the same superior selectivity for which Swan transceivers are noted. The filter is made especially for us by C-F Networks, and with a shape factor of 1.7 and ultimate rejection of more than 100 db, it is the finest filter being offered in any transceiver today.

For the CW operator the 500C includes a built-in sidetone monitor, and by installing the Swan VOX Accessory (VX-2) you will have break in CW operation.

Voice quality, performance and reliability are in the Swan tradition of being second to none.

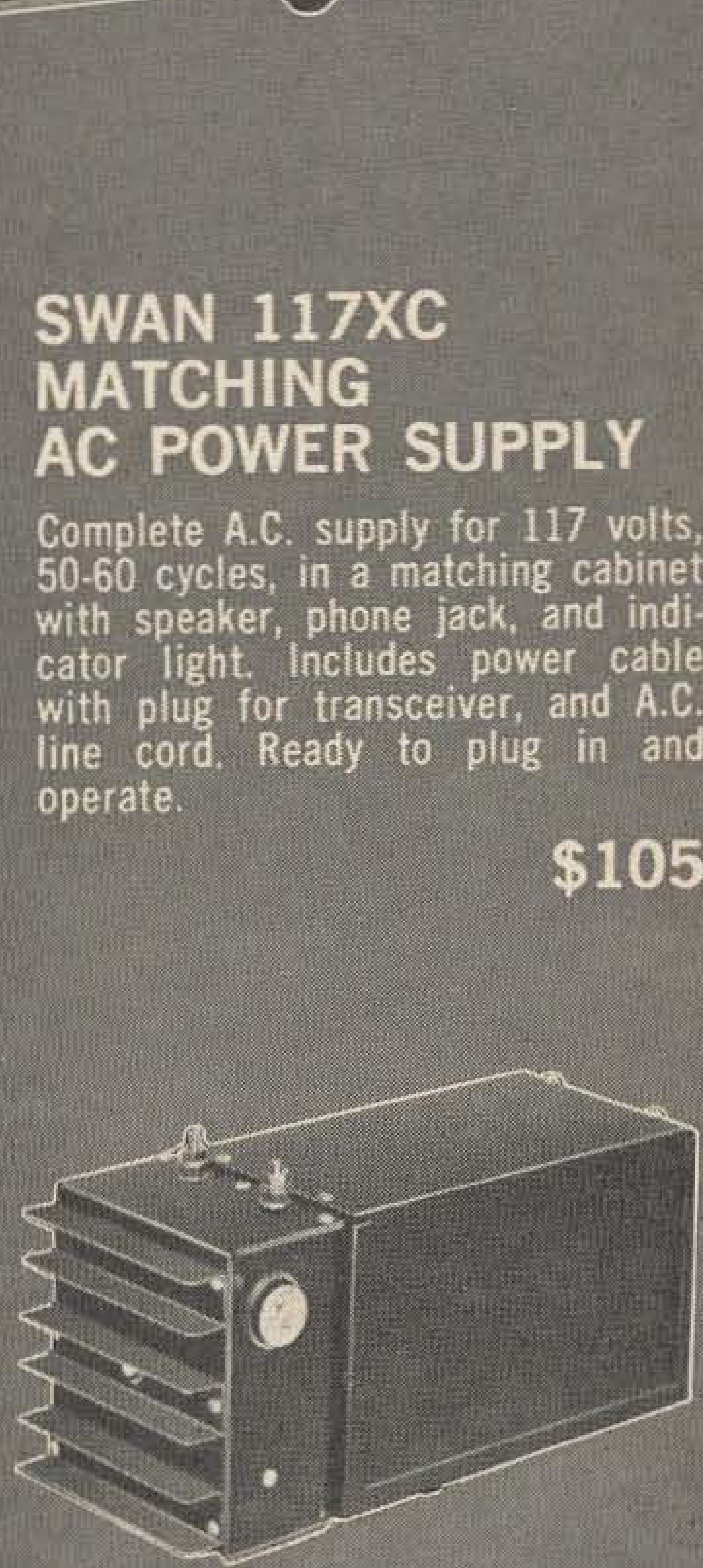
**$520**

SWAN
ELECTRONICS
OCEANSIDE, CALIFORNIA
*A Subsidiary of Cubic Corp*

## SWAN 117XC
## MATCHING
## AC POWER SUPPLY

Complete A.C. supply for 117 volts, 50-60 cycles, in a matching cabinet with speaker, phone jack, and indicator light. Includes power cable with plug for transceiver, and A.C. line cord. Ready to plug in and operate.

**$105**



## SWAN 14-117
## 12 VOLT DC SUPPLY

Complete D.C. supply for 12 volt mobile or portable operation. Includes cables, plugs, and fuses. Will also operate from 117 volt A.C. by detaching the D.C. module & plugging in 117 volt line cord. Negative ground standard. Positive ground available on special order.

**$130**

**SWAN SPEAKS YOUR LANGUAGE**

**ASK THE HAM WHO OWNS ONE**

# Why Not a Tilting Tower?

Norm Watson W6DL
5501 Via del Valle
Torrance, California 90505

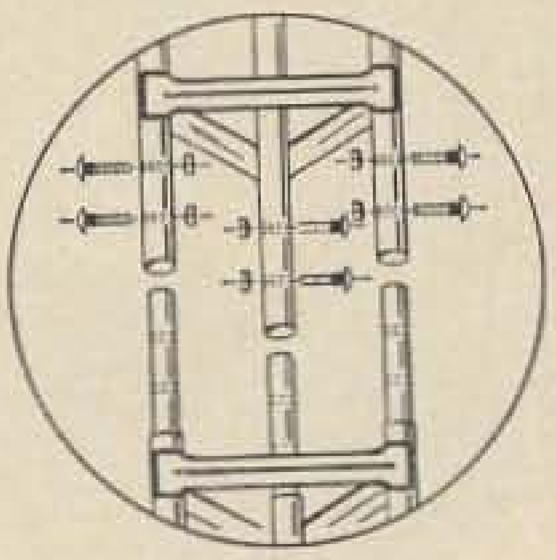


FIGURE 1

Fig. 1. Method of joining sections together.

This article describes a sixty-five foot tilting tower made up of commercial TV tower sections and two home brew tilting sections which are hinged together. Tilting of the upper portion of the tower is accomplished by means of a twenty foot cantilever boom which is attached to the upper tilting section and controlled by means of a boat winch attached to the tower at ground working level, with the winch cable secured to the lower end of the boom. The tower can be tilted down or raised in a few minutes and provides safe access to the rotor or beam working at ground level or from a moderate height step ladder. The idea for this type of tower is not new; however, the particular tower described here is not commercially available. It was built by the author for $260.00, included all costs for galvanizing, winch, shipment of purchased tower sections, etc.

The tower sections used are manufactured by Reference 1 and are the model 500 Super Kwick-Climb, hot dip galvanized units. These triangular sections are ten feet long and when two sections are bolted together, 5½ inches of tower height is lost due to overlap. Construction is of 1¼ O.D. x 16 ga. wall high strength tubing with cross braces spaced on 13″ centers. Method of joining sections is shown in **Fig. 1.** Sections available are shown in **Fig. 2.** The tower pictured utilizes two F sections and one each of sections A, C, D, and E for the tower proper and one each of sections A and B for the boom. Two tilting sections must be fabricated and interposed between sections E and F at 20 feet above ground.

As shown by the close-up photographs, the lower tilting section which was made 2′ long (but which can be made longer if a higher tower is desired) is constructed of three pieces of 1¼ inch O.D. x 16 gauge wall seamless steel tubing welded to an angle iron framework made up of 2 x 2 x 3/16 inch steel angle iron. Three pieces of 1 x 1 x ⅛ inch angle iron are used as horizontal braces and three pieces of 1 x 1 x ⅛inch angle are welded between the tubing and the 2 x 2 x 3/16 inch angle framework as diagonal braces. The three tubing legs of the lower tilting section are drilled to match the holes in the F tower section with which it mates. The angle iron framework was clamped together and welded first. The three 2′ long legs were then bolted in place on the F tower section and welded to the angle iron framework. The 1 x 1 inch angle braces were welded in place last. When welding is finished it is advisable to mark one of the mating tower legs with tape, or in some other manner, for ease of later alignment when the sections are reassembled.

The upper tilting section is a 2 x 2 x 3/16 inch angle framework welded to three five foot lengths of 1¼ inch O.D. x 16 gauge wall seamless steel tubing. Three pieces of ¾″ black pipe 10″ long are inserted three inches into the upper end of the 1¼ inch tubing and plug and seam welded in place. The ¾ inch pipe fits inside the lower end of the E tower section with which it mates and two ⅜ inch holes are drilled in each piece of ¾ inch pipe to mate with the holes


SECTION 500F 20" x 10' | SECTION 500E 16"-20" | SECTION 500D 16" | SECTION 500C 11½"-16" | SECTION 500B 11½" | SECTION 500A 11½"

Fig. 2. Typical TV tower sections available.

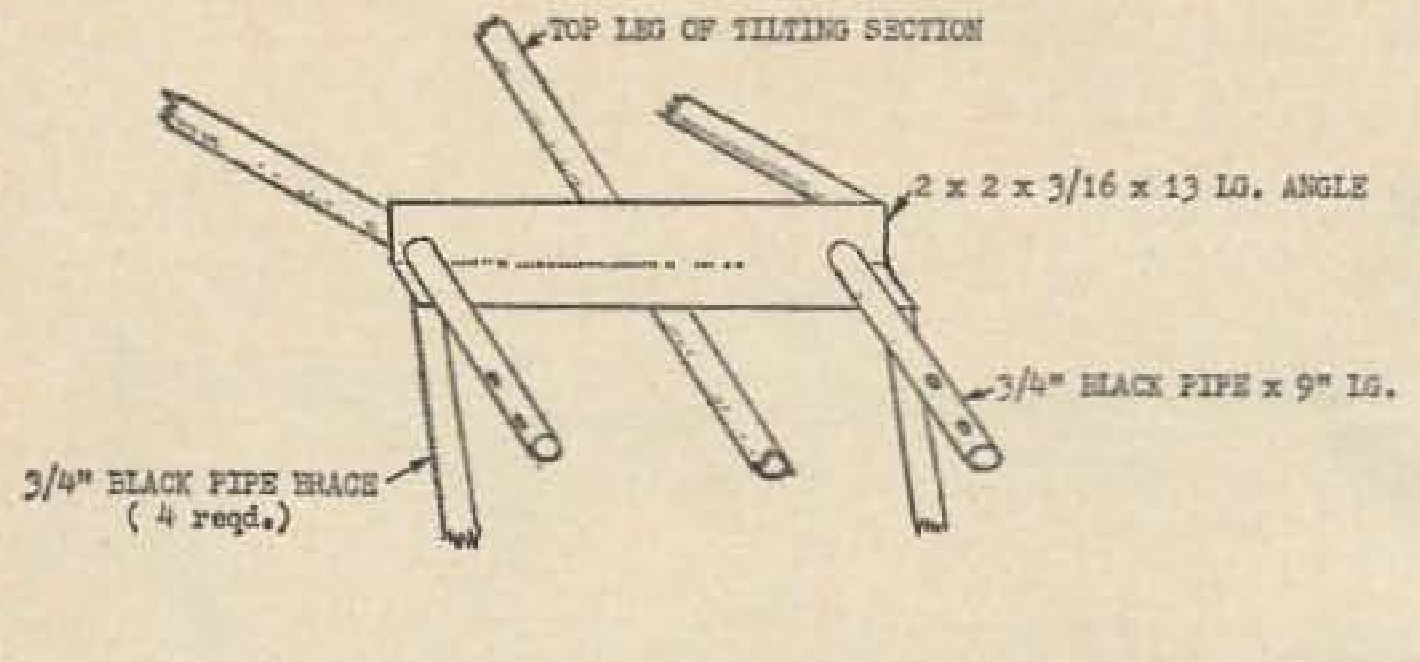



FIGURE 3

Fig. 3. The 2X2 cross angle is braced to the lower tilting section legs by four pieces of ¾ inch pipe.

in the E tower section. The holes in the pipe are drilled prior to welding the pipe to the 1¼ inch tubing.

1½ x 1½ x ⅛ inch angle is used as cross bracing on the upper tilting section. Twelve 19⅝ inch long pieces are required, spaced at approximately equal intervals along the 5 foot length of the tubing. The sequence of assembly of the upper tilting section members is as follows: As a first step the 2 x 2 angle upper framework is first clamped to the 2 x 2 angle framework of the lower tilting section for alignment since these two sections butt together when the tower is in the erect position. The four angle iron members which form the upper framework are then welded together. The three pieces of ¾ inch pipe are next welded into the 1¼ inch tubing (5 foot long) legs being careful to end up with three legs of the same length (5′ - 7″ lg.). One ¼″ diameter plug weld is used on each leg to hold the pipe in place in the tubing and then a weld bead is run around the circumference of the end of the tubing, thus joining it to the pipe. The three legs are next bolted to the E tower section and clamped to the 2 x 2 angle iron framework. The F tower section should be bolted to the lower tilting section and the entire assembly consisting of the F tower section, lower tilting section, upper tilting section and E tower section blocked up into alignment for tower straightness before welding the upper tilting section legs to the 2 x 2 angle framework. A simple and yet effective means of checking straightness is to stretch a piece of string from one end of the assembly to the other on all three faces of the tower section setup. After aligning, butt tack weld the 1¼ diameter legs to the 2 x 2 angle framework. With the setup still in place, tack weld the 12 horizontal braces in place on the 1¼ tubing legs. The E and F tower sections used for alignment can now be removed and the upper tilting section moved around for easiest finish welding positions.

The boom used for tilting the tower consists of one A and one B tower section bolted together. The B section of the boom attaches to the tilting section at two points. The upper end of the boom bolts to two 9″ long pieces of ¾ inch pipe which are shown in **Fig. 3** welded to a 2 x 2 cross angle which is in turn welded to the tilting section leg opposite the hinged side of the tilting secton. The 2 x 2 cross angle is braced to the lower tilting section legs by four pieces of ¾ inch pipe, shown in **Fig. 3.**

The boom is fastened with U bolts to the 2 x 2 angle framework of the tilting section as depicted in **Fig. 4.** Two clamps as shown in **Fig. 4** are required. The 1¼ x 1¼ angles space the boom out from the tower so that the winch can be attached to the lower part of the tower adjacent to the end of the boom. In setting up to weld the boom supports to the tilting section it is suggested that the A and B boom sections be bolted together and blocked up in place on the tilting section. The prefabricated clamps of **Fig. 4** are set in place and the boom aligned with the lower tilting section and F tower section before tack welding the boom supports. With tack welding complete the boom can be removed and welding completed in the easiest positions.

The B boom section as purchased is not strong enough in bending for use as a boom member and must be reinforced by means of a piece of ¾ inch black pipe, ¼ x 1 steel spacers and five ⅜ diameter tension members as shown in **Fig. 5.** As shown, the ¾ pipe extends across the A and B section joint and is bolted to the A section of the boom by two ⅜ inch bolts. One loose piece of 1¼ O.D. x 16 gauge tubing completes the

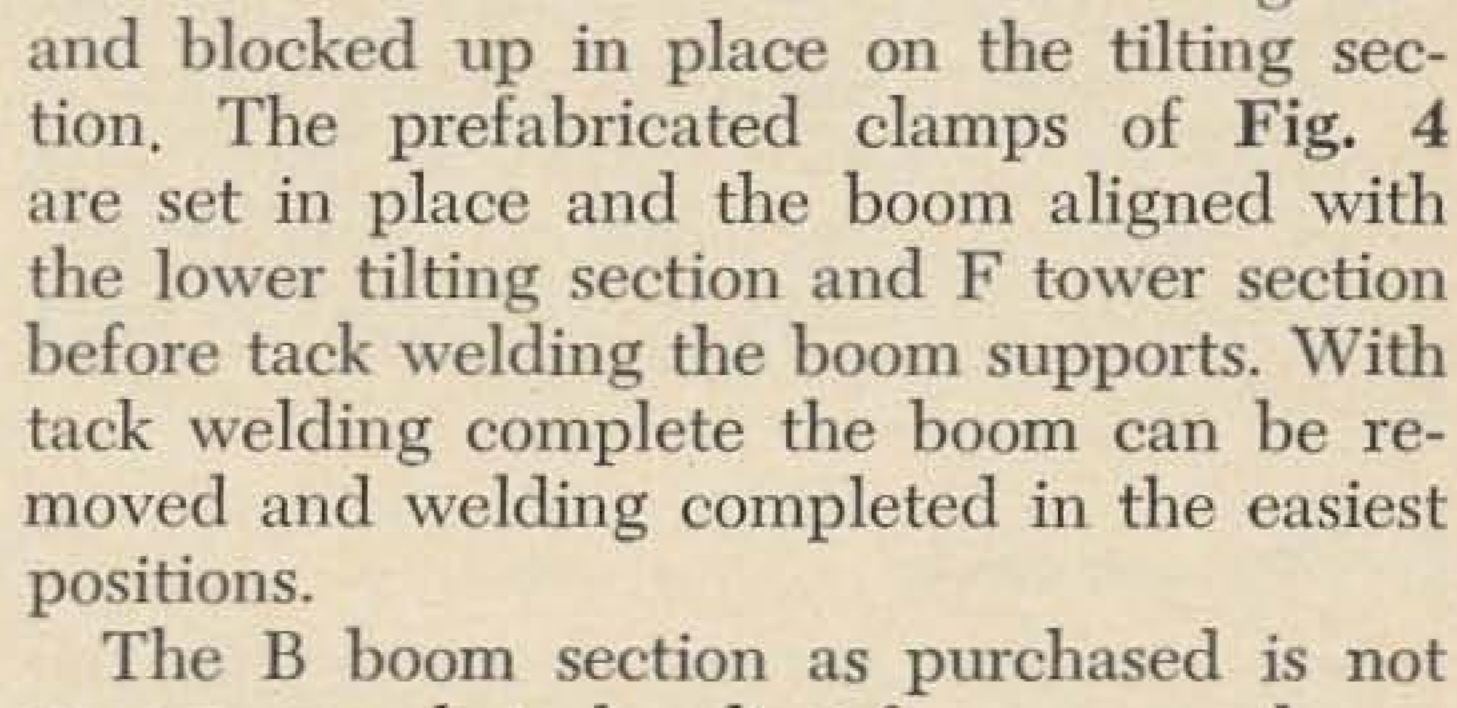



FIGURE 4

Fig. 4. The boom is fastened with U bolts to the angle framework of the tilting section.

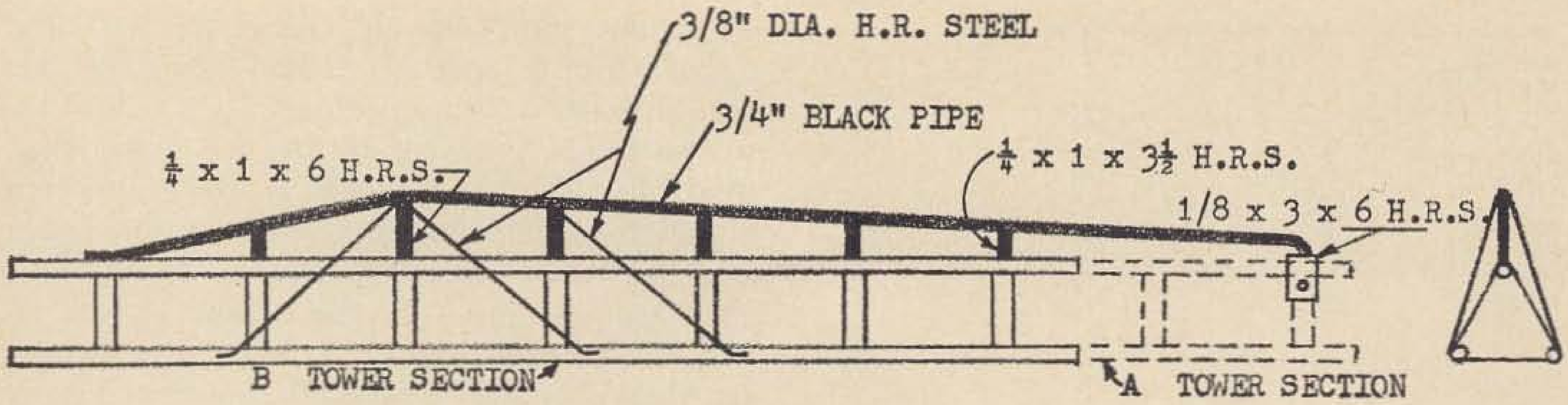



FIGURE 5

Fig. 5. Reinforcing the boom for greater strength.

boom. This tube bolts between the end of the B section and the E tower section to serve as a tension member as can be seen in **Fig. 7.**

Two hinges are welded to the front face of the 2 x 2 angle frameworks of the upper and lower tilting sections. One hinge is shown in **Fig. 6.** A ⅝ diameter bolt serves as a hingepin.

A Sears Roebuck double rachet boat winch costing $5.99 is adequate for tilting the tower. The winch is bolted to a plate which is fastened to the tower leg by U bolts. The winch rope is ⅜ x 30 foot long polyethylene. 3/16 diameter steel winch cable can be used alternately.

## Erection of tower

Select a site having clearance for the tower and boom to raise and lower. This may be a problem, what with telephone wires and trees. The author's tower is set next to a ranch style house and the tower lowers across the roof so that one stands on the roof to work on the antenna. The tower should be set in a concrete base a minimum of 24 x 24 x 36 inches deep. Set up two F sections and the lower tilting section bolted together and block in place over the base hole. Set a plumb bob up, level the tower and leave the plumb bob in place while the concrete is poured to make sure the tower stays plumb. Let concrete cure for a couple of days and then set the guy wires. Use either 2′ x 2′ x 1′ deep concrete blocks set 3′ below ground level for guy anchors or 6″ screw type anchors such as are available from Sears Roebuck & Co. Tension guys to equal pretension of about 300 lbs. Proceed with erection of remainder of tower and boom using either extension ladders or a gin pole. A gin pole is a simple pipe and pulley arrangement which can be clamped to the tower section already erected so that the next tower section can be hoisted up to the man who is setting the sections. Use a safety belt in standing directly on the tower during erection. Once the upper tilting section is in place you can alternately attach a tower section and a boom section while tilting the tower back and forth. This tilting procedure limits tower climbing to the twenty foot level, which helps the safety problem.

## Guying

The 65′ tower as described herein will safely withstand 87 mph winds carrying an antenna load such as a small three element Yagi-Uda or 2 section Quad beam when guyed with three ¼-inch diameter high strength guy wires attached to the tower just below the tilting section and anchored to the ground 22 feet out from the tower. (No comment is offered relative to survival

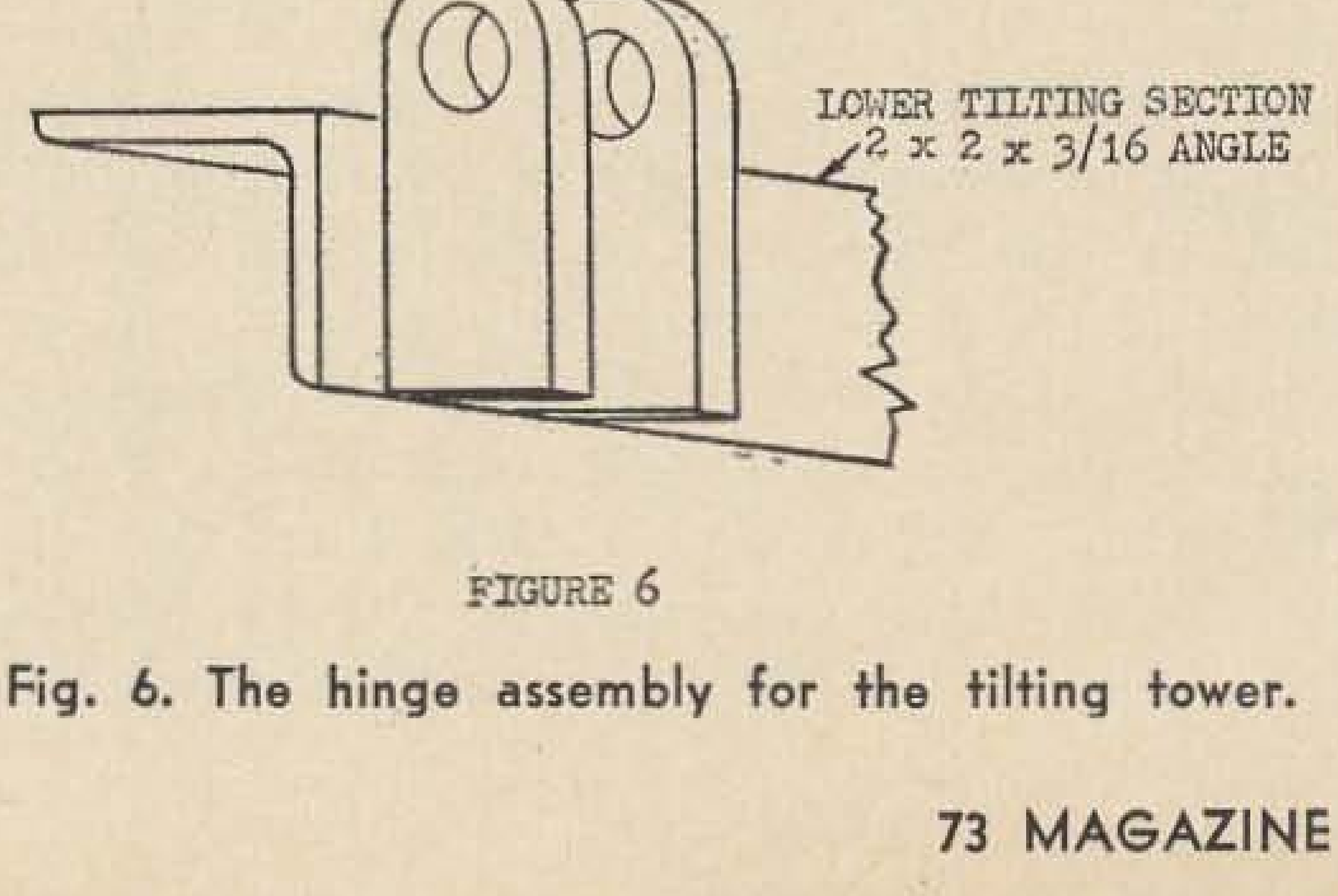
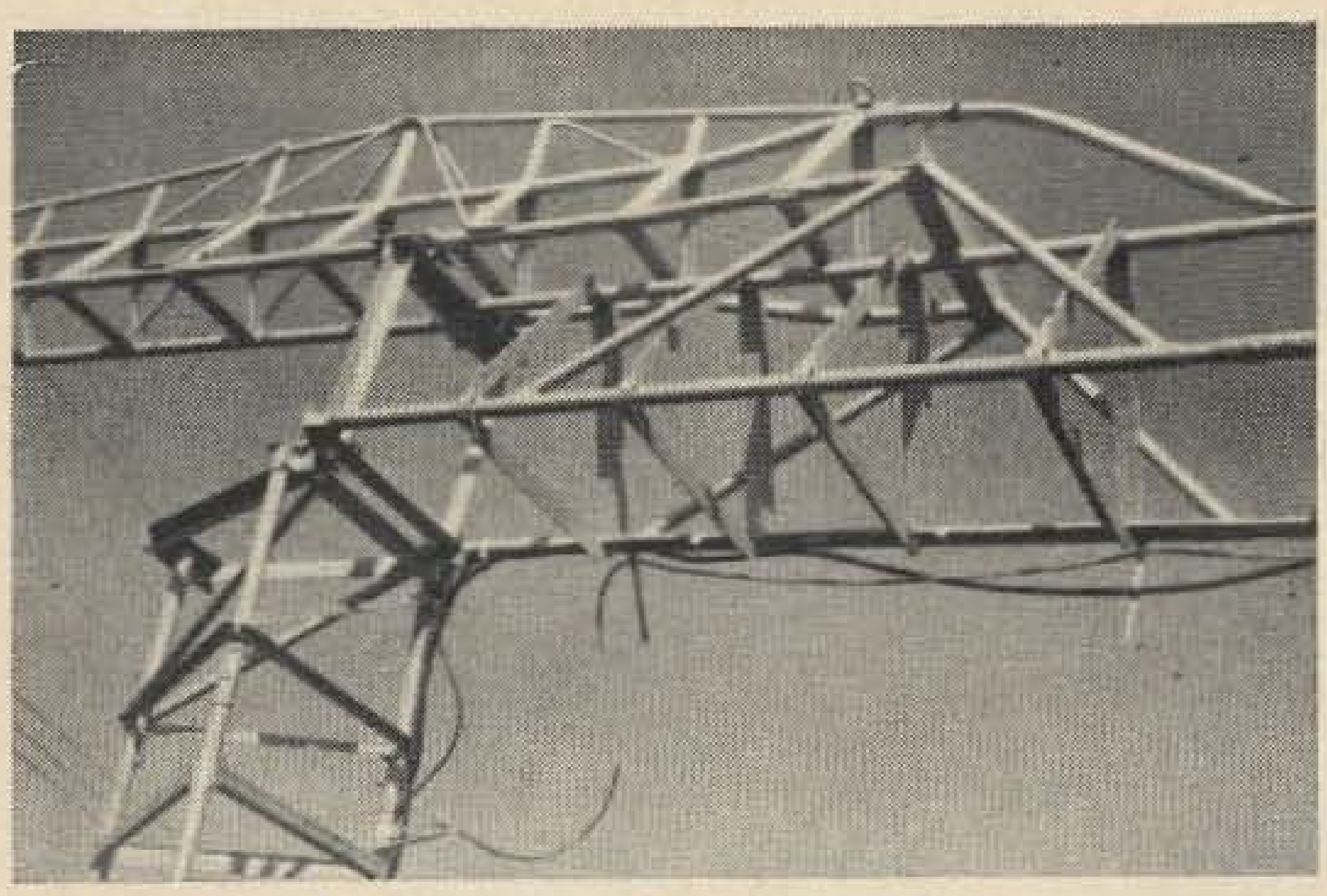


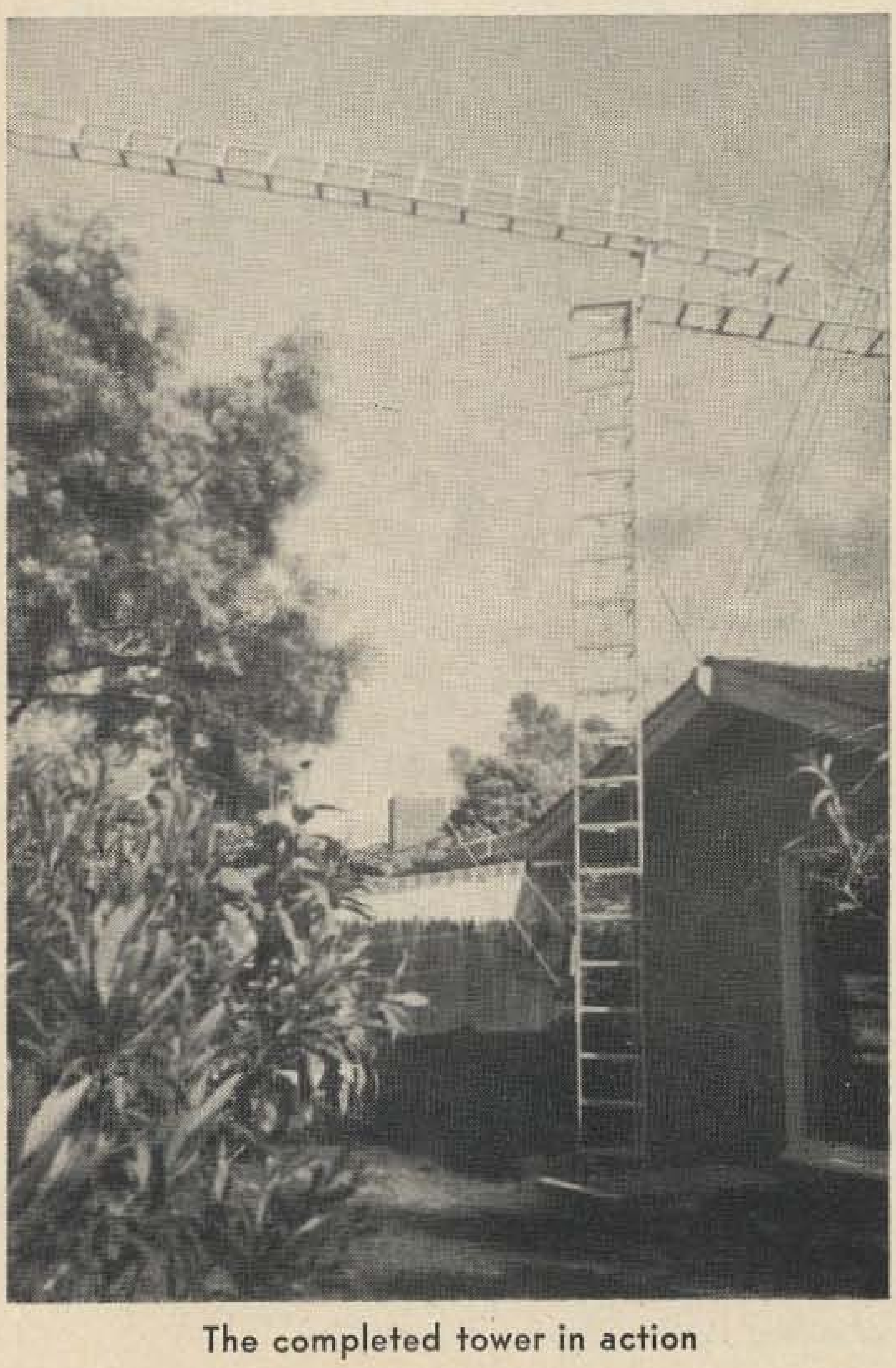

FIGURE 6

Fig. 6. The hinge assembly for the tilting tower.



Close-up of hinged section

of the beams.) If a large beam such as a four section quad (9 sq. ft. wind load area) is used, three ¼-inch diameter high strength guy wires attached 50′ above ground and at least 25′ away from the base of the tower at ground level will be adequate for 87 mph winds. (An 87 mph wind imposes a 30 pound per square foot load on the tower and antenna.) However, since the tower can be tilted down in a few minutes, it is logical to do so if hurricane velocity winds are anticipated. In a reasonable amateur installation where the tower is tilted down during



The completed tower in action

severe wind storms, this tower carrying a 9 square foot antenna wind load and guyed with three ¼ inch diameter high strength guy wires attached just below the tilting section is adequate for 65 mph winds.

## Welding

If you like to build, it is recommended that you buy one of the low cost arc welding units on the market, learn to weld, and do your own set up and welding on your tower. This was the author's method. With the contact rods available today, anyone can learn to run a strong weld bead in a few weeks of spare time practice. The welding and technique, incidentally, are invaluable in building antennae and many other things. Reference 2 is suggested for the beginner welder. Use 7014 welding rod for all of the tower welds.

Another variety of the tilting tower, which is incidentally stronger than the tower described, is to use three F tower sections below the lower tilting section and one each of the A, C and E sections above the upper tilting section. This has one disadvantage, namely, the end of the boom is now 15 feet above ground level instead of 5.5 feet. With the boom elevated, a pulley can be installed 15 feet above ground on the tower and the winch cable run from the end of the boom over the pulley and straight down the side of the tower to the winch. Still another variation which results in a 76 foot high tower is to build the tower as described, except use three F sections below the tilting section instead of the two F sections used by the author.

One last thought. If this all sounds like too much work and if you will be satisfied with a fixed tower, the Jontz tower is an excellent low cost unit, 60 feet for $141.00.

. . . W6DL

Ref. 1. Jontz Manufacturing Co.
1101 East McKinley Avenue
Mishawaka, Indiana

Ref. 2. *New Lessons in Arc Welding* (The Lincoln Electric Co.; Cleveland 17, Ohio). Price: $1.00

**RENEWAL CODE**

The two numbers under your call on the address label are the expiration code. We have tried to make it simple. The first number is the month that we send you the last copy on your subscription and the second number is the year. 78 would be July 1968, for example.

# A 40 Foot Non-Conductive Sky-Hook

*Paul E. Peterson K7VBQ*
*P.O. Box* 741
*Gila Bend, Arizona* 85337

"A" Frame masts with the necessary guy wires are functional, but require lumber, hardware, and a bit of carpentery skills. . .

TV masts will suffice for Field Day Doublets, but won't pack the weight required for the average Amateur antenna. . .

I enjoy dreaming over pictures of 60 foot tilt-over metal towers. . . *dream,* that is.

Most "Joe Average" types are resourceful and Hams are no exception, have you ever seen a 20 foot piece of half inch waterpipe tied to a treetop with a pulley on the end to raise an 80 Meter dipole?

In the November '65 issue of **73**, Earl Spencer K4FQU described his 80 foot telephone pole installation. It is interesting and serves as a good reference for this article.

Still, 80 foot poles don't grow on trees, so to speak, but there must be enough of the little ones around to equip every ham with at least one.

My problem is twofold. First, my station is located in a trailer park with not much more than room for a trapped vertical and possibly a VHF beam. Second, being a fringe T.V. area, it is almost a necessity to keep below 20 meters as the cleanest rig will block out the weak TV signals.

The only advantage is that every TV receiver must have an external antenna and mast or pole. It isn't too hard to sneak in a ham-band antenna with a little ingenuity.

To get on with it, no station is any better than it's antenna system, and the lower bands get short-changed because of the size required for a good half-wave dipole or quarter-wave vertical without a lot of messy guy wires.

I was fortunate to obtain a like-new utility pole from a friend, with the prime purpose of raising the wife's TV antenna higher for better reception, I told her. Of course I may have harbored a few thoughts for a ham antenna or three!

What can a Ham do with a nice big hunk of free-standing sky-hook? Well. . .

First it has to be brought home, and to say the least, this is no small obstacle. In fact, since it is the first of many, it is the

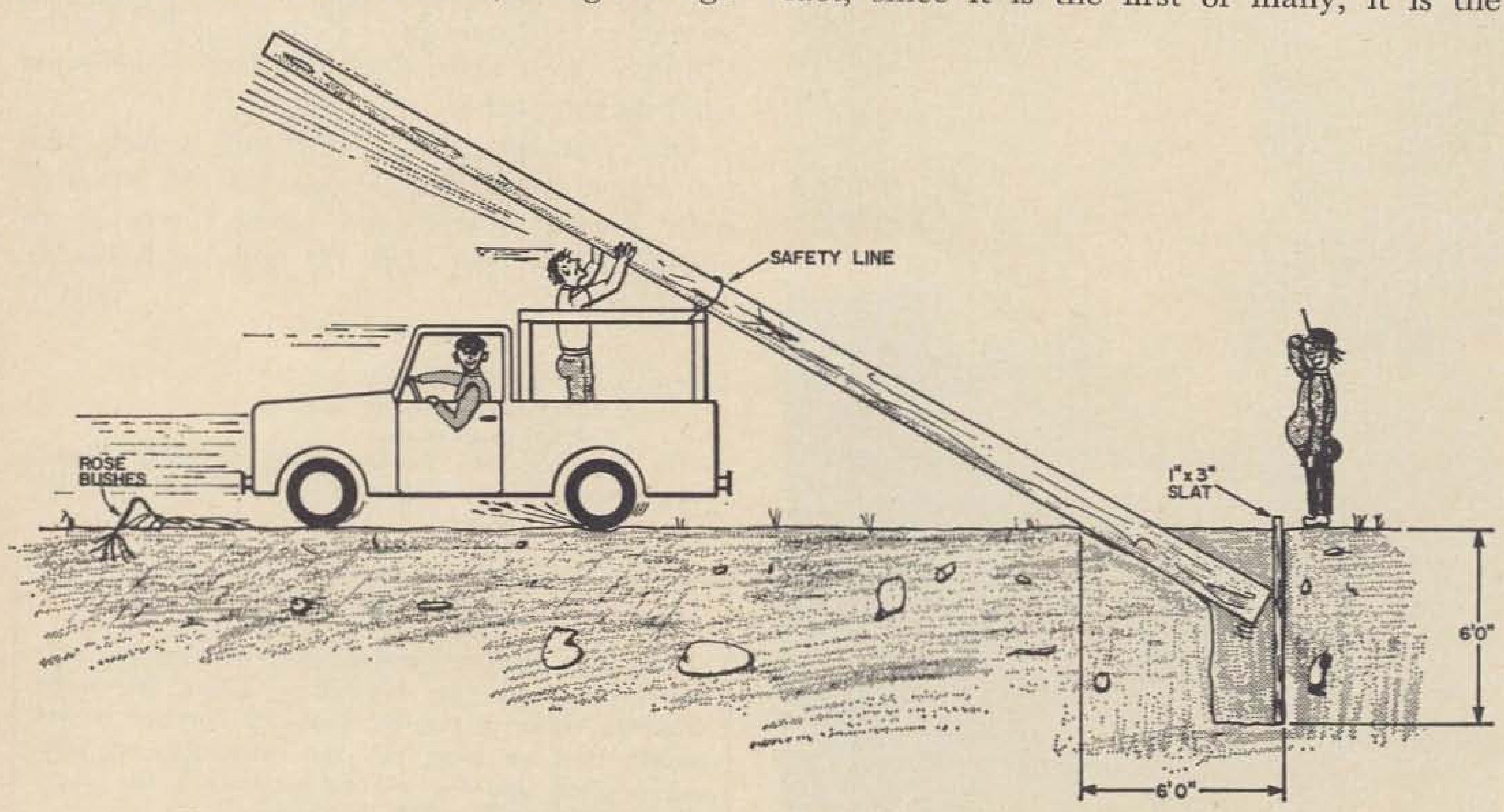



*Fig.* 1. *Easy does it. Actually it is simple. Just make sure the driver is sober!*

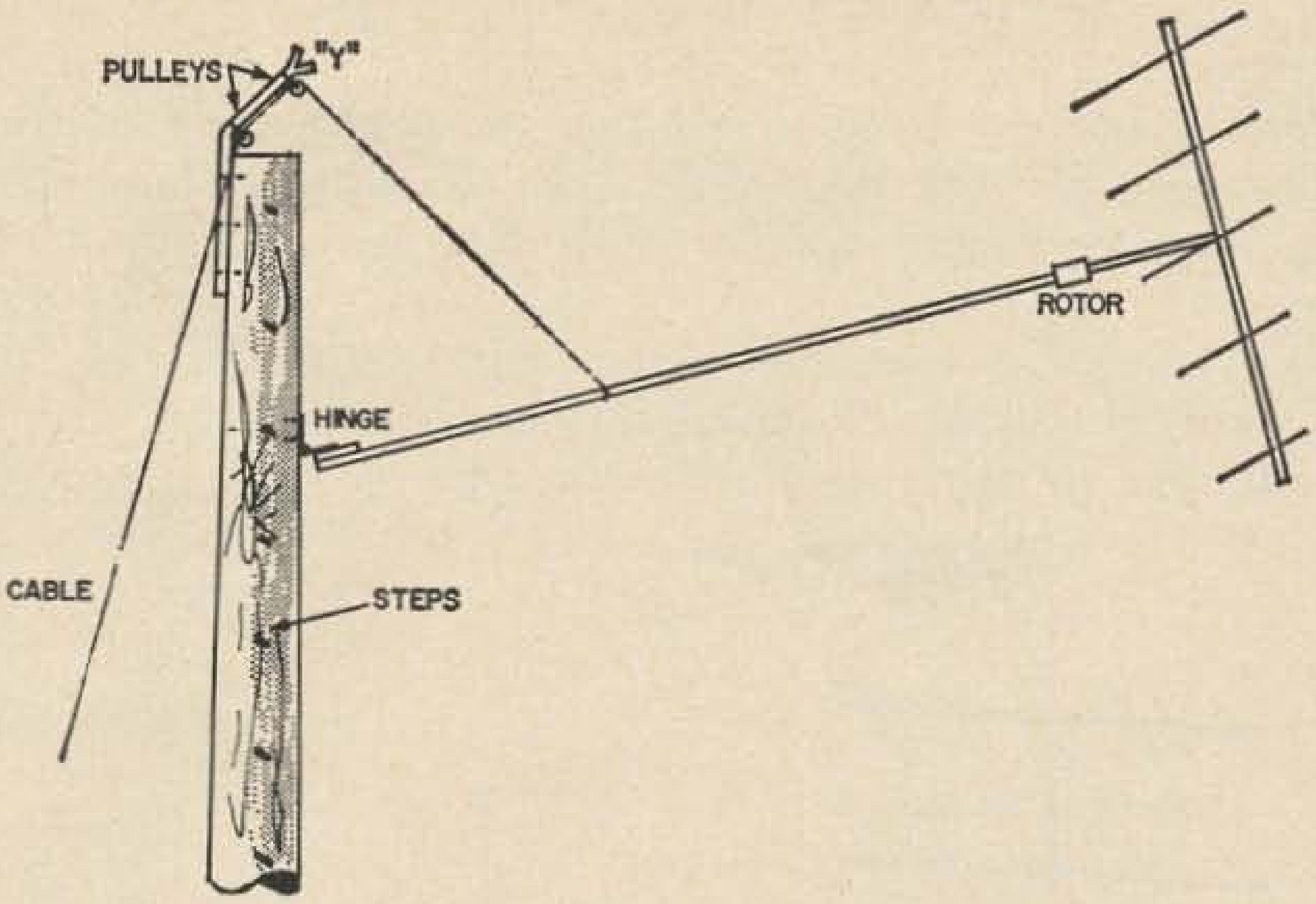



*Fig. 2. "Tilt-over" for UHF beams. Great for the VHF beams of under six elements, 6 meters that is.*

hardest. When you find the answer to the problem, any that follow will seem to be easier.

Having less than 2500 men, women and pets in town means I have to rely on "unskilled" labor. To recruit help I use the brew method, and rate all tasks by the six-pack or case. Hollering, "Pole Party at Peterson's house," will bring enough backs to get the job done. If there are high school athletes around, so much the better, cokes and snacks are cheaper.

## Take a Pole

Finding a pole in Arizona is not difficult. Farms ranches and small towns seem to have an abundance of them scattered around. These can usually be had for little or nothing, depending on your tact.

If these means are not available, try the utility company. they usually have poles that have been replaced for one reason or another but are still sound. You may have to shell out a few pesos and sign a release, but it should be nominal. New poles of 30 or 40 feet in length usually run about a dollar a foot, and a used one will run in the neighborhood of ten to twenty dollars, if you can't get it for your good looks.

## Add One Hole

Prepare the "pole hole" before bringing the pole home. Storage creates a problem.

For depth, I was told that one fifth of the pole should go in the ground, but that is for utility service, all those wires have a lot of wind drag. If the soil is sandy it should be no less than seven feet deep.

The soil here is dry, but hard as rock. I buried my pole six feet, and with proper tamping, it turned out like it grew there.

The diameter needs only to be about 12 inches larger than the pole's diameter for this method, versus several feet larger when using a boom truck.

Slant the hole on the side you intend to erect the pole from, as in **Fig. 1.** With the hole slanted, there will be more of the butt in the ground, sooner. Also, less dirt will get peeled off the near-side of the lip, and there will be less jerking as you near the upright position.

## Bring Together

Since the pole was mine for the taking, I had to devise a plan to get it home. All of three miles and across a U.S. highway.

A trailer used for hauling a jeep to the back country was the answer. The trailer was towed to the pole, facing the top end and about in the middle.

Three of us lifted the light end over our heads while the fourth man wheeled the trailer under the butt end as far as it would go. When we lowered it down the pole was balanced just right for towing. We secured the pole to the trailer hitch and the rear cross member with ¾ inch nylon rope.

To fasten the cludge to the vehicle, a ball socket should be attached to the light end with bolts or large lag screws.

We took a heavy chain, and with a clove hitch around the pole and a loop around the ball, were about ready to go. To further secure the chain, we put ⅜ inch bolts through the links to hold the chain securely.

It didn't slip, but this method isn't advised, Mr. Law becomes unhappy with such practices.

Don't forget to hang a red flag (or shirt) on the rear of your semi-pole, and, if possible, have someone follow with four-way flashers.

This operation cost the better part of a half case of Rocky Mountain Water, consumed back in the safety of the yard.

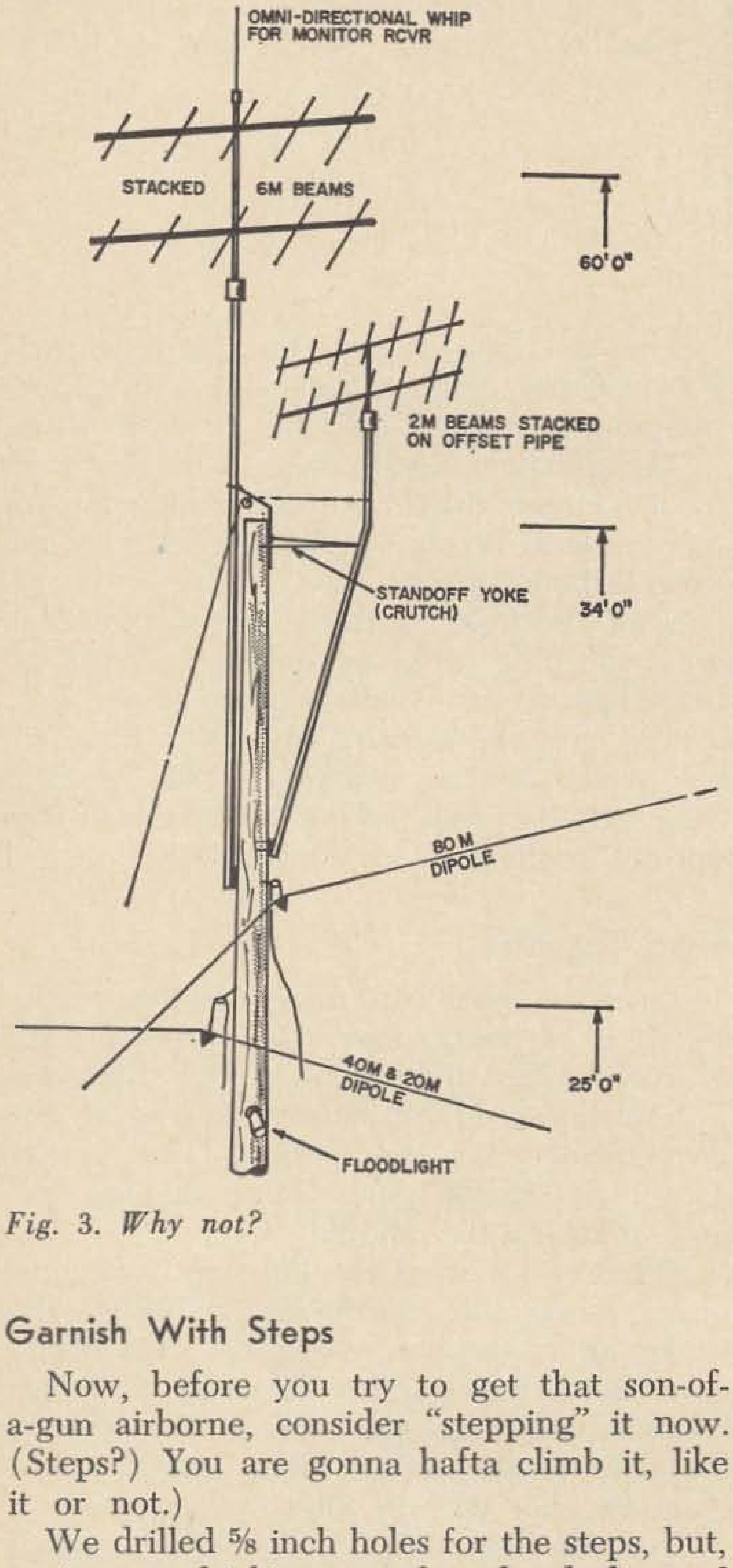



*Fig. 3. Why not?*

## Garnish With Steps

Now, before you try to get that son-of-a-gun airborne, consider "stepping" it now. (Steps?) You are gonna hafta climb it, like it or not.)

We drilled ⅝ inch holes for the steps, but, again not thinking too far ahead, listened to experts. It may take an extra fifteen minutes to set a pole with the steps installed, but it is much easier than a two hour stint later.

The holes are drilled three feet apart on a side and staggered from side to side to form 18 inch steps.

A sledge hammer is used to drive the steps in almost to the marking ring located about three inches from the threaded tip. Then the step is screwed in a couple of times to seat it.

Oh, one small detail, scrounge up around fifteen steps or reasonable facsimile unless you are adept with climbing hooks.

On good advice, I borrowed another friend's belt and hooks and such a hair-raising ordeal I never had! It was the first, and I hope the last time for that scene. Unless you have used hooks before . . forget it . . .!

Double stepping approximately five, and again at six and a half feet from the top makes working up there much simpler and safer. If your feet aren't on the same level you will get darn tired fast.

Climbing with steps is tolerable, but a belt of some sort is still necessary to free your hands safely.

## Combine Ingredients

Now to put your pride and joy up where the neighbors can admire it, in all it's splintery splendor.

We placed the butt over the hole, with the pickup at the other end. A couple of 1 x 3 inch slats were placed against the back of the hole, to keep the pole from hanging up and gouging dirt into the hole.

While two of us held the pole up, the third man backed the truck under far enough for us to place the pole on a sturdy pipe or ladder rack installed on the back of the pickup. From then on it was smooth sailing. With one man at the butt, and one in the back of the truck, the third man moved the truck back VERY slowly, a few inches at a time.

The man in back kept the pole from moving sideways, while the man at the butt kept it feeding properly by kicking it down, as it had a tendency to bind on the slats.

A roller of some sort on the rack would be desirable, and would make the operation a lot smoother, but isn't necessary.

After the pole is elevated to 45 degrees, it starts to get top heavy and much care need be taken. A loose loop of line was tied to the rack, around the pole, and again tied to the rack. This allowed the pole to move upward on the rack, but would have snubbed it if it had tried to go to the side. Remember, SLOW . . . Keep it centered at

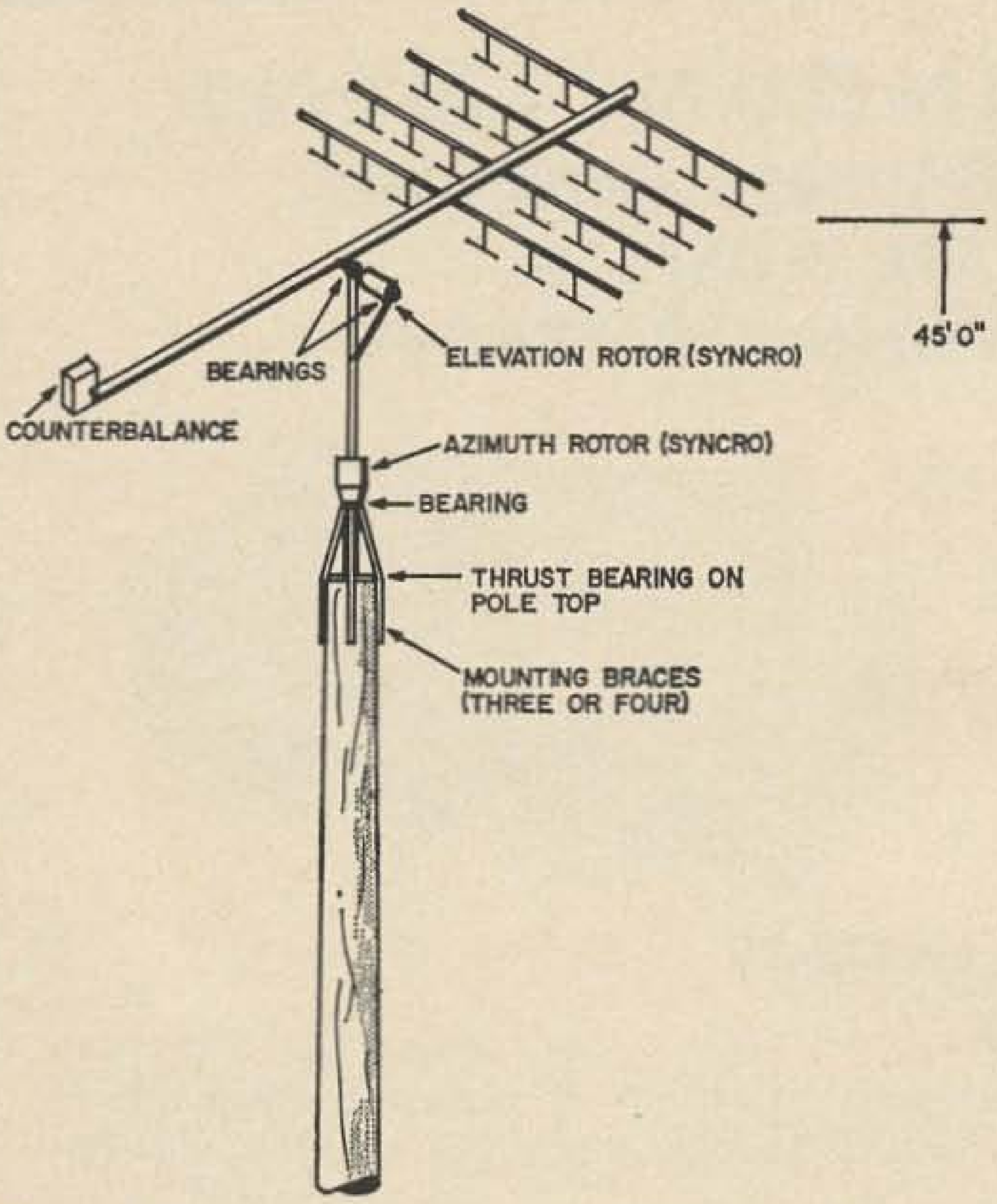



*Fig. 4. Moonbounce, anyone? Eliminate the counterbalance by making the array larger and putting the elevation rotor in the center!*

all times. If that beast gets away, something is going to get bent . . . and bad!

Keep the truck against the pole when it is vertical, and cinch up the snubbing line. Two men can hold the pole vertical while the third shovels in dirt. Pack it solid now and no loosening will occur.

One shoveling and three tamping is the rule. Tamping cannot be overdone! With a foot or so of loose earth around the pole, use a tamping bar or pipe until your arms ache. Add more dirt and repeat. Doesn't that brew taste good?

The tab for this part of the pole party came to one case, most of it lying on our backs and admiring our handy-work.

To thwart would-be Tarzans, there shouldn't be any steps below 7 or 8 feet. There are removable steps that hang on lag bolts screwed almost flush, but if they aren't available, you can use regular steps and remove them when not in use.

To enhance the appearance of your new marvel, try painting the first 6 or 7 feet white, and, if you have a feud going with the lid next door, continue on up with red and white, alternately.

## Attaching Antenna Masts

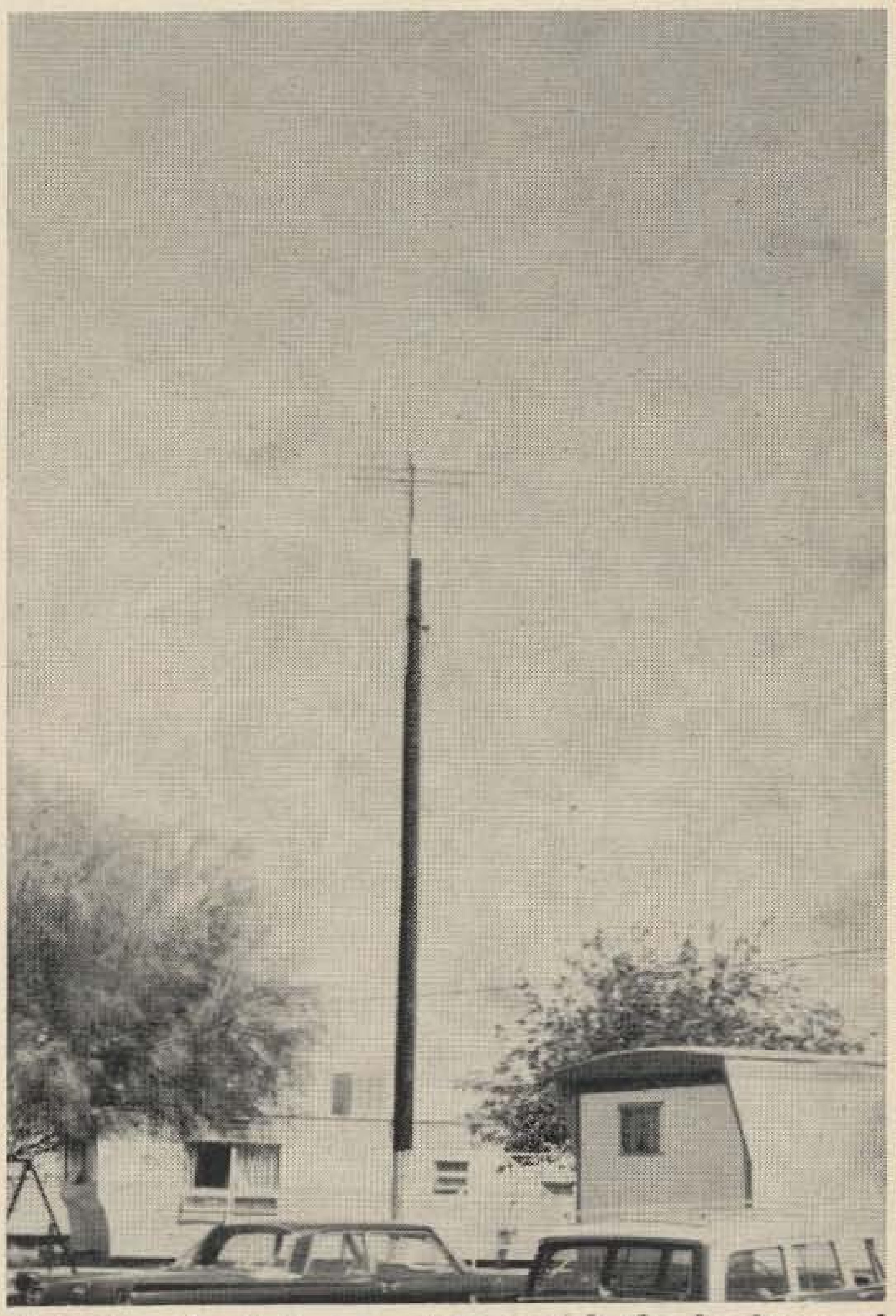
Now that the pole is up it is useless without a few antennas hanging from it. I won't elaborate on methods of mounting antennas of this type of pole. The variables of location, band requirements, and the individual Amateur's tastes are many and would require many pages of print. There have been numerous articles for specific installations so I will briefly cover a few which have struck my fancy and may stimulate your imaginations.

By looking at K4FQU's article in the November issue of 73, and another in the ARRL Antenna Book dealing with a 60 foot tilt-over made of will casing, you should be able to come up with a few ideas for mounting the larger 10 thru 20 meter beams, VHF collinear arrays and such.

For VHF beams, **Fig. 2** will be more than adequate. This installation works well for the larger TV Yagis around town and we get some fairly powerful dust storms.

All that is needed is a 6 foot piece of heavy angle iron, a pair of large pulleys, barn door hinge, a 10 to 20 foot piece of 2 to 2.5 inch water pipe or equivalent, and some large lag bolts.

If need be, K4FQU's latch arrangement can be incorporated, or the angle iron can



*Painting the bottom part to match the background helps to make the pole disappear?*

be bent as shown, and a "Y" attached to cradle the mast when it is upright.

The hinge should be located down from the top of the pole a distance equal to at least one third the length of the pipe and antenna support.

The cable should be attached to the pipe at the point that is directly opposite the upper pulley when the mast is upright.

The hinge is welded to the pipe and attached to the pole with large lag bolts, with the hinge being closed when the mast is up.

With this arrangement antenna adjustments or experiments will be simplified.

For a full quarter-wave 80 meter vertical I have only a start at the present, an old trapped vertical with the traps removed. The top of the vertical is 63 feet above the ground. I plan to bring heavy copper wire down from it's base, (bypassing the insulator) to one foot off the ground.



With proper radials it should load easily. Tuning will be with an SWR meter and a sliding tap.

I will cover the lower 8 feet with a piece of wood or fiberglass molding to prevent the possibility of someone getting an rf burn. (Leaving the base of the molding open for drainage.)

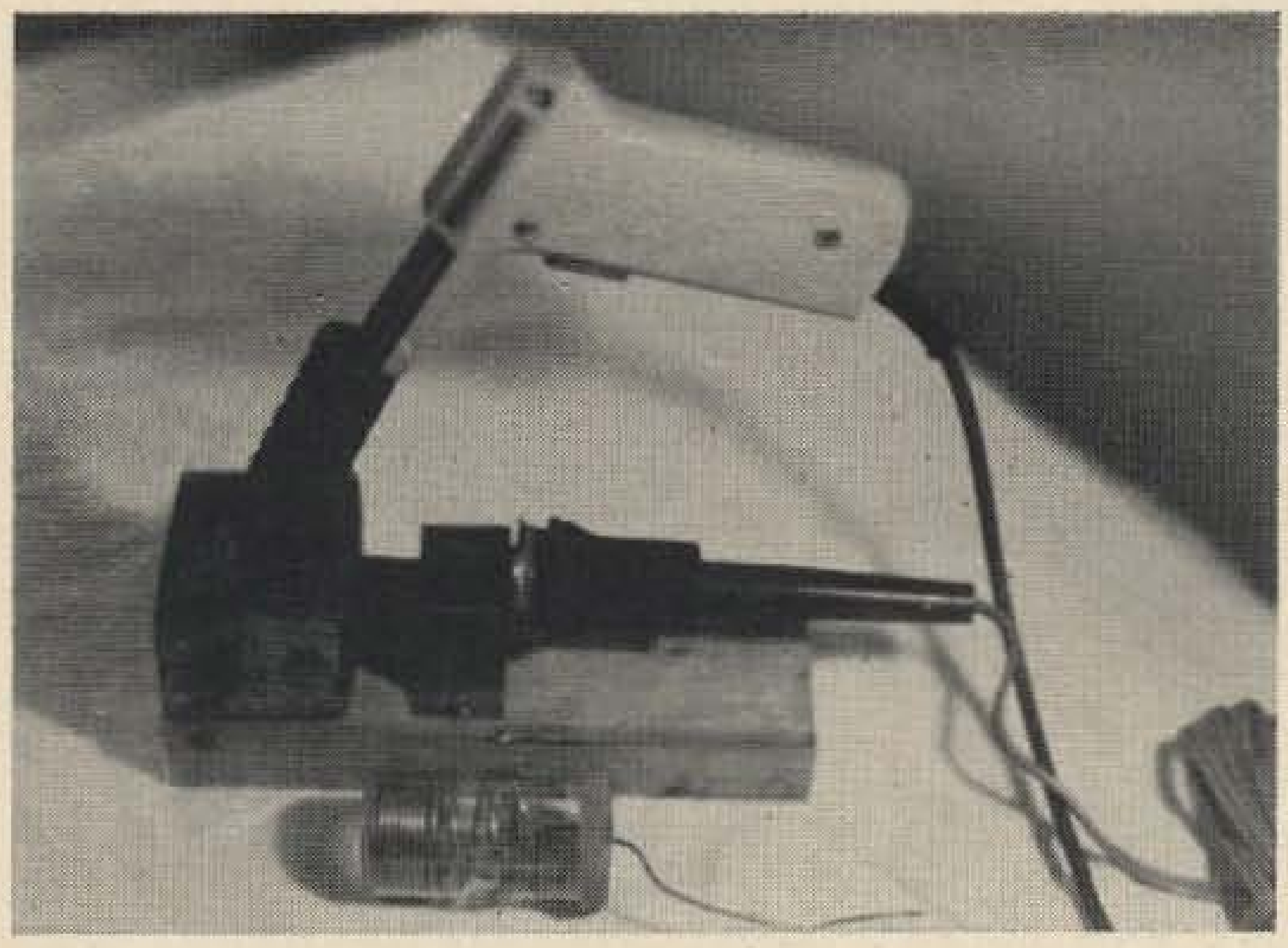
With a 2 x 4 and 2 x 2's laid across the top of the pole it would be possible to construct a "Lazy H" from a pair of 40 meter inverted "V"s suspended from the ends.

The possibilities are endless, take a look at **Fig. 3.** If that doesn't start you looking for a pole for your backyard, I wish you luck on your cross-town DX. Hi!

I got a bit carried away with **Fig. 4,** but the moonbounce boys can have a ball with this idea. With all the expensive receivers and arrays needed, the added cost of a tower has squelched a few would-be moonbouncers.

I hope to see a few new poles around with all types of goodies sprouting from their tops. If I can be of more help, I will answer any questions if at all possible. I'm in the book. . . . K7VBQ

## Burn Prevention



This soldering iron/pistol stand has been used at VE3BUE for several months without any burns!

How often has that soldering iron of yours burned you? Getting tired of cursing the blasted thing? I solved the problem by building a small "cage" type stand so that even if I did accidentally touch the stand I could not get burned.

As shown in the photograph, my stand holds two irons. The base is a piece of scrap pine. The stand for the pistol is made from an old loudspeaker back that used to hold the coil and magnet together. The spring can be replaced by a piece of pipe with plenty of holes drilled into it. The small iron has a homebrew bracket as shown in the photo.

In case you are worrying that the weight of the pistol will topple the stand, don't! The pistol is of German manufacture and weighs less than most irons. If you do use a transformer type soldering gun with this stand, the base will either have to be made larger or else bolted to your workbench.

D. E. Hausman VE3BUE

# AMATEUR ELECTRONIC SUPPLY

## RECONDITIONED HAM EQUIPMENT

★ 10 Day Free Trial (Lose only Shipping Charges) ★ 30 Day Guarantee ★ Full Credit Within 6 Months on Higher Priced New Equipment ★ Pay as Little as $5.00 Down – take up to 3 Years to Pay the Balance ★ Order Direct from this Ad!

**AMECO**
- CN-50 6m conv. $ 29
- PV-220 Preamp 9
- PS-1 AC supply 8
- TX-86 Xmtr 49
- TX-62 VHF Xmtr 109
- 621 VFO 39

**AZTEC**
- 876 DC supply $ 39

**B & W**
- 5100 Xmtr $ 89
- 51SB SSB Adaptor 109

**CENTRAL ELECT.**
- QT-1 Anti-trip $ 6
- 600L Linear 199
- MM-2 Analyzer 59
- RM adaptor 9

**CLEGG/ SQUIRES-SANDERS**
- 22'er 2m Xcvr $169
- 99'er 6m Xcvr 69
- Thor 6 (RF only) 89
- 417 AC sup./mod. 75
- 418 DC sup./mod. 75
- Zeus VHF Xmtr 375
- Interceptor B Rec. 349
- Allbander HF tuner 75
- Venus Xmtr 225
- 614B 6m Conv. 75

**COLLINS**
- 310B-1 Exciter $ 49
- 75A-2 Receiver 219
- 75A-3 Receiver 269
- 75A-4 (#3190) 425
- Speaker (A1,A2,A3) 9
- 75S-3C Receiver 499
- 51J-4 Receiver 995
- 32V-1 Xmtr 99
- 32V-3 Xmtr 175
- 30L-1 Linear 375
- KWM-2 Xcvr 750
- KWM-2A Xcvr 895
- 312B-5 Console 249
- 351D-2 Mount 75
- 516F-2 AC supply 115
- 516E-2 DC supply 75
- MP-1 DC supply 119
- DL-1 Dummy load 35
- 353C-31 plug-in ad. 10
- 302C-1 wattmeter 39

**R. L. DRAKE**
- 2B Receiver $189
- 2BQ Combo 29
- 2C Receiver 175
- 2CQ Combo 34
- R-4A Receiver 299
- T-4X Xmtr 299

**EICO**
- 722 VFO $ 34
- 723 Xmtr 29
- 730 Modulator 34
- 753 SSB Xcvr 139

**ELECTROPHYSICS**
- Autronic Keyer $ 59

**ELMAC**
- AF-68 Xmtr $ 49
- PMR-7 Receiver 39
- PMR-8 Receiver 79

**GLOBE/GALAXY/WRL**
- Champ 300 Xmtr $125
- SB-175 SSB Xmtr 59
- Galaxy 300 Xcvr 139
- PSA-300C AC sup. 40
- G-300 DC supply 49
- VOX (Galaxy 300) 12
- Galaxy V Xcvr 269
- AC-35 AC supply 65
- DC-35 DC supply 75
- CAL-35 Calibrator 12
- SC-35 Speaker 12
- 2000 Linear/sup 275
- UM-1 Modulator 29
- Rejector AC supply 4

**GONSET**
- Comm I 6m $ 69
- Comm III 6m 99
- Comm IV 6m 139
- 6m Linear II 69
- 6m Linear III 99
- G-50 Transceiver 175
- 900A 2m Xcvr 199
- 910A 6m Xcvr 189
- 3-way Supply 19
- Thin-Pak 19
- G-76 Transceiver 99
- G-77 Transmitter 45
- G-77A Transmitter 59
- GSB-100 Xmtr 169
- GSB-101 Linear 169
- 6n 12v converter 19

**HALLICRAFTERS**
- S-53 Receiver $ 39
- SX-101 Mk III Rec 149
- S-107 Receiver 59
- SX-110 Receiver 99
- SX-111 Receiver 139
- SX-115 Receiver 325
- R-48 Speaker 9
- R-48A Speaker 12
- R-50 Speaker 12
- HT-30 Transmitter 119
- HT-32 Transmitter 225
- HT-32A Xmtr 249
- HT-33B Linear 375
- HT-37 Xmtr 225
- HT-40 Transmitter 49
- HT-41 Linear 175
- HT-44 Xmtr 225
- PS-150-120 AC sup 75
- PS-150-12 DC sup 39
- MR-150 Rack 15
- P-500AC supply 75
- P-500DC supply 69
- SR-46 6m Xcvr 99
- HA-26 2-6m VFO 34

**HAMMARLUND**
- HQ-110C Rec $129
- HQ-170 Receiver 169
- HQ-170AC Rec 249
- HQ-180AX Rec 375
- SP-600 Receiver 175

**HEATHKIT**
- MR-1 Receiver $ 49
- RX-1 Receiver 149
- SB-300 Receiver 225
- SB-301 Receiver 249
- MT-1 Transmitter 29
- DX-60 Transmitter 59
- DX-100B Xmtr 99
- TX-1 Transmitter 115
- SB-10 SSB Adaptor 79
- HX-10 Xmtr 225
- HA-10 Linear 175
- HW-12 75m Xcvr 89
- HW-32 20m Xcvr 89
- HW-32A 20m Xcvr 99
- SB-400 Xmtr 275
- HP-24 AC supply 49
- SB-600 Speaker 12
- HG-10 VFO 29
- HW-10 6m Xcvr 149
- HP-23 AC supply 39
- MP-1 DC supply 24
- UT-1 AC supply 19

**HEWLETT PACKARD**
- 200CD Audio Osc $125
- 608D VHF Gen. 899
- TS-510A-U Gen. 699

**HICKOCK**
- 539C Tube tester $299

**HUNTER**
- 1000A Lin./Sup. $175

**JACKSON**
- 648 Tube tester $ 75

**JOHNSON**
- 122 VFO $ 19
- Ranger I 89
- 500 Xmtr 275
- KW amp/desk (store pick-up only) 495
- Audio Amplifier 25
- Invader 200 275
- 6N2 VHF Xmtr 89
- Mob. Xmtr (as-is) 15
- TR Switch 14

**KNIGHT**
- R-55A Receiver $ 44
- TR-106 6m Xcvr 109

**LAFAYETTE**
- HE-45 Xcvr $ 59
- HE-45A Xcvr 69
- HE-45B Xcvr 75

**LAKESHORE**
- Phasemaster II $ 89
- Bandhopper VFO 59
- P-400GG Linear 99

**LINEAR SYSTEMS**
- 250-12 DC supply $ 49
- 350-12 DC supply 69
- 500-12 DC supply 95

**LINCOLN**
- 6m Transceiver $ 39

**MARS**
- LE-2 Phone patch $19

**MIDLAND**
- RF Mon. Scope $ 49

**MOSLEY**
- CM-1 Receiver $ 99

**NATIONAL**
- NC-109 Receiver $ 79
- NC-125 Receiver 79
- NC-155 Receiver 99
- NC-270 Receiver 119
- HRO-50 Receiver 149
- XCU-27 Calibrator 15
- NCX-3 Xcvr 189
- NCXA AC supply 75
- AC-200 AC supply 59

**P & H**
- PS-1000B DC sup $ 59

**POLYTRONICS**
- PC-6 6m Xcvr $149

**RME**
- DB-23 Preselect $ 29
- 6900 Receiver 175
- 4302 Speaker 9

**SBE**
- SB2-XC Calib. $ 12
- SB1-LA Linear 149
- SB-34 Xcvr 289

**SWAN**
- SW-117 AC sup $ 75
- SW-12 DC supply 75
- 350 Xcvr (early) 269
- 350 Xcvr (late) 299
- 400 Xcvr 249
- 406 VFO 49
- 420 VFO 75
- 117B AC supply 65
- 412 DC supply 75
- 405X MARS Osc. 39
- 22 VFO Adaptor 15
- Mark II Lin/Sup 475

**UTICA**
- 650 Xcvr/VFO $ 99
- 650A Xcvr/VFO 119

**WATERS**
- 3001 Hybrid Cplr. $ 39
- 331 Grid Dipper 89

**WHIPPANY LABS**
- "Lil Lulu" Xmtr $ 89
- "Lil Lulu" Rec 89

**NEED CASH?**

**We'll buy your ham gear for spot cash. Tell us what you have to sell and we'll rush our offer.**

---

**To: AMATEUR ELECTRONIC SUPPLY**
**4828 West Fond du Lac Avenue**
**Milwaukee, Wisconsin 53216** C

Ship me the following Reconditioned Equipment:

FIRST CHOICE ______________________

SECOND CHOICE (IF ANY) ______________________

THIRD CHOICE (IF ANY) ______________________

I enclose $________; I will pay balance (if any)

☐ COD ☐ 1 year ☐ 2 years ☐ 3 years

Name ______________________

Address ______________________

City ______________________

State ____________ Zip ________

☐ Send Latest Ham Catalog.

---

The items listed below are brand-new and carry the full manufacturers New Equipment Warranty. Some items have been on display, but most are Factory Sealed. Due to limited quantities of the following Close Out items, terms are CASH IN FULL WITH ORDER – NO TRADE! ND = New Display.

| AMECO | | Reg. | NOW |
|---|---|---|---|
| TX-86 Xmtr kit, 6v fil. | | $ 89 | $ 54 |
| TX-86 Xmtr kit, 12v fil. | | 89 | 59 |
| AC-1 Transmitter | | 19 | 14 |
| **E. T. CLEGG CONVERTERS** | | **Reg.** | **NOW** |
| 228B 2m, 28.5-29Mc if | | $135 | $ 98 |
| 614B 6m, 14.0-14.5Mc if | | 115 | 83 |
| **R. L. DRAKE** | | **Reg.** | **NOW** |
| DC-3 DC Supply | | $149 | $ 89 |
| SC-6 6m Converter | | 65 | 54 |
| T-4X Transmitter | | 399 | 325 |
| **EICO** | | **Reg.** | **NOW** |
| 720 Transmitter - wired | | $129 | $ 99 |
| 730 Modulator - wired | | 89 | 69 |
| 730 Modulator - kit | | 59 | 49 |
| E-5 Enclosure for 730 | | 4 | 2 |
| 753 Transceiver - wired | | 299 | 239 |
| 753 Transceiver - kit | | 149 | 134 |
| 751 AC Supply - wired | | 109 | 89 |
| 751 AC Supply - kit | | 59 | 54 |
| 752 DC Supply - wired | | 109 | 89 |
| **GALAXY** | | **Reg.** | **NOW** |
| Galaxy V Mk II Xcvr | | $420 | $336 |
| DC-35 DC Supply | | 99 | 79 |
| PSA-300 AC Supply | | 119 | 49 |
| **HY-GAIN** | | **Reg.** | **NOW** |
| 2-BDP 80-40m Dipole | | | |
| 2TD Traps - 80 & 40m | | | 12 |
| 103B 3 el. 10m Beam | | | 22 |
| 111 11 el. 1¼m Beam | | | 9 |
| 12RMK Roof Mount Kit | | | 6 |
| TH-6DX Tri-Bander | | 149 | 119 |
| TH-2 Mk II 2 el. Tri-Bander | | 74 | 58 |
| **LINEAR SYSTEMS** | | **Reg.** | **NOW** |
| Adcom 250-6 DC Supply | | $145 | $ 50 |
| Adcom 350-6 DC Supply | | 125 | 65 |
| **MOSLEY** | | **Reg.** | **NOW** |
| V-5 80-10m Vertical | | $143 | $ 89 |
| V-4-8 40 & 80m Vertical | | 103 | 59 |
| S-402 2 el. 40m Beam | | 143 | 72 |
| A-203C 3 el. 20m Beam | | 129 | 79 |
| **NATIONAL** | | **Reg.** | **NOW** |
| 200 Transceiver | ND | $359 | $289 |
| AC-200 AC Supply | ND | 75 | 61 |
| NCXA AC Supply | ND | 110 | 90 |
| **NEW-TRONICS** | | **Reg.** | **NOW** |
| CD-40 40m Cliff Dweller | | | $ 50 |
| **REGENCY** | | **Reg.** | **NOW** |
| MR-33B 30-50Mc Monitoradio | | $84 | $ 68 |
| **SQUIRES-SANDERS** | | **Reg.** | **NOW** |
| 66'er 6m Transceiver | | $249 | $175 |
| 417 AC supply | | 139 | 69 |
| 418 DC supply | | 159 | 79 |
| Allbander Tuner | | 129 | 64 |
| 16" Video Monitor | | 299 | 149 |
| **TELREX** | | **Reg.** | **NOW** |
| 20M-317B 3 el. 20m Beam | | | $ 95 |
| 40m Inverted V kit/balun | | | 15 |
| **GAVIN** | | **Reg.** | **NOW** |
| Maverick II 6m filter | | $ 34 | $ 25 |

*William R. Hirt W7GBJ*
*1019 S.E. Roberts Ave.*
*Roseburg, Oregon*

# *The Beam Pole*

The beam pole has a number of features not possible with other means of supporting a beam antenna. A beam can be lowered in a horizontal position to within 7 feet of the ground if a wind storm threatens or if work on the beam or rotor is necessary. Since it can be run up and down the pole in minutes, the beam can be moved to any desired height for testing.

The pole should be set so that the beam is clear of obstructions. Dig a hole 4½ feet deep and large enough to receive the pole; place the butt at the edge of the hole and with the pole along the ground. It can be of any length but should have a 5 to 6-inch cross section at the top. A suitable pole can usually be purchased from your telephone or electric company for about $60.

Snap a chalk line the full length of the pole so it can be used as a reference mark. Trim the top of the pole so that a sheave housing can be fastened with lag screws. About 1 foot from the top, make two saw cuts 2½ inches apart, 1¼ inches deep, across the chalk line. Chisel out the wood between the saw cuts and smooth it out. Place one of the angle irons in the slot and bolt it through the pole with a ½ inch bolt. Do the same with the other angle iron about 2 or 3 feet above ground level at the butt end of the pole. Be sure that both top and bottom angles are in line.

Cut two pieces of ⅜ inch galvanized guy wire about 2 feet longer than the distance between the top and bottom brackets. Insert one end of each cable through the ½ inch outer edge holes in the top bracket and bend the ends back about 2 inches and fasten them securely with ⅜ inch cable clips. These clips should act as cable stops on the top side of the bracket; until the pole is erected the lower ends of these cables can hang free.

Run the 3/16 inch aircraft cable through the sheave and fasten the ends near the lower bracket temporarily with staples.

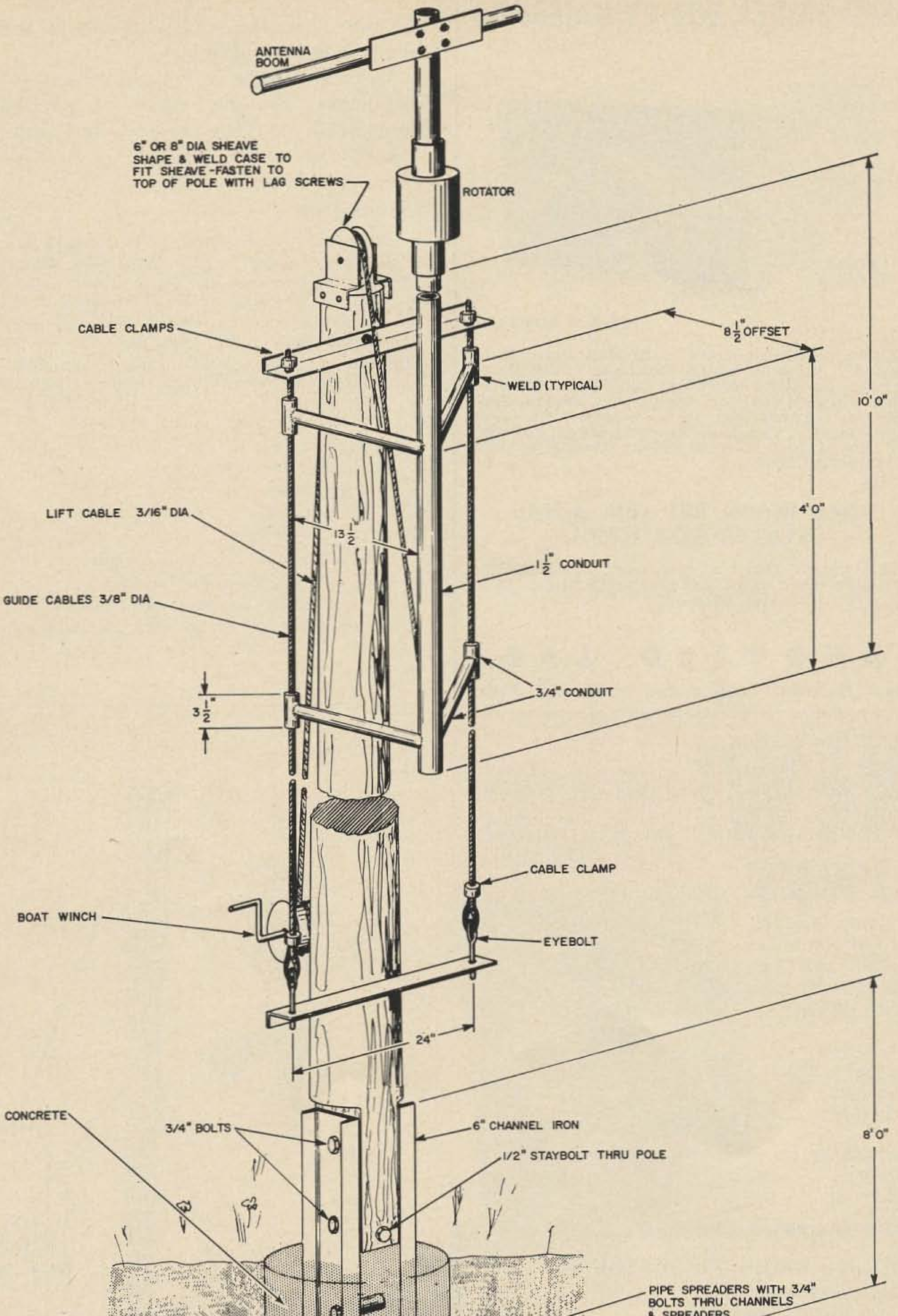
If the pole is to be set in the hole, the ground portion should be painted with some preservative, and the pole should also be painted. Setting the pole is a job for a telephone or electric company crew. They will usually do the job quickly for a reasonable price.

A hinge base for a pole, similar to those used on some flag poles can also be used. (See diagram for details). With a tilt-over installation, the pole can be raised with a car or truck, using a cable and a gin pole or crotch made out of two pieces of 2″ x 8″ x 14′ long.

When the pole is set, you can tie the sliding frame to the pole several feet above the lower angle bracket. The two ⅜ inch guide cables can now be threaded through the upper and lower guides on the sliding frame. Place the ½ x 8 inch eye bolts in the ½ inch holes at the ends of the lower angle bracket. Pass the cables through the eyes. Pull the cables as snug as possible by hand. Bend the ends up in a tight, close loop and secure with ⅜ inch cable clips. Cut off the surplus ends of the cable. By using an iron bar or wrench to hold the eye bolts from turning, tighten the nuts on the eye bolts until the cables are tight; alternate the tightening between the eye bolts to keep the top and bottom angle brackets parallel.

Select the desired height from the ground and bolt the boat winch on the back side of the pole. Loosen the staple holding the back half of the 3/16 inch pull cable and fasten the end securely to the cable drum. Now loosen the staple holding the front half of the cable, pass it through between the guide arms of the sliding frame and fasten it to an eye that has been welded to the low end of the mast. Use one or two 3/16 inch cable clips. Wind the cable on the winch and raise the slide frame about a foot.

You are now ready to mount the rotor and beam on the 1¼ inch mast part of the sliding frame. Connect the feed line and set the beam so that it is parallel with the top bracket. This is necessary so that the beam can pass the top bracket. The beam will extend above the top of the pole by about six feet when it's pulled up so that the top of the guildes will hit the lower side of the top bracket. Give an extra pull with



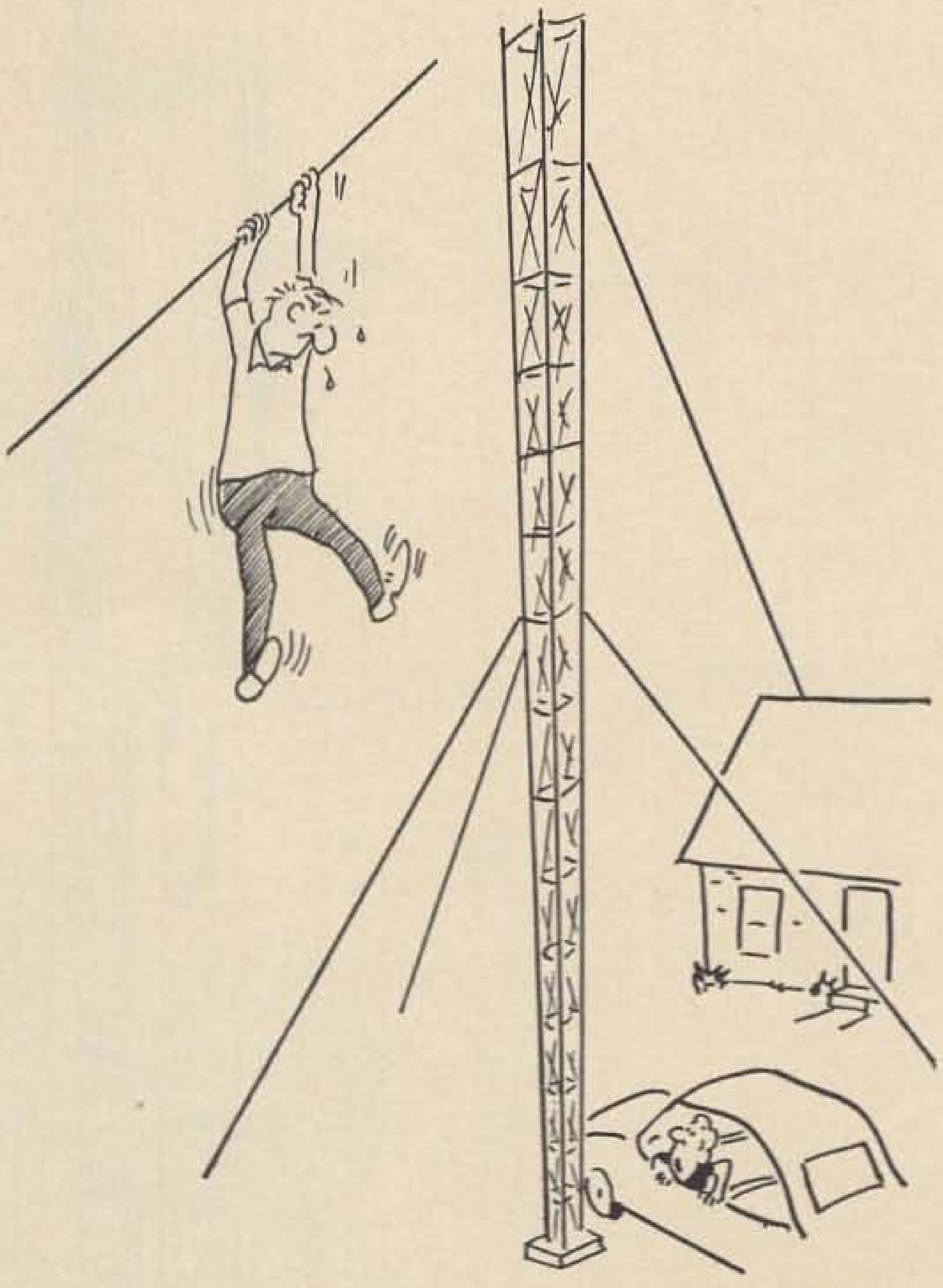
ANTENNA BOOM
6" OR 8" DIA SHEAVE SHAPE & WELD CASE TO FIT SHEAVE-FASTEN TO TOP OF POLE WITH LAG SCREWS
ROTATOR
CABLE CLAMPS
8 1/2" OFFSET
WELD (TYPICAL)
10' 0"
4' 0"
LIFT CABLE 3/16" DIA
13 1/2
1 1/2" CONDUIT
GUIDE CABLES 3/8" DIA
3 1/2"
3/4" CONDUIT
CABLE CLAMP
BOAT WINCH
EYEBOLT
24"
CONCRETE
3/4" BOLTS
6" CHANNEL IRON
1/2" STAYBOLT THRU POLE
8' 0"
PIPE SPREADERS WITH 3/4" BOLTS THRU CHANNELS & SPREADERS

the winch, so the pawl will engage the next notch to insure rigidity.

You now have a very satisfactory beam installation. No guy wires are needed and your beam can be lowered in a hurry for any reason. . . . W7GBJ

## Material list

1 pole 5 to 6" cross section at top; length as desired.
2 pieces 1/4" x 2 1/2" x 2 1/2" angle iron 26" long, 1/2" hole drilled at each end on 24" centers, 1/2" hole in center on opposite angle 13" from end.
3/8" galvanized guy line cable, to reach top and bottom brackets plus 2' for fastening.
3/16" air craft cable long enough to run from eye at bottom of mast through sheave at top and down to winch.
1 7" or 8" "Vee" belt pulley, 1/2" hub.
1 pulley housing.
8 3/8" x 3 1/2" lag screws.
4 3/8" cable clips.
2 3/16" cable clips.
2 1/2" x 8" eye bolts.
1 piece 1 1/4" x 10' thin wall conduit.
1 piece 3/4" x 6' thin wall conduit.
1 3/8" x 6" or 7" bolt and washers.
1 1/2" or 5/8" x 12" or 14" bolt and washers



They didn't have any 20 foot Ladders at The Hardware Store, do you want me to try the Radiostore?

Scott Marovich
2407 S. Rose St.
Kalamazoo, Mich. 49001

# *Electricity Abroad*

A handy reference for hams vacationing or traveling, and planning to operate overseas—or for anyone planning a DXpedition—is a new booklet prepared by the Department of Commerce, in co-operation with the U.S. Foreign Service, "Electric Current Abroad." Originally published in 1963 for use by U.S. manufacturers, exporters, and citizens living or traveling abroad, this 81-page revised edition has been expanded and updated to include a current list—arranged alphabetically—of the characteristics of the electric power supplied in most of the major cities and countries of the world.

The list includes the type of current (ac or dc), nominal line voltage and (if ac) frequency, phase of the system (single- or 3-) and the number of wires (2, 3, or 4). Frequency stability and freedom from service interruptions are indicated by "Yes/No" evaluations of whether electric clocks may be used reliably, and special wiring conditions such as "neutral" third wires are also noted. The list includes only the power supplied for domestic or light commercial service, and does not cover industrial, high-voltage, or other special applications. Also included are illustrations of the three types of plugs and sockets most commonly in use around the world, and an accompanying table showing, country-by-country, which are used where, and whether adapters are readily available.

Aside from being a valuable reference, "Electric Current Abroad" is also an interesting source of general information and, should you be so inclined, and aid to settling pointless arguments. A few salient facts, for example:

Aside from Argentina, Greece, and India, which seem to have mixed ac and dc systems, only a handful of major cities still rely on dc. Glancing down the list, I was unable to find a single ac system with a nominal frequency other than 50 or 60 Hz (50 having a slight edge over 60), although there seem to be quite a number of places where the stability or freedom from service interruptions are less than perfect (Northeast U.S., perhaps?). As in this country, most cities offer a single-phase voltage in the neighborhood of 110-130 v, and 3-phase power of 190-250 v, although a large number supply 190-250 v, single-phase, and 380-460 v, 3-phase. Some cities offer all three voltage ranges, and, going down the list, one can generally obtain all the possible permutations of voltage and phase, with some cities even offering one voltage range in ac and another in dc!

All in all, "Electric Current Abroad" is an interesting and valuable source book, especially considering the price (which we naturally saved until the end, to entice you): It's only thirty cents, postpaid, from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. Specify Cat. No. 0 265-525 when ordering.

# Tilt That Tower

Dennis Bryan W2AJW
4 Crescent Drive
Apalachin, N.Y.

Tower on the way down with helpful neighbor demonstrating the use of the restraining lines.

How many times have you read "beam antenna" construction articles and thought that you would really like to give it a try—except—how would you get it up on top of your tower. And right there you drop it and just keep on dreaming about 8.5 or 10 or 11 db gain—how it sure would give that extra punch to that rig you have.

Let's face it, no matter how good a rig you have, if you aren't radiating maximum you're not in good shape to compete for that rare DX.

So, if you can't afford a crank up tower, don't have a crane handy or can't muster up enough extra pairs of muscles whenever you want to work on the beam, then this article is for you.

Right now let's quench your fears of special parts, welding, etc., before we go on. Everything used in this project can be found in Sears Roebuck and Co., and a moderately stocked steel supply house. The actual conversion will depend on the type of tower you have, but the basic principle will remain the same.

There is one requirement with this type of construction article that should be kept in mind—be very critical of so called "junk-box" parts. Don't skimp on the quality of the material you use. You are dealing with considerable weight and a component failure could be catastrophic. No matter how confident you are of the finished product never allow anyone to stand under the tower when you are raising or lowering it!

The actual conversion will depend on the type of tower you have and for that reason actual dimensions will not be given. However, using my conversion and pointers as a guide, you should be able to do a safe and lasting job on your tower.

My tower was manufactured some 12 years ago, is 50 feet high, has one inch tubular legs on 12 inch centers and has horizontal braces also made of one inch tubular steel. This type of construction was typical for that era and compares with the newer towers using solid steel "zig-zag" or flat "corrugated" bracing.

The tower conversion can be broken down into four steps once you make sure you have enough room on *your* property on which to lay down the tower.

1. Construct a base hinge.
2. Construct in intermediate pulley mount.
3. Determine the weight to be lifted.
4. Select a proper cable, winch, and pulleys.

## Construct base hinge

The base hinge should be constructed one or two feet above the ground. Putting the hinge at that height will allow the winch to be mounted on the tower, eliminating the problems of mounting it on the house. The hinge should not be made any higher than two feet from the base as the thrust of the tower in the horizontal position may cause the vertical portion to bend. Examination of the photo will show the two 1¼ angle brackets that were added between the hinge and lower rear base for that reason.

The hinge itself is constructed by cutting the tower in two, midway between the horizontal supports, about one or two feet above the ground. Two pieces of 2 inch angle iron are bolted horizontally to the front legs. Two ⅜ inch bolts are used in each end of each piece of angle iron. A 1¼ inch length of angle iron is bolted to the rear of the lower front legs under the lower of the two ⅜ inch bolts. The 1¼ inch angle support brackets mentioned earlier are bolted at the upper end to this 1¼ inch angle iron. The lower ends of the 1¼ inch angle irons are bolted to the lower rear horizontal support member. The hinges are of the "Barn-door" variety from Sears Roebuck and Co. and are held to the 2 inch horizontal pieces by ⅜ inch steel bolts. Use the largest hinges that will fit your tower width.

The hinged section of the tower can be made stronger by inserting 18 inch steel rods or pipe into the hollow legs or by removing about 10 inches of the legs between the horizontal members where the hinge will be installed.

The clamp for the rear tower leg is made by splitting a 10 inch piece of one inch ID pipe or tubing with a hacksaw. This clamp is held with four ⅜ inch bolts, two above and two below the cut in the leg. When lowering the tower it is only necessary to remove the top bolts.

### Intermediate pulley mount

Since my tower was put up next to my house, the intermediate pulley mount was combined with a home made "house-bracket". The house bracket was made of two 2 inch by four feet lengths of angle iron. These two brackets extend approximately 21 inches out beyond the house. The underside of the roof where they are bolted is reinforced by 2 x 8 inch lumber. Just outboard of the roof of the house a length of 2 inch angle iron is bolted between the two arms. The intermediate pulley is bolted to this angle iron.

A length of 1¼ angle iron is U bolted to the inside of the front two tower legs at a height equal to the two 2 inch angle iron arms of the house bracket. When the tower is raised, this angle iron bolts to the two arms with ⅜ inch bolts.

Several of the preceeding steps require the bending of the ends of angle iron. This is easily accomplished by hacksawing the unneeded side off the angle iron and then using a hammer to obtain the required bend in the tab.

The winch is mounted on a 1½ x 3 inch "U" channel 19 inches long. A one inch hole is drilled 10½ inches from the left side of the channel. The channel is then slipped over the rear leg before the rear clamp is installed. One ⅜ inch hole is drilled through the channel and rear leg and another through the channel and front horizontal member. ⅜ inch bolts are used to secure the channel to the tower.

### Determine weight to be lifted

Three or four formulas will be used to determine the tension in the lifting cable, pully and winch:

**A1. Determine lifting weight of tower alone:**

For uniform construction towers.


W1= Weight of tower alone (weight per section times number of sections).
AD= ½ tower length or AC/2.
R2= Point tower raising cable attaches to tower.
R1= Base or hinge pivot point of tower.

To solve for R2:

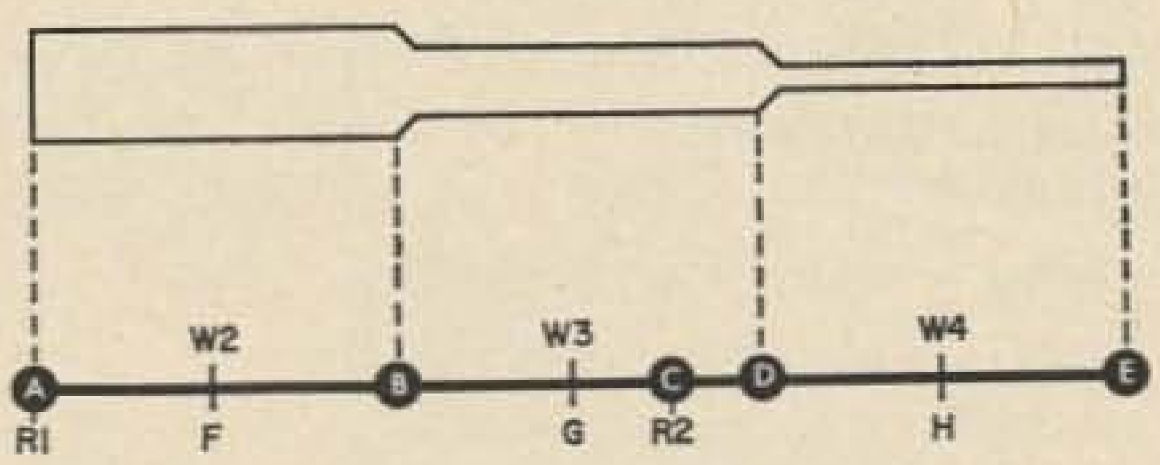
$$(AD)(W1)-(AB)(R2)=O \quad R2=\frac{(AD)(W1)}{AB}$$

To solve for R1:

$R1+R2=W1$
$R1=W1-R2$

**A2. Determine lifting weight of tower alone:**

For tapered tower construction such as the Spaulding "Strato-Tower".




W2= Weight of 1st section.
W3 =Weight of 2nd section.
W4= Weight of 3rd section.
R1= Base or hinge pivot point of tower.
R2 =Point tower raising cable attaches to tower.

$$AF=\frac{AB}{2} \quad BG=\frac{BD}{2} \quad DH=\frac{DE}{2}$$

$AG=AB+BG \quad AH=AB+BD+DH$

To solve for R2:

$(AF)(W2)+(AG)(W3)+(AH)(W4)-(AC)(R2)=O$

$$R2=\frac{(AF)(W2)+(AG)(W3)+(AH)(W4)}{AC}$$

To solve for R1:

$R1+R2=W2+W3+W4$
$R1=W2+W3+W4-R2$

**B. Determine lifting weight of tower, antenna, rotor, etc. combined:**


LW= Lifting weight of tower where cable attaches.

R1 and R2= From formula A1 or A2.

W5= Combined weight of antenna, rotor, etc.

AB= Distance from hinge base to lifting cable point on tower.

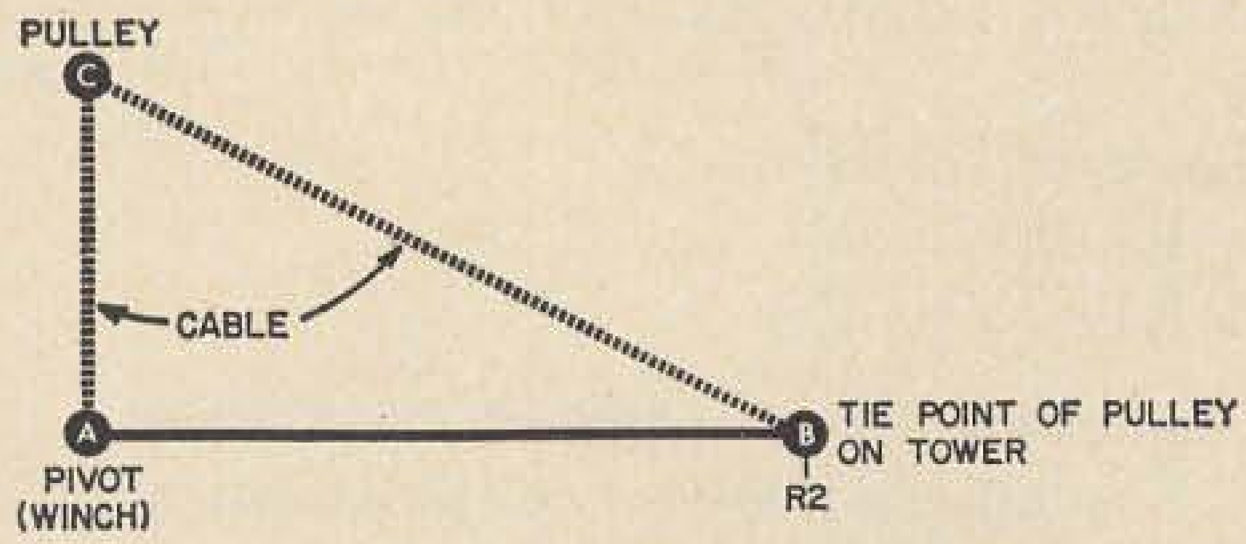
BC= Distance from lifting cable tie point to antenna at top of tower.

To solve for LW:

$$R1+(AB)(R2)+(AC)(W5)-(AB)(LW)=O$$

$$LW=\frac{R1+(AB)(R2)+(AC)(W5)}{AB}$$

**C. Determine tension in lifting cable, pulley and winch:**




R2= From formula B.

AB= Distance from hinge base pivot of tower horizontally to cable tie point.

AC= Distance from hinge base pivot of tower vertically to pulley.

T= Tension in cable ACB

$$CB=\sqrt{(AB)^2+(AC)^2}$$

To solve for T:

$$T=\frac{R2}{AC+CB}$$

Examination of the formulas will show that:

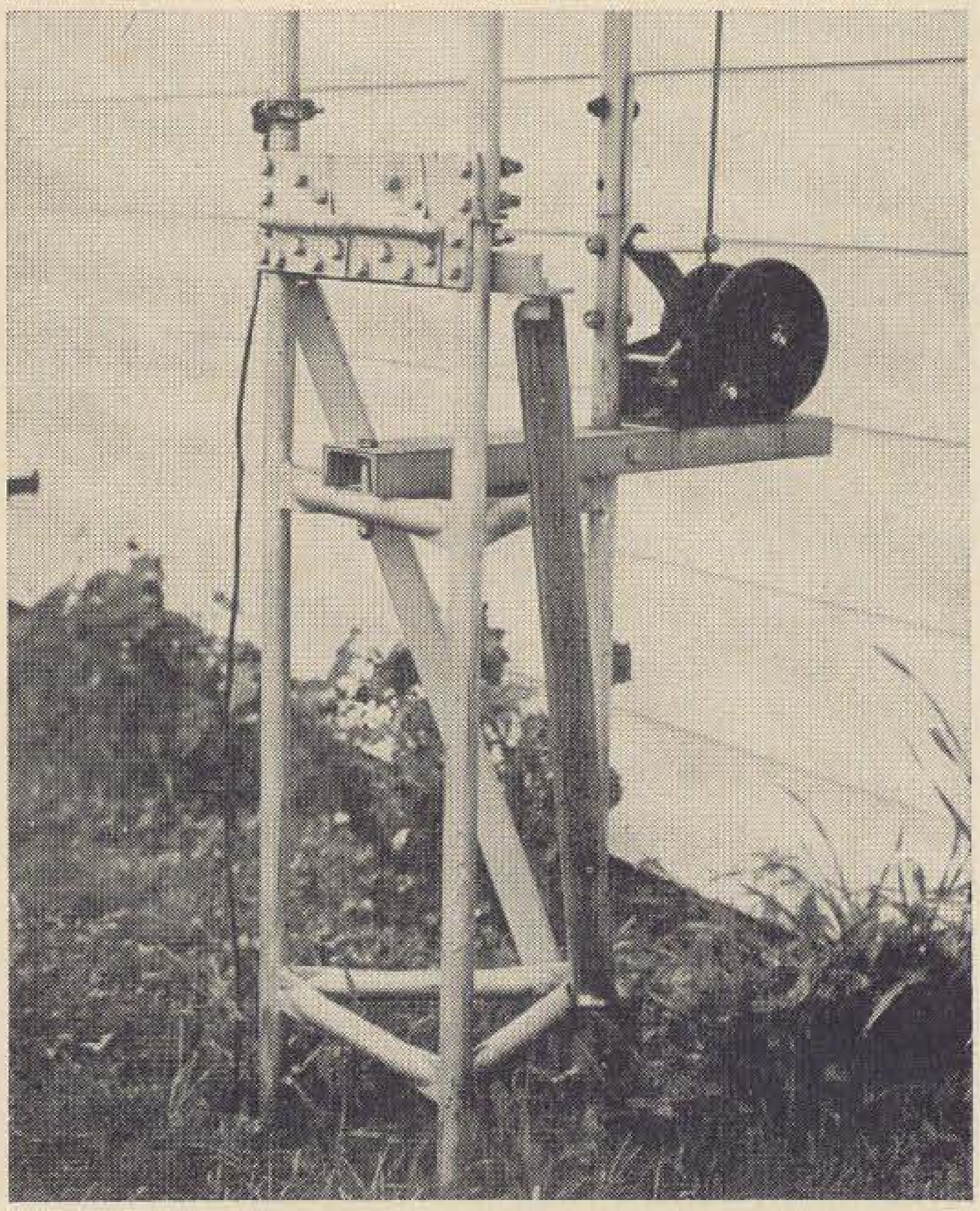
1. Establish the intermediate pulley point, point "C" in formula C as high as possible. The higher that point is the less the tension in the lifting cable.

2. Keep the cable tie point on the tower out as far as possible—at least half the tower length. The maximum distance out for the point will usually depend on the height of the intermediate pulley.

## Select proper cable, winch and pulleys.

A. Cable

Steel cable (wire rope) comes in a variety of sizes, strandings and strengths. Wire rope is commonly designated by two figures, the first indicating the number of strands and the second the number of wires per strand. That is: 6 x 7 is a six-strand rope having seven wires per strand. The higher the number of strands and wires per strand the more flexible the cable. For instance a 8 x 19 cable is much more flexible than a 6 x 7 cable. Because you will be using a small (2 or 3 inch) pulley you will want a flexible cable, say 6 x 29 or 8 x 25.



**Base hinge and winch mount. Note angle iron support struts going from upper front legs to lower rear leg.**

The strength of cable depends upon its size, kind of material of which the wires are made and their number, the type of core, and whether the wire is galvanized or not. This table gives the medium strengths of cable appropriate for this type of application:

3/16 2500 pounds
1/4 4000 pounds
5/16 6500 pounds
3/8 9500 pounds

A minimum factor of safety of three should be used when selecting cable. That is, multiply the cable tension previously calculated by three to determine what strength and therefore size cable to use.

B. Winch

Winch selection, as with cable, should be based on cable tension times a safety factor of three. Sears Roebuck and Co. has a good selection of winches ranging from 1000 pound capacity with a 3:1 gear ratio (maximum mechanical advantage of 38:1) to 2500 pound capacity with a 12:1 gear ratio (maximum mechanical advantage of 21:1). Even if you don't need the higher lifting capacity the selection to the higher capacity model with the mechanical advantage and higher gear ratio will save wear and tear on your arm muscles.

C. Pulleys

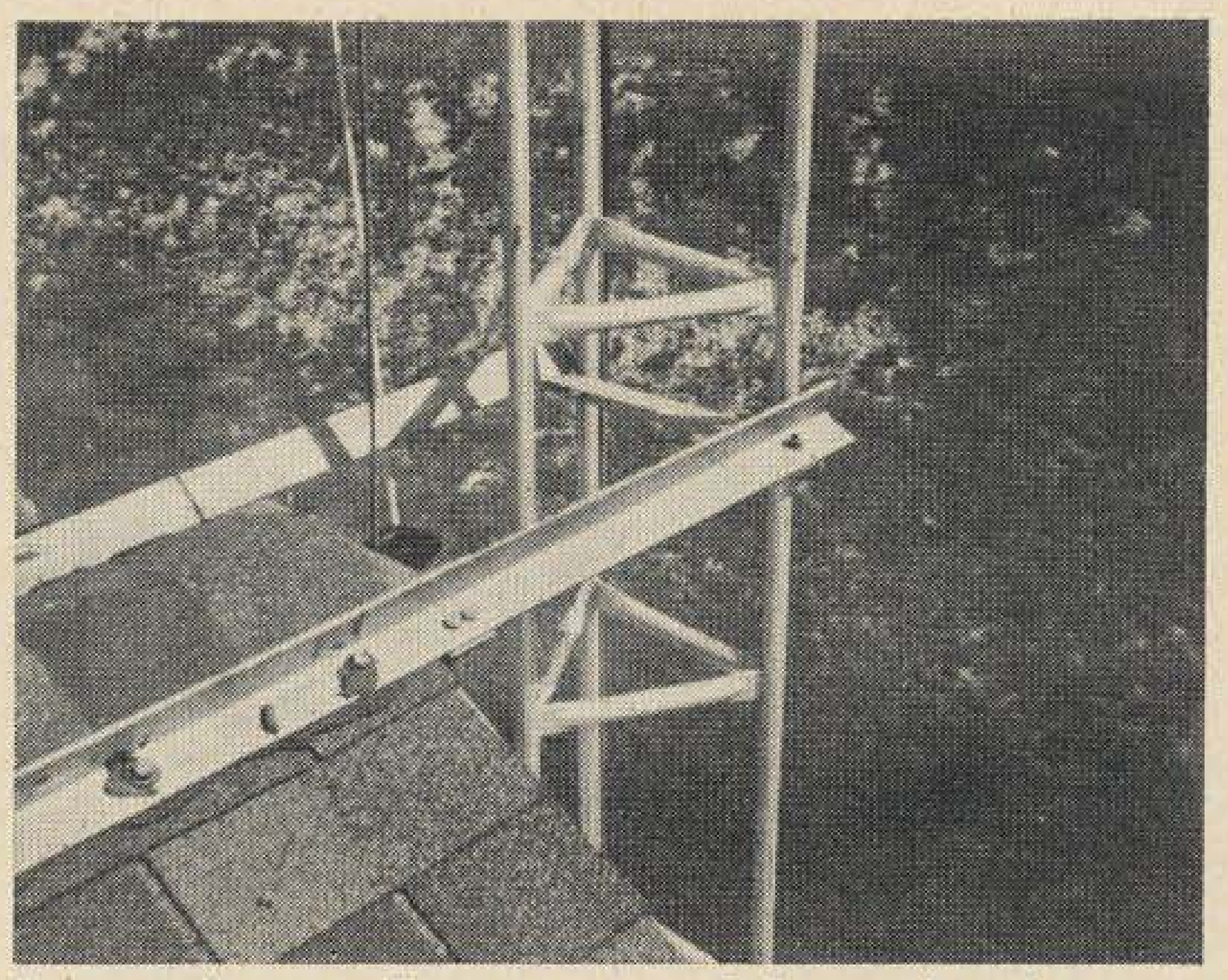
The pulley should also be selected based on required lifting tension times safety factor. The other pulley considerations are diameter and groove size. To realize maximum cable life the diameter of the pulley should be: for 6 x 7 cable D=72d (d= diameter of cable), for 8 x 19 cable D=31d. Note that the more flexible cables require smaller diameter pulleys. Because, at most, the cable in this application will see highly intermittent use it would be appropriate to use pulleys as much as one half that diameter specified.

Since the Sears winches have small diameter drums, several layers of cable should be turned on the drum before the weight carrying cable is wound on.

It is recommended that the pulley groove diameter be the same size or 1/64 larger than the nominal cable diameter. Too small a groove for the cable it is to carry will prevent proper seating of the cable in the bottom of the groove and consequently uneven distribution of load on the cable will result. Too large a groove will not give the cable sufficient support.

## Operation

One important consideration in lowering a tower of any size is the lateral leverage (or twist) the tower exerts on the vertical base and hinges. This leverage reaches maximum when the tower is completely horizontal but not resting on the ground. In that position any wind from the side, especially with a large antenna mounted at the tower apex, will tend to swing the tower sideways twisting the base. After one sad experience in which the author's tower was



Intermediate pulley mount and house bracket.

swung 45 degrees by a gust of wind; restraining lines were used on all lowering and raising operations.

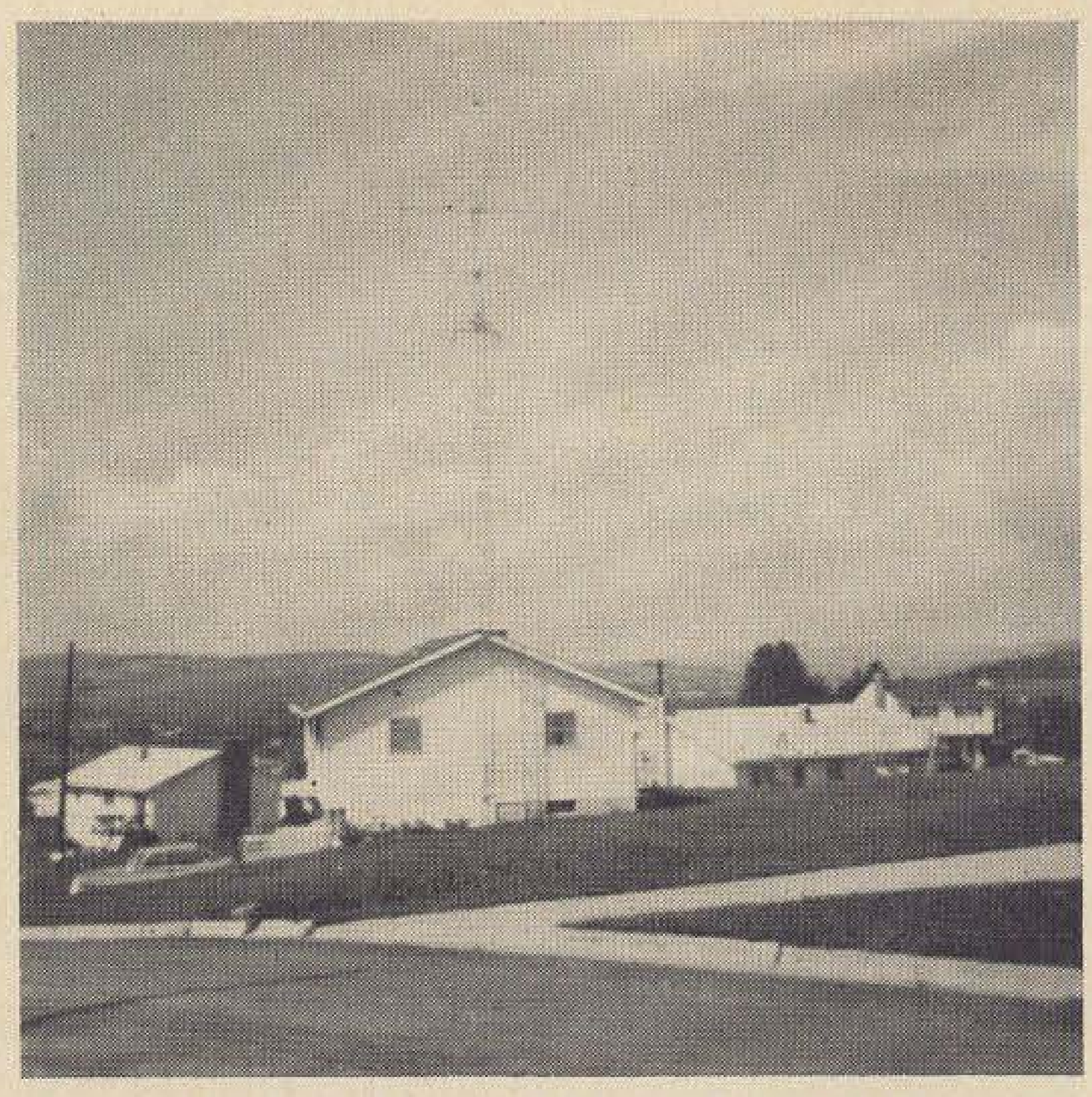
The restraining line operation consists of running one end of a 1/4 inch line through a guy thimble, used to hold one set of guy lines, then on to a point about 20 foot up the tower where it is made fast. The other end of the line is run through the other guy thimble and likewise tied to the 20 foot point on the tower. The center of the line then is brought back to the base of the tower where the slack can be taken up by the operator. The line is either taken in or let out depending on whether the tower is being taken up or down. (My tower has one set of guys at the top, one anchored to the roof of the house and the other two to the earth anchors).

This use of restraining lines requires very little effort to keep the tower from swinging about the base even in quite strong wind gusts. The best solution, of course, is to wait for a calm day. However, even in that case, it is best to have some insurance in the form of the restraining lines.

## Reducing winch load

One method to reduce the load on the winch and save muscle power is:

1. Mount the intermediate pulley as before.
2. Mount a second intermediate pulley at the tower lift point.
3. Fasten one end of the lifting cable to the angle iron holding the first intermediate pulley. Run the cable through the 2nd intermediate pulley on the tower then back through the first intermediate pulley then down to the winch. This arrangement can cut the lifting



The erect tower—A neat installation

load on the winch by as much as 5 percent.

### Operating procedure

1. Connect restraining line.
2. Remove guy lines (if used) from side of tower opposite hinge.
3. Remove house bracket holding screws.
4. Remove rear leg (base) holding screws.
5. MAKE SURE NO ONE IS STANDING IN FALL PATH OF TOWER!
6. Lower tower taking up slack in restraining line. The restraining line job is an easy job for the XYL or neighbor.

Finally—frequently inspect the tower construction, winch, cable, hinges, pulleys and other hardware for signs of strain and wear!

. . . W2AJW

---

## MOVING?

Every day we get a handful of wrappers back from the post office with either a change of address on them or a note that the subscriber has moved and left no address. The magazines are thrown out and just the wrapper returned. Please don't expect us to send you another copy if you forget to let us know about your new address. And remember that in this day of the extra rapid computer it takes six weeks to make an address change instead of the few days it used to when we worked slowly and by hand.

## Panel Gap Filler

Although rack panel and rack cabinet dimensions are supposedly standardized, so that all parts are completely interchangeable, almost all large rack-and-panel assemblies are afflicted with an interpanel gap, usually at a most unsightly location, and amounting to from 1/16" to 1/4". Location of this gap can be shifted somewhat by adjusting panel positions, but usually the gap cannot be entirely eliminated.

No standard fitting to fill these gaps has been marketed by the makers of rack-and-panel equipment. In fact, one manufacturer, in answer to a query, stated "all of our racks and panels fit perfectly, and no spacers are necessary". Perhaps he goofed on the "paint allowance".

Search for a suitable panel gap filler, to eliminate the need for milling out a special channel section, disclosed that an aluminum extrusion, used in connection with phenolic table tops and counter covers, is ideally suited to the purpose. This, known as a "divider", has an asymmetrical "H" cross section, as in **Fig. 1**, with the short bar of the "H" highly polished. As it is made of half-hard Dural, it is easy to cut and fit into place. Front surface can be left bright, or painted in any desired color to match, or contrast with, the panels. Dividers are made to accommodate 3/32, 1/8, 3/16 and 1/4 inch panels, and cost about 30 cents per running foot retail in small quantities. Stainless steel dividers, in similar, dimensions, are also available, at considerably higher prices. . . . IVES

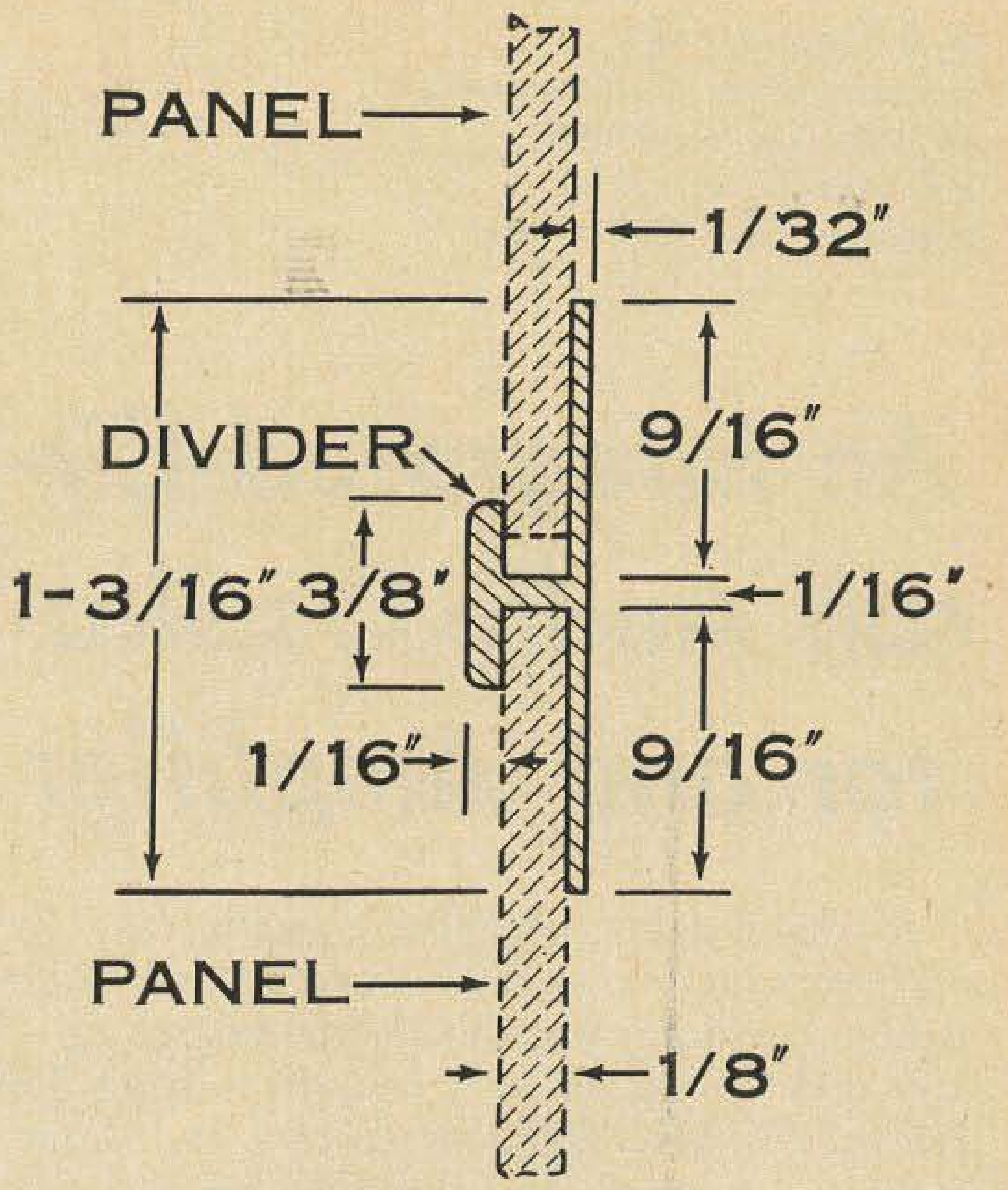
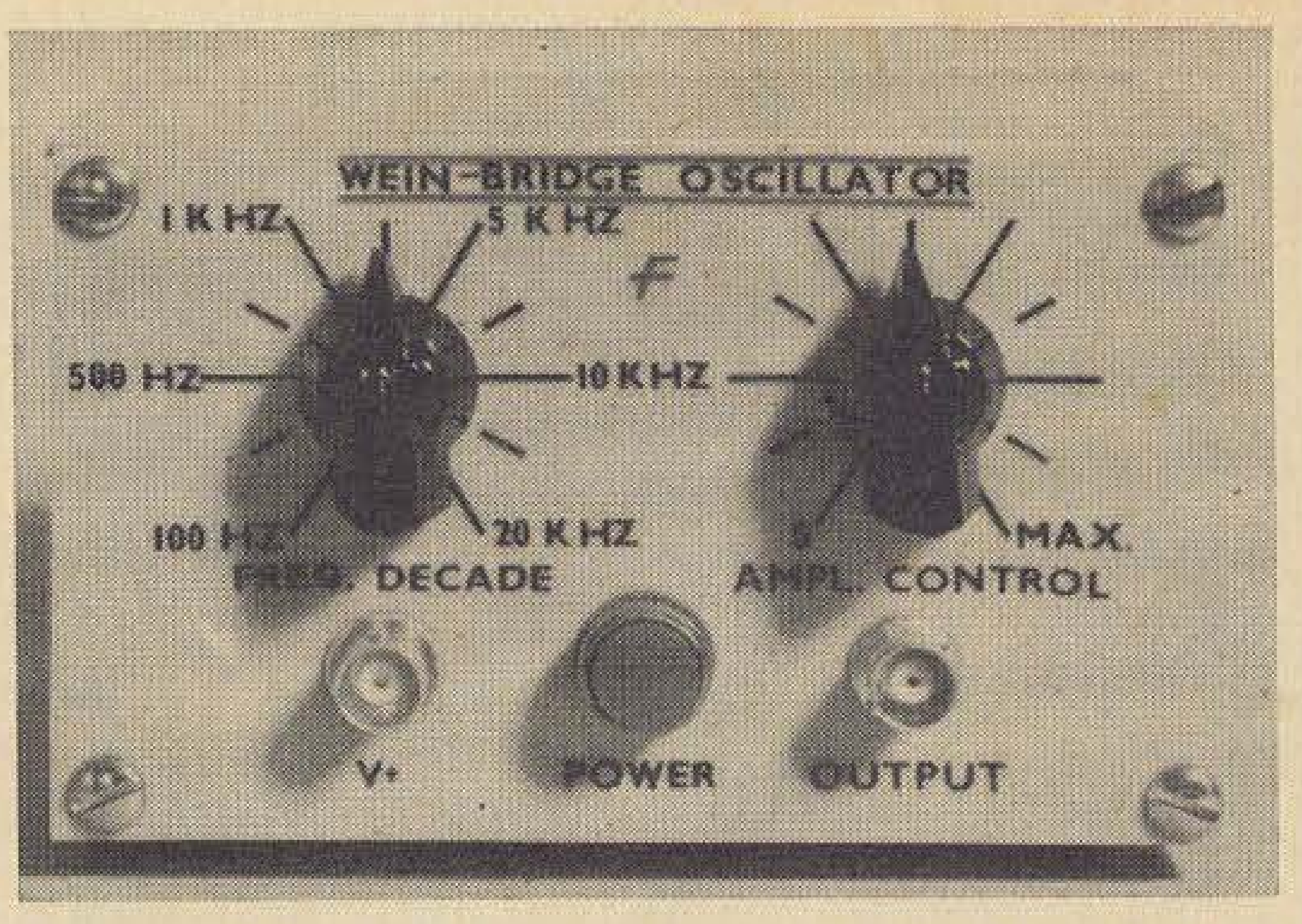



Fig. 1. Cross-section of aluminum divider, showing use in filling panel gap.

G. B. Estep W7AKS
Project Leader Communications
Fairchild Semiconductor
313 Fairchild Drive
Mountain View, Calif. 94041

# An Integrated-Circuit Audio Oscillator and Amplifier




A fixed-gain amplifier (such as the μA716C) may be easily connected as a Wien-Bridge oscillator capable of delivering up to 100 mW of power at frequencies from 100 Hz to 20 kHz. The low cost of the device makes it particularly attractive for the cost-conscious amateur or audio-phile. An oscillator of this type can be used for checking out a transmitter, high-fidelity sound system or as a code-practice oscillator.

The μA716C is basically a high-gain feedback amplifier constructed on a single 50-mil square chip and mounted in an eight-pin, TO-5 metal can. The device has four gain options of 10, 20, 100 and 200 available, but only the gain of 10 connection is needed for the oscillator. Operation as a Wein-Bridge oscillator is accomplished by adding suitable resistors and capacitors in a positive feedback loop, and by the addition of a diode and transistor automatic gain control. Although fixed frequencies of 100 Hz, 500 Hz, 1 kHz, 10 kHz, 15 kHz and 20 kHz are shown in the schematic, any frequency within this range may be obtained by suitable changes in the feedback capacitors. The frequency of oscillation will be given by:

$$\text{fosc} = \frac{1}{2\,RC}$$

$$= 33/C_{uF} \qquad \text{for } R = 5k$$

Where R and C are the resistor and capacitor connected to switch $S1_B$.

The complete schematic of the oscillator is shown in **Fig. 1.** The layout of the oscillator

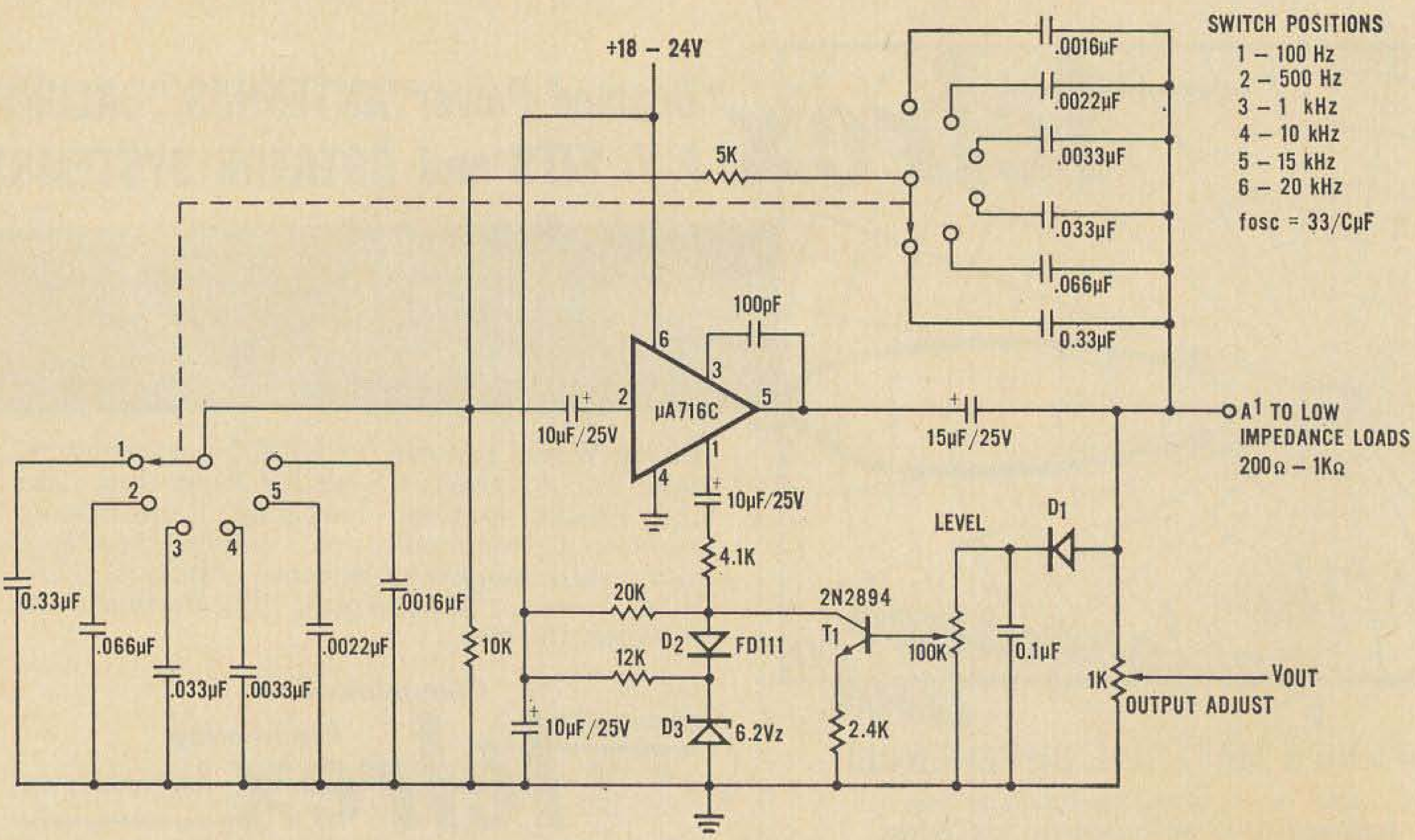



Fig. 1. The complete schematic of the oscillator.

is not critical, but should follow a neat pattern to assure error-free wiring. Selection of an operating frequency is accomplished by the two-pole six-position switch, $S_1$. Detection of the output voltage is provided by diode $D_1$, which rectifies the output voltage and applies the filtered dc to transistor $T_1$. Transistor $T_1$ sinks current from the 20K resistor connected to diode $D_2$, setting the gain of the $\mu$A716C at the point just sufficient to allow a low-distortion sine-wave oscillation to take place. Diode $D_3$, a 6.2 volt zener biases transistor $T_1$ sufficiently out of saturation to keep it from affecting the AGC performance. By changing the current through diode $D_2$, its dynamic resistance is altered in the direction necessary to establish a stable oscillation of the $\mu$U716C.

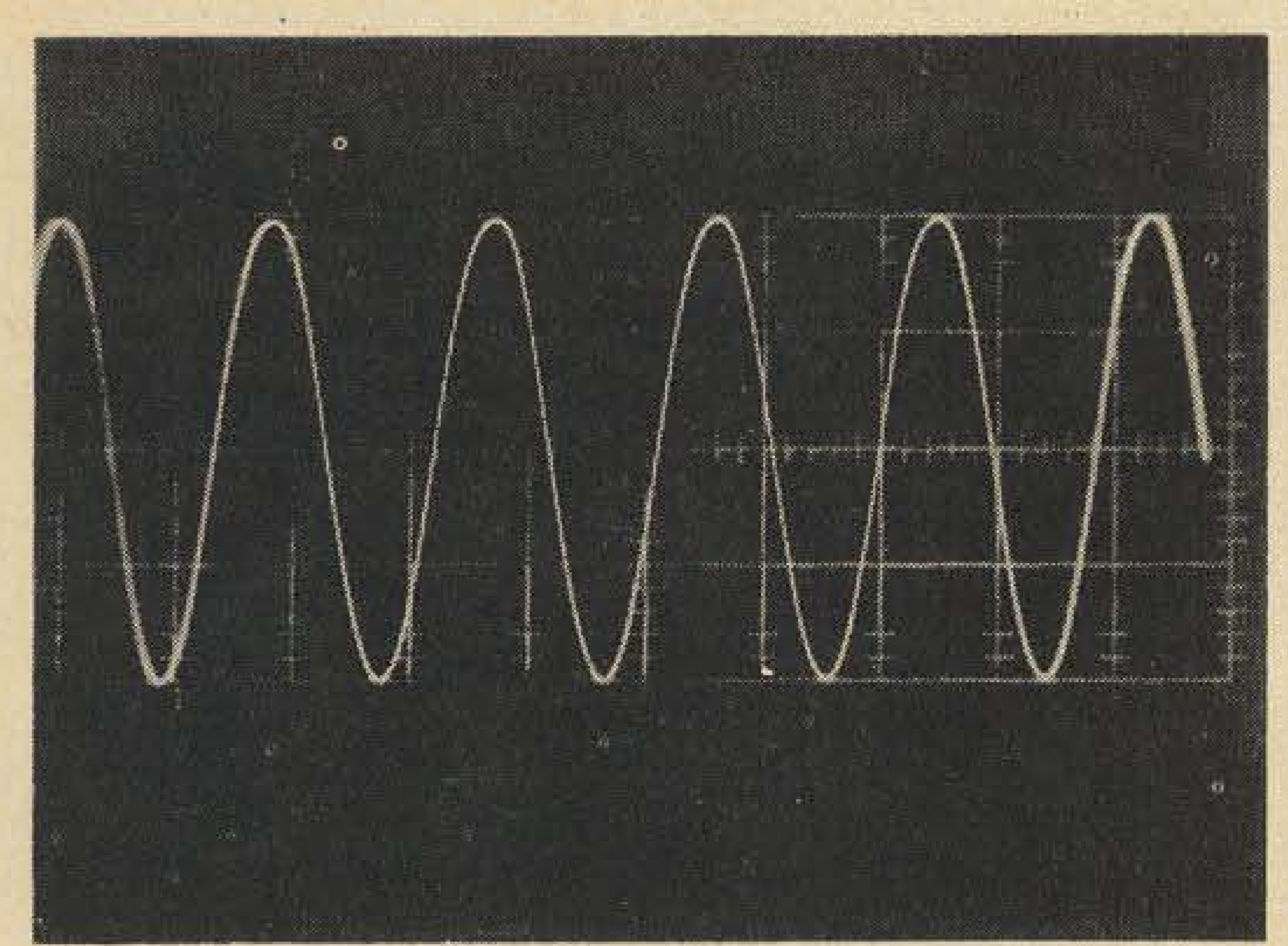


Fig. 2. A photograph of the output of the $\mu$A716C.

A photograph of the output of the $\mu$A716C is shown in **Fig. 2** for an output of 4 $V_{pp}$ at 1 kHz. The level control connected to $T_1$ should be adjusted for the maximum output

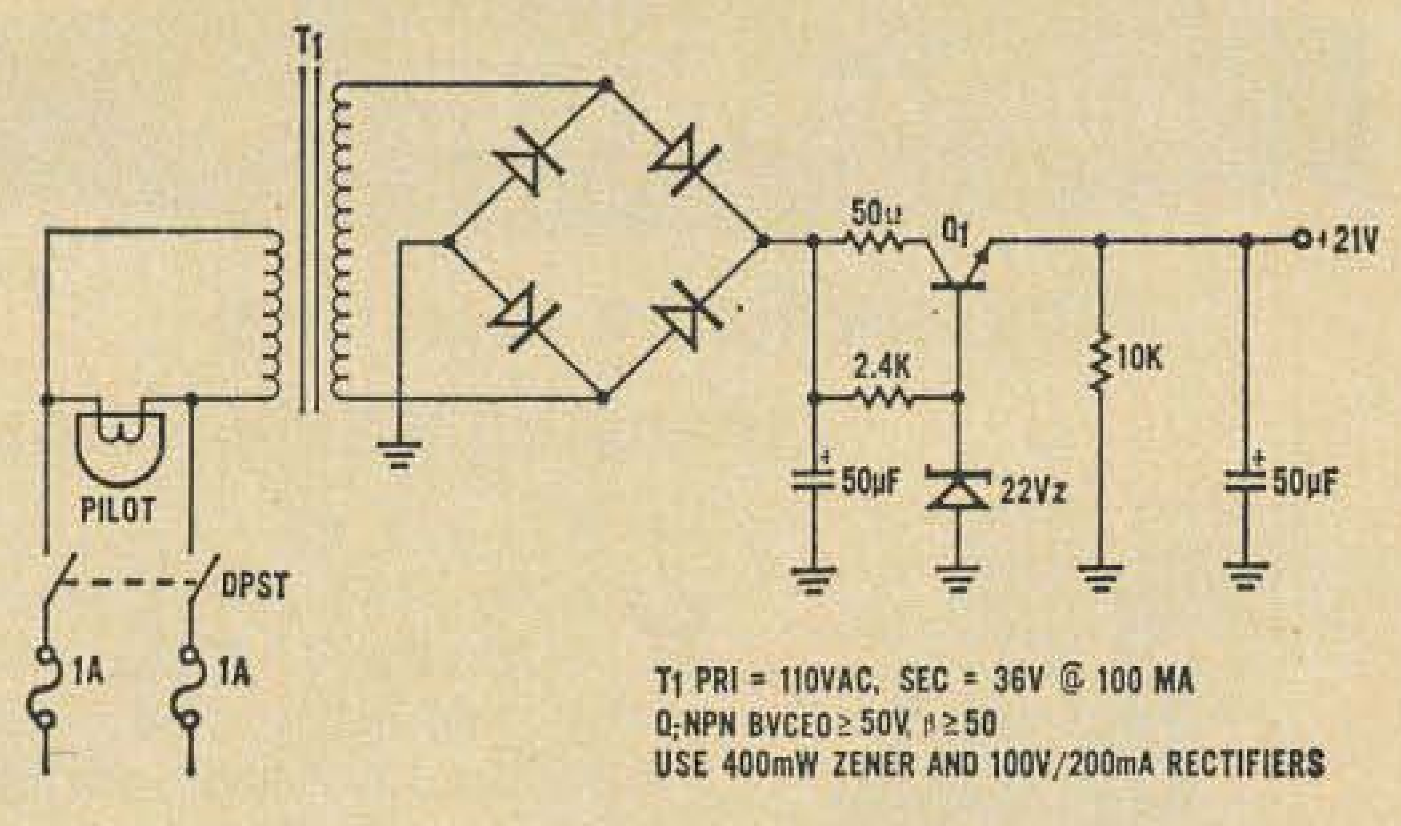



Fig. 3. Power supply

necessary at point A′. Output to the external circuitry should be adjusted to the desired level by the 1K ohm potentiometer. Operation with an output at point A′ of 8 volts peak-to-peak, or less, will result in minimum distortion (less than 1 per cent) while a higher output will be somewhat more distorted (less than 3 per cent at 15 $V_{pp}$ output).

The output from the 1K-ohm potentiometer should be sufficient for most applications, but if lower load resistances are to be used (less than 1K but greater than 200Ω) the output may be taken directly from point A′. Since the device operates from a low-voltage supply, keying may be accomplished in series with the headset if the oscillator is used for code-practice.

If a power supply between 18 and 24 volts at 50 mA is not available, the circuit of **Fig. 3** may be used for power. If desired, this supply could be built into the same box as the oscillator, to make the unit self-contained.

The uA716C integrated amplifier may

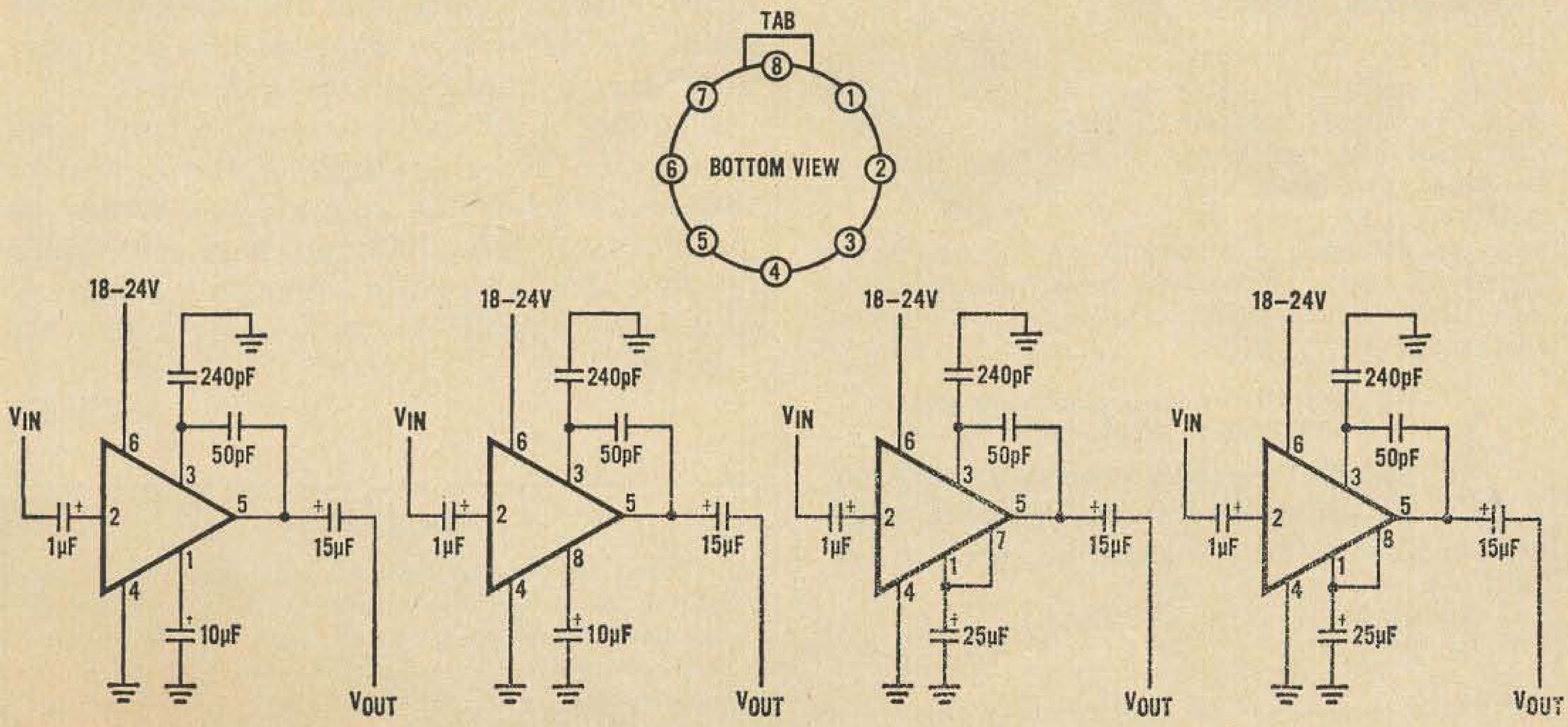
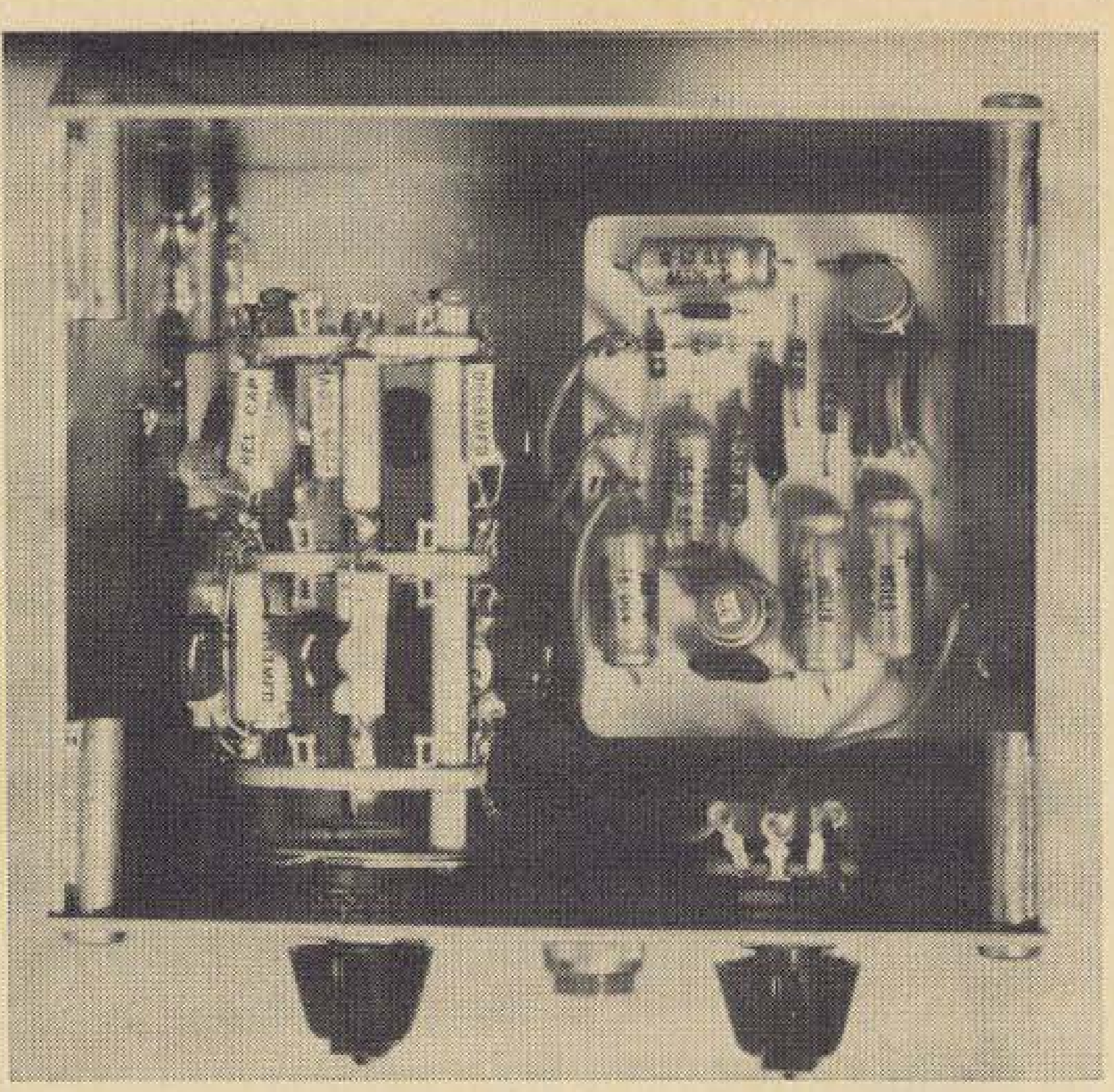



Fig. 4. Diagram showing connections for the $\mu$A716C.



Suggested layout.

also be used for driving headsets in either a communications receiver or for a high-fidelity sound system. Because of the large amount of feedback used in the amplifier the distortion of signals is very low (less than 1 per cent) so long as the input to the amplifier does not exceed the saturation value. The connection of the amplifier for each of its available gain options is shown in **Fig. 4.** To ensure low distortion the maximum peak-to-peak input voltage to the amplifier must not exceed

$$\frac{0.8 \times \text{V Supply}}{\text{Voltage Gain}}$$

For example, if a 20-volt supply is used and the voltage gain is 10, the maximum input voltage would be 1.6 volts peak-to-peak. For a voltage gain of 20, the maximum input would be 0.8 volts, etc.

Caution must be exercised when using this device to avoid shorting the output of the device when the supplies are turned on and to limit the minimum load impedance to 200 ohms. Possible damage to the amplifier may result if these suggestions are not followed.

. . . W7AKS

**YOUR CALL**

Please check your address label and make sure that it is correct. In cases where no call letters has been furnished we have had to make one up. If you find that your label has an EE3*&* on it that means we don't know your call and would appreciate having it.

# The New Tower

Muriel Joan Smith WA2GXT
135 Highland Ave.
Highland, New Jersey 07733

I'm a ham by marriage . . . and by love. By marriage, since I never would have given any thought to the hobby if my OM wasn't so vitally interested in it (it's easier to join 'em than fight 'em). By love, because it's impossible to shrug off such a fascinating pastime after that first contact.

Now, after this summer, I can also say I'm a ham by courage . . . I've had my first legal battle and climbed my first forty foot tower!

When we put our first antenna up, it was against the side of a house, easily accessible because of a lower roof. Then we moved, and the second antenna went up on the chimney, flanking a rather steep roof. I didn't assist with the installation of this one, claiming insufficient time and energy, the direct result of the acquisition of a twelve room, three-quarter century old house.

Then, after months of hard saving and careful scanning of ads, we agreed on a forty foot, self-supporting Spalding, which, we further agreed, would be erected in the back yard.

Because it is no small trick to hide a tower which is taller than anything else in the neighborhood, and because we wanted to avert the possible order to take it down because of neighborhood complaints, we decided to go about it legally and get a building permit . . . our very first mistake!

I went to the municipal building to read the section of the building code which governs towers. The regulations gave the necessary thicknesses of steel for the tower, and the approved widths for withstanding wind velocities. It said nothing about distance from other buildings, limit on height, or related subjects. This might turn out to be easy after, all . . . we even jived with the building code!

We knew Spalding had been in business long enough to have figured out wind velocities, snow weight and other minor problems, so we didn't give that part any thought as we headed to the building inspector for the required permit. (At this time, I'd like to interject that the BI is a non-ham, and a pigeon fancier to boot.)

The BI said fine when we told our plans, he'd be up to issue the permit. But a few hours later, he called and jubilantly (well, we thought he was, anyhow) claimed we couldn't put up a tower . . . the ordinance reads, he said, an antenna structure can't be any higher than half the width of our property. Well, to somebody who had just paid the better part of a hundred dollars to one of the best ham dealers around, and who owned a piece of property fifty-six feet wide, slightly narrower than the supposed eighty foot requirement for a forty foot tower, this didn't sit too well. Rather than admit defeat, we naturally assumed the BI read the ordinance wrong. Or even, the ordinance might have to be amended. It was as simple as that.

Working under the first assumption, we again visited the borough offices to read the building code (whose pages number in the thousands) with the inspector. Right off, (thank goodness) we found he had read the ordinance wrong. Our next problem was to convince him of it.

The inspector had completely disregarded the section on towers (he said that only referred to the "big city" where the big radio stations are) and read the section governing antennae. This section did clearly state that the antenna structure could not be of a height more than half the width of the property. We even agreed with this, indicating that our antenna structure, to be mounted atop a forty foot tower, was about four foot high.

We explained the difference between an antenna and a tower . . . but it was all to no avail. The BI was convinced that since the antenna and the supporting pole were to be mounted on top of the tower, this indeed made the tower an "antenna structure."

Our next course of battle was to ask if every house in the borough was to be considered an antenna structure, since every house (well, almost) had a television antenna atop it. We further pointed out that none of the houses, barring any, were less than half the width of the propery on which they were built.

Of course, our friend the BI disagreed. The primary purpose of the house, he said, was to live in; an antenna on top was a secondary purpose. Here we pointed up two more facts; one, the ordinance said nothing about primary or secondary purposes, and two, even if it did, perhaps we were erecting the tower because we like the looks of one hundred and twenty pounds of steel neatly arranged in the backyard. That a four element six meter antenna would be atop it was secondary. We went a few more rounds, but an inspector who uses pigeons rather than electronics for communications is a hard one to convince of the merits of amateur radio and related topics. He denied us our permit.

This left two other avenues open to us. We could either do it legally or illegally. For the first, we could get his denial in writing and appeal to the zoning board for a variance. But this would be like admitting the inspector was right, a fact of which we still weren't convinced. We could hire an attorney and have him explain the differences between an antenna and a tower. But after spending our hard earned and harder saved funds on said tower, this wasn't too feasible an idea either. We could plead our cause to the several hundred other hams in the county and picket borough hall . . . but pickets are too common now. We could appeal to the governing body and get their decision on the matter. But this would take months, and at a time when 6 meters was wide open, this wasn't too brilliant either.

The only other way open was the illegal way . . . . . go ahead and put up the tower and let the permits fall where they may.

The best part of the next day was spent digging a four foot deep hole, two feet in diameter, to house the base of the structure. Now, this sounds easy enough for a few well-bodied hams to tend to, but in a yard that has a slope of about forty degrees and earth which seems to be made entirely of ironstone in giant chunks, it's easier said than done.

But finally, the hole was dug, the base inserted, and the easy part began. It took a scant few minutes to assemble the five sections and walk them up to their full forty foot height. Next came mounting the antenna, antenna structure, and the rotor, and we were in business.

The OM climbed the tower many times, just for a lark, to get the feel of it, and to see the view (we're not far from the ocean). On my first attempt I climbed twenty-four feet and began to think how stupid it was to do this for no reason. I also figured it would be unfair to the OM if I climbed to the top. After all, I might fall and break a leg or something, and he'd have to take care of the four harmonics . . . . . how could I be so thoughtless?

But the days went by and that tower stood in the yard, the topic of conversation at all neighborhood coffee clatches, and the envy of every kid in town. But to me, it was a hundred and twenty pound hunk of steel that had the best of me. It seemed to stare down haughtily at me from its great height, and dare me to do something about it. I couldn't take it any more . . . I had to climb it or admit defeat . . . . . which was the worse alternative?

So with good sturdy shoes and a large helping of determination, I made the ascent. And do you know, it's not bad at all.

The tower stands now as a part of the community. It's ignored by the BI, held in awe by the neighbors, respected by the kids . . . . . and best of all, conquered by me, an xyl who's ready to climb it any time!

. . . WA2GXT

# *New 160 Meter Allocations*

We have been advised by the FCC that effective July 1, 1968 there will be new frequency and power allocations in the 160 meter band. In order to facilitate printing of this information, we have established the following key which will guide you in finding your frequency and power allocations for your particular state.

a. 1800-1825 kHz
b. 1825-1850 kHz
c. 1850-1875 kHz
d. 1875-1900 kHz
e. 1900-1925 kHz
f. 1925-1950 kHz
g. 1950-1975 kHz
h. 1975-2000 kHz
0 Not usable
1 100 watts days, 25 watts nights
2 200 watts days, 50 watts nights
5 500 watts days, 100 watts nights
k 1000 watts days, 200 watts nights

| | 160M Segments | | | | | | | | | 160M Segments | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | a | b | c | d | e | f | g | h | | a | b | c | d | e | f | g | h |
| AL | 5 | 1 | 0 | 0 | 0 | 0 | 1 | 5 | NM | 1 | 0 | 0 | 0 | 0 | 1 | 5 | k |
| AK | 2 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | NY | 5 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| AZ | 0 | 0 | 0 | 0 | 0 | 2 | 5 | k | NC | 5 | 1 | 0 | 0 | 0 | 0 | 0 | 1 |
| AR | k | 2 | 1 | 0 | 0 | 1 | 1 | 5 | ND | 5 | 1 | 1 | 1 | 1 | 2 | 2 | k |
| CA | 0 | 0 | 0 | 0 | 1 | 2 | 2 | 5 | OH | k | 5 | 1 | 0 | 0 | 0 | 0 | 1 |
| CT | 5 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | OK | 5 | 1 | 1 | 0 | 0 | 1 | 2 | k |
| CO | 2 | 0 | 0 | 0 | 0 | 2 | 2 | k | OR | 0 | 0 | 0 | 0 | 2 | 1 | 1 | 5 |
| DE | 5 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | PA | 5 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| DC | 5 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | RI | 5 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| FL | 5 | 1 | 0 | 0 | 0 | 0 | 1 | 5 | SC | 5 | 1 | 0 | 0 | 0 | 0 | 0 | 2 |
| GA | 5 | 1 | 0 | 0 | 0 | 0 | 0 | 2 | SD | 5 | 1 | 1 | 1 | 1 | 2 | 2 | k |
| HA | 0 | 0 | 0 | 0 | 2 | 1 | 1 | 5 | TN | k | 5 | 1 | 0 | 0 | 0 | 0 | 2 |
| ID | 1 | 0 | 0 | 1 | 1 | 1 | 1 | 5 | TX | 2 | 0 | 0 | 0 | 0 | 0 | 1 | 5 |
| IL | k | 2 | 1 | 0 | 0 | 0 | 0 | 2 | UT | 1 | 0 | 0 | 1 | 1 | 2 | 2 | k |
| IN | k | 5 | 1 | 0 | 0 | 0 | 0 | 2 | VT | 5 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| IA | k | 2 | 2 | 0 | 0 | 1 | 1 | 5 | VA | 5 | 1 | 0 | 0 | 0 | 0 | 0 | 1 |
| KS | 5 | 1 | 1 | 0 | 0 | 1 | 2 | k | WA | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 5 |
| KY | k | 5 | 1 | 0 | 0 | 0 | 0 | 2 | WV | k | 5 | 1 | 0 | 0 | 0 | 0 | 1 |
| LA | 5 | 1 | 0 | 0 | 0 | 0 | 1 | 5 | WI | k | 2 | 2 | 0 | 0 | 0 | 0 | 2 |
| ME | 5 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | WY | 2 | 0 | 0 | 1 | 1 | 2 | 2 | k |
| MD | 5 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | KP4 | 5 | 1 | 0 | 0 | 0 | 0 | 0 | 2 |
| MA | 5 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | KV4 | 5 | 1 | 0 | 0 | 0 | 0 | 0 | 2 |
| MI | k | 5 | 1 | 0 | 0 | 0 | 0 | 1 | KS4 | 5 | 1 | 0 | 0 | 0 | 0 | 1 | 5 |
| MN | 5 | 1 | 1 | 1 | 1 | 1 | 1 | 5 | KC4 | 5 | 1 | 0 | 0 | 0 | 0 | 0 | 2 |
| MS | 5 | 1 | 0 | 0 | 0 | 0 | 1 | 5 | KB6 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 1 |
| MO | k | 2 | 1 | 0 | 0 | 1 | 1 | 5 | KG6 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 |
| MT | 1 | 0 | 0 | 1 | 1 | 1 | 1 | 5 | KJ6 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 |
| NB | 5 | 1 | 1 | 0 | 0 | 2 | 2 | k | KM6 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 |
| NV | 0 | 0 | 0 | 0 | 1 | 2 | 2 | k | KS6 | 2 | 0 | 0 | 2 | 2 | 0 | 0 | 2 |
| NH | 5 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | KW6 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| NJ | 5 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | KP6 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 2 |

Allan S. Joffe W3KBM
531 East Durham Street
Philadelphia, Pa. 19119

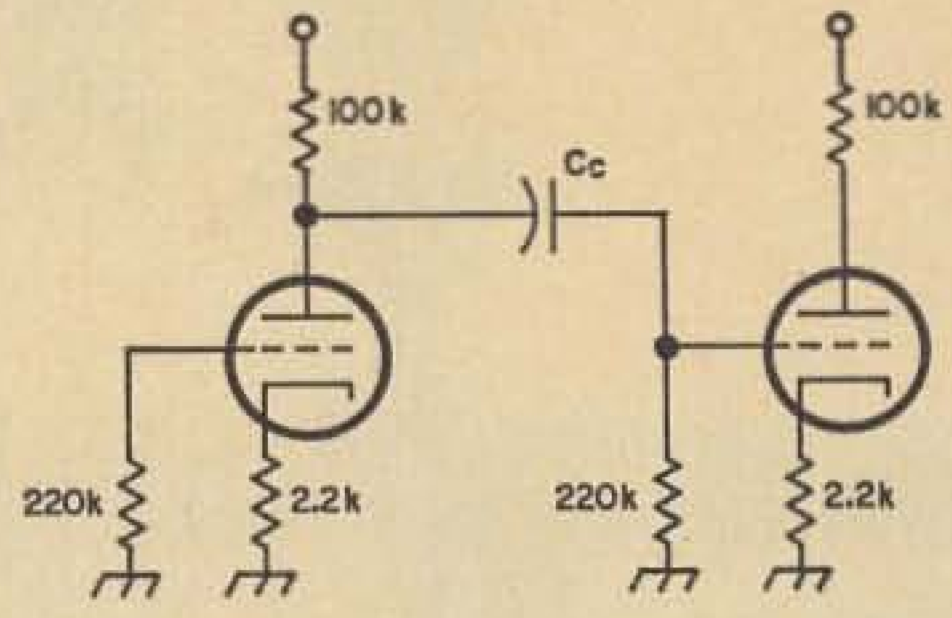



Fig. 1. Two stages of audio, resistance coupled.

# *Some Audio Thoughts*

Sooner or later the average ham rolls some sort of an audio modulator and faces the task of shaping the frequency response. Some fortunate souls drag out the slip stick or log tables and design a circuit which works like a dream. You and I hunt the junk box and solder in parts, hoping that Providence is guiding our hands as well as the audio bandpass. What I would like to suggest is that there is some sort of happy (?) middle ground.

Lets examine **Fig. 1.** It shows two stages of audio, resistance coupled. The triodes have a mu of about 70 and the assigned values of plate grid and cathode resistors are in the ball park. The cathode bypasses have been intentionally omitted to make the following point. If we put a 1 kHz tone through the amplifier and bypass either cathode with a high value capacitor (10 μF or so) we will notice that the gain of the stage goes up by six to eight db. The response at this point would be flat from about 50 Hz to well past the upper limit that we would be interested in obtaining in a communications modulator. Naturally if we bypassed both cathodes the overall gain would be some 12 to 16 dB higher than without the bypasses.

The frequency bandpass of average interest to the ham as regards his audio modulator runs from about 300 Hz on the low end to about 3000 Hz on the high end, a band pass which will provide adequate voice identity and intellegibility without taking up too much spectrum with side band or bands.

Lets take a peek at **Fig. 2.**

This shows what happens when the cathode resistors are bypassed by various small values of capacity. Notice that the 0.3 μF condenser provides all the bypassing needed at the high end to retain stage gain and at the same time gives a moderate roll off at the low end. This points up the idea that the voltage gain stages of your modulator do not need the big fat electrolytics so commonly seen. The smaller properly selected values do the trick nicely.

| | 100 Hz | 300 Hz | 1 kHz | 3 kHz | 5 kHz |
|---|---|---|---|---|---|
| 0.1 mfd | ±0 | +1 | +3.5 | +7 | +7.5 |
| 0.2 mfd | ±0 | +2 | +6 | +7.5 | +8 |
| 0.3 mfd | +1/4 | +3.5 | +7 | +8 | +8 |
| 0.4 mfd | +1 | +4.5 | +7.5 | +8 | +8 |
| 0.5 mfd | +1 | +5.5 | +7.5 | +8 | +8 |

Fig. 2. Gain vs. Frequency for various values of cathode by-pass.

The remaining reactive element in our simple voltage amplifier in **Fig. 1** is the interstage coupling condenser Cc.

The second stage grid resister is specified as 220 K, so the value of this coupling condenser is examined with this value in mind.

The coupling condenser in conjunction with the grid resistor forms a frequency sensitive voltage divider between the two stages. Since capacitive reactance varies inversely with frequency, the higher frequencies are more readily passed than low frequencies.

Let us take note of some Xc values at 1 kHz.

0.01 $\mu$F has a reactance of about 16,000 ohms.

0.005 Xc is about 32,000 ohms

0.001 Xc is about 160,000 ohms

Notice that only the latter value starts to exhibit a large proportion of the grid resistor 220,000 ohms.

Taking the circuit of **Fig. 1** without any bypass condensers across the cathode resistors, we substitute the three values of coupling condensers specified and the resulting frequency responses are tabulated in **Fig. 3.**

| | 100 Hz | 300 Hz | 1 kHz | 3 kHz | 5 kHz |
|---|---|---|---|---|---|
| .01 | -1.5 | -0.5 | ±0 | ±0 | ±0 |
| .005 | -3 | -0.5 | ±0 | ±0 | ±0 |
| .001 | -8 | -2 | ±0 | ±0 | ±0 |

Fig. 3. No cathode by-passes.

Now let's put the two methods of response control together by putting a 0.3 $\mu$F condenser across one of the cathodes bias resistors and substituting the same three values of Cc in the amplifier. **Fig. 4** shows the results of the combination.

Notice that the 0.001 $\mu$F Cc really begins to tailor the low end, although the .005 $\mu$F Cc would probably sound just as acceptable keeping in mind that the combination of different microphones and different voices coupled with shack acoustics enter into the final decision as to what is right for you.

You might well wonder what the relative responses would be if you repeated the experiment with a cathode bypass of 0.2 $\mu$F. The results here would be close to the values in **Fig. 4.** However if you dropped the cathode bypass value down to 0.1 $\mu$F you would notice that the 1 kHz gain would drop about three dB over the condition we had when we bypassed the cathode with a juicy electrolytic. This loss in gain would show up as a high frequency tilt in the response curve. Since we have achieved a reasonable depression of the low end of the response curve with little finite gain loss this would be designing in the wrong direction. So far our values of cathode bypass and coupling condenser most favorably disposed to meet our ends have been 0.3 $\mu$F and 0.001 respectively.

Recalling so far that we have only bypassed one of the two cathodes let us examine what happens when we bypass *both* cathodes with 0.3 $\mu$F condensers. We now

| | 100 Hz | 300 Hz | 1 kHz | 3 kHz | 5 kHz |
|---|---|---|---|---|---|
| .01 | -7.5 | -4.5 | ±0 | ±0 | +0.5 |
| .005 | -9.5 | -4.5 | ±0 | ±0 | +0.5 |
| .001 | -21 | -8 | ±0 | ±0 | +0.5 |

Fig. 4. 0.3 mfd by-pass.

pick up some six to eight db of gain and should expect the curve to tilt up in both directions. The results tabulated in **Fig. 5** show the results. These results are interesting but must be examined with respect to the rest of the contemplated circuit. An unbypassed cathode is a very nice point to return feedback which will contour the upper frequency response of your amplifier, so you may not want to bypass at this point. It is relatively simple to "build out" a modulation transformer with shunt capacitors to control the high frequency end of your modulator but a readily available feedback point is nice from the standpoint of distortion reduction also.

| | 100 Hz | 300 Hz | 1 kHz | 3 kHz | 5 kHz |
|---|---|---|---|---|---|
| .01 | -12 | -7 | 0 | +2 | +2 |
| .005 | -15 | -7 | 0 | +2 | +2 |
| .001 | -26 | -10 | 0 | +2.5 | +2.5 |

Fig. 5. Both cathodes by-passed.

If you favor a pentode triode combination for mike amplification the same general principles hold as already outlined. Playing with pentodes generally allows you to trade off surplus gain for the frequency roll offs desired. In addition you have the screen grid to play with as a low end control. Instead of bypassing the screen with a heavy hand, try selectively bypassing it with different values of capacitor and you will readily demonstrate that between complete by passing and the unstable too lightly bypassed region that there is an interesting area of frequency control available to you.

. . . W3KBM

J. K. Bach WB2PAP
Ivy Hill Road
Walden, N.Y. 12586

# *db*

Sooner or later it had to happen. The F.C.C. is putting db questions in its license examinations. The student who told me was quite bitter about it. He had memorized both db formulas and they did not help him a bit. It seems the Commission furnished neither slide-rule or log tables; they expected him to work the example in his head!

Questioning revealed that the example concerned the net gain in db of an amplifier with such and such tube gains, these and those transformer ratios, which were easy enough if you knew the corresponding db ratios, which he did not. Yesterday, a very few knew them; today, many find them useful, and tomorrow they will be required of all technicians. Since learning them is little more than a knack so there is little reason for procrastination.

In the early twenties, the AT&T Co. had a unit which they called a "Standard Cable Mile." This was the loss of one mile of exchange cable. They didn't coil up a mile of it in the basement for comparison, of course. They had a panel with a variable attenuator having one *mile* steps, and a switch. A tone through the panel was switched either to the circuit to be measured, or to a comparison circuit, and the result judged by ear.

Science marched on, and they came up with the Transmission Unit, or TU. This logarithmic unit was approximately the same as the Cable Mile, but by this time they had transmission measuring sets calibrated in TU. These were much more accurate and convenient.

Later still, the TU was renamed the decibel, or one-tenth Bel, one L. The Bel was named for A. G. Bell, of whom you may have head. The db was always to be written in lower case, and singular! Originally it was recommended that db be handwritten with the d and the b run together, sharing a common stem. Indeed, it can be easily and

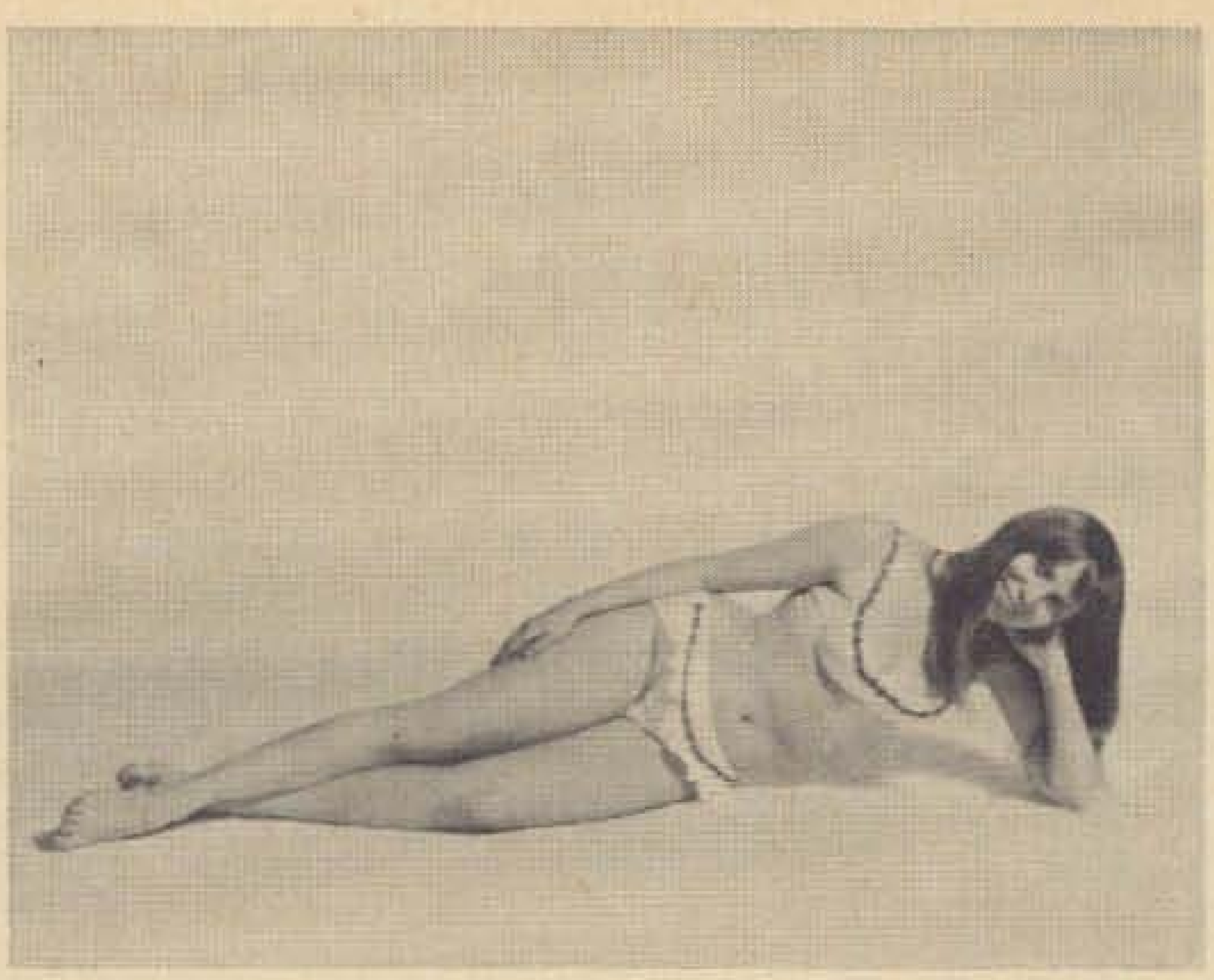


*Fig. 1. Since db are hard to illustrate, the author suggested we use a pretty girl. Appropriate since db is a measure of power and never underestimate the power of a woman. Our model is the lovely Mrs. Wayne Green (Lin), wife of our publisher.*

rapidly written this way, with a twitch of the fingers. This convention has been abandoned, probably because of its vulgar appearance[2]. This is one more reason for the paucity of illustrations in this article[3].

Now we need a few rules of thumb—and ear—to locate ourselves in this unfamiliar countryside. They should be memorized and used whenever possible for familiarization. You will find them useful.

*One db* is really quite small, with a power ratio of only 1.259 to 1. Don't memorize this, but remember that a *one db change in power is the smallest that can possibly be heard.* This is true whether you are talking about −37 to −38 db or plus 52 to plus 53 db—*the ratio is the same.* Broadcast stations have gain controls with steps. You never hear the steps, because they are ½ db ones.

*3 db* is a power ratio of 1.995 to 1. Remember it as *2 to 1 power ratio,* which is close enough[4]. With careful listening, you can detect this change in power in program material, speech, etc. You might say it is the *smallest change in power that can be detected* under average conditions.

*6 db* is a power ratio of 3.931 to 1. Remember it as 4 *to* 1*;* the error will never be important. 6 db *is the smallest worth-while increase in power, so far as the ear is concerned.* Significantly, it is also equal to one

"S" unit. 6 db is noticeable, but not overpowering.

*10 db* is a power ratio of 10 to 1 and it is EGG-ZACTLY ten to one by definition. Such a power increase *cannot be overlooked* under any circumstances—it is well worthwhile. When a broadcast station increases power, it often does so by ten db steps—5 watts to 50, 50 to 500 to 5,000.

If you swap your 10 watt hi-fi amplifier in on a 20 watt one, it will not sound "twice as loud." In fact, you will hear little if any difference, except possibly a little less distortion. Every ham knows about increasing power to get out better. If 100 watts puts you about 3 db above the average noise, you will be hard to read. 200 watts will then put you 6 db above the noise which is more better, and you will settle for that if you can't get plus ten db, the full gallon.

Most telephone lines will average out *6 to 10 db in loss*. You can talk quite easily over a line with 20 db loss—this is 10 plus 10 db or −20 db (minus to indicate loss) *or* 0.1 power *times* 0.1 power, which is 0.01, the ratio of input to output power.

If your line measures suddenly 35 db, you can suspect that *one side of the line has has gone,* especially if it also goes noisy. But you can usually still talk on it.

*10 db* is the most loss you can talk over—and this requires *no distortion* and a *quiet line*. You can hear the guy on the other end clearly, but oh so faintly—so far away!

And right here, my friends, is the Secret of the Barefoot SSB exciter. For many years, the transmission advantage of SSB over AM (with transmitted carrier) was explained on a concentration of sideband power at the transmitter (6 db) and halved receiver bandwidth (3 db) basis. The total advantage claimed is 9 db. Now this can be proved by mathematics, but is ridiculously conservative, as any ham knows. The real reason SSB gets out is that it is a *low distortion system*. I realize that many will scoff at this, but it is nevertheless a fact. It is the only way to account for the known facts—and the next time you hear someone's five watt exciter clear across the continent, think of this. He's faint—very faint!—but you can hear everything he says. An AM signal would be as loud—probably louder—but you couldn't get intelligence out of it.

To get back to the power ratios: they are all positive ones. To get negative ones, you just turn the fractions over, or divide them into one. Of course, if you know your Logarithms, you can work with negative values all right, and sometimes you have to—remember 8 dot umpty-ump −10 to simplify a minus two characteristic? But with db, nobody, but nobody!—ever does this. They figure positive values, and remember to call the answer negative. Plus three db (up) is twice power, while minus 3 db is ½ power. But it is easier to think two to one rather than one-half, and the *number comes out the same in db,* you just have to remember to call a loss, *minus*.

db notation is full of pleasant little surprises like this, if you know how to find them. Now rest your eyes a moment on **Fig. 1**, after which we'll make the following small table:

Table I

| db | Power ratio |
|---|---|
| 10 | 10 to 1 |
| 20 | 100 to 1 |
| 30 | 1,000 to 1 |
| 40 | 10,000 to 1 |

You see? A decimal, or finger-counting system—and you thought it was hard! Notice that the db values *add*, by tens, and the power ratio values *multiply* by factors of 10. It sounds a little silly to convert power ratios to db just to save the trouble of multiplying ratios, but in practice it is very much easier.

Here's something else to notice: 1 db (one-zero) equals 10 to 1 and ten has one zero in it. 20 db (*two*-zero) equals 100 to 1, and 100 has *two zeroes*[5].

At this rate, 60 db represents a power ratio of one million—a one, followed by six zeroes. How very nice it is to have something simple for once!

How about the values between the tens? Are we not approximating a little too much? Well, we haven't finished yet, for one thing, and the "ten-spots" are the ribs of the structure which we must get firmly in mind.

Everyone who proposes to explain db notation gets asked to cut out all the palaver and just draw a graph. OK, take another glance at **Fig. 1** and get a piece of 8½ x 11 and we'll draw one.

What scale shall we use? How about 0 to 100 db by tens along the bottom edge, and 1/10 inch to the db or vice-versa along the left edge? Start off with zero-zero in the lower left side-pocket. At the 10 db point, go up 1/10 inch and make the second dot. 20 db is ten times as much as 10 on a linear scale, so put it 1.1 inches over the base line at 20 db. 30 db, 11.1 inches, 40 db, off the paper, hmm!—50 db, out of the house, 60 db, across the street, 70 db across the river and under the trees, 80 db, the next town, 90 db, Peoria, and 100 db, Hawaii.

Obviously our db scale was too large. So let's make 1 db equal to one-hundredth inch. This keeps us on the paper ten db longer, but we still wind up in Peoria at 100 db. Me, whenever anyone says "One Hundred db." I stand and uncover. It is not a number to be taken lightly. OK, students—just how big *is* 100 db? What is the power ratio? If you made your scale 1/1000 of an inch to the db, where would you go off the paper? Of course I have heard of log paper. It tricks the eye, but never completely. You know the log scale represents a large quantity, but just *how* large? I can visualize it better myself as distances such as Peoria.

When Logarithm sharks and slide-rule jockeys work with db, they invoke "powers of ten" and "adding and subtracting exponents" and similar necromancy. A slide-rule is very useful for smelling out the intervals between the powers of ten, but stupid as hell about decimals, as any devotee will tell you. So your engineer has memorized his powers of ten until it is permanently in the head-bone, which-is-connected-to-the-neck-bone, and the big act with the slide and the cursor is just to find out how much 3.4 of 43.4 db is—he already knows how much the 40 db is.

So you cannot snow the engineer—snowing is his business. (I'm kidding—it is only a *very small part* of his business.) But operating and supervisory personnel are fair game, and easy game usually—they do a lot of kidding themselves and so are vulnerable.

Like so: Someone, possibly under post-hypnotic suggestion, happens to mention that Tropo-Scatter systems sure have a high path-loss——150 *db* or so. Don't *never* pipe up with "That's one times ten to the minus fifteenth." They'll shrug it off. Instead, fish out a piece of paper and *slowly* write a 1 with fifteen zeros after it. Do not *say* fifteen, or they may get the connection. Unless they know their logs well, they *still* won't get it after working it out with the tables—I don't know why, but they don't. Abstracted, maybe.

Maybe some wise-guy reads 73. Smile and shrug and walk away. Did he do his home-work? If not, you will still win out; soon no one will argue db with you if you know your stuff. This is the difference between *knowing* a subject, and knowing *about* it.

In that connection, people who know the db formulas, and little else about the db notation, often say "dee-beez of voltage" and "dee-beez of power." as if these were different things.

Not so. The db is by definition, a power ratio—and electrical power at that. The other formula? Well, when you say "Power" or "Watts", generally two formulas come to mind: E x I and $I^2R$. So do you say "I X E power" and "$I^2R$ power"? Hardly. Watts is watts. And db is db, and this turns out to be simpler, not more complex. You could actually take the formula for power ratios, db equals 10 log P2/P1 and substitute E2/E1 or I2/I1, *provided* you squared the E or I term first. It actually works! But it is a lot of trouble, and one of the very nicest things about Logarithms is that the *square* of a number is equivalent to its log *doubled*. So put a two in there somewhere and you can use the E or I ratio directly. The two times the 10 is 20, hence "20 log—" in the formula. *A db is always a db,* and there is only one kind. Since power is proportional to E or I *squared* you cannot compare 2 to 1 power (3 db) with 2 to 1 voltage (6db) legitimately.

Another glance at **Fig. 1,** another table:

Table II

| db | power ratio | E or I ratio |
|---|---|---|
| 30 | 1,000 | 31.62[8] |
| 3 | 2 | 1.41[7] |
| 6 | 4 | 2 |
| 10 | 10 | 3.162 |
| 20 | 100 | 10 |
| 30 | 1,000 | 31.62[8] |

You can complete the table yourself, taking it as high as you wish.

Now come we to *levels* expressed in db-. A db is a *power ratio* which expresses a *gain or loss* very well. Suppose we take some reasonable amount of power, such as the milliwatt, and call this 0 *dbm*—the *m* for *milliwatt*. Counting up ten db to *plus* 10 *dbm* we have 10 milliwatts, while down to —10 dbm we have one tenth milliwatt, or one-ten-thousandth of a watt. Simple enough.

*One milliwatt peak, or* 0 *dbm peak* is the power you can expect out of a telephone set, or an F-1 button. At one time, 6 milliwatts was a common reference but with the growth of Broadcasting, the milliwatt reference was universally adopted for uniformity. Note well that no impedance is specified. You can have a dbm at 1200 ohms or 600 ohms or 75 ohms or 124 ohms —all different voltages, all the some power.

In that connection—the dbv or db referred to one volt. Some measuring instruments are so calibrated when you are more interested in the difference between two values—in and out—than in the absolute power level, or output. You can always figure out the power, once the impedance is known. Of course, dbv is still a power ratio. You can argue the point, obviously, but not with me!

Instead, I have another delightful surprise for you—no matter how you read it, or what the impedance is, or what the db scale is referred to, the *difference* between readings on *any given db scale* is always accurate. −12 to −9 db on a dbm 75 ohm meter shows that the power has been *doubled* and plus 2 to plus 5 dbm on a dbm 600 ohm scale would show that the power was doubled. Notice, no mention of the impedance or scale reference. Also works, with dbv, obviously.

Here we go into the home stretch: Instant db Meter Calibration. You can learn to project a db scale on an ordinary meter with your own Evil Eye. This is useful where differences in db levels are wanted, for trouble shooting or such like. Of course, the meter should be reading ac, with no dc component. Thermocouple meters and rectifier-type meters are most suitable.

There is no zero, as such, on a db scale. The zero found in the dbm scale represents one milliwatt, of course. So we do not calibrate upscale from zero, but downscale from 100. Obviously, the first point is half voltage, −6db, at 50 on a 0-100 scale. The next half is −12 db at 25, and −18 db at

12.5, call it 12 or 13. There is a −20 db point at 10 on the scale, and the compression is such that this is the lower practical limit. We also know that −10 db, at ⅓ scale or 33 is another voltage point.

This leaves the bottom half pretty well filled, but look how empty the top half is—even if it contains only 6 db of the 20. Well: we know that 3 db is half *power*, so the corresponding voltage is the square root of this—the square root of 2 is 1.414, isn't it? This is negative db, so we use the reciprocal, 0.707 or 70 on the scale. Another method would be to simply memorize the points 90, 80, 70, 63, and 56. They correspond to −1, through −5 db.

Commercial Overseas transmitter operators use the −10 and −20 db points to set their SSB carrier suppression points. So far as I know, they are the only ones who do. I use it in shooting trouble in TD-2 Microwave receivers. The output meter has no db calibration, just an 0-2.5 and a 0-100 scale. However, the plus 10 db normal output level is usually set at 1.25 on the scale, which is also midscale (50). If this is plus 10, then 100 is plus 16 and 33 is plus 6, 25 is plus 4 and 10 is minus 4, all dbm read directly. When the reference is not known the difference readings are still useful. This knack is another baffling one for the uninitiated. Your projected scale is something like **Fig. 2**—at last, we got past Figure 1!—Of course, you can write in these figures on your own meter (I mean Figure 2 type figures, not Figure 1 type.) but this is less fun and you miss the chance to fool your friends.

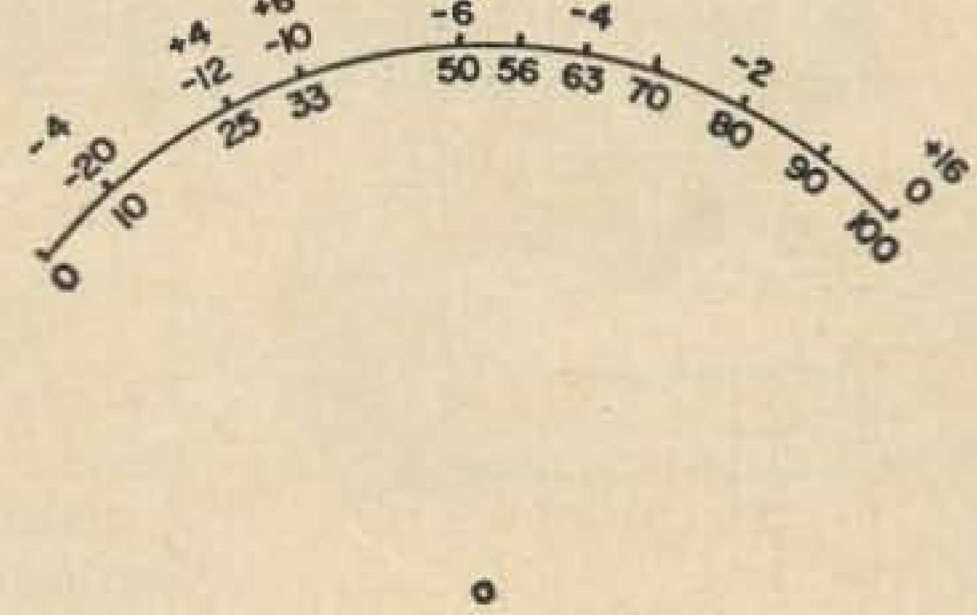



*Fig. 2. See above text.*

How much is plus 30? 1000, of course. So how much is 33db? 2,000 of course. Plus 27 db is, naturally, plus 20 minus 3 db, or 1000 cut in half, or 500 to 1. For more points you can use plus 6 and minus 6 db the same way—plus 16 is plus 16 is plus

10 or ten times power, times 4 for a total of 40 to 1. So between tens you can get plus 3, plus 4 (the next ten, minus 6), plus 6 and plus 7 db. Come to think of it, you can work out plus and minus 9 also, which gives you two more points. I question the worth of taking it this far, however. db to power ratios are easy, but the reverse is more tricky. Practice is the answer. And I wish more manufacturers would rate their transistors in db gain instead of just a tagless number.

Here are a few questions you can tease yourself with. The answers to them are not available, so mull them over until you are sure you are right. This way, you have fun and learn too; with the answers you stop learning. Get someone else involved, argue with him, teach him, and I'll guarantee you'll wind up with a thorough knowledge of db notation.

## Problems

1. Give plus or minus db for the following voltage ratios: ½, ¼, 3, 0.5, 10, 0.1.

2. Mentally calculate the voltage gain of the amplifier visualized as follows: Input transformer, 2 to 1 voltage ratio with high side to grid. Tube, having proper bias and voltages to give a 20 db gain with an output impedance of 2000 ohms. Output transformer has an impedance ratio of 2000 ohms to 500 ohms, which latter is the output. Also with 0.1 volts input signal, what is the output voltage? And the output power in milliwatts and in dbm. Of course, the impedance ratio business is a dirty trick, but if you work this out, FCC db questions won't even anoy you; they'll be fun.

3. A precision attenuator has a 0.1 watt maximum input rating. The oscillator with which it is used has a plus 10 dbm maximum output. Does this exceed the attenuator rating?

4. Signal on your VTVM changes from full scale to 90—what is the net change in db? 50 to 80? 10 to 33?

5. 100 db is what power ratio

6. With a crystal mike rated at −53 dbm output, how much gain is required to produce one milliwatt? 10 watts?

7. 60 db is what *voltage* ratio?

8. On a meter calibrated in dbv where 0 equals 1 volt RMS, how many volts is −26 dbv?

9. The best possible level estimate by ear is plus or minus how many db from a measured value? (Accuracy, I mean)

10. A dbm 600 ohm meter, such as a VU meter connected across a 1200 ohm load reads successively −2 and plus 3 dbm. What is the net change in db?

## References

(1) Who started this ridiculous dBm business? What we need is an International Committee in Charge of Leaving Well Enough Alone.
(2) You won't find it illustrated here, either.
(3) Two in all; how pauce can you get?
(4) You'll never need to get any closer.
(5) Mnemonics, yet!
(6) Nothing wrong with Peoria; the name charms me, is all. Substitute East Hernia, Unadilla or Jackson Junction if you prefer.
(7) The famous "square root of two." In each case, column 3 is the square root of the corresponding value in column 2.
(8) Note how 3.162 grows. It winds up 3162 and more.

. . . WB2PAP

# *International Ham Convention Knokke Belgium*

The "4th INTERNATIONAL HAM CONVENTION" will take place in the Casino at KNOKKE on the 13th 14th and 15th of September 1968.

A very interesting program is being organized. It will surely satisfy the most particular radio amateur as well as the YL.

Very well known OM's have been contacted as guest lecturers about parametric amplifiers and VHF amplifiers as well as about transmitters with transistors.

Touristic visits to BRUGES and DANME —Exhibition—Stand: Mobiles—Touristic RALLY.

Furthermore: LA NUIT DE L'AMATEUR Dancing in the Wiener WEINSTUBE—Foxhunting (direction finding)—An exercise in co-operation with the BELGIAN RED CROSS.

A unique opportunity to spend a few fine days with the YL at the Sea side.

Any OM who is interested can obtain the detailed program at the following address:

Lucien Vervarcke ON4LV
Lippenslaan 284
KNOKKE 1, BELGIUM

*R. C. Kyle, K6GRP*
*Star Rt Box 26*
*Kelsey, CA 95643*


# *More On Crystal Etching*

Supplimenting Nat Stinnett's "Crystal Etching Tips" article in the April "73" I submit the following: During the past several years I have etched many crystals, since I was told, over the air, about a dilute solution of hydrofluoric acid, easily obtainable at super markets, etc.

The product is labeled "Whink" in 4 or 6 oz. brown, flat type plastic bottles, and is designated, "Rust Stain Remover." The 4 oz. sells for 75¢ and the 6 oz. for $1.00 or less, so you can have a handy safe container.

I use a little 1 oz. plastic medicinal cup or vial, easily obtainable at pharmacies or drug stores for almost nothing. They are tapered, one inch across the bottom, 1½" across the top, and 1½" deep. The curve of the sides makes it just right for the crystal, standing in the solution, to lean against the side of the cup with only the edges touching.

I use 2 of those vari-colored plastic picks, 3½" long, commonly used by hamburger joints or restaurants to spear into sandwiches. I make a pair of tongs with them by drilling a tiny hole through the middle of each, and threading a ⅝" piece of #22 bare copper wire through the holes as the picks are put together with the holes matching, then bending the wire over and around the picks in opposite directions, making an ideal tool for the purpose, which will not absorb the solution or water as will wood. With these you can place the crystal in the solution for etching, then remove it and swish it around in the rinse water with ease before drying it in between a piece of old sheet or shirt tail, clean and lintless.

I use the cup about ⅔ full of the solution during the etching, with a cup of rinse water alongside, and I time each dunking, and log the time required to go so many cycles, so guarding against going too far and having to try and bring it back with pencil dots.

This "Whink" solution will not etch as fast as the saturate solution, but I have found it safer in sneaking up on the exact frequency you want, without over-shooting.

. . . K6GRP

## 20,000 OHMS per VOLT V-O-M

DC Volts: 2.5, 50, 250, 500, 5000. AC Volts: 10, 50, 250, 500, 1000. OHMS: 1K, 10K, 100K, 1M.

DC mA: .05, 50, 500. Decibels —20 to +62 db. Few small VOM's read up to 5000 volts, yet this is just what you need for testing your rig. 3" meter with mirror for high accuracy of readings. This meter has both the low scales and sensitivity for checking transistor circuits as well as the high ranges for transmitters. Buy one for the shack and one for the car. Light and rugged for traveling.

**SPECIAL $9.95**

**plus 75¢ postage & handling**

**Greenville Radio Electronic Equipment Distributors**

**GREENVILLE, NEW HAMPSHIRE 03048**

## OPERATING DESK

This beautiful operating desk is just perfect for the modern transceiver ham station. The desk is 28" high, and about 40" by 18" top area. It is made of Pervaneer, which is scratch resistant and almost impervious to stains, age and heat. There is a large side shelf cabinet with a swing door for power supplies and other accessories. Walnut finish. Shipped FOB Wright City, Mo. Weight 39 lbs. Also makes a fine small office desk or students desk. What a birthday or back to school present for the junior op! Assembled in minutes. USA only.

**SPECIAL $24.95**

**Greenville Radio Electronic Equipment Distributors**

**GREENVILLE, NEW HAMPSHIRE 03048**

## TEN-IN-ONE MINI-LAB


Here is a complete test laboratory all in one package! A modern miracle of electronics. This one unit contains an AC-DC Voltmeter: 50, 150, 500 volts; 0-500 mA; 10K, 100K, 1M ohms; resistance and capacitance substitution; 9 vdc battery supply; RF Signal generator 455 kHz (and up to 700 kHz); plus an audio generator at 400 Hz. You can service just about anything with this lab. You can signal trace and align receivers and trace audio systems, speech equipment, hi-fi and tape recorders. This is probably the single most useful piece of test equipment ever to come along.

**SPECIAL $24.95 pp**

**Greenville Radio Electronic Equipment Distributors**

**GREENVILLE, NEW HAMPSHIRE 03048**

## 24 HOUR CALENDAR CLOCK

This clock reads out the day, date and time in large, easy to read numbers. None of that little tiny number business for your shack. Set this up on GMT and never make a mistake again on logging time and date. 8"x3½"x3½", brushed aluminum case. Synchronous self-starting movement, 110 v 60 cycles. Make your operating desk look outstanding with this new type of clock.

**SPECIAL $49.50 pp**

**Greenville Radio Electronic Equipment Distributors**

**GREENVILLE, NEW HAMPSHIRE 03048**

# How to Write for Service Information

Steve M. Fried K2PTS
8747 Bay Parkway
Brooklyn, New York 11214

*Have you ever written to a manufacturer or supplier for information and received a half answer, or no answer at all? It is possible that the fault was not at the other end. Do not blame the other fellow until you have examined your own letter.*

All reputable manufacturers strive for top customer service, but the customer often makes this aim difficult. Let us look at some of the simple rules which guarantee best results.

The most important things are how your letter looks (format) and what is in the letter (content).

## Format

Always put your return address at the top of the letter. Do not write it on the envelope alone. In a large company's interoffice mail system the letter and envelope are often separated, leaving the customer service man holding a piece of paper signed "John Smith". Who is he?

If a typewriter is available, use it. A typewritten letter is more effective than the nicest handwriting. A typewritten letter in proper business form will almost always get top priority, if only because it is easier on the eyes. If you must hand write, however, print or write neatly. A sloppily written letter shows your indifference and may end up at the bottom of a large stack of correspondence.

A self-addressed stamped envelope is not necessary if you are writing to a company. If the answer will be a few words or a sentence or two, a self-addressed postal card is handy; or you may indicate that you do not mind having the answer written across the bottom of your original letter. This does eliminate dictation and transcription time, sometimes two or three days during a busy season.

## Content

When you write for information about a particular piece of equipment, be sure to say what it is. Specify the make and model number, the serial number, when and where it was purchased, and how it was purchased (new or used, cash sale, trade-in, or swap). These are cut and dried facts, not a long story, so state them briefly and early. They make a good opening sentence. In the same sentence or paragraph, be sure to say what you want. Are you writing for service information, a schematic diagram, voltage and current specs, or something else? Tell them.

In the next paragraph, say exactly what is wrong and what steps have been taken to rectify the situation. For example, a customer might write this about his receiver.

"The receiver (he has already said what model, serial number, etc.) works well on all bands except 7-8 MHz, which is the third band range. Nothing is heard in this range except something that sounds like background noise. I have a transmitter which operates in this range i.e., 40 meters. I use a coax switch and dipole antenna (sketch of the hookup enclosed). The tubes in my receiver all test "good" in a quality tube tester."

The above is a pretty fair description of the receiver malfunction. Many a customer service man would suggest from this that there is something wrong with the rf input, the front end, and it has been affected by power feeding in from the transmitter. In all probability it would boil down to a burned out antenna coil. The writer gave a detailed outline of what is wrong and what is not wrong ("it works well on all bands except 7-8 MHz, which is the third band range"). This customer has helped the manufacturer to help him, by including a detailed drawing of the transmitter-receiver antenna switching system, as well as by saying that all tubes check good.

When you write letters for information, do not bother with emotion and story. It will do no good to go into detail about how angry you are and that you have had bad dreams, and so on. That might come in a later letter, but for the time being just give him a chance to help you fix your gear. He may send a couple of aspirin tablets however, if you continue to tell him about your headaches. In short, keep it short. And to the point.

If you want to service the equipment yourself, be sure to tell the manufacturer the extent of your experience and what test equipment you have available. If you have any doubts about your ability, tell him what your knowledge amounts to and ask him if he thinks you can trouble shoot the gear in question. Remember, you might be fine on audio circuits, but what about double conversion receivers? Do you have the proper tools and knowledge? It is best to check with the manufacturer (if the service manual does not tell you what is needed). Ask him before you try an alternate method of aligning or adjusting your equipment. If your method were recommended, it would be in the manual. Remember to ask his opinion; he has spent thousands of dollars on development, engineering, and engineers.

Always try to address your letter to the proper department. If you have trouble with ham gear contact the customer service department. A person's name within the department is helpful but not necessary. Always keep a copy of the letter you have written. That way you can better understand his reply; and in case of an unsatisfactory reply, or no reply, you can forward copies of your original letter and a covering letter of explanation to both the sales manager and president of the company. (This action should only be taken when absolutely necessary).

### After writing the letter

When the letter is written, go back and reread it. Better yet, have a friend go over it. Is it clear and to the point? Is it void of emotion and unnecessary detail? Have you supplied all the details of the situation? Did you give the name and number of the gear, along with the conditions of purchase? Have you described the problem and the steps you have already taken to remedy it? Did you say what kind of information you want in your return letter? Can your friend understand the letter in all details? If he cannot, start again from scratch. If he can, send it. You have helped the manufacturer help you! . . . K2PTS

Carole Allen W5NQQ
308 Karen Drive
Lafayette, La. 70501

# The Care and Feeding of a Ham Club

Live wires can be dangerous around a ham shack, but in a radio club, the more the merrier! Everybody knows that a group just has to have one or more of these energetic planners and pushers known as "live wires" or "spark plugs." For some mysterious reason these folks don't mind burning midnight oil and applying elbow grease to dream up programs, head committees, type publicity releases, mimeograph bulletins and newspapers, or perhaps a joyful combination of several duties. And all this work is done to see that fellow hams get the most out of their radio club.

This is written for you wonderful live wires who are tracking down fresh ideas for a new or not-so-new club. If you're starting an organization, you're anxious to get it going on the right foot with interesting programs and side activities to attract members and their families. As a new officer of an established group you want to keep everything going smoothly; or as an experienced president or program chairman, maybe you just woke up to the fact that your sessions are sad and even the parties are painful. Regardless of your particular situation, you'll find encouragement in the material that follows.

## Get it in Black and White

Publicity Chairman of a radio club may seem a simple title, but it's like DX contests and marriage, you've got to get involved to really know what it's like. The primary purpose of this job is, of course, to tell the members what's going on and when.

"Most hams have too many irons in the fire to rely on their memories," said one club official; "So, somebody's got to help."

Mailing postcards and mimeographed letters is quite effective in keeping members on their toes. Notices placed in local newspapers and spot announcements on radio and television stations are good, too.

If meetings are held weekly or bi-monthly, members usually know what's coming up, but there's still the problem of those who miss a few sessions and have to depend on word-of-mouth information that sometimes gets crossed up. Individual notification by the "printed word" is about the most dependable way of seeing that everybody knows when the picnic is being held or what time the executive committee is meeting.

Typing or writing out postcards for every meeting is simple if a group is small, but the larger it grows, the bigger the burden

One of the secrets of getting a full house at club meetings is knowing what kind of program everyone wants. Note WØFQY, Carl (The Old Man Himself) Mosley, seated just to the left of the center of the picture.

on the publicity chairman, who will soon develop a severe case of writer's cramp. Buying a postcard printer won't dent the treasury too much and will pay off in well-informed members and good attendance.

If you have up to fifty or so postcards to print you can do just fine with the Heyer Postcard Printer. This sells for $12.95, complete with a kit, in most stationery stores. You can order this by mail from Goldsmith Brothers, 77 Nassau Street, New York 10038 if you add a little for postage. This printer works on the mimeograph principle and you have to put each postcard in place and roll the stencil over it.

The Print-O-Matic postcard duplicator has an automatic feed and will run off a hundred or three cards in a few minutes. This sells for $22.95 these days and is available from Goldsmiths . . . catalog number 71YL-A2R. The Heyer is catalog #71YL-60.

The least expensive addressing machine is the Heyer Addresser. This uses the "Ditto" principle of printing. You type the names and addresses on a roll of paper using a special carbon paper. The roll will hold 250 names and addresses. You run a felt with an alcohol-type spirit on it on your envelope or card and then roll the address over the damp spot. Enough of the carbon sticks to the spirit to transfer the address. You can use this a hundred times or so before the carbon wears out. This costs $12.95, complete with the kit. Goldsmiths #71YL-100. Plus postage, of course . . . and tax if you are in New York.

Since everyone belongs to three, four, or more organizations in the community, you'd better specify that "The regular monthly meeting of the Montgomery County Amateur Radio Club will be held Wednesday evening, June 20, at 7:30 P.M. at the club house," instead of just saying "The club will meet on the regular day, etc." And for the newcomer or visitor in town, add that the meeting place can be found at the corner of South Main and Fairground Avenue.

In an additional paragraph, *sell* the club meeting and give every member a good reason to forget about "The San Antonio Kid" on Channel 5. Say, "An interesting movie on transistor circuits will be featured," or "Frank, K9HYZ, will present a short talk on building transceiver kits." Throw in an invitation to the ham's family to come along and enjoy refreshments after the program.

This same material should be included on

Meetings held in homes work out well for small groups, especially when the XYL is interested in her OM's hobby. Here is Mary, the enthusiastic XYL of Bill Jenkins W9WHL of Bedford, Indiana.

a printed sheet which can be mimeographed and then folded, stapled, and stamped. Since there will be more room on this larger sheet, don't hesitate to dress up the notice with cartoons or drawings. Even if you're far from a second Rembrandt, you can always trace something on the stencil to catch the reader's eye.

Dropping the notices in the mailbox at the right time is just as important as any other phase of the publicity chairman's job. If members aren't reminded of Saturday night's transmitter hunt until the day before, chances are other committments will already have been made. On the other hand, if notices go out three weeks before a get-together, they often find their way into waste baskets long before the big day. The publicity chairman has to be one of those fine souls who can remind himself or herself to prod the members at just the right time. This "lucky" person should have access to a typewriter, mimeograph, hectograph, or card-o-graph and accessories, including a date-book and calendar. And although this suggestion may get a laugh at first, it's good to remember that some of the best publicity chairmen have top-notch jobs with efficient secretaries!

### Where's the Meeting?

Admittedly, hams are the most entertaining and intelligent of all hobbyists, but merely sending out meeting notices doesn't guarantee a memorable gathering. In fact, if someone hasn't spent a little time making plans, the result can be a waste of time and members will wish they had "stood" at home to battle 40 meter QRM.

The where-to-meet question should take some thought, although it's true that hams can meet almost anywhere. You'll find them in basements, attics, public halls, firehouses, school rooms, police stations, storm cellars, fallout shelters, and on military bases. And they're quite at home sitting on orange crates or lounging on over-stuffed sofas.

The ideal situation is to have your own private clubhouse with a permanent station, chairs, tables, cozy kitchen facilities, and plenty of lawn space for antennas. If your club is prosperous or if the city fathers have smiled generously, the where-to-meet question is no problem. One such fortunate club is the San Gabriel Valley Radio Club in California that meets in a specially-designed disaster communications room built for them by the County of Los Angeles.

Small groups with few funds have to meet where they can and face the sad fact that few landlords want their premises wired for DX. Depending on the numbers involved, meeting in one another's homes works out very well, especially if the lady of the house likes her OM's hobby or is licensed herself. It's always fun to inspect the other fellow's shack and refreshments can be served easily. By moving from home to home, nobody's welcome is worn thin. But in case the "fireside" idea doesn't appeal to the group, you'd better start scouting. Maybe one of the gang has "pull" with a civic body that can be coaxed out of a key to the city hall or maybe to the firehouse. And don't be too shy to toot ham radio's horn if that's what it takes for tenancy. Sometimes people have to be reminded that hams are dedicated to public service and spend long hours preparing to meet emergencies, handling disaster traffic, or standing by to help someone else.

If your club is new or if you're on a committee looking for a different landlord, it isn't a bad idea to consider the activities your group will have in the future. In other words, look for a meeting place that's suited to your club. Skip the meeting room that isn't big enough for all the members and their families, too. Equally taboo are quarters so spacious that the secretary has to yodel roll call. Can a screen, film projector, and blackboard be set up conveniently? Is the ventilation good enough to keep the speaker from choking down in cigarette smoke? Are there kitchen facilities for coffee brewing?

If you use someone else's building such as the city hall, school room, or firehouse, better mark the calendar and check with the owner shortly before your meeting. There's nothing quite like barging in on the local historical society or Daughters of American Gull-watchers.

Climate also has a great effect on the type of meeting place rented, begged, or borrowed. The mobileers of Southern California may be able to rendevous at a beachhouse the year 'round, but heaven help the boys in Indiana who forget about fall frosts and winter snowstorms and rent a hall without heat.

In a nut-shell, an ounce of planning for a club meeting is sure to save at least five pounds of embarrassment.

### What? No People?

If the publicity chairman does a good job and there are still a lot of empty chairs on meeting night, it's safe to say something else is wrong. How about the time of the meeting and the day of the week? Is there a regular conflict with other established community functions such as church activities, football games, or service club meetings? Sure, you won't be able to please everybody, but why pound the club's head against a wall when the meeting night just isn't working out for the majority?

Once the club has decided to meet on a certain night or nights, it had better stick to its guns and not start hopping from night to night to please the president of the Audubon Society or secretary of the book club. If members know definitely that the club meets the first and third Monday of each month or every other Wednesday, they'll work the meetings into their schedules and not miss them.

Next, consider the time of the meeting. Does it allow for working people who have to fight traffic an hour or so before reaching home? Do they have enough time to eat supper and read the paper before taking to the road again? These considerations apply to adult groups; however, if families attend meetings, the rules have to be reversed. The treasurer of the Copperstate Roadrunners, Inc., of Phoenix, Arizona, says their motto is "Fun for the whole family with the family." This means that meeting times are set early enough to allow a short business meeting and snack before the kids get too sleepy and start howling to go home.

High school students usually have a check-in time at home which should also be considered.

Another big factor in deciding how many doughnuts to buy for refreshments is whether or not XYLs and YLs attend meetings. Although OMs have worn the pants in ham radio since it started and probably always will, statistics show that lots of women are learning code and theory and getting their own tickets. Besides that, the most popular American sports and hobbies seem to be those which families enjoy together. Just because a fellow likes to have a night out now and then doesn't mean he wants his radio club to be a stag affair. The truth is that a lot of clubs would welcome women, but as pointed out by the President of the Muskogee, Oklahoma, ARC, "We just haven't been able to figure out a program to attract the ladies."

Although licensed ladies will be interested in just about any speaker or film, they usually won't attend a club meeting if they're outnumbered by men forty to one; and the XYLs without licenses are bored to tears with technical programs and can't be blamed for staying home. A discussion of phasing-type single sideband exciters versus filter-type would make about as much sense to her as a cake recipe in Greek. Obviously, the club must decide whether or not they want to plan programs to include the gals.

Clubs such as the Amateur Radio Technical Society of St. Louis concentrate on building equipment and experimenting. They keep the membership at a minimum in order to meet in one another's homes. Only social affairs are planned with wives and families. A group of this kind is exactly the opposite of the Radio Amateur Mobile Society, Inc.

known as the RAMS of Sacramento, California. Former President Leon C. Nielsen, W6QHP, says "Our formula of success is to plan all activities including the ham and his family, whether they're all licensed or not."

Both types of clubs are extremely important to amateur radio although opposite in programming. A technical society made up of members who share knowledge and concentrate on experimental projects proves the value of the amateur to the electronic industry. Similarly, the club which provides entertainment and encourages family participation in radio is equally important to the community and to the hobby.

The club should choose its goals in the beginning and decide how it intends to reach them. If members agree to have only technical programs and discussions to benefit builders and serious students of electronics, then it is understood that only those similarly interested will enjoy the meetings. A ladies auxiliary that meets in another room or holds a kitchen gab-fest while preparing snacks will enable OMs to bring their wives, while not subjecting them to technical talk.

If a vote reveals that most members would prefer a variety of programs with features to entertain and benefit wives and families, then the program chairman and officials can split the programs or make appropriate arrangements.

The secret of planning meetings for a full-house lies in knowing just what most of the members want.

More next month! . . . W5NQQ

I keep dropping those little resistors

D. E. Hausman VE3BUE

## A Confined Space Nut Starter

If you have ever had the pleasure (?) of holding a nut in a severely confined space so that you could fasten it to its mating screw, you know how frustrating life can be. A simple nut holder/starter that can be used in spaces so small that your finger or a commercial nut starter would be too big, is a piece of *insulated wire*! Select a piece of wire from your junk box (the softer the insulation the better) whose outside diameter is a shade larger than the inside diameter of the nut you want to start. Carefully, screw the nut onto the wire. One turn should be sufficient to support the nut. Now you can put the nut in even the most crowded places. As long as their is enough room to get the nut where you want it, then there is enough room to get it started!

It would be wise to make a set of wires, about six inches long apiece and each wire a different size to accommodate all standard sized nuts.

## Eliminating Chirp in the DX-60A

All chirp in the Heath DX-60A series transmitter during crystal control operation can be eliminated at no cost merely by relocating one wire. The problem is a result of the oscillator being keyed to facilitate break-in operation. For those not using break-in operation, the following modification can be easily made to convert to unkeyed oscillator operation.

Locate VI, oscillator tube. A resistor runs from pin 9 of this tube to a nearby terminal board. Disconnect the wire from the terminal board, leaving the end connected to pin 9 unbothered, and reconnect the wire to the ground lug on the nearby VFO input phono Jack (or any nearby ground point). This effectively removes the oscillator from the keyed circuitry. Since the oscillator now runs at all times during "Tune" and "Transmit" positions, the oscillator can be heard in the monotoring receiver but no backwave is put out on the air. VFO operation is not affected by this modification.

A SPDT toggle switch may be easily installed to switch the resistor lead either to the ground connection or to the terminal board at the option of the operator. This will give a choice of keyed or unkeyed operation at the selection of the operator.

Fred W. Fetner, Jr. WB4EFA

# Why Not a Photographic QSL?

Robert C. Green W3RZD
3304 Collier Rd.
Adelphi, Md. 20783

Since the beginning of amateur radio the fraternity has been enriched by the sending and receiving of QSL cards, and now the group of QSL exchangers has grown to include CB'ers and short-wave listeners who also delight in sending QSLs. There has been one big fault with cards; that is that so many of them are alike, the only basic difference being the call-letters, the date and the name and address. This is the main reason why so many printers of QSLs are in the business, each trying to give his customers a little something different in the way of a card; something more personalized. The same thing held true for Christmas cards until the photofinishers began offering personalized cards. If you have received one you no doubt looked at it a little longer than the rest of the cards, especially if it had a picture of an old friend on it. We can take an idea from these cards and make up some personalized QSL's, and in so doing you can let your imagination run wild in the design.

There have been other articles on the subject, but to the newcomers we offer the following ideas which will make a very good looking card. First of all let's see what has to go on a card; the call-letters, signal report, equipment, name-address, and the date plus a few remarks. Sometimes there is a drawing or other imprint to set it off from other cards. In the photographic card this could be a picture of the operator, the shack, the antenna, or a map of your state, perhaps.

There are two ways of making cards; the semi-photographic and the true overall photographic card. The standard post card is 3-1/4" x 5-1/2" so everything you want to go on it has to be considered carefully, especially if a photo of your equipment is to be shown. The photo has to be large enough to show, yet not take up so much room as to leave no space for the vital information. The picture should take up about 1/3 the area of the card.

Let's say that you want a picture of your shack, the equipment and operating position on your card. Normally the equipment is arranged as you want it to appear in the picture, but look at it carefully. Does it show what you want it to show? Does the picture have composition? Does the viewer's eye strike the important points first, or does it wander around before picking out the main objects? And don't forget to clean up the place before you take any pictures. After you think you have picked the best composition for your picture, set up some flood lights. Flood lights are better than flash because the scene can be viewed through the camera's view finder under the light that will be used. Angle and top lighting are excellent because they tend to reduce the chance of getting "light kicks" in the lens); a shiny metal panel will reflect a lot of light. Don't take just one picture, take several, move the lights or the camera angle slightly. If the exposure can be varied, stop down the camera to a small lens stop and try a time exposure, painting with light. That is, hold another small flood in your hand and "paint" the area with light.

Now that you have taken the picture, decide what type of card you are going to make. Are you going to make a simple card with the picture glued on it and the information hand written or typed beside it, or a fully photographic card. If you decide on the glued-on type, pick out the best picture and have reprints made of that negative. The local drug store will be glad to handle this little detail for you at about five to seven cents each for reprints. The next step is at the post office for the blank post cards at five cents each. So far the cost of each card is nine to twelve cents, plus the labor which we can call a labor of love.

That's the first method, fairly simple and effective, but now let's go on to the regular photographic card. With a photographic card we have to work to a standard, and that standard is a rectangle. This is because of the equipment used by the photofinisher to print the cards. This time we want to make the layout 6½" x 11", twice the size of a standard postcard. The printing can be freehand or use a set of letter stencils or the rub-on type of decal. The call letters should be about 1½" to 2" in height and the small lettering ¼" high; don't crowd, remember that it will be reduced by one-half on the finished card. Use black India ink and a lettering pen to fill in the call letters and for the small lettering. It is wise to pencil in the letters first then go over them with the ink.

If you have already taken a picture of your shack, have an enlargement made which is about 3½" x 4½" or 4" x 5" or even 4½" x 4½". The size depends on the layout you have decided on. If you want to, a Polaroid shot can be used because an enlargement will not be necessary. After you decide that "That is it", make up a new master that is free of fingerprints and smudges.

Visit the local photofinishers, (check the yellow pages of the phone book for these,) but don't go to the drug store. Tell the photofinisher exactly what you want—a rectangular negative of the master QSL, that he can handle in his automatic printer. The negative may vary from a 35mm that has to be enlarged, to a contact print that is 3¼" x 5½". But in any case let the photofinisher tell you what he can handle and what size is best. Have him show you both double weight and single weight paper for printing of cards. The double weight paper is heavier and can be mailed as is, the single weight paper requires an envelope. The author prefers double weight plus an envelope. Choose a matte finish over glossy paper because the matte finish will take ball point pen ink better than the glossy finish when filling in the date and time. If you decide to use envelopes they can be purchased for about thirty cents per hundred and by using a five cent stamp the envelopes can be mailed unsealed. The cost of the printed cards will vary depending on the number you have printed; about eight cents each for a hundred and down to about 6 cents each in lots of more than a hundred. The cost of the master negative will be about one dollar, but it can be kept and used over and over again.

If you have a friend who is a camera bug, have him take the pictures of your shack; he will have a more experienced eye for lighting and camera set-up. If he has a darkroom he could make up the master negative and run off a couple of cards for you so you can see exactly what they will look like. Don't ask him to run off a hundred or so cards or you won't have a friend.

This system of making photographic QSLs works, and works well. Try it and see, you will like the personalized touch your cards have and you will be proud to send them. At Christmas you can even make up a truly personalized Christmas QSL for contacts made during this part of the year.

. . . W3RZD-

# A Report on the WTW Award

At long last the WTW is ready to roll with a report of its activity every month. Many items caused the sluggish activity of the WTW being reported in 73 every month. When Jim Fish left 73 Magazine the hunt began for all the records at Peterborough, if all the records have been found we have no way to be sure. Another very confusing factor was the Certificates being issued from Peterborough and all certifications being done in Cordova, S.C. There was always a certain lag in time between here and there and at times we both swear mail got lost between us—this made things very interesting to say the least. After spending about one month and getting all loose ends tied up we have things pretty well lined up now and everything should go smoothly from now on.

To prevent confusion please send me (Gus M. Browning, W4BPD, Route 1, Box 161-A, Cordova, S.C. 29039) all reports on WTW—DON'T SEND ANYTHING to 73 Magazine direct. I have the certificates here now and they will be sent out pronto to those who qualify. Remember I still have an ample supply of our WTW-Country/Tally sheets for the asking, send 50c to cover costs for them. They make keeping your and our WTW records a lot easier, PLEASE USE THEM. You should keep one copy and send us or your QSL check point a copy. Watch the dates of your QSO—quite a few have been coming in with the wrong date shown for the QSO—All QSO's should be AFTER May 1, 1966 0001 GMT. All QSO's same band and same mode. You may send as many over the required number and we will give you credit for every one you send and place the extra ones in your Honor Roll standing which we will publish practically every month. My records here indicate the following Awards have been issued with these serial numbers. If the number on your Certificate doesn't tally with our records please send me your certificate for a new one with the number on it that my records indicate you should have. Its a lot easier for me to change certificate than to change all my records. Only a few have the wrong serial number on them. Please check yours. Don't ask me to change my records to agree with your serial number because this could involve many others to be changed also. Now for the various Awards issued to this date (May 7, 1968):

### WTW-200 14 MHz PHONE—

| | | |
|---|---|---|
| #1 | W4NJF | Gay Milius |
| #2 | W3DJZ | "Hop" Hopple |
| #3 | K3YGJ | Dick Leavitt |
| #4 | K6CAZ | Joe Butler |
| #5 | W3AZD | Don B. Search |
| #6 | XE2YP | Jorge P. Parada |
| #7 | WA2SFP | James L. Lawson |
| #8 | WA5LOB | James D. Edwards |
| #9 | WB2WOU | Herbert Rugoff |
| #10 | W1MMV | G. W. Cunningham |

### WTW-200 21 MHz PHONE

| | | |
|---|---|---|
| #1 | W4OPM | Joe Hiller |

### WTW-100 28 MHz CW—NONE

### WTW-100 28 MHz PHONE

| | | |
|---|---|---|
| #1 | WA2SFP | Jim Lawson |
| #2 | W4GJO | Ansel E. Gridley |
| #3 | W5YPX | J. B. Jenkins |
| #4 | WA5LOB | James D. Edwards |
| #5 | W2VBJ | Harry J. Marschausen |
| #6 | WA5DAJ | Leonard P. Malone |

### WTW-100 21 MHz CW

| | | |
|---|---|---|
| #1 | W4OPM | Joe Hiller |
| #2 | VE6TP | Gene H. Krehbiel |
| #3 | WB2UDF | Douglas J. Gorga |
| #4 | WA6GLD | Frederick J. Hagen |

### WTW-100 21 MHz PHONE

| | | |
|---|---|---|
| #1 | WA2FQG | Ted Marks |
| #2 | WA2SFP | James Lawson |
| #3 | W4OPM | Joe Hiller |
| #4 | K9PPX | Scott G. Millick |
| #5 | W6YMV | Paul E. Friebertshauser |
| #6 | WA4WTG | R. Robert Kaplain |
| #7 | W9NNC | Don Misch |

| | | |
|---|---|---|
| #8 | WA5DAJ | Leonard P. Malone, Jr. |
| #9 | W8WRP | James Horvat |
| #10 | WAØOAI | George C. Blunck |
| #11 | WB2OBO | Jess Miller |
| #12 | WA5LOB | James D. Edwards |

### WTW-100 14 MHz CW

| | | |
|---|---|---|
| #1 | WA2DIG | Vice Ulrich |
| #2 | W8EVZ | James Resler |
| #3 | K8IKB | Dan Redman |
| #4 | W4CRW | Robert C. Sommer |
| #5 | WB6SHL | John Scanlon |
| #6 | W9HFB | Newton K. Gephart |
| #7 | W5ODJ | Fred A. Fisher |
| #8 | WB2TKO | William Meeker |
| #9 | WA9KQS | Edward F. Bauer |
| #10 | W1ETV | Moulton Larmay |
| #11 | K5BXG | Charles E. Calhoun |
| #12 | K4ASU | Robert C. Webb |
| #13 | WA6GLD | Jerry Hagen |
| #14 | WB6NWW | Marty Hartstein |

### WTW-100 14 MHz PHONE

| | | |
|---|---|---|
| #1 | W4NJF | Gay Milius |
| #2 | W5KUC | Bob Wagner |
| #3 | W3DJZ | "Hop" Hopple |
| #4 | W4CCB | Bob Gilson |
| #5 | WA2SFP | Jim Lawson |
| #6 | K6CAZ | Joe Butler |
| #7 | WØNGF | Warren Johnson |
| #8 | W3MAC | Lew Papp |
| #9 | K1SHN | George Banta |
| #10 | K8IKB | Dan Redman |
| #11 | W6YMV | Paul Friebertshauser |
| #12 | W1SEB | Jay Chesler |
| #13 | WA5LOB | James Edwards |
| #14 | W4TRG | Bill Galloway |
| #15 | WB2NYM | Olgierd Weiss |
| #16 | KP4RK | Jose Toro |
| #17 | W1MMV | Gerald Cunningham |
| #18 | WA9KQS | Edward Bauer |
| #19 | WA4WIP | Dick Tesar |
| #20 | W4FPW | G. Gus Brewer |
| #21 | K9OTB | Jack McNutt |
| #22 | W4JVE | Charles R. Sledge |
| #23 | DL5HH | Ira C. Crowder |
| #24 | W4FPS | James Leonard |
| #25 | K3YGJ | Richard Leavitt |
| #26 | VE6AKP | Gordon Read |
| #27 | K2BQO | Paul Haczela |
| #28 | W3AZD | Don B. Search |
| #29 | WA5DAJ | Len Malone |
| #30 | OZ3SK | Egon Gadeberg |
| #31 | ZL3OY | G. Coull |
| #32 | K4RZK | John F. Berryman |
| #33 | CN8FC | William T. Broder |
| #34 | WAØOAI | George C. Blunck |
| #35 | WØSFU | Bob Parlin |
| #36 | W4HA | John McCaa |
| #37 | ZL3MN | J. T. McMullan |
| #38 | W3NKM | Stanley S. Springer |
| #39 | W8WAH | Ray Slater |
| #40 | VE3UR | Ray Hunter |
| #41 | VE3ELA | G. L. Clark |
| #42 | WA4WTG | R. Rober Kaplan |
| #43 | W6MEM | Stephen M. Stambuk |
| #44 | WA2OEQ | C. C. Unrah |
| #45 | WB6RMZ | Dwain Schunke |
| #46 | K5BXG | Charles E. Calhoun |
| #47 | WA4OPW | William G. Rogers |
| #48 | W8BVF | Jim Lancaster |
| #49 | W6OHU | Murray H. Link |
| #50 | W8FPM | Hugh K. Cotton |
| #51 | K2QOU | C. Buchheit |
| #52 | VK3XO | L. A. Paul |
| #53 | VE6AKV | D. C. McKoen |

### WTW-100 7 MHz CW

| | | |
|---|---|---|
| #1 | W4BYB | Rex G. Trowbridge |
| #2 | W3WJD | R. Sigismonti |
| #3 | W8ZCK | Bill Price |

That wraps up the WTW for this month. How about some additions to your scores for the Honor Roll next month? I will accept any number of cards to check, provided you send along a stamped return envelope. We want a good competitive standing in the WTW Honor Roll. Please date all correspondence and give your call sign and WTW certificate number in every letter to me. . . . W4BPD

## Radio Amateur Rockhounds

### R.A.R. for short

Are you interested in rock collecting or exchange, or semi-precious stones or information about this hobby?

Robby, 5Z4ERR (E. Robson M.P.S., Box 3077, Nairobi, Kenya) is president of a new club for Radio Amateurs only. Do you want to sked and meet any R.A.R.s on the air?

To join, send your address and a SAE and postage and you are in!

After a breather, Robby will circulate a list of call signs and suitable frequencies and time to hook up on 20 meters. If enough hams join in, it can be decentralized and the Ws, VKs, ZLs, and S. Africans can get together with their own groups as well as on an international basis.

### Liasons Needed

We need amateurs in Tucson for liason with APRO, in Washington, DC for NICAP, in Boulder for the Air Force Project, and in Pittsburgh to contact the UFO Research Institute. The Instutite has a 24 hour a day answering service and is attempting to get a team to any sighting within 200 miles of Pittsburgh.

### Organization Schedule

Perhaps it is time for those interested in the founding of the UFO network to get together for some preliminary organization discussions. Let's meet on 14,300 on Wednesdays evenings at 0200 GMT and see who is there, what suggestions they have, and what plans can be made. The time would seem to be a reasonable compromise, being 7 pm in California and 10 pm back east. Propagation conditions may make communications a problem between some of the stations, so perhaps we should try 3950 on Thursday evenings at the same time and see how we do there.

## YOU CAN HELP

Thousands of amateurs around the world would like to be reading 73, but either the subscription price is beyond their means or else their governments won't permit them to send money out of the country. You can help spread the amateur spirit through a gift subscription. We will send a gift card in your name to the recipient.

__$5 enclosed for a one year subscription.
__$10 enclosed for two one year subscriptions.
__$25 enclosed for six one year subscriptions.

Please list the name and address below (and call) of the recipient(s). If you have no one in particular in mind please check the following so we can follow your preferences.

__Asia
__Africa
__Russia
__other . . .
__ARRL Director (12 out of 16 Directors do not subscribe to 73). You can help them get 73 so they can keep up on current events and better represent their constituents. They might be interested in keeping up with the latest technical developments too. Help these fellows out.

(*W2NSD/1 from pg. 4*)

In addition to exposing amateur radio to the general public in rather large masses, the early May ham gathering in Paramus brought together a goodly number of VHF amateurs. The big drawing card was Ray Naughton VK3ATN, flown over by Quantas Airlines by arrangement with the Garden State Shopping Plaza. Ray is the chap who has been setting the two meter worlds records via moonbounce.

I visited Ray during my short visit to Australia on my round the world trip a bit over a year ago. He'd kept after me every time I got on the air from a new country and by the time I arrived in Australia the details of my trip to Birchip, Victoria had been worked out. It meant cutting a day off my visit to Sydney, which, unfortunately, the chaps in Sydney took with bad grace.

From Melbourne I took a train north to the end of the line in Bendigo. There I was met by two local hams. They popped me into their car and drove me about 50 miles across the flat countryside, much like Kansas, to a small town where we met Ray. Ray drove me another 20 miles or so and then changed me to the car of a friend of his who wanted to meet me and we drove on to Birchip. Ray lives on the outskirts of a small farming town and, looking out his back door, there were antennas as far as I could see. Towers were all over the place. The most remarkable of all was his 50 wavelengths long two meter rhombic system. Ray is on all bands and can work anyone in the U.S. that has a reasonable signal on 160M, 80M, 40M, 20M, 15M and 10M. He'll be on six one of these days when he gets a better location for his rhombics, one a little further from the power lines.

Ray played tapes of his moon bounce echoes on two meters for me. They are excellent echoes. That evening we got on 75 meters and worked back to W2NSD/1 with S-9 plus signals both ways. Now that was a thrill I won't ever forget. Then we shifted up to 20 and my home rig was booming through about 40 over 9.

We talked ham radio and Ray's plans and accomplishments on into the night. The next morning I had to get moving on again. Ray had arranged for a small private plane to take us up to a town in New South Wales, Griths, where I met a commercial plane that took me on to Sydney. It was a fascinating flight and I had a chance to see first hand the amazing water transport system they use to water just about all of Victoria and most of New South Wales. The water travels along hundreds of miles of open ditches, gravity flow with about 6" to 9" drop per mile. There is a heavy loss due to evaporation and they calculate that only 15 gallons of every hundred manages to get to Birchip.

When Ray found that he was going to get a trip to the States he wrote to me and I quickly invited him to return my visit. Ray did get up here for a visit and he brought me up to date on his two meter accomplishments . . . and they are considerable. He had been active on two meters for several years and pretty well worked what there was to work around Australia. He was looking for more to conquer. He had read several articles about moonbounce and had been kind of mulling it all over in his mind. Then one day he was driving on a long trip and was talking with Sam, W1FZJ/KP4 down in Arecibo, the grandaddy of moonbouncing. Ray had been thinking about trying a long rhombic for two meters and Sam encouraged him to get going on it, saying that he was sure that it would work. Sam has problems, but being technically wrong isn't one of them, so Ray got to work researching the literature on long long rhombics. The QSO with Sam was in November 1965. The researching lasted through January 1966 and in February Ray started putting up his antenna. It was 50 wavelengths long and consisted of two stacked rhombics, a full wave apart. He figured that if he aimed the rhombic at a spot in the sky where the moon would pass he would have a few minutes a month when he would be able to bounce signals into the States.

On March 28th, 1966, Ray fired up his 150 watt rig, the power limit for Australia, and sent out signals toward the moon. The receiver was an Ameco Nuvistor (6CW4) converter with no preamplifier. Back came the echoes. Weak, to be sure, but there was no question about it. I've heard the tape he made of that historic night. A couple nights later Ray was listening for K6MYC and heard him coming through very weakly.

That really got Ray going. He decided to put up two more rhombics in the stack. This should give a gain of about 34 db, about equivalent to a 2500 element collinear antenna. He added a preamplifier and a noise blanker. He also put up a series of arms on the lead tower so he could skew the whole rhombic a few degrees one way or the other to give him a couple more days or so a month.

When I arrived in September 1966 Ray had several good tapes of K6MYC, but Mike had yet to copy his own signals from the moon or to hear Ray. He was working at it though. The big schedule was set up for the 28th of November, the next time the moon would be in the right spot. The boys from K2MWA called in on 15 meters and asked if Ray would listen for them and Mike sat there in California hearing both sides of the QSO while K2MWA made the first U.S.-Australia two meter contact. That must have been about the last word in frustration. In December, when the next chance came, Mike was there and made it a second state for Ray. Mike was operating portable at Stanford University using a 320 element beam.

The 320 element beam was split up in 1967 with half going to WB6KAP and the other going home with K6MYC. In December 1967 Ray worked Mike at his home QTH using the 160 element beam. Ray has heard WB6KAP several times, but KAP can't yet hear his own echoes and hasn't been able to hear Ray.

Ray has also heard W6YK, who is using four 8 over 8 J slot yagis. YK can't hear his own echoes and has yet to copy Ray.

In February 1968 Henry, KØIJN up in Minnesota put up a big collinear, hooked up the transmitter and receiver, and proceded to work Ray the first time on. He started out sending CW at about 20 wpm, but then found Ray sending back at the normal moonbounce high speed of about three wpm and slowed down so Ray could get his signals through the fading.

Ray is hoping that a lot more states will come on with adequate moonbounce signals so he can get his WAS certificate. Or even his WAAS (Worked Almost All States).

K6MYC is using the Cushcraft collinear antenna. While visiting up here Ray had a chance to stop and visit with Les and Bob Cushman at their plant in Manchester, New Hampshire. He let them hear the tapes of the signal from the Cushcraft beams as heard in Australia. Ray was quite enthusiastic about the new Cushcraft two meter combination collinear antenna with a director on each bay. This makes each 16 element colinear bay end up with 20 elements. They apparently find that this makes for much better matching than the double directors they had made for me for use up on 73 Mountain a few years back.

Eight of these 20 element sections will give you all the gain you need for good moonbounce signals, according to Ray. He should know. This certainly puts moonbounce operations right down where a lot of VHF men will be able to participate. Cushcraft has all the matching and phasing sections available, so the real hard work has been done for you. Watch the Cushcraft ads for an announcement of this new collinear with director elements. If you put your antenna on a moveable mount you will be able to moonbounce every day, though you'll have to wait for the two days a month that the window is open to Ray (24 minutes each day).

Even the rig isn't much of a problem any more. Ed Clegg tells me that he expects to have a good solid very full kilowatt rig on the market by the end of this year for two and six meters. A lot of us will be looking forward to that one.

Speaking of six meters, Ray feels that there should be little problem in bouncing signals off the moon on six meters with a rhombic. As soon as he can find a spot far enough away from the power lines to keep the local noise down he is going to get set up with a nice six meter rhombic. Before long you'll be able to work Ray on eight amateur bands.

Ray has given me the full particulars on his two meter rhombic and I will write it up for those of you who have a few acres sitting there in need of some fancy antennas. Actually it isn't all that hard to get up in the air and tune up. It took Ray about a month and his resources are meager when compared to those up here in the States. Ray has had to do everything the economical way, being just as short of money as most of the rest of us. He runs a small applicance shop in Birchip, a town of about 1000. This makes for a comfortable, but not extravagant, living.

This trip to the States is Ray's first experience as a traveling ham and he is finding out how wonderful the hospitality of hams everywhere really is. He's been shuttling from ham to ham, rarely let go to bed before 2 am despite rising times usually around 6 am. When he visited here he had to get up at six to catch an 8 am plane up here. It was the only flight of the day. It was worse when the two of us left here and flew out to Rochester for the VHF Conference. The plane left Boston at 7:20, so we had to get up at 4:30 to make it.

### Rochester

They had a marvelous crowd there. Though they had a full schedule of speakers they worked in a good spot for Ray and he held one of the largest audiences of the day spellbound with his talk and the slides of his antenna farm.

The number of fellows that stopped by the 73 booth to say that they would be coming up to see us on July 6th for our hamfest was more than encouraging . . . it was almost frightening. If that many are coming from as far as Rochester . . . how many may be here in total? I think we're going to have a ball.

Though I expected only a small turnout of saucer devotees for my own talk of the day on our UFO Net, I was surprised to find the large room filled to standing capacity with an interested and enthusiastic audience. I explained about the sorry state that our government has left UFO research in and how much amateur radio can do to help this miserable situation. It is one of the greatest opportunities for contributing to our country that we have ever had.

Jim Sipprell K2HYQ, the local representative for NICAP (National Investigations Committee on Aerial Phenomena) contributed the most interesting part to my talk by showing slides of some of the most carefully authenticated UFO photos. Any ham clubs within driving distance of Kenmore, N.Y. would do well to get in touch with Jim and get him to bring his program to your next club meeting. Write Box 209, Kenmore.

# *Subscription Premiums*

Wait'll you see some of the goodies I've rounded up for you as premiums for new subscriptions. The other day I was sitting here figuring out what it costs us to get new subscriptions to 73. It costs plenty by the time you add in the cost of addresses, the mailing pieces, postage, and all the work of putting the mailing pieces together, addressing them, sorting and tying the mail according to post office specifications, etc. Why not, says I, see if we can't get our boosters to go out and get new subscriptions for us and give them all that loot in the form of interesting and valuable prizes?

Immediately I thought of those wonderful world globes that we have been offering recently. These are perfect for any ham shack. I keep mine right by the rig and use it every time I go on the air to see the spot I'm talking with. I got my pencil out and sharpened up the point to see how good a deal I could make on the globes. I think you'll like it. The super deluxe 18" lighted globe sells for $24.95 in all the stores and we can offer it for five new one year subs plus just $5 cash. Not bad, eh? The 13" lighted globe sells for $16.95 in the stores and we will send you that one in exchange for four new one year subscriptions!

The next thing I ran across, once my mind was working on the premium level, was a new desk name plate machine put out by Dymo. Heretofore these desk plates have been so expensive that few hamshacks have sported them. Every operating desk should have the station call letters proudly displayed. So I sent off for one of the big contraptions that makes these desk plates and we'll have them available FREE with one new subscription. Surely anyone can find at least one friend that should be reading 73. Or perhaps this is the time to subscribe for the local high school library or community library, with the desk plaque as a bonus.

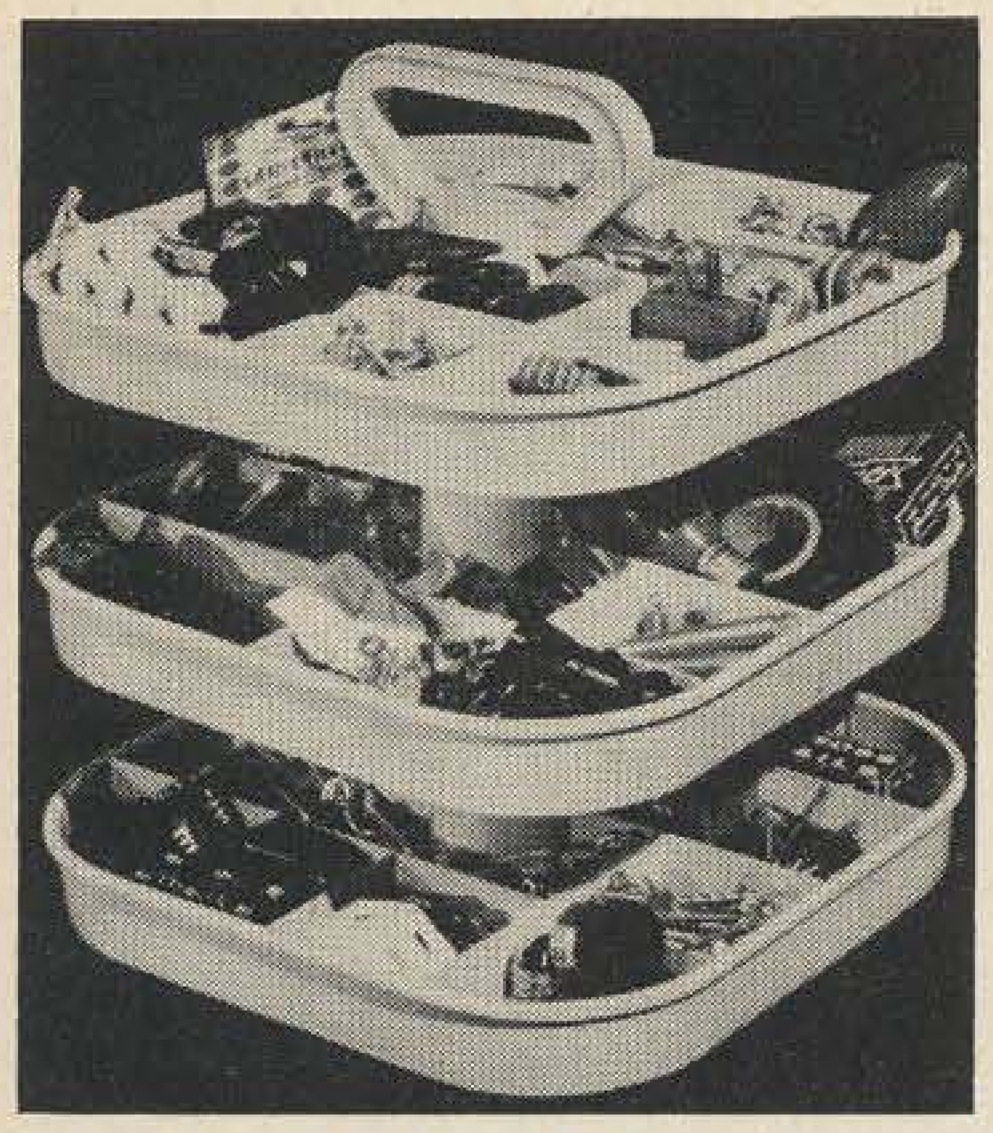
Polaroid had a brand new Big Swinger on display that they are just announcing to the public. This corker sells for $25 and uses the regular film pack that is used by the big Polaroid cameras. It has a fixed focus lens and an automatic shutter for perfect exposures every time. I use one of the more complicated model 100's and I am always forgetting to set something, with the usual result that it takes two shots for one picture. The Big Swinger has a flash unit built right into the camera, all you do is drop in the flash bulb. I did some quick calculations and figured that we could give one of these beauties away with every seven subscriptions that are sent in.

Operating desks are expensive as a rule, so when I ran across a small desk that looked just the right size for the modern transceiver station my eyes perked up. I think we can give these away with six or seven new subscriptions, FOB the factory. I'll set one up here and take a picture of it so you can get a good look as soon as I can.

Ever since operating a 4U1ITU where they have some of those magnificent Italian digital clocks with very large numbers, I have coveted. Unfortunately the darned things cost a couple hundred dollars and my covets run to the dollars, not the hundreds. There, at the show, was a covet answer. The Caslon clock that we pictured in our January issue was on display and it sure looked great in person. The numbers are big and easy to read. They flip over. And best of all the clock comes in either 12 or 24 hours versions. They net for $25, which might stop me, I suppose. We can give these fabulous clocks away absolutely FREE with every five new subs sent in! The same clock with the date also registering costs $50 and I calculated that we could manage that one for five subs plus $12.

It didn't take me long to get a hold of some of the transistor AM-FM radios to see how good they were. We've got a portable 15 transistor job that is really amazing. Even up in the mountains of New Hampshire it pulls in FM stations all up and down the dial. It has a big speaker and sounds great. It operates from batteries or ac. It can be had FREE for six new subs. The AM-FM-Clock radio has been going night and day in my office since it arrived. It has twin speakers and is handsome. We have some nice good music stations down in Boston that are soothing to my tortured nerves. This radio normally sells for $59.95 and we can give it away FREE with only 10 new subs.

# IS THIS BRIBERY?



$5 PARTS BIN

**FREE**

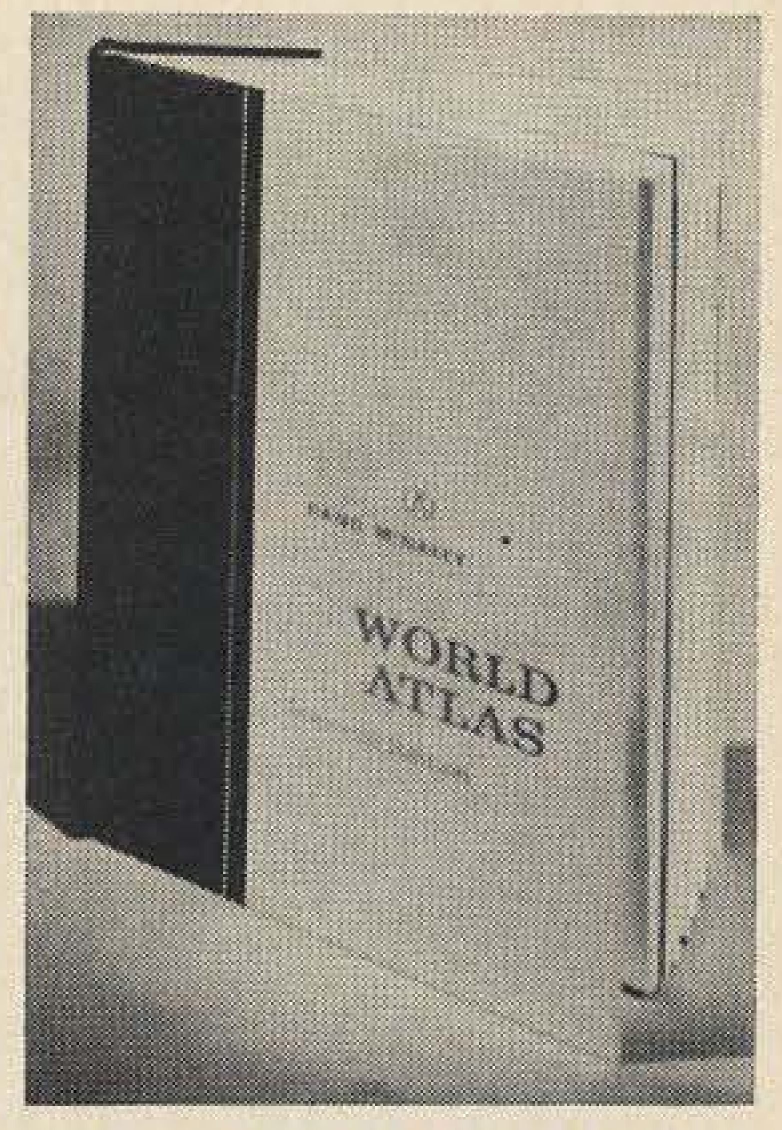
**With 1 New Subscription!**

This three-tiered parts holder is just the thing for the workshop. Each of the three shelves revolves to put parts right at your hand. Stop searching for things.

**FREE**

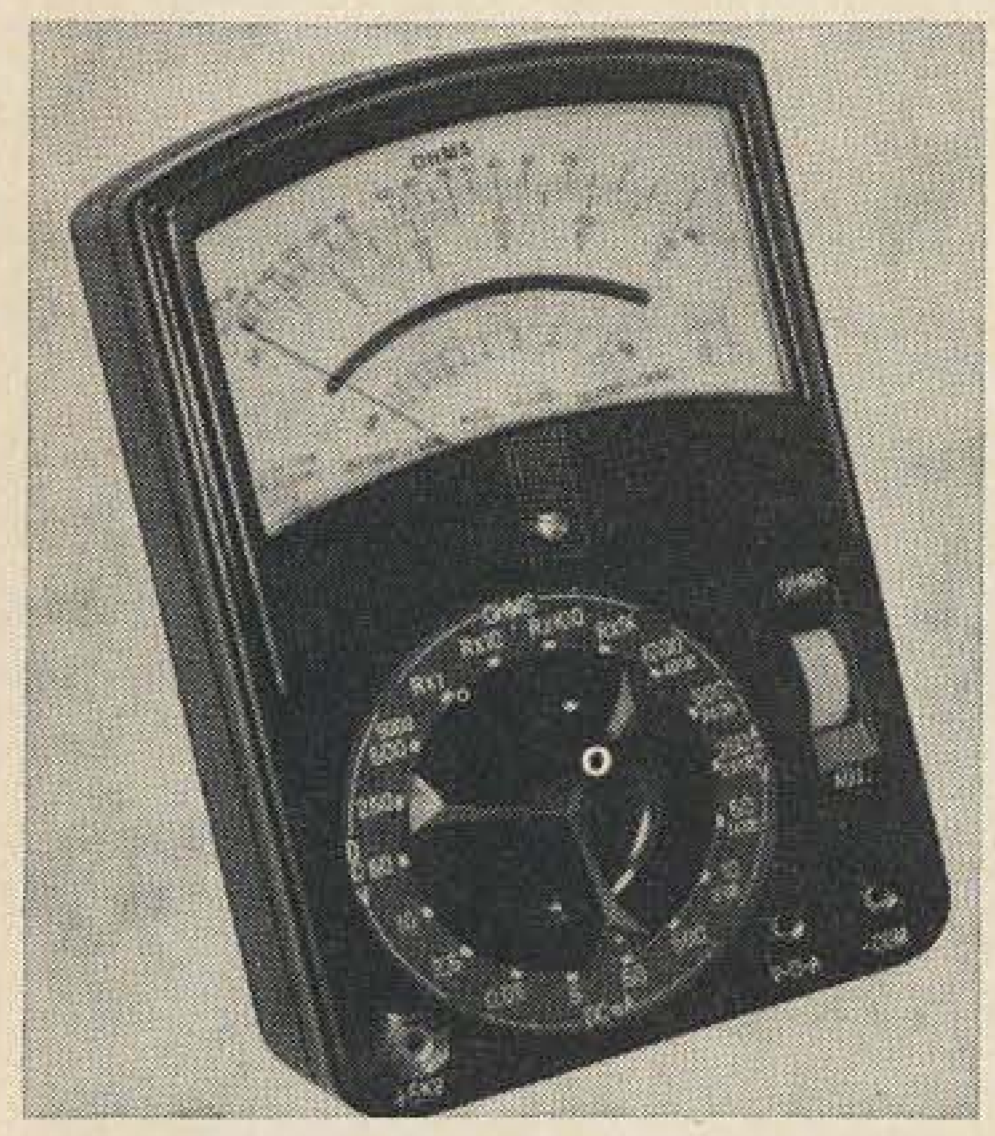
**With 2 New Subscriptions!**

The famous Rand-McNally Imperial world atlas. Over 300 pages, handsomely bound. For the ham shack, for the family, for the student. Maps, people, political information, historical gazetteer, facts. Makes working DX twice the fun.




$13 WORLD ATLAS

HOW COME? We added up the cost of soliciting new subscribers through the mail: mailing lists, brochures (paper, artwork, typesetting, printing, folding, delivery), envelopes (plus printing and shipping) for the brochures, return envelopes, putting brochures together, addressing, bundling by zip, plus postage. Multiply that by ten to account for the one in ten response and add the return postage. We decided to put all that money into premiums and give them to readers that sell new subscriptions to their friends and fellow club members. It seemed worth a try.



$10 V-O-M

**FREE**

**With 3 New Subscriptions!**

20,000 ohms per volt V-O-M. Ohms: 1K, 10K, 100, 1M; Volts dc: 2.5, 10, 50, 250, 500, 5000; volts ac: 10, 50, 250, 500, 1000; dc mA: .05, 5, 50, 500; db: 0, 14, 28, 34, 40. Invaluable around any hamshack or workshop.

**FREE**

**With 4 New Subscriptions!**

Hammond 18" International World Globe. This not only makes DXing more fun, it is of value to the whole family. No child should grow up in a household without a good world globe. You can use charts if you like for swinging your beam, but a globe is better.

$17 HAMMOND GLOBE

HERE'S THE DEAL. These premiums are for getting new subscribers for 73, not renewals. **You**, knowing 73 as you do, can sell it a lot better than one of our mailing pieces. **You** won't get lost in the daily deluge of mail solicitations and the credibility gap that they have wrought. **You** know what's good about 73 and what's bad. You know that you will be doing your friends a favor if you get them to subscribe because you will be making ham radio a lot more fun for them. Our hobby is much better when you keep up to date on technical and political developments. Send in the subscriptions with $5 for each new one year sub, each on a separate 3 x 5 card with name, call, address and zip code, and add one card with your name and address and the prize you desire. Not bad for doing a few friends a favor! This offer is good in the USA and APO only. Offer expires July 31, 1968. All subs will start with September issue.

# FREE GIFTS!

# MORE GIFTS!

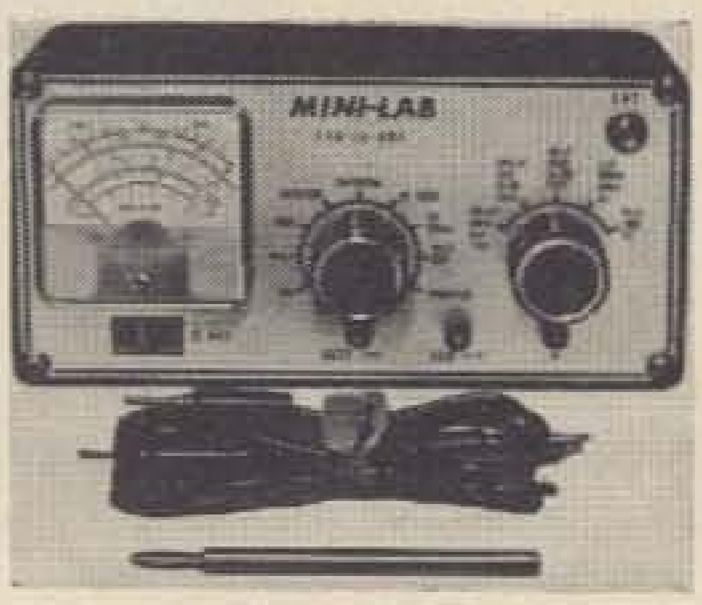
**$35 LIGHT-CLOCK RADIO**
**FREE WITH 5 NEW SUBSCRIPTIONS!**

This high intensity lamp is on a telescoping arm and swivels in any direction. Lamp has high or low power. The clock-radio combo is handy for remembering appointments at the office if you use the unit on your desk or for skeds if you use it on the operating desk.


**$12 BLANKET**
**FREE WITH 2**
**NEW SUBSCRIPTIONS**

This 50″ x 60″ sport blanket comes from Spain and is made of virgin wool, cotton and rayon. Machine washable. Beautiful yellow red and black design. Comes in zipper vinyl case with handle. Fine for the car, picnics, etc.

**$25 TEN-IN-ONE**
**MINILAB**
**FREE WITH 5**
**NEW SUBSCRIPTIONS**




Volts ac & dc: 15, 50, 150, 500; Ohms: 10K, 100K, 1M; mA: 500; resistance substitution: 100, 1K, 10K, 100K, 1M; Capacitance substitution: .002, .005, .02, .1, 10uF; RF field strength; 9V battery supply; RF signal generator at 455 kHz to 700 kHz; AF generator at 400 Hz. Comes with test leads, antenna and battery. Invaluable for mobile servicing or around the shack.


**$25 NEW BIG SWINGER**
**FREE WITH 7 NEW SUBSCRIPTIONS**

The New Big Swinger Polaroid camera uses the regular black and white film packs, making the large 3¼x4¼″ pictures. Drop flashbulb into camera. Built in photometer. No focusing two feet to infinity. Why miss out on Polaroid fun any longer?


**$35 AM-FM AC-BATTERY RADIO**
**FREE WITH 5 NEW SUBSCRIPTIONS**

Solid state 10 transistor AM-FM with AFC in wooden cabinet with tote handle. Telescoping antenna. AC adaptor built in; Complete with batteries and earphone. 7″ x 4″ x 4″. FM has the best programs and the least interference, so why wait any longer?

## *73* MAGAZINE

## PETERBOROUGH, N.H. 03458

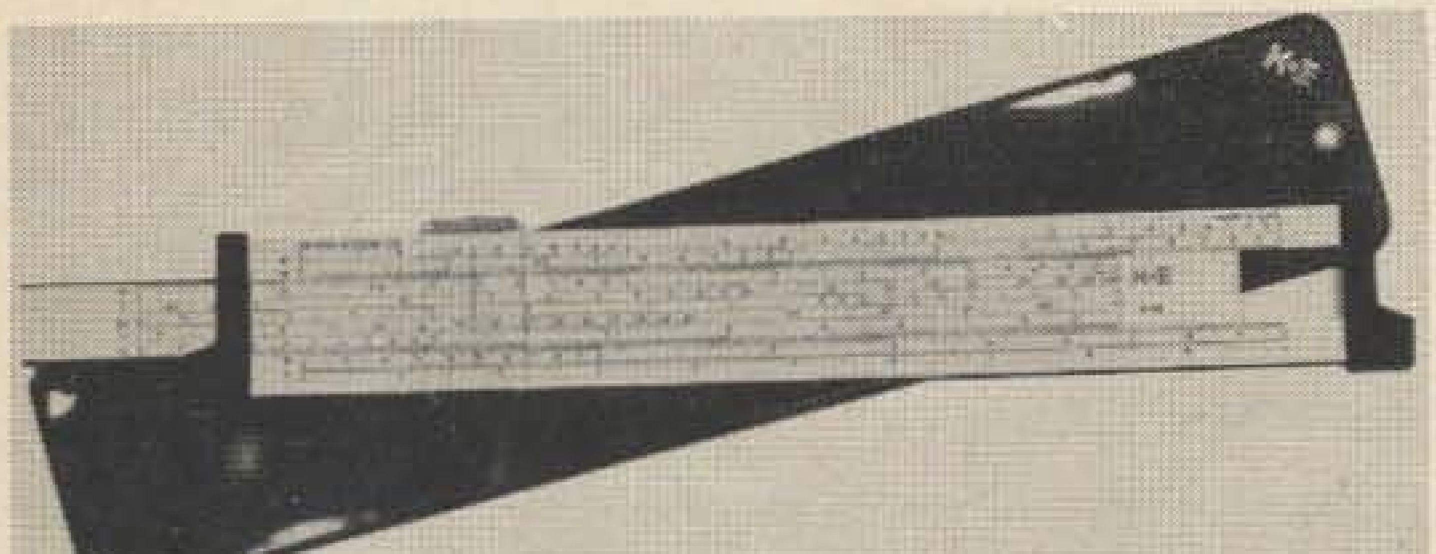
# MORE GIFTS FOR NEW SUBS


**$2.50 DESK NAME PLATE**
**FREE WITH 1 NEW SUBSCRIPTION!**

Every shack should have the ops name and call letters prominently displayed. Desk plates like this used to be too expensive, running $5 to $10 or so. Here is a custom desk plate with your name and call for FREE. Up to 20 letters & spaces.

**$60 AM-FM-CLOCK RADIO**
**FREE WITH 10 NEW SUBSCRIPTIONS!**

Powerful ten transistor radio with twin speakers for excellent tone. AFC and tone control. Telechron clock with alarm, radio alarm, snooze timer (60 minutes) and alarm delay for that extra sleep after the first alarm goes off. A beauty.



**$3 K & E SLIDE RULE**
**FREE WITH 1 NEW SUBSCRIPTION!**

A slide rule is indespensible around the ham shack or the office. This one has everything you need, but is inexpensive enough so you can get two or three. Has C, D, A, B, S, T, C1, L, and K scales. Comes complete with case. 10" long with indented green ruling.

**$35 AM-FM**
**Bat.-ac portable**
**FREE WITH 6 NEW SUBS**

15 Transistor AM-FM with AFC radio, leatherette case with handle. 5" x 7" x 3". AC or batteries. A very hot set. Great for kitchen, shack, trips, car, bathroom. Large speaker for good quality.

It won't hurt to keep in mind that the subscription rates to 73 are going up to $6 per year on August 1st. Act now while the old rates are still good.


**24 HOUR OPERATING DESK CLOCK**
**FREE WITH 5 NEW SUBSCRIPTIONS!**

This beautiful clock has numbers you can really see. Keep it right in front of the rig and set up with GMT time so you can keep the log correctly. The numbers go up to 24 hours. This desk clock normally sells for $25.

---

These premiums are offered for groups of new subscriptions to 73. USA or APO only. Send each new subscribers name, call, address and zip on a separate 3 x 5 sheet of paper. Subscriptions take about six weeks to process. On a separate sheet give your name, call, address and zip and the premium you want. Please allow eight weeks for delivery just in case the demand is heavy and we have to wait for factory delivery. We'll try to make immediate delivery when possible. This offer expires July 31st and all subs must be postmarked before that date. Send $5 for each new sub.

## 73 MAGAZINE PETERBOROUGH, N.H. 03458

# The Anatomy of a pile up

Edgar Wagner G3BID
5, Ferncroft Avenue,
London, N.W.3.

The "Pile Up" is, of course, a well known phenomenon on the amateur bands, and one which one expects if one goes to operate from a relatively rare country like ZD3 or 6W8.

It was, therefore, particularly interesting to study this phenomenon from these countries.

The first point which strikes the visitor to a rare country is *not* the pile-up itself, which one expects, but the extraordinary fact that one can pick a clear channel and call CQ, and have no one come back. Of course this clear channel may appear to be clear from the DX station locality, but need not be clear at the other end. To try to eliminate this factor, I frequently called CQ on *various* frequencies for up to half an hour when the band was clearly open. Nor can it be argued that I was not getting out, because at the end of half an hour a station came back and this soon developed into a pile-up.

It has frequently been observed that pile-ups are virtually self-generating. That is, if the station is calling and getting no replies, it is often left to call and get no reply at all. Once several stations are calling, the pile-up generates itself.

This leads to the conclusion that many amateurs are unwilling to tune the band for a possibly rare station but are attracted to the frequency because they hear a pile-up. Further testimony that many amateurs chase the "pile-ups" rather than chasing DX, is how often one hears "QRZ the DX station on the frequency" in the middle of a pile-up. Clearly the operator had not heard the DX station and merely noticed a pile-up and immediately been attracted–not by the DX station, which he hasn't heard–but by the pile-up, which he had heard.

Some time ago I was operating G3BID/CN/M and heard four Americans discussing me. One stated that he heard that G. . . would be operating Mobile in Morocco and asked another if he knew when he would be on. Another asked what bands the station was expected to operate on, as he was keen to work the Mobile in Morocco. They passed it round so fast that although I was listening on the frequency and repeatedly tried to break in they never gave me the opportunity, and after about a quarter of an hour or twenty minutes listening to them saying how anxious they were to work me, I had to move off the frequency as it was quite hopeless to try to break in.

There seems to be a curious pride with some operators in seeing how fast they can pass it round without a moment for a DX station to break in.

One of the best examples of Pile-ups was when I heard of a pile-up on an EA8 while I was operating from ZD3. Very few contacts were made as the EA8 could not pick out the calls from the pile-up. I chose a clear channel 7 kHz above the EA8's pile-up and called CQ, hoping to thin out the EA8's pile-up and so enable the stations to work both the EA8 and ZD3. By all normal calculations ZD3 is rarer than EA8. Nevertheless I did not get a single reply to repeated CQ's only 7 kHz above the EA8 Clearly the callers were attracted to the "pile-up" rather than to the station.

It would be an interesting experiment to "organize" a pile-up on top of some quite common call, and see how much of a pile-up one could generate from almost nothing because it does seem clear that it is the pile-up itself which attracts many callers.

I notice too, how quickly a pile-up disintegrates if one switches to split frequency operations. There may have been twenty or more stations calling on the frequency; one announces that one will listen 10 to 20 Hz higher and in the whole 10 Hz only three stations are heard. I realize that some people can only operate transceive, but not as high a proportion as that surely.

Curiously enough while it is very difficult to get people to call 10 or 20 Hz off the frequency, there are also many operators who cannot or will not zero the frequency accurately when one is operating transceive. Quite a few stations seem to find great difficulty in accurately zero-ing a frequency.

It is understandable for a station to call 2 Hz or even 1 Hz off the DX stations frequency in the hope of being heard, but surely no one *deliberately* calls ½ Hz or ¼ Hz off the frequency. One is left with the only possible conclusion that these people are *unable* accurately to zero on to the frequency. It was surprising how often when working transceive with quite an orderly group calling me after each QSO, for quite a high proportion to be just far enough off frequency to necessitate re-tuning to their frequency and so moving the transmitting frequency or having great difficulty in copying.

One wonders that the licence examinations include no "practical exam". Clearly, this point of accurate zero-ing is totally neglected in the licensing examination, since, —apart from the Morse Code test—the examination is purely writtten.

If the Code test is a "practical examination", might not a "Netting" or "Zero-ing" test be a good idea.

I noticed with interest that the more difficult tests and exams in the U.S.A. for the "advanced" and "Extra" class included a higher standard of Theory and of Morse Code "practical" test, but no "practical" test of handling the equipment.

Many complaints can be read in the magazines about "Appliance Operators", but the official licensing tests do not even include any practical test of the ability to operate the appliance. . . . G3BID

---

D. E. Hausman VE3BUE

## Keeping Contacts Clean

Solid state gear is becoming ever more popular. Where current was once measured in milliamps, it is now measured in microamps. As a result, it is imperative that relay and key contacts be kept clean. Otherwise, erratic operation might result.

A simple way to keep your contacts clean is to use a small automotive file used for filing spark plug gaps. The teeth on such a file are very fine and remove only the dirt from contacts. This file is available at most auto supply stores for about twenty-five cents.

A further method of keeping contacts clean in the long run is to cover your key or relay with a small plastic container.



### YOUR CALL

Please check your address label and make sure that it is correct. In cases where no call letters has been furnished we have had to make one up. If you find that your label has an EE3*&* on it that means we don't know your call and would appreciate having it.

# Getting Your Higher Class License

## Part IV — Antennas, Transmission Lines and SWR

This is the fourth installment of our study course for the new Advanced Class license examinations. In previous installments we have examined radio waves, propagation, single sideband, and some principles of transmitter design, construction and operation.

In the process, we have gone through 15 of the 51 questions on the FCC study list.

This month, we're turning our attention to a subject of general interest to everyone —whether he is studying for a new license or not. This time, we're looking at antenna matching, transmission lines, and SWR.

Some of this material was brushed across lightly in our first installment (radio waves and propagation). Because of this, we can take on more than our scheduled five questions this month. The study list includes seven questions dealing directly with antenna adjustment, matching, and feeding, which we haven't already examined, and we'll take them all.

The specific questions we're looking at this month (numbers are from the FCC study list sequence) are:

2. What is a good indication that a high standing wave ratio (SWR) is present on a transmission line? Where is the best point on a long, transmission line measure the SWR?
4. What happens to the voltage, current, and impedance along a transmission to line with a SWR of 1?
11. A transmission line that feeds an antenna has a power loss of 10 dB. If 10 watts are delivered to the transmission line input, how much power is delivered to the antenna? List possible causes of power loss. How can the SWR of the line be made as low as possible?
29. When can a low-pass filter be installed in a coaxial cable without causing a large power loss?
30. How can the resonant frequency of an antenna be increased? Decreased?
31. A 70-ohm half-wave antenna operating on a frequency of 7300 kc is to be matched to a 50-ohm transmission line. Calculate the characteristic impedance of a quarter-wave matching section and the physical length of the antenna at the frequency given. What is the SWR between the antenna and transmission line without a matching section?
45. What are the advantages and disadvantages of using the same antenna for receiving and transmitting?

As usual, we'll paraphrase all these questions into another group of questions to spotlight the technical points involved, and then examine the resulting "general" questions rather than the detailed problems presented by the study list. An understanding of the principles will permit you to solve any specific problems if the necessary details are provided.

Four of the seven questions deal directly with "SWR" while a fifth one requires a knowledge of SWR for its answer. Therefore our first "general" question must be, "What Is Standing-Wave Ratio?". Equally important is the second: "What Are The Effects of SWR?"

Two of the questions deal with facets of "matching" between transmission line and antenna. A third "general" question, then, is: "How Can Lines and Antennas Be Matched?"

To wrap up the discussion, and to permit us to deal with questions 11 and 29, we must ask: "How Are dB Related to Power Loss?", and question 45 may then be examined without need to paraphrase it.

We thus have reduced the seven original questions to five, but the answers to those five will provide the tools necessary to answer the original seven as well as all other questions of similar nature.

### SWR

*What Is Standing-Wave Ratio*? To determine just what "standing-wave ratio" (which we will henceforth abbreviate as

SWR) is and how it affects antenna performance, we must back up a bit to matters discussed in the first installment and look at a "standing wave".

Remember that a radio wave is propagated by the fields which result as current flows through an antenna. While we looked at only the field produced by a single point of current flow along the antenna, it takes little imagination to realize that every one of the points along the antenna wire has its own current flow at any instant, and that all of these currents are continually changing.

The situation is very much like a long water pipe connected to a piston-type pump at one end, with the other end stuck in a pond. When the piston pushes, the water in the pipe is pushed away from the pump and toward the pond. When the piston pulls, the water is sucked back from the pond toward the pump.

In a pump, of course, you have a valve which eliminates either the "push" or the "pull" so that the water moves only one way. The propagation of rf energy down a feedline (or up a feedline) is more like a child blowing into straw and sucking liquid back up.

The top line (1) in **Fig. 1** shows this situation, with the piston at the left of the illustration. The figures in the drawing represent "pounds of pressure" and the arrows indicate its direction. If the piston is capable of producing 10 pounds of pressure, the pipe at any instant will have points within it at which 10 pounds of pressure is moving away from the pump, other points at which a corresponding 10 pounds of pressure is moving toward the pump (pull), and halfway between these points of opposing maximum pressure will be points at which the pressure is nothing at all, 0 pounds.

If the pipe is the same inside diameter all the way from the piston to the pond, this pattern will also be the same for the entire length of the pipe.

However, if we run out of large pipe halfway to the pond and put in a reducing joint so that we can finish the run with smaller pipe, the picture changes. This is shown by lines 2 through 5 of **Fig. 1.**

The piston can still produce 10 pounds of pressure; the smaller pipe, though, can accept only 7 pounds of this pressure. The other 3 pounds has to go somewhere; with no place left to go when it reaches the reducing joint, it has no choice except to

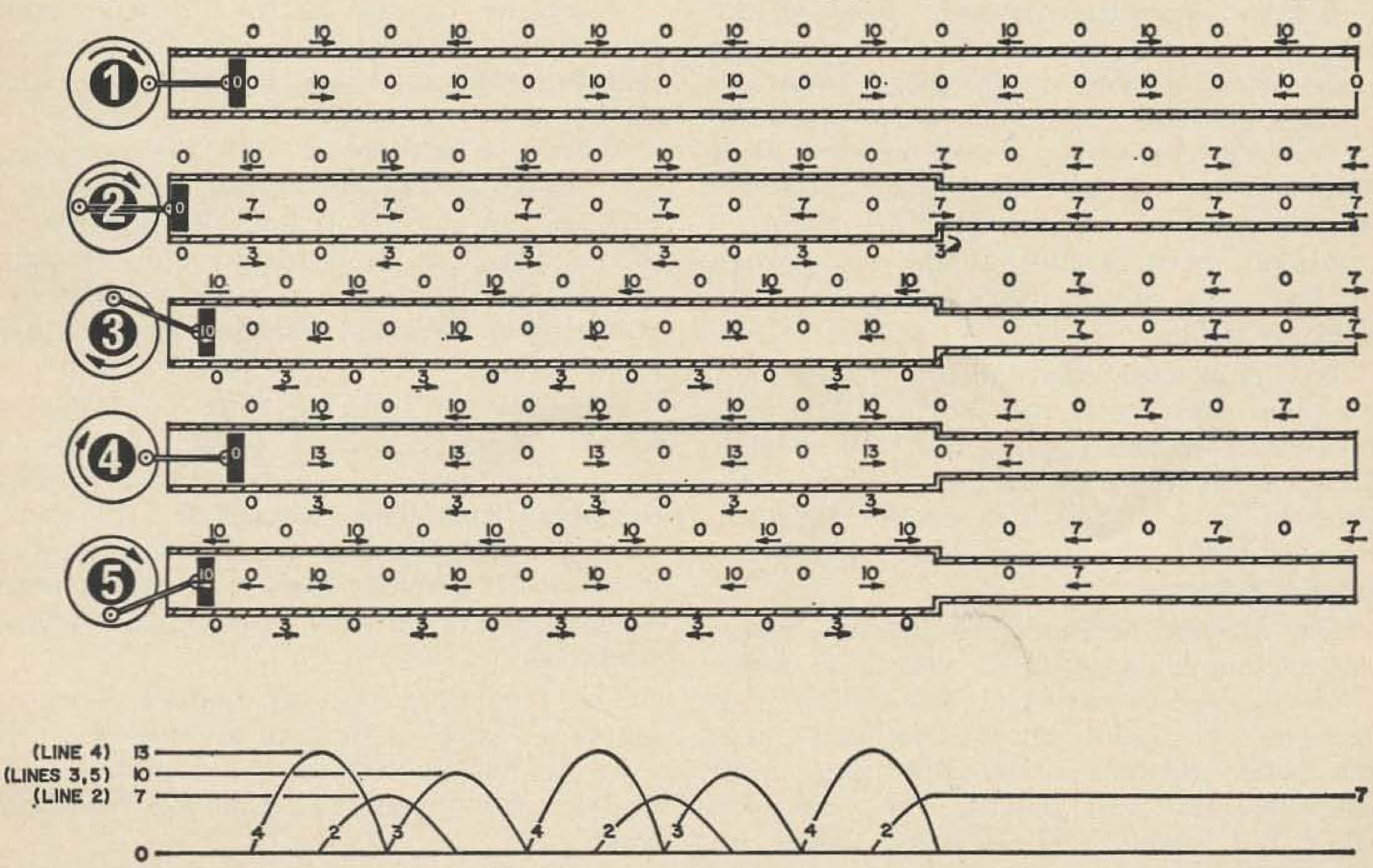



*FIGURE 1—RF energy flowing in a transmission line may be compared to water being forced down a pipe by a piston. Line 1 shows the comparison for an unencumbered pipe. Lines 2 through 5 show what happens when the pipe suddenly gets smaller; some of the pressure turns around and pushes back. See text for explanation in detail.*

turn around and come back to the piston.

This means that each forward "push" of the piston imparts up to 10 pounds of "forward" pressure to the water inside the pipe, but up to 3 pounds of "reflected" pressure which has gone the distance from the piston to the reducing joint and back again is bucking against the "forward" pressure.

At some points in the pipe, and at some times during the push-pull pumping cycle, both the "forward" and "reflected" pressure waves will be moving the same way. This is shown in line 4 of the drawing. When this happens, the two add together to produce 13 pounds peak pressure.

At other points in the pipe, and other times during the cycle, the two pressure waves are going in oposite directions. Line 2 shows this effect. When this occurs, the smaller cancels out part of the larger and only the difference is left, moving in the same direction as the larger of the two original waves.

Any time that the two waves do not either completely add (as in line 4) or completely subtract (as in line 2), they modify each other in a more complex manner. Lines 3 and 5 show two examples of this occurrence. In line 3, for example, the piston is moving forward at maximum pressure. Between the face of the piston and the first zero-pressure point of the forward wave, the pressure decreases gradually from 10 pounds to zero. In the reflected wave, a zero-pressure point exists at the piston face; from there reflected pressure climbs until it reaches a maximum of 3 pounds at the same place in the pipe as the forward-wave's zero-pressure point.

It's fairly clear that at the piston face, the total pressure is the sum of 10 pounds forward and zero reverse, or 10 pounds forward. At the forward wave's first zero-pressure point, the total pressure is zero forward plus 3 pounds reflected, or 3 pounds reflected.

The forward and reflected pressure waves are moving in opposite directions, so *somewhere* between the piston face and the first zero-pressure point of the forward wave the total pressure within the pipe must pass through zero pounds. This happens when the forward and reflected waves are of exactly equal strength; at this point they cancel each other out.

As we examine the line on beyond the first total-pressure zero point we have just located, we will find that the forward wave is "pulling" at the same time that the reflected wave is "pushing" so that the result is a pond-toward-pump wave stronger than either wave alone. This total pond-toward-pump wave reaches its maximum pressure just before the reflected wave drops to zero pressure since the forward wave, which is much stronger, is increasing in pressure more rapidly than the reflected wave is falling.

This process continues the length of the line until the reducing joint is reached.

Line 5 shows a similar process; the only difference is that we are looking at a difference point in the pump cycle, and so the push and pull relationships between the waves are reversed.

Now let's imagine that the pump is speeded up tremendously, so that we can no longer visualize the individual points of peak "push" and "pull" pressures. They will still interact just as we have seen, but when we attempt to measure pressure inside the pipe at any point we will get a reading which is the *average* or *effective* pressure at that point, and which is the product of many individual wavefronts and their interactions.

When we do this to the unencumbered pipe shown in line 1, we find an even 10 pounds of pressure all the way along the pipe.

When we attempt it with the restricted pipe shown in the other lines, however, we will find an even 7 pounds of pressure in the smaller pipe. In the larger pipe, though, we will find that the pressure reading depends upon the point at which we take our measurement!

Right at the reducing joint, for instance, we will read an even 7 pounds just as in the smaller pipe. As we move back toward the pump from there, we will find the pressure increasing until it reaches a maximum of about 13 pounds. Then it decreases until it gets back down to 7 pounds, and begins rising again.

The pressure variations themselves, then, follow a "wave" pattern in a cycle—but this wave is not in motion; it's standing still. And for that reason, it's called a "standing wave".

When we deal with rf rather than water in a pipe, it's actually a little more complex than that, but the principles are the same. The standing wave is created by interaction between the "forward" wave going from the transmitter or other source out to an intended destination, and a "reflected" wave which bounces back from any restriction or "discontinuity" in the line.

If the discontinuity is minor—that is, if almost all of the available energy can move past it in the "forward" direction and only a small portion is "reflected" back to the source—then the reflected wave will be very small compared to the incident wave and the resulting standing wave will also be small.

If the discontinuity is large, so that much of the available energy is reflected and less continues in the "forward direction", then the standing wave will be large.

In the extreme example of an open-circuited or short-circuited line, where the energy has no place to go and so must all be reflected, the standing wave will be as large as the available energy permits.

Some method of measuring the strength or size of the standing wave is necessary, and that's where SWR comes in.

A "small" standing wave will show very little variation between the voltage at its "maximum" points and that at its "minimums". A large one, on the other hand, will show a large variation. The *ratio* between the voltage at a maximum and the voltage at a minimum thus provides a measure of the "size" of the standing wave. This ratio *is* our old friend SWR.

In the days of open-wire feeders, SWR was actually measured in just this manner, using an rf voltmeter. This procedure was noted for its tendency to produce rf burns; the voltage at a maximum with a high SWR can easily run into the kilovolts!

Fortunately, SWR can be measured by simpler means. The "directional coupler" and its cousins are among the simplest. These are instruments which employ some special coupling and phasing circuitry to separate the "incident" and "reflected" components which are present at the same time in the same feedline, permitting you to measure each component individually. Since the ratio of forward energy to reflected energy is what actually creates the standing wave, a knowledge of this ratio (called the "reflection coefficient" by the engineers) permits a calculation of the SWR. This calculation is made by special calibration of the dials on today's SWR meters, virtually all of which use the directional-coupling principle.

We have seen, now, that *any* discontinuity in a line carrying rf energy creates reflections of the energy, and that these reflections create standing waves which are measured by SWR. Before we move on to examine the effects of a high SWR, we should note that the most common cause of such discontinuities is an impedance mismatch between feedline and antenna, and that improper installation or maintenance of the feedline runs this a close second in the "most common" list. If, on the other hand, a perfect impedance match is obtained, no reflections can result since no discontinuities exist. In this case the voltage, current, and energy will remain essentially constant at all points along the feedline, and the "SWR" will be 1.0 since the "maximum" and "minimum" points are at the same voltage.

We should also keep in mind that 1.0 is the best possible SWR. Anything *less* than 1.0 is not possible, because this would mean that more energy was being reflected than came up the line in the first place! Even if a reading of "0.7" could be obtained, it would refer to the same SWR as would a reading of "1.4", except that you would be looking in the opposite direction along the line (from load to source rather than from source to load).

*What Are the Effects of SWR?* Now that we know just what SWR amounts to, we are ready to examine its effects. The major effects of standing waves fall into three categories:

Most important, at the antenna, is that a standing wave permits energy to radiate, and is in fact necessary to permit radiation. While this is a desirable effect at the antenna, it is most undesirable anywhere else. You want the energy to get *to* the antenna before it is radiated! Anything lost by radiation on the way is just that much power lost.

The remaining two are two sides of the same coin. A high SWR means, by definition, that the voltage across the line has values at some points along the line which are much higher than those at other points along the line, since SWR is simply the ratio of these maximum and minimum voltages. When a high SWR exists, so do points of unexpectedly high rf voltage. These high-voltage points can damage equipment, and even injure you.

At the points where voltage is high, current must be low, since the power put into the line remains constant. Similarly, where voltage is low, current is high. These high-current points also cause trouble. They can vastly increase your power losses in the line, since power lost is equal to current *squared* times resistance. If the current is 10 times as high as expected, the power lost is 100 times greater. With an SWR of 10 to 1, which is not uncommon in badly matched lines, power losses can be expected to be around 100 times greater than expected.

This high power loss produces excessive heat at the points of maximum current; the feedline may actually be melted as a result. The current effects, then, produce both a loss of power and possible damage to equipment.

The undesired radiation due directly to the presence of the standing wave, and the increased losses due to the current peaks within the line produced by the standing wave, are the two most major effects normally noted from a high SWR.

Several other effects, which result from the abnormal voltage and current patterns caused by the SWR, are not so frequently attributed to standing waves—except by persons who really understand SWR. One of these is high power loss in low-pass filters.

A filter, to perform its function properly, must be operated exactly as its designer intended. The function of a filter is to introduce extreme power loss at certain frequencies, while having very low losses at other frequencies. Those frequencies lost in the filter are "filtered out" while those not affected become the normal output. To do this, the filter must "see" the proper impedance level at both its input and output terminals. If an improper impedance is present, the high-loss action may be moved into the intended operating range.

When a transmission line has a high SWR, its voltage and current relationship is no longer the same as with a low SWR. With SWR of 1.0, the line's impedance is determined entirely by its physical construction. When SWR is greater than 1, the line impedance may be either greater or less than its physical construction would indicate. The limits of variation are set by the SWR. For instance, a 52-ohm feedline operated at an SWR of 1 would always appear to be 52 ohms. At an SWR of 2, it could be anywhere between 26 and 104 ohms; when SWR rises to 5, impedance can range from 10.4 up to 260 ohms.

The lower limit of impedance is equal to the "normal" line impedance *divided by* the SWR. The upper limit is the "normal" line impedance *times* the SWR. Whenever the SWR is greater than 2, then, the actual feedline impedance a filter may be looking at is anybody's guess.

The points of maximum and minimum current are determined by the distance back toward the source from the discontinuity which is producing the standing wave. Every half-wavelength back from the discontinuity, the conditions at the discontinuity are duplicated. If, then, the discontinuity consists of an impedance *lower* than the feedline impedance, the *minimum* impedance will be present every half-wavelength back along the line. On the other hand, if the discontinuity is a *higher* impedance, then the maximum impedance will be present at half-wave intervals.

At the quarter-wavelength points which separate the half-wave positions, the *opposite* impedance condition exists. If a 75-ohm antenna is fed with 50-ohm line, this produces an SWR of 75/50 or 1.5. Every half-wavelength back from the antenna, the feedline will show 75 ohms (1.5 times 50 ohms) impedance. At quarter-wave points between these, the feedline impedance will be 33.3 ohms (50 ohms divided by 1.5).

At either of these points, whether maximum or minimum, the voltage and current are in phase with each other and the feedline represents a "pure resistance" load. Between these points, though, voltage and current are out of phase to a greater or lesser extent, and the feedline looks like either an inductor or a capacitor.

When a filter is involved, this can be disastrous, since the unintentional connection of an extra coil or capacitor into its tuned circuits may pull them completely out of adjustment. The result—excessively large power loss.

Even without filters in the act, the reactive impedance presented to a transmitter's output jack by a line with only moderate SWR can lead to surprising effects. For example, at certain critical line lengths an SWR as small as 1.3 can show an imped-

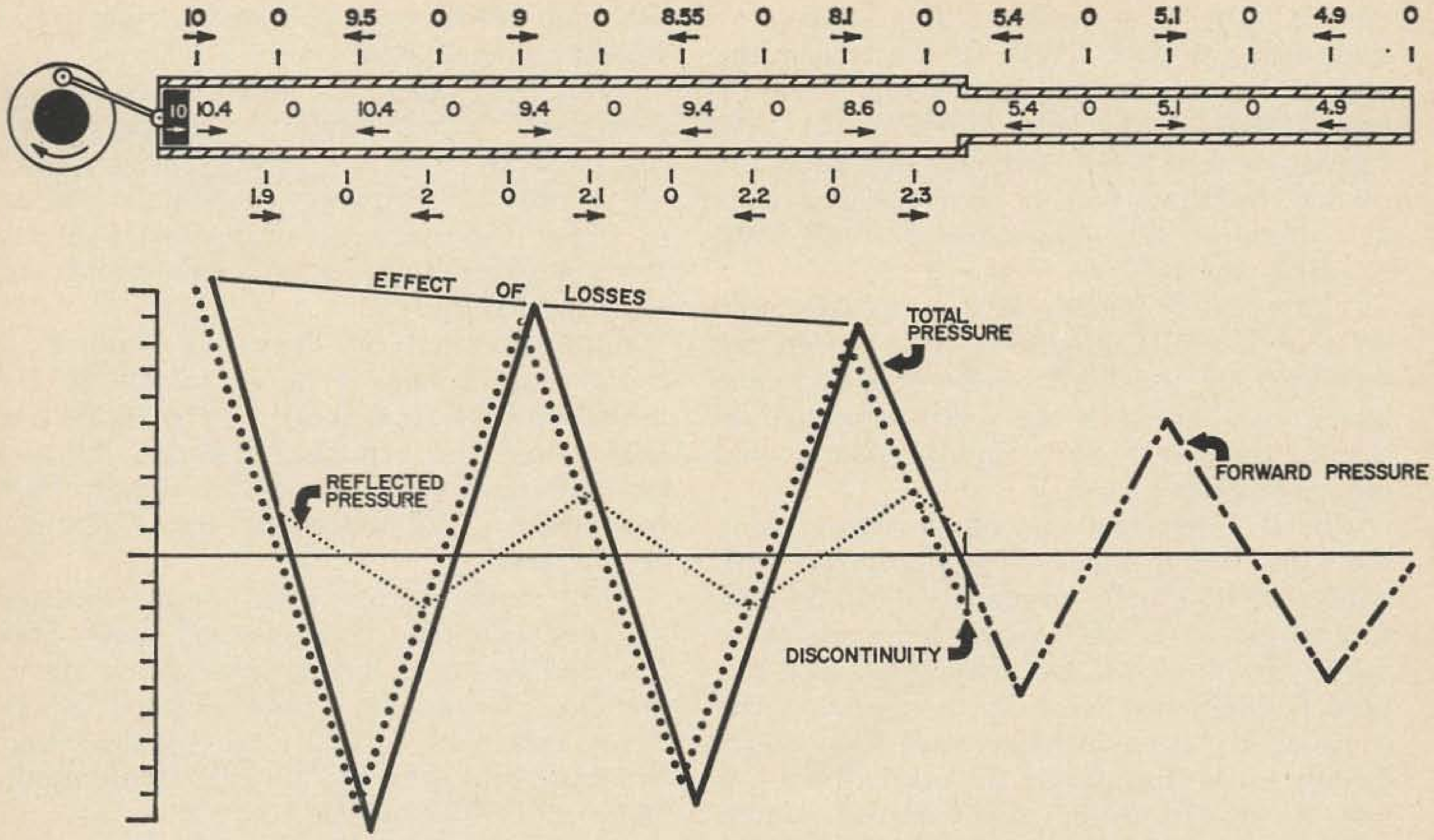



*FIGURE 2—Losses in line cut back strength of reflected wave, thus reduce SWR.*

ance which cannot be matched by most pi-network output circuits, although pi-nets are popularly supposed to be capable of matching anything! This particular condition comes about when the line looks like a large coil; the "coil" cancels out all of the pi-net output capacitance and there's nothing left to tune with. The cure is either of two things: get the SWR down still lower (preferred, but often impossible), or extend the feedline by an additional 1/8 wavelength to escape the critical area.

This effect of SWR is the reason so many antenna articles advise you to "prune" feedline length for best results. No installation can hope to maintain an SWR of 1.0 for any length of time; coax deterioriates, joints may corrode, and the antenna feedpoint impedance itself will change with the weather. Some SWR is always present. At critical line lengths it can produce startling effects. To avoid these, keep the feedline at multieples of 1/4 wavelength—or "prune" it for easiest transmitter adjustment.

We have seen how high SWR affects power loss, by increasing current density in the feedline. Surprisingly enough, power losses also affect the SWR despite many claims that the only factor affecting SWR is the impedance match.

Remember that the SWR is simply the ratio of peak to null voltage or current in a standing wave, and that the standing wave itself is due to interaction between a forward wave and a reflected wave.

At any point along a feedline, the forward wave is making its initial trip "up" the line. The reflected wave, however, has not only come this far from the source, but has also gone on out as far as the discontinuity, and then come back down the line that far again to get back!

For instance, if a feedline is 100 feet long, then at the transmitter output connector the forward wave has gone only a few inches (if that far) but the reflected wave has traveled 200 feet. At the midpoint of the line, the forward wave has gone 50 feet but the reflected wave has gone 150 feet—the same 50 feet traversed by the forward wave, plus the remaining 50 feet to the antenna, and then that last 50 feet back again in the opposite direction. And at the antenna, the forward wave has gone 100 feet but the reflected wave's journey is the same length.

If no line losses existed, it would make no difference where on the line you looked: the SWR would be the same everywhere.

But with line losses involved, the reflected wave gets weaker as it travels further. As the reflected wave weakens, the SWR becomes lower. It is quite possible to have an apparently perfect SWR at the transmitter end of a coaxial cable, and to have an infinite SWR at the other end of the line. In fact, serious VHF workers sometimes use several hundred feet of disconnected coax as a dummy load, since it has the best SWR available at UHF!

The effect is particularly noticeable with very high SWR, since the line losses are increased by the high SWR. The high line losses then cut back the reflected wave, reducing the SWR more rapidly than would otherwise be the case.

**Fig. 2** shows how the effect works, using the same water-line and pump image with which we originally examined SWR in **Fig. 1.** Instead of a solid pipe, we're going to use a choked-down fire hose now. The fire hose is somewhat leaky, so that some of the pressure is lost along the way. This corresponds to the line losses we meet in a feedline. As in **Fig. 1**, the numbers are pounds of pressure and the arrows indicate direction.

## Matching

*How Can Lines and Antennas Be Matched?* The cure to SWR problems is to "match" feedlines and antennas, so that any major discontinuities are removed and SWR remains low.

This can be accomplished in many ways. Rather than attempting to list in detail all of the ways in use, we'll refer you to any good antenna handbook for the gruesome details and here we will concentrate on the principles *behind* matching.

The whole idea of matching is to eliminate discontinuities in the path of the rf, and thus do away with the reflected wave which results in a high SWR. The simplest way to do it, whenever it may be practical, is to choose an antenna which is inherently matched to the feedline you intend to use; then you have no discontinuity in the first place. This solution, though simple, is not often practical, because antenna impedance varies with height, length, frequency, and even the weather. A perfect match one day may be a mismatch the next.

However, the simple half-wave dipole antenna and the folded dipole are both popular for "direct feed" use; the dipole is a fair match to either 52 or 75 ohm line while the folded dipole, as normally used, matches 300-ohm feedlines if operated at the proper height above ground.

Both these antennas, though, are "single-frequency" affairs insofar as perfect matching goes. If either is operated even slightly off its resonant frequency, it will show traces of either inductance or capacitance at the feedpoint—resulting in a discontinuity and resulting SWR.

So for normal use across a band, even these require some type of matching. For multi-band use matching is even more necessary, and the matching question becomes as important as the antenna design itself when beams and other directional antennas are involved.

Most matching networks operate indirectly; they eliminate the reflected wave from the feedline by giving it some place *else* to go. Thus the matching network itself usually has a rather high SWR; the feedline from transmitter to network, though, is essentially "flat" with SWR approaching 1.0.

An excellent example of this type of action is the "stub match" which is popular at VHF and finds some use at lower frequencies. This consists of a feedline section either shorted or open at the end (the "stub"), connected in parallel with the regular feedline at some place near the discontinuity. The stub deliberately introduces a *second* discontinuity, but the length and tap point of the stub are both chosen so that this second discontinuity cancels the effects of the first. The wave reflected from the first winds up harmlessly in the stub, and the feedline itself is free of standing waves.

One of the most popular matching devices is the "quarter wave transformer" which consists of a section of feedline 1/4 wave long, connected between the line and the antenna to be matched.

Remember that no matter what the SWR on a feedline, the feedline impedance will be resistive every quarter wavelength, and will alternate from minimum to maximum and back at these points. If a 150-ohm is connected to a 75-ohm antenna, it will have an SWR of 2 (line impedance divided by antenna impedance, or 150/75). Then 1/4 wavelength back from the antenna, it will have an impedance of 2 times 150, or 300 ohms.

Similarly, a 100-ohm line connected to a 300-ohm antenna has an SWR of 3, and 1/4 wave back from the antenna the line impedance would be 100 divided by 3 or 33.33 ohms.

Therefore, a 1/4-section wave of transmission line can be used as an impedance transformer, to change the effective impedance of an antenna or a feedline to some new value. The new value is determined by the impedance of the 1/4-wave section; we could just as truthfully say that the impedance of the 1/4-wave section is determined by the transformation values needed, if we had some means of adjusting the built-in line impedance to any value we desired. If open-wire line is used, we have this means available, since its impedance is determined by the spacing between wires. For a 1/4-wave section, we can build our own to whatever spacing we happen to need.

The relationship of impedance in a 1/4-wave transformer section is: line/transformer = transformer/antenna. If both the line and antenna impedances are known and we need to find out what impedance we need in the transformer, we can rearrange this into:

6

$$\text{transformer} = \sqrt{\text{line} \times \text{antenna}}$$

For example, 50-ohm line and 70-ohm antenna give 3500, and the square root of 3500 is approximately 59.16. Since none of our values are accurate to 1% in ham radio, the closest-guess answer we would get by using 3600 instead of 3500, which is 60 ohms, would be close enough for all practical purposes.

The 60-ohm transformer section, connected to a 70-ohm antenna, would have upon it an SWR of 7/6. At the other end of the transformer the impedance would be 60 divided by 7/6, or 360/7 ohms. This comes out to 51.4 ohms, which would be a negligible discontinuity for a 50-ohm line.

If we left out the matching section, the SWR would be 7/5 or 1.2, with a 50-ohm line connected to the 70-ohm antenna. Use of the matching section has thus reduced the SWR to 51.4/50, or 1.028.

We've already looked at the means of measuring SWR. It's worth noting at this point that most SWR measuring devices are not sufficiently accurate to show you an SWR as small as 1.028; many of them won't indicate anything smaller than 1.05. Because of the effects of line loss in reducing apparent SWR, too, measurements aren't accurate unless they're taken as close to the antenna (or matching network) as you can get with the instruments.

## DB

*How Are DB Related to Power Loss?* All along we've been talking about power loss; now it's time to look at the term most frequently employed to measure power gains and losses—the "decibel", which is abbreviated "dB".

It's named for Alexander Graham Bell, but the original unit turned out to be too large for convenient use and so the metric prefix "deci" meaning "one-tenth" was added to the basic "bel".

Like SWR, decibels measure a *ratio* rather than a *quantity*. This is what makes them so useful for gain and loss discussions.

Where we would have to multiply and divide, if we were working with the power-in/power-out ratio to measure power loss, the use of decibels lets us add and subtract instead.

Although the formula for calculating dB from the power ratio involves the use of log tables, you can be as accurate as is ever necessary if you just remember two pairs of numbers: a 3-dB power gain (or loss) means a 2-time change, while a 10-dB power gain (or loss) means a 10-time change.

That is, a feedline with 3 dB loss will lose half the power put into it, and deliver only the remaining half at the far end. The power put in is two times the power put out.

If the line has 10 dB loss, input must be 10 times output; to get any specific amount of power out, you must put in 10 times as much.

Working with these definitions you can determine the approximate power ratio for any other number of dB. For instance, a 7-dB loss is 3 dB less than 10 dB. Were it 10 dB, power out would be 1/10 of power in. Since it is 3 dB less than this, power out will be twice this, or 2 times 1/10, or 1/5 of power in. This means that 7 dB is a power ratio of 5 times.

To get the ratio corresponding to 4 dB we can first figure that for 7 dB and then multiply it by 2 again; the result is 2-1/2 times. Similarly, 1 dB is 1-1/4 times.

The exact formula, if you prefer to do things mathematically, for determining dB

$$\text{decibles} = 10 \times \log (\text{power}_1/\text{power}_2)$$

If $power_1$ is the larger of the two power figures, the dB will be positive and the result will represent a gain. If $power_1$ is smaller, the dB will come out negative and the result will represent loss. The easiest way to keep all the numbers straight is to define $power_1$ and $power_2$ so that the dB always come out positive (turning the ratio upside down if necessary to do this); if you have measured or calculated the power you already know whether gain or loss is involved, and you can then make the final figure either positive or negative as required—positive for gain, or negative for loss.

The fact that dB are expressed, by definition, in log terms is what permits us to add instead of multiply and subtract instead of divide. This, in turn, permits coax cables to be rated for loss in "dB per foot" or "dB per hundred feet"; we can find out the total rated loss of a feedline merely by multiplying its loss per foot in dB times the length in feet, and the result is the dB loss for the full line.

As an example, suppose a coax line is rated at 2.5 dB loss per 100 feet at 50 Mc (a not-unusual loss figure). If our coax is 200 feet long, we will have 5 dB loss in it even with a perfect antenna match and SWR of 1. If we now put in 10 watts from a transmitter, what will we get at the antenna?

From our 10-dB and 3-dB definitions, we know that we will get less than half, but more than 1/10, of the power through. Were the loss 6 dB, the ratio would be 4 (2 times 2). By taking 6 dB from 10 dB as we did earlier, we know that a 4-dB loss would be a ratio of 2-1/2. This means that our antenna will get less than 4 watts (10 divided by 2-1/2) but more than 2-1/2 watts (10 divided by 4). We may now either divide the 4 watts (4 dB loss result) by 1-1/4 (1 dB, from earlier example), or multiply the 2-1/2 watts by 1-1/4 (6 dB and 1 dB).

In the first case, we get 16/5 or 3.2 watts as the power delivered to the antenna. In the second, we get 25/8 or 3.125 watts for an answer. The variation is because there is a trace of inaccuracy in the definition of 3 dB (it's actually a ratio of 1.995 rather than 2) and when we apply it repeatedly, this inaccuracy begins to show up.

If we apply the formula directly, we find that the power delivered is 0.316228 times the power put in; with 10 watts in, the antenna receives 3.16228 watts. While neither of our non-formula answers was exactly correct, both were close enough for all practical applications. On the FCC exam it's most likely that the questions will deal only with 3, 6 or 10 dB figures; they're more interested in determining that you know what dB are and how to use them than in your ability to manipulate higher math!

All of our examination of decibels so far has been strictly in connection with *power* ratios. The decibel measures *only* a power ratio, but if a few rather strict rules are followed it's possible to express power in terms of voltage or current rather than directly in watts. The major rule is that both voltage or current readings must be made with reference to the *same* impedance level, and the minor one is that voltage can be compared only with voltage, and current only with current.

When this is done, decibels can be used to express the resulting "voltage" or "current" ratios. The definitions of dB then appear to change; actually, the definition stays the same but the way it's expressed changes. If you just remember that you're actually measuring *power* even when you're thinking *volts* it will help keep things straight.

For, you see, a change of either voltage or current in a circuit with its resistance fixed (the major rule) will change the other element, current, or voltage. And power is the product of voltage times current. If you double the voltage the current also doubles, and the power increases by four times. In any circuit to which you can legitimately apply dB for comparing voltage or current, the power will change as the *square* of either voltage or current.

A 2-time increase in voltage, then, produces a 4-time increase in power. And this 4-time increase in power is equal to 3 dB plus 3 dB, or 6 dB.

A 10-time increase in voltage produces a 100-time increase in power. This is 10 dB plus 10 dB ($10 \times 10$), or 20 dB.

When the comparison is made using voltage or current measurements, the resulting dB figures must be multiplied by 2 to be accurate. Twice the voltage is 6 dB; 10 times the voltage is 20 dB. The formula becomes 20 times log (E1/E2) rather than 10 times log(P1/P2). But all in the world this is doing is converting your *voltage* measurement into a *power* figure, by automatically squaring the ratio!

It's sometimes convenient to speak of "voltage dB" or "power dB"; it hurts nothing to do so, so long as you remember that they're actually all the same decibels, and only the measurements differ.

Decibels apply to many things besides transmission lines—it just happens to be easier to see how they work here than anywhere else. Receiver noise figures in dB are a comparison of power ratio between the smallest discernible signal and the inherent receiver noise. Antenna gain is a power ratio between the antenna being measured and one which has no gain at all.

*What Are the Advantages and Disadvantage of Using the Same Antenna for Receiving and Transmitting?* Both transmitters and receivers require antennas; this means that we have the choice of either providing separate antennas for receiving and transmitting, or using the same antenna for both purposes.

Either choice has some advantages and disadvantages compared to the other; most operators have their own personal prejudices as well.

First off, *any* antenna which will transmit a signal well will receive that same signal well. This is the "law of reciprocity" and means that you'll pay no performance penalty by using the same antenna for both purposes. The advantages and disadvantages, then, must lie in other areas.

The comparison is complicated by the fact that there are antennas and other antennas. It's hard to compare, for instance, a half-wave dipole or a mobile whip with a quad-Yagi high-gain VHF beam array, or a UHF parabolic dish. Yet the choice between separate antennas, and single-antenna operation, must be made for all these types.

The major disadvantages of using the same antenna for both purposes are (1) it must be switched from receiver to transmitter and back again for every transmission, and (2) you can't listen while the transmitter is on. The first is usually overcome by an antenna relay or a T-R switch (electronic rather than mechanical relay), and the second isn't usually considered a disadvantage by very many folk.

The advantages of a single antenna are (1) any gain present in the antenna is there for both receiving and transmitting and (2) less space, material, and money is required to erect only one.

The first of these advantages is meaningless if your antenna has no gain in the first place, although it's important for the users of beams and other gain antennas. The second is influenced by the first—hanging up a second length of wire to install a separate dipole antenna is far less costly than erection of a second 60-foot parabolic dish complete with three-dimensional rotation!

For beginners, the advantages probably favor use of separate antennas. No switching is necessary, and the use of separate antennas permits on-the-air monitoring of the transmitted signal. Advanced workers, on the other hand, show strong tendencies to favor single-antenna installations with T-R or relay switching.

It used to be said that full break-in operation on CW required a separate receiving antenna. The advent of differential-keyed transmitter circuits and fast-acting T-R switches has sent this statement the way of the dodo bird; these days you can use the same antenna for transmitter and receiver, and still hear a breaking station between your own dits. Most of the other traditional arguments for and against separate antennas have gone the same route. The four facts listed above are just about all that remains—*except* for personal prejudices—upon which to make the choice or answer the examination question.

*Next Round.* We've looked at a little bit of everything in ham radio so far. Next month will mark the half-way point in this series, and one major area hasn't yet been touched. We'll get it then, when we examine receivers and how they work. ■

# Letters

## Intruders

Dear Kayla,

It is a well known fact that no dummy load can duplicate exactly the electrical characteristics of a real antenna. It is also known that tuning up one's xmitter on the air is poor operating procedure at best, and a source of QRM at worst.

I have adopted the following procedure: I find a propaganda station, tune to their precise frequency in the ham band in which they are intruding, and load the Xmtr on their exact frequency. I can cause no addition to the QRM they are causing, and I would take delight in knowing that I caused their SWL listeners some difficulties in reception. I intend to continue this practice in the hopes of causing them some discomfiture.

Your suggestion that SSB transmissions a few cycles away would help drive them out is a good one. If I ever go SSB, I'll be happy to help out. In the meantime, I'll continue to load my antenna on a zero-beat with their frequency. Yours for more QRM for the intruders.

**Herbert J. Dunkerley WA3JIX**
**Jeannette, Pa.**

*Zero-beat won't do it. Set up a howl 50 Hz off zero-beat and you might have a good plan.*

Dear Kayla,

Hurray, and a tip of this OM's hat to you! Re your editorial in the May issue, I've finally heard someone speak out on these 40 meter Broadcasters; it took a woman to do it . . . alas!!

I've personally heard the BBC QRM. Really nice chaps!! We had better start fighting fire with fire before we lose the frequencies to these intruders. Better late than never??

**Bill De Lage WA1HAA**
**Esmond, Rhode Island**

Dear Kayla,

Your May 1968 editorial was on target. Positive action must be taken to combat the foreign broadcasting on 40 meters. Here is my proposal:

Allow unlimited amateur power between 7100 kHz and 7300 kHz from 6:00 PM local time to 6.00 AM, local time.

There are a number of American hams who have the wherewithall and initiative to run super-power (that is for hams) and utilize beam antennas to enhance their signals even more. I say, let us allow this regulation. I'm sure it would result in a re-evaluation by broadcasting interests of programming in the 40 meter band.

One final word. While it is "legal," the Voice of American broadcasts appearing in the region 2 40 meter ham band (and on 80 meters also) are not consistent with our government in respecting their own U.S. amateur radio frequencies.

**James A. Gundry W8BW**
**Dearborn, Michigan**

*I don't think we should allow UNLIMITED power! Maybe we should limit it to 50 KW?*

Dear 73,

W1EMV's April editorial on incentive licensing is well written. Concerning that poor soul who was making $200 per week, suddenly being cut to $150; then trying to find reason to work even harder to get back to his previous status: It isn't difficult to figure out what his next move will be.

This same idea could be appplied to commercial amateur equipment whose 100% *use* value and actual cost is $200, for example. However, with incentive licensing, we have the situation where the use value is suddenly cut to something less than 100%, but the cost is still $200. Upon purchase of gear, you may not be able to utilize it fully unless you have, or acquire, a certain amateur license. This takes away the "incentive" to buy.

. . . for most of us, incentive licensing means back to the books. This is great as we will contribute something to the betterment of amateur radio (we think), but we certainly won't be rewarded by a much needed raise in pay from the boss upon passing that next higher amateur license.

**Earle B. Foote K1BTF**
**Framingham, Massachusetts**

## Article Comments

Dear 73,

In conjunction with the timely article, "Are Phone Patches Legal?" by Ken Sessions, K6MVH in the May issue of *73*, I call attention to the last sentence in his paragraph II: Instead of a "—threat to their overall income" of the telephone company, the amateurs' phone patches are directly responsible for probably tens of thousands of dollars in additional income.

I am an Airforce MARS phone traffic net member, and our WESCOMMRGN alone handles thousands of phone patches each month from South East Asia, let alone other MARS nets in the Mid-West and East doing likewise from European installations of the U.S. Government.

This service is free to our service men, but, when the calls come through to Stateside, I would say without fear of contradiction, that the majority of them are put through on a collect basis and the folks "back home" accept the charges.

It goes without saying that were it not for the phone patches, these telephone calls would not be made over these great distances as the cost would be prohibitive.

Unquestionably the telephone company is well aware of this. They would have to be awfully dumb not to, and they are not dumb, but I assume they feel they would lose face to admit it, or they, on the otherhand, will not acknowledge to the amateur his just dues.

**R. C. Kyle K6GRP**
**Kelsey, California**

Dear 73,

A few comments on the IC Keyer in March '67 *73* page 50. It works fine business, but there is an error in the schematic. The SN7032 flip-flop has only 14 leads. The lead marked 15 in the diagram should read 5. C4 may also be low in value; if the dash flip-flop won't work, increasing C4 to 100 mmF may help. The unit I built needed about 100 mmF at C4 to trigger the clock pulse of the dash generator. Again, the keyer works FB and congratulations to W5FQA for a good keyer and construction project.

**Tony Suruda WB3JXE**
**Baltimore, Md.**

Dear 73,

Recently I completed my version of the Kleiner Keyer. I am very satisfied with the job this unit is doing. This is the first time I've used a transistor for keying grid block bias. I have built two other keyers previously, using plate circuit and mercury wetted relays, but they can't compare with the clean and crisp keying I'm getting from the Kleiner Keyer. Many thanks to W4UHN/WB2PKE.

**Gent C. Lam WA1CQF**
**Springfield, Mass.**

Dear OM's,

As a founder and member of the International Amateur Radio Club and Administrative Officer of the ITU in Geneva, I read the W2NSD editorial in the March 73 about our frequencies with interest. Nobody can say if we will lose our bands in the future, but we all must take care not to put amateur radio under a cloud by using illegal call signs. Rather we should work on the positive side and improve our **image.**

On February 24th I found myself involved in a story which made the papers in most of Europe and which should increase our reputation. I picked up an SOS message from Poland asking for a rare drug to keep a four year old child alive. The child would die unless the drug could be rushed to Nowa Sol within 24 hours.

Within the 24 hour period the Geneva hospital pharmacists were called back from weekend leave, three doses of the medicine were prepared, the Red Cross and airline officials arranged customs clearance and the medicine was flown to Paris and then on to Poland. I have a letter from the boy's father letting me know that the boy's life was saved!

**Fernand Dubret HB9PJ**

## UFOs

**Dear Wayne,**

That "Flying Saucer" in the May issue. Take a REAL CLOSE LOOK. I can detect a very fine thread line from the center of this old hat upward to the upper end of the photo.

**Jim W8BU**
**Cleveland, Ohio**

*The original Polaroid picture was greatly enlarged and examined very carefully for any possible tricks, sharpness of focus of the UFO in comparison to the foreground and backgrounds, etc. The estimate of the experts was that the photo was authentic. The original has since been borrowed by the government and "lost."*

**Dear Mr. Green,**

I would like to commend you on your superb suggestion for the establishing of a UFO communications network spearheaded by amateur radio operators. While I am not a ham operator myself, several members of the Louisville UFO Investigations Committee are. The Committee as a whole is quite excited about your proposal.

I am writing to suggest to you that Louisville, Ky., be designated one of the "control stations" for the network. Louisville's qualifications are many. It is located near the population center of the United States, and despite being situated in the Ohio Valley, weather conditions are generally adequate for proper communications. Louisville is also located in an area of rather frequent UFO sightings. One of our Committee members already possesses a station with equipment enabling him to be heard across the nation with relative ease. And the Louisville and Jefferson County police departments, Civil Defense, aviation authorities and news media are already familiar with the Committee and its operations. We would be more than happy to take the necessary steps to establish a net control center here in Louisville.

Perhaps I had better tell you a little more about the Committee. The Louisville UFO Investigations Committee is a group of business and newsmen in Louisville and Lexington, Ky. dedicated to the scientific study of the phenomena. Our members include three newspaper writers, two electronics engineers, a flying service owner, medical student and a chemical engineer, just to name a few. No doubt your office is being flooded with letters of this type. But I hope to impress upon you the sincerity and *ability* of our organization to be of help in the functioning of the network.

You have made the need for such a communications network very evident. Your contribution to the study of the UFO problem will be a great one if the network in fact comes about. Our hearts, minds, bodies and wallets if necessary are with you one-hundred per cent. Please let us know exactly what contribution we may be able to make. The time has come for action—and we are both ready and willing to act.

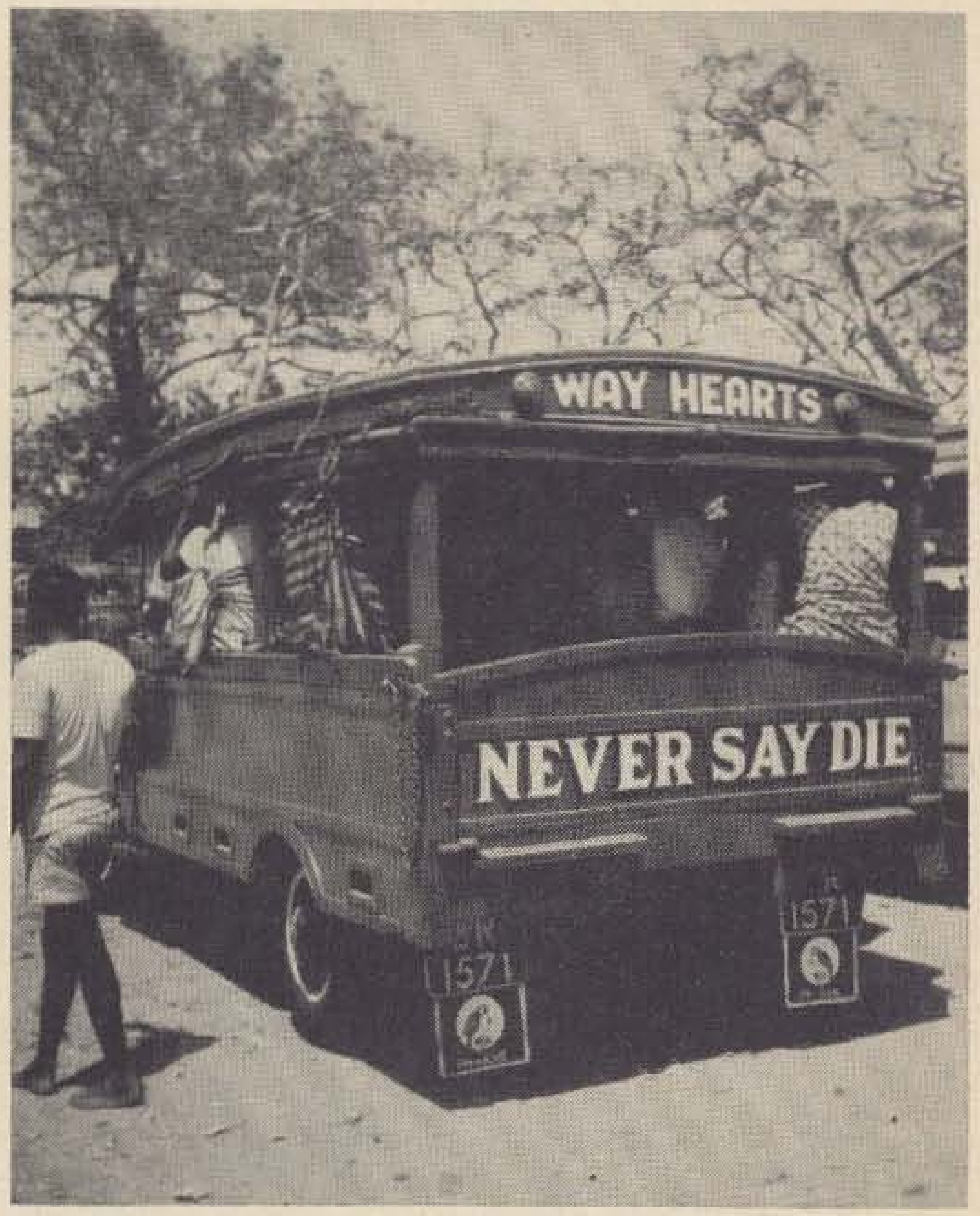
**Glenn O. Rutherford**
**Chairman**
**Louisville UFO Investigations Committee**

*Good to hear from you. Louisville might be just fine for a control center. Schedules are for 0100 GMT on 14,300 Wednesdays and 3900 on Thursdays, same time.*

**Dear Wayne,**

This photo was taken in Ghana. The vehicle is called a "Mammy Bus." The photo brought down the house at the DX Convention in Fresno this year.

**Lloyd & Iris Colvin**
**W6KG—W6DOD**




**Dear 73,**

I have become very interested in the 900 young men at Boys Town, Nebraska, and their amateur radio station WAØOGI. I have been helping the boys there to work DX and have enjoyed it very much.

They have had a hard time getting out due to a very poor antenna installation and location. It is only up 20 ft. and just 4 feet off a metal roof. In a westerly direction, the antenna faces the side of the 70′ field house which is also metal.

The board members refuse to allow the antenna to be put up on top of the field house, or to allow a guyed tower or telephone pole, but would permit a self standing tower to be erected.

Since Boys Town is supported purely by voluntary contributions, the income does not permit such an expense. I am willing to make a $5.00 contribution to such a project and wonder if other amateurs would feel the same way. If they would forward ideas and/or help to me, I will do all in my power to see that Boys Town has the best club station possible.

**Marty O'Hara WAØRWW**
**36 Pine St.**
**Millard, Nebraska 68137**

Dear Wayne,

How about running an Employment page for Communications and Electronics type people. Large companies spend plenty to send recruiters around the country. They are looking for top notch men, as a rule, and the reject rate of applicants tested runs as high as 97 percent, I am told. I know what I'm talking about because I have been "recruited" several times for various projects. Maybe you could solicit some recruitment advertising at attractive rates, since this would also be a reader service. Some companys who might be interested are: Federal Electric Corp., Paramus, N.J., RCA Service Company at Cherry Hill, N.J. and Page Communications Engineers at 3300 Whitehaven Street in Washington, D.C.

Point number two is this: What gives with Radio and Electric Industry as a way to make a living. I have been in this sorry business for twenty years and the only time the pay has been anywhere near what a plumber makes, is when the job was overseas. Here in Michigan, Electricians make 5.37 an hour for little more than pulling wire, and threading conduit and in the same town I have found Radio Stations offering $80 a week for a man with a First Phone license. If you ever quit the magazine business how about starting a *good* union, something like the Airline Pilots have? I would like to see if there is any reader reaction to this idea.

**Harvey Heinz**
**Gladwin, Michigan**

*(The job column is an excellent idea, though I might take the first good one that came along. And on the union idea . . . all we need is a union that is run by the same guy that botches up 73 every month. Wayne.)*

## Help Schools and Libraries

How would you like to have an impact on your own neighborhood all out of proportion to the effort it will take? Why not see that copies of 73 yet into your local town library so that teenagers will have a better chance to get exposed to amateur radio? Here's your chance to get kids in your area interested in ham radio at the best time of their lives. You'll be doing ham radio a great benefit, your neighborhood a benefit, the kids a benefit . . . and even helping our country by encouraging more kids to pursue an interest in a technical hobby which can and usually does lead to work in electronics.

Just send in subscriptions today for your local library and high school library and we'll start their subscription and inform them that it is a gift from you.

## Third Party Traffic Notice

This is to advise that United States amateur stations and amateur stations of U.S. Armed Forces personnel in West Berlin may exchange third party communications. Such West Berlin stations are identified by call signs DL4Q. . and DL5Q. . Third party communications with amateur stations in other parts of Germany is *not* authorized.



## Code Practice Stations

In England there are several dozen stations participating in sending code practice. Perhaps we are a bit behind in the U.S. due to our dependence on WIAW for our code. They do a nice job of it, doubtless, but they are hard to copy in much of the country and sometimes it is difficult to fit your schedule to theirs.

If any of our readers are sending code practice on a regular schedule and wish to make their service known we will be glad to list your schedules in 73. Please send in the times, days of the week, speeds, and frequencies for our listing.

I would suggest that automatic tape sending equipment is a must for such a service. Dependability is another must.

Now that all of the DX'ers are working for their Extra Class License there will be a demand for twenty words per minute code as well as the 13 wpm. There will probably be a great demand along about November when the first slice comes off the meaty end of the DX bands.

# 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.

★ 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 . . .

---

**GONSET 6 METER** 200 Watt Linear and h.b. exciter $90. Telrex 11 element 6m spiralray $85. Topaz transistorized 300 watt p.s. C10WDG $50. Clegg Thor VI w/a.c. p.s./mod. $169. Motorola 30D on 6 A.M. w/transistorized modulator $35. Gonset #3012 (152-162 M.C.), #3011 (40-50 M.C.) tuners @ $35. All F.O.B. Richard M. Jacobs, WAØAIY, 4941 Tracy, Kansas City, Missouri 64110.

**BACK ISSUES WANTED.** I am the agent for "73" in Scandinavia. Many people want reprints of articles in copies no longer available. Can you help?? Need Jan., Feb., 61; Jul., 66. Your price paid if reasonable. Write to: Eskil Persson, SM5CJP, Frotunagrand 1,19400 Upplands Vasby, Sweden.

**MECHANICAL ELECTRONIC DEVICES CATALOG 10¢** . . . Teletype Model 14 reperforator with automatic tape take up rewinder 115VAC 60cy. Both units new, unused $69.95 . . . ARR27 Receiver 29 tubes 465-510 MHz w/60 MHz if new, unused $35 . . . 1/16 laminated copper clad 2 oz. 2 sides, for printed circuits 9½x4½ $1 . . . 3/$2. Transistor boards bonzana $5.95 . . . Wide band balanced modulator $4.95 . . . 30 MHz IF Assembly $5.95 . . . Transmitter TDG w/Modulator easily converted to 2 meters $49.95 . . . Low pass filter 0-32 MHz 52 ohm $9.95 . . . 5KV/2KV/1KV at 750 ma/200ma/250ma Power supply write for details. Fertik's, 5249 'D", Phila., Pa. 19120.

**"SAROC" FOURTH ANNUAL FUN CONVENTION** scheduled January 8-12, 1969 in Hotel Sahara's new space convention center, Las Vegas, Nevada. Advanced registration closes January 1, 1969. Ladies program in Don The Beachcomber. Technical seminars, FM, MARS, RTTY, QCWA, WCARS-7255. Registration $12 per person entitles 'SAROC" participant to special room rate $10 plus room tax per night single or double occupancy, admittance to cocktail parties, technical seminars, exhibit area, Hotel Saraha's late show, Sunday breakfast equal to any banquet dinner, ask any 'SAROC" veteran. Brochure planned November mailing for details QSP QSL card with ZIP Southern Nevada ARC, Box 73, Boulder City, Nevada 89005.

**VIKING RANGER F.W.** $110. 250 QST's HO CQ Magazines $35. A. Urquhart, 198-26 Epsom Course, Hollis, N.Y. 11423.

**GSB-2 GONSET SIDEWINDER,** good condx, $190. Trade for late SBE-33. New 911A AC PS $40. DL5QN, Box 448, Co. A, USASAFSBERLIN, APO NY 09742.

**THE QUAD CITY AMATEUR RADIO CLUB** has scheduled its annual Mississippi Valley Hamfest for August 18, 1968 at the Rock Island Arsenal, Rock Island, Illinois. The site this year is an all-weather site with adequate display facilities. Lunch will be served in the cafeteria. Price for tickets is $1.50. Contact John E. Greve, W9DGV, 2210-30 St Rock Island, Ill 61201 for advanced tickets. Frequencies to be monitored are 3900 50.4 and 146.94 mc.

**SWEEP GENERATOR,** Philco model G8002, 470-890 MC ±1DB, Sweep width 0-50 MC, new condition in factory carton. Cost $289.50, Sell $50.00. W4JGO, R #2, Box 149, Salem, Virginia 24153.

**HAMMARLUND HQ-180 AC,** excellent cond, 4 yrs old, with noise immunizer, S-200 speaker, $285. Write—Walt Snyder, Apt. 4, 916 Shippan Ave., Stamford, Conn. Call days—212-HA2-4800, x 755.

**R-388-51J3 BFO,** transformer wanted (500kc) Will pay cash or trade. WA2ULP Donald Van Dorn, 7 Layman St., Ravena, N.Y. 12143.

**COLLINS—SELL R388** (51J3) $425, R390-A $750. R391 $800. All new condition factory aligned. Dumont 403R Scope $200. Box 781, '73", Peterborough, N.H. 03458.

**CANADIANS:** Wanted VHF FM Rcvr. 130-150 mhz for satellite APT reception experiments. Power supply and fancies not essential. Advise your item. A. Lacell, VE4LR, Box 95, Ft. Churchill, Manitoba.

**SONY VIDEOCORDER TV** tape recorder, 9" monitor, camera and accessories. Cost $1400. New—$900 sacrifice. Guaranteed perfect. K9EID Bob Heil, Marissa, Ill. 62251.

**IBM CABINET & RACKS,** idea for operating position or super rig. Steel desk console 57"w, 47"d, 66"h., 2 racks 21"w, 82"h, one full of plug-in units, tubes, components; other with door. Make offer. K6BCS, (213)886-0111.

**CANADIANS:** FOR SALE EICO 754 & 751. Transceiver and power supply. Best offer. Write VE7KC, 89 Corry Place, Penticton, British Columbia, Canada.

**SACRIFICE.** Must sell all my teletype equip. Model 15 $45.00. Model 19 $75.00. TD $25.00. Reperf. $20.00. Make offer on all. Will trade. K6OBH 2253, Kelton, L.A., Calif.

**432MC CONVERTER.** Convert to 7-30MC. Removed from missile guidance system, size 2"x3"x 3½", 2 tubes-2 diodes, complete with schematic & instructions less crystal. Unused $14.95 each. Also 100V PIV, 1.5A Epoxy diodes, 45¢ each, 10 for $3.99. Tubes 6146A, unused, $1.00 each. We pay postage on prepaid orders. Alpha-Tronics, Dept. A, 14251 East Colfax, Aurora, Colo. 80010.

**SELLING OUT.** Any reasonable offer will be accepted. AF-68, PMR-8, M-1070 Elmac, VHF-1 Seneca, 621 Amplidyne Transmitter, HW-30 tower, HE-80 receiver, HQ110A, 425 Eico, 950B Eico, 710 Eico, 260 Simpson, TG34 Keyer, RBC receiver, misc. converters, Citation IV pre-amp. and more. Irv Better, 2500 Channing Rd., Cleveland, Ohio.

**THE WABASH VALLEY ARA** will hold its twentieth annual VHF Picnic on Sunday, July 28, at Turkey Run State Park, about 40 miles north of Terre Haute, one mile off U.S. Route 41 and on Ind. Route 47. One dollar ($1) registration charge at gate only. Swap tables, eye-ball QSO's, entertainment for the ladies and mobile check-in on 52.525 M.C.

---

**TRADE—NORELCO STEREO** Continental "400" three-speed stereophonic tape recorder Model EL-3536A/54. Want 2 meter FM gear, good camera, or what have you? K9MWA, 609 Henrietta St., Gillespie, Ill., 62033.

---

**THE KNIGHT RAIDERS VHF** Club will hold its Second Annual Hamfest on Saturday, July 20, 1968 at Weasel Drift Picnic Grove, Garret Mt. Reservation, West Patterson, N.J. from 10 am until dark. The location is the same as last year. Manufacturers displays, swap shop, junque tables, contests, door prizes, and a good time for all will be the order of the day. Picnic tables and barbeque pits available. No tickets, no fee, it's free. Refreshments will be available. Talk in station K2DEL/2 will operate on 50.4 MC and 146.898 MC. Special certificate for contacting the talk in station available. For more details write K2DEL.

---

**SELL:** HQ-100-C w/speaker, Eico 720, 730, 722. Mike, SWR, low-pass, VOM, pre amp, extras. $175 FOB. Stephen Clifton WA2TYF, 800 West End Avenue, New York, N.Y. 10025.

---

**PACKAGE**—NCX-200 + NCX-A AC/speaker console. Factory sealed and guaranteed. $410 postpaid. Kight Electronics, Box 998, Abilene, Texas 79604.

---

**AMATEUR RADIO AND YOUR CALL** on 7" x 4" reflective Scotchlite decal, 1½" letters. $1.75. Will last years. Stan's Signs—W7CRG, 618 Beth Drive, Great Falls, Montana 59401.

---

**BEAUTIFUL GOLD BORDERED CERTIFICATE** that no ham station should be without. Answers questions that visitors may ask. Yours for a donation of fifty cents in coin to: The Rockaway Amateur Radio Club, Post Office Box 205, Rockaway Park, New York 11694.

---

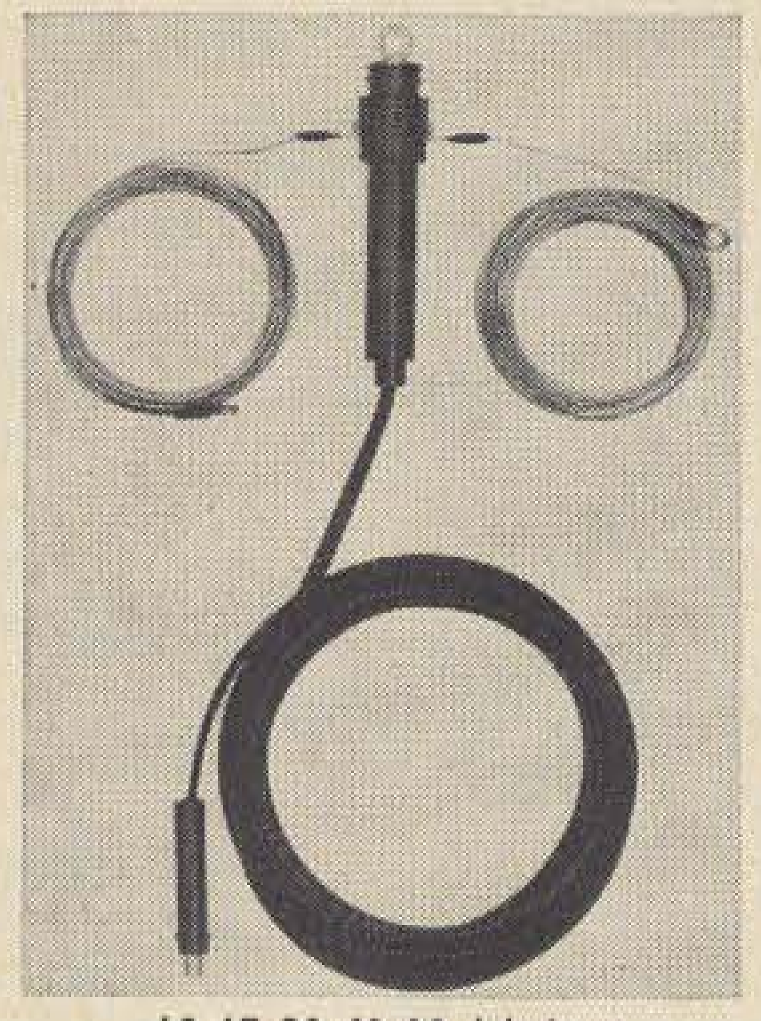
**CANADIAN:** For sale—ARN7 receivers in clean condition. $14.95 F.O.B. Edmonton. Allow for 50 lbs. freight and $1.00 crating charges. T. M. Brynko, 8319 101 Ave., Edmonton, Alta., Canada.

---

**DISCOUNT PRICES—TIME PAYMENTS.** New equipment, factory sealed cartons, full warranty. Drake R-4B $379. T-4XB $379. L-4B $599. TR-4 $511. Galaxy V Mark III $369. National NCX-200 $315. NCL-2000 $595. SBE-34 $380. All new factory sealed cartons, no down payment with approved credit. New CDR Ham-M & Indicator $99.95, TR-44 $59.95. All equipment in stock—immediate delivery. Mosley TA-33 (Reg. $120.99) Discount Price $99.95. New Triex W-51 self supporting tower (Reg. $362) $299.95 prepaid. Reconditioned specials —Swan SW-500C $399. SW-350C $319. SW-250 $239. Time payments on any purchase. Send for free catalogue. Edwards Electronics, 1314—19th St., Lubbock, Texas, 806-762-8759.

---

**SELL:** Immaculate SB-34 transceiver with mike, $300. Eico electronic keyer, new, $45. Hallicrafters SX-42 and R42 speaker, aligned and reconditioned, $150 or make offer. KWS-1 serial, #1465, $800. Knight RF 'Z' bridge impedance device, $10. Turner 80X microphone, $5. Eldico SSB-100F aligned and reconditioned, $275. Spare 5894/AX9903, good, $4. Lee Richmond, 166 Floral Ave., Plainview , N.Y. 11803, DE 3-8663.





**RTTY GEAR FOR SALE.** List issued monthly, 88 or 44 MHy torroids 5 for $1.50 postpaid. Elliott Buchanan & Associates, Inc., 1067 Mandana Blvd., Oakland, California 94610.

**3000 V @ 3μF** brand new GE Pyronal oil capacitors $3 each. Can mail. 3-lbs each shipping wt., FOB P. Wandelt, RD # 1, Unadilla, New York 13849.

**WRL'S USED GEAR** has trial-terms-guarantee! Gonset GSB6-$189.95; HW 12-$89.95; Galaxy V-$269.95; SR46-$99.95; AF67-$49.95; Valiant-$149.95; Viking II-$79.95; 600L Linear-$179.95; HQ100-$99.95; 75A1-$169.95; RX1-$149.95; RME 4300-$79.95. Hundreds more—low prices. Free "Blue-Book" list. WRL, Box 919, Council Bluffs, Iowa, 51501.

**INTEGRATED CIRCUIT PROJECTS.** Audio amplifier, signal tracer, code practice osc., two-tone test osc., audio generator, sensitive f.s. meter, square wave generator, etc. Catalog, 25¢. Plans $1.00 each. Catalog free with order. One IC and printed circuit board builds all. $5. Hals Electronics, P.O. Box 137, Milpitas, Calif. 95035.

**THE TRI-STATE AMATEUR RADIO SOCIETY'S** Twenty-first Annual Hamfest will be July 21 at The 4H Center on North 41 Highway near Evansville, Indiana. Large air conditioned auditorium, Ladies Bingo, Swapper's row, over-night camping, fun and games for all the family. Advance registration $1.50 ($2.00 at the door). For details contact K9LAU Jack Young, P.O. Box 492, Evansville, Ind.

**CERTIFICATE AVAILABLE.** 1968 is Centennial year for Ogdensburg, New York. Contact two members of the Ogdensburg Amateur Radio Club and send for certificate to Lois Ierlan, 725 Proctor, Ogdensburg, N.Y. 13669.

**THE ESSEX COUNTY V.H.F. SOCIETY** will award an annual trophy to the highest VHF/UHF Field Day score in North America, from completed logs submitted to the Society, postmarked no later than July 31st, 1968. A.R.R.L. rules apply in all respects as applicable. Mailing address: Essex County VHF Society, Box 1137, Essex, Ontario, Canada.

**LOUISVILLE HAM KENVENTION,** Saturday, August 31 at the Executive Inn, featuring Dealers and Manufacturers; Technical Forums; Contests; Fashions for the Ladies. 648 South Fourth Street 40202.

**THE AMATEUR RADIO COUNCIL OF ARIZONA** will sponsor a Hamfest in Flagstaff, Arizona on July 26-28. The Hamfest will be held at Fort Tuthill in Coconino County Fairgrounds. Included will be games of skill, contests, swap table, auction, and a Pot Luck dinner on Sunday. Free sites for camping, campers and trailers are provided at the Fairgrounds with rest room facilities available. Motel accommodations are available in Flagstaff, just north of the Fairgrounds. All amateurs, families, friends and would-be amateurs in the state are welcome, as are any amateurs passing through. There will be talk in stations for mobiles on 3878 KHZ and 50.34 MHZ. For further information write Amateur Radio Council of Arizona, P.O. Box 6602, Phoenix, Arizona 95005.

**WANTED:** Military, commercial, surplus Airborne, ground, transmitters, receiver, testsets accessories. Especially Collins. We pay freight and cash. Ritco Electronics, Box 156, Annandale, Va. Phone 703-560-5480 collect.

**NOVICE OR OLD-TIMER.** PLANS: 4 band 50-watt cw XMTR. XTAL or VFO, inexpensive to build, good, $2.00. Bert Dawson, 304 Third St., Eau Claire, Wisc. 54701.

**SWAP:** BC221 frequency meter, original calibration book, excellent condition, for Heath HP23 A.C. power supply. John Orange, 24 Lincoln Av., Jeannette, Pa. 15644 W3ZDF.

**TWENTY-METER ANTENNA SYSTEM.** Vesto HPX-100 tower, Telrex 20M-546 beam and A2675RIS rotor. $1800. FOB Alamogordo. Write for details. W5OPL, 710 Arnold, Alamogordo, N. Mex. 88310.

**PRINTED CIRCUIT BOARD**—single or double sided 9x12—75¢; 6x9—40¢; 4½x6—20¢; 3x4½—15¢. Minimum order $1.00—no. C.O.D. Star Sales Company, 404 West 38, Wilmington, Delaware 19802.

**ANNUAL UPPER PENNINSULA** of Michigan Hamfest to be held in Sault Ste. Marie, Michigan, August 3 and 4, Saturday and Sunday. There will be a banquet on Saturday evening complete with the usual "Afterglow." Twin Sault Radio Club, Box 279, Sault Ste. Marie, Mich., 49783.

**MUSKEGON AREA AMATEUR RADIO COUNCIL** (MAARC), will offer a special QSL card to commemorate Muskegon, Michigan's Annual Seaway Festival 6/30-7/5. This special QSL will be available from Muskegon amateur radio stations contacted from June 24 through July 5. All bands and modes will be used including RTTL and novice participation. These contacts will also make stations eligible for the coveted 'Muskegon County Award" (Mich. stations work 15, U.S. work 5, and foreign stations work 2). For the County Award, log data only should be sent to P.O. Box 691, Muskegon, Mich.

**THE MT. AIRY V.H.F. RADIO CLUB** is holding its 13th Annual Family Day and Picnic on Sunday, August 11 (rain date August 18) at Fort Washington State Park, Flourtown, Pa., in cooperation with the Delaware Valley Chapter of the QCWA. Come and get together with your families and friends for an old time outing of games, cook-out and just plain relaxing for a day away from home. There will be games for the kids and activities for the YL's and XYL's. Free soda for all. No reservations required. $2.00 per family.

**NATIONAL INCENTIVE LICENSING POLL RESULTS**—639 against and 178 for. Our ads were in the three leading ham magazines. WB2NOD, Box 685, Moravia, N.Y. 13118.

**FOR SALE.** 75A4, Serial 4190, .5, 2.1, 3.1 filters with SB610—$475. HT-37, 3 xtals full 10 mtr coverage—$250. B&W L1000A linear with input tuned ckts—$175. HX-20, HR20, HP20, HP10 plus mobile mike—$250. Joseph Soroka, Jr. W3LGD, P.O. Box 88, Irwin, Penna. 15642.

**CONVERTER SALE** three transistor, 50-54 MHz input, 14-18 MHz output, wired, tested printed circuit. Crystal controlled, $6 ppd. Adjustable, $5 ppd. Syntelex, 39 Lucille, Dumont, N.J. 07628.

**TRADE** Auto-Rollieflex Camera with eveready case, Rolleikin 35mm adaptor, exposure meter and other supplies for a good receiver. John E. Bagwell, Somerville, Tenn. 38068.

**KNOB,** for Collins 75-A receiver, 6 to 1 reduction. $7.00 postpaid. Jules Wenglare W6YO, 1416 7th Ave., Delano, Cal. 93215.

## INDEX TO ADVERTISERS


A T V Research 69
Adirondack 87
Alltronics-Howard 91
Amateur Electric Supply 22-23
Ameco 39
Antenna Mart 88
Aquadyne 47
Arcturus 75

B C Electronics 88
Bigelow 94
Bob's Amateur Electronics 94

Camp Albert Butler 61
Columbia 94
Crabtree 21
CushCraft 45

Deans, Wm. 41
Denson 66
Devices 91
Drake Cover IV
Dura Tower 61
DXER Magazine 94

Editors & Engineers 36
Epsilon 46
Estes 64
Evans 64
E-Z Way 3

Fair Radio Sales 96
Freck 75

Galaxy Cover II
Gateway Electronics 93
Gateway Tower 88
Goodheart, R.E. 91
Gordon, Herb 51
Greenville Radio & Electronic Equipment Distributors 51

H&L Associates (Unity) 94
Hafstrom (BTI) 68
Harris 94
Hi-Par 48
Hunter 49

International Crystal Cover III

James Research 85
JAN Crystal 92
Jeff-Tronics 87

Leger Labs 59
Lewispaul 92
Liberty 96

M&M 69
Maco 50
Meshna 95
Midway 87
Mission 32
Mosley 5
Murch 92

Palomar 59
Parks 94
Poly Paks 58

Radio Amateur Callbook 49, 57
Radio Amateur Services 91

Salch 93
Scott 68
Slep 69
Sound History Recording 38
Space Military 75
Stellar 44
Swan 9 11

TAB 67
Tekrad 39
Telrex 27, 33
Tower Communications 50

United Radio 49
U.S. Crystals 91

V H F Associates 92
Vanguard 20, 26, 46, 57, 65
Vibroplex 87

Walkey 87
World Radio Labs 26

73 Magazine
53, 70, 71, 72, 73


## —THE NEW 500 WATT MASTERPIECE

# It takes a lot of guts to do something *like this*...but we did it!

Changes aren't accidental at Galaxy...we make them on purpose. It takes a lot of guts (and know-how) **to improve an already great product and still sell it for the same price...$420.00**...*but we've done it!*

That's why we're putting a new name plate on our masterpiece. Those classic lines remain the same . . . but it's now the improved **GALAXY V Mark 3!**

We use two of the specially designed GE 6LB6's—the most efficient tube of this type. That means a 30% increase in plate dissipation...less heat...more reliability, and longer life!

**A new grid/cathode design,** coupled with easier-to-drive tubes, means greater protection against TVI. **A new, improved ALC circuit design** insures positive control of flat-topping and spurious signal emission.

New "horsepower"! The all-new power capability is greater. We're rating the new Mark 3 with a **conservative 500 Watt PEP input.** Any questions?

***See your nearest Dealer—or write us for Free Brochure.***

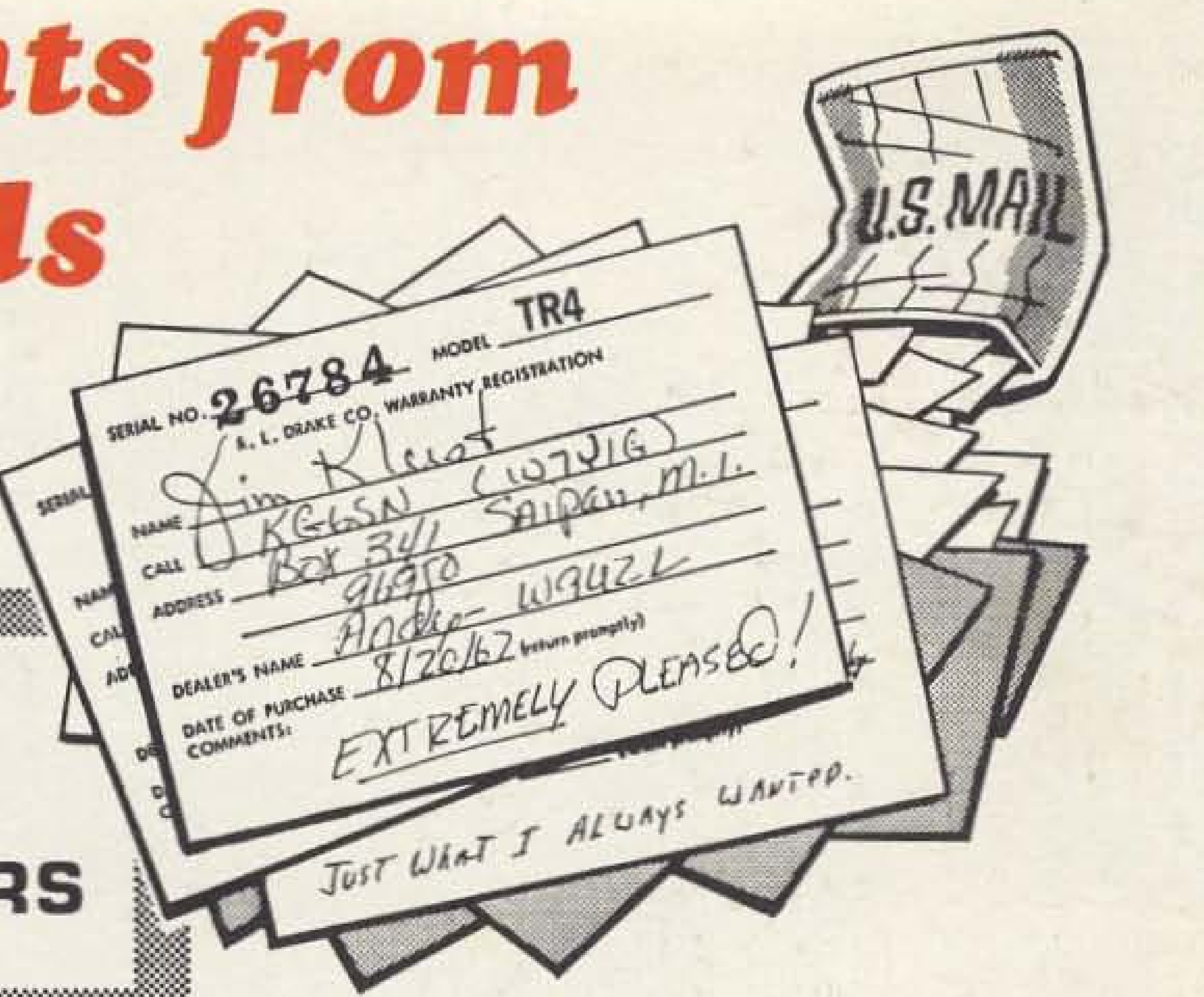
G

## GALAXY ELECTRONICS

*"Pacesetter in Amateur / Commercial Equipment Design"*

10 South 34th Street • Dept. 73-h31 • Council Bluffs, Iowa 51501

# *Some comments from warranty cards by owners of*




## DRAKE TR-4
## SIDEBAND TRANSCEIVERS

"The TR-4 is the best rig I have ever known to be made. Glad to own one."

Dan Tangorra, WA7FWH
Tacoma, Wash.

"Finally got what I wanted!"

Ronald E. Lyons, WB2BQX
Oakhurst, N. J.

"A superb piece of equipment, no comments necessary.

C. G. Noakes, G3UHR/VO2
Labrador City, Newfoundland

"Great rig—First contact was an ON5 in Belgium."

Bill Busse, WA9TUM
Mt. Prospect, Ill.

"Best gear I have had the pleasure of working with. Receiver is exceptionally sharp and stable."

Albert V. Mitchell, WA9BUP
Jeffersonville, Ind.

"Nothing to comment, except that my TR-4 is a real jewel, and I am very satisfied with it. I would like to receive the catalogue of your products."

Joe Braz Ribeiro, PY4UK
Monte Carmelo (MG) Brazil

"A very F.B. piece of equipment. Audio very nice, especially on SSB, which is rare."

Thomas F. Totten, Jr. WB2GZR
Saratoga Springs, N. Y.

"Running it with a Mosley "Classic" beam and proves a most fine and nice transceiver. Really proud of it."

Orlando Escudero O., CE-3-OE
Santiago, Chile

"Looks good—sounds good—very well pleased with performance."

Wayne M. Sorenson, WAØETL
St. Paul, Minn.

"Have had Drake 2-B for three years. Knew that TR-4 was same Good Stuff."

Charles E. Bishop, WA8FTT
Columbus, Ohio

"Just what I always wanted."

Daniel N. Hamilton, WA4WXQ
Ashland, Va.

"Why not build a good 6 Meter SSB & AM Transceiver . . . hurry up, I'm waiting."

Harold A. Zick, WA9IPZ
Creve Coeur, Ill.

"Excellent equipment."

W. T. Newell, WB6UZU
Palm Springs, Calif.

"O.K. 100 x 100. RV-4: O.K./W-4: O.K./ L-4: O.K. Very Good!"

Franscisco Fau Campmany, TI-2-FAU
San Jose de Costa Rica

"A beautiful piece of equipment. My second piece of Drake. The first was a 2-B and this sold one friend an R-4 receiver and another a TR-4. We are Drake-minded here in town. Many thanks."

Charles E. Boschen Jr., WA4WXR
Ashland, Va.

"I'm sure this, like the other Drake equipment I have, is the finest money can buy. YOU MAY QUOTE ME ON THAT."

C. E. (Ed) Duncan, WA4BRU
Greenville, S. C.

"I'm a real happy man with it. Does a real good job of getting thru."

Jerome D. Lasher, W2RHL
Hamburg, N. Y.

"Replaces my TR-3."

D. G. Reekie, VE 6 AFS
Calgary Alberta Canada

"Finest performing gear I have ever had the pleasure of operating."

Milton C. Carter, W2TRF
Lakewood, N. J.

"PS Several months have passed . . . I now employ TR-4 as mobile unit and base station. I have logged more than 1000 contacts, many being rare DX. I am looking forward to owning a second unit to be used strictly for mobile. To date TR-4 has been trouble-free."

Milton C. Carter, W2TRF
Lakewood, N. J.

"Well pleased."

Rev. James Mohn, W3CKD
Lititz, Pa.

"I am delighted with Drake gear. This is the second of your transceivers for me. I have used a TR-3 in my car for about 2½ years — only trouble: replacing a fuse!"

Guy N. Woods, WA4KCN
Memphis, Tenn.

## *"Ask the ham who owns a Drake TR-4"*

. . . or write for details . . .

Dept. 358 **R. L. DRAKE COMPANY** 540 Richard St., Miamisburg, Ohio 45342