CQ

November 1974
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Impedance Measurements at Radio Frequencies

P. 18

Author K4KJ and daughter tune 40 m. mobile whip.

08240 The Radio Amateur's Journal

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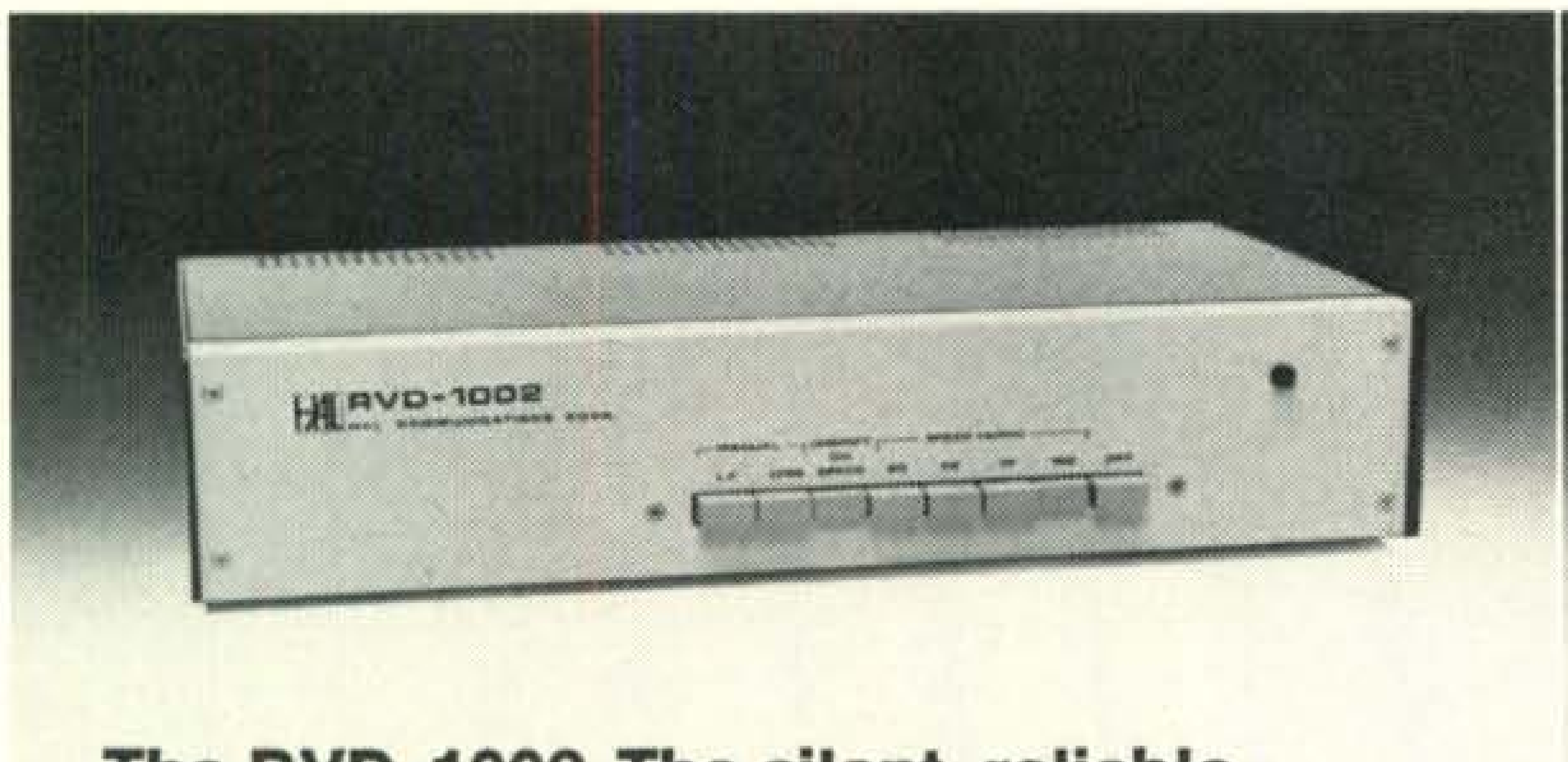

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Price: ST-6 $310 Assembled, $147.50 Kit, ppd USA. 425 Hz Discriminator $40 Assembled, $29 Kit, ppd USA. AK-1 AFSK $40 Assembled, $29 Kit, ppd USA. Air shipment: Assembled ST-6 with any or all options $10, ST-6 Kit $4, 425 Hz Kit $1, AK-1 Kit $1.

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NOVEMBER, 1974 VOL. 30, NO. 11

The Radio Amateur's Journal

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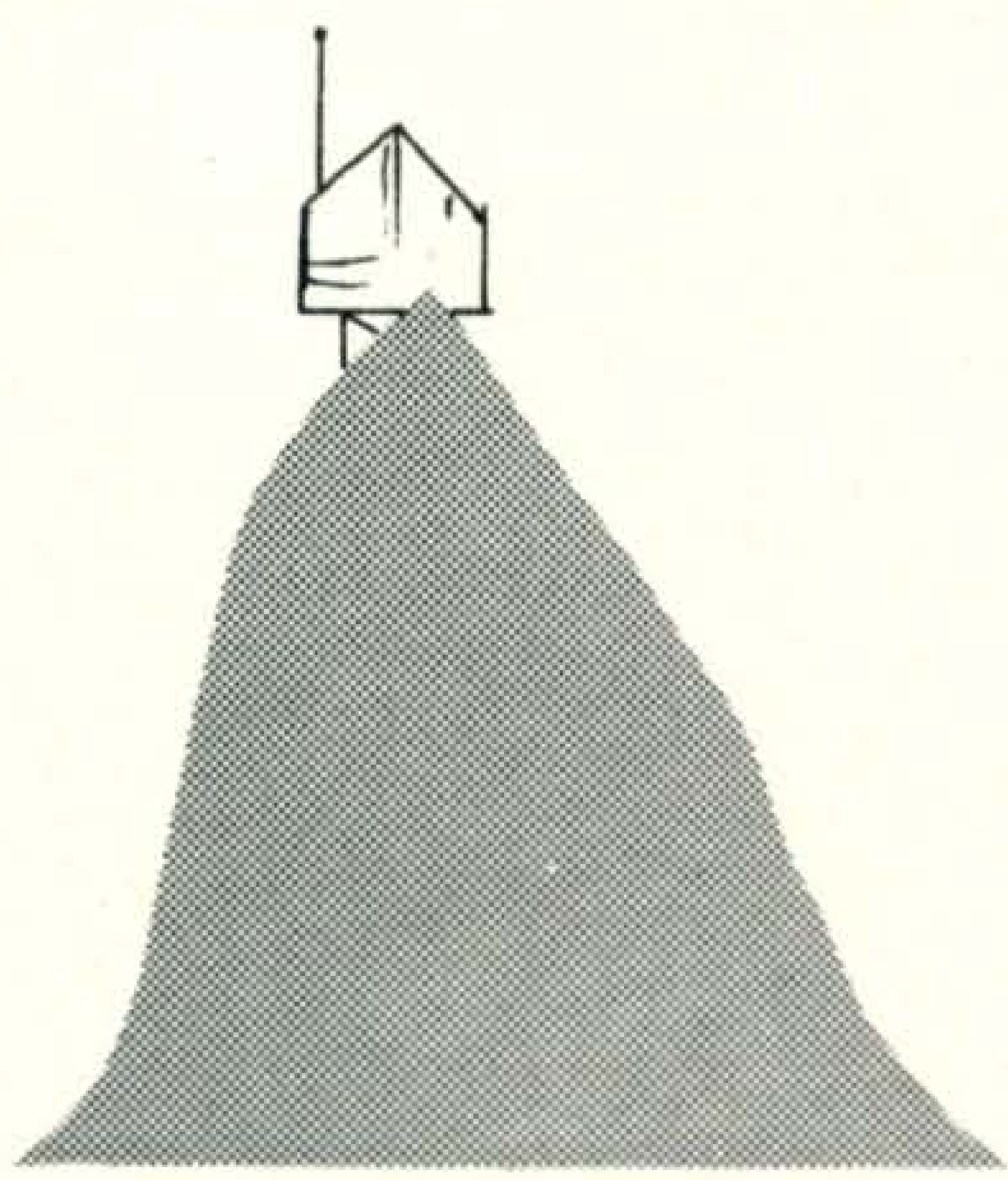

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OUR READERS SAY

Jamaican Licensing

Editor, *CQ*:

In the article "Happiness is visiting a Ham" by George Pataki WB2AQC, *CQ* January 1974, it was stated "It is not difficult to get a license in Jamaica: it may take a few weeks but JARA can help to cut the red tape. Contact Lloyd 6Y5LA for details."

I would like to correct this grave mis-statement. What it is believed George really meant but did not say is, under a reciprocal agreement between Jamaica and the United States, it is not difficult for one with a valid U. S. Amateur license to get a permit to operate Portable in Jamaica.

To get a license is an entirely different matter. Firstly one must be a citizen of a member country of the British Commonwealth and secondly the applicant must pass a very rigidly administered examination in radio theory, practical application, Morse code and international rules and regulations. This examination is administered by the Post and Telegraph department and neither the J.A.R.A. nor any of its officers can exercise any influence in the matter. It is not easy to get a license in Jamaica.

It was a great pleasure meeting George and I am confident he won't mind this correction.

Ruel Samuels, 6Y5RS
First Vice President,
Jamaica (W.I.) Amateur Radio Association

Deaf Amateurs

Editor, *CQ*:

For a long time it has saddened me that, for all Amateur Radio is usable for in the light of bringing mankind closer together, there is nothing to permit the deaf person to participate in this wonderful hobby. FCC regulations require a person to be able to receive (aurally) certain minimum speeds of Morse Code in order to obtain a license.

With the advent of SSTV, there now exists two modes of amateur communications capable of being carried out on a purely visual basis (the other being RTTY, of course). It seems to me that an exception could be made to the FCC licensing structure to permit the deaf person to participate in Amateur Radio. Visual signal monitoring techniques and crystal control on certain band segments are obvious ways to permit the deaf person to communicate on the amateur bands with a minimum of interference to other radio activities.

Maybe I'm just ignorant and there are deaf amateurs around already, but, if not, I think it is worth serious consideration on the part of all amateurs to support this view I have.

Thomas G. Brooks, Jr., WB5JME
White Sands Missile Range,
New Mexico

Editor's Note: Paragraph 97:29(c) of the Rules and Regulations stipulates, "The code test required of an applicant....shall determine the applicant's ability to transmit by hand key....and to receive by ear, in plain language, messages in The International Morse Code at not less than the prescribed speed...."

No Contest?

Editor, *CQ*:

I want to express an opinion I have harbored for a few years now; ever since I became aware of the disgraceful state of DX competition (in and out of contests). I operated as HL9VO during 1971/72, and before I QRT'd in California in 1971, I had accumulated two hundred and forty confirmed countries - all c.w. I have over one hundred confirmed on forty meters. This was accomplished with four hundred watts or less, a tribander at sixty feet, and a vertical on forty. I don't have any interest in applying for a DX award. I just like to work DX and compete in contests. What I must compete with to win big in a DX contest, or pull down the good ones in the pileups is, however, ridiculous. I almost submitted my log for a recent contest, but reason prevailed. In the San Francisco bay area, my home QTH, there are "amateur" stations equipped with finals capable of greater than 20KW DC input. A four or five KW rig is almost commonplace. These rigs aren't rumor, I've seen them under construction, and on the air. Ironically, these "power" finals usually feed an antenna system which is superior to 98% of all hams'. So where's the competition? Where's the amateur in amateur radio? It is the obvious, but unfortunate fact that the FCC has no interest or no capability for apprehending these violators.

How can responsible amateurs allow this to taint an otherwise respectable hobby?

I propose the following: Any amateur who wishes to be eligible for an award in any contest must solicit letters of reference from two local-amateurs of respected stature and integrity by the fraternity, to confirm that he does not own a rig capable of more than 2x legal power. This isn't difficult to determine, since it is a reasonable assumption that a final using 4CX10,000 won't be run at 1KW DC input! This same rule would apply to DX Honor Roll members as well for issuance of awards.

When the sponsors of contests and DX awards take meaningful action toward restructuring DXing, I'll resume hamming, and enjoy it. In the meanwhile I'll be laughing at those hams who are aware of the situation but too apathetic to act, and sympathize with the eager concerned ham who naively wastes his time competing when there is "no contest."

Gary W. Grant, K6VOQ
Seoul, R.O. Korea

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223.26	224.74	146.19	146.72	52.82	52.68
223.30	224.86	146.22	146.76	52.88	52.72
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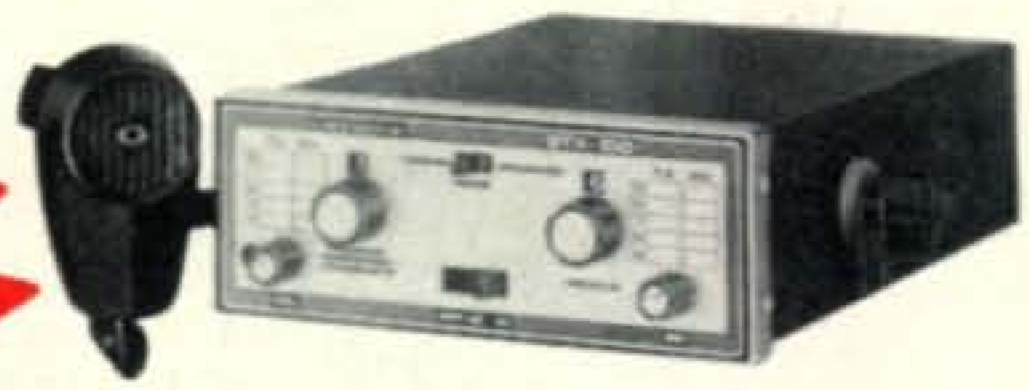

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Announcements

Alexandria, Virginia

There is now a packet available to amateurs on legal and public relations aspects of Radio Frequency Interference. This packet, prepared by the RFI Task Group, can be obtained by sending a large (9x12) self-addressed manila envelope with 40 cents postage to Ted Cohen, Secretary, ARRL RFI Task Group, Conover Place, Alexandria, VA 22308.

Fort Meade, Maryland

Sometime during the period 1600, 6 Sep - 1620 7 Sep '74, at the MARS Radio Station, Fort Meade, MD, person(s) unknown forcibly gained entry and stole the following items:

5 Collins KWM-2A's, S/N's, 11359, 10731, 10095, 11218, and 16066.

2 Collins 30L1's, S/N's 10620 and 11012.

3 Power Supply, SN's 12046, 12045, and 12015.

2 Radio Receivers, S/N's 2918 and 1168.

1 Multimeter, S/N 11065.

Anyone having any information concerning the above items should contact their local FBI office and/or this office. (Fort Meade Field Office, USACIDC, Fort Meade, MD 20755, (301)-677-6466 or 677-6622).

Canton, Ohio

The Massillon ARC annual Flea Market and Auction will take place November 22, 1974. For map and details send a card to MARC, Box 8711, Canton, OH 44711.

Hot Springs, Arkansas

On Saturday, December 7, 1974, the annual Banquet of the Arkansas DX Association will take place. Registration and reservations can be obtained from W5QKR, Box 254, Hot Springs, Arkansas 71901.

New Paltz, New York

The Radio Amateurs Chess Players Net meets on 3928 Khz daily at 7:30 p.m., and 11 a.m. Saturdays, Sundays and holidays. It is the northeastern United States network. For more detailed information, send a SASE to Irv, W2OLT, 25 Cherry Hill Rd., New Paltz, NY 12561.

Oak Park, Michigan

On Sunday, January 12, 1975 the Oak Park Amateur Radio Club will hold it's sixth annual Swap and Shop at Frost Junior High School. Address: 23261 Scotia, Oak Park, Michigan. For more information, write to Leonard Nathanson, W8RC, 14300 Oak Park Blvd., Oak Park, Michigan.

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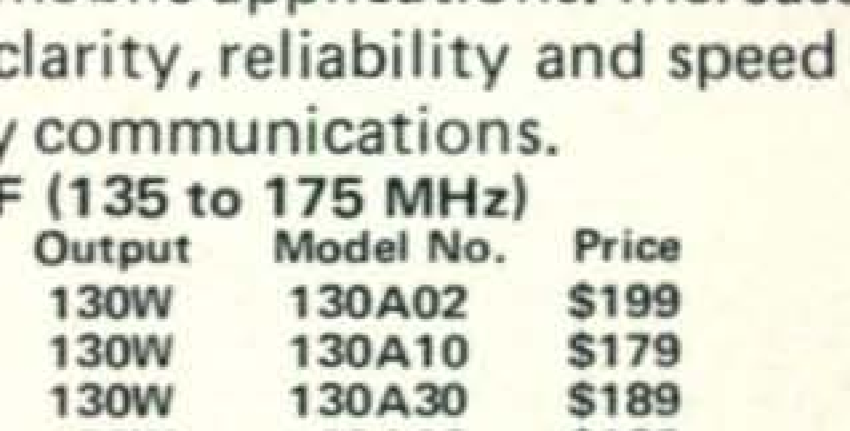

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Impedance Measurements at Radio Frequencies

BY JOHN J. NAGLE,* K4KJ

THE great English physicist Lord Kelvin (William Thomas, 1824-1907) once said, "When you can measure what you are speaking about, and express it in numbers, you know something about it; but when you cannot measure it, when you cannot express it in numbers, your knowledge is of a meager and unsatisfactory kind: it may be the beginning of knowledge, but you have scarcely, in your thoughts, advanced to the stage of science."

This statement was never more true than when applied to antennas and other passive devices at radio frequencies.

One of the most critical parameters in the operation of a radio transmitter, for instance, is the load impedance into which the transmitter operates. This is especially true in the case of high power where, literally, sparks can fly if the load impedance is not correct.

It is not generally appreciated but the impedance seen by the antenna terminals of a receiver can play an important part in determining the proper performance of a receiver as it affects the noise figure and bandwidth of the input stage.

*12330 Lawyers Road, Herndon, VA 22070.

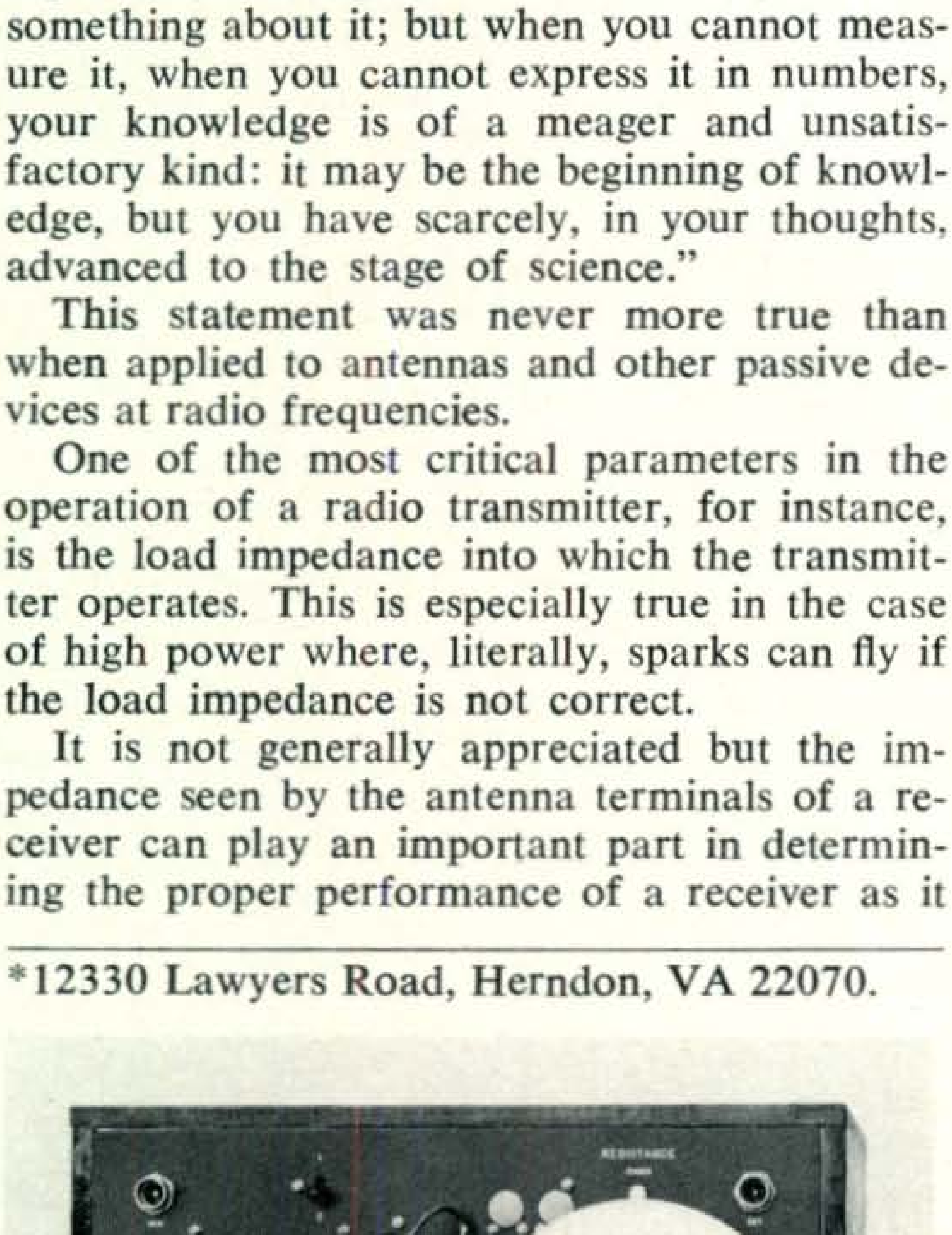


Fig. 1—An early G-R model 916-A r.f. impedance bridge. Note the three concentric rings around the unknown terminal (just to the upper right of the "reactance ohms" dial). These are part of the elaborate shielding system of the bridge. Photo courtesy General Radio Co.

Unfortunately, the methods employed by most amateurs to measure antenna (and other) impedances are rather crude. The most usual procedure is to use the antenna in the transmit mode and measure the v.s.w.r. by means of a Micromatch, Antennascope, through-line wattmeter or similar equipment. These devices, in effect, measure the absolute magnitude of the mismatch without giving any information as to whether the antenna impedance is high or low, real or imaginary. In short, these devices will tell an operator when the antenna impedance is correct or how incorrect it is without giving any information as to the direction in which it should be changed.

To intelligently correct an antenna impedance, it is necessary to measure separately both the resistive and reactive components of the impedance; mathematically, these are known as the real and imaginary components.

Unfortunately, the equipment necessary to measure both the resistive and reactive components with reasonable accuracy is beyond the scope of most amateurs, even advanced amateurs, to construct at home. Fortunately, some of the older commercially built equipment is beginning to appear in amateur fleamarkets and used equipment houses at prices the home experimenter can afford. This article will describe one type of laboratory grade r.f. impedance measuring equipment that is becoming available to the amateur radio community, the General Radio 916 family of bridges, since these are probably the most popular instruments for this purpose.

Historically, the first practical instrument to become commercially available with acceptable accuracies was the General Radio model 916-A r.f. impedance bridge. The original 916-A came out in the late 1930's and the basic design of the 916 is one of those gems that, in over 30 years, has not become obsolete. The same basic instrument is still in the GR catalog as the updated model GR-1606-B r.f. impedance bridge. The 916 family is probably the most popular

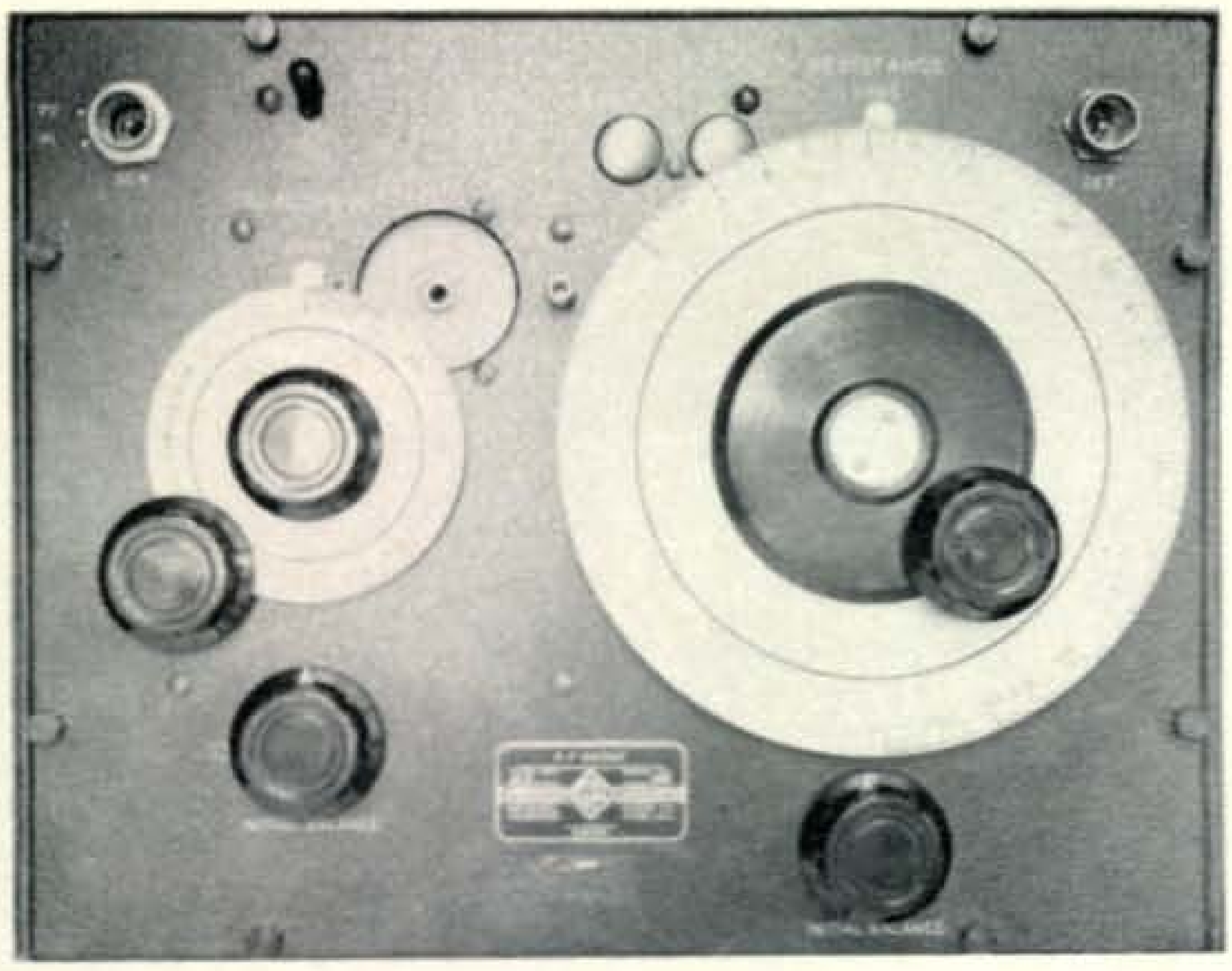


Fig. 2—A later model of the 916-A. Both this bridge and the model shown in fig. 1 use the now-obsolete 774 series G-R connectors at the generator and detector terminals.

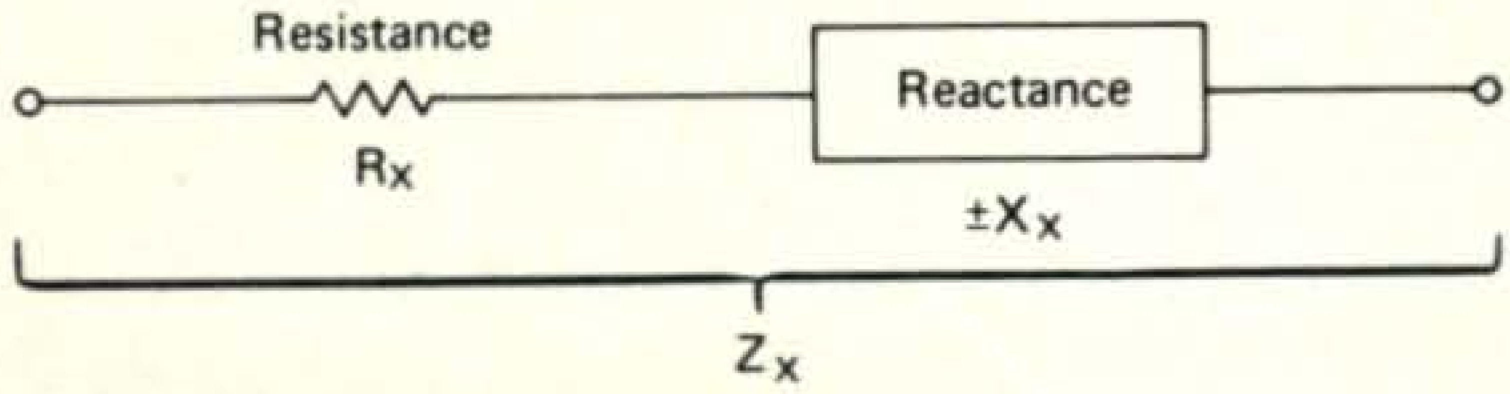


Fig. 3—Equivalent series impedance as measured by the 916/1606 family of instruments.

measuring instrument in the medium and high frequency bands. In addition to being a good basic design, this popularity is also due to the fact that the bridge is relatively easy to use; when properly used, it will give 2-3 percent accuracy and it covers a frequency range of great importance in the broadcasting and communication fields, roughly from the broadcast band through the 6-meter ham band. I would guess that at least 99 percent of the broadcast stations in this country determine their output power by antenna impedance measurements made with this instrument. As the 916-A is older and more generally available to the amateur, I will devote most of this article to it with comments toward the end on the principal differences between the 916-A and the 1606.

A photograph of an early 916-A bridge is shown in fig. 1 and of a later 916-A in fig. 2; the pertinent specifications are:

Frequency range: 400 kHz to 60 mHz

Resistance range: Direct reading in ohms between 0 and 1000 ohms

Reactance range: 0 to 5000 ohms at 1 mHz either inductive or capacitive

Note that the reactance dial is direct reading only at 1 mHz. At all other frequencies, the dial reading must be divided by the measurement frequency in megaHertz to obtain the true reactance. Thus, at 500 kHz, the reactance range is actually 0-10,000 ohms while at 60 mHz the range is only 0-83 ohms. Both inductive and capacitive reactance in these ranges may be measured.

The bridge measures the equivalent *series* resistance and reactance of the unknown impedance, as shown in fig. 3. This fact is important to remember when using the results or comparing them with measurements obtained from other types of instruments which may give answers in terms of an equivalent *parallel* combination of resistance and reactance or conductance and susceptance. The numerical results between equivalent series and parallel measurements will not be the same although the equivalent series impedance can be mathematically converted into the equivalent parellel impedance (or admittance).

I will not go into a detailed discussion of the bridge here; a thorough analysis may be found in the operating and maintenance manual which, at the time this is written (summer 1974), is available from the manufacturer.[1] For those with access to a good technical library, a very informative and readable paper has been written by D. B. Sinclair.[2] The Sinclair paper is highly recommended for those using, and especially for those who must service, the bridge as it explains the design problems and how they were solved.

The basic circuit of the 916 family of bridges is shown in fig. 4; it is a modified form of the Schering bridge. With this arrangement, the resistance balance is obtained by adjusting C_A; the dial on this capacitor is calibrated directly in ohms. The reactance balance is obtained with C_P, and the dial on this capacitor can be calibrated directly in ohms at any one frequency; the frequency selected in this case is 1 mHz. The actual reactance is obtained by dividing the dial reading by the test frequency in megaHertz.

One of the problems in the design of measuring equipment to cover this wide a frequency range is the effect of stray capacity and, to a lesser extent, stray inductance, particularly at the higher frequencies. The control and minimization of the stray reactance is essential in the design of a useful instrument. An example of some of these measures can be seen in figs. 1 and 2. The three concentric rings around the "Unknown" terminal (which is at 2 o'clock with respect to the Reactance dial) are shields; each shield is connected to a different part of

[1] *Operating and Maintenance Instructions for type 916-A Radio-Frequency Bridge.* Available from Sales Promotion Dept., General Radio Co., 300 Baker Avenue, Concord, Massachusetts, 01742. Price, $2.00.

[2] D. B. Sinclair. "A Radio-Frequency Bridge for Impedance Measurements from 400 Kilocycles to 60 Megacycles." *Proc. I. R. E.*, Vol. 28, No. 11 (November 1940). Pp. 497-503.

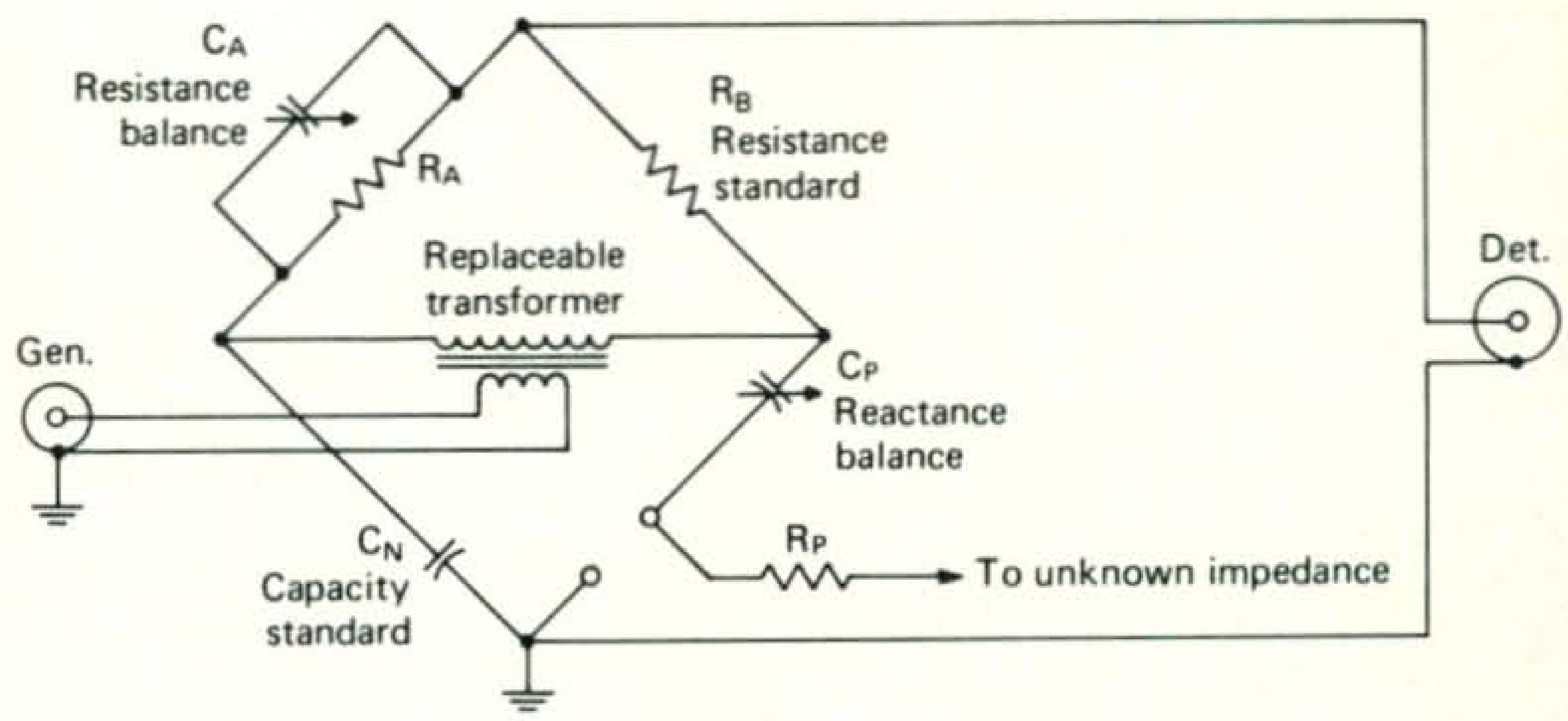


Fig. 4—Basic schematic diagram of the 916-A impedance bridge.

the circuit. In this manner, the stray capacities can be localized and transferred to parts of the circuit where they do little harm.

The effects of stray reactance are further minimized by using the "substitution principle" for making measurements. In using this method, the "Unknown" terminals of the bridge are initially short-circuited with the "Resistance" and "Reactance" dials set to zero; the bridge is then balanced with the two "Initial Balance" controls. This is known as the "initial balance"!

An unknown impedance can now be measured by connecting it to the "Unknown" terminal (remove the short) and rebalancing the bridge by using the "Resistance" and "Reactance" dials. These dials are calibrated to read the equivalent amounts of resistance and reactance that were removed to rebalance the bridge. This, of course, is equal to the resistance and reactance added by the unknown impedance. Hence the name "substitution principle."

In this manner, the effects of the stray reactances are minimized since they are in the circuit for both the initial and final balance. Remaining stray reactances, such as the change in the inductance of a variable capacitor when the plates go from fully meshed to completely out, cause second order errors that cannot be eliminated, but only reduced by careful design of the circuitry and components. Charts showing these corrections are given in the operations manual.

Figure 4 also shows that one side of both the "Detector" and "Unknown Impedance" terminals is grounded. This arrangement, in turn, requires that both generator terminals of the bridge must be above ground. Because it is necessary to accurately control the stray capacities, as described above, and because most signal generators have one output terminal grounded, it is necessary to use a special transformer with an unbalanced primary and balanced secondary to drive the bridge. This transformer is a critical element and we will discuss it in more detail later.

In practice, a communications type receiver is usually used as a detector, preferably one with a coaxial antenna terminal. A well shielded signal generator is used to supply energy to the bridge; one to ten volts is desirable to feed the bridge.

So much for a basic description of the GR-916 family of bridges; the next question is: What does one look for and look out for when buying a used instrument? As with any other piece of equipment, the first step is a thorough inspection. Are there any signs of mechanical damage or abuse? Do the controls turn freely? Are there any parts missing? This is an important consideration since replacement parts are no longer available from the manufacturer (except for those components that happen to also be used on the current production of GR-1606 instruments).

Observe from fig. 2 that for the later models the front panel is held in the case by eight easily removable thumb screws. Not evident in the photograph is the fact that all bridge components are mounted to the front panel. It is, therefore, relatively easy to remove the bridge from its case to more carefully examine its "guts."

Electrically, an r.f. bridge is a purely passive device; it has no vacuum tubes, transistors, or power supplies. Also, it operates at a very low r.f. voltage so that voltage stresses on the components are for all practical purposes nonexistent. Because of this, there is very little to burn out unless the instrument has been abused. Mechanically, these instruments are like burlesque queens—they are really built—so that if the bridge does not show signs of abuse, either electrically or mechanically, and if there are no missing components, they will probably work.

The next thing is to look at the accessories; the most important of which are the two transformers, and these are critical! All other accessory items that are required can be homemade *except* the transformers. As discussed previously, both sides of the generator must be off ground; and a transformer is necessary to accomplish this. Due to the state-of-the-art that existed in wide-band transformer design at the time this bridge was developed, two transformers are needed to cover the frequency range of the bridge: One transformer covers

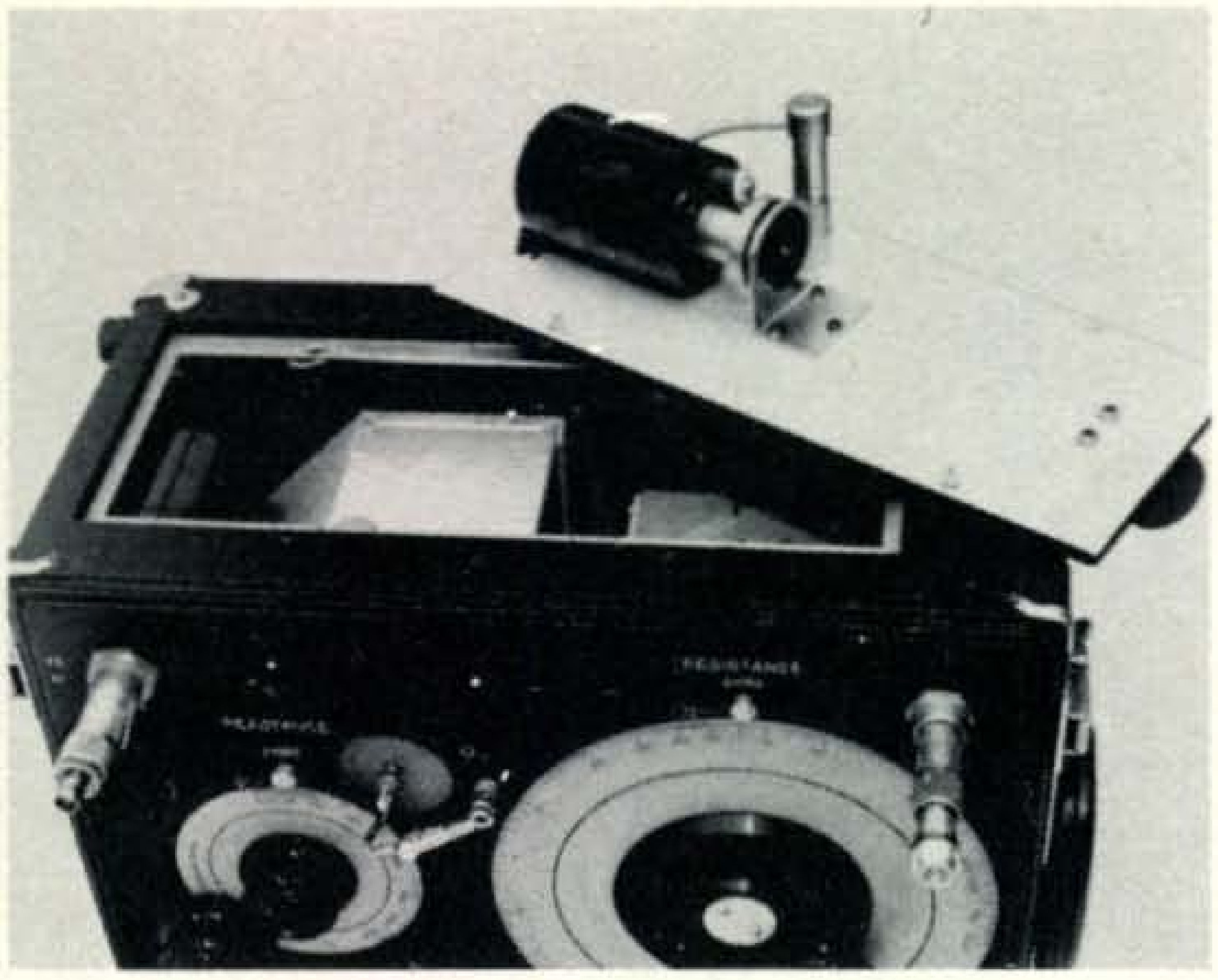


Fig. 5—Photo of the rear panel of the 916-A showing unused transformer mounted in its storage position. A portion of the transformer being used can be seen behind the connector in the upper left-hand corner of the bridge.

the frequencies from 400 to 3000 kHz and the second, 3000 kHz to 60 mHz. The transformer for the frequency range in use is mounted under the top panel beneath the "Generator" jack; access is by means of a removable panel on the back of the instrument. The unused transformer is stored on this panel in a mounting bracket provided for this purpose, as shown in fig. 5.

Both transformers are necessary, not only to cover the entire frequency range, but also because the unused transformer must be in storage position on the back panel when the bridge is in use in order that the stray capacity of the bridge be the same as it was when the bridge was designed. The absence of the unused transformer from the back panel will upset the dial calibration! The panel, of course, must be in place when the bridge is used.

Examine both transformers to insure that they are in good mechanical condition. The shielding on the flexible lead is especially subject to fraying caused by frequently changing the transformers.

The transformers are individually adjusted to the particular instrument they were sold with. Therefore, try to determine if the transformers are the original ones.

I do not recommend the purchase of any 916 bridge for which both transformers are not available and in good condition. These transformers went out of production many years ago and are no longer available from the manufacturer. Due to the multiple shielding and the stringent controls on the stray capacity, it is doubtful if they could be successfully duplicated by anyone else.

If the instrument you are considering passes the above tests, you probably have a usable instrument.

The two sets of accessories, test leads and connecting cables, which will be discussed now, are not critical and can be home-made. If they are available, however, it will make life easier.

Each bridge was originally supplied with two test leads to connect the device being measured to the "Unknown" terminal, a long lead for convenience and a short lead for high frequencies. These test leads are not as simple as they appear, but can easily be fabricated. The lead to the unknown terminal of the bridge *must* have a resistor in series with it of between 240 and 270 ohms. This resistor is shown as R_L in fig. 4. The exact value is not critical since the test lead and resistor are used to obtain both the initial and final balances; its actual value, therefore, cancels out, but failure to use a resistor may make it impossible to obtain an initial balance at the higher frequencies.

If you have difficulty in obtaining an initial balance, especially at the higher frequencies, check the value of this resistor.. The resistor must be composition, of course; a power rating of one-half watt or even a quarter watt is plenty. If the highest accuracy is desired, this resistor should be shielded; the shield must be connected to the end of the resistor toward the

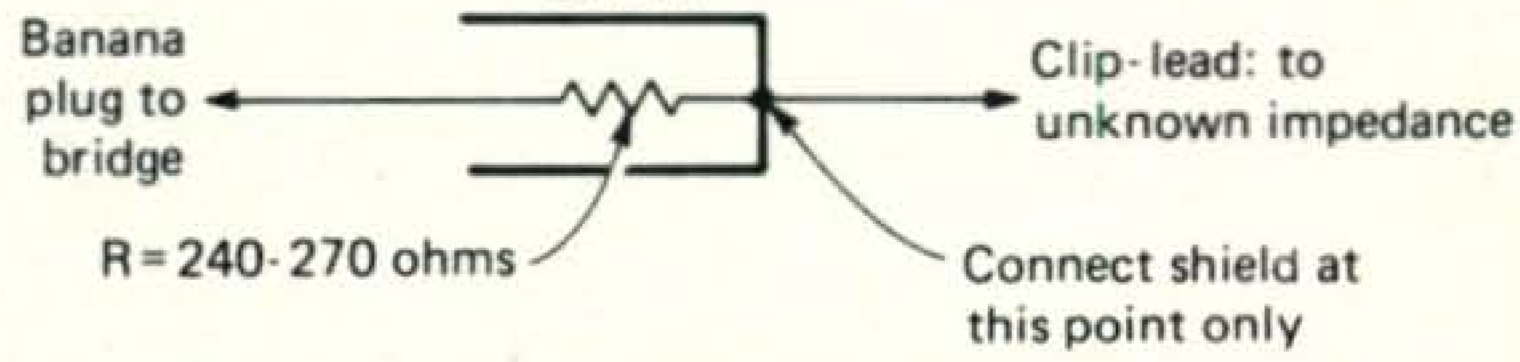


Fig. 6—Schematic of test lead shielding.

unknown impedance and not the end toward the bridge. This is shown in fig. 6. The length of the lead is not critical, but should be as short as possible, especially at the higher frequencies. The reasons for putting this resistor in the test lead external to the bridge and not inside the bridge are given in reference 2. Using the above ideas, special leads may be easily fabricated for specific applications. The end of the resistor that connects to the bridge terminal should be terminated in a banana plug.

In addition to the test leads, each bridge was originally supplied with two coaxial cables to connect the bridge "Generator" and "Detector" terminals to the signal generator and receiver, respectively. Early production of the 916-A bridges were equipped with the General Radio 774 series of connectors which are now obsolete. The 774 series of connectors have long since gone out of production and adapters from this series to other types of connectors are no longer made either. Later production of the 916-A and all 1606 bridges are equipped with the 874 series which are currently in production and create no problems.

If the instrument you are purchasing has cables with the appropriate connectors to match your bridge, you are in business. If the bridge is equipped with 774 connectors and the cable is bad, save the connectors and install them on new cables with 774 connectors on one end to match the bridge and connectors on the other end to match the receiver and signal generator you intend to use with the bridge.

If you are unable to get matching 774 series connectors, the fact should certainly be considered in arriving at a price for the bridge, but all is not lost. An adapter can be home-made as follows: In its simplest terms, the GR series 774 connectors as used on the 916 bridges were simply shielded banana plugs. Fortunately, the center conductor of a UHF connector fits very nicely over a standard banana plug. Therefore, if you start with a UG-363/U straight adapter and turn down one end on a lathe, or otherwise, to a diameter of 0.54 inches (1.37cm) for a distance of five-eighths of an inch (1.59 cm) as shown in fig. 7, it can be inserted into a 774 series jack. A sketch is shown in fig. 7. A finished adapter is shown in the photograph in fig. 8.

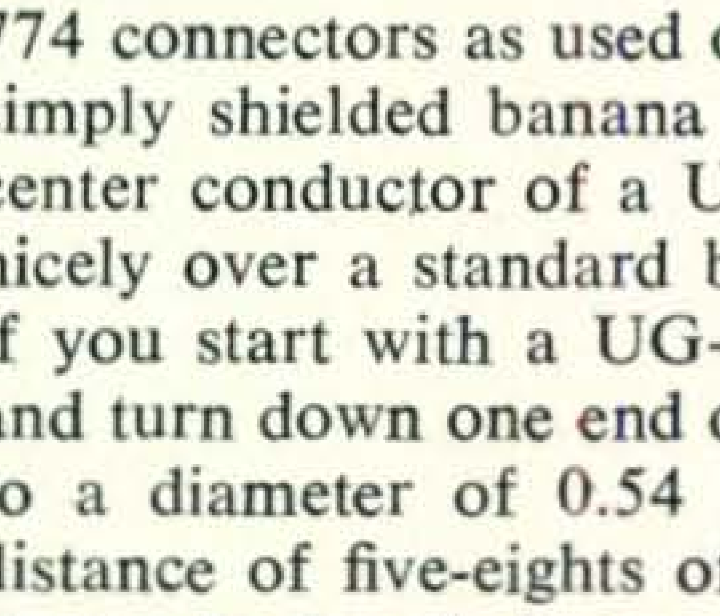


Fig. 7—Home-made adapter to go from G-R 774 series to UHF.

The turned end of the adapter will fit into the series 774 connectors on the bridge. The 0.54 inch outside diameter will give a loose fit in the connector; this is done purposely since there is no spring material to compensate for wear. A tight fit can (and should) be made by placing a short piece of solder "in parallel" with the connector when it is inserted in the plug. The soft solder will be mashed down, making a tight fit without damaging either the adapter or the bridge. As the adapter will not extend up beyond the height of the knobs, the adapter may be left permanently in the plug even when the top is on. Since the adapters from UHF to any other type of connector can easily be obtained, no further problems should be encountered. One word of caution, however: Do not twist the adapter when it is being inserted or removed from the jack because the center conductor (banana plug) in the jack may be broken.

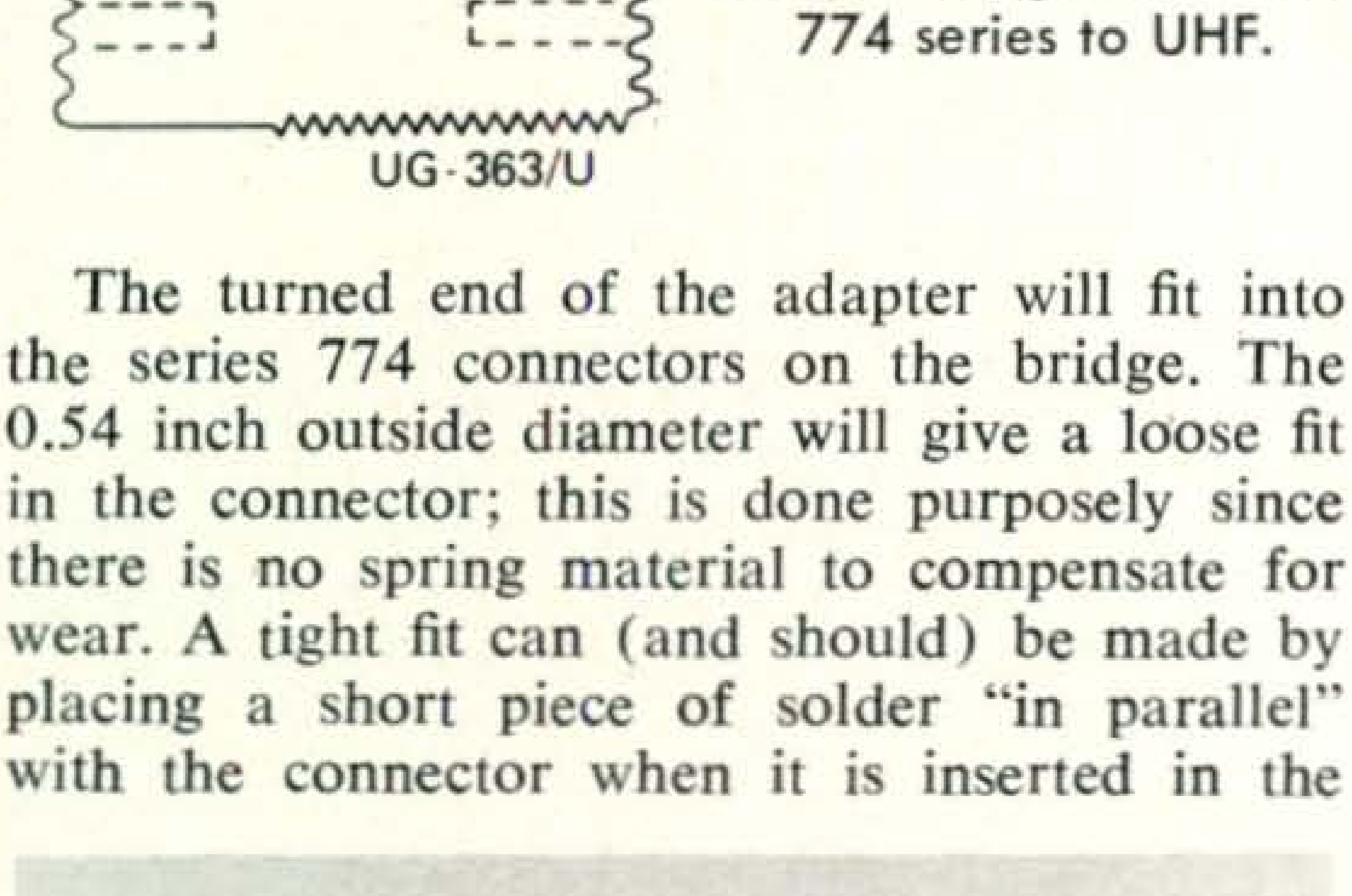


Fig. 8—Two home-made G-R 774 series to UHF adapters. Note that the adapter on the right has a UHF-to-BNC adapter. A home-made test lead to connect the bridge to the unknown impedance is shown at the center. For improved accuracy the resistor should be shielded as shown in fig. 6.

If, after considering the above, you are still interested in the instrument and have the opportunity to test the bridge, the manufacturer suggests the following test to check the calibration.[1] Measure the resistance of a composition resistor (not wire wound) in the 50-100 ohm range with an accurate d.c. ohmmeter. Then measure this same resistor with the bridge at 1000 kHz (use the proper transformer in the bridge). The resistance as measured by the bridge should be within two percent of the d.c. value.

While operating the bridge, I suggest that you also note whether the null is smooth and complete and whether there is any noise while adjusting the controls. Control noises can usually be eliminated by careful cleaning with contact cleaner. Since the adjustable controls are all variable capacitors, not subject to wear as is a variable resistor, control noise is not a serious problem. An incomplete null is probably caused by a poor test set-up. A null that is not smooth may be caused by variable capacitor plates shorting out.

If the unit still looks good, take it!

A few comments on the newer 1606's are in order since they occasionally turn up in the marketplace. A photograph of this bridge is shown in fig. 9. W4ZLH obtained this unit through the MARS program which should not

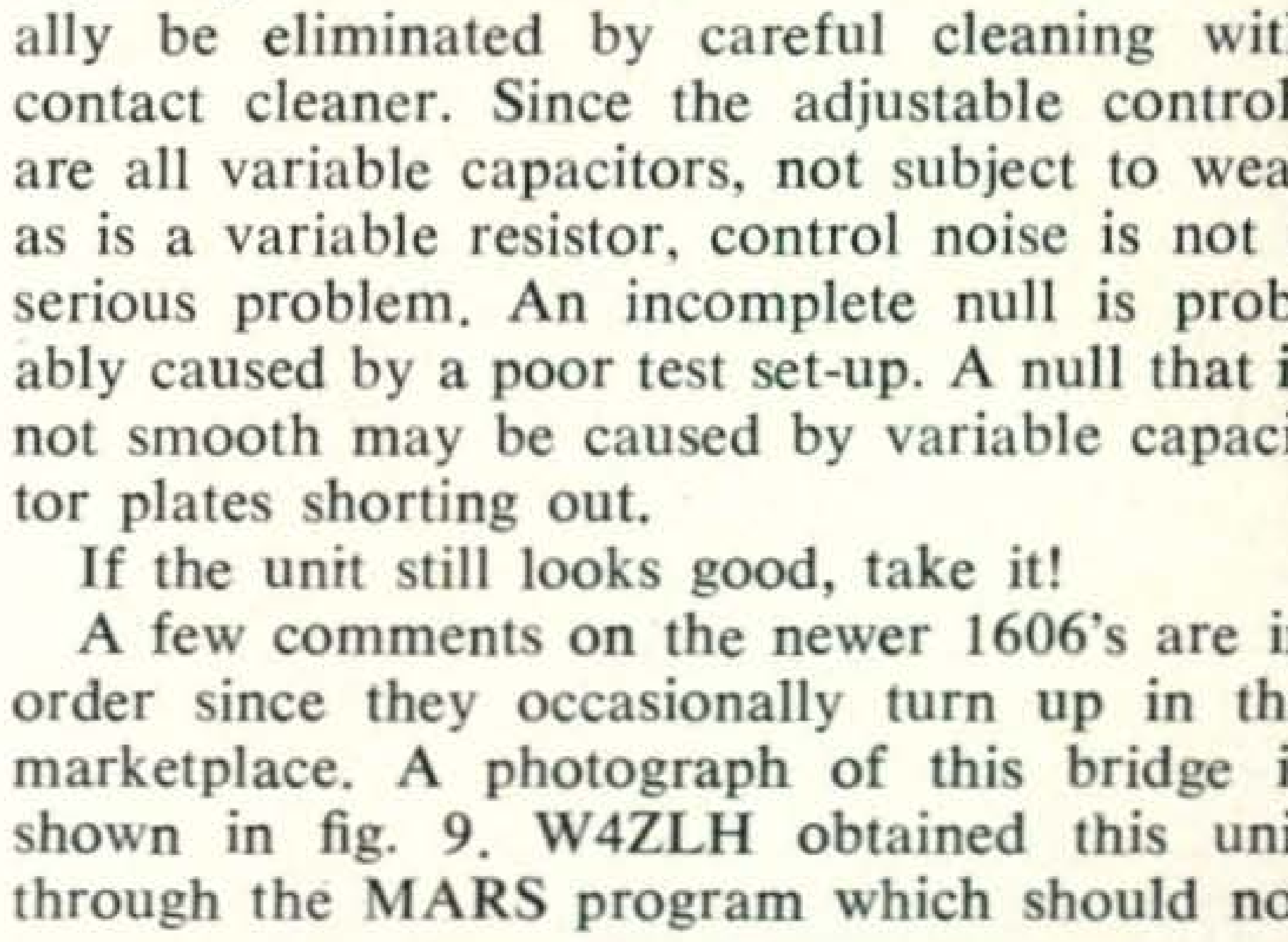


Fig. 9—Top view of the G-R 1606-A r.f. bridge. This instrument is used by W4ZLH who obtained it through the MARS program.

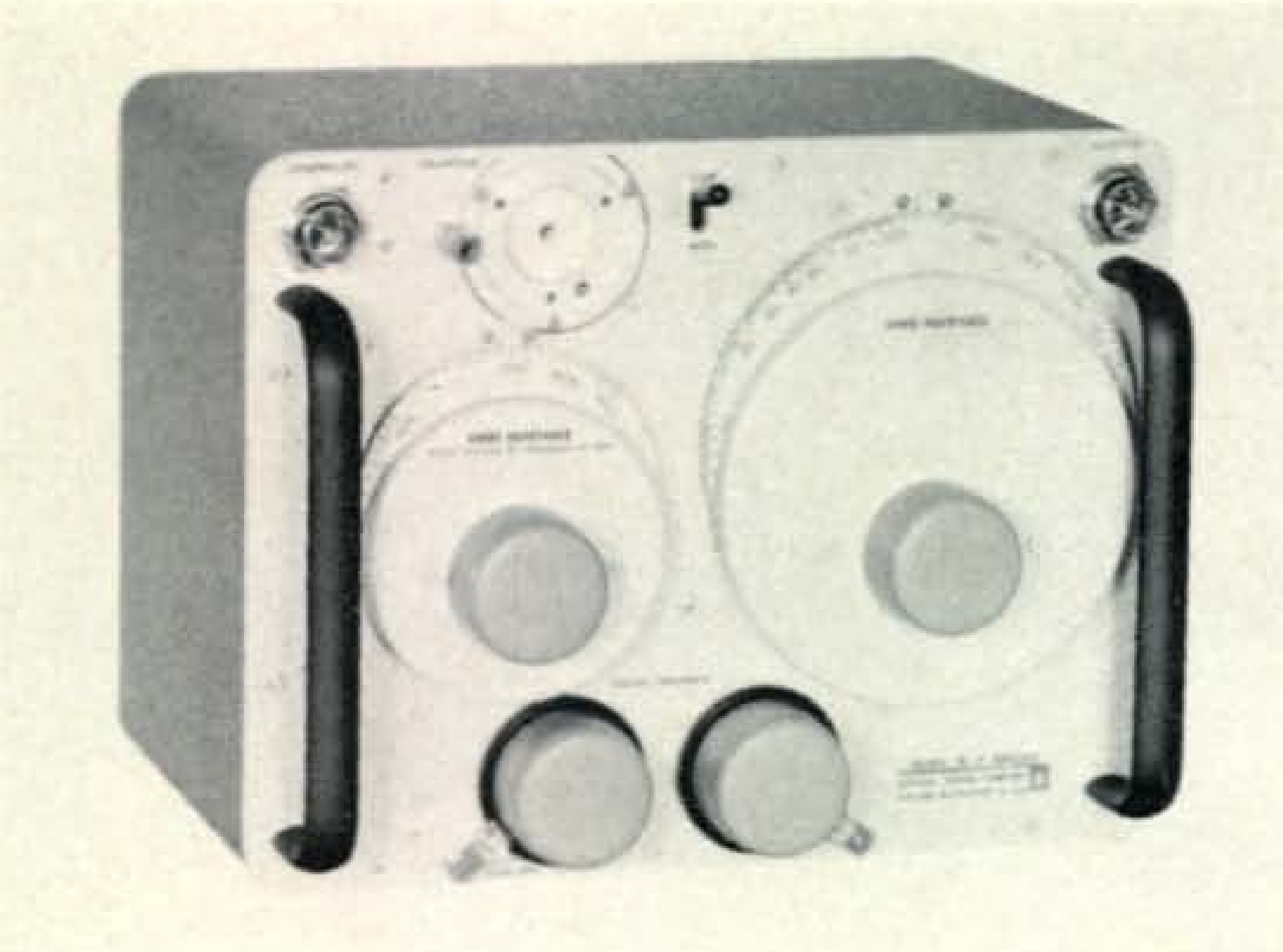


Fig. 10—A G-R 1606-B which is the current production version of this family of instruments. Photo courtesy General Radio Co.

be overlooked by its members as a possible source for these instruments.

The GR-1606 is basically the same instrument as the 916 with the following differences:

1. The entire frequency range is covered with one generator transformer which is permanently mounted in the bridge. The requirement that both transformers be available is therefore not applicable. The fact that it is not necessary to change transformers is a considerable operating convenience when measuring impedances over a wide frequency range.

2. A series resistor should not be used in the test lead; this resistor has been incorporated in the instrument itself.

3. All 1606 bridges use the current 874 connectors in the "Generator" and "Detector" terminals. Adapters from this series to the types of connectors used by the amateur community are readily available from General Radio.

4. The "initial balance" controls have locks on them. If used, these locks will obviate the need to repeat the initial balance routine if the controls are accidentally jiggled.

These improvements in the 1606 should not be taken as detracting from the usefulness or desirability of the older 916 instrument. By no means turn down an otherwise acceptable 916 just because it is not a 1606.

A photograph of the current version, the 1606-B, is shown in fig. 10. It is interesting to compare the current model with the early 916 instrument shown in fig. 1. The most obvious difference is the stylish appearance of the 1606-B as compared with the utilitarian look of the older 916. It is not hard to tell which was laid out by an engineer and which by an industrial designer! I believe the fact that the two instruments have the same basic mechanical design after more than 30 years of continuous production indicates the soundness of the original design. It is in the same class the the original HRO.

Before giving an example of the usefulness of these bridges, a note of caution is in order. In addition to the various instruments described above, General Radio also produced a 916-L/916-AL model; the "L" stands for "low frequency." This model covers the frequency range 50 kHz to 5 mHz. The "L" model is virtually identical in appearance to the higher frequency models, but due to its frequency range (it covers only the 160 and 80 meter amateur bands), it does not appear useful for general amateur applications. I, therefore, do not recommend purchase of any model having an "L" in its model number by amateurs, unless, of course, you have a specific application in its frequency range.

Finally, we close this discussion with an example showing the usefulness of the 916-A bridge.

The first application to which I put my 916-A after bringing it home was to adjust a mobile whip. For some time I had been using (or trying to use) a 40-meter Hy-Gain Ham-Cat whip antenna and had been unable to get the transmitter to load properly. I was getting very poor signal reports.

Measuring the input impedance of the antenna with the whip fully extended gave 100 ohms resistive and a large *inductive* reactance. (I did not keep very good notes in those days.) The inductive reactance surprised me as I had always thought short antennas were capacitive. Making the whip section shorter lowered the resistive component; when the resistive component became 50 ohms, the reactance was 304 ohms inductive. Since the 916 measures the series equivalent impedance, it is necessary to put 304 ohms of capacitive reactance in series with the antenna terminal to tune out the inductive reactance. This requires a 72 pf

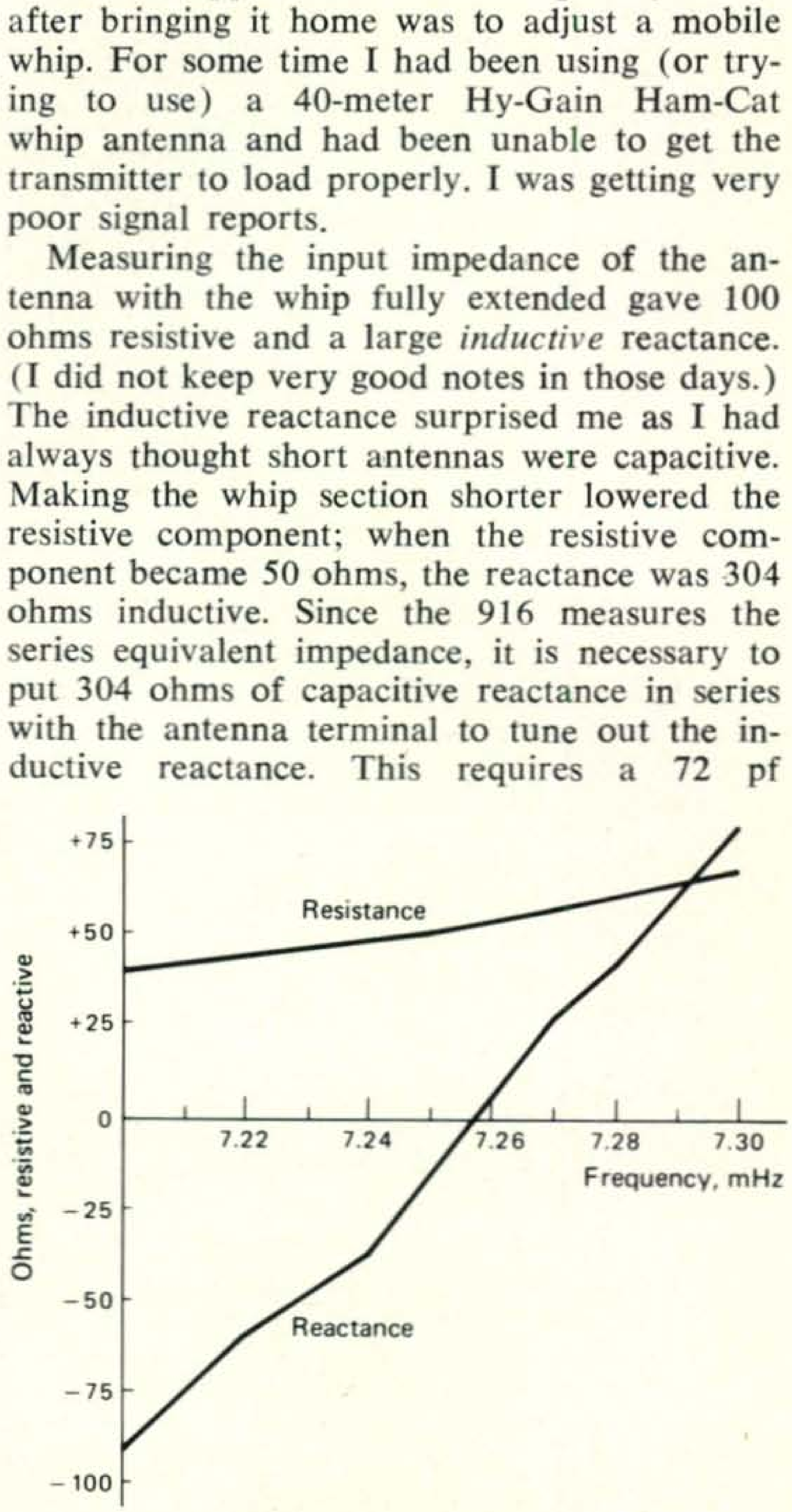


Fig. 11—Resistance and reactance measurements taken on a Hy-Gain Ham-Cat 40 meter antenna with 75 pf series capacitor.

Fig. 12—Test set-up for measuring the antenna impedance of a mobile whip.

capacitor, ideally; I used 75 pf which is the nearest available value. The input impedance of the antenna was then 50 ohms resistive with negligible reactance, thereby very nicely matching 50 coaxial cable. These measurements were made at the middle of the 40-meter 'phone band, 7250 kHz. To anticipate readers' questions, let me say that the length of the upper whip section was 28-5/16 inches (72.7 cm) and I have *not* made any measurements on 75 or 20 meter antennas.

With this arrangement, the transmitter loads up much better and my signal reports are, "Very strong for a mobile."

With the antenna configured as above, impedance measurements were made across the 'phone band, 7.2-7.3 mHz; the resistive and reactive components are shown in fig. 11. Note that the total variation in resistance across the band is only about 26 ohms while the change in reactance is almost 180 ohms. The resonant frequency of the antenna (frequency of zero reactance) is about 7258 kHz. The reason the resonant frequency is not the design value of 7250 kHz is the series capacitor being smaller than its rated value. Alternatively, an adjustable capacitor could be used to resonate the antenna to any frequency in the band. The test set-up is in fig. 12.

These data show that the bandwidth of the antenna is limited much more by the change in reactance than by the change in resistance. If the rate of change in reactance could be reduced, the instantaneous bandwidth of the antenna could be increased.

While I do not care to become involved in the design of center loaded whips in this arti-

[*Continued on page 68*]

CQ World-Wide DX Contest
ALL-TIME PHONE RECORDS

BY FRED CAPOSSELA, JR., W2IWC/6

In the records listed below, boldface listings denote world records. Number groups after calls are: year of operation, total score, contacts,

Single Operator/Single Band
WORLD RECORD HOLDERS

1.8	**KV4FX ('72)**	**8,050**	**168**	**8**	**15**
3.5	**VE3MR/4X ('71)**	**197,106**	**742**	**22**	**69**
7.0	**HR1RF ('72)**	**399,542**	**1349**	**28**	**93**
14	**CV4C ('73)**	**1,233,128**	**2518**	**37**	**130**
21	**CW4CR ('70)**	**1,196,085**	**2462**	**39**	**126**
28	**KG6SL ('72)**	**933,577**	**2467**	**33**	**94**

AFRICA

1.8	No Entrant				
3.5	CN8HD ('72)	55,366	303	13	49
7.0	CN8HD ('73)	213,465	691	27	78
14	ET3DS ('71)	1,026,480	1957	35	147
21	CR6NO ('73)	658,668	1706	34	97
28	CR6CN ('72)	650,160	1737	31	95

ASIA

1.8	No Entrant				
3.5	**VE3MR/4X ('71)**	**197,106**	**742**	**22**	**69**
7.0	VE3MR/4X ('72)	215,840	643	27	88
14	UA9DN ('69)	699,105	1478	39	126
21	JA1RJW ('69)	379,136	1197	37	91
28	4X4JU ('69)	570,836	1522	34	99

EUROPE

1.8	GM3YCB ('71)	4,590	253	4	14
3.5	LA0AD ('70)	80,754	757	20	66
7.0	SM5BPJ ('69)	138,061	622	30	91
14	G5AAM ('67)	824,344	1634	39	144
21	G3HCT ('69)	832,016	2124	37	112
28	DL4PM ('68)	614,544	1858	34	84

NORTH AMERICA

1.8	**KV4FZ ('72)**	**8,050**	**168**	**8**	**15**
3.5	KV4FZ ('73)	183,200	836	20	80
7.0	**HR1RF ('72)**	**399,542**	**1349**	**28**	**93**
14	KV4FZ ('71)	1,208,180	2680	40	153
21	VE3MR ('69)	550,212	1292	39	117
28	KP4AST ('70)	630,180	2010	31	104

OCEANIA

1.8	KH6CHC ('73)	272	12	5	3
3.5	KH6EPW ('66)	5,040	82	10	11
7.0	VK6CT ('73)	135,810	521	29	61
14	VK6HD ('72)	706,251	1483	37	132
21	KG6AQY ('70)	749,529	2353	32	72
28	**KG6SL ('72)**	**933,577**	**2467**	**33**	**94**

SOUTH AMERICA

1.8	CX3BH ('73)	18	4	2	4
3.5	YV4AGP ('72)	72,666	388	18	48
7.0	4M1BI ('72)	155,664	604	26	69
14	**CV4C ('73)**	**1,233,128**	**2518**	**37**	**130**
21	**CW4CR ('70)**	**1,196,085**	**2462**	**39**	**126**
28	YV1LA ('68)	664,560	1898	33	87

Single Operator/All Bands

AF	ZD3Z ('73) (Opr. OH2MM)	5,085,806	4097	113	305
AS	UW9WR ('72)	2,531,694	2207	108	323
EU	EA4LH ('72)	2,744,119	2399	125	344
NA	KV4FZ ('70)	4,961,551	4362	128	369
O	KH6RS ('72) (Opr. K2SIL)	5,331,072	4739	128	256
SA	**4M4UA ('72)** (Opr. W6BHY)	**5,409,315**	**4104**	**128**	**331**

WORLD RECORD

Station	Band	Contacts	Zones	Countries
4M4UA Opr. W6BHY (1972) 5,409,315	1.8	2	2	2
	3.5	128	13	28
	7.0	366	22	58
	14	1017	35	99
	21	1388	29	68
	28	1203	27	76
	Total	4104	128	331

Multi-Operator/Single Xmtr*

AF	IH9AA ('73)	3,719,573	3229	102	305
AS	UK9ABA ('72)	3,813,066	2219	144	434
EU	UK3AAO ('72)	3,883,008	2939	137	375
NA	**VP2M ('73)**	**167,355**	**5011**	**116**	**322**
O	KG6SW ('73)	2,662,968	2928	113	195
SA	PJ1AA ('72)	4,206,341	3405	115	304

WORLD RECORD

Station	Band	Contacts	Zones	Countries
VP2M (1973) 5,167,355	1.8	50	7	9
	3.5	359	13	37
	7.0	460	19	47
	14	1468	28	93
	21	1198	27	82
	28	1520	21	64
	Total	5011	116	322

Multi-Operator/Multi-Xmtr

AF	ZD3X ('72)	14,501,872	8571	141	455
AS	4Z4HF ('71)	6,106,290	3994	125	409
EU	OH5SM ('69)	11,593,925	6771	153	526
NA	PJØMM ('68)	7,037,658	6406	134	343
O	KS6DH ('72)	5,488,856	5304	116	242
SA	**PJØDX ('69)**	**17,613,400**	**9270**	**156**	**488**

WORLD RECORD

Station	Band	Contacts	Zones	Countries
PJØDX (1969) 17,613,400	1.8	36	4	8
	3.5	452	22	60
	7.0	929	24	70
	14.0	2739	39	146
	21.0	2699	35	116
	28.0	2415	32	88
	Total	9270	156	488

Club Record: Potomac Valley Radio Club ('69) 44, 441, 644

CQ World-Wide DX Contest

ALL-TIME C.W. RECORDS

MEMBER, CQ CONTEST COMMITTEE

zones, and countries. All-band and Multi-Operator records include a band-by-band breakdown of the world leader in each category.

Single Operator/Single Band WORLD RECORD HOLDERS

1.8	**KV4FZ ('73)**	**21,320**	**220**	**11**	**29**
3.5	**DL7AV ('72)**	**110,424**	**759**	**23**	**63**
7.0	**KP4AST ('73) (Opr. WA4PXP)**	**447,421**	**1479**	**32**	**95**
14	**KV4FZ ('70)**	**908,514**	**2315**	**36**	**117**
21	**CW9BT ('72)**	**696,133**	**2068**	**31**	**82**
28	**CX1AAC ('70)**	**681,636**	**1711**	**36**	**93**

AFRICA

1.8	No Entrant				
3.5	CN8DW ('70)	15,759	153	9	26
7.0	5A1TW ('64)	227,814	918	22	64
14	1G5A ('66)	792,370	1594	37	133
21	TJ1AW ('70)	549,888	1447	35	93
28	CR6IK ('69)	498,800	1439	36	80

ASIA

1.8	ZC4RB ('67)	4,335	86	3	14
3.5	UG6AD ('70)	76,012	436	13	49
7.0	4X4FA ('64)	174,505	781	25	60
14	HL9KH ('63)	339,920	910	37	103
21	KA6AY ('72)	284,688	920	30	78
28	HZ1AB ('68)	132,390	578	21	55

EUROPE

1.8	GM3WDF ('72)	5,280	206	6	15
3.5	**DL7AV ('72)**	**110,424**	**759**	**23**	**63**
7.0	LAØAD ('71)	177,450	851	31	74
14	SM4CMG ('71)	367,356	1172	38	100
21	G3HCT ('70)	317,312	924	38	96
28	DL4AAP ('57)	253,680	728	36	84

NORTH AMERICA

1.8	**KV4FZ ('73)**	**21,320**	**220**	**11**	**29**
3.5	W1MX ('72)	80,410	329	22	64
7.0	**KP4AST ('73) (Opr. WA4PXP)**	**447,421**	**1479**	**32**	**95**
14	**KV4FZ ('70)**	**908,514**	**2315**	**36**	**117**
21	WA8LYF ('70)	286,767	756	35	94
28	K1JGD ('68)	158,510	520	28	82

OCEANIA

1.8	KH6CHC ('73)	2,845	62	8	7
3.5	KH6HCM ('70)	11,286	200	10	6
7.0	VK3ANP ('72)	126,996	559	25	51
14	VK3APJ ('67)	422,240	1150	35	95
21	VK6HD ('71)	531,354	1576	32	82
28	VK8UG ('67)	320,008	1048	32	72

SOUTH AMERICA

1.8	9Z4GS ('73)	5,252	70	10	16
3.5	YV5AW ('73)	74,144	445	17	39
7.0	CV7B ('73)	196,480	834	25	55
14	PY4AP ('71)	836,250	1874	37	113
21	**CW9BT ('72)**	**696,133**	**2068**	**31**	**82**
28	**CX1AAC ('70)**	**681,636**	**1711**	**36**	**93**

Single Operator/All Bands

AF	**ZD3X ('73) (Opr. OH2BH)**	**3,524,826**	**3404**	**96**	**251**
AS	UK9ABA ('70)	1,719,663	1366	124	327
EU	OH5SE ('69)	1,419,186	1374	124	298
NA	KV4FZ ('69)	2,719,152	2867	127	287
O	KH6RS ('72) (Opr. W6MAR)	2,748,307	2990	121	190
SA	9Y4AA ('69)	3,088,968	2623	123	279

WORLD RECORD

Station	Band	Contacts	Zones	Countries
ZD3X Opr. OH2BH (1973) 3,524,826	1.8	—	—	—
	3.5	176	13	32
	7.0	391	20	44
	14	1057	24	70
	21	1170	21	60
	28	610	18	45
	Total	3404	96	251

Multi-Operator/Single Xmtr*

AF	No Entrant				
AS	UK9AAZ ('72)	1,102,960	1137	96	244
EU	UK5IAZ ('72)	2,112,240	1885	140	380
NA	K1DIR ('72)	1,985,310	1401	133	353
O	VK4VU ('72)	621,712	1094	72	124
SA	**PJ1AA ('73)**	**2,493,304**	**2636**	**100**	**219**

WORLD RECORD

Station	Band	Contacts	Zones	Countries
PJ1AA (1973) 2,493,304	1.8	10	3	4
	3.5	222	13	25
	7.0	623	20	45
	14	842	28	71
	21	496	18	44
	28	443	18	30
	Total	2636	100	219

Multi-Operator/Multi-Xmtr

AF	ET3FMA ('67)	1,387,680	1476	105	231
AS	VU2IRA ('70)	2,273,616	2128	125	307
EU	OH2AM ('68)	4,118,688	3277	155	412
NA	W4BVV ('70)	5,552,352	3056	158	456
O	KS6ER ('73)	1,415,650	2136	102	128
SA	**PJØFC ('70)**	**11,586,428**	**7090**	**150**	**401**

WORLD RECORD

Station	Band	Contacts	Zones	Countries
PJØFC (1970) 11,586,428	1.8	92	8	8
	3.5	668	17	46
	7.0	1338	26	75
	14.0	1974	34	109
	21.0	1641	34	84
	28.0	1377	31	79
	Total	7090	150	401

*Because of significant changes in rules for Multi-Op./Single Trans. stations, records date from 1972 test.

MATH'S NOTES

BY IRWIN MATH,* WA2NDM

BEFORE beginning this month, I would like to thank the many readers of this column for their overwhelming response and favorable comments on my synthesizer suggestions in the March 1974 through July 1974 columns. I have simply not had the time to answer the many letters and therefore have tried to present new information in the columns as I have obtained it. At this point, three or four serious amateurs have indicated that they are building units along the lines discussed and I will report their results, with schematics, when I receive them.

In keeping with this interest in frequency synthesis methods we have decided to look at some of the many synthesizing techniques that have been proposed in the hope that other experimenters may find a convenient "jumping off point" for their own particular designs of these versatile devices.

An early form of circuit that attempted to get many frequencies from a single crystal is shown in fig. 1. This is a so-called direct synthesizer as there are no other oscillators except for one in the entire design. Operation is as follows. A stable 1 mHz reference oscillator is fed to a buffer stage to "unload" it from the succeeding circuitry and then applied to a transistor or diode pulse generator that distorts the incoming wave shape so as to provide rich harmonics, every 1 mHz all the way up to 10 mHz. A simple TTL gate with its very fast rise time or a conventional class C amplifier (untuned) would be perfect for this application.

*5 Melville Lane, Great Neck, N.Y. 10023.

The harmonic rich output is now fed to three filters which allow only the 2, 3 or 9 mHz harmonic components to pass through them. These outputs, along with the 1 mHz buffer amplifier output is now fed to a two pole 10 position switch which is used as the output frequency selector. This switch applies various combinations of fundamental and harmonic energy to a typical mixer which then adds or subtracts the inputs producing the final output. In this manner, a single 1 mHz crystal is employed to cover the entire 1 mHz to 10 mHz range in steps of 1 mHz. As an example, 6 mHz is derived by mixing the output of the 3 mHz filter and the 9 mHz filter and taking the difference (9—3) frequency which is 6 mHz. Naturally the output of the mixer must be filtered or tuned to only pass the desired output frequency.

While such a synthesizer can actually be built, attempts to obtain better resolution pose all sorts of problems with regard to mixing products since the method of tuning the output of the mixer to eliminate these products becomes as complex as the rest of the circuit. Consider for example, the filter requirements to add 1 kHz to, say the 6 mHz output. The mixer must accept 6 mHz and 1 kHz at the input and reject 6 mHz, 1 kHz and 5.9 mHz (the difference) while allowing 6.1 mHz to pass.

Another relatively simple frequency synthesizer approach proposed by Servo Corporation in 1955, is interesting in that it seems to overcome the small increment problem. A 10 kHz signal, derived either from a divided higher frequency oscillator, actual 10 kHz oscillator, or beat frequency scheme, drives a harmonic generator producing strong 10 kHz harmonics throughout the frequency range to be covered. These 10 kHz signals are then used to heavily

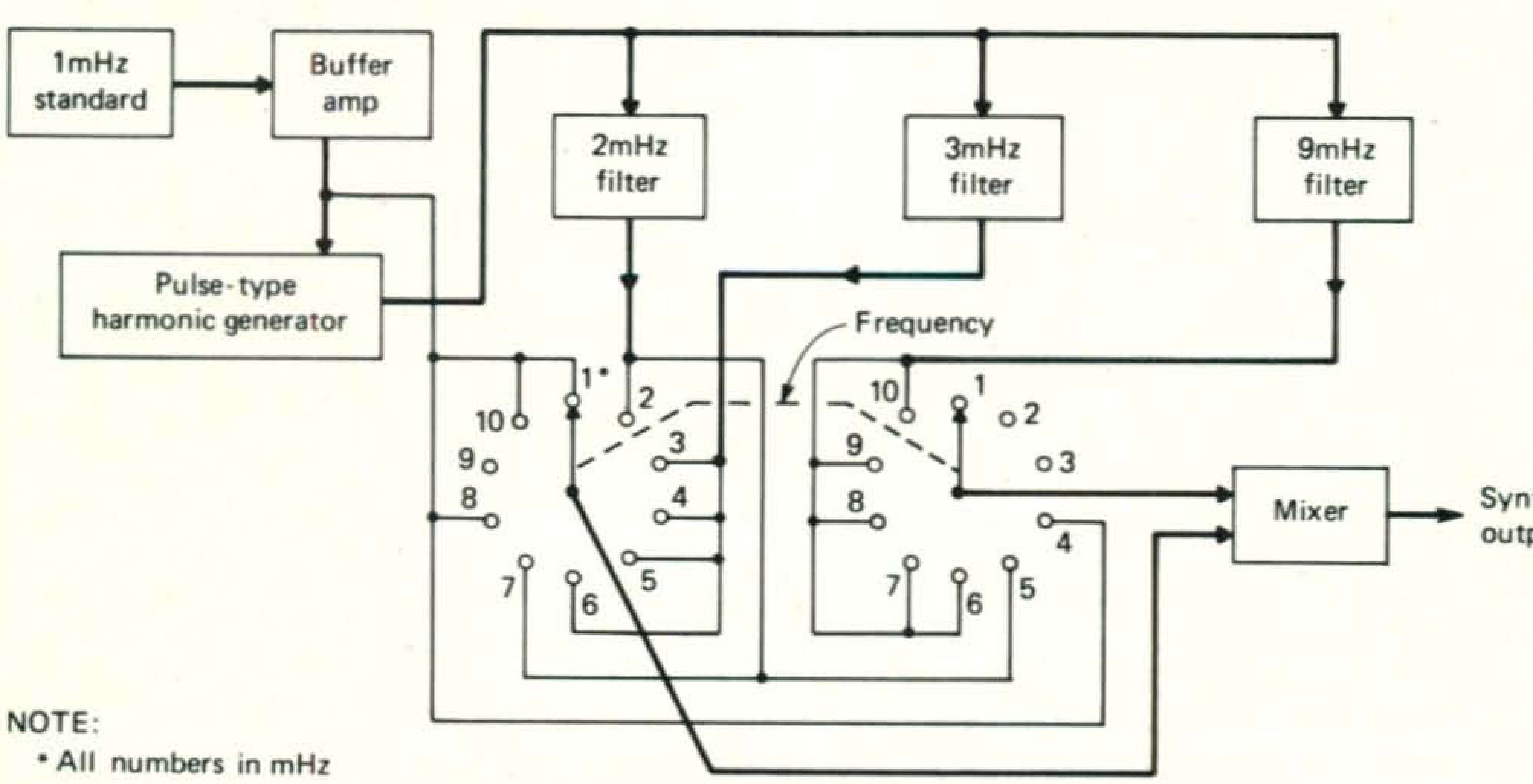


Fig. 1—Direct frequency synthesizer discussed in the text.

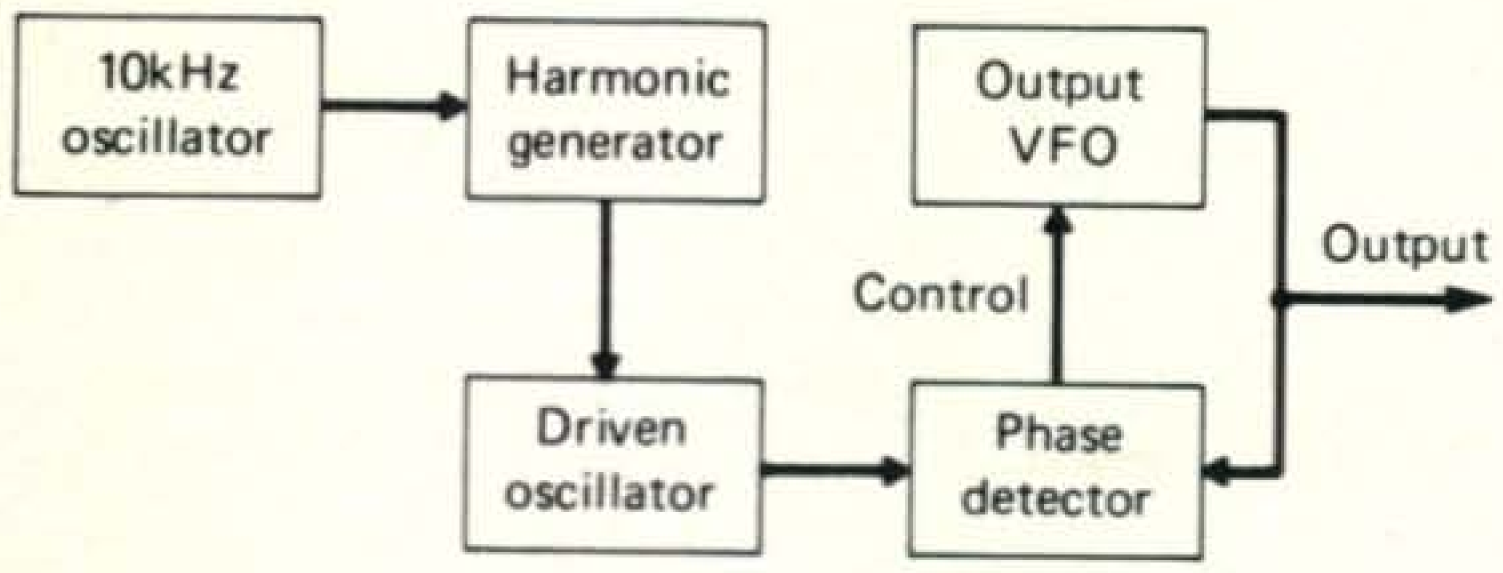


Fig. 2—Simplified Servo Corp. proposed frequency synthesizer.

drive an oscillator in the desired output frequency range. This oscillator produces strong locked harmonics every 10 kHz throughout the frequency range of interest. A tunable oscillator and phase comparator are now locked to these harmonics producing the synthesized output. By properly designing the phase detector, the output v.f.o. will tune through its range in "jumps" of 10 kHz resulting in a stable, pure output signal. In a breadboard built at the time this technique was instituted, stabilities of 1 p.p.m. (that of the initial crystal) with sideband suppression ±10 kHz of an operating point of —50 db reportedly obtained.

Naturally, by using a 1 kHz oscillator, or 100 kHz oscillator, these increments could be covered. The only real problem we see in this method is knowing just which harmonic you are locked on (without a counter). Also, the output frequency range is of course limited to the range of the output v.f.o. which should not be a problem in amateur type v.f.o.'s as only 500 kHz or so is all that is usually necessary.

Figure 3 shows another technique of obtaining many frequencies from a few crystals. This particular example is from the military AN/PRC-35 transceiver. Here, 20 crystals are used to provide 800 discrete frequencies in a scheme that is more direct and less prone to spurious problems than other methods. While it is originally intended to cover the 30-69.95 mHz range in 50 kHz steps, the same technique could of course be modified to cover a smaller range with less crystals. It is the technique that we really wish to stress here.

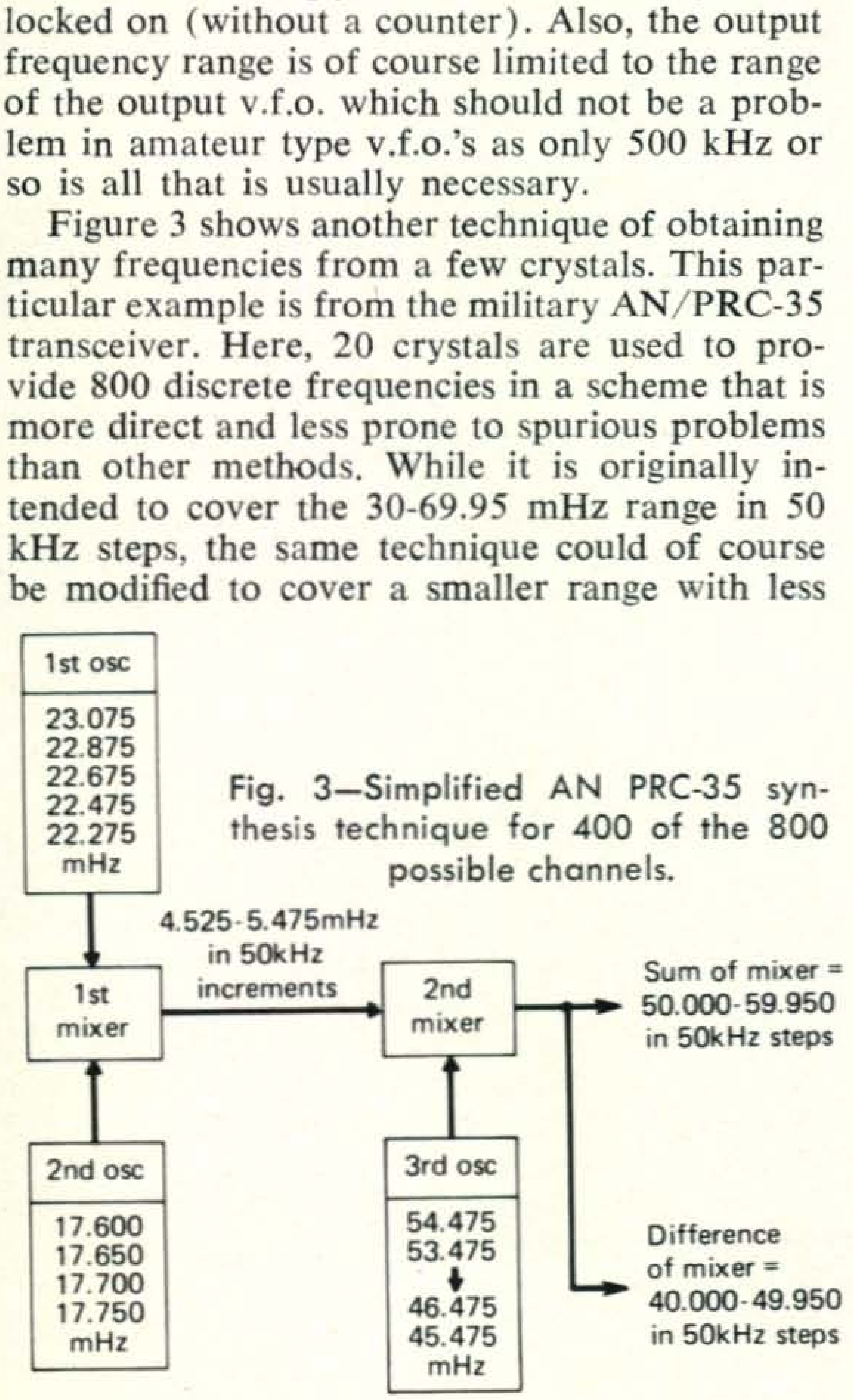


Fig. 3—Simplified AN PRC-35 synthesis technique for 400 of the 800 possible channels.

Two crystal oscillators are used initially, one with 5 crystals spaced 200 kHz apart and a second with 4 crystals spaced 50 kHz apart. These are mixed and the difference frequency selected. This results in the production of a series of twenty frequencies between 4.525 and 5.475 mHz, easily filtered as it is quite far from the sum frequencies (at this point we should mention that one could use the sum frequencies, 38.875-40.825 mHz in another application as they can be just as easily filtered).

The 4.525-5.475 mHz frequencies are now mixed with the output of a third oscillator which contains 10 crystals spaced 1 mHz apart. The output of this mixer, as shown in the figure, can be any one of 400 frequencies from 40.000 to 59.950 mHz. In the actual AN/PRC-35 another 10 mHz oscillator is used to mix with these 400 outputs giving another 400 frequencies or, as the military puts it, "40 frequencies per crystal".

What is most important in using this method is the fact that the various operating frequencies are all sufficiently far apart to allow relatively simple filters or tuned circuits to be used. Alignment is also quite easy and not very critical.

A master switching scheme could also no doubt be devised that would simplify frequency selection and finally, the loss of 1 or 2 crystals would not result in the total loss of transmitting or receiving capability as in the case of other types of synthesizers.

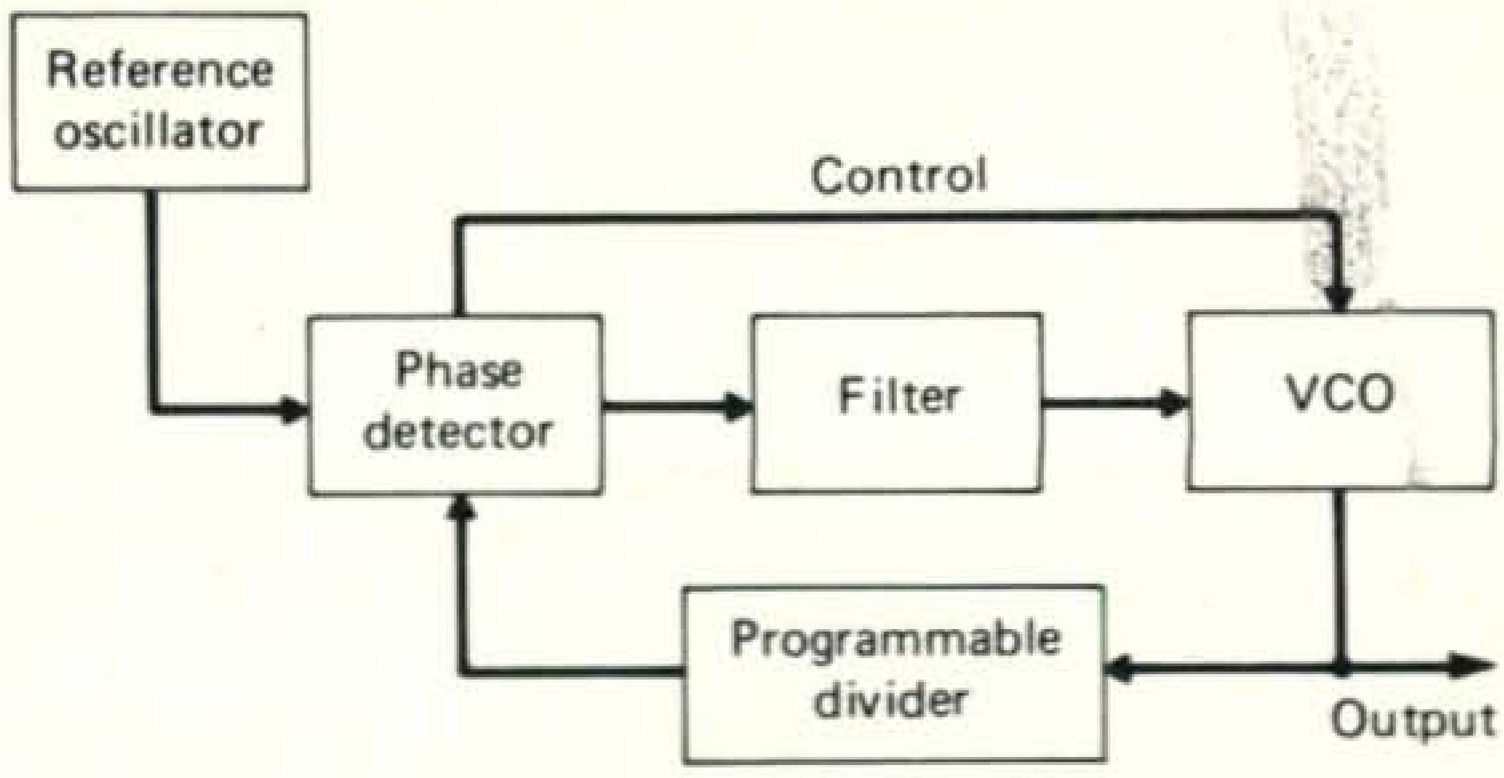


Fig. 4—Popular synthesizer method using phase locked loops.

Our final example this month is the classical scheme being used today with the wide usage of the integrated circuit phase locked loop. Figure 4 shows this scheme.

Operation is as follows: The output frequency of a voltage controlled oscillator is divided by a conventional programmable frequency divider to a value that is the same as a stable reference input. These two signals are then compared in a phase detector which produces an error signal proportional to the difference between the two signals. This error signal is then applied to the VCO and tends to vary its frequency so that the error approaches zero. A filter is usually inserted between the phase detector and VCO to improve the short term stability.

[*Continued on page 68*]

NOVICE SHACK

BY HERBERT S. BRIER,* W9EGQ

CONTINUING our discussion of **capacitance** from the September NOVICE SHACK, correct the equation for calculating capacitive reactance to:

$X_C = 1 \div 2\pi FC$, where X_C is capacitive reactance in ohms; π is 3.14; F is frequency in H_z; and C is capacitance in Farads. Solving the equation for a capacitance of 18.5 mf and a frequency of 60 Hz gives $X_C = 1 \div (2 \times 3.14 \times 60 \times 18.5 \times 10^{-6}) = 144$ ohms (at 60 Hz).

To compare **reactance** to **resistance,** a 100-watt, 120-volt light bulb also has a "hot" resistance of 144 ohms. If the capacitor and the light bulb are connected across a 120-volt, 60 Hz power line, they will each draw a current of 0.83 amperes. But the bulb will become hot while the capacitor will remain cool! The explanation is that the current and voltage are "in phase" in the resistor; therefore all the power fed to it is consumed as heat. In the capacitor, however, the current leads the voltage by 90 degrees; consequently, the current that flows into the capacitor during one part of the a.c. cycle flows back out of it later in the cycle, something like water being continuously poured in and out of a bottle.

Inductance

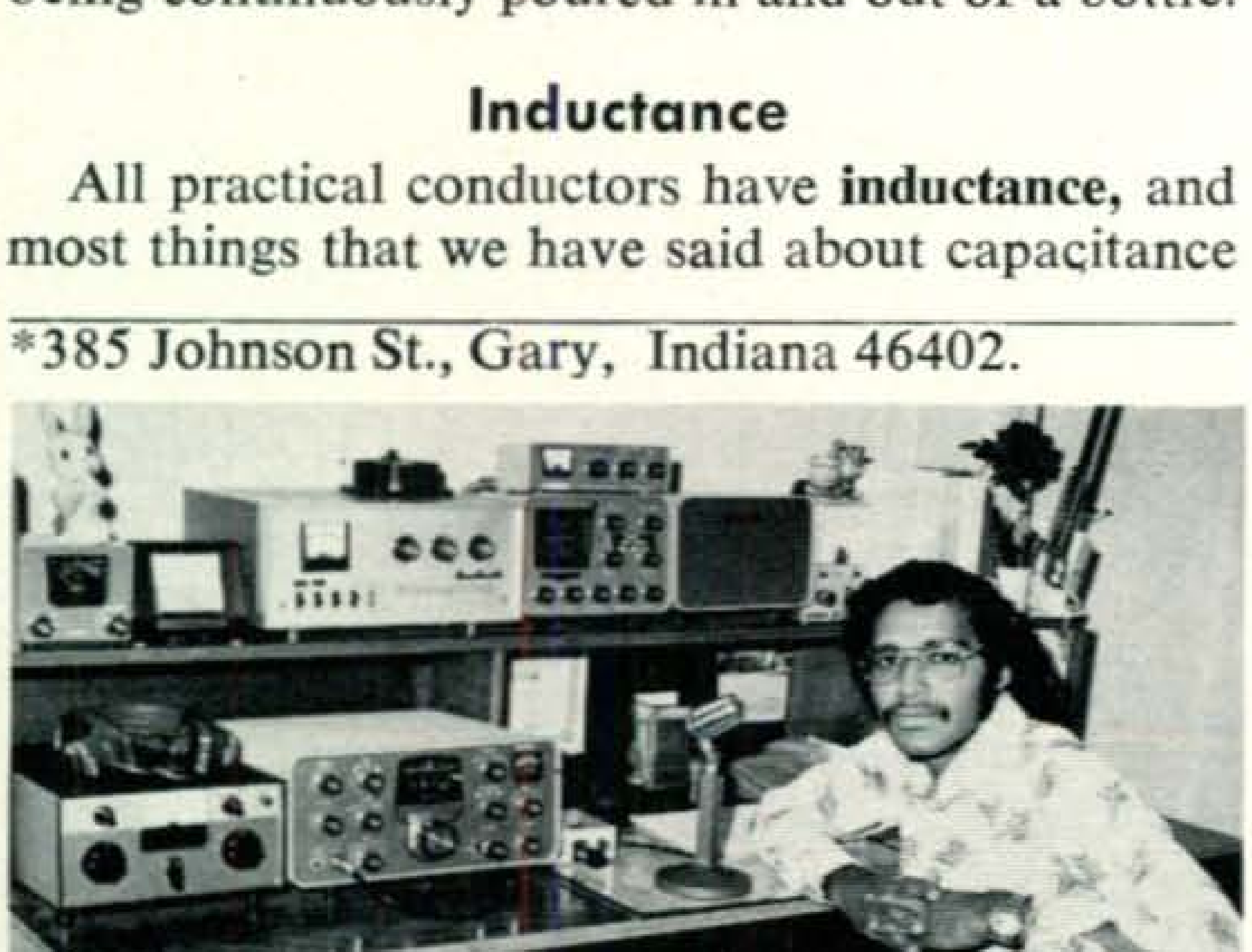
All practical conductors have **inductance,** and most things that we have said about capacitance are true in an inside-out sort of way about inductance. When a voltage is applied to a conductor, the current in the conductor starts *increasing* from zero and induces an *increasing* magnetic field around the conductor that generates an *increasing* counter voltage that tries to force the current in the conductor to flow in the *opposite* direction. If the current *decreases,* however, the *collapsing* magnetic field around the conductor generates a voltage of the *opposite* polarity that tries to *increase* the current. When the applied signal is alternating, these actions and reactions occur continuously, but the voltage changes always lead the current changes by 90 degrees. And they are manifestations of **inductance** in action.

All conductors have inductance, although a straight conductor does not have much of it per unit length. However, winding a long conductor in a coil, thereby concentrating its length and magnetic fields in a small area, results in an inductance that varies by the square of its turns ratio. The inductance may be further increased by winding the conductor on a magnetic core which concentrates the magnetic field tightly around the turns. Unfortunately, iron-core inductors have more losses than air-wound coils, especially on the higher frequencies; as a result, they are usually used on low frequencies, often in the form of multi-winding audio and power transformers. The unit of inductance is the *Henry (H),* but small inductors are often rated in *millihenries (mH)* and *microhenries (μH).*

Inductive reactance is proportional to frequency and is equal to: $X_L = 2\pi FL$, where X_L is inductive reactance in ohms; π is 3.14; F is frequency in Hz; and L is inductance in henries.

[To Be Continued]

*385 Johnson St., Gary, Indiana 46402.



Mark Vargas, WB2SFF, 260 Ft. Washington Ave., New York City, N.Y. 10032, thinks his station photograph is as deserving of display in the Novice Shack as the station of his brother, WB2SPQ, in the June issue. They are both DX chasers, but we have no information as to whether either of them has worked any DX, yet.

Effects of the new FCC Logging Requirements

Many amateurs are making the new FCC amateur station logging regulations adopted July 10, 1974, unduly complicated for themselves. The minimum requirements for a fixed station will be met by posting a photocopy of your amateur station license in the front of your logbook and entering the dates that you start and stop operating from that location. You may transcribe your call letters, station location (address), and your signature in the front of the book in place of the photocopy, if you wish.

It might be wise to make an appropriate entry if you plan to be off the air for an indefinite time and enter a new start-up date when you resume operations. If you operate "portable" from different locations, enter the starting and ending dates and locations for each of the operations. Even if you operate "portable" from a specific location for only a few minutes in a parked car, log the date and location. It is not necessary to log mobile operations, however, except when third-party traffic is handled. In fact, the logging requirements when third-party traffic is handled are unchanged.

So much for the legal requirements. Actually, a log satisfying the minimum requirements is virtually useless as a station record. We recommend strongly that you continue to log the stations you work, dates, times, signal reports, frequencies, operators' names and addresses, in a standard amateur station logbook. All this information is vital in swapping QSL cards and earning achievement awards like WAS or WAC. The best time and place to record it is in the logbook without delay.

Lower License Fees on the Way

As a result of a Supreme Court decision that Federal Communications Commission fees must have some relationship to the value of the service to the licensee, the Commission has proposed reducing the charge for a 5-year amateur license to $6.00, and a modification without renewal will be $5.00. Still no charge for Novice licenses. The charge for a special call sign—for the few that can qualify for one—is still an additional $25.00. The actual reduction of fees must await the outcome of a formal hearing of the matter. Until then, the fee remains $9.00. Incidently, the American Radio Relay League, Inc., and possibly others, were expected to petition that all fees for amateur licenses should be abolished. We wish them luck!

Amateur Operating Accessory

W. L. Klett, WN9MVB, 5B Main St., Lombard, Ill. 60148, suggests a useful accessory for your operating position. It is one of the 3½-×-3½" cubes available at photography shops and other stores to display and protect six photographs. WN9MVB suggests using one of the cubes on your operating desk to display information helpful in the operation of your station. Suggested information includes: RST signal reporting system; Q signals; phonetic alphabet and amateur abbreviations; Transmitter/Transceiver/Receiver dial settings for the frequencies you operate and frequency limits for your license; W1AW Code Practice schedule; favorite picture—radio or otherwise; call letters, names, and telephone numbers of local amateurs. Telephone number of the fire department.

News and Views

Louis Kruh, WN2TSD, 17 Alfred Road West, Merrick, N.Y. 11588, sends an SOS to anyone who can help him set up an efficient antenna for the Novice bands on his 60 × 100′ lot. At present, his 15-meter dipole, Star receiver, and Star transmitter are not setting the bands on fire. Louis is affiliated with the American Cryptographic Association and wants to hear from other amateurs interested in codes and cryptology. . . .

Marilyn Harman, WB8NPR, 3616 Kendall Ave., Cincinnati, Ohio 45208, is our first Novice Shack Photo Contest winner. WB8NPR operates 80 and 40 meters using a Heathkit Apache transmitter, a Hallicrafters SX-100 receiver, and a Hy-Gain vertical antenna and has worked 27 states and Canada. Marilyn was exposed to amateur radio as a girl—her father is W9MNO—but was apparently unimpressed with it. After her non-amateur husband died, however, she started studying for her Novice license and now has her General ticket. Her sons, ages 13 and 16, are not interested in their mother's hobby, except to accuse her of causing TVI, a charge she indignantly denies.

Each month until further notice, we will send a 1-year subscription to CQ to the sender of the "best" picture we receive. To enter the contest, send a clear photograph (preferably black and white) of yourself and amateur station and some details about your radio activities to Novice Shack Photo Contest, 385 Johnson St., Gary, Ind. 46402. Non-winners will be published as space permits.

the following letter from Bob Lucas, **WA0DXZ,** R.R. #3, Box 124, Iowa City, Ia. 52240, refers to work last spring, but it still carries an important message. ". . . It doesn't take high power and a beam to work DX on the 15 meter Novice band. Running 40 watts to a 40 meter inverted-V antenna, I have worked F3, ZL1, ZL2, YU3, KZ5, WP4, WH6, CR6, VE1, VE2, VE3, VE4, and many, many more on the 15 meter Novice band in the past three weeks. I have easy pickings, because very few of the DX stations I call are called by any Novices. I have watched Novices try to work DX by calling CQ, and a few

[*Continued on page* 68]

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CQ World-Wide DX Contest
ALL-TIME U.S.A. RECORDS

Tabulated below are the record-high scores achieved by U.S. contesters in the *CQ* World Wide DX Contest. All-Time World-High scores are shown on pages 26 and 27. Number groups following calls and bands are: year of operation, total score, contacts, zones, and countries.

PHONE

Single Operator/Single Band

1.8 WB8APH ('73) 462	66	6	8
3.5 W5SZ ('73) ....36,630 (Opr. K5ZJK)	208	24	50
7.0 W3PHL ('72) 99,912	316	31	88
14 W4AXE ('70) ..595,725 (Opr. WA4PXP)	1068	39	156
21 W2AH ('72) 485,605	1129	34	111
28 W2SKE ('68) ..429,976	1030	34	108

Single Operator/All Band

Station	Band	QSOS	Zones	Countries
W6RR (1972) 2,350,964	1.8	—	—	—
	3.5	50	18	28
	7.0	164	22	33
	14	297	32	87
	21	949	31	86
	28	360	31	81
	Total	1820	134	315

Multi-Operator/Single Xmtr*

Station	Band	QSOS	Zones	Countries
W7SFA (1972) 2,294,522	1.8	—	—	—
	3.5	69	16	24
	7.0	216	22	35
	14	406	36	88
	21	1004	34	74
	28	260	22	50
	Total	1955	130	271

Multi-Operator/Multi-Xmtr

Station	Band	QSOS	Zones	Countries
WA2ZAA (1969) 6,743,880	1.8	4	3	3
	3.5	127	19	46
	7.0	228	29	78
	14	936	39	138
	21	1183	38	126
	28	1012	33	103
	Total	3490	161	494

CW

Single Operator/Single Band

1.8 K1PBW ('71) 2,914	36	11	20
3.5 W1MX ('72) ......80,410 (Opr. WA1CQW)	329	22	64
7.0 K6EBB ('72) ..228,786	774	31	71
14 W4AXE ('68) ....396,414 (Opr. WA4PXP)	836	39	123
21 WA8LYF ('70) 286,767 (Opr. K8HLR)	756	35	94
28 K1JGD ('68) ..158,510	520	28	82

Single Operator/All Band

Station	Band	QSOS	Zones	Countries
W3WJD (1972) 1,527,500	1.8	—	—	—
	3.5	138	20	46
	7.0	215	28	70
	14	295	36	88
	21	323	30	81
	28	150	20	51
	Total	1121	134	336

Multi-Operator/Single Xmtr*

Station	Band	QSOS	Zones	Countries
K1DIR (1972) 1,985,310	1.8	13	6	9
	3.5	110	20	47
	7.0	419	27	79
	14	334	33	84
	21	319	27	75
	28	206	20	59
	Total	1401	133	353

Multi-Operator/Multi-Xmtr

Station	Band	QSOS	Zones	Countries
W4BVV (1970) 5,552,352	1.8	14	4	5
	3.5	173	25	56
	7.0	665	33	86
	14	810	38	122
	21	909	37	107
	28	485	31	80
	Total	3056	168	456

Club Record: Potomac Valley Radio Club ('69) 44, 441, 644

*Because of significant changes in the Multi-Op./Single Trans. rules, records date from the 1972 contest.

Visiting The Balkan Hams

Part II—Conclusion

BY GEORGE PATAKI,* WB2AQC

LAST month I described our travels to Romania, Bulgaria and Turkey. The second half of our trip took us to Greece, Yugoslavia and Hungary, and then home to the US. Let's pick up our adventures in Greece.

Greece: Where People Played Soldier

Not wanting to push our luck too far in Turkey, our previous stop, we took a plane to Athens. Half an hour after checking into our Athens hotel, we were up on the Acropolis. That alone is worth the visit. A phone call from the Acropolis brought Marino, SV1BR, with whom we had several QSO's from home, and George, SV1AG, President of the Radio Amateur Association of Greece. We operated that evening from Marino's neat and excellent station, using his call and identifying ourselves as the operators.

Originally, we had planned to operate from Crete and Rhodes. A slightly unreliable Greek ham, while visiting with us in New York, (we run a Welcoming Center for Foreign Amateurs Visiting New York City), boasted that he had strong connections in the Greek government, and that he would be able to obtain Greek licenses for us. He knew, but we didn't, that the average foreign tourist cannot get a Greek license. SV1 licenses are given only to Greek citizens, while SVØ's are issued by the US Embassy only to diplomatic and military personnel. The Greeks intend to sign a Reciprocal Operating Agreement with the US, but before they can, they must complete the legalization of their own operations. Greek amateurs have operated for the past 30 years on "temporary" licenses.

We spent the next day sightseeing. At the Archeological Museum in Athens I discovered that I'd have to purchase a special ticket to be able to take photographs. When I tried to use my newly purchased "rights" to photograph Eva standing near a statue, a guard jumped in front of me saying that it was prohibited. I showed him my special ticket, but he persisted.

"What is prohibited?" I asked, "Photographing my wife or the statue?"

" You can photograph your wife separately and the statue separately, but you cannot photograph them together."

"Why? My wife doesn't mind, and I don't think the statue would."

"That's the rule," stated the guard.

"What kind of rule? I never heard of it."

"It's a Greek rule."

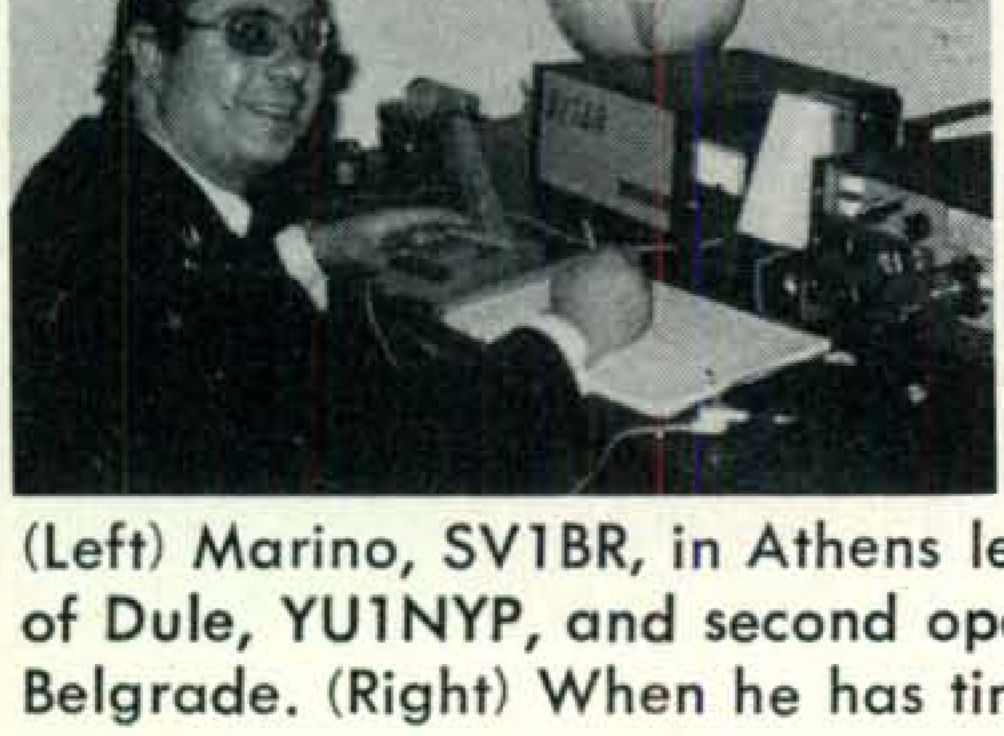
"That's possible," I admitted, "it sounds Greek to me."

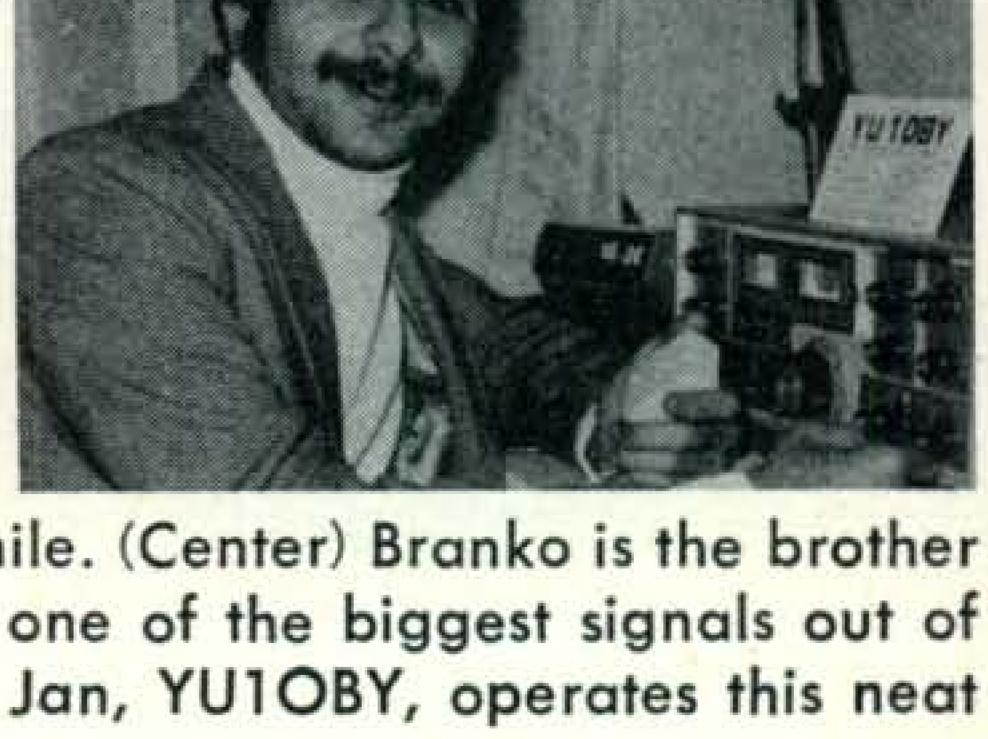
"You'd better listen to me," he yelled like a drill sergeant, "I have a uniform!" I did listen to him—who can argue with a Greek uniform—but now I'm sorry I didn't photograph him with the statue. Their brains matched so well.

In Greece there are two amateur radio organizations; one, the "legalist," belongs to the IARU. The other one, the not-so-loyal opposition to the first, is led by our slightly unreliable Greek friend.

Our sightseeing included the famous changing of the guards in front of the Greek Parliament house. Two guards dressed in what resemble white panythose and black ballet tutus, and wearing very large black shoes, goose-step up and down with their big rifles, guarding the (then) empty Parliament house. Every now and then, three other big husky guards, identically dressed in white pantyhose and black tutus, march up and relieve the first two. One of the three is in charge and shouts the commands, while the other

*34-24 76th Street, Jackson Heights, NY 11372





(Left) Marino, SV1BR, in Athens let us operate his neat station for a while. (Center) Branko is the brother of Dule, YU1NYP, and second operator of his station, which produces one of the biggest signals out of Belgrade. (Right) When he has time to spare from his college studies, Jan, YU1OBY, operates this neat station.

two execute the funniest dance step I ever saw, sometimes bumping into each other, and I couldn't figure out if they were trying to add to the entertainment or were just plain clumsy.

Next day George, SV1AG, who is a radio engineer, picked us up again and took us to his radio shop where we saw his rig. He built it himself, but it looks better than anything factory made. Later we met Janis, SV1HE, and went to see his station. We were also invited by George, SV1AA, a retired general and past president of the Radio Amateur Association of Greece. On our last day in Athens, Janis came again, this time with Tony, SV1GH, a school teacher, and we took a long drive, visiting Pireus and the surrounding countryside.

Greek hams speak good English and use good factory made gear, but they are not too enthusiastic about sending QSLs. I recommend a vacation in Greece and as soon it will be possible, an operation from Crete and Rhodes, both needed by a very large number of hams.

Don't miss the changing of the guards in front of the Parliament and climbing to the Acropolis.

Yugoslavia: A Broken Promise

Last year Tine, YU3EY, visited us in New York and he said that it would be possible for a foreigner to get a temporary YU license. Yugoslavia is not on the most wanted list, but we thought it would be fun to operate from there with special YU7 callsigns.

A couple of months before our trip we filled out the necessary papers and indicated that we would like to start to operate from the first of May. We kept contact with a Yugoslav ham who was helping our cause, but our applications moved very slowly from one office to another. There were many other foreign applications, mostly from Europeans. Ours supposedly were on the top of the list and they issued even the calls: YU7LGA for me and YU7LGB for Eva. One more signature was needed, but it was already the middle of May and the final OK was still missing. We had to give up and leave because we wanted to cover one more country: Hungary.

When we arrived at the Belgrade airport, Zoran, YU1OFX, and Jan, YU1OBY, were waiting for us. Zoran just graduated from the Faculty of Natural Sciences and he was the chief operator of the faculty's club station YU1BWX. Jan is a college student.

That evening as we checked in the hotel, the manager noticed in my passport that I was born in Romania.

"Oh, you are Romanian! I welcome you as a dear brother," he said.

"Thank you. I would like to pay for the room. What kind of currencies do you accept?"

"Any kind, my dear brother."

"Romanian currencies also?"

"Oh no, we love you, my dear brother, but we love the dollars even more."

"OK," I said, "here are your beloved dollars, but I want you to know that I've quit your dear family."

But the Yugoslavs are very hospitable. We went to see Zoran's club station, YU1BWX, which is on the top floor of the faculty building. We contacted this station from New York several times and were anxious to see it. At Jan's station, YU1OBY, we were shown many rare DX QSLs. We couldn't envy him more.

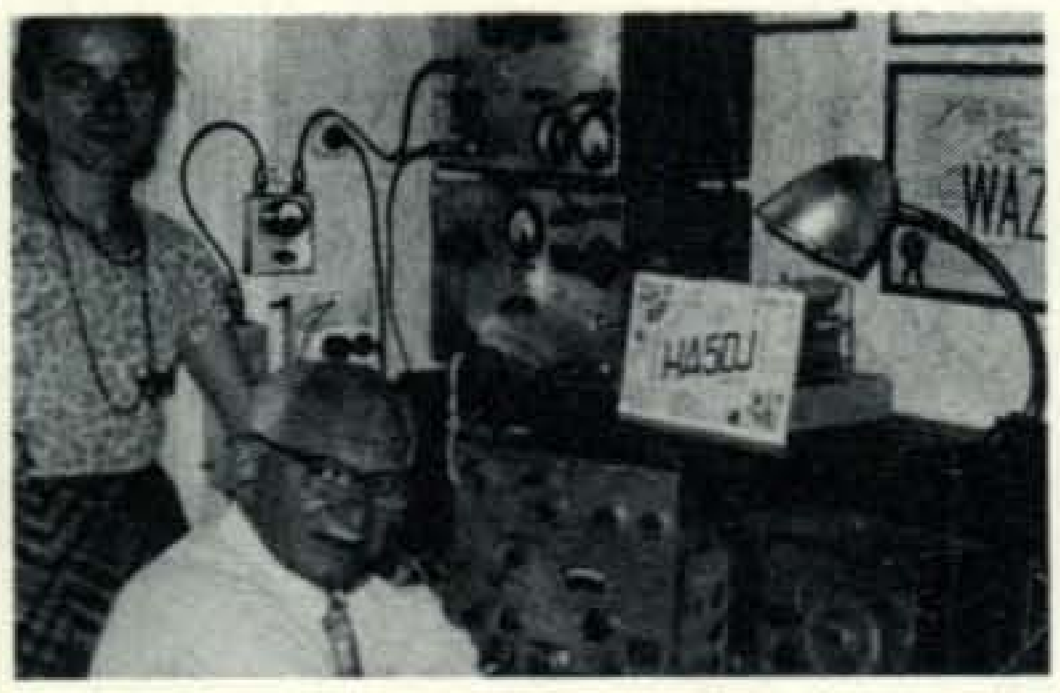
At YU1BKL, a club station of the city of Belgrade, we met many of the club operators. This station was supposed to be at our disposal if we could have gotten licenses.

Yugoslavia boasts lots of clubs and private stations using good factory made equipment, mostly from Germany, Japan and the USA. The Yugoslavs are the only ones in Eastern Europe who can travel unrestricted to the West and they can bring home the best equipment they can afford. They have to pay very high customs duty but they are still much better off than the rest of the "family."

The YU hams are very active and good operators. They have plenty of good equipment and are enterprising people. Then why don't they make a few DXpeditions? Albania is right in their backyard and what a nice place to operate from.

I recommend a visit to Yugoslavia, especially to the Adriatic coast, but don't forget, if you are on the Balkans, the official wheels move slowly.

[*Continued on page 68*]



(Left) Operating YU1BWX from the Faculty of Natural Sciences of Belgrade is chief operator Zoran, YU1OFX. (Center) Eva, WA2BAV, visiting Joska, HA5DJ, and his entirely home-brew station. (Left) Pista is one of the operators of HA5KFZ, the club station of the Ganz company, manufacturer of electrical equipment.

COP's COLUMN

BY COPTHORNE MACDONALD,*
WØORX

IF you run a kilowatt, and your antenna is above or right next to the house, you probably have that troublesome disease called "RF in the Shack." (A common variation is "RF in the Neighbor's Stereo.") Often, the ham gear itself appears untroubled and there are no problems until you try to play back an audio tape on the air, or find that your slow-scan pictures look better when the transmitter is off. Judging from the comments of many hams, the RFI problem is widespread, and cures come hard. This month and next we'll look at the problem and discuss fixes.

Though I certainly didn't set out to do so, I've found myself working on RFI problems for some time. A change of QTH a couple of years ago settled our family into the second floor of a frame house. The lot is small, we rent the place, and the only practical antenna run puts the shack and living quarters just 20 feet below the antenna. When transmitting, the house becomes an r.f. test chamber. Among the pieces of solid state equipment which protested violently during my first QSOs from this location were a color TV set, f.m. receiver/stereo amp, reel-to-reel tape recorder, cassette recorder, and a home-brew SSTV monitor. Making all this gear work under the abominable conditions which exist has *not* been my idea of a fun ham radio project. It will be some consolation, though, if what I learned helps you to cure your own RFI headaches. The discussion will deal primarily with RFI caused by transmissions on the h.f. bands, but much of it will be applicable to v.h.f. and u.h.f. also.

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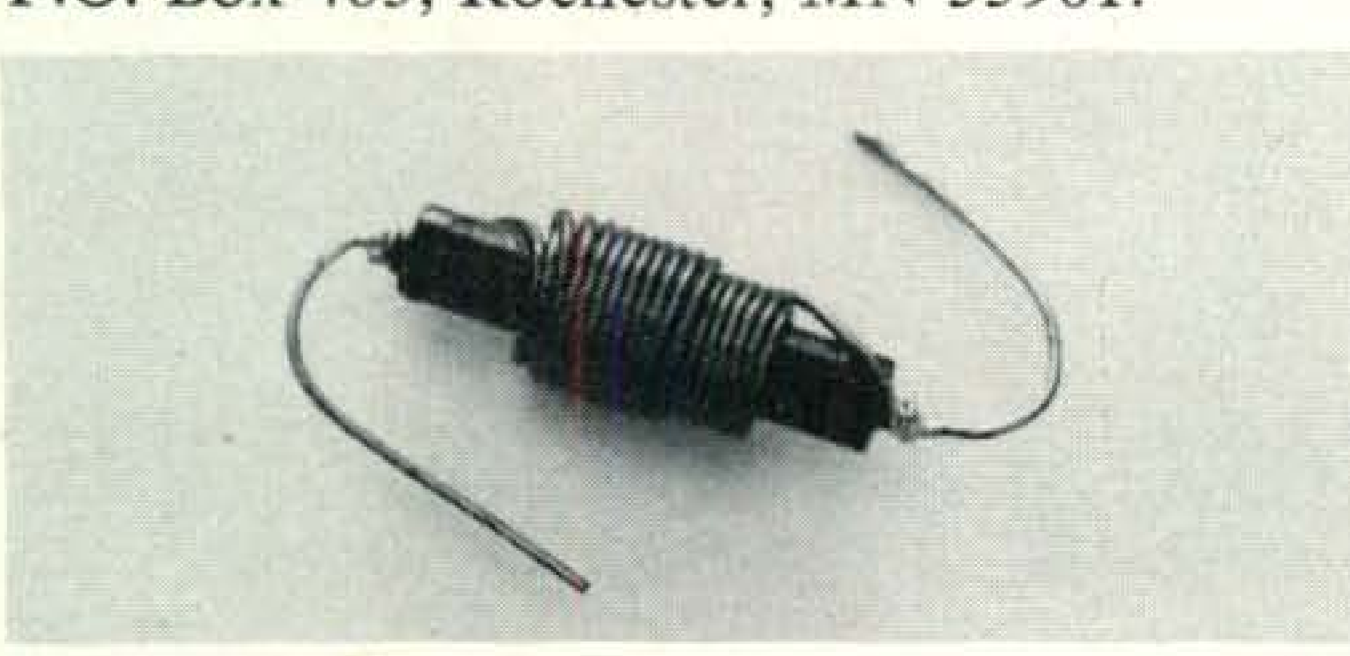


A commercially made line choke capable of handling a couple of amps of a.c. line current.

The basics are pretty simple. If the a.c. voltage swing between base and emitter of a transistor exceeds 0.1 volt peak-to-peak or so, the stage amplification gets non-linear. If the voltage reaches half a volt, there is rectification at the base-emitter junction and a "class C" effect at the collector. The feedback normally used in audio amplifiers acts to keep the *base-to-emitter* swing for audio signals small, even when the *base-to-ground* swing is several volts. Unfortunately, the feedback doesn't usually work at r.f. because the stage bandwidth is limited. In this case, then, a few tenths of a volt of r.f. base-to-ground swing results in a few tenths base-to-emitter swing, and rectification results. If the r.f. amplitude is steady, the audio being amplified becomes distorted. If the r.f. is modulated, then the modulation is detected and amplified as an unwanted audio frequency signal.

OK, it takes only a fraction of a volt of r.f. at the base of a transistor to produce an undesirable effect in an audio frequency amplifier stage. Couple this with a situation such as mine where the r.f. field intensity 20 feet below my antenna is high—upwards of 30 to 100 volts per meter when running a KW. It is clear that even a short lead acting as an "antenna" in that intense field could deliver the unwanted few tenths of a volt to the base of a transistor. Sadly, some very large "antennas" get into the act; like the a.c. power wiring, the cables connecting various pieces of gear together, and maybe even that ground wire which we've been told will cool the shack off. Everything conductive in the field of the antenna becomes "hot" to some extent. R.f. voltages are developed, and when these conductive things are connected together, r.f. currents flow.

Reducing the RF Field

The situation can be pretty depressing, but it's not hopeless. If confronted with an r.f.-in-the-shack problem, the first thing to consider is the possibility of reducing the strength of the r.f. field to which the shack, the house wiring, and the plumbing are subjected. Is it possible to move the antenna further away from the house? The field strength goes down roughly as the square of the distance from the antenna. In my own example then, raising the antenna from 20 feet above the shack to 40 feet would have cut the r.f. field strength (and the induced voltages) by a factor of 4. Raising it from 20 feet to 60 feet would have cut the field to 1/9 of its original level. When you consider that reducing the power level from a KW to 100 watts would only reduce the field strength by a factor of 3.16 ($\sqrt{10}$), the importance of getting the antenna away from the house becomes clear. (The potential problems caused by indoor transmitting antennas and by bringing one end of the antenna into the shack to end feed it are also evident.)

Even if the antenna itself is a sufficient distance from the house, r.f. will be brought into the shack if there are antenna currents on the transmission line. The standard preventive measures are using a resonant antenna (or in the case of open wire feed, at least a balanced antenna) and bringing the transmission line away from the antenna at right angles. Other possible aids are a balun at the antenna if it is coax fed, grounding the coax shield with a ground rod right at the base of the tower, and burying the coax.

Grounding

What about grounding the gear in the shack? Bringing a good driven-rod or buried-metal ground into the shack is an excellent idea from the standpoint of operator safety, but rarely will it act as a good ground at r.f. Figure 1 illustrates the problem. Let's assume that the ground itself is near perfect—driven stakes, buried radials, and all. Let's assume that the lead up to the shack is half inch diameter (4/0 gauge) copper cable having a d.c. resistance of less than .001 ohm. At 60 Hz it's a beautiful ground, but on 20 meters it's worthless. Sixteen feet is roughly a quarter-wave at 14 mHz. Even though the bottom end is solidly at "ground," the impedance to ground at the shack end will be hundreds or thousands of ohms. We're trying to get an r.f. ground in the shack by tying the gear to the top of a ¼ wave antenna, and that ain't gonna work! Even on 10 meters where the length is ½ wave, the radiation resistance of this ground lead will result in a "resistance-to-ground" at the shack of several tens of ohms. The main point here is that unless your gear is

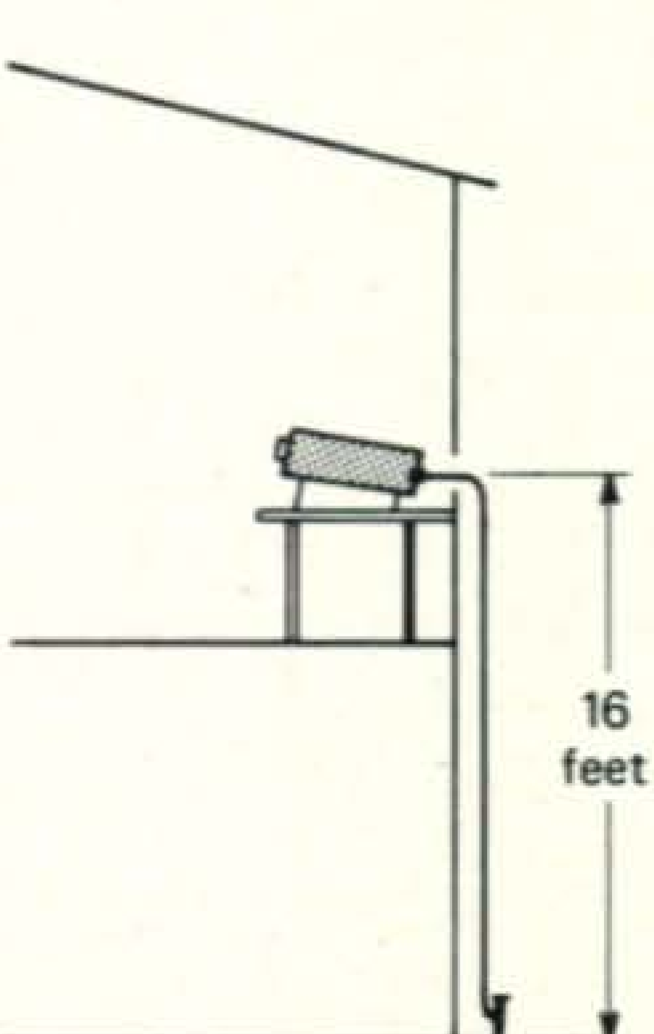


Fig. 1—A ground that isn't a ground (at least at 14 mMz).

lined up against the basement wall and you drive your ground rods horizontally into the ground through holes in the wall, there is no such thing as a really low impedance r.f. ground in the shack.

Even if an absolute "ground" is unattainable, many RFI problems can be solved by getting all equipment cases and chassis at the *same r.f. potential.* A compact arrangement with transmitter, receiver, linear amp, SSTV gear, tape recorder speech processor, scope, etc., physically close to each other is a good start. Then the game is to bond the chassis of all these units together in the lowest impedance way possible. Copper sheeting of the type used in roofing work can be useful. If the units are lined up side by side on a table, a long copper sheet, perhaps a foot wide, can be put under the units and each unit connected to it with a short length of braid or copper strap. If the units are mounted on shelves, bookcase style, a copper sheet can be mounted vertically behind the shelves, and the units grounded to it. The copper sheet should be connected to a good d.c. ground such as a cold water pipe or driven ground rod, but this is for safety, not real r.f. grounding. This ground connection should be made at the same point on the sheet as the transmitter (or linear amp) connection so that any antenna currents on the outside of the coax will flow directly into the ground lead and not through the copper sheet.

RF on the AC Line

One evening, with the lights off during an SSTV transmission on 75 meters, I saw the hall light glow dimly even though the light switch was off. That is r.f. on the power line! Even if your case is not as severe, the chances are that r.f. pickup on the a.c. wiring will be at least part of your RFI problem. There are two approaches to keeping this r.f. out of the insides of that solid state gear. If you have managed to consolidate all your equipment compactly around one of those copper sheets, you might try filtering the a.c. going into a multiple outlet strip, and plug all equipment into that strip. Figure 2 illustrates this approach. The chokes limit the r.f. current that can flow, and the bypass capacitors provide a low impedance r.f. path from the copper sheet to both sides of the a.c. line going to the outlet strip. The cords for the individual pieces of gear should be hanked up short so that they don't act as antennas. The choice of r.f. chokes will depend upon the total power consumed by the gear. J.W. Miller type 7828 chokes are rated at 20 amps (and 200 μh). Alternative chokes could be made by winding 20 feet or so of No. 10 or No. 12 Formvar coated wire on 2 or 3 inch diameter forms. It is important to mount the chokes so they present no shock hazard, and no danger

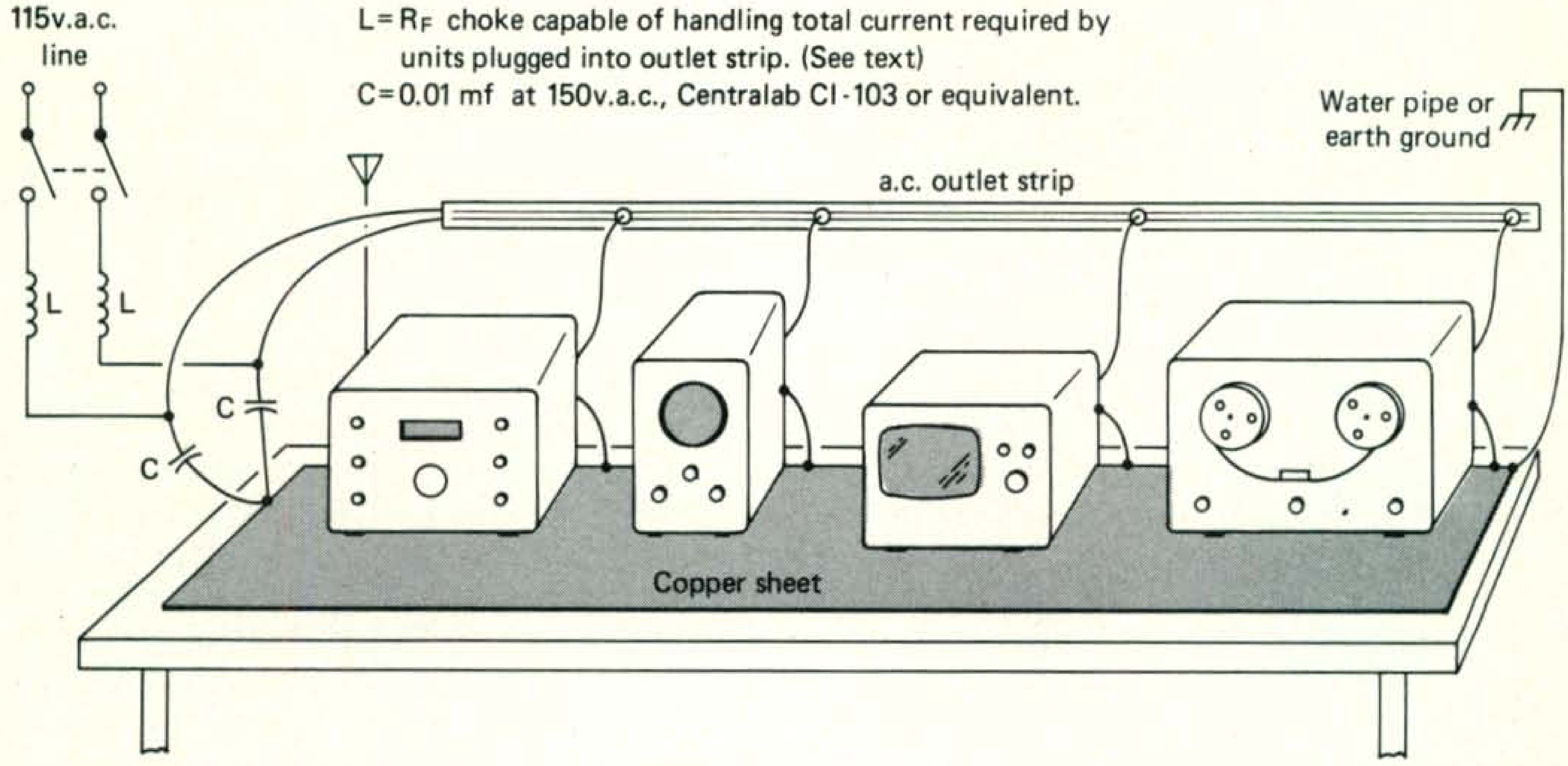


Fig. 2—An approach to eliminating RFI in interconnected units by filtering the a.c. line and using a wide copper sheet to provide a low impedance ground connection between all units.

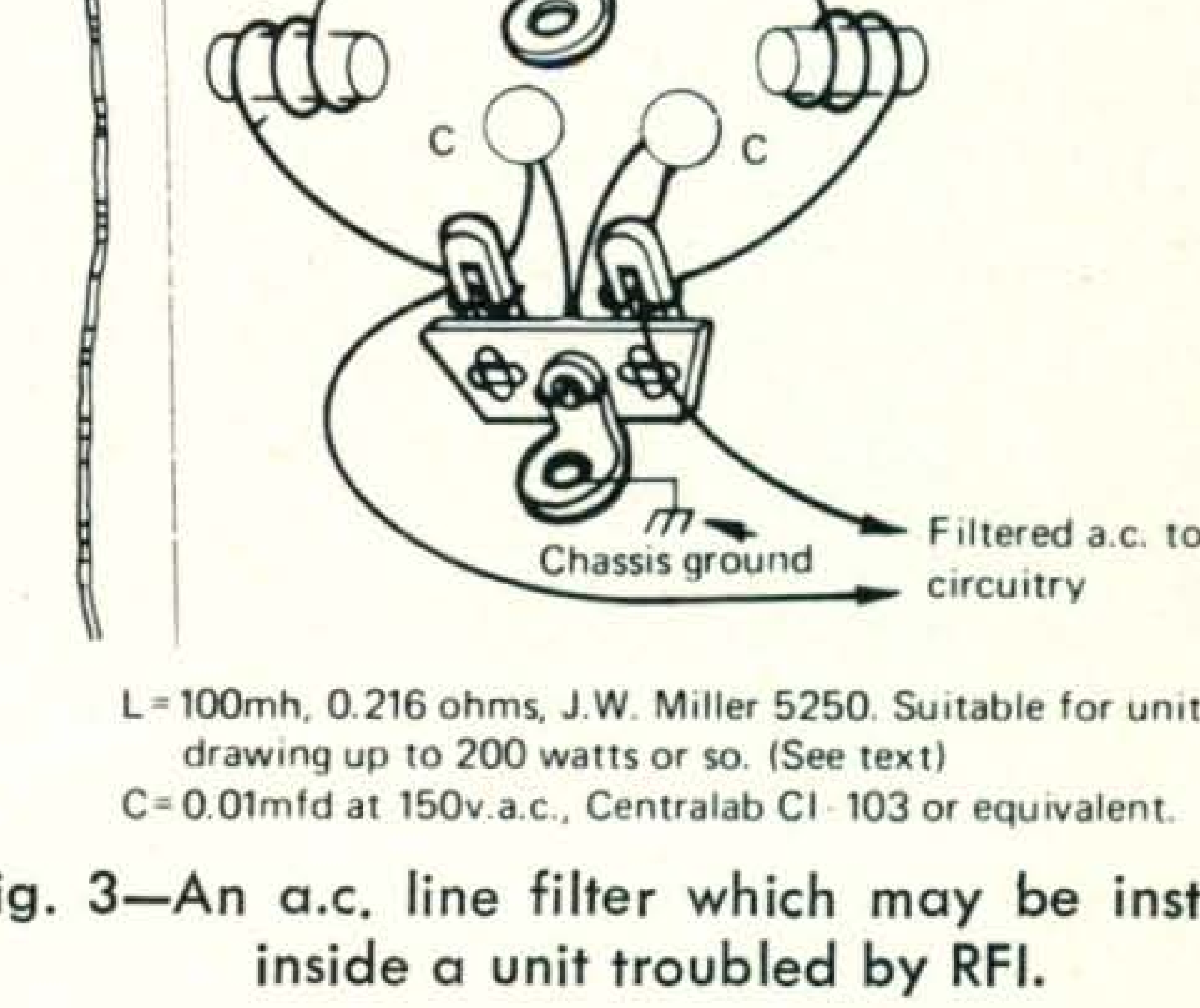
of fire in case of a short circuit. Installing a main power switch on the line side of the filter is not a bad idea either.

The other approach is to filter the a.c. input of each individual piece of equipment which exhibits RFI symptoms. This approach is necessary for pieces of gear such as stereos and a.m./f.m. radios which are not part of the shack equipment. The approach may also be necessary in stubborn cases where the first approach has been tried, but interference persists. The details appear in fig. 3. A commercially available choke is mentioned, but you can roll your own with 18 gauge Formvar covered wire. Wind five to ten feet of wire on any convenient form (from ¼ to ½ inch diameter) to make each choke. The chokes may even be outside the chassis. An easy approach here is to split the zip cord line cord into two separate insulated wires while still leaving the a.c. plug attached. Wind each wire around its own core. A ferrite or powdered iron core is ideal, but using air core forms of any convenient diameter will usually give sufficient inductance. (In cases where the RFI is strong, and the inductance is less than optimum, it may be necessary to add one or two additional .01 mf capacitors in parallel with the ones shown.) The a.c. plug—which will be very close to the chassis after this procedure—can then be plugged into the socket of an a.c. extension cord to bring power to the unit.

A few words of caution. The ceramic capacitors specified are U.L. recognized for a.c. line operation. If you can't locate this type, be sure to use capacitors having a rating of at least 1600 v.d.c. Also, with transformer powered equipment, be sure to ground the chassis to a water pipe or driven ground. If not grounded, the chassis will float at 55 v.a.c. The capacitors limit the current to less than 1 ma, but even that is enough to produce an uncomfortable shock if you have one hand on the chassis and the other on grounded metal. This 55 volts can also pop transistors if you start patching ungrounded units together. Transformerless, line operated, equipment such as many TV sets should *not* be grounded. Their chassis are already hot with a.c. directly from the line. These units are safe because the cabinets have been designed to eliminate the possibility of bodily contact with the chassis.

If you get this far and your problem still isn't solved, don't get too discouraged. Next month we'll talk about ways of taming pickup on interconnecting cables, r.f. suppression in the audio amps themselves, and take a look at some specific cases.

Vy 73, Cop, WØORX



L = 100mh, 0.216 ohms, J.W. Miller 5250. Suitable for unit drawing up to 200 watts or so. (See text)
C = 0.01mfd at 150v.a.c., Centralab CI-103 or equivalent.

Fig. 3—An a.c. line filter which may be installed inside a unit troubled by RFI.

QRP_P

LOW-LOW POWER OPERATING

BY ADRIAN WEISS,* K8EEG

Field Day Results

Well lads, Field Day 1974 was really a hot one for the QRP_P gang. I'd venture to say that a greater number of fellows got their feet wet with less than five watts this year than ever before—almost doubled the number of entries for the coveted Milliwatt Field Day Trophy! Before I get into the rundown from the operators themselves, let me take a moment to lament my miserable showing.

Everything went perfectly for me—last year I had taken care to coil all the antenna wires, leads, guy lines very neatly, so it came apart beautifully. Likewise, three tosses of a brick put my guy lines over the exact branches that I aimed for, and the 80ft "8JK" was aloft at 50ft with no sweat. Loaded up beautifully. The KE-93 receiver had been converted to solid state and, with its 14 tuned circuits plus double conversion gain, it just sliced the unwanted sidebands "outa sight"! My 80-15 meter FET v.f.o. rig (published in *ham radio,* July, 1972), had been redesigned with a new r.f. driver section and a 2N5590 final which could perk out 10 watts easily. I suppose this part went just too well. Propagation got me! Unbelievable short skip just hung my low angle signal out beyond optimum areas—I was even working guys in IA on 20 meters! It was real work though. Had no trouble in working a ZL2 on 20—a 3×3 call and quick exchange and that was it! But alas, anything in between was hard to work. But wait until next year! Nuts.

Of course, good old Murphy was on the scene, particularly for WN3UDS. For those of you who had problems and gave up, read on and learn the true QRP_P attitude: "I was racing to complete my HW-7 for FD but Murphy, in the guise of a leaking hot water tank in the house, almost QRT'd the whole project. I finished the water tank and HW-7 with only two hours left in the contest! So, there was no time to erect an extensive image-plane vertical as I'd planned, and a deluge outside at the time was surpassing the previous deluge inside from the water tank. I had to settle for a ¾ wavelength end-fed wire. I coasted the VW partway down the driveway, put the wire out the window to a tree branch (average height—about 3ft!), and a screwdriver in the lawn served as my ground. The batteries were putting out less than 10 volts in the transmit mode, but I managed three big QSO's (MI, ONT, OH). W8TO/8 answered my CQ and gave me a 599! He still insisted on 599 when I told him that I was QRP_P. So much for QRP_P QSO's numbers 2-4. Number one was 5T5CJ, but that's another story!"

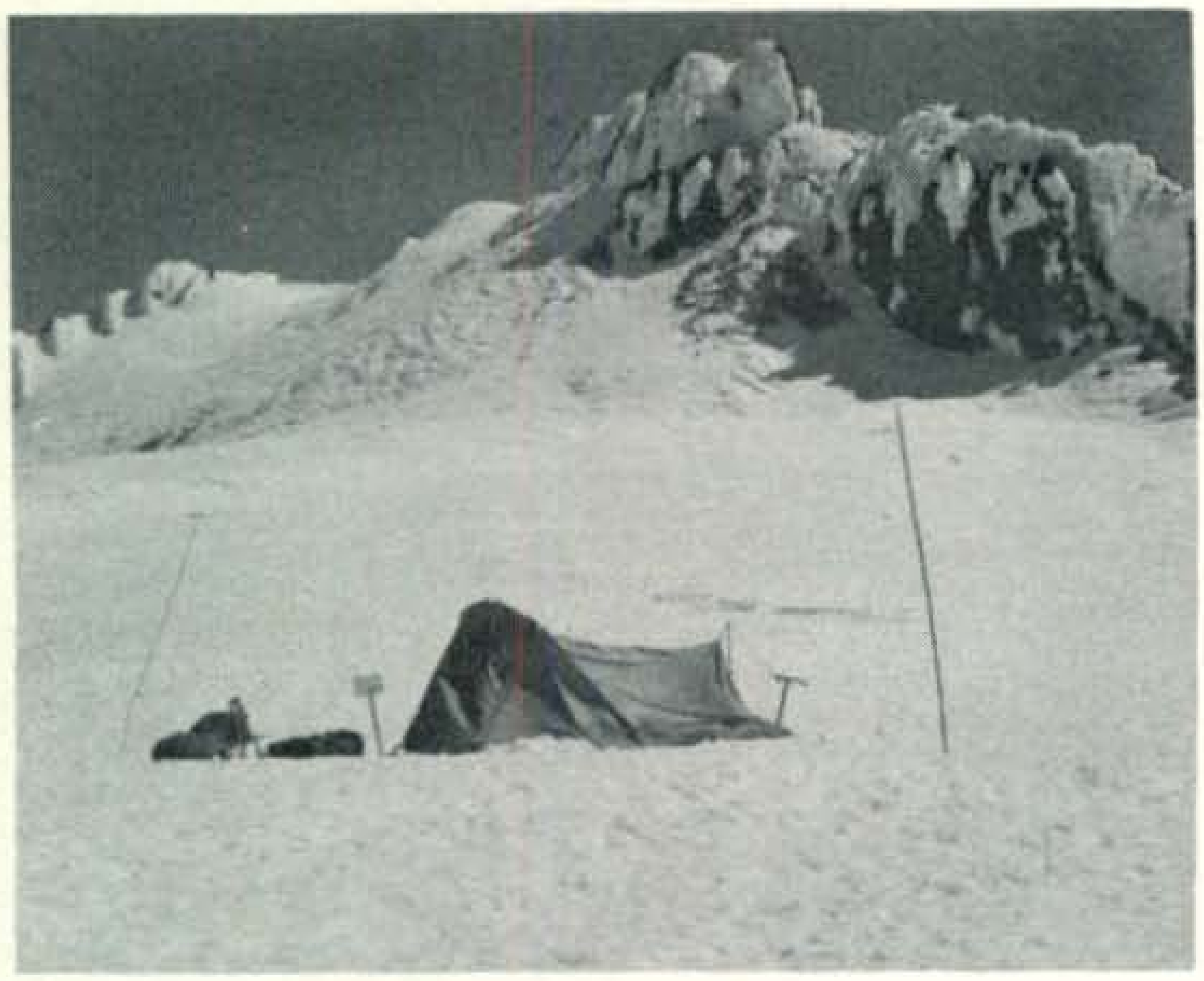
QRP_P was well represented at the top of the nation's mountain peaks by two units—one led by W7ZOI which manned seven complete stations at the top of a mountain out in ORE. The other involved W6JTH and WA6VBA tackling the 14,000ft Mt. Shasta in CA. For you city-slickers who consider it hard work to drive the generator/station van out into a pleasant meadow, read on. Dick (W6JTH) writes: "The small town of Mount Shasta lies at the mountain's base at slightly over 3000 ft. Between eight and nine we had breakfast there, registered with the police department (which handles lost climbers), and headed off for the ski area from which the actual climb would begin. From 8000ft level we climbed in stretches typically lasting half an hour, interweaving them with rest stops of the same duration. By late Friday we had reached the lower end of a crumbly knife edge at about 12,000ft. With a certain amount of mountain engineering two platforms suitable for sleeping were exacted from the mountain. Dinner was prepared using snow scooped from a patch about twenty-five feet below our makeshift camp. The platforms served well enough that we overslept

Results:
Milliwatt Field Day Trophy 1974

Standing	Station	Number of QSR's	Power Mult.	Score
1.	WØIYP/ WØZHN	439	4	2784
2.	WA3HBT	248	4	1638
3.	K1GAX	152	4&5	1120.5
4.	W5TVW	151	4	1056
5.	K8EEG/Ø	120	4	870
6.	WA5WYO	103	4	768
7.	W8NDG	76	5	720
8.	W6JTH WA6VBA	93	4	708
9.	K6GKU	115	4	690
10.	WB9LKC	68	5	660
11.	WN8OSM	91	4	546
12.	WB5IOG	49	5	517.5
13.	VE3ECJ	55	4	480
14.	W9PNE	50	4	450
15.	WA2TLQ	72	4	432
16.	K4BNI	60	4	360
17.	WA2KTW	38	4	228
18.	WN3UDS	3	5	172.5

Scoring: QSO's × power multiplier (× 4 under 5w out, × 5 under 1w out) × 1.5 battery power + 150 bonus for complete portable setup away from home shack.

*213 Forest Ave., Vermillion, SD 57069.



W6JTH/WA6VBA location for 1974 Field Day. Mt. Shasta peak in the background, tent foreground. Backpacks can be seen to the left of the tent. Ski-pole holding end of dipole visible to right of tent. Now, fellas, how's this for comfort!

the next morning. The final climb to the summit required negotiating the remainder of the knife edge, which we eventually chose to by-pass at the expense of several hundred feet in elevation, and slowing but patiently walking up the last thousand vertical feet on a wide snow and ice covered slope. Below the true summit of Mt. Shasta is a relatively flat, quarter-mile long, windswept area known as Misery Ridge. Although operation from the 14,162ft peak would have been aesthetically more pleasing, its pinnacle nature and severe winds whipping the mountain top made Misery Ridge a much more attractive alternative.

By 1230 the tent had been erected and some of the antennas were being installed. A bamboo pole carried from the car, and a long plastic tube removed from a defunct slalom course at the ski area provided end supports for the trap dipole which was oriented for Pacific Coast coverage. Sometime later, the 40 meter dipole was installed over the other support for improved radiation on that band toward the east. Contest work began shortly after 1300 and continued until about ten that evening, when a combination of band conditions, sore backs, and numbing cold did in both operators. The wind which had greeted us upon our arrival on Misery Ridge at noon Saturday blew through the night, increasing in ferocity with each hour. Gusts tore at the tent fabric raising a cacophony of noise and throwing tiny frost particles—moisture which had condensed and frozen on the tent walls—about the inside of the tent as though we were in the midst of a small blizzard. Sleep was virtually impossible but we did get some rest.

Toward morning the support poles on the windward side of the tent separated and the blue nylon fabric began to cave in. With the little available light is was possible to venture out into the 20° temperatures and 30 mile wind to make repairs. Although it was not yet 0500, there seemed no prospect of finding the sleep that had been so elusive during the night, so we resumed FD operations. Band conditions were not good—long skip was definitely in on 40, a state of affairs which has always been intriguing for us as QRP_P operators but which has resulted in no success in making contacts—but there was hope conditions would improve. After forty-five minutes of fruitless calling, we made our first Sunday contact. As skip shortened, QSO's became more frequent and by mid-morning they were following at a very satisfactory rate.

In terms of operating, 40 proved to be the most reliable throughout the contest period. Brief forays on 20 and 15 netted four QSO's per band at a discouraging rate. On both higher bands, many signals were being received, but few would respond to our calls. For 93 contacts, this all may seem like a lot of effort. From the FD point of view, however, we doubled our 1973 score and have found another mountain which serves admirably as a communications site. From the mountaineering side, any 14,000ft peak is a challenge and the panoramic spectacle from the top of Mt. Shasta is unsurpassed. There are still ten remaining 14,000ft peaks in CA awaiting us for future years; in the meantime, upgrading and testing of the equipment for mountain hamming goes on." Thanks much to W6JTH and WA6-VBA for this report—you've won the admiration of amateurs the world over! I don't suspect you'll get too many converts though! Takes a real man!

Let me run some other comments by you. de . . . WA3HBT: "My plan was to use s.s.b. first and then a combination of c.w. and s.s.b. with the Argonaut. Antennas were all dipoles with an average height of 40ft, plus one long-wire through a matchbox. I got off to such a good start on s.s.b. that I decided to stick with. I dislike mixing modes. Ended up with 61 s.s.b. QSO's on 15, 108 on 20, 20 on 40, and 59 on 75—all with 2.5 watts s.s.b. to dipoles!!! I enjoyed this FD the best ever. Next year I plan a rotable quad. I'm being spoiled by the Argonaut—it's a good little machine!" de . . . WØIYP: "I am still surprised that we did so well using only a 135ft center fed antenna with 300 ohm open line to a kw matchbox. The wire was strung from the top of the Long Lake watertower to a telephone pole. The low end was 20ft high and the other about 120ft up. A very nice setup." de . . . WA5WYO: "We were sure disappointed in our 40 meter efforts and aim to get with a big 40 meter antenna for next year's FD effort!" de . . . VE3ECJ; "My antenna tree was a tall basswood standing 60ft above the surrounding cedars and birch on a lakefront. This large tree was leaning in the direction of my tent and was rather weak near its base, so when the windstorm came I had to

[*Continued on page 70*]

MORE THAN THREE YEARS AGO, HEATH ENGINEERS ACCEPTED THE CHALLENGE TO DEVELOP A COMPLETELY NEW APPROACH TO AMATEUR RADIO DESIGN.

THE RESULTS SOON WILL BE HEARD WORLD-WIDE.

LIFT

THE NEW HEATHKIT SOLID-STATE TRANSCEIVER

SB-104 ... the most advanced design in amateur radio

All the modern circuitry, built-in features, high performance, and honest operating convenience you have wanted for years... here today.

Completely solid-state...from front end to RF output, with over 275 advanced solid-state devices, including 31 ICs, 75 transistors and 171 diodes. The result is a design that runs cooler, quieter, better, longer. The four finals are totally protected.

Totally broadbanded. The new 104 means instant QSY. You can go from CW on the low end of 80 to USB on the high end of 10 in seconds ...with perfect tune. Gone are the bothersome Preselector, Load and Tune controls. Just choose the band, dial in the operating frequency, select your mode...and go!

True digital readout. The new SB-104 provides 6 digits of large, bright, easily read frequency information...with resolution down to 100 Hz on all bands. And unlike other so-called digital readout systems that interpret just the VFO frequency, the SB-104 incorporates true digital frequency measurement circuitry that takes into account all three frequencies: VFO, HFO and BFO. What you see is where you are... always.

Total operating convenience. The front panel is clean, well-labeled and easy to use. The large spinner knob on the VFO delivers about 30 kHz per revolution. To the right of the VFO knob are controls for Drive Level, Bandswitch and the switched (Off-fast-slow) AGC to suit various operating conditions. Pushbuttons select mode (USB/LSB/CW), a Tune button for loading linear amplifiers, a Hi-Lo power switch, and Power on-off switch. On the left of the VFO knob are controls for audio and RF gain, jacks for a PTT mike and phones, and pushbuttons to monitor input DC voltage, ALC action and relative power on the front panel meter. The built-in VOX can be switched in and out with another pushbutton...and we've put the VOX gain and delay controls on the front panel, too. And, if you've installed the optional Noise Blanker, a front panel pushbutton switches it on or off.

Available December

Performance-plus! The SB-104 is more than convenient to use... it's a pleasure. The transmitter delivers a solid 100 watts *output* in the high power position; for QRPers the output can be switched to one watt instantly with the front panel pushbutton.

The broadband receiver performance is spectacular... carefully designed to minimize cross-modulation and intermodulation; active devices are kept to a minimum ahead of the highly selective crystal filter. Adjacent signal overload is negligible, yet sensitivity is better than 1 μV. And there is a 15 MHz WWV receive position on the band switch.

Easy assembly and alignment. We believe the new SB-104 is the most sophisticated amateur radio transceiver on the market. It has over 2800 parts, consequently it won't go together in just an evening or two, (we have averaged about 50 hours in pre-production assembly). But it does go together easily, easier than any we've ever offered. All but a handful of the components mount on one of the 15 glass epoxy boards, and two wiring harnesses eliminate most of the point-to-point wiring. Eleven of the boards plug-in for easier assembly, and 7 of them can be extended out of the chassis.

And still more features! The SB-104 will operate directly from a 12V automobile electrical system. For fixed station use, just hook-up the new HP-1144 supply. Complete back panel inputs and outputs...see feature photo on right page. And, we've even designed-in a place on the readout panel where you can light up your call sign when you build the SB-104...we give you all the letters and numbers you need to do it.

This is the transceiver you'll be hearing worldwide. Years ahead of every other... at any price. The SB-104... it belongs at your operating position.

Kit SB-104, 31 lbs. **669.95**

Kit SBA-104-1, Noise Blanker, 1 lb., mailable **24.95**

Kit SBA-104-2, Mobile mount with hinged rear, telescoping front support, 11′ cable, power relay, and circuit breaker, 6 lbs., mailable. **$34.95**

Kit SBA-104-3, 400 Hz CW crystal filter, 1 lb., mailable **34.95**

SPECIFICATIONS

SB-104 SPECIFICATIONS — TRANSCEIVER SECTION — GENERAL OPERATION: Frequency Coverage: 3.5 MHz through 29.7 MHz amateur bands, 15 MHz WWV receive only. **Frequency Stability:** Less than 100 Hz/hr drift after 30-min. warmup; less than 100 Hz drift for ±10% change in primary voltage. **Modes of Operation:** Selectable upper or lower sideband (suppressed carrier) and CW. **Readout Accuracy:** Within ±200 Hz ±1 count. **Audio Frequency Response:** 350 to 2450 Hz ±75 Hz (6 dB bandwidth). **Dial Backlash:** 50 Hz max. **Phone Patch Impedance:** 4 ohm output to speaker; high impedance output to transmitter. **Power Requirements:** 13.8 VDC nominal (max. 16 VDC) at: Receive: 2 amp. Transmit: low power: 3 amps.; high power: 20 amps. **TRANSMITTER: RF Power Output: High Power** (50 ohm non-reactive lead). SSB: 100 watts PEP ±1 dB; CW: 100 watts ±1 dB. **Low Power** SSB: 1 watt PEP (minimum); CW: 1 watt (minimum). **Output Impedance:** 50 ohms, less than 2:1 SWR. **Carrier Suppression and Unwanted Sideband Suppression:** 55 dB down from 100 watt single-tone output at 1000 Hz reference. **Harmonic Radiation:** 45 dB below 100 watt output. **Spurious Radiation:** −50 dB within ±3 MHz of carrier; −60 dB farther than ±3 MHz from carrier, except −40 dB at 3.39 MHz on 80 meter band. **Third Order Distortion:** 30 dB down from two-tone output, reference at 100 watts PEP. **Transmit/Receive Operation:** SSB: PTT or VOX; CW: Keyed-tone VOX or manual. **CW Side-Tone:** Internally switched to speaker or headphones in CW mode. Approximately 700 Hz tone. **Microphone Input:** High impedance with a rating of −45 to −55 dB; approx. 25K ohms to match Heath desk-type microphone. **RECEIVER — Sensitivity:** Less than 1.0 microvolt for 10 dB signal-plus-noise-to-noise ratio for SSB operation. **Selectivity:** 2.1 kHz minimum at 6 dB down, 5 kHz maximum at 60 dB down. (2:1 nominal shape factor). **CW Selectivity:** (with accessory CW filter) 400 Hz at 6 dB down; 2 kHz max. at 60 dB down. **Overall Gain:** Less than 1 microvolt for 0.5 watt audio output. **Audio Output:** 2.5 watts into 4 ohms, 1.25 watts into 8 ohms, at less than 10% THD. Low impedance headphones (4-8 ohm). **AGC:** Less than 1 millisecond attack time; switch selectable 100 µsec. and 1 msec. release, and OFF. **Intermodulation Distortion:** −65 dB min. **Image Rejection:** −60 dB min. **IF Rejection:** −60 dB min. **Internally Generated Spurious:** Below 2 microvolt equivalent antenna input, except at 3.65, 3.74, and 21.2 MHz. **MECHANICAL — Front Panel Controls/Switches:** AGC — Off, Slow, Fast; AF Gain; Microphone Jack; Headphone Jack; Main Tuning; Mic/CW Level; Vox Gain; Vox Delay; Band Switch. **Pushbuttons:** ALC (Meter); 13.8V (Meter); Relative Power (Meter); 100 Hz (Disable); Noise Blanker (On/Off); LSB (Mode); USB (Mode); CW (Mode); Tune; Hi/Lo (Power Select); VOX (On/Off); PWR (On/Off). **Rear Panel Controls/Sockets:** Anti-Trip; Sidetone Level; Linear Amplifier ALC Input; Phone Patch Input; Phone Patch Output; Key (CW) Input; Speaker (4 ohm) Output; Spare (2); Receiver Audio Input; VFO Input; VFO Output; IF Output; Driver Output; Ground Post; Power Plug; Accessory Socket (includes relay output); Antenna Input; Receiver Antenna Input; Common/Separate Antenna Switch. **Dimensions:** 5¾" H x 14¹⁵⁄₃₂" W x 13⅞" D. (Less knobs, feet and connectors). **Weight:** 20 lbs.

The SB-104 output board and final transistors are warranted for one full year.

HP-1144 SPECIFICATIONS — Output Voltage: 13.8 VDC regulated (Adjustable from approximately 11 to 16 VDC). **Maximum Output Current:** 20 amperes, Intermittent. 8 amps continuous. **Transistor Integrated Circuit and Diode Complement:** 2N3643 transistor; 2N3055 transistor; 40411 pass transistor (2); MFC6030 regulator IC; 1N4002 silicon diode; MDA990-2 bridge rectifier. **Power Requirements:** 110 to 130 VAC @ 6A or 220 to 260 VAC @ 3A, 50/60 Hz maximum. **Dimensions:** 5½" H x 9¼" W x 10¼" D. **Regulation:** Less than 2% output voltage variation from no load to 20 amperes. **Ripple:** Less than 1% at 20 amperes. **Fuses:** 7-amp, 3AG, slow-blow primary. 20-amp, 3AG, output. **Net Weight:** 23 lbs.

SB-604 SPECIFICATIONS — Speaker Size: 5" x 7" oval. **Voice Coil Impedance:** 3.2 ohms. **Frequency Response:** 300 to 3000 Hz. **Magnet Weight:** 3.16 oz. **Cabinet:** Aluminum with gray wrinkle finish. **Dimensions:** 7⅛" H x 10⅛" W x 14" D.

SB-644 SPECIFICATIONS — Frequency Coverage: 5.0 − 5.5 MHz allowing 80, 40, 20, 15, 10 meter operation in the SB-104. **Frequency Stability:** Less than 100 Hz drift per hour after thirty minute warmup. **Modes of Operation:** Remote VFO; Main VFO; Receive Remote/Transmit Main; Receive Main/Transmit Remote; Crystal frequencies (2) (crystals not supplied). **Dial Backlash:** 100 cycles max. **Power Requirements:** 11V and 13.6V at 500 mA from the SB-104. **RF Output:** 0.34 to 0.4V RMS over 5 to 5.5 MHz into a 50 ohm load.

SB-634 SPECIFICATIONS — CLOCK — Display: Six full digits. **Time Base:** 24 hours. **Accuracy:** Determined by accuracy of power line frequency. **TIMER — Display:** Three full digits. **Time Interval:** 10 minutes with automatic reset. Manual reset at any portion of 10-minute period. **Accuracy:** Determined by accuracy of power line frequency. **Signal:** Visual only or both visual and aural; switch selected. **RF POWER/SWR METER — Frequency Range:** 1.8 to 30 MHz. **Wattmeter Accuracy:** ±10% of full-scale reading. **Power Handling Capability:** 2000 watts (maximum). **SWR Sensitivity:** Less than 10 watts. **Impedance:** 50 ohm nominal. **SWR Bridge:** Continuous to 2000 watts P.P. **Connectors:** UHF type SO-239. **PHONE PATCH — Circuit:** Telephone hybrid circuit. Allows voice control or manual operation. **TELEPHONE LINES — Input Impedance:** Approximately 600 ohm. **Null Depth:** At least 30 dB isolation between transmit and receive circuits. **Receiver Impedance:** Effective match from 3 to 16 ohm. **Transmitter Impedance:** 600 ohm or higher impedance output. **GENERAL — Meter:** 100µA movement. VU readings for phone patch monitoring. Null depth indication. RF power output, relative power, and SWR readings. **FRONT PANEL CONTROLS — Timer:** Off, Visual, Aural Visual. **Reset:** Push-button switch. **Patch Gain:** Transmitter, Receiver. **SWR:** Sensitivity. **Mode:** SWR, Forward and Reflected. 2000 W and 200 W. Phone Patch. **Rear Panel Controls — Clock:** Time hold, minutes set, seconds set. Null Adjust control; Null-Monitor switch; C adjust control; R adjust control. **Power Requirements:** 120/240 VAC, 50/60 Hz, 15 watts.

SB-614 SPECIFICATIONS — RF SAMPLING SECTION: Frequency Coverage: 80 through 6 meters (3.5 − 54 MHz). **RF Power Limits:** Exciter input (50 − 75 ohm) 10 to 300 watts; Antenna input (50 − 75 ohm) 10 to 1000 watts (up to 1500W PEP). **Insertion Loss:** Negligible. **VERTICAL AMPLIFIER: Input Impedance:** 1 Megohm shunted by 75 pf. **Sensitivity:** 60 mV rms/¼" vertical deflection. **Attenuator:** 2 position; x1, 2 volts rms max. input; x10, 20 volts rms max. input. **Frequency Response:** 10 Hz to 50 kHz ±3 db. **HORIZONTAL AMPLIFIER: Input Impedance:** 1 Megohm shunted by 50 pf. **Sensitivity:** 50 mV rms/¼" horizontal deflection. **Frequency Response:** 10 Hz to 3 MHz ±3 dB. **SWEEP GENERATION: Type:** Recurrent, automatic sync. **Frequency Range:** 10 Hz to 10 kHz in three ranges. **GENERAL: CRT:** 3RP1/A flat face, green, medium persistence phosphor. **Graticule:** .250 inch squares 6 x 8 (1.5 x 2.0 inches total viewing area). **Power Supplies:** All solid-state rectifiers. All amplifier supplies regulated. **Power Requirements:** 110-130 or 220-260 VAC, 50/60 Hz, 35 watts. **Front Panel Controls:** Intensity — Off-on; Mode — SSB, TRAP, CROSS; Focus; Vertical Gain; Vertical Position; Horizontal Gain; Horizontal Position; Sweep — variable; Range — 100 Hz, 1 kHz, 10 kHz. **Rear Panel Controls:** Astigmatism; Vertical attenuator −X1, X10. **Rear Panel Connectors:** Antenna: SO-239; Exciter: Phono; Vertical Input: Phono; Horizontal Input: Phono. **DIMENSIONS:** 7¼" H x 10¼" W x 15¼"D. **Net Weight:** 12 lbs.

SB-230 SPECIFICATIONS: Band Coverage: 80, 40, 20, 15 and 10 meter amateur bands. **Maximum Power Input:** 1200 W PEP SSB; 1000 W CW; 400 watts RTTY/SSTV. **Duty Cycle: SSB:** continuous voice modulation; **CW:** continuous (max. key-down time 30 seconds); **RTTY/SSTV:** 50% (max. transmit time 10 minutes at 400 watts). **Driving Power Required:** less than 100 W. **Third Order Distortion:** −30 dB or better. **Output Impedance:** 50 ohms at 2:1 SWR max. **Input Impedance:** 52 ohms at 1.5:1 SWR max. **Meter Switch:** Exciter only; Relative Power; Plate Current; Grid Current; High Voltage. **Front Panel:** Load; Tune; Band; Relative Power sensitivity; Power switch; Meter switch. **Rear Panel:** ALC output; Exciter relay; RF input; RF output; Ground lug; Fuse; Line cord. **Tube:** Type 8873. **Zero signal plate current:** 25 mA. **Power Requirements:** 120 VAC, 50/60 Hz, 14 A max. 240 VAC, 50/60 Hz, 7 A max. **Dimensions:** 14¾" W x 16" D x 7" H. **Net Weight:** 33½ lbs.

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NEW SYSTEM-ENGINEERED

SB-604 Station Speaker

Designed and styled to match the new SB-104 Transceiver, the cabinet is large enough to house the HP-1144 AC Power Supply. The 5" x 7", 3.2 ohm speaker is response-tailored for SSB. Connector cable & plug are included.

Kit SB-604, Speaker & cabinet,
8 lbs., mailable **29.95**

HP-1144 Fixed-Station AC Power Supply

This new 120 V/240 VAC operated supply provides the 13.8 VDC required by the new SB-104 Transceiver. The full-wave bridge circuit has triple Darlington regulation with an integrated circuit which samples, compares, and automatically adjusts transistor bias to maintain a fixed output level. Output is remotely sampled at the load end of the power cable, thereby compensating for voltage drop across fuse and cable, to provide almost no change in voltage from no load to full load conditions. A cable and socket provide output power and a series connection to the SB-104 remote on-off switch. The generous heat sink fits on the back of the supply, and the entire unit may be mounted within the SB-604 speaker cabinet.

Kit HP-1144, fixed-station supply,
28 lbs., mailable **89.95**

SB-634 Station Console

Five station accessories in one!

24-hour digital clock: six half-inch gas discharge digits indicate hours, minutes and seconds. The clock runs continuously, as long as the console is plugged in.

Ten-minute ID timer: Three gas discharge digits indicate minutes and seconds up to 9:59. At ten minutes the timer recycles and provides either a visual alarm or both visual and audible alarms. Pushbutton zero reset.

RF wattmeter: The big meter delivers measuring capability of either 200 watts or 2000 watts full scale. 160 through 10 meters.

SWR bridge: Push a button to measure SWR. Separate front panel SWR sensitivity control.

Phone patch: The hybrid patch can be used either manually or with VOX control without switching connections. VU capability on the meter and separate front panel controls to adjust transmitter and receiver gain independently. Line isolation can be adjusted with a rear panel control.

Kit SB-634, 14 lbs. **179.95**

SB-644 Remote VFO

Designed exclusively for the new SB-104. The new SB-644 provides serious DXers with really useful split transmit/receive capability. With the "104/644" combination, you aren't frequency limited in any way — the transceiver can be at one end of the band, the remote VFO at the other end.

Multi-mode capability. The "644" allows transceive operation on either itself or the "104"... transmit on the "104" and receive on the "644" ...receive on the "104" and transmit on the "644". And you can use either of the two crystal positions in the "644" for fixed-frequency control.

Easy pushbutton operation. Front panel pushbuttons on the "644" control all transceive, transmit and receive modes on both the "104" and the remote VFO. No switching on the "104" is necessary. Status lamps behind the window indicate frequency-control mode.

Digital readout in the SB-104. Although the SB-644 includes a linear dial on its front panel to get you into the right frequency area, actual frequency readout takes place in the "104". The display automatically changes to the correct frequency as you go from transmit to receive.

Kit-built VFO. The "644" uses the same kit VFO as the new SB-104. And thanks to the true digital frequency readout in the "104", concern about dial VFO linearity problems is a thing of the past. If you work serious DX with your new SB-104, you'll want the new "644".

Kit SB-644, 10 lbs. **119.95**

SOLID-STATE ACCESSORIES

SB-614 Station Monitor

How clean is your signal? With the SB-614, you'll know. It monitors transmitted SSB, CW, and AM signals up to 1 kW from 80 — 6 meters. The highly visible 1½ x 2" CRT, with push-pull drive for a keystone-free, sharp, clean trace, indicates a wide variety of common operating problems. non-linearity, insufficient or excessive drive, poor carrier or sideband suppression, regeneration, parasitics and CW key clicks. The manual includes 40 CRT display illustrations and explanations.

Complete controls. All standard scope control functions are available in the "614"...Vertical Gain & Position, Horizontal Gain & Position, Focus, Mode (SSB, Trapezoid & Cross for RTTY Mark/Space adjustments). The improved recurrent, automatic sync-type sweep generator is adjustable in three ranges from 10 Hz to 10 kHz. Front panel control gives 11 steps of attenuation. For limited test applications the "614" can be used as a normal scope, and provides 10 Hz to 50 kHz bandwidth, good sync and high input sensitivity. A rear panel 10:1 vertical attenuator provides extra convenience.

Additional features include all solid-state design; rear panel Astigmatism control; standard horizontal and vertical inputs for use as a scope; exciter and linear inputs/outputs. Circuit board/wiring harness design makes assembly fast and easy. What kind of signal do you have? Order your new SB-614 today and know.

Kit SB-614, 17 lbs. **139.95**

SB-230 Conduction-Cooled 1 KW Linear

Strong and silent. The new "230" uses a husky Eimac 8873 triode in proven, stable, grounded grid circuitry to deliver up to 1200 watts PEP SSB, 1000 watts CW input from less than 100 watts drive. And the "230" is also rated at 400 watts input for slow-scan TV and RTTY. A massive heat sink eliminates the need for a fan.

Complete operating convenience. On the front panel of the new SB-series low profile cabinet you'll find all controls at your fingertips for easy operating. Bandswitching is done with a single knob...Load and Tune controls are clearly marked. Full metering facilities.

A full complement of built-in safety features. The cabinet features microswitch interlocks on both the top and bottom to shut down the primary power when the cabinet shells are removed. Front panel status lights indicate Hi Temp, Exciter and Delay. The heat sink for the 8873 is temperature monitored; if the temperature rises too high, a thermal circuit breaker opens, the linear shuts down and the Hi Temp light goes on. The Exciter light indicates that the linear is running straight through, without amplification. To allow the tube sufficient time to warm up, a delay circuit is built-in. When warm-up is completed, the Delay light goes out. The On-Off switch also includes a built-in circuit breaker for the primary side of the power transformer. And the cathode of the tube is fused for additional protection.

Easy assembly. The new SB-230 goes together in 15 to 20 hours. No alignment is necessary.

The new SB-230, styled to match the SB-104 transceiver, delivers all the features and performance you've come to expect from Heath. We think you will agree it's the greatest value in modern linears.

Kit SB-230, 40 lbs. **319.95**

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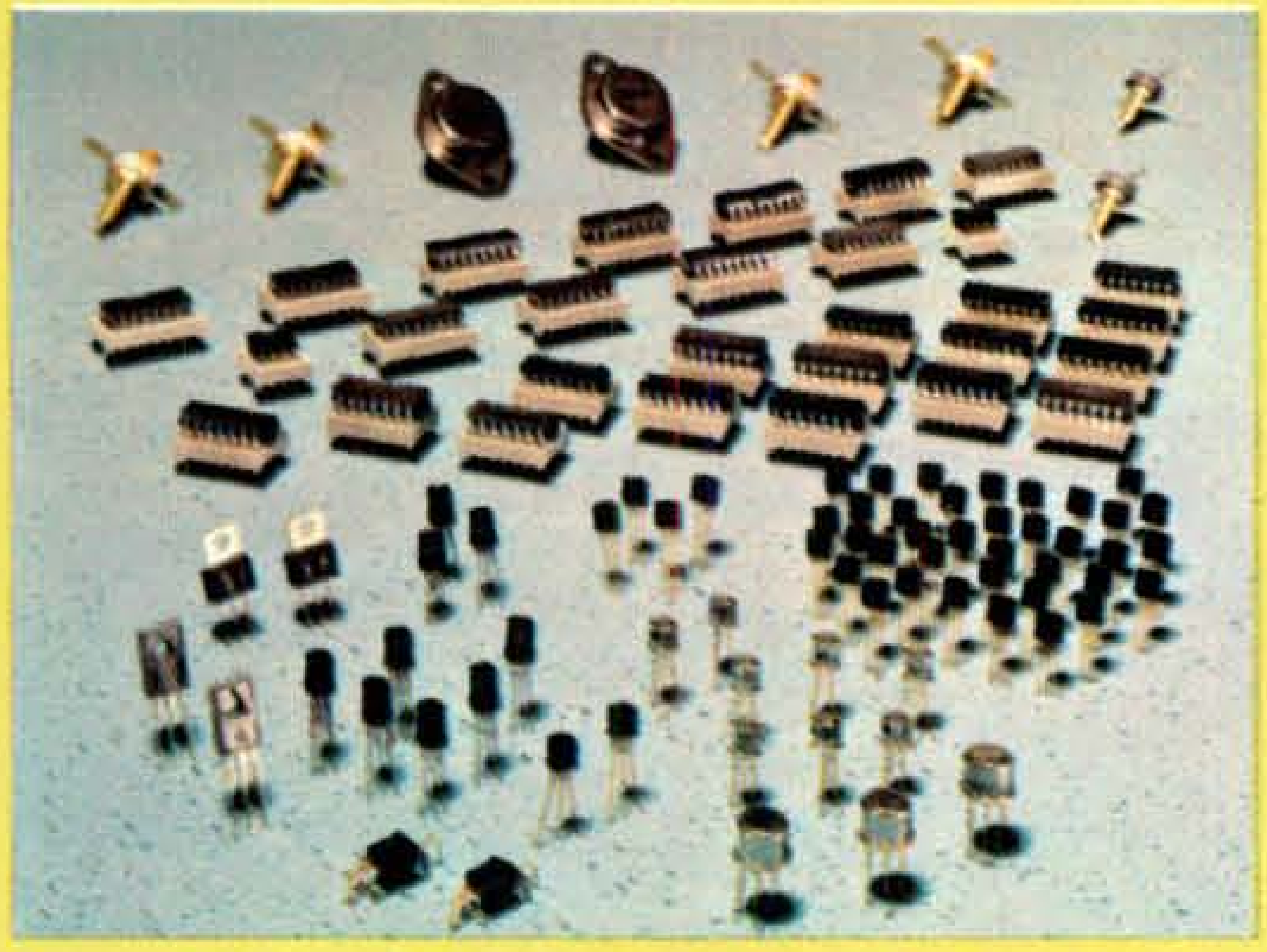
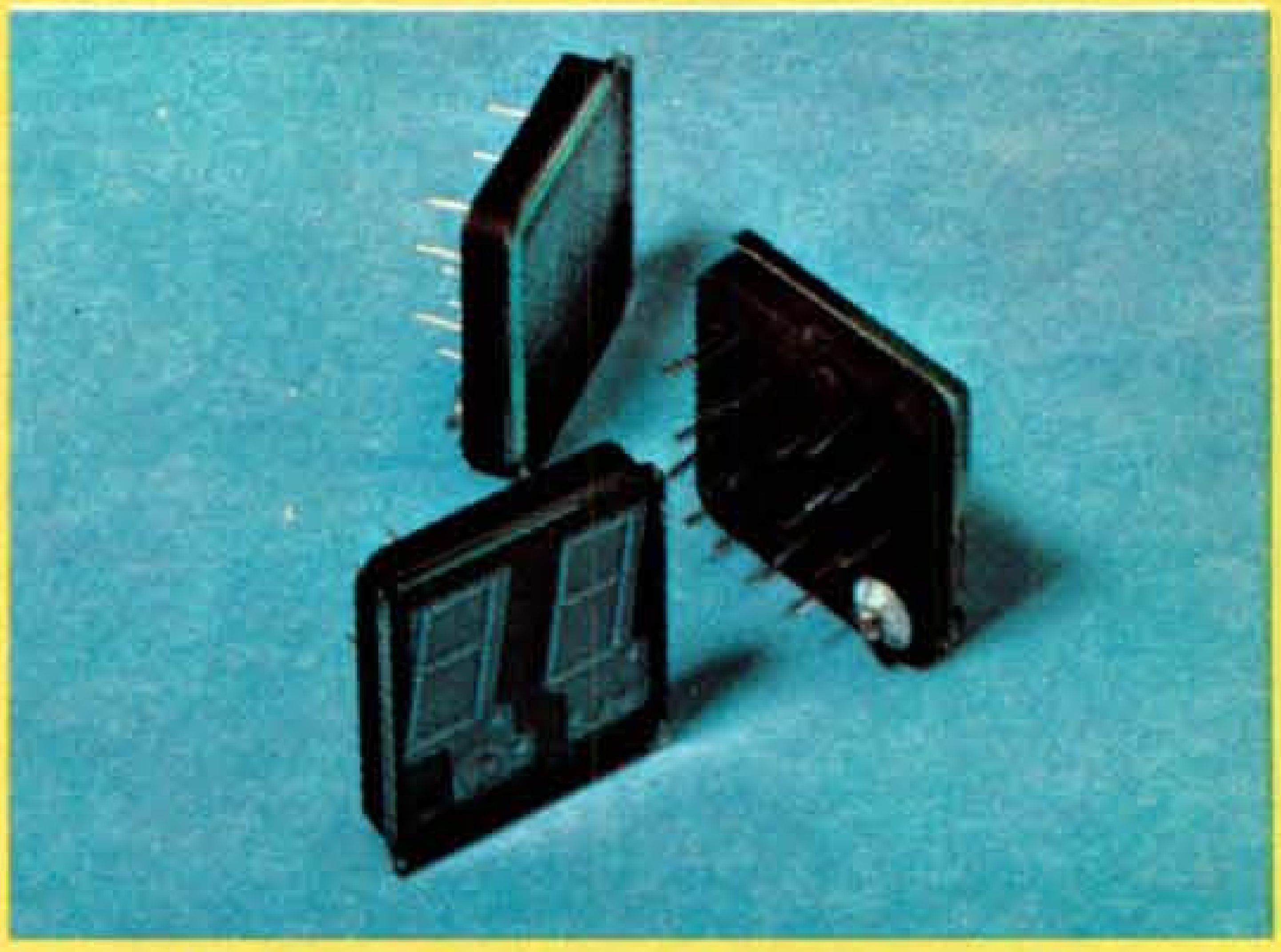
Prices & specifications subject to change without notice.

SS-103

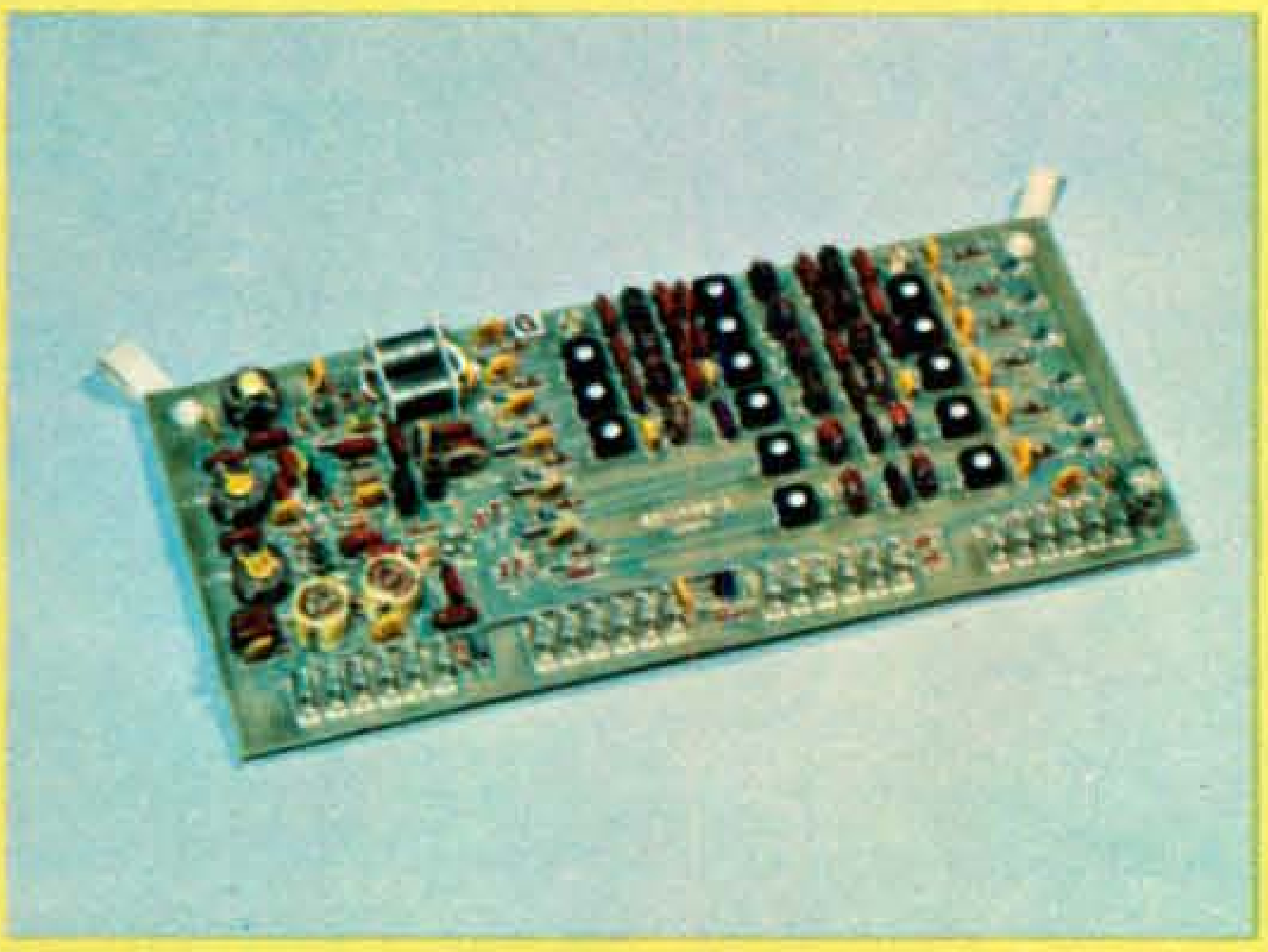
CHECK THESE ADVANCE DESIGN FEATURES:



Completely solid-state design...including the finals. Over 275 solid-state devices, including 31 integrated circuits. ***The SB-104 output board and final transistors are warranted for one full year.***



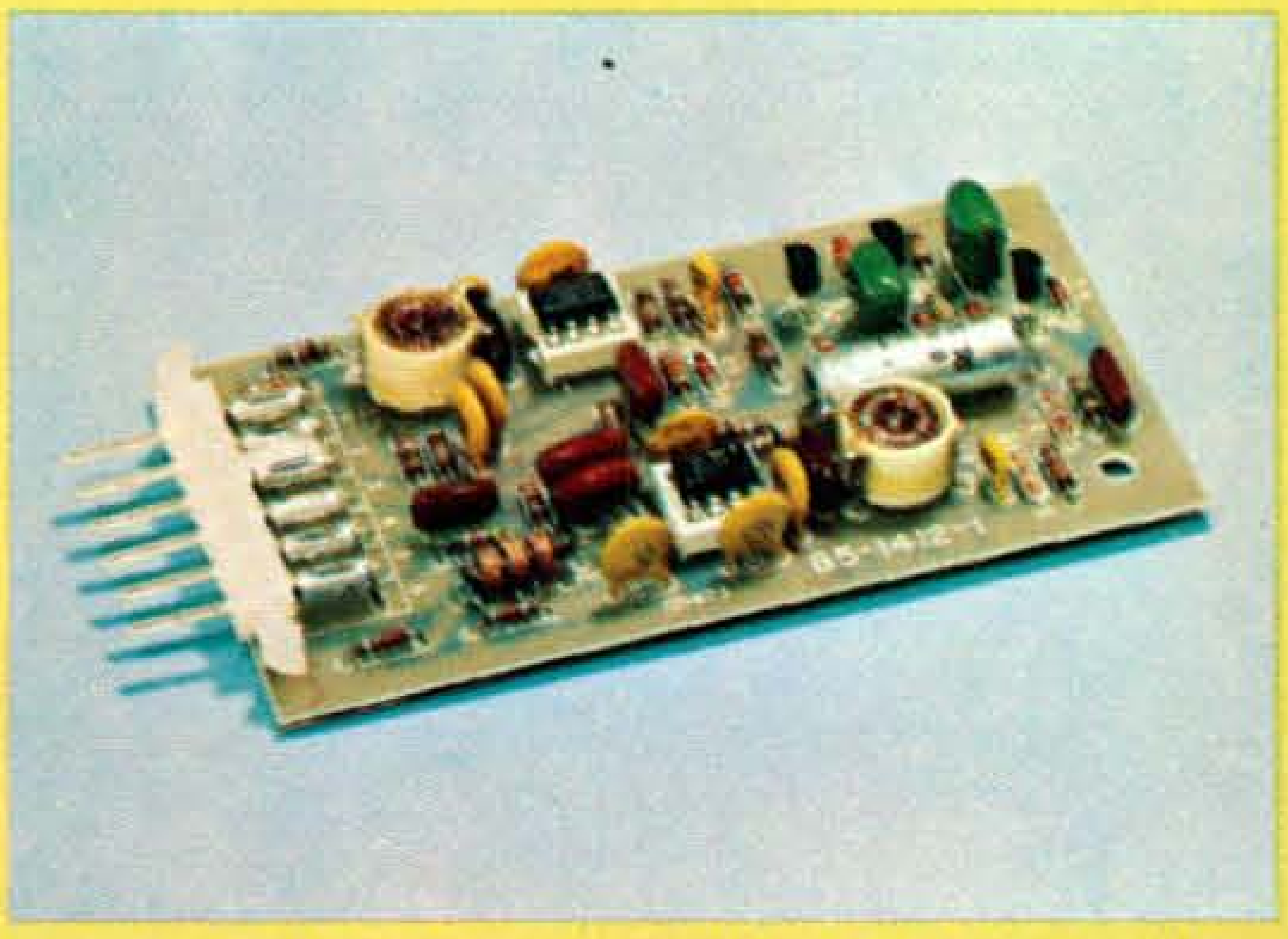
True digital readout. Six ½″ gas-discharge displays deliver resolution down to 100 Hz with across-the-room visibility.



Completely broadbanded. Neither the transmitter nor receiver sections require tuning from 3 to 30 MHz...instant QSY from 80 to 10 meters is a reality.

Circuit board construction. Most components mount on 15 circuit boards for easy assembly. The seven major boards can be extended out of the chassis for adjustment or troubleshooting while rig is operating.

Complete back-panel connections: Phone patch in & out; auxiliary audio input; speaker; key; ALC; VFO in & out; driver out; IF out; accessory plug; power plug; two spare jacks; separate transmit & receive antenna jacks.



New noise blanker plugs into SB-104 & solves the ignition noise problem. Provides up to 50 dB of effective blanking. Rep rate 10 to 2000 pulses/sec.; pulse widths 1 to 250 μsec.

LIFT

antennas

BY WILLIAM I. ORR,* W6SAI

"My friend, you look very sad." Pendergast tossed aside the copy of *Appliance Operator* magazine he had been reading and took his feet off the operating table. "I was just looking at the ads for the Pachenko machines."

"What's a Pachenko machine?," I asked.

"A Japanese transceiver with solid-state read-out. The word *Pachenko* means pin-ball machine in Japanese. You know, one of those things with lights and bells. Well . . ."

"I see the comparison," I said.

"Enough of this chatter. Tell old Pendergast your problem," said my friend.

"Well, old Pendergast, I sort of worked myself into a box with my recent *CQ* columns," I replied. "In the last few issues I discussed the so-called invisible antenna and the problems some hams have in erecting a good antenna in the face of building restrictions, suspicious landlords and the like. Obviously I hit a vital point. Some hams have single story homes with a height limit of 16 to 26 feet on buildings and accessories. Some have a restriction on antennas of any kind. It's a tough situation."

"Well, how about the good old, reliable ground plane antenna," demanded Pendergast. "That's not very high for 20 or 15 meters, and it is inconspicuous. In fact, *you* have one of them, don't you?"

"Yes," I admitted. "I have a 21 mHz ground plane at my vacation spot and it has worked well for years. The base is very close to the ground however, and I have always been very uneasy about it, especially after reading W2FMI's very fine series of articles about vertical antenna systems in *QST* over the past few years. Jerry proved that a ground-mounted vertical antenna needed a large number of radials before it worked efficiently. The garden variety of amateur ground plane—with 3 or 4 radials—mounted close to the ground exhibited about 8 db less signal strength than a similar antenna mounted over a good ground plane."

"Yes," said Pendergast. "I remember you saying in your September *CQ* Antenna column that a ground plane vertical is only half of an antenna system and the ground radials (or screen) make up the other half."

"Right," I replied. "Well, to try and get around the problem, and to make a better low-profile antenna, I could either add a lot of radials, or try another approach. So I took down the 21 mHz ground plane—it only had 4 radials—and in its place I put up a vertically polarized Quad loop antenna (fig. 1) at about the same height. The Quad loop exhibits about 3 db gain over a ground plane and the loop is a complete antenna so the electric field does not have to penetrate the earth to reach the missing portion of the antenna, as is the case with the ground plane. The loop antenna, in itself, is a complete entity. Hopefully, then, the electric field losses inherent in the ground

*48 Campbell Lane, Menlo Park, CA 94025.

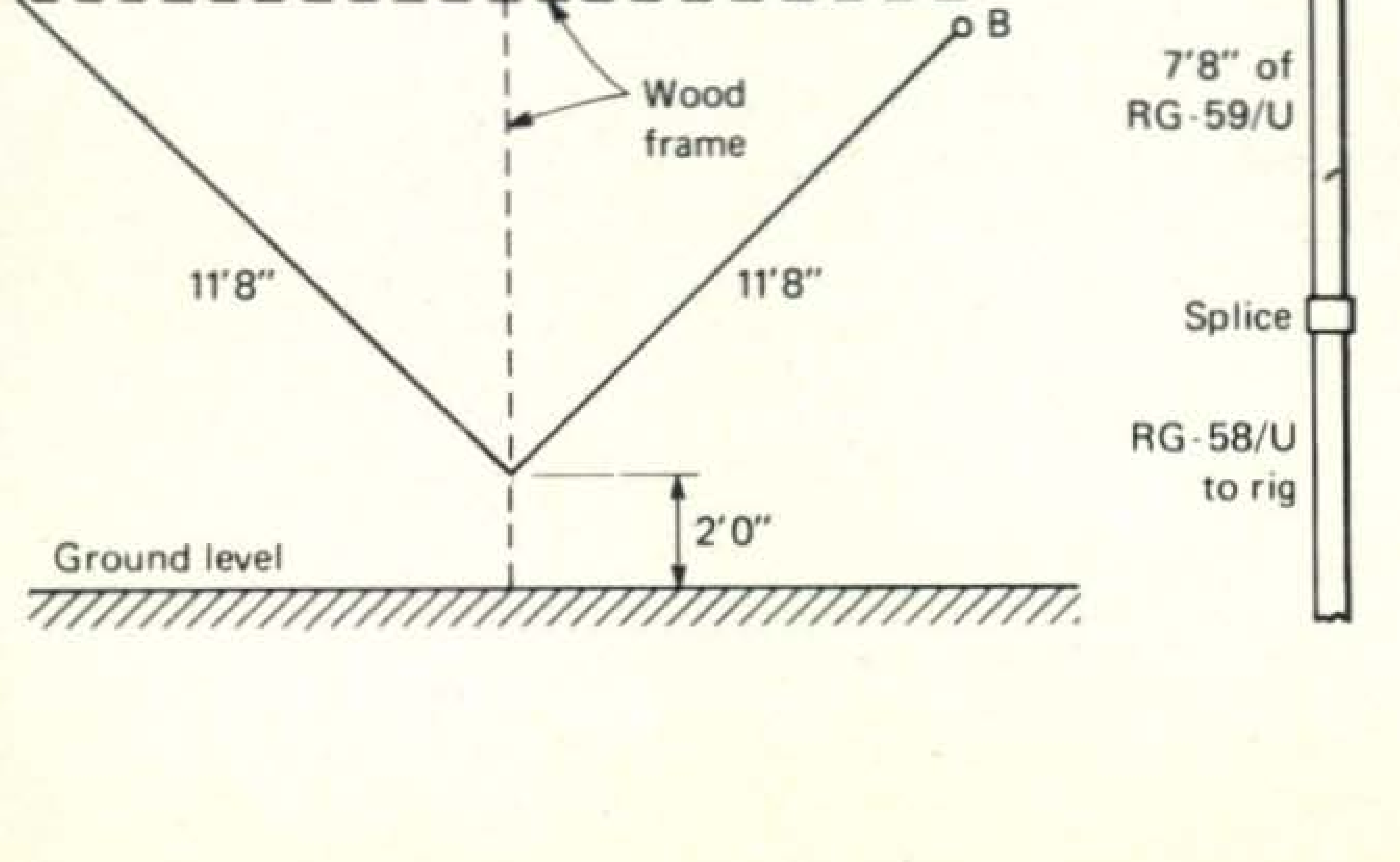


Fig. 1—The single quad loop antenna. This experimental loop antenna was mounted on a wood mast about 18 feet high. Loop was made of #18 wire, 11'8" on a side. The low point of the loop was about 2 feet clear of the ground. For vertical polarization, the loop was fed at one corner (A-B) with one-to-one balun and a quarter-wavelength Q-section made of 7'8" of RG-59/U line (75 ohms). The transmission line was RG-58/U (50 ohms). The measured s.w.r. at 21.2 mHz was 1.3. Raising the loop so that the bottom was 6 feet above the ground raised the s.w.r. to 1.8 at 21.2 mHz. The loop is directional broadside, with minor lobes in the plane of the loop. The balun and feedline are dressed along the horizontal arm back to the center of the loop, then drop down the mast to ground level.

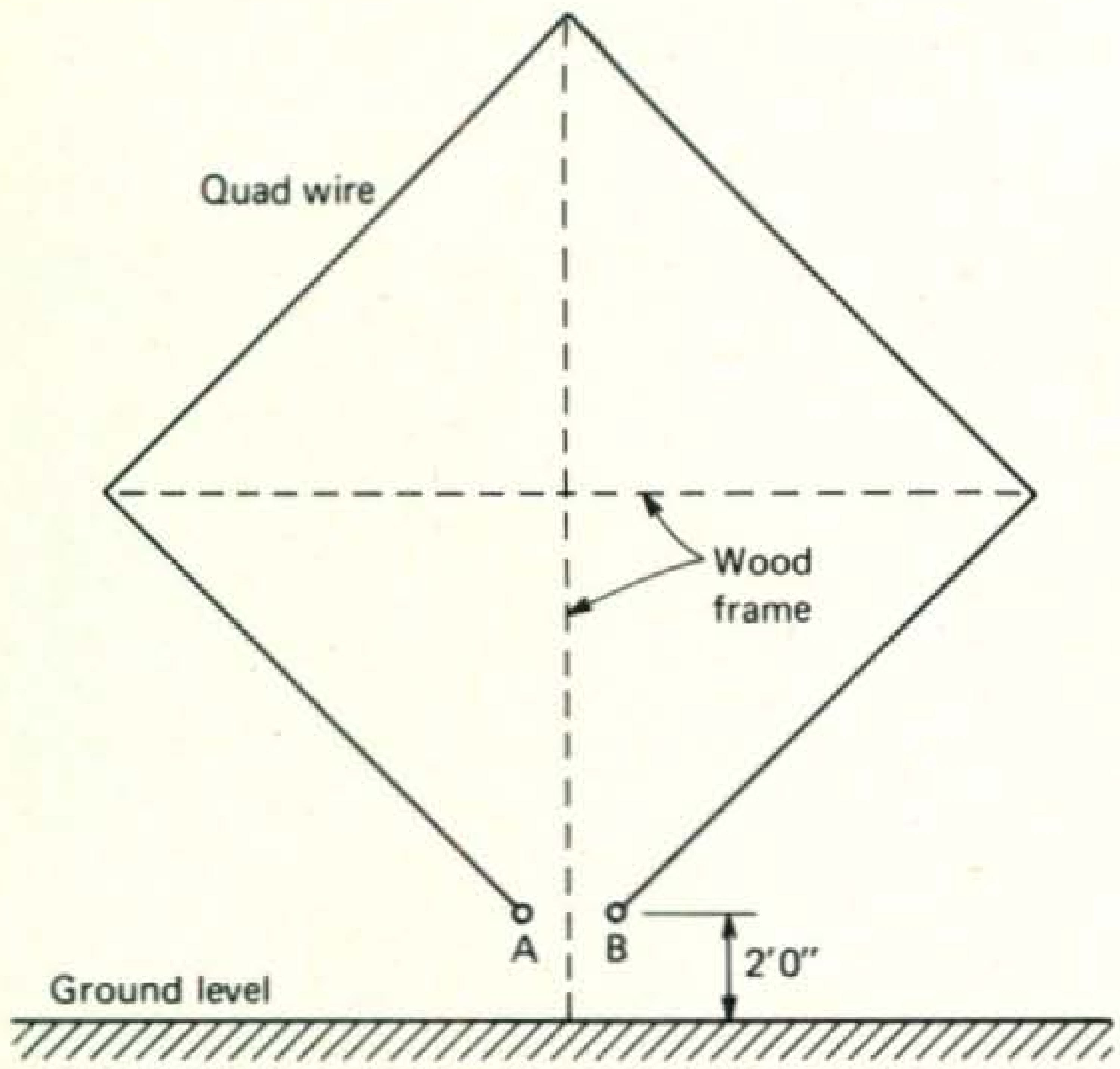


Fig. 2—The horizontally polarized loop. The loop of fig. 1 was revised to provide horizontal polarization by feeding it at the base (A-B). Dimensions of loop and matching line remain the same. The line was brought down to the ground and led away from the loop at ground level. This low loop proved to be much better than a ground plane antenna with 4 radials mounted at the same base height.

adjacent to the vertical loop are less than those encountered with a ground plane. I reasoned that I could eliminate all radials and at the same time end up with a better antenna."

"How did the Quad loop work?," asked Pendergast.

"After the loop was up, I used it for some weeks. I immediately noticed better results in that my ratio of replies to calls went up, and I was able to work appreciably more DX with less effort than before. I would estimate that I was getting better than the 3 db gain I had hoped for, as compared to the ground plane."

"Hurrah!," said Pendergast. "You have invented the better mousetrap. The ground plane is relegated to the junk box."

I ignored the thrust, and continued. "My next experiment was to change from vertical to horizontal polarization by feeding the loop at the bottom (fig. 2). It worked even better; it seemed that I could almost compete with the big boys. So I decided to dismantle the whole antenna and bring it home with me and make direct comparisons against my 3 element Yagi on a 45 foot tower. This would be the supreme test.

"And that's exactly what I did. I reassembled the loop and tested it against the beam, both for horizontal and for vertical polarization. The results were certainly very interesting."

Pendergast bounced up and down in his chair. "What happened?", he asked. "Don't tell me the loop down close to the ground was as good, or better than, your beam up 45 feet?"

I sighed. "It really was a very unscientific experiment. I checked the antennas on receiving and asked for comparative reports on transmitting. My own S-meter is calibrated at about 4 decibels per S-unit, but I couldn't tell just how the S-meter at the other end of the circuit was calibrated. In any event, I came to the conclusion that the vertically polarized loop close to the ground was about 12 db down in signal strength from the beam. That's about 3 to 4 S-units. And the loop exhibited a lot more fading on DX signals.

"Three to four S-units worse?," yelled Pendergast. "No way!"

I continued. "After these tests, I switched the loop over to horizontal polarization and ran some tests. This loop was better, markedly, but still about 10 decibels down in signal strength compared to the beam."

There was a long silence. Finally, Pendergast sighed heavily and said, "Let me get this straight. The vertically polarized loop was at least 3 db better than the ground plane and the horizontally polarized loop was better than the vertical one."

"Right," I said.

"Well, then," Pendergast continued triumphantly, "what you are saying is that the ground plane is the worst of the lot, and probably about 13 to 15 decibels *weaker* than a good beam!"

"Let's not play decibelmanship," I replied, "But that seems to be a good guess. But if the ground plane is so bad, why is it that many stations have worked plenty of DX with it? The answer, I think, is that *most of the fellows that have had success with the ground plane antenna have mounted it high in the air,* where it radiation angle and behavior are more like a vertical dipole and where the ground losses are much less. Remember, my ground plane was very close to the earth."

I rummaged through a stack of magazines on the desk. "One of the unsung heros in the vertical antenna game was VE3AAZ. He generated a computer program to determine the effect of ground loss on vertical antennas. His article is in June, 1965 issue of *QST*. I suggest you read it.

"In his computer program, working from known radiation patterns and given amounts of ground loss, VE3AAZ — among other tests — compared a horizontal dipole antenna to a vertical antenna and to a ground plane at different elevations and found that the vertical dipole, whose center was ½-wavelength above ground compared favorably with a ground plane antenna at a takeoff angle of 10 degrees, there being less than one decibel difference between the two. VE3AAZ also computed that a vertical antenna two wavelengths high had a 5 db to 8 db advantage over a ground plane antenna mounted at ground level. Finally, he computed hy-gain

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264 High efficiency, vertically polarized omnidirectional roof top whip. 3 db gain. Base matching coil for perfect 52 ohm match. DC ground. Coax and connector furnished.

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261 Same as above, with 18′ coax and connector.

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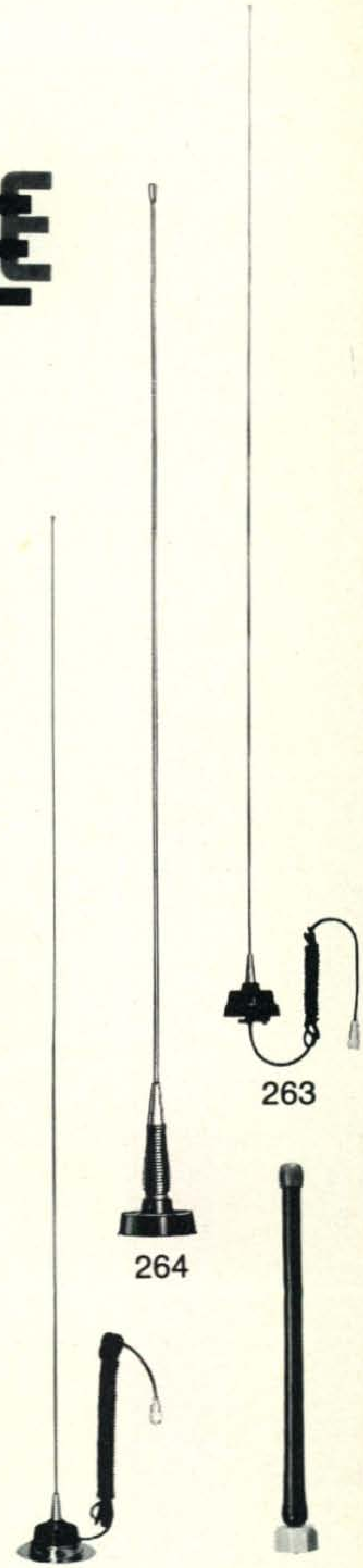

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that a horizontal dipole at a height of 2 wavelengths had a 2.5 db advantage over a vertical antenna whose center was at the same height. Thus, *the horizontal antenna 2 wavelengths high has an advantage of 7.5 db to 10.5 db over a ground plane antenna, mounted close to the earth,* at least for a takeoff angle of 10 degrees (fig. 3).

"Of course, the gain figures vary with elevation and takeoff angle, but I picked the values I did because my beam is just about 2 wavelengths above ground.

"Now, I know my beam has a power gain of 7.5 db over a dipole. So that makes my beam 15 db to 18 db better than a ground-mounted ground plane, at least on paper. And going one step further, it looks as if my beam is about 10 db to 13 db better than the low. horizontally polarized Quad loop. And that range of figures agrees fairly well with my estimate based upon signal reports and listening tests."

Pendergast shuddered. "How can you work any DX if you give away 10 db or more to your competition?"

"Don't forget that this is a paper argument," I replied. "But the computer study of VE3AAZ does agree with what I found out the hard way. Even so, the ionosphere is a great leveler of signals.

"In the conclusion of his article, VE3AAZ says, 'there seems to be very little to be said for vertical polarization except for the non-directional feature.' He was talking about h.f., not v.h.f., of course."

"You both are certainly shooting the popular ground plane antenna down in flames," said my friend. "It sounds as if you couldn't punch your way out of a paper bag with it."

"That's part of the game," I replied. "I do know the vertical loop, close to the ground, is better than a ground plane at the same height above ground. And the horizontal loop is better than the vertical loop. The whole picture is rather confusing, but it is possible to draw some interesting conclusions from the whole exercise."

"And these conclusions are?," asked Pendergast.

"Simply this. If you are restricted to a ground plane for the h.f. bands for esthetic or other reasons, you should either get it high in the air, where it will work with a few radials, or use a half-wave vertical antenna. If the ground plane must be mounted close to the ground, because of necessity, use plenty of radials on it. Read W2FMI's series of *QST* articles on this subject.

"If you can go to a Quad loop, even though it is close to the ground, it will perform better than the ground plane antenna. Horizontal loop polarization, moreover, seems to outperform vertical polarization. It still might be a good idea to put a radial system under the loop. I feel sure it will help, especially with vertical polarization, but I haven't tried it."

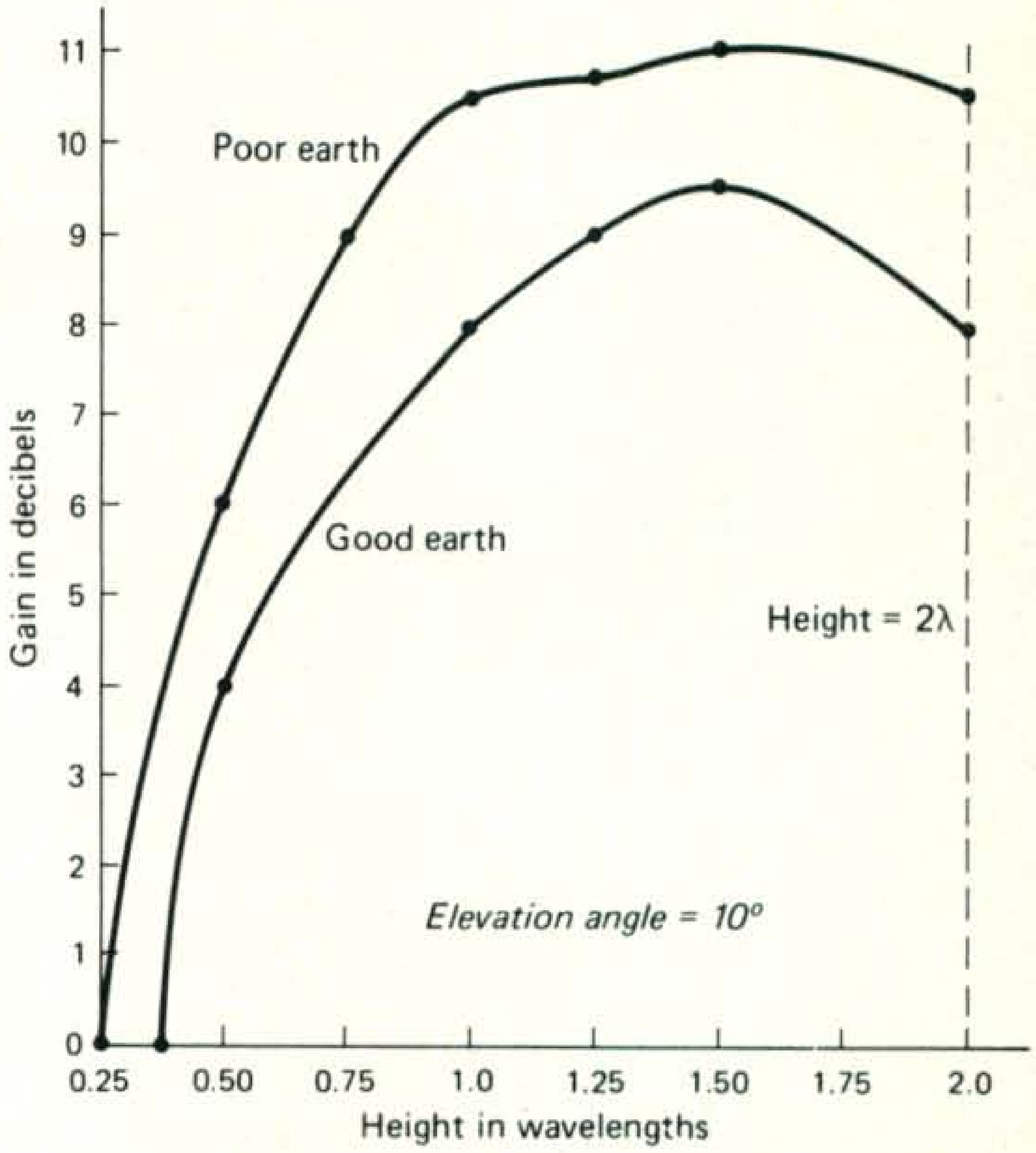

Fig. 3—Horizontal dipole outperforms ground-plane antenna. The horizontal dipole consistently provides a better signal at an elevation angle of 10 degrees above the horizontal that does a vertical dipole antenna whose center is ¼-wavelength above ground. At a height of 2 wavelengths, for example, the horizontal dipole is from 7.5 db to 10.5 db better than the vertical, depending upon ground conductivity. (Data extracted from "Antenna Behavior Over Real Earth," by W. H. Anderson, VE3AAZ, *QST*, June, 1965).

"The closer to the ground, the greater the need for radials," said Pendergast.

"Apparently that's so," I responded. "I would like to hear from readers of this column who have used a ground plane or half-wave vertical on the h.f. DX bands with success. It would be interesting to see how they worked out, DX-wise."

"Are you going to give a freebie?," asked Pendergast.

[*continued on page 66*]

Mako ...by JA3OVM

Mako meets a smooth-talking operator.

DX

Cesar, CR3WB, is active from Bissau, the capitol city of the Republic of Guinea. *(Tnx CT1UA.)*

BY JOHN A. ATTAWAY,* K4IIF

LATE summer and early fall have brought several outstanding DX Meetings across the country. In July, the ARRL National Convention contained a full schedule of DX activities which were attended by over 400 DXers. Meetings featured Bob and Ellen White of the ARRL DXCC, Rich, FP8AA, DXing with OSCAR by K2BZT, George, WB2AQC on "Visiting the Balkan Amateurs," Jim, W2PV, on high efficiency antennas, Don, XU1DX, and Ted, W3UMF, on propagation. As usual, the unofficial hospitality suites were packed and plenty of beverage was consumed! The Banquet was even exciting due to an unexpected "Streaker." The W9 DXCC Meeting was held on September 21st, near Chicago, and featured W9RX on 40 and 80 meter propagation, K9LTN on towers and zoning, WA9UCE with slides of the Kingman Reef DXpedition, Bob White on DXCC and LU5HFI with a special program. This program was sponsored by the North Illinois DX Association. The National Capitol DX Association held DXPO 74 near Washington, D.C., on September 28th. Featured speakers included, W3ASK and W4UMF on propagation, W3KT and W4WSF on QSL bureaus, KV4FZ on 160 meter DXing, W3BWZ and W1CW on the DXCC Advisory Committee, W1ICP on RFI, XE1IIJ on contest operating, W6OAT with a Kingman Reef presentation and LU5HFI with his special adventure.

In October, the New England DX Meeting was held with programs by ARRL DX personnel and a Kingman Reef presentation.

Wow, that's quite a banquet circuit; we hope many DXers were able to enjoy these fine programs.

*P.O. Box 1271, Covina, CA 91722

The CQ DX Award Program

C.W. DX

161......G3FVC

2XSSB DX

361......9Q5RK
362......I5XRR
363......GW4BLE
364......I5FCK
365......DK4FW

Complete rules and application forms for the *CQ* DX Award Program may be obtained by sending a business size, self-addressed, stamped envelope to DX Editor, P.O. Box 1271, Covina, CA 91722.

CQ WW Contest DXpeditions

Six members of the South Jersey Radio Association hope to activate Navassa Island for the **CQ** WW CW Contest. Landing on Navassa is quite difficult as the Island is quite rugged.

KH6HDA and WB6CZB hoped to operate from the Tokelau Islands during the month of October. The calls ZM7AI and ZM7AH were issued, however, transportation to the Islands is difficult to arrange. Tom (KH6HDA) and Jim (WB6CZB) hoped to be able to operate during the *CQ* WW Phone Contest using the call ZM7AJ.

Rich (K2OJD) activated FP8AA during the *CQ* WW Phone Contest. Before the contest, SSTV and 2-meter f.m. operation were also attempted.

The Richardson Wireless Klub of Texas activated the special call VP2G during the *CQ* WW Phone Test.

Martin (OH2BH) again operated from ZD3X in the **CQ** WW Phone Test and was active on 160 through 10 meters.

Canadian DX Association member VE3EZM is making a DXpedition through Oceania and the Caribbean which included *CQ* WW Phone Contest operation from VR1 and c.w. planned from 3D2. Other stops include KJ6, KX6, C21, A35, VK2, ZL, ZK1, PJ2, 8P6, VP2K, VP2V and VP5. Main frequencies will be 14.150 and 14.195 s.s.b. All QSL's go to VE3GUS.

A DXpedition to Bajo Nuevo is being planned by WA6AHF, WA6JZL and several KZ5's for the last week in November, and will hopefully include the *CQ* WW CW Contest.

The Northern Illinois DX Assn. was pleased to host an active DXer, Ahmed, AP2AD, in June. L. to R.: Brian WA9LZA, NIDXA Secty., AP2AD, and Tom, W9ILW, CQ SSB DX Award Honor Roll member.

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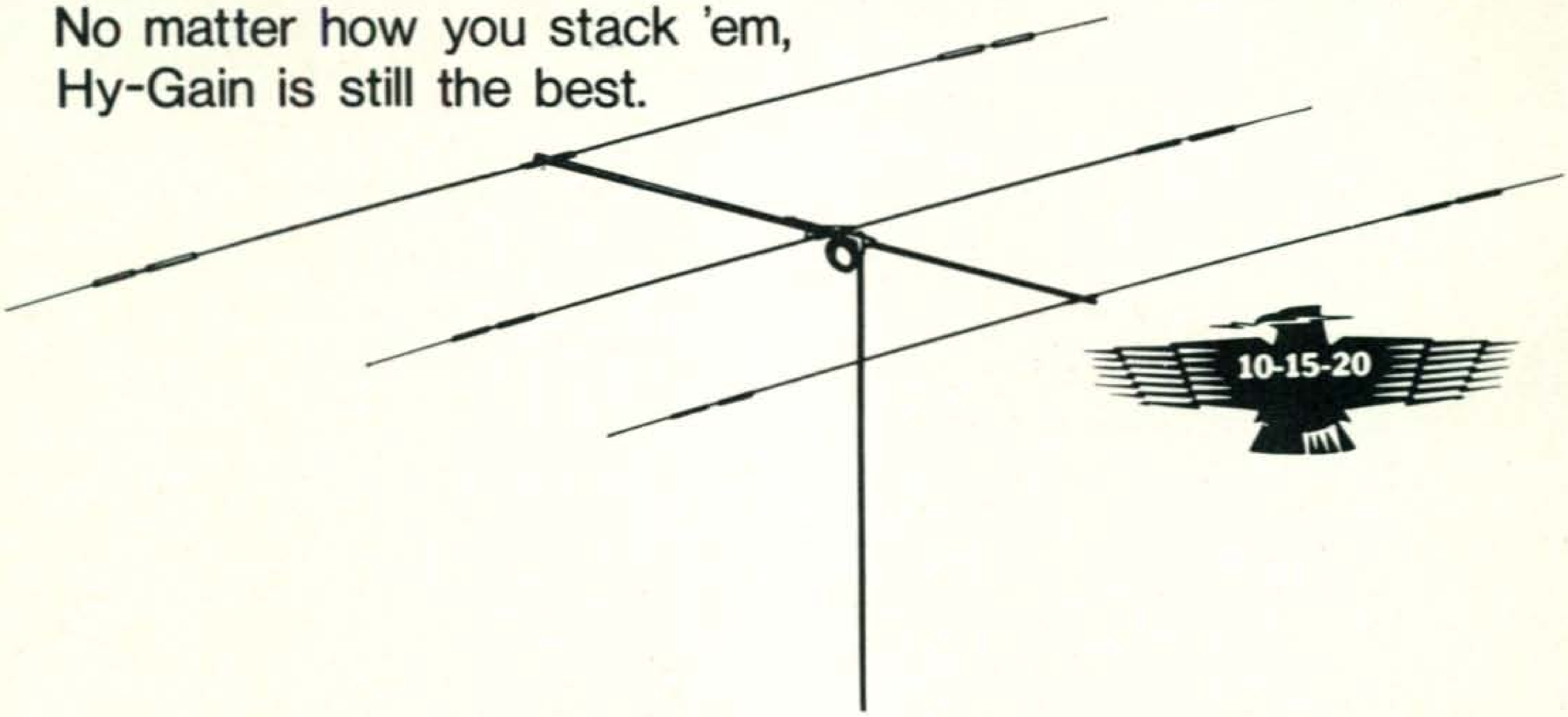

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- Up to 8 db gain.
- 20-25 db front-to-back.
- VSWR less than 1.5:1 at resonance.
- 1 KW AM, 2 KW PEP power capability.
- Turning radius...15.7'.
- Net weight...36 lbs.
- Boom length...14'.
- Longest element...27'.
- Surface area...5.1 sq. ft.
- Nominal 50 ohm input.

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CQ DX AWARD HONOR ROLL

The *CQ* DX Award Honor Roll recognizes those DXers who have submitted proof of confirmation with 275 or more countries for the mode indicated. The ARRL DXCC Country List, LESS DELETED COUNTRIES, is used as the country standard. The total number of current countries on the DXCC list as of this listing is 321 with the addition of Kingman Reef, however no credits have been added as of press date.

C.W.

W6PT 319	W4YWX 309	W0AUB 304	DL3RK 298	K1SHN 289
K6EC 315	W4IC 308	W6ISQ 303	W4BQY 295	WA6EPQ 288
W6ID 315	W9DWQ 305	K6LEB 302	W6NJU 294	WA8DXA 287
W8KPL 314	ON4QX 304	VK3AHQ 301	WA6MWG 292	DJ7CX 281
W8LY 310				

2XSSB

W2TP 319	G3FKM 313	VE3GMT 307	WB6DXU 299	DL6KG 287
IØAMU 318	I8AA 313	K3GKU 307	HP1JC 298	K1KNQ 287
TI2HP 318	I8KDB 313	WA6MWG 307	WØYDB 298	DL1MD 286
W2RGV 318	SM6CKS 313	F9MS 306	K4HJE 297	OE3WWB 286
DL9OH 317	W2QK 313	K6EC 306	W6FW 297	K8GQG 286
WA2RAU 317	W6EL 313	W9QLD 306	W9KRU 297	W3CRE 284
K2FL 316	W6KTE 313	XE1AE 306	YV1KZ 296	W9OHH 284
W4NJF 316	W6RKP 313	OZ3SK 305	G3RWQ 295	W8ZOK 283
SM5SB 315	K6WR 313	KH6BB 305	YS1O 295	DK1FW 282
W4SSU 315	W9JT 313	VE2WY 304	K1SHN 294	VA7WJ 282
W6EUF 315	WA2EOQ 312	W2CNQ 304	WAØCPX 293	WB6PNB 282
W6REH 315	K4MQG 312	G3DO 303	I8YRK 291	W6TCQ 282
IT9JT 314	F2MO 311	WA6AHF 303	WØSFU 291	WA2VEG 280
VE3MR 314	W6NJU 310	ZL1AGO 303	G3KYF 290	W6FET 280
W3AZD 314	ZL3NS 310	VE3MJ 302	WB2RLK 290	OK1MP 279
W3NKM 314	ZS6LW 310	W6KZS 302	XE2YP 289	W6HUR 279
W4IC 314	W3DJZ 309	OE2EGL 301	YV1LA 289	I1WT 275
W9DWQ 314	W6YMV 309	SM6CWK 301	OE1FF 288	VE7HP 275
W9ILW 314	IØZV 308	WA2HSX 301	WAØKDI 288	W5QBM 275
F9RM 313	K4RTA 308	WA3IKK 299	DJ7CX 287	

WPX News

The late summer and early fall were busy times for WPXers as many special prefixes have been activated. Thanks to W4LRN, *West Coast DX Bulletin* and *Long Island DX Club Bulletin* for the majority of the WPX information shown below:

CY2—Special CY2 calls were issued in Quebec, Canada, to publicize an International French Youth Festival.

FYØ—FYØBHK (F5IQ) and FYØBHI (F5QQ) have been reported active on the 20 meter c.w. Band.

KL2—KL2ARW was authorized to celebrate Amateur Radio Week in New York and 2280 QSO's were made with 49 states.

KX8—The special KX8BCF was used in September for the Belmont County Fair in Ohio.

KS9—The call KS9EAA was used for the meeting of the Experimental Aircraft Association.

PZØ—The Caribbean Scout Jamboree used the special call PZØCJ.

SQ—Polish amateurs are authorized to use the SQ prefix in commemoration of 30 years of the Polish Peoples Republic.

R—In August, the USSR Radio Magazine commemorated 50 years of Amateur Radio by use of prefixes R1 through RØ. Operation was limited to August 3 and 4.

U3Ø—Several special prefixes such as UC3ØWI and UP3ØKA were activated to commemorate World War II battles.

WC1—The call WC1CMC was used in New Hampshire for the North-East Wheelchair Games.

WW3—The 8th Annual Festival of American Folklore in Washington, D.C., was authorized the call WW3FAF during July.

WG4—The Kentucky Bicentennial Festival used the call WG4TWN during October.

WX4—The Annual Neptune Festival used the special WX4NEP during September from Virginia Beach. Operation was by the members of the Virginia Century Club.

WMØ—WMØSF was used for the Missouri State Fair.

7SL—Several 7SL2 prefixes (7SL2AO and 7SL-2AN) were worked and commemorate the 350th anniversary of famous Swedish regiments. These prefixes count for 7SØ for WPX!

Here and There in the World of DX

Caribbean DXpeditioner K6SE/2 hopes to operate from HH2WF from January 16-19, 1975. Frequencies will be 3900, 7230, 14280, 21360 and 28600 (if open)—c.w. calls will be acknowl-

The WAZ Program

S.S.B. WAZ

1220 W6PSQ	
1221 EA3NA	1223 DL3RK
1222 DL2IT	1224 WB9EBO

C.W.—Phone WAZ

3742 K8UNG	3749 UM8FM
3743 WA9RRN	3750 UK5EAE
3744 DM4XXH	3751 UK2GAN
3745 DA2TR	3752 UK0FAA
3746 DJ5AI	3753 OK2BLG
3747 DK4PE	3754 OK1KZ
3748 UT5WW	3755 YU2NU

Phone WAZ

498 DJ1TC	499 I3VER

Complete rules for the Single Band WAZ program are shown on pgs. 57-58 of the December, 1972 issue of *CQ*. Complete rules for regular WAZ may be found on pgs. 64-66 of the June, 1970 issue. Application blanks and reprints of the rules for WAZ awards may be obtained by sending a self-addressed, stamped envelope to the Assistant DX Editor, P.O. Box 205, Winter Haven, FL 33880.

Al, 5X5NA (left) was the first station to be awarded the Western Washington DX Club Totem Award. The certificate was delivered by Norm, W7LFA who was on an African Safari.

edged on the s.s.b. frequencies. QSL's will be handled by WA2JDT.

WØMHK has 1200 QSO's from VP2MHK in June and was surprised by the number of "First VP2M" comments received. Bill states that operating tactics of W/K's were generally good.

The North Florida DX Association will activate VP5WW from Providenciales during the *CQ* WW Phone Test in October.

W6CUF, QSL Manager for W6BHY operations from ZD8Z, 9Y4AA, 9Z4AA, KB6DA, VR1W and 4M4UA, intends to close the logs for these operations on July 1, 1975.

The Western Washington DX Club has a special club antenna kit with plenty of muscle to raise member's beams or make necessary repairs!

The Southern California and Mexico Amateur Radio Mobile Group, known as "Colegas y Amigos" made their 12th annual trip to Ensenada B.C., Mexico, on October 5-6, and again donated many items to the Chiquita Semilla (deaf-mute) school in Ensenada.

New officers for the Potomac Valley Radio Club are: President—W3LPL, VP—W9SZR/3, Treasurer and *CQ* DX Committee member—W4WSF and Secretary—WA3HRV.

The WPX Program

Mixed

451......K6AAW
452......WA5SPC
453......YU1BCD
454......WA9UEK
455......UY5OQ

S.S.B.

813......PY1CHP
814......YU1BCD
815......DK4OG
816......WB4SPG

C.W.

1342......W6RQZ
1343......G3JFC
1344......OK3TCA
1345......OK2BON
1346......WA7OBL
1347......WB4SPG
1348......UA3TAM
1349......UV9DO
1350......UA9AAP
1351......DK1OU

VPX

77......UB5-059-105
78......UB5-078-158

Endorsements

Mixed: W4LRN-1400, WB2FMK-1000, W4WSF, W4IC-950, YU1BCD-900, WA2EAH-800, WA5VDH-750, K3SXQ-650, W2FVS, W6KYA-550, UY5OQ-500, WA9UEK-450

SSB: HP1JC-900, IØZV, W4WSF-850, W3DJZ, F2MO-800, W8GKM, WA6AHF-750, YU1BCD, W2EHB-650, WA1KYW, W6TTS-600, WA5VDH-550, WA6-ESB-500, VK3SM, WB4SPG-450

CW: W9FD-900, W3ARK-800, YU1BCD-750, VE1MF-600, WØTDR-550, WA2EAH, VO1KE, W2FVS-500, DJ2IW, OK3TCA, OK2BON, WA4SPG-450, K4CK-400, G3JFC-350

VPX: SM4-3434-600, I1-12487-350

80 Meters: YU1BCD

40 Meters: YU1BCD, WA2EAH, VO1KE, W4WSF

20 Meters: YU1BCD, UA3TAM

15 Meters: YU1BCD, W4HHN

10 Meters: YU1BCD

Africa: YU1BCD, I8YRK, W8IBX

Asia: YU1BCD, I8YRK, DJ2IW

Europe: YU1BCD, I8YRK, WØMHK, UV9DO, UA3TAM, DK1OU

North America: YU1BCD, I8YRK, WB8AAX, W2EHB

Oceania: YU1BCD, I8YRK

South America: YU1BCD, I8YRK, W2EHB

Complete rules for WPX, WPNX and VPX may be found on page 67 of the February 1972 issue of *CQ*. Application forms and reprints of the rules may be obtained by sending a business size, self-addressed, stamped envelope to WPX Award Manager, P.O. Box 1271, Covina, CA 91722—USA.

160 Meter News

The 1974/1975 Trans-Atlantic and Trans-Pacific 160 Meter DX Tests will be held as shown below. A special effort will be made to help "first time" QSO's between continents by new 160 meter DXers. An s.a.s.e. sent to W1BB will provide more details.

42nd Annual TransAtlantic 74/75 160 Meter "First-Timers" DX Tests

DATES—Nov. 17, Dec. 22, Jan. 12, Feb. 9
TIMES—0500 to 0730 GMT Sunday mornings
mHz —W/VE's 1800-1807. DX 1825-1830.

7th Annual TransPacific 74/75 160 Meter "First-Timers" DX Tests

DATES—Nov. 16, Dec. 21, Jan. 11, Feb. 8.
TIMES—1330-1600 GMT Saturday mornings
mHz —W/VEs 1800-1807, JAs 1907.5-1912.5, ZLs 1875, KH6 1996-2000, VKs 1800-1805, Others 1800-1805 *or* DX Window 1825-1830

QSL Information

KA8AA—Via W7PHO
KA8JN—Via W7PHO
KC6VE—Via W7PHO
A6XB—Via K1DRN
A7XA—Via DJ9ZB
A9XW—Via WA5ZNY
C21DX—Via JA1OCA
C31CH—Via F8YY
C31DM—Via F5AX
C31EN—Via F6BCG
CN8CC—Via F6CVE
CR3ON—Via CT1BH
EA6BG—Via W1RLV
EL2DS—Via WB4SRX
EL2FT—Via WA3NGS
FC2CH—Via WA8TDY
FY7AN—Via WB4VUP
FY7AQ—Via WB4VUP
FY0BHI—Via F5QQ
FY0BHK—Via F5IQ
GM6RV—Via K9KLR
HH2WF—Via WA2JDT (Jan. '75)
HL9TG—Via WA7KYZ
HR6SWA—Via W8CNL
IBØJN—Via I8KDB
ID9DMK—Via I2DMK
JW5DQ—Via LA5DQ
KG6SB—Via W7PHO
KX8BCF—Via W8BQV
KS9EAA—Via WA9GJU
P29FV—Via K6ZDL
PQ0ARM—Via PY7ARM
TF2WKP & W5ILR/TF E. Daigre, Box 5066, Driver Sta., Suffolk, VA 23435
VP5WW—Via WB4EYX
WW3FAF—Via W3DOS
WG4TWN—Via WB4SIJ
WX4NEP—Via W4LRN
WMØSF—Via Box 61, Sedalia, MO 65301
WM0SF—Via Box 61, Sedalia, MO 65301
YB7AAJ—Via W7PHO
3A2GX—Via I1SCL
5V7PW—Via DJ1AW
5T5CJ—Via W4BAA
5T5LO—Via K9KXR
5X5NK—Via DL1YW
7Q7DW—Via G3AWY
8P6CW—Via W2GHK
9K2DC—Via W3HNK
9V1RW—Via SM5CAK

73, Jerry, WA6GLD

Propagation

BY GEORGE JACOBS,* W3ASK

LAST MINUTE FORECAST

Day-to-Day Conditions Expected For November, 1974

	Rating & Forecast Quality			
Propagation Index	(4)	(3)	(2)	(1)
Data *November*				
Above Normal: 2-3, 6-7, 29-30	A	A-B	B-C	C
Normal: 1, 4-5, 8-9, 13-14, 18, 20, 22-24, 26-28	A-B	B-C	C-D	D-E
Below Normal: 10, 12, 15-16, 19, 21, 25	B-C	C-D	D-E	E
Disturbed: 11, 17	C-D	D	E	E

Where *expected signal quality is:*

A—Excellent opening, exceptionally strong, steady signals.

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

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

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

E—No opening expected.

HOW TO USE THIS FORECAST

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

2. With the *propagation index*, use the above table to find the expected signal quality associated with the particular opening for any day of the month. For example, all openings shown in the Charts with a *propagation index* of (3) will be fair-to-good (B/C) on Nov. 1, good-to-excellent on the 2nd and 3rd, and fair-to-good during the *CQ* World-wide DX Contest c.w. section on Nov. 23-24, etc.

For updated information dial Area Code 516-883-6223 for DIAL-A-PROP, or subscribe to weekly MAIL-A-PROP, P.O. Box 86, Northport, NY 11768.

THE c.w. section of the 1974 *CQ* World Wide DX Contest will take place on the week-end of November 23-24. Chances look good for both days to be *Normal* for DX propagation conditions. Check the "Last Minute Forecast" at the beginning of this column for a more up-to-date forecast.

Special DX Propagation Charts for use during the contest period appeared in last month's column. Be sure to check these Charts for band openings forecast for the c.w. section.

Contest Tips

Here are some propagation tips that should be useful in working DX during November, especially during the c.w. section of the Contest, as long as conditions turn out to be NORMAL or better.

Midnight to Sunrise:—Check *20 meters* for openings to South Pacific until 1 A.M. in EST and CST time zones and until 3 A.M. in MST and PST zones. Slight possibility for deep opening into South America and Antarctica for an hour or so after Midnight. Best band during this time period should be *40 meters*. Look for openings towards Europe, the Middle East and parts of Africa until 3 A.M. in EST and 2 A.M. in CST zones. Check for long-path openings between 6 and 8 A.M. in PST zone. Good openings from all time zones towards South America should be possible, with signals strongest to Caribbean, Central America and northern countries of South America between Midnight and 5 A.M. in EST and CST zones, and to 4 A.M. in MST and PST zones. The path towards the South Pacific looks good from PST and MST zones between Midnight and sunrise, with openings possible from the CST and EST zones between 2 A.M. and sunrise. Weakish openings to the Far East and Asia should be possible from the PST zone from Midnight to sunrise. There's also a possibility for a *40 meter* opening to Antarctica from the PST and MST zones between Midnight and 5 A.M. *Eighty* should open from EST and CST zones to Europe, parts of Africa and the Middle East until 2 A.M., possibly for an hour or so longer in EST zone. Band looks good from PST and MST zones to the South Pacific from Midnight to almost sunrise, and from the CST and EST zones from about 3 A.M. to almost sunrise. Check for good openings to the Caribbean, Central America and the northern countries of South America between Midnight and 5 A.M., and to 3 A.M. for deeper openings into South America. There's a slight possibility for an opening from the PST zone to the Far East and Asia between 1 and 3 A.M. Openings on *160 meters* should be possible from the EST and CST zones to Europe between Midnight and 2 A.M. In PST zone check for openings towards the South Pacific between 2 A.M. and sunrise. Openings toward the Caribbean, Central America and the northern countries of South America should be possible from all time zones from about 2 A.M. to 4 A.M.

Sunrise to Sunset:—Check *10 meter* openings to Europe from EST and possibly CST zones between 8 and 10 A.M. Openings to Africa look possible from all time zones between 8 and 11 A.M., and may extend an hour or two longer in CST and EST zones. Good openings into South America should be possible between 9 A.M. and 3 P.M., with a peak between 10 A.M. and 2 P.M. Check for openings towards the South Pacific between 10 A.M. and 5 P.M., with a peak expected between 1 and 4 P.M. Look for openings to the Far East and Asia from PST zone between 2 and 5 P.M., and to Antarctica between 1 and 3 P.M. DX conditions on *15 meters* should hold up well during the entire daylight period. Check for openings towards

*11307 Clara Street, Silver Spring, MD 20902

HOW TO USE THE SHORT-SKIP CHARTS

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

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

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

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

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

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

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

South America as early as 8 A.M., with the band peaking between Noon and 4 P.M. Openings to Africa should be best from the EST and CST zones between 10 A.M. and 2 P.M., and until Noon in MST and PST zones. Band should open to Europe from EST and CST zones between 8 A.M. and Noon, and until 10 A.M. in MST and PST zones. Check for openings towards South Pacific between 2 and 6 P.M., with the band open an hour or so longer in PST zone. Band may also open towards the Far East and Asia between 4 P.M. and sunset. *Twenty* should open to all areas of the world just after sunrise, and remain open to at least 10 A.M., with strong signals. From 10 A.M. through the early afternoon signals should weaken considerably, with the band open only to Europe, northern Africa, the Caribbean, Central America, the northern countries of South America and short openings towards the South Pacific. After 2 P.M. signals should begin to peak again towards Europe, Africa and the Middle East, and remain strong to about 3 P.M. in the PST and MST zones and as late as 5 P.M. in the EST and CST zones. Check for long-path openings from EST and CST zones to Australasia between 3 and 5 P.M., and short-path openings from the PST zone between 4 P.M. and sunset. Look for strong signal openings to all areas of South America from about 4 P.M. onwards. *Forty* should begin to open towards Europe and to the Caribbean, Central America and the northern countries of South America about an hour or so before sunset, but signals may be weakish.

Sunset to Midnight: — *Twenty meters* could hang in for an hour or so after sunset to southern parts of Europe and parts of Africa from EST and CST zones. Check for long-path openings to Europe and Africa from PST zone beginning 10 P.M. Band looks good to most of South America to about 8 P.M., and to Antarctica right up to Midnight. Should remain open to the South Pacific to Midnight and to the Far East and Asia until 10 P.M. Expect some fairly good openings on *40 meters* to Europe and parts of Africa throughout the entire period, and to most of South America. In PST zone check for openings towards the South Pacific beginning about 10 P.M. *Eighty* should open towards Europe, Africa, the Caribbean, Central America and the northern countries of South America during most of this time period. Check for possible openings on *160 meters* towards the Caribbean, Central America and possibly in the northern countries of South America between 10 P.M. and Midnight in all time zones, and to Europe from the EST zone after 10 P.M.

Short-Skip Charts

This month's column contains a Short-Skip Propagation Chart for use between distances of approximately 50 and 2300 miles. Special charts for use between the mainland and Alaska and Hawaii are also included. Instructions for the use of these Charts are given elsewhere in this column.

Sunspot Cycle

The Swiss Federal Observatory at Zurich reports a monthly mean sunspot number of 33.7 for August, 1974. The sunspot cycle index, based on 12-month smoothed running numbers, is now 36, centered on February, 1974. A smoothed sunspot number of 26 is forecast for this November, as the cycle begins to decline again.

V.H.F. Ionospheric Openings

Some auroral-type v.h.f. ionospheric openings are likely to occur during the month, especially when ionospheric conditions on the h.f. bands are below normal or disturbed. Check the "Last Minute Forecast" at the beginning of this column for the days that are most likely to be in these categories during November.

Two short, but significant meteor showers are expected during November, which should make possible some meteor-scatter type openings on the v.h.f. bands. The *Taurids* shower, lasting for a day or two, should peak on November 4 with an expected count of about 15 meteors an hour. A second shower of about the same intensity, called the *Leonids,* should begin on November 16 and peak at about 7 A.M. EST on the 17th.

Good luck in the c.w. section of the *CQ* World Wide DX Contest, and please let us know how the special Contest propagation forecasts work out.

73, George. W3ASK

CQ Short-Skip Propagation Chart

November & December, 1974

Local Standard Time

At Path Mid-Point

Band (Meters)	*Distance Between Stations (Miles)*			
	50-250	*250-750*	*750-1300*	*1300-2300*
10	*Nil*	*Nil*	11-16 (0-1)	09-11 (0-1) 11-14 (1-2) 14-16 (1)
15	*Nil*	10-12 (0-1) 12-14 (0-2) 14-16 (0-1)	09-10 (0-1) 10-11 (1-2) 11-12 (1-3) 12-14 (2-4) 14-15 (1-3) 15-16 (1-2) 16-17 (0-1)	08-09 (0-1) 09-10 (1-3) 10-12 (3-4) 12-14 (4) 14-15 (3) 15-16 (2-3) 16-17 (1-2) 17-18 (1) 18-19 (0-1)
20	*Nil*	07-09 (0-1) 09-11 (0-2) 11-14 (0-4) 14-15 (0-3) 15-17 (0-2) 17-19 (0-1)	07-08 (1) 08-09 (1-3) 09-11 (2-4) 11-14 (4) 14-15 (3-4) 15-17 (2-4) 17-18 (1-3) 18-19 (1-2) 19-21 (0-1)	06-07 (0-1) 07-08 (1-2) 08-09 (3) 09-15 (4-3) 15-17 (4) 17-18 (3) 18-19 (2-3) 19-21 (1) -
40	07-09 (2) 09-10 (1-3) 10-15 (3-4) 15-17 (2-3) 17-18 (1-2) 18-20 (0-1)	07-09 (2-3) 09-10 (3) 10-15 (4-3) 15-16 (4) 16-17 (3-4) 17-18 (2-4) 18-20 (1-3) 20-00 (0-2) 00-07 (0-1)	07-09 (3) 09-14 (3-1) 14-15 (3-2) 15-16 (3) 16-18 (4) 18-20 (3-4) 20-22 (2-3) 22-00 (2) 00-04 (1-2) 04-07 (1-3)	07-08 (3-2) 08-09 (3-1) 09-14 (1-0) 14-15 (2-0) 15-16 (3-1) 16-17 (4-2) 17-18 (4-3) 18-20 (4) 20-22 (3-4) 22-00 (2-3) 00-02 (2) 02-04 (2-3) 04-06 (3)
80	08-17 (4) 17-19 (2-4) 19-00 (1-2) 00-07 (1-3) 07-08 (2-3)	08-09 (4-2) 09-16 (4-1) 16-18 (4-2) 18-19 (4-3) 19-00 (2-4) 00-07 (3-4) 07-08 (3)	08-09 (2-0) 09-16 (1-0) 16-18 (2-1) 18-19 (3) 19-20 (4-3) 20-04 (4) 04-06 (4-3) 06-07 (4-2) 07-08 (3-1)	08-16 (0) 16-18 (1-0) 18-20 (3-2) 20-04 (4-3) 04-06 (3-2) 06-07 (2-1) 07-08 (1)
160	07-09 (3-2) 09-11 (2-0) 11-17 (1-0) 17-19 (3-2) 19-07 (4)	07-09 (2-0) 09-17 (0) 17-19 (2-1) 19-04 (4) 04-06 (4-2) 06-07 (4-1)	07-09 (1-0) 09-17 (0) 17-19 (1-0) 19-20 (4-2) 20-21 (4-3) 21-04 (4) 04-06 (2-1)	06-19 (0) 19-20 (2-1) 20-21 (3-2) 21-04 (4-2 04-06 (1)

HAWAII

November & December, 1974

Openings Given In Hawaiian Standard Time†

To:	*10 Meters*	*15 Meters*	*20 Meters*	*40/80 Meters*
Eastern USA	09-10 (1) 10-12 (2) 12-13 (1)	07-08 (1) 08-10 (2) 10-12 (3) 12-14 (2) 14-15 (1)	06-08 (2) 08-12 (1) 12-13 (2) 13-15 (3) 15-16 (2) 16-17 (1)	17-18 (1) 18-21 (2) 21-02 (3) 02-03 (2) 03-04 (1) 19-23 (1)* 23-02 (2)* 02-03 (1)*
Central USA	08-10 (1) 10-12 (2) 12-13 (1)	07-08 (1) 08-11 (3) 11-13 (4) 13-14 (3) 14-16 (2) 16-17 (1)	06-07 (1) 07-08 (3) 08-12 (2) 12-13 (3) 13-15 (4) 15-16 (3) 16-17 (2) 17-18 (1)	17-19 (1) 19-20 (2) 20-02 (3) 02-03 (2) 03-04 (1) 19-21 (1)* 21-02 (2)* 02-04 (1)*
Western USA	09-11 (1) 11-13 (2) 13-15 (1)	07-09 (1) 09-10 (2) 10-13 (4) 13-14 (3) 14-16 (2) 16-17 (1)	06-07 (1) 07-08 (2) 08-10 (3) 10-15 (4) 15-16 (3) 16-18 (2) 18-20 (1)	17-18 (1) 18-20 (2) 20-01 (4) 01-04 (3) 04-06 (2) 06-07 (1) 18-19 (1)* 19-21 (2)* 21-04 (3)* 04-05 (2)* 05-06 (1)*

ALASKA

November & December, 1974

Openings Given In GMT†

To:	*10 Meters*	*15 Meters*	*20 Meters*	*40/80 Meters*
Eastern USA	*Nil*	17-19 (1) 19-22 (2) 22-23 (1)	12-14 (1) 17-20 (1) 20-23 (2) 23-01 (1)	06-12 (1) 07-11 (1)*
Central USA	*Nil*	18-20 (1) 20-23 (2) 23-00 (1)	13-15 (1) 18-20 (1) 20-21 (2) 21-23 (3) 23-01 (2) 01-02 (1)	06-14 (1) 07-12 (1)*
Western USA	*Nil*	19-20 (1) 20-21 (2) 21-23 (3) 23-00 (2) 00-01 (1)	17-19 (1) 19-20 (2) 20-21 (3) 21-23 (4) 23-00 (3) 00-02 (2) 02-03 (1)	02-04 (1) 04-09 (2) 09-12 (3) 12-14 (2) 14-16 (1) 04-09 (1)* 09-12 (2)* 12-14 (1)*

†See explanation in "How To Use Short-Skip Charts" in box at the beginning of this column.

*Indicates best time for 80 Meter openings. Openings on 160 Meters are also likely to occur during those times when 80 Meter openings are shown with a forecast rating of (2), or higher.

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

THE awards PROGRAM

BY ED HOPPER,* W2GT

USA-CA Honor Roll

2500	1500
W5RDV 177	WA4AUL 336
2000	**500**
W5RDV 207	SP3AIJ 1010
	WB8NVD 1011

THE November, "Story of The Month" as told by Les, is:

Lester A. Jeffery, W8WT

(All Counties #92, 1-3-73)

"A Michigander, I was born in Detroit, as was my father. My mother was born in the Upper Penninsula of Michigan, and my wife Hazel, is from Michigan also. Our daughter lives in California.

"Not a ham in the entire family. We enjoy bowling, and golfing. I have other hobbies but none get the play that hamming does.

"Although I didn't know it at the time, early in 1921 I was getting educated and primed for amateur radio. In grade school I found a friend who was enjoying a crystal set that he had made, and it didn't take me long to learn more about it. By scrounging around I finally found enough wire and the other 'stuff' to assemble one of my own. Those were the good old days when it was necessary to save tin foil, waxed paper and oatmeal boxes in order to make a radio. Headphones were hard to come by, but my mother must have gone without some things in order to get me a pair of Murdock phones for Christmas in 1923. I built many different sets during the next few years, one that was quite popular was the Harkness reflex.

"It wasn't until 1929 that I got the Short-wave bug. I can still hear the squealing of those early regeneratives, but you know, we used to hear a lot of stations on those critters. After listening to 'those hams', I just couldn't resist the temptation and found myself studying for a license.

"In 1932 I got the present W8WT call-sign after having W8EMF for a year. About this time I was working as a draftsman at a local company, the Chief Engineer was a radio ham and was pioneering in television. His brother, a transformer designer, also working there, was a ham. Between the bunch of us, we built a scanning disc type TV rig and had a great time sending out pictures that we ran from an old Powers projector. Things in that line, sure have changed for the better.

"Getting back to ham radio. I must have known I was going to collect awards as I saved every QSL card and made an extra effort to get each one. Sending out cards immediately after the contact seems to be a good idea. I think the person at the other end still has the points of interest about the contact and some incentive that may disappear if you wait very long. In forty-three years and nearly 30,000 cards later, I've amassed a return of about 25,000 for my files and shoeboxes.

"It was in 1957 that I was able to put up some antennas that really did a good job, before that I was a city-dweller and had the usual poor compromises.

"In 1960 I visited a couple of National Ham Conventions and saw many collections of awards and certificates. The WPX program looked very inviting to me and I got busy and came up with number one, on phone. Since then I have gotten quite a few, at last count I had over 1500 different certificates.

"County Hunting has really been the most exciting phase of ham radio for me, and I've met many of the 'gang' who just have to be the *best* bunch of people, anyplace, anywhere.

"The innovation of the County Hunter QSL Bureaus, sure help in the percentage of returns as well as substantial saving in postal costs. Currently I'm trying to complete all the counties on 14, All Mobile and as many bands as possible. As this is being written, I have All on S.S.B., need 4 to make All Mobile and 11 for All 14.

For you who read this, I hope *this* will be the year that *you* get 'em *all*." Note—Les got USA-CA-500-#1Q—9-24-61).

Awards Issued

Herb Skidmore, W5RDV made it USA-CA-2000 and USA-CA-25000, All 14; All S.S.B.; All Mobiles.

Ken Distel, WA4AUL (not to be confused with Bud, K4AUL) added USA-CA-1000 to his collection.

Tadeusz Babczynski, SP3AIJ was issued USA-CA-500, All A-1—this is #2 Award to an SP3 and #5 to Poland.

Awards

GPCW Award: Sponsored by the Beach Group of c.w.—Santos—Brazil, the GPCW Award is issued to amateurs of any Country who send proof of contacts with 3 different members. Contacts must have been made after November 5, 1973. All authorized amateur bands can be used, but only c.w. (A-1), with a minimum report of 3-3-8. Applications should include log data authenticated by a recognized Amateur

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

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Mark II 80-10m Linear	749.95
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230XC 230v AC Supply, spkr., cabinet	134.95
14-117 12v DC Supply w/cable	149.95
14C 12v DC Module/cable ONLY	84.95
117X Basic AC Supply - w/117v cord	79.95
510X MARS Oscillator - less crystals	54.95
508 Full coverage VFO	189.95
VX-2 Plug-in VOX	44.95
FP-1 Phone Patch	54.95
MTK Mobile Mounting Kit	9.95
GMTK "Gimbel type" mobile mtg. kit	5.20
SS-16B Custom Crystal Lattice Filter	89.95
600T 80-10m Transmitter, 600w	589.95
600RC CUSTOM Receiver	545.95
600RC CUSTOM Receiver/SS-16B	599.95
600S Speaker for 600R	24.95
600SP Deluxe Speaker (w/phone patch)	69.95
600 Hz CW Filter for 600R	34.50
AM Filter for 600R	44.50
SWAN 444 Desk Mike	35.95
SWAN 404 Hand Mike	24.95
WM-1500 Wattmeter	64.95
Solid-State 80-10m Transceivers (12 volt)	
SS-15 15 watt PEP input	$599.95
SS-15 with SS-16B installed	669.95
SS-200A 300 watt PEP input	799.95
SS-200A with SS-16B installed	869.95
Mobile Mounting Kits for SS-15, 200	
SSGMTK "Gimbel type" (under dash)	$ 11.95
SSMTK Hump-mount kit	16.95
PS-10 AC Supply for SS-15	99.95
PS-20 AC Supply for SS-200	159.95
PS-210 220 volt AC supply	109.95
PS-220 220 volt AC supply	169.95
SS-208 External VFO	189.95
610X Crystal-controlled oscillator	54.95
Solid-State Mono-Banders (12 volt)	
MB-40 40m Xcvr, 75w PEP input	$299.95
MB-80 80m Xcvr, 75w PEP input	299.95
MB-40A 40m Xcvr, 160w PEP input	329.95
MB-80A 80m Xcvr, 160w PEP input	329.95
P-1215 AC supply for above MB's	49.95
P-2015 220v AC Supply for MB's	59.95
MBCW CW Monitor for MB's	19.95
Model 45 80-10m Antenna	84.95
Kwik-on Connector	7.95
BMT Bumper Mount	26.95
FM-2XA 2m FM Transceiver	$259.95
AC Supply for above	40.00
FM-1210A 2m FM Transceiver	319.95
AC Supply for above	40.00
Crystals for FM-2XA and 1210A. each	5.00
MD-4 2m Antenna	21.95
TMD Trunk mount for MD-4	9.95
RMD Roof mount for MD-4	5.95

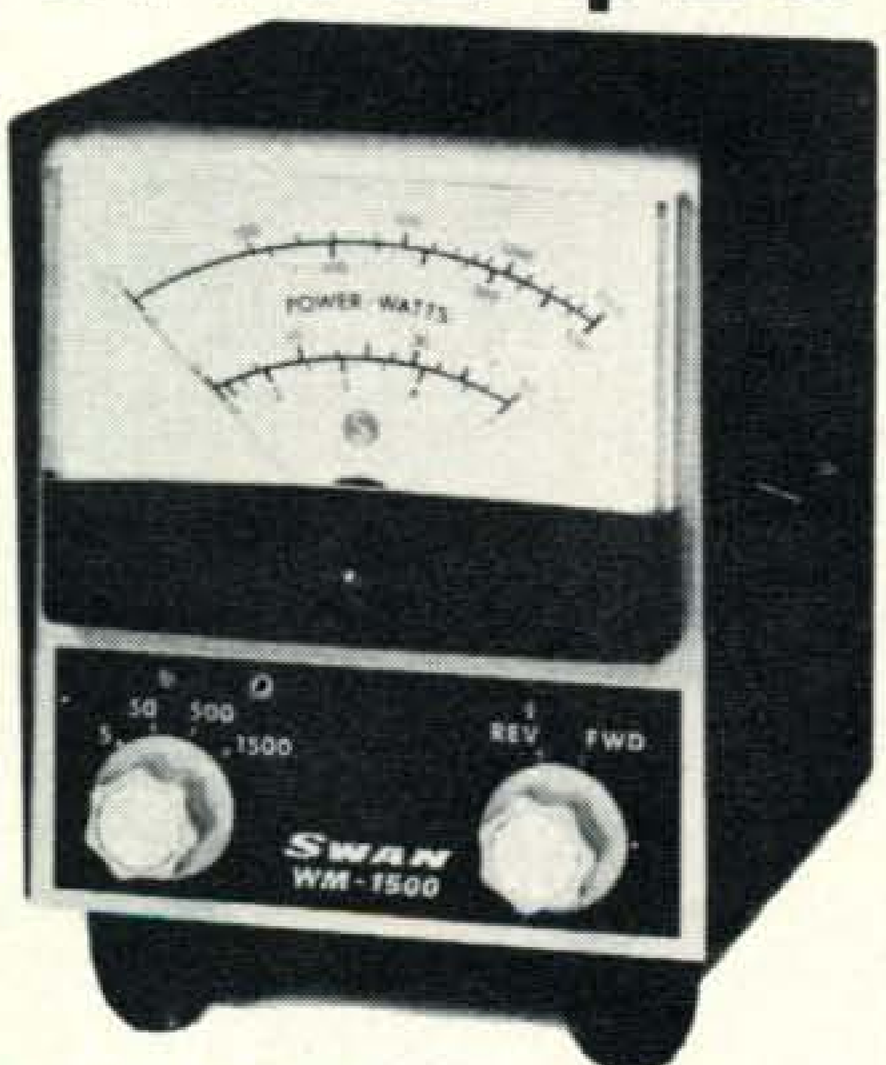
SAVE $70

SWAN 160X 160m Xcvr, 1.8 to 2MHz. 1 KHz Readout, Switchable pwr. - 50, 100, 200 or 400 watts PEP. Less pwr. supply (117XC)
Reg. $469 NOW ONLY $399

SAVE $50

SWAN VHF-150 2m amplifier (143-149 MHz). 180 PEP or 150W DC input on CW & FM with 6 to 10w of drive. Built-in AC supply.
Reg. $299 NOW ONLY $249

SAVE $15



SWAN WM-1500 In-Line Wattmeter 2-30 MHz. 0 to 5, 50, 500 & 1000 watts.
Reg. $64.95 NOW ONLY $49.95

Now you can use your
SWAN CREDIT CARD
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AMATEUR ELECTRONIC SUPPLY
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Issued To: Joe Ham
Address: 599 QSO Lane, Anywhere, USA
Call: W9XYZ
Joe Ham
Signature

NOTE We are able to offer the special price on the WM-1500 due to a large purchase made at the old price

SAVE $30
External VFO for 160X
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NOW $89.95

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am interested in the following new equipment: ______

I have the following to trade: (what's your deal?) ______

Ship me: ______

I Enclose $______; I will pay balance (if any):
☐ COD Swan Credit Card ☐ GECC Revolving Charge Plan
☐ Master Charge* ☐ BankAmericard ☐ American Express

Account Number: ______

Expiration DATE ______ *Master Charge Interbank number ______ (4 digits)

Name: ______

Address: ______

City & State: ______

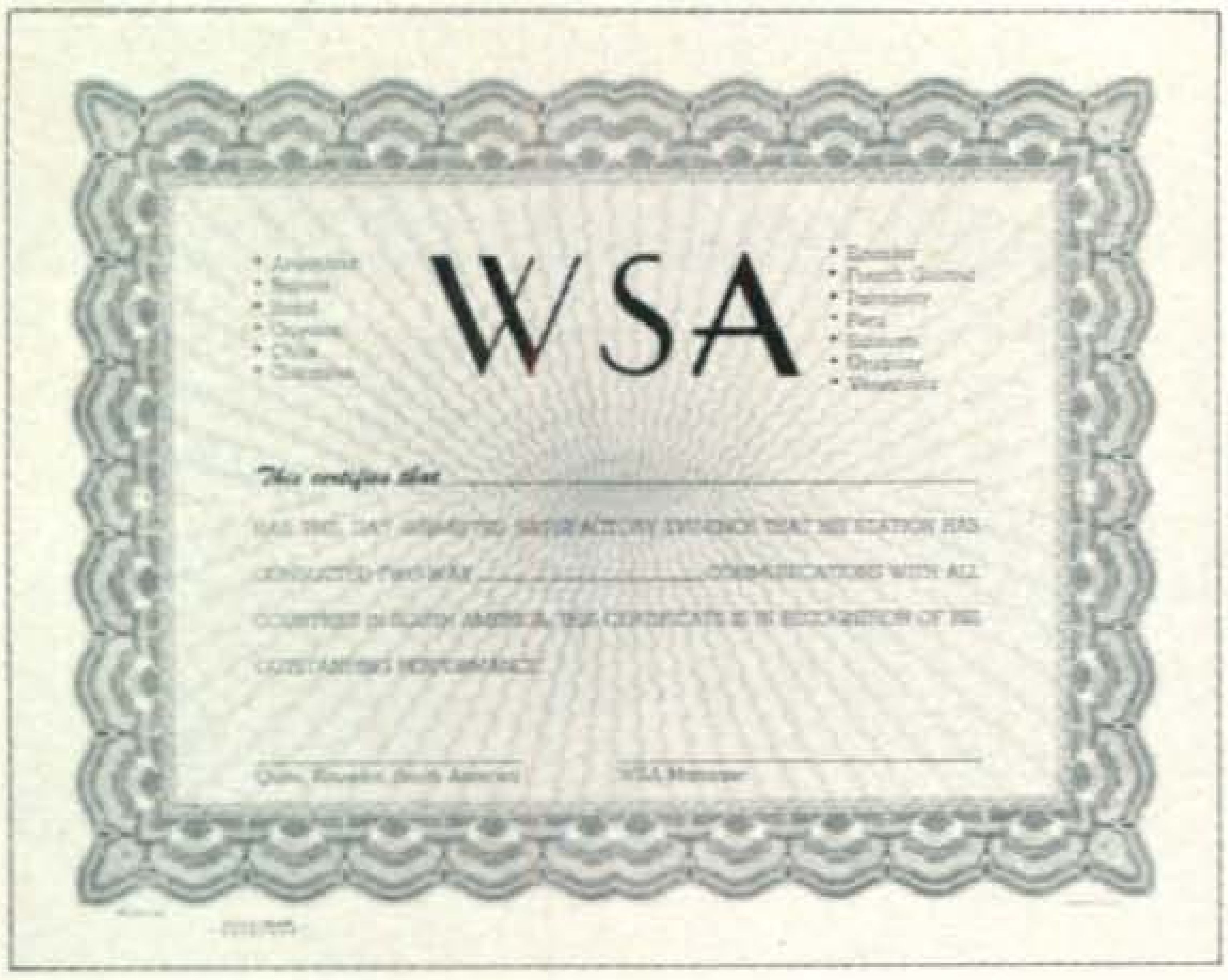
☐ Send used gear list

AMATEUR ELECTRONIC SUPPLY

4828 West Fond du Lac Ave. Milwaukee, Wis. 53216
Phone (414) 442-4200
HOURS: Mon & Fri 9-9; Tues, Wed & Thurs 9-5:30; Sat 9-3

IMPORTANT! – Please Be Sure to send all Mail Orders and Inquiries to our Milwaukee store, whose address is shown above. The following Branch stores are set up to handle Walk-in business only.

17929 Euclid Ave.; Cleveland, Ohio Phone (216) 486-7330
621 Commonwealth Ave.; Orlando, Florida Phone (305) 894-3238



Worked South America.

Radio Association/Club and be sent to: Grupo Praiano DE CW—GPCW, P.O. Box 1319, Santos, 11.100 S.P., Brazil. To cover postage, 5 IRCs should also be enclosed. Members are: PY2BBO; PY2BKT; PY2CE; PY2CJW; PY2CZL; PY2-EQR; PY2FNE; PY2FPE; PY2TT.

Worked South America: Issued for working all 13 South American Countries, Argentina, Bolivia, Brazil, Guyana, Chile, Colombia, Ecuador, French Guiana, Paraguay, Peru, Surinam, Uruguay and Venezuela. Send list and $1.00 to: Thomas T. Hoke, HC1TH/K5ODZ, 4805 Willowbend Blvd., Houston, Texas 77035. He has another, Worked Central America Award that I'll tell you about next month.

How was your month? 73, Ed., W2GT.

Portable Operator's Award: This Award is actually two certificates. You may earn it for having worked portable stations or for having operated portable. The requirements are entirely different from each other. Each Award is issued in three classes and may be endorsed for one band and one mode. The Awards are issued by Boy Scout Troop #94, of Scituate, Mass. 02066.

For *working* Portable stations:

Class C for working 33 portable stations in at least 16 Counties.

Class B for working 66 portable stations in at least 33 Counties.

Portable Operators Award.

Class A for working 100 portable stations in at least 50 Counties.

For *operating* Portable stations:

Class C for operating portable in at least 6 different Counties.

Class B for operating portable in at least 12 different Counties.

Class A for operating portable in at least 18 different Counties. Fee for either basic Award is $1.00. Higher class seals for s.a.s.e. No date or time limits. If a new band or mode endorsement is desired, fee is 25c as a new Award will be issued for the band/mode.

For *working* Portables, confirmations must have been received but not submitted, submit GCR list with your application fee.

For *operating* Portable, send full log data showing at least one station worked from each claimed County.

Awards Custodian is: Robert W. Jennings, W1DKD, 15 Cliff Avenue, Scituate, Mass. 02066.

Portables Defined: For the purpose of this Award, a portable is a station operating away from the home address as specified in the station license. Mobiles do *not* count. A basic mobile installation is considered a portable, *provided* the station can not get underway while receiving or transmitting. Examples: Operating from 110 volt landline power, operating from a gasoline generator set on the ground, operating into a fixed antenna istallation separate from the mobile, etc . . .

Diplome Des 100: The Secretary General of the International Telecommunication Union announced on 1st September 1973, the establishment of an Award for amateur radio operators and shortwave listeners in recognition of their efforts to promote international goodwill through amateur radio. This Award will be given to any radio amateur who submits proof of contact with radio amateur stations in each of 100 different countries, members of the Union and to any shortwave listener who submits proof of reception of amateur radio stations from 100 different countries, members of the Union and to any shortwave listener who submits proof of reception of amateur radio stations from 100 different countries, members of the Union. There are presently 145 countries-members. Stickers will be given for each additional 10 contacts.

The administration of this Award has been delegated to the International Amateur Radio Club (4U1ITU), Geneva (Switzerland). For full information and list of countries-membership and date of such, address inquiries to: Mr. Lyman M. Rundlett, K4ZA, Awards Manager, IARC, 206 East Amhurst Street, Sterling Park, Virginia 22170, U.S.A. May I suggest you send along a s.a.s.e. or s.a.e. and IRC, please.

73, Ed, W2GT

Contest Calendar

BY FRANK ANZALONE,* W1WY

Calendar of Events

*Nov.	1-4	CHC/FHC/HTH Party
Nov.	2-3	ARRL C.W. Sweepstakes
*Nov.	2-3	RSGB 7 mHz Phone Contest
Nov.	4-10	ARCI QRPp C.W. Contest
*Nov.	7-8	YLRL Anniv. Phone Party
Nov.	9-10	North Carolina QSO Party
Nov.	9-10	Rocky Mountain QSO Party
Nov.	10	Czechoslovakia Contest
Nov.	16-17	ARRL Phone Sweepstakes
Nov.	**23-24**	**CQ WW DX C.W. Contest**
Nov.	29-30	Delaware QSO Party
Nov.	30	10 Meter Ground Wave Test
Dec.	7-8	TOPS C.W. Contest
Dec.	6-8	ARRL 160 Meter Contest
Dec.	7-8	Space Net VHF Contest
Dec.	8-14	Indiana Amateur Radio Week
Dec.	14-15	ARRL 10 Meter Contest
Dec.	14-15	Spanish C.W. Contest
Dec.	22	Hungarian Contest
Jan.	11-15	YU 80 Meter C.W. Contest
Jan.	11-12	DL QRP C.W. Contest
Jan.	**24-26**	**CQ WW 160 C.W. Contest**

*Covered in last month's Calendar

ARCI QRPp C.W. Contest

Starts: 1300 GMT Monday, November 4
Ends: 2300 GMT Sunday, November 10

This is the 4th annual contest sponsored by the QRP ARC International with emphasis on real low power, 5 watts or less output. The contest is open to all whether or not they are members of QRP ARC International.

Exchange: RST, QTH (state/province or country) and QRP number. (non-members send NM and power in lieu of number).

Scoring: Contacts with members count 2 points, non-members 1 point. A station may be worked on each band for QSO and multiplier credit. There is also a power multiplier as follows: 15 if output is ½ watt (500 mw) or less, 10 if 2 watts, 5 if 5 watts, and no multiplier if over 5 watts.

Final Score: QSO points × QTH multiplier × power multiplier.

Frequencies: 3540, 7040, 14065, 21040, 28040.

Awards: Certificates, 1. Top scorer world wide. 2. Highest score in each state, province and country. 3. Lowest powered station showing 3 or more skip contacts.

*14 Sherwood Road, Stamford, Conn. 06905.

Include a summary sheet with your log showing the scoring, equipment description and power used. Also a signed declaration that all rules and regulations have been observed.

Logs must be postmarked no later than Dec. 10th and go to: Earl R. Lawler, W5JLY, Rt. 2, Box 24K, Burnet, Texas 78611.

Delaware QSO Party

Starts: 0001 GMT Friday, November 29
Ends: 0001 GMT Sunday, December 1

The party is again sponsored by the Delaware ARC. (W3SL) The same station may be worked on each band but only one mode per band.

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

Scoring: Del. stations score 1 point per QSO, multiply total by number of states, VE provinces and DX countries worked. Others get 5 points for each Del. QSO, and multiply total by 1 if one Del. county is worked, 3 for two counties and 5 for all three counties. (There are 3 Del. counties, New Castle, Kent and Sussex).

Frequencies: C.W.—3560, 7060, 14060, 21060, 28160. Phone — 3975, 7275, 14325, 21425, 28650. v.h.f.—50.4 & 145.1 Novice—3710, 7120, 21120, 28160.

Appropriate awards will be given, and in addition a certificate to stations working all 3 Del. counties.

Mailing deadline is Jan. 15th and logs go to: John R. Low, K3YHR, 11 Scottfield Drive, Newark, Del. 19711. Applications for the WDEL Certificate go to same address, but include a s.a.s.e.

10 Meter Ground Wave Contest

9 P.M. to 1 A.M. EST Saturday, November 30

This operation organized by the Breeze Shooters of Pittsburgh, Pa. is now in its 22nd year. It should be of interest to stations in Western Pennsylvania and surrounding nearby states.

All modes are permissable and exchange contact points are determined by a distance basis. There are separate awards for leaders in four circular zones centered on Pittsburgh.

No other details were given so it is recommended that you write K3DE for rules and log forms. Mailing deadline for logs is Dec. 9th and they go to: Herbert Heller, K3DE, 2873 Beechwood Blvd., Pittsburgh, Pa. 15217.

TOPS C.W. Contest

Starts: 1800 GMT Saturday, December 7
Ends: 1800 GMT Sunday, December 8

This is the annual contest for the Tops C.W. Club whose activity is concentrated on 80 meters. For the contest it will be between 3.5-3.6 mHz, with DX on the low end.

Exchange: RST report only.

Scoring: Contacts with own country 1 point. Contacts with stations in the same continent 2 points. Contacts with stations in other conti-

Gordon Marshall, W6RR receiving the Potomac Valley Radio Club Trophy from our Committeeman Fred Capossela, W21WC at the Fresno Convention last April. Gordon is being rewarded making the top USA single operator all band score in the 1972 CQ World Wide Phone Contest.

nents 5 points. (each call area in W/K, VE/VO, UA and VK will be considered as separate for scoring purposes.)

Final Score: Total QSO points multiplied by number of prefixes worked. (Same as WPX).

Entries may be single or multi-operator.

Mailing deadline is January 16th to: Peter Lumb, G3IRM, 14 Linton Gardens, Bury Saint Edmunds, Suffolk IP33 2DZ, England.

Space Net VHF Contest

Starts: 6:00 P.M. Saturday, December 7
Ends: 6:00 P.M. Sunday, December 8
(Local Time)

This one highlights Skylab 3 with rules same as previous Space Net contests.

Use any of the v.h.f. bands, 50, 144, 220, and 432 mHz. (But no repeaters.)

Exchange: RS(T) and Zip Code number. Non-US use P.O. name.

Scoring: Two points per QSO on each band. Multiplier is sum of different Zip Code and P.O. areas worked. (Counted only once.) There is also a bonus of 10 that you add to your multiplier.

Final Score: Multiplier + 10 × QSO points. Same station may be worked on each band for QSO points but multiplier is counted once only.

Awards: To 1st and 2nd place winners in three classes based on power used. 1-25, 25-100 and over 100 watts input. There are also awards for multi-operator stations, clubs and Novices. All stations submitting a log will receive an attractive certificate.

Logs and requests for additional information go to: Space Net VHF Contest, Att: A. W. Slapkowski, WB2MTU, Box 909, Sicklerville, N.J. 08081.

ARRL 160 C.W. Contest

Starts: 2200 GMT Friday, December 6
Ends: 1600 GMT Sunday, December 8

This will be the 5th Top Band contest run by the ARRL. Contacts will be between stateside stations, and with VE's and also DX. (no DX to DX however).

Exchange: RST and ARRL section, country if its a DX station.

Scoring: Contacts between stations in ARRL sections 2 points, QSOs with other areas 5 points. The multiplier is the number of ARRL sections, (74) VE8 and DX countries worked. (See section list in *QST*.)

Awards: Certificates to high scorers in each section and DX country.

This year you will be required to submit your log. (only a check list was required last year.) A s.a.s.e. to ARRL will get you the necessary forms.

The usual grounds for disqualification, violation of rules, excessive duplicate contacts and etc. will prevail. And you are requested to keep the "DX Window" 1825 to 1830 clear of stateside operation.

All entries should be received no later than one month after the contest. Send to: ARRL Communications Dept., 160 Contest, 225 Main Street, Newington, Conn. 06111.

Hoosier Amateur Radio Week

Starts: 0000 GMT Sunday, December 8
Ends: 2400 GMT Saturday, December 14

This activity is held each year during the week of December 11th, the date Indiana became a state. It is not a contest or party, just a getting acquainted time. The Hoosier boys will be looking for out of state stations and give out interesting items about their state.

Work 10 different Indiana stations and you are eligible for a certificate. Novice, VHF/UHF and DX stations need only 3 contacts.

Send list of Indiana stations worked and your nomination of the Indiana station you pick for the Hoosier Hospitality Plaque.

Mailing deadline is January 13th to: David E. Mitchell, WB9INF, Box 67, Dupont, Indiana 47231.

Spanish C. W. Contest

Starts: 2000 GMT Saturday, December 14
Ends: 2000 GMT Sunday, December 15

It's the world working the Espanoles on C.W., all bands 3.5 thru 28 mHz in this one.

Exchange: Six figures. RST plus a 3 figure contact number starting with 001.

Scoring: Contacts between EA stations and the Phillipines or Hispanoamerican countries are worth 3 points. (DU, CE, CO, CP, CX, HC, HI, HP, HR, KP4, LU, OA, PY, TG, TI, XE, YN, YS, YV and ZP or equivalent prefixes.)

Between EA and all other non-Hispano and non-European countries, 2 points.

Between EA and Europeans, 1 point.

Multiplier: For EA, each DXCC country worked on each band. Others use EA call districts.

Final Score: Total QSO points from all bands times the sum of the multiplier from each band.

The same station may be worked on each band for QSO and multiplier credit.

Awards: Gold, silver and bronze medals to the first 3 place winners, both Spain and overseas.

Include a summary sheet with your log showing the scoring and other pertinent information and your name and address in BLOCK LETTERS.

Your entry must be postmarked no later than one month after the end of the contest to: U.R.E. Concurso International, P.O. Box 220, Madrid, Spain.

Editor's Notes

A reminder that your Phone logs must be mailed no later than December 1st, and for the upcoming C.W. contest you have until January 15 to get them in the mail. I would highly recommend registered mail where practical. Or at least include an addressed stamped card that we can mail back to you when your log has been received. Several entries never did make it last year, and you may have noticed that there was no Hungarian listing in the C.W. results. A large package of HA logs never did show up and presumably were lost in route.

If you did not avail yourself of the latest propagation forecast for tht Phone contest I highly recommend that you do so for the C.W. weekend when conditions are usually more critical. George Jacob's Column will have had a detailed forecast in the October issue. A special Contest issue covering both weekends is available at $15.00 from PROP, Box 86, Northport, N.Y. 11768. For the very latest last minute forecast use DIAL-A-PROP, 516-883-6223.

And say, did you notice that this year the C.W. dates do not fall on Thanksgiving week-end? So you state-side fellows cannot have that as an excuse for not participating.

Good luck, if you do not hear me in the pile-ups I will still be in there listing.

73 for now, Frank, W1WY

Erratum

In the C.W. results in the August issue. A typo in the 14 mHz top scores. The #2 spot is CR6IK, not 6LK as shown.

The following stations were inadvertently ommitted. DL7AV on 3.5 mHz with a score of 104,622. YU2CDX on 7 mHz with a score of 27,654. SM0BDS on all bands with a score of 37,232.

In the photo of VS6AW, Doug's stateside call was incorrectly listed as K4EVL. The correct call is KV4EZL.

In the 1974 WW Contest rules in the September issue, Par. IX Trophies & Plaques, the #3 Canadian Single Band Phone Award, the correct call is VE7DKS. Gene is now a resident of British Columbia.

DIAL-A-PROP 516-883-6223

SURPLUS sidelights

BY GORDON ELIOT WHITE*

ABOUT the time of last spring's Dayton Hamvention, the R-392/URR receiver began to show up in surplus channels in reasonably large numbers, and at prices making it quite attractive. Despite having a few drawbacks, the R-392 is probably the most generally useful new surplus item in years to become generally available.

This receiver is a cousin of the well-known and highly-respected R-390 and 390-A general coverage receivers. It covers the same frequencies, 500 kHz to 32 mHz in 32 bands, has high stability and excellent calibration, although it does not have the mechanical filters of the R-390-A.

The chief characteristic of the R-392 that shoul be noted by anyone planning to use it around the shack is its power requirement of 24 volts d.c. It was built for use in military vehicles, such as jeeps and trucks which use 24 volt battery electrical systems. There are many good d.c. regulated power supplies in the surplus stores capable of putting out the required 3 amps of power, or a home-brew supply can be rigged up. Obviously the jeep electrical supply was nothing special in terms of voltage stability, so there is no great need to get one percent regulation in anything you might build to run an R-392.

Another little problem with the R-392 is the miniature tubes, which use 24 volts d.c. on the plates as well as the filaments—shades of the old BC-1206 range receiver of 1942. The tubes are not exactly common in your local TV repair shop.

The power plug is moderately difficult to find, so if you can get one with the set, do. The audio output impedance is 600 ohms for headsets, so a speaker will require a 600:3.2 transformer to match the receiver for decent output.

The Technical Manual is 11-858, and may be purchased from Quaker Electronics, Hunlock Creek, Pa., or Sam Consalvo, 7218 Roanne Rd., Oxon Hill, Md.

The R1392 is specifically designed for use with radioteletype, and has a 455 kHz intermediate frequency output jack for an i.f. type demodulator. The receiver is, of course, a.m.

The whole unit is pretty rugged, and the tubes are specially-designed for field use to withstand the shock of being dropped in a standard Army parachute delivery container. The case is immersion-proof when closed.

*1502 Stonewall Rd., Alexandria, Va. 22302

Operation of the set is rather straightforward, and is much like that of the R-390 receiver. In decent shape the R-392's nice digital readout is quite accurate, and may be calibrated by use of the internal crystal frequency standard. The procedure is to switch to CAL position on the AGC control, activating the calibration oscillator. Turn the b.f.o. on, and set at zero. set the kiloHertz dial to the nearest 100 kHz and lock the dail lock. This locks the dial mechanism internally, but allows a few kHz of play in the tuning, thus with the kHz control knob, it should be possible to adjust the front end of the set to zero-beat with the calibrator at a 100 kHz point. If not, the mechanism is too far out to calibrate, and more heroic measures may be required. Further adjustments definitely require a manual, much patience and great care.

Technical Manuals

In a recent column I listed sources for certain technical manuals. Fred Schmidt, W4NYF, advises me that he has substantial stocks of almost all Teletype parts, adjustment and operating books. He operates as Typetronics, Box 8873, Ft. Lauderdale, Florida, 33310.

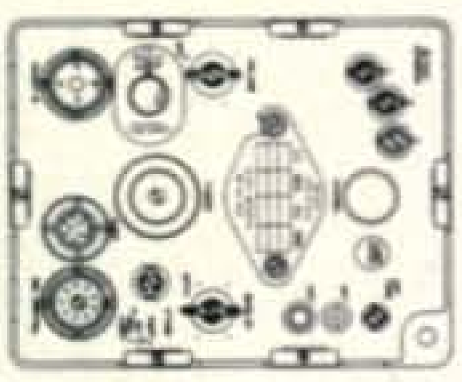
Correction

Also, in a recent column, I mentioned something about an "internal dynamotor in the ART-13 Transmitter. This is incorrect. There is an *external* dynamotor for the ART-13. I was thinking of another set. Sorry about that one. ■

R-392/URR RECEIVER

R-392/URR RADIO RECEIVER 500 KHz to 32 MHz in 32 Bands of 1 MHz ea. Except 500 KHz to 1MHz is ½ MHz. Type Signal is CW, MCW, Voice and Freq. Shift Keying. Triple Conversion on Lower Eight Bands, Double on all others. Continuous tuning read directly on Counter Type Indicator; Built-In Crystal Calibrator, 100 KHz points. With 25 tubes of 26A7, 26A6, 12AU7, 26C6, & 26D6. Power required for operation: 24/28 VDC @ 3 Amps. High Performance, Rugged Design. Portable. Size: 11½x14¼x11 wt: 52 LBS. Shpg. wt: 70. Price: Used reparable $95.00 ea. Power input plug, $2.00.

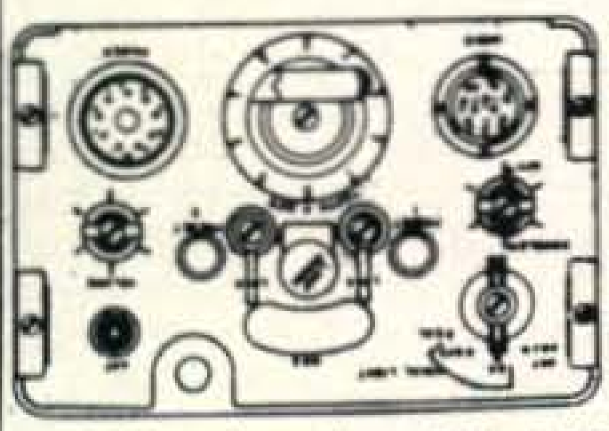
38 to 54 MHz RECEIVER



R-110 Receiver 38 to 54 MHz FM continuosly tuneable, variable squelch and audio, output impedance 600 Ohms. 4.3 MHz. I.F. with tubes 3/1U4, 2/1L4, 1A3, 2/3A5, 1S5, 2/3Q4, 2/6AK5 & OB2. Voltages req. 135 VDC @ 70 MA. and 12 volts @ 2 amps.

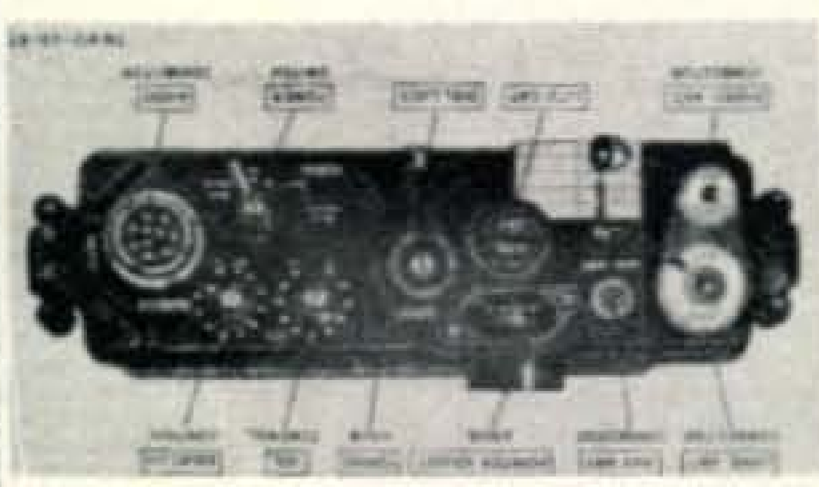
Size: 9x13x7½; WT: 32 LBS. Used $35.00.

RT-70 RECEIVER-TRANSMITTER



47 to 58.4 MHz FM voice communications. Features continuous tuning or two pre-set channels and push-to-talk transmission. The receiver circuit is the Dual Conversion type with the 1st IF 4.3 MHz and the 2nd IF 1.4MHz. With variable squelch control. 600 Ohm Audio Output Impedance. The transmitter circuit has a 500 MW Output and an Audio Input Imped. of 150 Ohms. Power required: 90 VDC @ 80 MA, 6.3 @ 360 MA and 6.3 @ 160 MA. With tubes: 6/1U4, 3/1L4, 2/1R5, 1S5, 1AE4, 4/3Q4, 3A5, and 3B4. Size 4¾x13x8 WT: 20 LBS. Used $20.00.

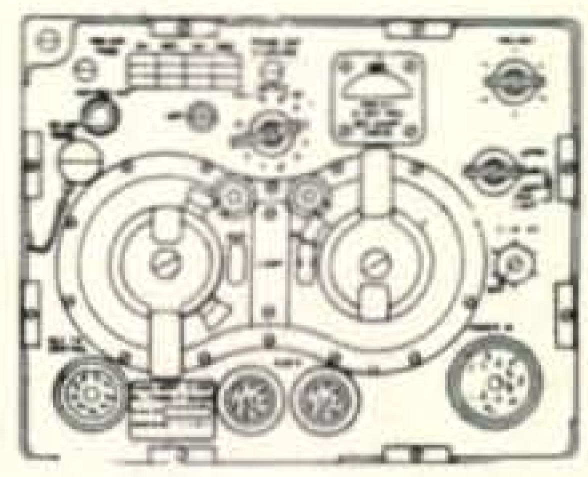
PRC - 10 RECEIVER - XMITTER



RT-176/PRC-10 Radio Receiver - Transmitter; portable unit operating from 38 to 54.9 MHz FM voice communications. The receiver section has an IF of 4.3 MHz and an audio output imped. of 600 Ohms. Transmitter output is 0.9 watts with a normal range of about five miles. Microphone input imped. 150 Ohms. Both Receiver and Transmitter sections are continuously tuneable. With controls for volume, tuning, squelch, pointer adjust and dial lock. Connector for external speaker. With tubes 9/5678, 2/5672, 3/5676, 1AD4 and 5A6. Power required; 135 VDC, 67 VDC and 1½ VDC. Less Battery case. Size: 9½x3x10½ WT; 9LBS. RT-176/PRC-10 Used $19.00.

All Prices FOB Wilkes Barre PA. Shipping charges collect. Send Money Order or Check.

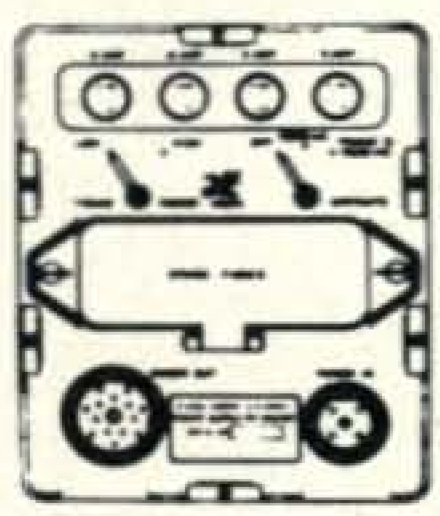
RECEIVER–TRANSMITTER



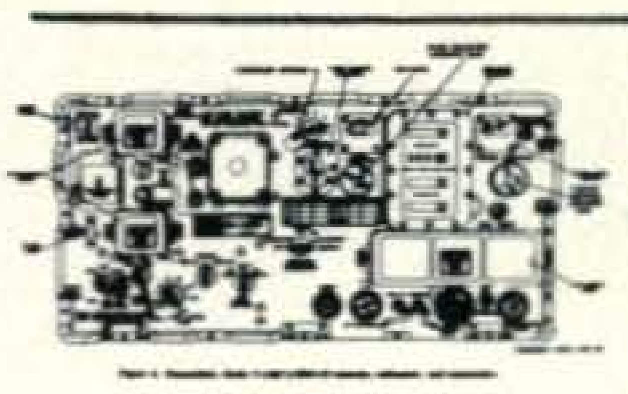
RT-68/GRC Receiver - Transmitter, 38 to 54.9 MHz range continuously tuneable or 100 KHz-step Detent channels or two preset channels. Receives and transmits both voice and 1600 Hz ringing FM signals. The overall communication range is from 10 to 15 miles. The receiver circuit is a Dual-Conversion superheterodyne type with the 1st IF variable from 4.45 to 5.45 MHz and the 2nd IF fixed at 1.4 MHz. The receiver has a variable squelch control and a 600 Ohm output impedance. The transmitter circuit uses a crystal-controlled oscillator and oscillator power amp and puts out 2 watts on low power voltage or 16 watts on high power voltages supplied from the power supply sold separately. The RT-68 also provides a meter and test switch to monitor transmitter power output filaments and the 90 volt input. With tubes 4/1U4, 2/1A3 2/1L4, 4/1R5, 2/1AE4, 1S5, 4/3Q4, 3/3A5, 2/3B4, 3A4, 6AK5 and 2E24. Size: 9x13x11¼ WT: 42 LBS. Used $40.00.

RT-66/GRC Receiver-Transmitter same as RT-68 above except 20-27.9 MHz range. Used $35.00.

RT-67/GRC Rec-Trans. Same as RT-68 except 27-38.9 MHz range. Reparable $35.00.

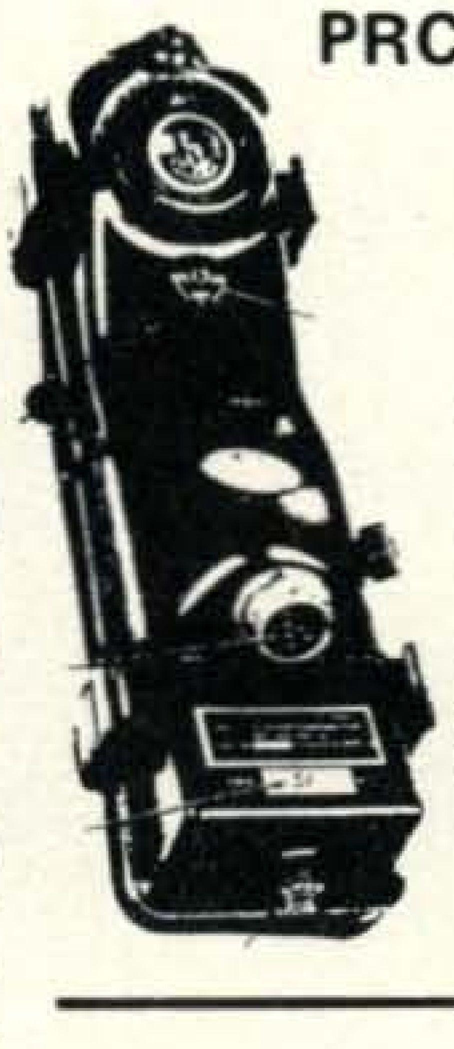


PP-112/GRC 24 Volt power supply for the RT-66, 67 and 68 series receiver-transmitters. This unit supplies all the necessary voltages for the receiver and transmitter circuits. Includes low and high power switch for the transmitter section. Size: 9x13x7¼ WT: 38 LBS. Used $20.00.



T195/GRC Transmitter 1.5 to 20 MHz 24 to 28VDC 100W output 10 Bands 8 Channels. CW, Voice, FSK. 20 tubes 122 LBS. Price used repairable, $50.00 ea.

PRC - 6 WALKIE - TALKIE



RT-196/PRC-6 Receiver-Transmitter F.M. 47 to 55.4 MHz, crystal controlled one preset channel, about 1 mile depending on terrain and conditions. Handheld unit has push to talk switch Mic., phone, fold down antenna, shoulder-strap etc. Also provisions for using H-33/PT Handset. With tubes 6/5678, 3/5672, 2/5676, 3B4, Power Req. 1.5, 45, and 90 VDC, usually supplied by BA-270 Battery (dry) not available. Size: 15x5x4½; WT: 5 LBS. Used $22.00.

ELECTRONICTOWN INC.

1623 South Main Street - Wilkes-Barre, Pa. 18702 Area Code 717 822-6127

Antennas *[from page 50]*

"Why not?," I replied. "For every contribution I receive and put in the column, I'll be pleased to send the contributor a complimentary *Handbook* of mine."

Pendergast stretched and yawned. He started toward the door of the shack. "Glad I don't have to worry about ground planes and low, low loops. My six element Yagi on the 110 foot tower really does the job."

"Yes, and your Pachenko machine helps too, doesn't it?," I rejoined. But Pendergast was on his way and didn't hear my final remark. ■

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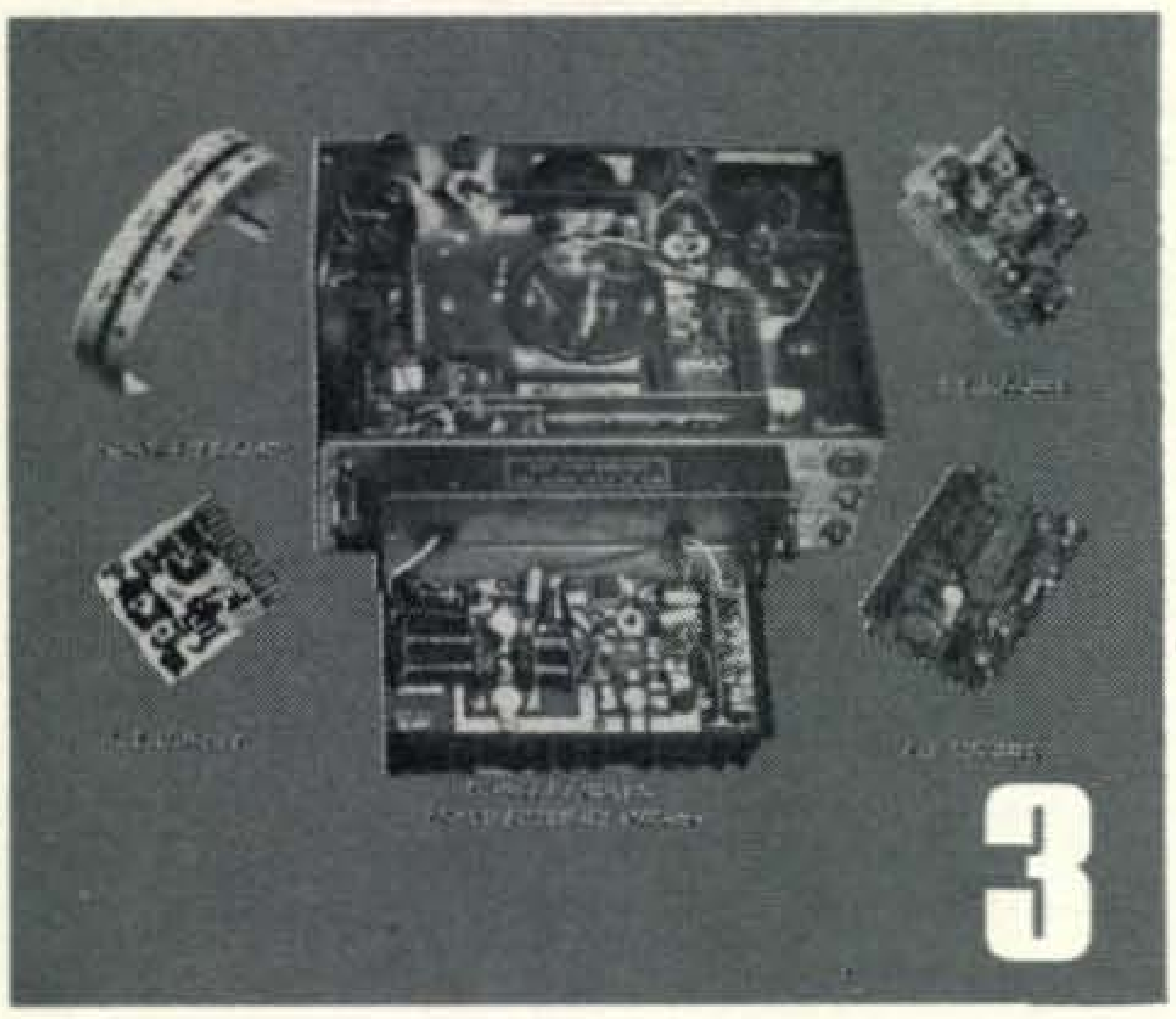

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Math's Notes [*from page 29*]

In future columns, if readers show a suitable interest, we will be glad to discuss other frequency synthesis methods with single or multiple crystals. Also, we will be glad to publish interesting synthesizing schemes developed by our readers.

73 Irv, WA2NDM

Impedance Measurement [*from page 24*]

cle, it may be possible to increase the bandwidth by putting less inductance in the center loading coil—about 300 ohms less. Recall the reactance of the antenna alone was 300 ohms inductive at 7250 kHz. If we are able to find a value of center inductance that makes the antenna reactance zero so that the antenna can be fed directly without the use of a capacitor, the rate of change of reactance will be greatly reduced and the bandwidth may be increased. But this is another story.

Paraphrasing Lord Kelvin's quotation at the beginning of this article, When you can measure both the resistance and reactance of an antenna and express these in numbers, you know something about the antenna; but when you can only measure your antenna with a v.s.w.r. bridge, your knowledge is of a meager and unsatisfactory kind: you can scarcely in your thoughts intelligently improve the antenna.

Novice [*from page 31*]

seconds later, calling CQ again and again, instead of listening for and answering the DX stations that call CQ or even answering the DX that respond to their CQ's! I know that it has been said many times before, but the secret to working DX is to *listen* and *listen* some more for the DX stations to call CQ or to sign off with a station after a contact. After all, if you cannot hear these stations, you will never hear a DX station that might answer your CQ." WAØDXZ's wife is WNØKRN, his mother-in-law is WNØHUG, and his brother-in-law is WNØHUH.

John A. Clausen, WNØLYV, 714 Elk St., Beatrice, Nebr. 68310, uses a Heathkit HW-16 c.w. transceiver driven by a Heathkit HG-10 variable-frequency oscillator (v.f.o.) in conjunction with a Mosley TA-31, 10, 15, 20 meter rotary dipole and a 80-40 meter dipole up 50 feet. With this equipment, he has worked 25 states. . . . **Douglas G. Probst, WNØKUT,** also of Beatrice, Nebraska, and a buddy of WNØLYV's, uses a venerable Globe Scout transmitter assisted by a Ten-Tec v.f.o., and he receives on a Hallicrafters SX-100 receiver. Doug's Mosley TA-31 rotary dipole is 25 feet high, and his 80-40 meter dipole is 40 feet high. He has worked 48 states. . . . What will Betty Crocker cook up next? **Matt Ziegler, WB8KZO,** president of the very active Talawanda High School Amateur Radio Club, WB8PTN, Talawanda High School, Oxford, Ohio 45056, reports that the club turns out many Novice operators who get their General tickets before the year is up. The club's Novice station and also the General station gets heavy use. Unfortunately, the General station is not equipped for s.s.b. but the club is conducting a drive to remedy this deficiency. All it will take is 130,000 Betty Crocker coupon units found on many General Mills food product packages. The drive has been o.k'ed by the school principal and by General Mills. If you would like to help, send coupons or requests for further information to the address above.

Will we read about you and your station in a subsequent NOVICE SHACK? And will we see what you look like? The first step is up to you. Write that letter and send it with a picture, if available, to the address on the first page of the column. We will take it from there.

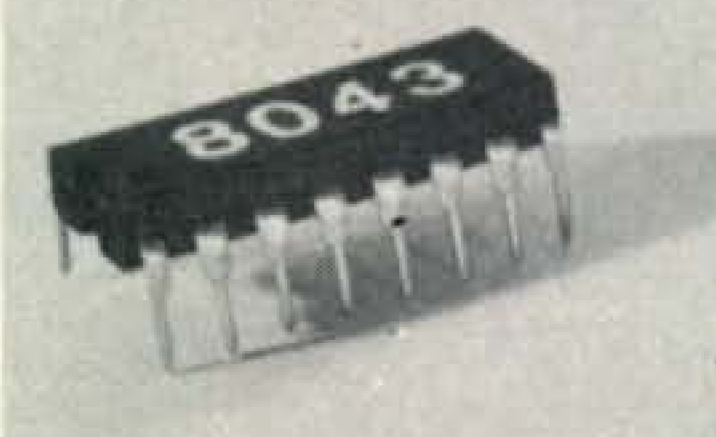
73, Herb, W9EGQ

Balkan Hams [*from page 35*]

Hungary: And Getting Sick Of It

Our trip to Hungary started out bad and ended bad. And the middle wasn't too good either.

We entered Hungary from Romania. Leaving Romania by train, the border guard stamped our passports "Exit on May 20, 1974." Twenty minutes later entering Hungary, the Hungarian officer stamped our passports by mistake "Entered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on May 5, 1974." This was his fault but we had to pay for it. Later I was repeatedly asked to explain how we could enter Hungary 15 days before we left Romania. Besides, we had only a 3-day visa and from May 5 to May 23 when we left, there are 18 days.

Out of the six countries we visited, Hungary was the only one that charged for a visa ($4.50/person) and the only one that required us to exchange in advance a certain amount of dollars for each day we expected to stay.

While in the other countries there was either no need for visas, or they were given right at the border, we had to apply in advance for the Hungarian visa.

Once we arrived to Budapest and settled in a hotel, I tried to get in touch with local amateurs, those we had QSOs with before. I had a long list of HA5s and I called up a couple of them, but none wanted to meet us. As a matter of fact, long before we started the trip, I wrote to the Central Radio Club in Budapest, and to several hams, but did not receive a single reply.

Generally, amateurs like to meet other amateurs, especially foreigners or those they have met on the air. Why did the Hungarian hams show so much restraint?

After many polite excuses I got to Joska, HA-5DJ, and although he was working in a contest, when he heard that an American ham of Hungarian ancestry would like to meet him, he came right away.

Joska is a retired electrical engineer, an oldtimer with many years in amateur radio. He designed and built all of his own equipment and is very active on the air. When Joska arrived at the hotel, we called up Frici, HA5KF, another very active oldtimer. Frici is an MD and a DDS and he is the chief operator of club station HA5KFZ. Frici met us after he finished his work and took us to his club.

HA5KFZ is the club station of the world famous Ganz, manufacturers of heavy electrical equipment, and Frici is one of the company doctors. The radio club has a large meeting room, a construction shop, library, an active station and a bunch of excellent operators like Pista, Miki, and others.

Most of the Hungarian amateurs are highly skilled technicians and their official magazine *Radiotechnika* keeps them informed about everything new in the field.

Next day we went with Joska to the Castle Hill. I was in Budapest many times before but the sights around the Fisherman's Bastion are so beautiful, we had to go again.

Afternoon we visited Joska's station, HA5DJ, (all home made) and even if it doesn't look like Collins, it certainly works like Collins.

At our departure another unpleasasnt situation: checking-in our luggage we found that we had an overweight of about 4 lbs./person. The Hungarian airline clerk did not allow any weight for our baby Diane despite the rule in the books. What's more, he insisted on also weighing our flightbags and us paying for "excess weight." He was so hungry for dollars that I started to suspect that the name of this country has something to do with his attitude.

Anyway, I opened our luggage and in the middle of the international departure hall, I began to throw out our "excess weight," mostly souvenirs we bought in Eastern Europe. In the meantime I cursed them in every language I knew, including Hungarian. Then I remembered that I had to make a last phone call and left Eva to finish the job. Moments after entering the phone-booth, the scared airline clerk dragged me out saying that everything was OK, we could take with us all our "excess weight." He even helped us to re-pack! Unintentionally but successfully, the old "phone-call to a big-shot" trick worked again.

If you like to meet local hams when you travel, I don't recommend going to Hungary. But if you are in Budapest, I recommend visiting the Fisherman's Bastion on Castle Hill, which is up on the heights of Buda, overlooking Pest, the other part of this huge city.

Before I Finish

I would like to mention that next year we hope to go on a real DXpedition and we wouldn't mind joining a group for that purpose. If there is a group with strong men to carry the gear, tireless operators to handle the pile-ups, rich members to pay the bills, a good cook and a pretty baby sitter, I would be happy to accompany them. ■

QRP [*from page 40*]

QRT for fear of being squashed. Got on two hours after the contest began, and headed straight for 15 to catch any possible opening. Boy was I surprised! 15 was loaded with signals and by the sounds of it, sporadic E was at its best. I worked 53 stations on 15 s.s.b. ranging from as close as London, Ont.' (360 mi.) to KZ5WA in the Canal Zone." WB9LKC and son WN9LVZ used a PM-2B and the antenna described in an earlier column. It took them two hours to make a second QSO, but they got rolling to a total of 68—a good showing for first time out. W8NDG was out again with his 80 meter HW-7—asks me to pass along a clarification to his picture in the May column. The 80 meter HW-7 is a specially built unit using the basic HW-7 scheme, but with circuits tuned to 80. So much for FD 1974. A great success. Milliwatt Field Day Trophy standings shown elsewhere, with WØIYP's astounding effort coming out on top. But everyone showed excellent results—much higher scores and number of contacts than in earlier years. A job well-done fellows!

That's it until next time. Good QRP_p'ing and 73, Ade, K8EEG

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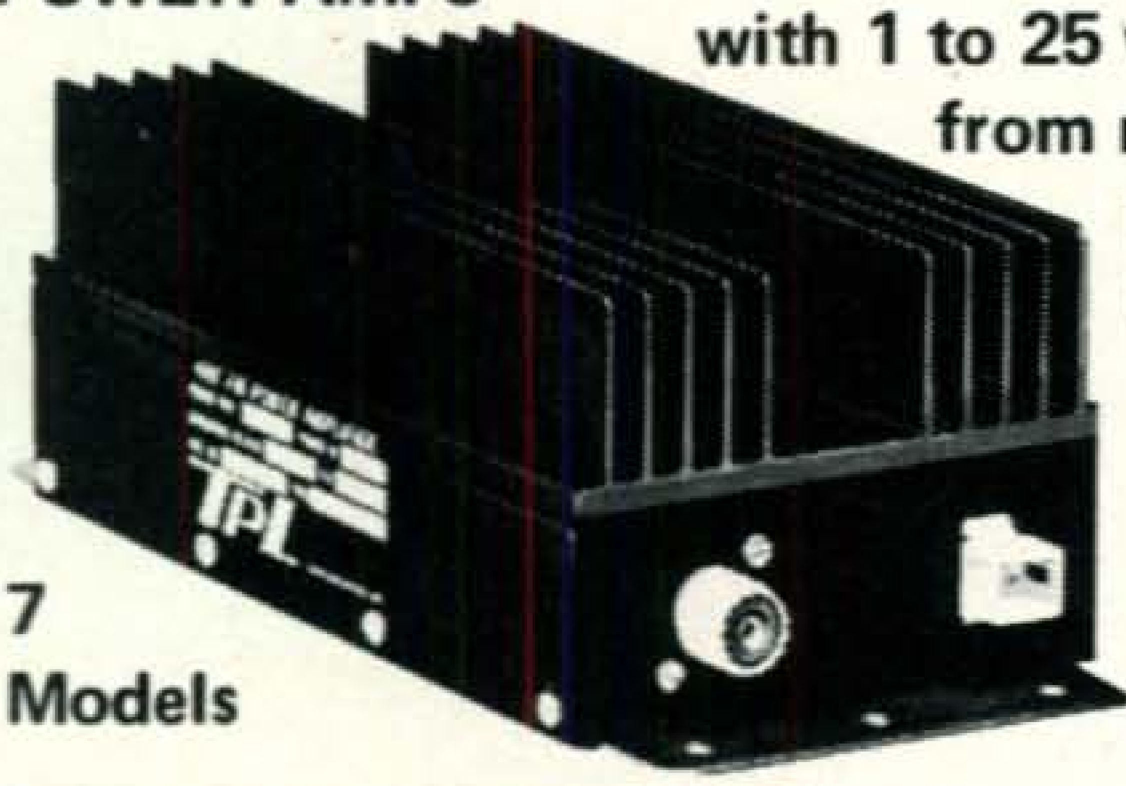

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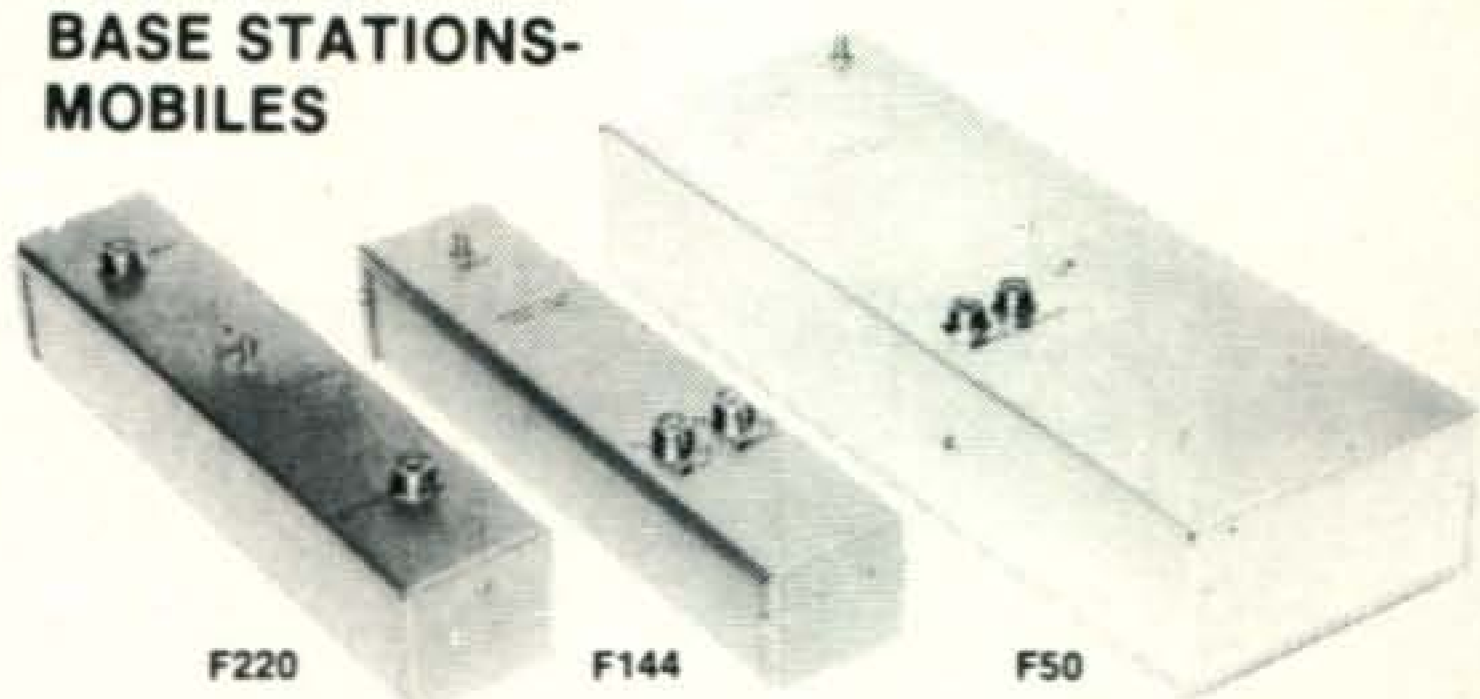

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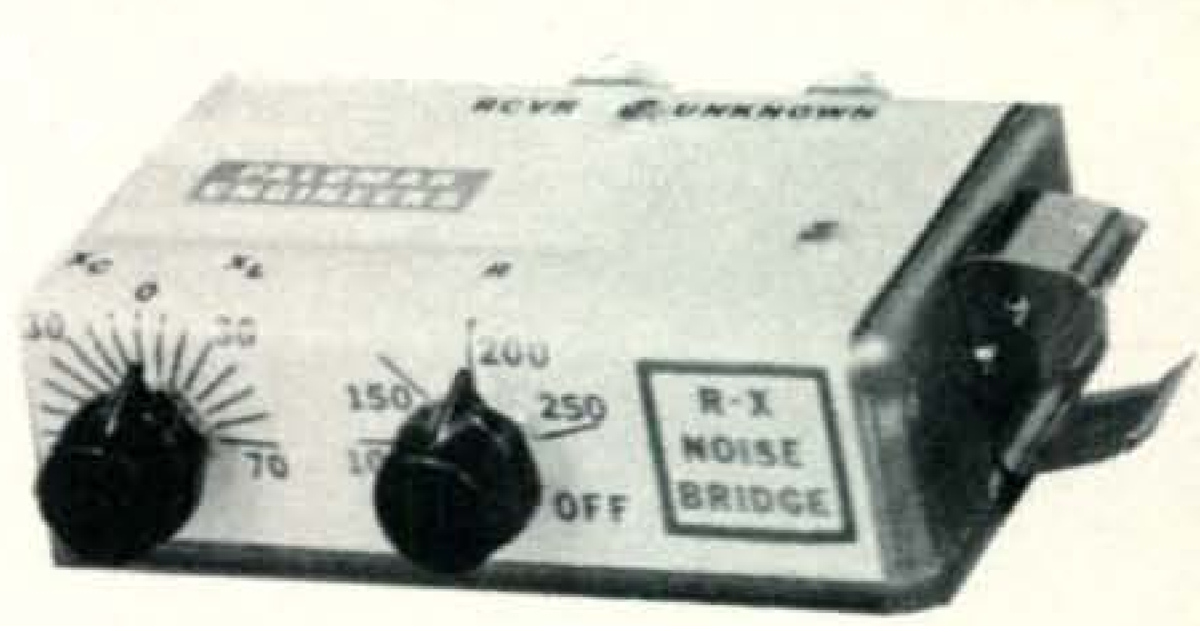

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