SEND FOR FREE COLOR BROCHURE!

Yes! I'm interested in a Vesto Tower. Please RUSH complete information!

Name: ____________________________  
Address: __________________________  
City: ___________________________ State: __________________________  
Call Letters: ______________________

Amateurs! Experimenters!  

READ WHY  

VESTO  

IS "THE TOWER THE AIRPORTS USE!"

These Are Standard VHP-50 Towers with B 200 Safety Platforms

SMALL DOWN PAYMENT!  
24-MONTH TERMS!  
Pick the Tower You Want! Vesto Will Arrange Terms If You Need 'Em!  

22'............ $192  
28'............ $243  
33'............ $288  
39'............ $343  
44'............ $395  
50'............ $468  
55'............ $529  
61'............ $596  
77'............ $898  
100'........... $1392

"Mage" Magers, WØOJI, says  
"Old Timer or Novice—it will pay you to choose the lifetime steel tower the airports and many leading hams use! It's fun to erect this tower yourself. Just dig 4 holes, set anchor posts in place, and bolt the pieces together. 5½-foot ladder sections make it easier to assemble as your tower goes up! Let me send you all the dope today!"

HURRICANE PROOF! NO VESTO HAS EVER FAILED!

HERE'S WHY:  
• 4-Post Construction for Greater Strength!  
• Completely Self-Supporting—No Guy Wires to Break or Stumble Over!  
• Completely SAFE—Ladder to Top!  
• Hot-dip Galvanized Steel Lasts a LIFETIME!  
• Tower Shipped Complete—Ready to Assemble!

"VESTO TOWERS ALL OVER THE WORLD"

VESTO CO., Inc.  

20TH & CLAY  NORTH KANSAS CITY, MISSOURI  

"Mage" Magers, President  WØOJI
The Whole of the Doughnut.............................................. W4BRS................................. 6
Toroidal coils for kilowatt amplifiers.

A 1296 Grid Dipper ..................................................... WIDTY................................. 16
1050 to 1320 MHz with a converted APX-6.

Using FET's in the Command Set Transmitter ............... K3LCU................................. 23
Results in a very stable VFO.

The Dichotomy of a Tube Man ....................................... W5SOT................................. 26
Putting an FET in the BC-906 frequency meter.

Converting the Swan 120 to 6 Meters ......................... K6RIL................................. 28
Be prepared for the six-meter openings this fall.

Military Quartz Crystals for the Radio Amateur ............. WØHYB................................. 36
A survey of surplus crystals.

Converting the BC-728 ................................................. K3HIL................................. 38
A fine superhet for 160, 80 and 40 meters.

Photographing Your Electronic Gadgets ..................... VE3DAN................................. 42
Must reading for authors.

Panoramic Display from the AN/APA-38 Indicator ........... W6JTT................................. 46
Low-cost panoramic reception.

RDR Receiver Conversion ............................................. K3HIL................................. 48
Crystal controlled channels on 220 MHz.

Build a 40-Meter Rotable Dipole .................................. W8GZL................................. 50
Maximum effectiveness on 40 meters with a shortened dipole.

Operating the BC-611 Walkie-Talkie ........................... W1MEG................................. 55
Great for short distances over flat terrain.

A Poor Man's Transmitter Cabinet ............................... WA4RHT................................. 56
Using old TV cabinets.

Micro-logic for Non-logical Users ................................. W6GXN................................. 58
How to use digital integrated circuits in ham projects.

Proportional Transistor Control of AC Circuits ............. Ives...................................... 66
Solid-state replacement for a variable transformer.

Phone Patching—More Light in a Gray Area ................. K8LLL................................. 69
From the legal point of view.

The Heathkit SB301 Receiver ........................................ W2JDL................................. 76
One of Benton Harbor's newest releases.

Face-Lifting the TS34/AP Oscilloscope ......................... K6GKX................................. 110
A great scope for less than twenty dollars.

Climbing the Novice Ladder: Part VII ......................... W7OE................................. 111
Judy and Joe take the written test.

Ham Public Service and Broadcast Stations ................. K4HKD................................. 117
Another approach to better public relations.

Gus: Part 24 .................................................. W4BPD................................. 119
Sir Gus tours ZS-land.

The View from Here ................................................. 2
WTW Report ......................................................... 72

Letters .......................................................... 4
What's New ....................................................... 74

Why Fight Ohm's Law .............................................. 44
New Products ...................................................... 130

Heathkit Transistor Tester ........................................ 52
Caveat Emptor .................................................... 137

The Vacatorner Portable Antenna .............................. 54
Propagation ....................................................... 142

AC Ammeter ........................................................ 54
Ad Index ......................................................... 144

JUNE 1967
With all the technological advancements that have been made in amateur radio in the past few years, there’s no reason why we must perpetuate antiquity by using AM on any of the high-frequency bands.

I’m sure this will evoke a few cries from isolated corners, but the fact is, if you listen in on the bands below 30 MHz at any time of the day or night, AM stations in the American phone band are few and far between.

Ten years ago it was the other way around—sideband stations were in the minority. Even five years ago the gentlemen’s agreement on twenty meters was useful—now it is ridiculous. The two or three AM stations operating between 14200 and 14250 do a lot of complaining about the sidebanders’ violation of this archaic agreement, but they’re the only AM stations on the band. Everyone else has gone to more efficient and compatible sideband.

When king spark was outlawed in favor of CW and modulated oscillators were eliminated from the high-frequency bands, there were cries of anguish from a few who had fallen behind the times. The same thing is true today. There are always a few who fail to keep the pace.

The spectrum that we have available is limited and there’s not a chance in the world that it will be enlarged. There’s even a good possibility that we’ll lose part of it. At the very best we’ll have to contend with more and more intruders. Therefore, it’s incumbent upon us to use the space we do have available to the best advantage. Maximum utilizations of the bands available, cannot, within any stretch of the imagination, include the use of Ancient Modulation. Most amateurs are aware of this and have switched to sideband.

Not only do AM transmitters require much more bandwidth, they are inefficient and in many cases, ineffective. This has been proven many times in the past, both theoretically and practically. If you can copy a station Q5 on CW, about 90% of the time you can make a successful contact on sideband. Don’t try it on AM—90% of the time you won’t make it.

Although spectrum utilization and interference are the two big arguments against AM, there is one other important consideration—state-of-the-art. In years past, amateurs donated much to the advance of the radio art. As our technology sky-rockets forward, there doesn’t seem to be an awful lot that the backyard experimenter and amateur can contribute. However, we can use the best techniques that are available—this doesn’t include AM; it went out with 872 rectifiers, general coverage communications receivers and swinging links.

A lot of the AM procrastinators will holler about the high cost of sideband. Bunk! You can buy a high-frequency sideband transceiver today from five or six prominent manufacturers for about the same thing you paid for a good communications receiver a decade ago. If you don’t like transceiver operation, remote VFO’s are available from most of the same manufacturers for less than a hundred dollars.

Kilowatt power amplifiers are no problem either—if it will work on AM, a few modifications will turn it into a linear. In most cases all that is required are a few changes in bias. While all tubes were not designed for linear operation, most of them will perform pretty well when properly biased.

Furthermore, the conversion of an AM transmitter to double sideband is a relatively easy operation. Although double sideband uses twice the bandwidth of single side-band, it has at least the same efficiency and the troubleshooting carrier is eliminated. The widespread use of single sideband has pretty much inhibited any serious experimentation with double sideband, but it appears to offer at least one advantage—synchronous detection. When a properly designed double side-band system with synchronous detection is used, QRM free QSO’s are apparently the rule rather than the exception. Not that I’m advocating double sideband—I just think it deserves more investigation.

It doesn’t really make a great deal of difference whether we use one sideband or two—either system is compatible with the other. Actually, there is little danger that double sideband will ever be very popular; single sideband equipment is too readily available.

None the less, AM is not compatible. It’s not compatible with sideband, nor spectrum utilization, nor state-of-the-art. It’s inefficient and ineffective. Isn’t it about time we eliminated it from the high-frequency bands?

Jim, WIDTY
ORDERING INSTRUCTIONS

(1) Use one order card for each frequency. Fill out both sides of card.
(2) Enclose money order with order.
(3) Sold only under the conditions specified herein.

SPECIFICATIONS: International Type "EX" Crystal is available from 3,000 KHz to 60,000 KHz. The "EX" Crystal is supplied only in the HC-6/U holder. Calibration is ±0.02% when operated in International OX circuit or equivalent.

CONDITIONS OF SALE: All "EX" Crystals are sold on a cash basis, $3.75 each. Shipping and postage (inside U.S. and Canada only) will be prepaid by International. Crystals are guaranteed to operate only in the OX circuit or its equivalent.

COMPLETE OX OSCILLATOR KITS
Everything you need to build your own oscillator. Two kits available. "OX-L" kit 3,000 to 19,999 KHz. "OX-H" kit 20,000 to 60,000 KHz. Specify "OX-L" or "OX-H" when ordering. $2.35

MINIMUM DELIVERY TIME We guarantee fast processing of your order. Use special EX order card to speed delivery. You may order direct from ad. We will send you a supply of cards for future orders.

INTERNATIONAL CRYSTAL MFG. CO., INC.
10 NO LEE • OKLA. CITY, OKLA. 73102

JUNE 1967
Mighty big in towers

CATV • Microwave • Communications • Broadcast • Home TV • Amateur • Specialty Towers

The dominant position ROHN enjoys in the tower industry has its foundations established on a concept of providing the customer with more than he expects to get. The built-in extra quality factor begins with:

ENGINEERING AND DESIGN — computer-assisted for exactness

MANUFACTURING — vast, modern, custom-designed facilities and methods

FINISHING — hot-dipped galvanizing after fabrication and continues with...

ROHN SERVICE — strategically located warehousing, worldwide representatives, turnkey tower erection service and complete lines of towers, lighting, microwave reflectors, accessories and equipment.

Representation and Distribution Worldwide
For further information contact ROHN®

Home Office
P.O. Box 2000, Peoria, Illinois 61601
Ph. 309/637-8416 TWX 309/697-1488

Letters

The Price of Progress

Dear 73:

... A few months ago I subscribed to 73 and had a rude awakening. I did not know the language well enough to read half the articles. Progress had run ahead of me and I was in bad shape. Since that time I have been trying to catch up and it's rough...

Just wanted you and your associates to know that you are greatly appreciated and I think you are doing a great job for the fraternity. Maybe some of the youngsters like to buy ready-to-operate, but there are still some of those left around that like to experiment and build our own. Again, thank you very much for the fine job you are doing. Keep up the good work.

Emery White, Sr. W4TQD
Glasgow, Kentucky

Dear 73:

... Your magazine is getting better all the time and you may yet make a technician out of a mathematician.

John Bauer
Kanata, Ontario, Canada

QRP

Dear 73:

The following might be of interest to younger hams and perhaps refresh the memories of some of the old timers. The following input powers were taken from QSL cards received from stations worked on 28 MHz in 1948. My call was then KZ5RS; QZ5J—12 watts; ZL1DW—70 watts; ZS1CG—25 watts; OQ6HF—60 watts; GM3BON—35 watts; and VK3PG—50 watts. My reports to these stations were 57 or better.

R. W. Stewart WA4EKF
Warner Robins, Georgia

The sunspots do make a difference.

Transistor Circuits

Dear 73:

Congratulations on your article by W1DTY—too bad you cut off the "T" in his call on the front cover of the March 73. His 73 transistor circuits are going to be a big help to this ham and a lot of others I am sure.

S. R. Gross W9OJI
Wheaton, Illinois

Dear 73:

... the transistor circuits article in the March issue was a real dandy and received a lot of favourable comment from the boys around here.

George Cousins VE1TG
Nova Scotia, Canada

Dear 73:

Only two tubes in the March issue—what did you do, flog the drawer of tube diagrams? If so, FB, Promote Fisk for his solid state jewel!

Ev Taylor W6DOR
Sacramento, California

(turn to page 126)
KNOW... your rig is running right!
(keep it in constant check)

Waters

DUMMY LOAD • DUMMY LOAD/WATTMETERS

DUMMY LOAD/WATTMETERS
MODEL 334A... Reads power output to 1000 RF watts over 2 to 230 MHz. 4 calibrated scales for accurate readings. THE wattmeter if you operate through VHF!

MODEL 374... Indicates RF power to 1500 RF watts from 2 to 30 MHz. Has 4 calibrated scales. Specifically designed for the 2KW PEP Linear to 30 MHz.

DUMMY LOAD
MODEL 384... Handles up to 1500 RF watts from DC to 230 MHz. Combined with Waters Reflectometer operates as a Dummy Load/Wattmeter — and a VSWR Meter.

CANADIAN HAMS: Order direct from M. J. Howard & Co., Ltd., 1300 Carling Ave., Ottawa, Canada.

You'll transmit a consistently better signal with your rig kept under constant operating surveillance. And a Waters Dummy Load/Wattmeter will help you do just that! Even more... you'll know with every transmission your precise power output measured directly in RF watts. Dummy Load/Wattmeters are available in two models to handle either 1000 or 1500 RF watts.

Send for your copy of Waters new Catalog.

WATERS MANUFACTURING INC.
WAYLAND, MASSACHUSETTS
The Whole of The Doughnut

How to use toroidal tank coils in high power amplifiers for increased efficiency with reduced size. Practical inductors are shown for 100, 500 and 1000 watts.

Toroid rf tank coils have brought a new era of construction technique to the amateur builder as well as commercial manufacturers. Spurred on by modern requirements for compact construction, the toroid has seen recent applications in DC to DC power converters, interstage audio transformers, and many other uses. Indeed, the largest single application of the toroidal coil is the television flyback transformer which has been taken for granted for years in the home TV set. Recent articles have described toroidal coil applications in VFO's, low power transmitters, VSWR meters and multi-band tuners. Now, for the first time, the outstanding advantages of toroids have been realized in higher power transmitter rf tank circuits.

The impact of toroids upon modern electronic equipment design has been of first order importance. Not since the advent of transistors or SSB itself, has so important an advance in construction technique been available to the electronics industry. Significant reductions in size, ease of packaging and improved efficiencies lead the list of reasons why toroids have emerged as the currently favorite tool of electronic designers.

Advantages of toroids

The most significant feature of the toroidal coil is that its magnetic flux is almost entirely contained within the coil itself. This means that generous spacing of the coil from adjacent components, panels and chassis need not be provided. Further, by virtue of using a powdered iron core within the coil, an adequate inductance can be achieved with fewer turns, smaller diameters and resultant smaller physical sizes. When fewer turns are used for the coil, larger gauge wire can be accommodated. Also, if the flux is restricted within the coil, greater Q and improved power transfer efficiency are achieved. These factors add to accomplish less heating loss within the tank coil assembly itself, resulting in more power output.

In rf tank circuits for example, we are able to achieve a volumetric size reduction of better than 8 to 1. Part of this is due to the fewer turns and smaller diameter winding which is possible. More importantly, however, less spacing is required around the coil to accomodate its magnetic flux, because this flux for the most part is contained within the toroid. Therefore, a favorably high Q is achieved without spacing the coil at least one diameter away from the chassis as would normally be required with conventional construction. While toroids promise many desirable features, several new design considerations must be recognized. The higher Q presented by a toroidal coil makes its tuning relatively sharp. This is particularly true when tuning an unloaded or lightly loaded tank circuit. There-
Fig. 1. Toroidal rf tank coil for use in a 100 watt transmitter. The powdered iron core provides High-$Q$ and therefore, good energy transfer. Compact construction results in a tank coil only a fraction of the size normally encountered in conventional designs. The core is given several coats of epoxy cement prior to winding so as to prevent flash-over from the winding to the core.

Therefore, when a toroid is used in a transmitter final tank circuit, it may be necessary to "re-dip" the final more often than a conventional circuit when changing from one operating frequency to another. Also, when the quasi-conductive powdered iron core is placed within a high power rf tank coil, some tendency toward flash-over to the core is experienced. However, with proper precautions and adequate spacing as described later, this tendency can be eliminated.

The toroidal core

Cores for the toroidal tank coils described in this article were obtained from Ami-Tron Associates, 12033 Otsego Street, North Hollywood, California. Their model T-200-2 was selected for its large size (2 inch out-
Fig. 3. Taps for connecting to the band change switch are made to small "U" shaped loops in the wire. These loops are placed on the edge of the coil facing the switch and leads are only about 1/2 inch long. The switch is a Mallory ceramic wafer switch.

insulated laminations in a conventional power transformer or choke coil. Higher frequency applications require smaller granule sizes.

The 100 Watt toroid

In our experimentation with toroids in rf tank circuits, three different sizes were selected to satisfy three different power ranges; 100 watts, 500 watts and 1000 watts. The builder might well use somewhat higher or lower powers in connection with the physical sizes of the coils illustrated here.

Corona flash-over to the iron core mass is eliminated by first coating the T-200-2 toroid core with several coats of epoxy cement. Teflon, vinyl or fiberglass tape may also be used for this purpose. Fig. 2 gives the winding data and shows the placement of taps which are connected to a ceramic wafer band change switch. Number 14 AWG enameled copper wire is used. The windings for the 10, 15 and 20 meter portions of the coil are spaced out at the center of the toroid equal to the wire diameter. The remaining 40 and 80 meter portions of the coil are close spaced at the toroid center.

Fig. 4. Schematic of a typical pi network. Additional fixed capacitance is provided at both the input and output in the 80 meter position. This permits smaller tuning capacitors to be used.
Taps to the toroid tank coil are made by forming a small loop in the winding as shown in the cross-section, Fig. 3. Stout needle-nose pliers are used for this purpose. After all windings are completed, the enamel is scraped from the loop and short sections of the #14 buss wire are soldered on, completing the connections to the band change switch. These short sections provide a rigid mounting of the coil to the switch and permit the completed assembly to be panel mounted.

The reader will note that a double pole wafer switch was selected for the 100 watt toroid tank coil. This permits the switching in of a fixed 50 pF paddler capacitor on the 80 meter band as shown in Fig. 4. Consequently, the smaller 100 pF variable tank capacitor can be used, resulting in further space and cost savings. In the 80 meter position, a switch tap is also available for padding the output or antenna loading capacitor.

**Winding toroids**

When winding toroids commercially, specialized machines are used. Large numbers of turns are made by passing a bobbin of wire thru the toroid on a circular guide ring. Winding rf tank coils with heavy gauge wire presents a whole new family of problems. The toroids in this article were all wound by hand with a predetermined length of wire.

The builder's first inclination is to hold the core in a bench vise and pull the turns taut with pliers as shown in Fig. 5. Don't do it! A broken core is bound to result. The core should be held by hand and each turn is pressed into place. While this is a challenge to the strength and endurance of one's fingers, it is necessary for successful toroid construction. Powdered iron cores are fragile and if one happens to be dropped or otherwise broken, it can be cemented together again as shown in Fig. 6. Remember, that insulation between the iron granules of the core is fundamental to its design. Avoid use of organic cements which deteriorate with heat or age.

The following are a few pointers which will ease the task of designing and winding toroids employing heavy gauge wire:

1. If the proper number of turns is not known, wind the coil first with small size bare wire. It will be easier to wind, easier to space out the turns and more convenient to solder on taps to verify where they should be placed. After making the necessary electrical measurements, the small wire can be clipped loose, discarded and replaced with wire of the proper size.

**Fig. 5. How not to wind your toroidal coils!** The fragile core is sure to break if heavy wire is pulled taut with pliers. When winding toroids, the core should be hand held, and the wire pressed into place with your thumb.

**Fig. 6. Broken powdered iron cores may be repaired with epoxy or household cement.** Core material is a quasi-insulator and electrical contact between the broken pieces is neither required nor desired.
2. The length of heavy gauge wire required should first be calculated or simulated with string. This will avoid the inconvenience of threading an excessive length of wire through the toroid and will eliminate wastage when cutting off the surplus after the proper number of turns are reached.

3. Note the direction to which the windings advance; left to right. Determine the proper winding direction so that taps for the various bands proceed from left to right when viewing the band switch from the front panel.

4. Prior to starting the winding, straighten the wire and remove kinks. This can be done by holding one end in a bench vise and jerking the far end with a pair of pliers. Alternately, the far end can be twisted an equal number of turns to the right and then to the left with a hand drill. Avoid excessive working of the copper which causes it to harden and become more difficult to handle.

5. Start winding from the center of the measured length of wire and work toward each end. This eliminates passing the total length of wire through the toroid core on each turn. It also minimizes work-hardening of the wire and kinking due to excessive handling.

6. Press wire firmly in place on each quarter-turn so that tight windings and neat right angles are obtained on each turn.

7. Prior to passing the free end of the
wire thru the core, unwind the last quarter turn slightly. This permits the wire to thread through parallel to the axis of the core and avoids kinks.

8. When spaced turns are called for, first wind them close spaced. After the proper number of turns are in place, space them out to the desired locations. This results in neater windings and tends to tighten them upon the core.

500 watt toroid coil

Fig. 7 shows the 500 watt toroid. An Ami-Tron T-200-2 core is also used with this coil. The band change switch pictured with the coil is the husky tap switch taken from a surplus BC-375 antenna tuning unit. These are still available for little cost from surplus dealers who advertise in this magazine. If a new switch is to be purchased for this purpose, the Ohmite power tap switch model 111 or 212 will work very well.

The reader will observe that insulating end spacers have been employed to hold the wire away from the powdered iron core material. About one-eighth inch of space is thus provided and has served well to prevent flash-over from the coil to the core. This spacing is about equal to that usually used between the rotor and stator of a tank capacitor selected for this power level.

Enamed copper wire of #12 AWG size is used for the 500 watt toroid coil. It is wound using the same general instructions as used with the 100 watt unit. Because a larger coil diameter results from use of the end spacers, fewer turns can be employed. This is a welcome advantage due to the smaller inner diameter of the end spacers and less space which is available for the windings. Fig. 8 gives the winding data and tap information for the amateur bands from 80 to 10 meters inclusive.

1000 watt coil

Fig. 9 illustrates the high power coil which is suitable for 2 kW PEP on single sideband. The 10 meter portion of the coil has been externally wound. This was done to provide further isolation of the high impedance or highest voltage end of the coil from the powdered iron core. Copper tubing of 3/16 inch diameter is used for the 10 meter coil and #10 AWG tinned copper buss wire is used for the remainder of the coil within the toroid core.

In the 1000 watt coil, two Ami-Tron T-200-2 toroid cores are used to minimize the possibility of core saturation and "flat-topping". Prior to winding, the two cores as well as the end spacers are cemented together with epoxy cement. This makes winding of the coil much easier. Alternately, the two cores and two end spacers could be temporarily clamped together or lashed with string until the initial windings are in place.

The heavy duty band change switch is again used as previously described. Even with the greater mass presented by the two cores and heavier wire, no problem was encountered in making the complete assembly rigidly panel mounted by short pieces of #10 AWG copper buss connecting the taps to the band change switch. Fig. 10 provides the winding data for the high powdered coil. This spacing is ensured by placing small ⅛ inch by 2 inch pieces of 1/16 inch aluminum or plastic between the turns at the center of the coil. After proper and uniform spacing is achieved the individual turns are secured to the end spacers with epoxy cement. The temporary spacers can then be removed.

End spacers

Polystyrene sheet ⅛ inch thick is used to...
Fig. 9. High power tank coil for 1 kW operation. Two cores are stacked to lessen the possibility of core saturation. Larger wire (#10 AWG) is used in this model. The same heavy duty band change switch is used for this and the medium power version.

make the end spacers. Fig. 11 gives the dimensions of these pieces. Lucite or bakelite should not be used due to their inferior dielectric strength. The end spacers can be readily make on a lathe or can be cut out and recessed by means of a chassis fly-cutter in a drill press. If the end spacers are to be cemented to the toroid core, it is not necessary to cut the circular recess in them as pictured.

Tap connections

Fig. 12 shows alternate methods of securing tap connections to the toroid coils. Good success was achieved by providing about a ½ inch overlap of the tap lead on the coil winding. Solder is cautiously flowed on both sides of the tap taking care not to melt the polystyrene end spacer material. When assembling the coil to the band change switch, it is desirable to first form and solder the two major coil ends to their proper terminals on the switch. This serves to position the coil and makes it more convenient to form the taps and solder them in place.

Coil measurements

A Boonton Q Meter is invaluable in the empirical design of coils. However, such an instrument is not generally available to the amateur constructor. In lieu thereof, a grid-dip meter and calibrated capacitor will serve for frequency determination. A recent article in 73 Magazine described this method. The three toroid tank coils were measured on a Boonton Q-meter and the following unloaded Q values were recorded:

<table>
<thead>
<tr>
<th>Band</th>
<th>100 watt</th>
<th>500 watt</th>
<th>1000 watt</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>310</td>
<td>360</td>
<td>332</td>
</tr>
<tr>
<td>40</td>
<td>177</td>
<td>200</td>
<td>190</td>
</tr>
<tr>
<td>20</td>
<td>160</td>
<td>205</td>
<td>188</td>
</tr>
<tr>
<td>15</td>
<td>132</td>
<td>186</td>
<td>190</td>
</tr>
<tr>
<td>10</td>
<td>128</td>
<td>146</td>
<td>250</td>
</tr>
</tbody>
</table>

The lower Q values measured at the higher frequency bands are due to the coil being “bunched-up”. That is, the small number of turns occupy only a fraction of the total core length. To achieve maximum Q for any given number of turns, those turns should be spaced out evenly over the whole core.
The high power coil utilizes two powdered iron cores whose larger winding cross section requires that still fewer turns be used than for the medium power coil. While it is optional with the builder, in this case, the 10 meter section of the tank was externally air-wound. This is desirable because it reduces the electro-potential stress between the "hot" end of the coil and the core. Four turns of 3/16ths inch diameter copper tubing are wound on a 1 1/4 inch diameter form and spaced out to 1 3/4 inches long.

length (or circumference). This situation is always encountered with a multi-tapped coil. It is interesting to note that the high power 10 meter coil has a relatively high Q. This is obviously due to its heavy construction, optimum length/diameter ratio and the fact that it is self-supporting, external to the toroid.

Fig. 13 provides a handy guide in determining the value of tank capacitance to be used in resonating these coils. Of course, the first step to be taken when designing a resonant tank circuit for your transmitter is to select the proper L/C ratio to match the tubes output impedance. The toroid coils described in this article are suitable for most tubes in common use today. However, if several amplifier final tubes are paralleled as is frequently done, the reader should be guided by the references on this subject in one of the amateur radio handbooks to obtain a proper L/C ratio.

The future of toroids

Having already gained wide spread use in many lower power applications, toroids can now be used to great advantage in high power transmitters. Perhaps before long, commercial transmitters will be using toroids. In the meantime, the amateur may avail himself of their superior compactness and efficiency and thereby continue the pioneering heritage which has earned the amateur radio operator and constructor his place of respect today.

Acknowledgement

Mr. Joe Williams, W6SFM, of Ami-Tron Associates was most helpful in furnishing toroid core material, technical advice and encouragement in developing the coils described here. To Mr. Paul Sellers, W4EKO, goes thanks for early design criteria and the pioneering approach to high power toroid rf coils. The assistance of Mr. Frank Emens, W4HFU, was invaluable in making coil measurements, and Mr. Jim Bauman and

Fig. 12. Details of alternate methods for making the tap connections to the toroidal tank coils. Care must be taken to prevent solder from bridging over to the core, thus promoting a flash-over. Excessive heat must be avoided when soldering near the end-spacers so as to prevent their being melted.
AMI-TRON

Ferromagnetic Products

Red "E" Cores — 500 kHz to 30 MHz:
T-200-2 $3.00
T-94-2 .75
T-80-2 .60
T-68-2 .50
T-50-2 .45
T-37-2 .40
T-25-2 .30

Yellow "SF" Cores — 10 MHz to 90 MHz:
T-94-6 .95
T-80-6 .80
T-50-6 .50
T-25-6 .35

Black "W" Cores — 30 MHz to 200 MHz:
T-50-10 .60
T-37-10 .45
T-25-10 .40

FERRITE BEADS: Package of 12
Spec Sheet: $2.00
Kilowatt Toroid Balun Kit: $5.00
Experimenter's 2 Core Toroid Kit: $1.50
Minimum Order: $1.00
Please add 25c per order for packing and shipping.

Ami-Tron Associates
12033 Otsego Street
North Hollywood, Calif. 91607

Fig. 13. Charts showing the capacitance required to resonate the three toroid tank coils on the five amateur bands. The L/C ratios obtained on each band match the tube impedances most frequently used today. If a very low tube output impedance is encountered, such as found in paralleling of many TV tubes, a much lower L/C ratio would be called for.

Mr. Jack Hood of RCA, Huntsville, Alabama deserve credit respectively for the model shop work and art work used in this article.

... W4BRS

References

"Vacationer"

PORTABLE ANTENNA
with Non-Shatterable Base

- 20-15-10-6-2- Meters
- Very Low SWR
- Folds to 19 inches
- Weighs only 2 pounds
- Complete for 5 Frequencies

$24.50

ask your local dealer
or

DPZ CORPORATION
P. O. BOX 1615
JUPITER, FLORIDA 33458
Get an Exciting Job "Inside" Radio or Television...as a Broadcast Engineer

No college or high school diploma needed—just a Government FCC License. Here's how you can prepare in your spare time.

Looking for a job with more money and more excitement? Become a Broadcast Engineer!

When you work at a radio or TV station, you're where the action is. You're in on news as it breaks. You hear new records before they're released. You often know the behind-the-scenes stories of important events. You rub shoulders with famous people in show business, athletics and politics. And you may get to announce news or music and become a local celebrity yourself.

There are deeper satisfactions too. In emergencies you help save lives and restore order. During the great power blackout of 1965, radio helped prevent widespread panic.

Yes, broadcasting is exciting. And breaking into it is easier than you might imagine. Right now, there's a desperate shortage of broadcast engineers—a job that pays from $185 to $215 a week at big-city stations once you have a little experience under your belt.

All You Need Is a License

You don't need an engineering degree to qualify. You don't need a high school diploma. All you need is a Government 1st Class FCC License. If you have one, most stations will welcome you with open arms. In fact, Radio-Electronics magazine says: "If you can't get a good job with one...you'd starve to death in a candy store."

For some men, getting an FCC License is easy. For others it's hard. It depends on how much electronics you know when you take the licensing exam.

Our specialty is making it easy. For over 30 years, we've been teaching men electronics in their homes. No lost income—no classes to attend. Yet our graduates learn their electronics so well, 9 out of 10 pass the FCC exam. Without our training, two out of three men fail! For this reason we can back our license-preparation courses with our iron clad Warranty: Upon completion of your course, you must be able to pass the FCC exam—or your tuition will be refunded in full.

What makes our course so good? For one thing, we use AUTO-PROGRAMMED™ lessons. You build your knowledge of electronics the way you'd build a brick wall—one piece at a time. Each "piece" is small and easy to handle, And it rests securely on the pieces that came before it. It's easy to learn this way, even if you once had trouble with your studies.

And you get more personal attention than you might in a busy classroom. Your instructor doesn't merely correct and grade your work—he analyzes your thinking to make sure you are staying "on the right track." Then he mails back your assignment the same day he received it, so you can read his notes and corrections while everything is still fresh in your mind.

These 2 Free Books May Change Your Life

If you itch for a better-paying, more interesting job, the two books we offer may have your answer. One tells how to qualify for some of today's many fabulous career opportunities in electronics. The other tells how to get your FCC License and break into broadcasting. Both are free. No obligation—just mail the coupon. It may be the turning point of your life.

Cleveland Institute of Electronics
1776 E. 17th St., Dept. ST-12, Cleveland, Ohio 44114

Please send me without cost or obligation:
1. Your 40-page book "How To Succeed In Electronics" describing job opportunities in electronics today, including those in broadcasting, and how your courses can prepare me for them.
2. Your book on "How To Get A Commercial FCC License."

Name
Address
City, State, Zip
Occupation
Age

Check here for G.I. Bill Information

Accredited Member National Home Study Council
A Leader in Electronics Training...Since 1914

CIE
Cleveland Institute of Electronics
1776 E. 17th St., Dept. ST-12, Cleveland, Ohio 44114

June 1967

15
A 1296 Grid Dipper

Conversion of the APX-6 transponder to a grid-dip oscillator that covers from 1050 to 1320 MHz.

One of the big problems with operating on 1296 MHz is locating the operating frequency of your equipment. Not only is the newcomer faced with this problem—any longtime resident on 1296 will attest to the many checks he has made to ascertain operating frequency and band edges. Some UHF amateurs have been able to obtain signal generators that cover the 1215 to 1300 MHz band, but many must resort to the time-proven lecher-wire system for any meaningful frequency measurements on this band.

Each of the systems commonly in use suffer from one disadvantage or another. Moreover, there is no commercial grid dip meter on the market, to my knowledge, which will cover this range. Most of them stop at 1000 MHz or so. This conversion of the APX-6 is not difficult and results in a very versatile grid-dip meter. Like its lower frequency counterparts, it may be used for dipping resonant circuits, detecting rf energy or as a signal source. The built-in Veeder-Root counter provides excellent frequency readout and the internal gear system ensures repeatability.

The only part of the APX-6 you need for
this conversion is the cavity assembly. You can buy the door assembly of the APX-6 from many surplus dealers, but this contains the IF strip which you don’t need. In any case, the cavity assembly, with or without the IF strip can usually be obtained for less than ten dollars. I picked mine up at an auction for five bucks—the original owner had started to convert it but evidently had given up. No matter, the transmitter and T-R cavity don’t serve any useful purpose in this conversion. In fact, if you can obtain an APX-6 that has already been converted for use on 1215 MHz, by all means do so. Many times units that have already been converted go for much less. The only requirement for this conversion is that the receiver local oscillator cavity has not been disturbed. This is the case in most of the popular conversions.

The first step in this conversion is to pull out the tubes and separate the cavity assembly from the door. Now remove the screws holding the cathode cavity plate to the cavity body and the six screws holding the cavity body to the gear and counter housing. To remove the cavity body, pull it straight up from the casting. With the unit broken down to its three main parts, we can start the actual conversion process.

First of all, pull the plate off the back of the gear housing. Inside you will find three sets of bevel gears and the rest of the paraphernalia that translate cavity plunger movement into numbers on the counters. Turn one of the counters up to 999 or down to 000. Note the tab on the horizontal gear which engages with the tab on the small bevel gear to prevent further movement of the tuning plunger. As you look at the casting from the rear, the receiver cavity is on the left, the diplexer (transmit-receive) cavity is in the center and the transmitting cavity is on the right.

Remove the five screws which hold the bottom plate on the housing and carefully remove it from the casting. It has to be pulled straight out. Three long pins with small locating tabs at the top are mounted on this plate. These tabs fit into keyways located in the tuning plungers. The receiver and diplexer plungers are removed by pulling them out from the gear end; the transmitter plunger is lifted from the top after unscrewing it from its drive gear. Now remove and discard the transmitter and diplexer Veeder-Root counters and gear trains. To remove the \( \frac{3}{4} \) inch drive shafts (on which the knobs were mounted), drive out the small retaining pins with a pin punch.

Unscrew the receiver tuning plunger from the gear assembly and cut \( \frac{3}{4} \) inch off the end. This can be done on a lathe by any machinist or, with care and a very fine hack-saw, at home. To prevent undesired resonances the cut must be exactly perpendicular to the plunger axis—this is best accom-

Fig. 1. Schematic diagram of the APX-6 grid-dip oscillator. Note that a 2C42 is used in the oscillator instead of the original 2C46. The built-in bypass capacitors and cavity inductance are not shown in this drawing.
The three pieces of the cathode cavity plate—the modified plate to the left, the serrated contact ring in the center and the new plate cover on the right.

plished on a lathe. Handle the plunger very carefully so the surface is not scratched. If it is damaged, the diplexer plunger may be used as a substitute.

While the plungers and gears are out of the housing, remove the shoulders around the transmitter and diplexer drive shafts on the front of the casting. If these shoulders are not cut off with a hack saw or filed down, the completed unit won’t sit flush against the new front panel.

After the piece is cut off the tuning plunger, screw it on the gear drive assembly and push it through the contact fingers on top of the gear housing. Set the Veeder-Root counter to 000 and put the bottom cover in place. Now you have to do a little juggling. Adjust the plunger so it just protrudes through the contact fingers. Now mesh the drive gears so that the stop tabs engage. Usually you’ll have to move the gears a few teeth each way to get the shaft to stop with the counter on 000. When the gears are all lined up, install the screws in the bottom cover.

The first step in the conversion of the cavity body is to remove the large coaxial connector. Remove the screw from the split collar which holds the connector on the front of the cavity. When the screw is removed you should be able to rotate the connector in the collar. The center contact is soldered to a pickup loop which is located in the wall between the diplexer and transmitter cavities. When this joint is unsoldered the connector may be easily removed. Remove the collar by unsoldering it from the front of the cavity.

Cut out a piece of copper 1-23/32 inches wide by 2-1/4 inches long. This will be used as a partition in the center of the old diplexer cavity. If you cut this partition a little larger than required and form lips at the edges, it may be force-fit into the diplexer cavity and no soldering is required.

Look down inside the receiver cavity. You will note that the plate voltage is applied through a feedthrough capacitor (C403) to a piece of wire which winds spirally around the plate line. Unsolder this wire from the capacitor, remove the three retaining screws and pull out the plate line. This line must be shortened by ½ of an inch. This is most easily accomplished with a tubing cutter.

In the unmodified APX-6 the local oscillator energy from the receiver cavity is coupled into the crystal mixer with the small loop adjacent to the aperture in the cavity wall. Somewhat heavier coupling must be provided for grid dip service. Cut a strip of copper ¾ inch wide and about 2½ inches long. Form a short tab on one end of this strip and solder it to the bottom of the receiver cavity about ¼ inch out from the wall. Put a “Z” bend in it as shown in Fig. 2. and solder it to the contact on the crystal mixer. After the new coupling loop is in place, put the modified plate line back in place and reconnect the B plus line to the feedthrough capacitor.

Unscrew the connector from the crystal mixer and pull out the diode. Remove the crystal retaining fingers from the BNC connector with a pair of pliers and push an awl through the ceramic capacitor which is built into the connector. Remove the pieces of ceramic and pull out the center contact.
Save this female pin. If the ceramic capacitor is not removed, all of the 1200 MHz oscillator energy will be bypassed to ground.

If you look closely at the back end of the mixer assembly you will see a round cover plate which is soldered in place. You will also see that a small hole has been drilled through this plate. Form a small hook in the end of a piece of #16 buss wire and hook it through this hole. Heat the cover plate with a small torch and when the solder is softened, pull the plate free with the buss wire. Solder a two inch length of #18 wire to the center contact of the mixer assembly and run it up through the connector body—cut it so it extends 13/16" above the threaded shoulder. Solder the female connector pin to the end of this wire and replace the BNC connector. Replace the round cover plate on the rear of the old mixer assembly and solder it in place. Modifications to the cavity body are now complete.

Unsolder the diplexer cavity from the cathode cavity plate and discard it. Discard the transmitter cathode cavity and saw off the grid contact fingers which extend above the plate at the transmitter end. Using the cathode cavity plate as a guide, cut out a piece of thin aluminum as shown in the photographs to cover up the holes. This cover serves no functional purpose, but it does make a neater looking unit. All that is left are the modifications to the receiver cathode cavity.

If you look inside the receiver cathode cavity, you will see that the grid contact is suspended from the top of the cathode cavity with three wires. These wires are soldered to both the cathode cavity and the grid ring. Carefully unsolder the support wires from the top of the cavity and pull out the grid ring; remove the three wires. Enlarge the three holes in the top of the cavity with a reamer, install three 500 pF feedthrough capacitors (Erie X5U0 501M or equivalent), and solder them in place. These feedthroughs consist of a coaxial shell and are actually only half a capacitor—when you run a wire through the center, the capacitor is formed. If you can't locate this type of capacitor, you can make your own by unsoldering and removing the center conductor from a conventional feedthrough capacitor.

Solder three 1\(\frac{1}{2}\)" lengths of #16 buss wire to the grid ring and put it back in the cathode cavity with the new support wires going through the feedthrough capacitors.

Place the 2C46 in the cathode cavity and use it as a guage for placing the grid ring in the proper position. When you have everything all lined up, solder the three supporting wires to the feedthrough capacitors. It's a good idea to check for shorts between the grid ring and the cathode cavity before soldering everything down—they should be electrically isolated for dc.

The APX-6 cavity modifications are now complete. It will tune smoothly from about 1050 MHz to well over 1300 MHz and grid current may be monitored in the modified cavity. All that is left is the power supply and modulator.

For maximum stability the power supply is regulated with a zener diode. The ninety volt supply is more than adequate for this purpose—when the grid is shorted to ground the grid current is nearly 1 mA. With the 10,000 ohm grid resistor, grid current is on the order of 150 A. A 200 microampere meter
is ideal for this grid dipper, but since I had a large 1.5 mA meter which I wanted to use, I incorporated a simple transistor meter amplifier. The negative supply voltage for the amplifier is developed across the 330 ohm resistor in the power supply. The meter amplifier transistor and bias resistors are mounted on a small piece of Vector board which is mounted on the meter terminals. If you don't want to use the meter amplifier, simply connect the meter between the arm of the sensitivity control and ground.

Modulation of the oscillator is provided by the 1000 Hz transistor phase-shift oscillator—modulation is adjustable up to about 90%. The oscillator is constructed on a small piece of Vector board which is mounted behind the APX-6 cavity on the main chassis. A jack on the front panel may be used for external modulation—a three to four volt audio signal will provide 90% modulation.

I built the chassis for my APX-6 grid-dipper from sheet aluminum, but a standard 12” x 11” x 8” utility cabinet can be used if you don’t like to bend aluminum. My chassis is 11” wide, 10⅞” high and 5½” deep and consists of two U-shaped pieces. Bracing is provided by two brackets across the top and bottom as shown in the photographs. These brackets are made up from do-it-yourself aluminum angle and actually serve two purposes. In addition to strengthening the chassis, three tapped holes in each bracket accept the cover retaining screws. The front panel is laid out as shown in Fig. 3. Even if you don’t use this type of chassis construction, it is recommended that you use this panel layout.

The parts placement was chosen to provide a balanced layout. This means that all the available space is used. In fact, the two phone jacks occupy space previously taken up by the discarded counters in the gear housing. If they are moved to any great extent, they will interfere with the gear housing. The layout for the square counter cutout and five cavity mounting holes are not shown in Fig. 3—these are best obtained by using the old APX-6 door as a template.

Construction is quite straightforward and no problems should be encountered. Note, however, that the phone jack in the grid lead must be isolated from ground—this is easily done with fiber washers. Since the jacks are hidden by the gear housing when the cavity is attached to the front panel, wiring to them is run through the small screw holes drilled in the bottom of the housing. These holes were originally used to hold the counters in place.

The output of the oscillator is connected to the front panel connector with a short

![Fig. 3. Front panel layout for the APX-6 grid dipper. The locations of the square counter cutout and cavity mounting holes are not shown—they are best determined by using the old APX-6 door as a template.](image-url)
length of coaxial cable. One of the newer Teflon insulated cables would be ideal for this purpose, but RG-58/U is perfectly adequate—that's what I used. Mismatch losses at the BNC connectors may be minimized by using the connector assembly diagrams in 73°.

Although a 2C46 was used in this cavity in the original APX-6, I found that it would not always oscillate in the modified cavity when power was applied. Substitution of the 2C42 from the old transmitter cavity solved this problem. An added bonus was the extra power output available with the 2C42.

Since there is a considerable difference in grid current between the oscillator and detector modes, be sure to turn down the sensitivity control before switching from one mode to another. If you don't, the needle will slam against the pin. It's also a good idea to turn the modulation control down when modulation isn't required. Since the meter indicates the relative magnitude of the modulating signal, less meter sensitivity is required when the oscillator is modulated. If the modulation is turned up when you switch from carrier to detector through the modulated position, a bent meter pin is inevitable.

After you have completed the unit, all that is left is calibration. There are several approaches at this point, depending upon the type of equipment you have or can borrow. Lecher wires are the most straightforward but not necessarily the easiest. I used a General Radio 1140A wavemeter and an old surplus echo box and then made a double check with an LAE signal generator which covers this range. The calibration curve (Fig. 4) was then mounted on the front of the grid dipper for easy reference.

The completed unit tunes very smoothly through its range with no jumps in frequency. A few false dips in grid current appear around 1100 MHz, but in the main range of interest, 1200 to 1300 MHz, there are no false dips. In the detector mode, rf signals down to several millivolts provide an upsing on the meter. When used as an oscillating detector with headphones, significantly lower magnitude energy may be readily detected.

For the amateur who is interested in operating on the 1296 band, this grid dipper is a very useful piece of equipment. It may be used for tuning up converters, dipping out filters, detecting parasitics, determining transmitter frequencies and in tuning up frequency multipliers. In a pinch it may even be used as a low power transmitter by plugging in an external modulator.

... W1DTY
The Classic 10-15

The New 'CLASSIC' Approach
To The Hot Bands
... 10 & 15 Meters.

Have you tuned 10 and 15 meter bands recently? They're quite active again. The 15 meter band is now considered the best daytime DX band and 10 meters is gaining more ground every day. An All New approach to these bands is the Classic 10-15. The newest addition to the Classic Trap-Master beam family, incorporating the very latest in matching systems, Broad Band Capacitive matching (Pat. Pend.), first introduced last year in the now famous Classic 33.

The Classic 10-15, power rated for 1 KW AM/CW and 2 KW P.E.P. SSB input to the final. Gain, a FULL 8 db. compared to reference dipole or 10.1 db. over isotropic source. Incorporates durable metal enclosed traps made famous by the Trap-Master TA-33. Maximum front-to-back, And so lightweight (only 27.5 lbs. assembled weight) it may be easily stacked with your present 20 and/or 40 meter beam.

Another reason why you select quality when you specify Mosley. Write for more information.

Write Dept. No. 131
4610 N. Lindbergh Blvd., Bridgeton Mo. 63042
Using FET's in the Command Set Transmitter

How to build a very stable VFO using a Command Set and three transistors—one FET and two conventional types.

Do you need a good stable VFO that's quite easy and inexpensive to build? Well I did, and after discarding many possibilities I came back to the old reliable Command Set. Tubes were definitely out—after all, who needs them with so many types of semiconductors to choose from. Besides, the FET is supposed to behave like a tube, why not use it.

Hastily I attached an FET to the cathode, grid and plate pin of the oscillator tube. Boy, was I surprised—the oscillator took right off when voltage was applied without any component changes.

Enthusiastically, I began to remove everything from the chassis and decided to cut down its size as detailed in the Command Set book. All parts except those associated with the oscillator were removed. The set was then rewired as shown in Fig. 1. The first transistor after the FET oscillator is operated as a class A buffer amplifier to isolate the oscillator from the output transistor and to build up the small signal to drive the next stage. The output stage is a broadband class C amplifier and only draws current when the oscillator is operating. No tuned circuits are used except the original circuit so the output is constant across

The shortie, transistorized Command Set. The transistor sockets are mounted in the center of the old octal tube sockets.

the band. With a 10 volt supply you get a full watt of input power to the final transistor. This is plenty enough to drive any crystal controlled transmitter.

All the HF Command sets were tried and the oscillator functioned perfectly. I won't attempt to give any of the basic data on converting the Command Sets. This information is quite readily available and would only bore most readers.

To keep the heat dissipation of the final transistor within safe limits, 10 volts is used for the supply voltage. Even with 10 volts a cap type heat radiator should be used. An increase of 2 volts more than doubles the power so be careful. When driving a Gonset Communicator III, for which this unit was designed, I find that dropping the supply voltage to 6 volts is more than ample to drive the transmitter to full output.

The transistors really carry a nice price tag, and should appeal to almost everybody. They are made by Fairchild Semiconductors and sell for about 62c apiece. The FET is a Siliconix unit. If another type is used it should have a transconductance of 1000 or better. If you really like pleasant surprises try this conversion.

. . . K3LCU
It won’t take long for the new Swan 500 to establish itself as “King of the Road.” 480 watts of solid power, improved circuit efficiency, and Swan’s excellent audio quality combine to give you home station performance while operating mobile.

At the top of the Swan line, the 500 offers many extra features: Automatic noise limiter, selectable upper and lower sideband, 100 kc crystal calibrator, and provision for installation of an internal speaker.

The new 500 is equipped with the finest sideband filter used in any transceiver today. With a shape factor of 1.7 ultimate rejection better than 100 db, and a carefully selected bandwidth of 2.7 kc, this superior crystal filter combines good channel separation with the excellent audio quality for which Swan transceivers are so well known.

Frequency coverage of the five bands is complete: 3.5-4.0 mc, 7.0-7.5 mc, 13.85-14.35 mc, 21-21.5 mc, 28-29.7 mc. (In addition, the 500 covers Mars frequencies with the 405X accessory crystal oscillator.)

Along with higher power, improved styling and many deluxe features, the new 500 has the same high standards of performance, rugged reliability and craftsmanship that have become the trademark of the Swan Line. Backed by a full year warranty and a service policy second to none, we feel that the Swan 500 will establish a new standard of value for the industry.

So if you’d like to hear a VK, ZS or UA say “stand by, the mobile station,” put a Swan 500 in your car this summer!

ACCESSORIES:

- Full Coverage External VFO. Model 410 ............... $ 95
- Miniature Phone Band VFO. Model 406B ............... $ 75
- Crystal Controlled Mars Oscillator, Model 405X ............... $ 45
- Dual VFO Adaptor, Model 22 ............... $ 25

SEE IT AT YOUR SWAN DEALER

SWAN ELECTRONICS
Oceanside, California
The Dichotomy of a Tube Man

Including the use of a FET in the BC-906 frequency meter.

It is hard to resist a winning combination, particularly when that combination happens to be articles and ads in 73 magazine. The spell-binders referred to are, “Field Effect Transistor Primer” by Jim Fisk and “Two Transistor Testers” by Frank Jones.² Couple these with advertisements such as Poly-Paks and Meshna in which you find almost unbelievable semi-conductor and transistor bargains and you are lost.

When such a powerful coalition causes an old died-in-the-wool tube man to become a transistor enthusiast, that is an accomplishment. Would you believe a fellow who buys two assortments of 50 new, unused, 20–24 year old tubes for $2.95 per assortment*, just to have them on hand in case? Hold on now, consider what electronic miracles you might perform with an orbital beam, hexode uhf amplifier, type 1630, Army Signal Corps Tube VT-128! Just to hold it in your hand and look at it is inspiring. It looks like a grown-up 955 acorn tube, except that it has 12 radial electrode wires instead of five. Into this world of dreams came WHAM, POW, SOT–Fisk and Jones et al.

After the order of solid state goodies arrive, you find yourself impressed by how few identifying marks are on the TO-5 and other style cases. In fact, you reminisce and recall that at least you could peek inside

* 1964 Catalog, McGee Radio Company, Kansas City, Missouri.

It takes two excruciating 1964 Catalogs, and not even a frantic thumbing of the hundredth time, you have an excruciating cramp in the thumb! But wait; now that these wonderful things are sorted, how do you know which of them is “Power”, “RF”, “IF”, “Audio”, “Switching” and no test? Frantic thumbing through all issues of 73 from January 1962 forward was of little help for a solution to this new dilemma. In fact it was a hindrance. You find far too many tube articles which you remember wanting to try! Anyway, after having invested so heavily—at least $10 so you can take advantage of the double bonus—it is incumbent upon you to take the next step to find out which of these little three-pronged rascals will oscillate. A circuit to help sort the unmarked transistors further is shown in Fig. 1.³

This is a Clapp transistor oscillator, either crystal or series L-C resonated. As shown, the battery and meter are set up for PNP’s. Change the polarity to check NPN’s. By using several crystals, for example, 450kHz, 2MHz, 3.5MHz and 7MHz or higher, you can learn which of the 100 or more bargain transistors in your possession will oscillate. It sure takes a lot of plugging but it’s worth it. Imagine the thrill that shivers through your frame as you hear that crystal clear note in the station receiver. It takes you back to the days when—for old-timers—after you sawed two hacksaw slots at right angles across the bakelite base of a type 76 triode, between the four prongs, so as to decrease the dielectric shunting, you got the

Fig. 1. Circuit for testing the oscillating characteristics of unmarked transistors. This circuit is shown with a negative supply for PNP transistors—for NPN units reverse the meter and use a positive supply.
tube to work at 2½ meters! For the younger man the occasion might be similar to uncorking his first 807 on 10 meters. At any rate, the yield of good oscillators from the packet of 100 bargain items is surprising. Many were vigorous to 7.3 MHz. How well they will work in other circuits remains to be learned. It may be safe to assume that some of them will perform as rf amplifiers; how noisy they are can be learned from trial and error unless one uses the more modern transistor testers which are available at much greater cost than the simple ones referred to in this work.

The field effect transistors are indeed fascinating. It boggles the mind to think what would have happened to the radio-radar-sonar systems had the solid state version of the tube arrived first. We'd probably be discovering the vacuum tube about now and that would be a blessing to those of us who need bi-focal glasses in order to work with these miniature components. Jim's FET Primer caused me to try the FET's offered by Poly-Paks. Again, the ones received are unmarked except that one is painted an ominous black. The advertisement seems to say that mine are low noise FET's made by Crystalonics. The package has a nice re-print from 73 and also some data which leads me to believe that one of the FET's is a C-610. Since my surplus BC-906E Frequency Meter had a 1S5 tube which went west, it was a logical choice to go FET. The original and modified circuits are shown in Fig. 2.

The FET can be plugged into the tube socket for experimentation, then later soldered in if you so desire. The schematics show the tube socket pin numbers in which to plug the FET leads. It is necessary to remember that when looking at the bottom of the FET, the base lead is where the collector lead normally is located on a standard transistor. (Not on all FET's, Consult manufacturer's data sheet if in doubt. Ed.)

The absorption wave-meter with the FET performs much the same as the original tube version. One less battery is required and the battery voltage will depend upon the FET used. The FET which I assumed to be a C-610 works well with 1.5 volts. When the meter reads 500 micro-amperes full scale, the measured drain current is 1.5 milliamperes. As the cavity is tuned through a two meter rf field, the drain current will dip just as it did with the vacuum tube in the circuit.

The sensitivity may be improved by leaving out the IN34 diode and disconnecting the 1.5 megohm resistor from the end of the radio frequency choke nearest the Hi-Lo switch. These modifications are indicated in Fig. 2 by the heavy lines. Then, with the rf lead from the cavity connected to the gate of the FET, the field effect transistor will act like an old-fashioned vacuum tube with a floating, leaky grid.

With this modification the frequency meter will respond to 100 microvolt signals fed into the cavity by way of the plug-in antenna. The fact that the FET will perform in this manner is a measure of compensation and a bit of solace to a hard vacuum tube man.

W5SOT

1. WA6BSO, "Field Effect Transistor Primer," 73, December 1965.
Converting the Swan 120 to 6 Meters

With the continued upswing in sunspot activity, intercontinental DX on 6 meters is just around the corner. This simple and inexpensive conversion will provide a complete SSB transceiver for six.

This conversion makes a complete 180 watt PEP six meter transceiver with more features than the original 20 meter unit and compares favorably with commercial 6 meter units at much less cost.

General description
With the Swan single band transceivers consistently appearing on the used market, the SW 120 models may be purchased for a very reasonable price. This inspired me to investigate the possibility of converting one into a 6 meter transceiver. The investigation seemed to prove that this was entirely possible.

I noticed that the Swan people left a lot of chassis room in the right hand side around the final section, so I decided to take a chance. A SW 120 was purchased for $85.00 and the modification was started. I was quite amazed at how simple the modification appeared. As described previously, there is a lot of empty space under the chassis for adding extra parts.

New transmitter circuit
The transmitter conversion consists mainly of changing the original driver stage to a second conversion mixer and removing the original driver plate coil and all of the final circuits. The new driver, a 6CL6, operating in class A, and new final with 6146's operating in AB1 were added. In addition, a local oscillator with buffer was installed. These added parts fit into the empty space very nicely. When checking out the transmitter, two major problems were encountered. First,
the final showed signs of instability even after neutralizing. This proved to be parasitic oscillations—parasitic chokes in the plate leads cured this problem. The driver was also unstable—the original 11 pF butterfly driver capacitor was used to reduce the cost of modification, but this capacitor produced too much feedback due to the configuration so a new double section capacitor had to be used. Since a small capacitor with low capacity was not available on the market, a small bracket was fabricated and two Johnson type 160-140 capacitors were ganged for this job. This arrangement provides good isolation, takes up a minimum of space and gives more than adequate tuning range.

New local oscillator circuit

A new local oscillator and buffer were installed using a 6EA8. The triode section operates as a standard crystal oscillator with low voltage applied to the plate and the pentode section provides a small amount of gain and acts as a buffer to prevent frequency shift. A crystal switch and five sockets were installed to give additional coverage in the band. The crystal switch also has additional contacts to resonate the buffer coil when the oscillator frequency is changed—this adjusts the buffer output to maintain a constant injection level.

The crystal switch mounts in the hole where the tune switch was originally mounted; this tune switch was completely removed and the wires disconnected. The 12AV6 that was used as an audio oscillator is converted to an AGC amplifier.

Other transmitter changes

The basic exciter was left as original
Fig. 2. Conversion of the SW 120 receiver to six meters. L1 consists of 10 turns number 26 closewound on a ¼" slug-tuned form. L2 and L3 are both 12 turns number 26 closewound on a ½" form; L4 and L5 are 30 turns number 30 closewound on ¼" form; L6 and L7 are 11 turns number 26 closewound on a ¾" slug-tuned form.

except for the minor changes shown in the carrier balance control and transmit-receive switch. Also, the VFO was adjusted to cover 14.0 to 14.150 MHz to the 12BY7 mixer. This was only done to use a crystal that was available. The original dial calibration was used with the 20 meter markings removed with a pencil eraser (don’t use paint thinner). New markings were made to indicate 0-100 kHz and 150 kHz. When calibrated, the dial now can be read to 1 kHz and crystals can be selected to cover any 150 kHz range in the band.

The original driver plate coil with associated capacitors is now installed under the chassis and connected to the grid of the 12BY7 mixer. A 10 pF capacitor is connected between the two coils—this forms a 14 MHz bandpass coupler for added rejection.

Transmitter modification

Before starting the conversion to six, a preliminary check of the transceiver should be made to insure proper operation on the original band. Disassembly is accomplished by first removing all covers and the front panel. Mark any wires that may be disconnected. Follow these steps for removal of the unused parts:

1. Remove the final tube and all parts in the final compartment; leave only the plate and load capacitors and the two stand-off insulators.
2. Remove the 6DQ5 socket, disconnect wires and mark each with the pin number as it is removed. Pull the wires back through the chassis, but leave the meter wires in place.
3. Remove the driver plate coil and the associated wiring from pin #7 of V2 (12BY7) and driver tune (butterfly) capacitor.
4. Check to see that all parts from the driver plate and final grid are removed.
The plate meter should also be removed before holes are drilled.

Mark the chassis for new holes by referring to the photos. Holes should be drilled with a small drill before enlarging for the chassis punch; use care when drilling so you don't damage parts left in the chassis. Holes for the crystal sockets require careful layout or much filing will be needed. New holes for the 6146 final tube sockets will have to be cut in the ventilation holes in the bottom of the final compartment. The tubes will now be mounted in the vertical position. Several stand-off terminal strips must be installed for assembly of the new circuits; these holes should also be drilled before any parts are installed. When the holes have been deburred and all chips removed, the chassis is ready for installation of new parts.

Transmitter assembly and wiring

The new sockets can now be installed. If the 6146 sockets have no ground lugs, extra lugs will have to be installed. Install the mixer and driver coils as shown in photo—the new mixer coil is mounted under the chassis on an L-bracket. Position the terminals for direct connections. Wiring of the new mixer plate, driver, local oscillator and buffer should be done in sequence starting with the 12BY7 mixer plate. Be sure to leave room for the new driver capacitor and bracket. This capacitor should be installed last—refer to the photos and circuit diagrams for connections and layout. The new crystal switch mounts in place of the tune switch. Assembly of the final output circuit will require installation of a new coil with a better blocking capacitor. Start by installing the original neutralizing capacitor, modified plate choke and original dc bypass capacitor; position the parts as shown in the photo.

Modify the large loading capacitor by dis-
Fig. 4 New filament circuit for the modified SW—all others are original.

receiver modifications

Since no room was available on the main chassis for the new rf and mixer stages, the 6 meter front-end and mixer were built on a small sub-chassis and attached to the VFO housing. This front-end consists of a 6CW4 cascode rf amplifier and a 6CW4 mixer. The local oscillator energy is injected into the 6CW4 cathode across a 47 ohm resistor. A double tuned output feeds the grid of the original 12BE6. The 6BA6 was originally used, but I found that the receiver had too much gain and excessive background noise. By eliminating the 6BA6 (V5) and feeding the first mixer directly to the 12BE6 mixer, the overall receiver gain is ideal. A very weak signal can be copied as well as on the more elaborate equipment I have available. The 14 MHz bandpass coupler must still be used between the two mixers for rejection of unwanted signals. A length of 50 ohm coax is used to couple the local oscillator injection and if output. The final output tank also serves as the receiver input. Coupling to the 6CW4 grid is provided by two 3 pF capacitors. On transmit the 6CW4 is cut off by switching bias to the grid as is done in the original circuit.

By referring to the chassis layout and circuit diagram, the new front-end can be built and checked out prior to installation. This completes the receiver changes except for the AGC and audio modifications.

AGC and audio modification

As most persons know, the single band Swan has no AGC circuit or audio level control. With no control to hold the audio level at a pleasant volume, a loud signal blasts the operator out of his shoes before he can get the rf gain turned down. After using the transceiver a few days like this, I decided something had to be done.

In the original SW 120 the 12AV6 (V15)
is a tune-up oscillator which generates a lot of excessive noise when tuning. This stage was converted to an AGC amplifier. Some early transceivers didn't have this oscillator.

The AGC system used is an audio derived method. The audio signal is sampled from the plate of the product detector and amplified. Finally, it is converted to a minus dc voltage which is proportional to the audio level. This voltage is then fed to the grids of the tubes to be controlled.

In this case the first rf and second if stages are controlled with the AGC loop. This allows the rf gain to be run full open. An audio volume control must now be used to adjust the audio level. The original rf gain control was moved to the hole which was occupied by the on and off switch. The new volume control with power supply switch is now in the space left by the rf gain control. Two signals with extreme variations in strength now sound the same level in the speaker and very little popping or distortion is noticed even on loud signals.

The 50k pot marked AGC threshold should be adjusted with the antenna connected—adjust the control to give a residual voltage of -0.3 volts and a little kick on background noise from autos or static.

This AGC circuit works much better than any other version that I tried. I find it hard to give signal reports because most signals now sound the same strength. As stated previously, the quality of the stations received are still very good regardless of the signal level and I wouldn't be without AGC control. This circuit can be adapted to all the single band Swan transceivers whether modified to 6 meters or not.
Miscellaneous changes

A new function switch is shown in the circuit diagram. This will allow the operator to insert carrier for different modes by simply turning the switch. Fixed resistors are selected for AM and tuneup modes.
A calibrator was installed for checking calibration. This switch is mounted in place of the old transmit-receive switch.

Adjustment and operation

Transmitter section

Preset all coils with a grid dip meter, disconnect the final screen and plate voltages, and check to be sure there are no short circuits and wiring is complete. Apply power and with the grid dip meter in the diode position, tune the local oscillator and buffer for maximum output indication. Turn on the transmitter, insert carrier and adjust the mixer and driver plate coils for maximum output at 6 meters. Set the VFO dial to the center of the range and peak up the 14 MHz bandpass coupler for highest level at 6 meters. Connect a voltmeter across the 10k bias resistor feeding the grids of the final tubes and again adjust all coils for maximum voltage on the meter.

Check to be sure the output is on 6 meters. The driver tuning capacitor should be set at near maximum capacitance for the low end of the band—this will allow coverage of 2 MHz or greater range. All coils should be peaked several times to make sure maximum output is obtained.

Neutralization

Connect a detector probe and VTVM to the final output jack. With the screen and plate voltages disconnected apply drive to the final and adjust the final plate and output capacitors for maximum reading. Next adjust the neutralizing capacitor for minimum output. Check to make sure the capacitor is not completely open or closed—it should be in the center range and the output reading low in relation to the original level. Now the screen and plate voltages can be applied and carrier inserted. Peak the driver tuning, connect the output into a good load, and tune up the final to about 230 mA with full drive.

Receiver

The new front-end should be adjusted for maximum gain before mounting to the VFO housing. Only slight peaking is needed for final adjustments.

The crystal calibrator is wired with a lead run into the final compartment and positioned about one-half inch from the final tank coil.

Final comments

This transceiver has proved to be a very worthwhile investment; the reports are excellent and it does a fine job. The final runs the same power as most other transceivers on 6 meters and will drive a 2 kW linear with power to spare. It makes a very handy rig for portable, mobile or just general use, and the Swan power supplies can still be used for fixed or mobile operation. With 6 meters looking up for the next few years, the VHF operator can get ready for lots of enjoyment from this conversion. Get your tools out and get to work.

... K6RIL
LINEAR SYSTEMS all Solid-State Power Supplies are built by the company most experienced in designing mobile power supplies for the amateur. They provide higher transmitter power output at all input voltages, have multiple output voltages to operate all transceivers, are used by the military without added ruggedization, and have the highest efficiency of any mobile power supply on the market. They come complete with cables, are available from dealers throughout the country, and are modeled as follows:

- Commander Model $189.50
- Century Models $124.50 — $149.50 — $249.50

LINEAR SYSTEMS INC.
220 Airport Boulevard, Watsonville, Calif. 95076 Tel. (408) 722-4177
Military Quartz Crystals for the Radio Amateur

How to find crystal bargains

Surplus military quartz crystals are available at just about any frequency throughout the low and high frequency portion of the radio spectrum. These crystals can be very useful to hams and are available at modest prices from many electronic surplus houses or through some crystal manufacturers and dealers. Surplus crystals can be put to many good uses including transmitter and/or receiver frequency control, band pass filters, frequency standards and many others.

The writer has gathered together a lot of useful data on military quartz crystals and has presented it in tabular form (Tables 1 and 2). The information contained in the tables was derived from the "D" revision of the Military Specification MIL-C-3098, General Specification for Quartz Crystal Units. The table does not reference all of the 69, yes I said 69, types of quartz crystals used by the military. Rather, only the more common types frequently found in the surplus markets are discussed.

<table>
<thead>
<tr>
<th>Holder Type</th>
<th>Pin Dia.</th>
<th>Pin Spacing</th>
<th>Holder Height</th>
<th>Holder Thickness</th>
<th>Holder Width</th>
</tr>
</thead>
<tbody>
<tr>
<td>HC-5/U</td>
<td>0.156</td>
<td>0.812</td>
<td>2.205</td>
<td>1.817</td>
<td>1.594</td>
</tr>
<tr>
<td>HC-6/U</td>
<td>0.050</td>
<td>0.486</td>
<td>0.775</td>
<td>0.317</td>
<td>0.725</td>
</tr>
<tr>
<td>HC-10/U</td>
<td>0.062</td>
<td>N.A</td>
<td>1.055</td>
<td>0.560</td>
<td>N.A</td>
</tr>
<tr>
<td>HC-13/U</td>
<td>0.050</td>
<td>0.486</td>
<td>0.775</td>
<td>0.317</td>
<td>0.725</td>
</tr>
<tr>
<td>HC-18/U</td>
<td>0.017</td>
<td>0.192</td>
<td>0.530</td>
<td>0.150</td>
<td>0.402</td>
</tr>
</tbody>
</table>

Note: All dimensions are in inches.

Table 1. The dimensions of popular military crystal holders.
<table>
<thead>
<tr>
<th>Item</th>
<th>Military Type</th>
<th>Holder Type</th>
<th>Frequency Range</th>
<th>Oscillating Mode</th>
<th>Freq. Tolerance (%)</th>
<th>Resonance</th>
<th>Drive Level (mW)</th>
<th>Temperature Range (degrees C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>CR-15B/U</td>
<td>HC-5/U</td>
<td>80-200KC</td>
<td>Fundamental</td>
<td>±.01</td>
<td>Parallel</td>
<td>-</td>
<td>-40 to +70</td>
</tr>
<tr>
<td>2</td>
<td>CR-16B/U</td>
<td>HC-5/U</td>
<td>80-200KC</td>
<td>Fundamental</td>
<td>±.01</td>
<td>Series</td>
<td>-</td>
<td>-40 to +70</td>
</tr>
<tr>
<td>3</td>
<td>CR-17/U</td>
<td>HC-10/U</td>
<td>15-25MC</td>
<td>3rd Overtone</td>
<td>±.005</td>
<td>Series</td>
<td>-</td>
<td>+60 to +80</td>
</tr>
<tr>
<td>4</td>
<td>CR-18A/U</td>
<td>HC-6/U</td>
<td>0.8-20MC</td>
<td>Fundamental</td>
<td>±.005</td>
<td>Parallel</td>
<td>5-10</td>
<td>-55 to +105</td>
</tr>
<tr>
<td>5</td>
<td>CR-19A/U</td>
<td>HC-6/U</td>
<td>0.8-20MC</td>
<td>Fundamental</td>
<td>±.005</td>
<td>Series</td>
<td>5-10</td>
<td>-55 to +105</td>
</tr>
<tr>
<td>6</td>
<td>CR-23/U</td>
<td>HC-6/U</td>
<td>10-52MC</td>
<td>3rd Overtone</td>
<td>±.005</td>
<td>Series</td>
<td>-</td>
<td>-55 to +105</td>
</tr>
<tr>
<td>7</td>
<td>CR-24/U</td>
<td>HC-10/U</td>
<td>15-25MC</td>
<td>3rd Overtone</td>
<td>±.005</td>
<td>Series</td>
<td>-</td>
<td>-55 to +105</td>
</tr>
<tr>
<td>8</td>
<td>CR-25A/U</td>
<td>HC-6/U</td>
<td>200-500KC</td>
<td>Fundamental</td>
<td>±.01</td>
<td>Series</td>
<td>-</td>
<td>-40 to +85</td>
</tr>
<tr>
<td>10</td>
<td>CR-27A/U</td>
<td>HC-6/U</td>
<td>0.8-20MC</td>
<td>Fundamental</td>
<td>±.002</td>
<td>Parallel</td>
<td>2.5-5</td>
<td>75 ± 5</td>
</tr>
<tr>
<td>11</td>
<td>CR-28A/U</td>
<td>HC-6/U</td>
<td>0.8-20MC</td>
<td>Fundamental</td>
<td>±.002</td>
<td>Series</td>
<td>2.5-5</td>
<td>75 ± 5</td>
</tr>
<tr>
<td>14</td>
<td>CR-31/U</td>
<td>HC-6/U</td>
<td>1-10MC</td>
<td>Fundamental</td>
<td>±.005</td>
<td>Series</td>
<td>-</td>
<td>-55 to +90</td>
</tr>
<tr>
<td>16</td>
<td>CR-33A/U</td>
<td>HC-6/U</td>
<td>10-25MC</td>
<td>3rd Overtone</td>
<td>±.005</td>
<td>Parallel</td>
<td>2.5</td>
<td>-55 to +105</td>
</tr>
<tr>
<td>17</td>
<td>CR-35A/U</td>
<td>HC-6/U</td>
<td>0.8-20MC</td>
<td>Fundamental</td>
<td>±.002</td>
<td>Series</td>
<td>2.5-5</td>
<td>85 ± 5</td>
</tr>
<tr>
<td>18</td>
<td>CR-36A/U</td>
<td>HC-6/U</td>
<td>0.8-20MC</td>
<td>Fundamental</td>
<td>±.002</td>
<td>Parallel</td>
<td>2.5-5</td>
<td>85 ± 5</td>
</tr>
<tr>
<td>19</td>
<td>CR-37A/U</td>
<td>HC-13/U</td>
<td>90-250KC</td>
<td>Fundamental</td>
<td>±.02</td>
<td>Parallel</td>
<td>-</td>
<td>-40 to +70</td>
</tr>
<tr>
<td>20</td>
<td>CR-38A/U</td>
<td>HC-13/U</td>
<td>16-100KC</td>
<td>Fundamental</td>
<td>±.012</td>
<td>Parallel</td>
<td>-</td>
<td>-40 to +70</td>
</tr>
<tr>
<td>21</td>
<td>CR-42A/U</td>
<td>HC-13/U</td>
<td>90-250KC</td>
<td>Fundamental</td>
<td>±.003</td>
<td>Parallel</td>
<td>-</td>
<td>75 ± 5</td>
</tr>
<tr>
<td>22</td>
<td>CR-43/U</td>
<td>HC-16/U</td>
<td>80-860KC</td>
<td>Fundamental</td>
<td>±.01</td>
<td>Parallel</td>
<td>-</td>
<td>-30 to +75</td>
</tr>
<tr>
<td>24</td>
<td>CR-45/U</td>
<td>HC-6/U</td>
<td>455KC</td>
<td>Fundamental</td>
<td>±.02</td>
<td>Series</td>
<td>-</td>
<td>-40 to +70</td>
</tr>
<tr>
<td>25</td>
<td>CR-46A/U</td>
<td>HC-6/U</td>
<td>200-500KC</td>
<td>Fundamental</td>
<td>±.01</td>
<td>Parallel</td>
<td>-</td>
<td>-40 to +85</td>
</tr>
<tr>
<td>27</td>
<td>CR-48/U</td>
<td>HC-6/U</td>
<td>800-3000KC</td>
<td>Fundamental</td>
<td>±.008</td>
<td>Parallel</td>
<td>-</td>
<td>-55 to +90</td>
</tr>
<tr>
<td>28</td>
<td>CR-50A/U</td>
<td>HC-13/U</td>
<td>16-100KC</td>
<td>Fundamental</td>
<td>±.012</td>
<td>Series</td>
<td>-</td>
<td>-40 to +70</td>
</tr>
<tr>
<td>29</td>
<td>CR-51A/U</td>
<td>HC-6/U</td>
<td>10-61MC</td>
<td>3rd Overtone</td>
<td>±.005</td>
<td>Series</td>
<td>20.0</td>
<td>-55 to +105</td>
</tr>
<tr>
<td>30</td>
<td>CR-52A/U</td>
<td>HC-6/U</td>
<td>10-61MC</td>
<td>3rd Overtone</td>
<td>±.005</td>
<td>Series</td>
<td>2.4</td>
<td>-55 to +105</td>
</tr>
<tr>
<td>31</td>
<td>CR-53A/U</td>
<td>HC-6/U</td>
<td>50-87MC</td>
<td>5th Overtone</td>
<td>±.005</td>
<td>Series</td>
<td>20.0</td>
<td>-55 to +105</td>
</tr>
<tr>
<td>32</td>
<td>CR-54A/U</td>
<td>HC-6/U</td>
<td>50-125MC</td>
<td>5th Overtone</td>
<td>±.005</td>
<td>Series</td>
<td>2.0</td>
<td>-55 to +105</td>
</tr>
<tr>
<td>33</td>
<td>CR-56/U</td>
<td>HC-18/U</td>
<td>17-61MC</td>
<td>5th Overtone</td>
<td>±.005</td>
<td>Series</td>
<td>2.0</td>
<td>-55 to +105</td>
</tr>
<tr>
<td>34</td>
<td>CR-56A/U</td>
<td>HC-18/U</td>
<td>50-125MC</td>
<td>5th Overtone</td>
<td>±.005</td>
<td>Series</td>
<td>2.0</td>
<td>-55 to +105</td>
</tr>
</tbody>
</table>

Table 2. Operating characteristics of popular military quartz crystals.

The next time you visit your local surplus store on a crystal buying spree, bring along the tables. You will find that they will be very useful as you rummage through the bins.

Table 1 can be used when selecting the crystal type to match a particular socket and vice versa. Table 2 provides much needed information for designing the oscillator circuit of a receiver or transmitter or when trying to select an appropriate crystal oven.

. . . WØHYB
Converting the BC-728

A low frequency superhet receiver for 160, 80 and 40 with a very attractive price.

One of the items you can sometimes find on the surplus market is the BC-728 receiver, a six tube superheterodyne battery operated unit for shoulder carrying. This unit is advertised by several dealers for the amazing price of $7.95!

It is possible, for a bit extra, to buy the units complete with antenna, wet battery and charging cable. This antenna is a good deal if you are going to use the unit for portable use, the most logical application. This plugs into the antenna jack on one side, has a heavy cable with shoulder strap on it and the antenna fastens to the other side of the case. Thus the antenna feedline is used for the shoulder carrying harness. The antenna is telescoping for easy portability.

The case is rugged and most units are waterproof. If you have a selection you might pick out one with a sliding cover over the loudspeaker which would be very handy should you leave it out in the rain on Field Day.

The receiver has four pushbuttons inside to select the received channel. Channel one tunes from 2.0 to 2.6 MHz, channel two from 2.6 to 3.5 MHz, channel three from 3.5 to 4.5 MHz, and channel four from 4.5 to 6 MHz. While this was designed as a fixed channel receiver, you will find that there are tuning knobs right below each push button for tuning the channel. Thus, if you want to use the receiver for amateur use you can tune channel one, with a little padding, to the 160 meter band. Once you have peaked up the antenna and rf knobs you only have to tune the oscillator knob to cover the band.

Applications

For amateur band reception it is simple to slightly retune channel one for 160 meters. Channel three covers 75 meters as it stands, and channel four can be retuned to cover 40 meters quite easily.

Boating enthusiasts (or friends of boating enthusiasts) will find channel one worth more than the price of the whole unit for it covers the ship-to-shore bands and really brings them in with a wallop.

People having an interest in time and frequency standard signals (astronomy, piano tuning, watch adjustment, event timing, etc.) will find the receiver ideal. Channel one brings in WWV on 2.5 MHz, channel two tunes CHU on 3335 kHz, channel four tunes WWV on 5 MHz, and channel three can be retuned to bring in CHU on 7335 kHz. At least one of these should be available at all times of the day or night.

Conversion

Unless you are interested in wet nursing a wet battery it is a good plan to forget the beautiful vibrator power supply built into the case. This is designed to work with a 2 volt midget wet battery ("Keep upright when charging"). There is also a charging circuit with an external plug to go to a six or twelve volt battery. If you get the charging cable it should come with the battery clips.

Should you agree that dry batteries are
far better than wet (when one is inclined to forget about charging) then you can follow
the next instructions. If you are planning
to use the receiver for long periods then the
wet battery would be a better deal, but
for short periods of use dry batteries are
ideal.

Step one: remove the power unit. Unscrew
all of the bolts you can see coming through
the outside case, bottom, top, back, and sides.
Open the case and unscrew the knurled screw
holding the antenna plug. This plate is also
held by two small knurled nuts which will
probably take a pliers to loosen. Lift the
plate out and let it dangle. Unplug the power
plug and gently lift the whole power supply,
easing it out of the compartment. There is
a little finger that extends into the power
supply from the back of the case which will
keep the unit from slipping out easily. You
will have to work it out. Par for getting the
unit out, counting all the screws and antenna
plate, is six minutes.

The power unit can be relegated to the
“junk box” for possible ravagement on future
construction sprees. There are a lot of real
nice goodies in it so don’t give it the heave-
ho.

Power cable

Your choice: remove the power connector
socket from the power unit and connect the
batteries to this or else remove the plug from
the wires and connect them directly. If you
decide to deplug the power line then keep
track of the wires and connect them the same
as you would with the plug.

Batteries

A number 6 dry cell is best for the fila-
ments. They draw 300 mA at 1.5 volts, which
will run down a flashlight cell pretty fast.
And besides, there is plenty of room for the
larger cell. A small 67½ volt portable radio
battery will give more power than you need
for the B plus and the drain is only 7 mA,
so even the small #VS-016 batteries will
give good life. You will also need a bias
supply. Since there is no current involved
here you can use small transistor radio or
phothoflash batteries. You will need about
7 volts, so a 7½ or 9 volt battery will do fine.
Penlight cells, soldered in series are excellent
and inexpensive.

Retuning the channels

Once you have gotten the receiver working
and have checked out all the channels you are
ready to retune. Let us take one specific
channel and go through the process. For
instance, if we want to move channel three
so it will cover the 40 meter band, here
is what we will have to do.

Since you will be about doubling the fre-
cquency of the channel you will have to re-
move about half of the windings from the
three coils in that channel. Remove the
shield can over the antenna coils and cut the
connections to coil 3. The four small tongues
can be bent back from the bottom of the
coil form to release the coil. It is easier to
remove turns when you have the coil right
out there in your hand. Unwind half of the
turns from the terminal end of the coil. Don’t
be afraid, make it a good generous half or
you may have to pull it back out and pull
off some more. Resolder the wire end of the
coil to the terminal and put the form back
into the set. Once the coil is soldered back
in the circuit you can make sure you hit the
right spot by checking it with a grid-dip
meter and tuning the slug to both extremes
to find out the new range of the antenna cir-
cuit.

Be very careful of the bottom end of the
coil for if you should break the wire going
from the terminal to the bottom of the coil
you will have problems. The coil is wound
with every other turn overlapped so that it
is extremely difficult to unwind a turn or
two from the bottom of the coil in order to
give you enough wire to reach back up to
the terminal. Better careful than sorry, to
coin a phrase.

Step two is the rf stage. This is just as
easy as the antenna coil. Do it the same
way. There are not as many turns on this
coil so you will only have to pull off about
30 turns instead of 40; run it down half
way. Dip this one too if you have the instru-
ment. Order a dipper if you don’t have one
so you’ll be in better shape for the next
conversion you try. Every ham shack should
have a dip meter.

Now comes the p-d-r (piece de resistance),
the oscillator. This coil is well shielded and,
short of major surgery, you haven’t a prayer
of getting the coil out to work on. So?
So work on it in the set. Warning: be care-
ful. But don’t worry, even if you louse every-
thing up you can get back out of the predic-
ament in a few minutes. Clip the wires going
to the coil terminals from the set. Then clip
the terminal board so that the two terminals
are free. Next pry out the circular piece
that keeps you from seeing down into the coil. Watch yourself on this move for you can break off one of the wires of the coil which come through the two holes in the circular piece. The upper terminal (on the rf coil side) is the bottom end of the winding. Lay that over the coil shield out of the way. Now reach down with a midget screwdriver and pull off the tape from the top of the coil. With that off you can unwind the coil turns freely. Pull off 35 turns. If you lose count don't worry about it. You can stop at any time and resolder the wires into the circuit and see where the oscillator is perking by turning on the set. A dipper won't give you much indication due to the coil shield.

When checking for oscillator range it is handy to have a signal generator on hand. This is another pretty basic piece of test equipment for the well run ham shack. Lack­

ing this basic unit you can always tune in a distinctive signal and hunt for it on your regular all-wave receiver. Good heavens, don't you even have that?

When you are all through pruning the coils it wouldn't hurt any to paint on a bit of coil dope to hold them together.

What's that Elmer? You say you broke the wire on the oscillator coil and don't know what to do. Well, in that case you can pull off all the wire from this coil and scrape the form as clean as you can. Then you wind up a new coil for yourself out of #31 enamel covered wire (or #29, 30, 32 etc.) and slip it over the form, holding it in place with the aforementioned coil dope. About 35 turns should do.

Antenna

The AN-75-C antenna, which was designed for the BC-728, is the best deal, but you may have some trouble locating it. For some obscure reason the antennas seem to have gone one way and the receivers another, though both are available in quantity. Should you decide for one reason or another to do without the AN-75-C you can get fine results by connecting a short length of wire to a Motor­

ola type plug. Fifteen feet works well. You can coil this up and carry it inside the set when not in use and then fling it up into a nearby tree or house for operation. Or you can put a clip on the end of the wire and connect onto more ambitious wires. When changing antennas remember to open up the set and retune the antenna circuit for max­

imum volume.
### MOBILE RECEIVER

**get rolling!**

**WE NEED TRADE INS!**

<table>
<thead>
<tr>
<th>Product Description</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>COLLINS KWM-2</td>
<td>$1150.00</td>
</tr>
<tr>
<td>516F2 AC pow/sup</td>
<td>$153.00</td>
</tr>
<tr>
<td>MR-1 DC pow/sup</td>
<td>$198.00</td>
</tr>
<tr>
<td>351D-2 mobile mount</td>
<td>$120.00</td>
</tr>
<tr>
<td>DRAKE TR-4</td>
<td>$599.95</td>
</tr>
<tr>
<td>AC4—AC p/s</td>
<td>$99.95</td>
</tr>
<tr>
<td>DC3—DC p/s</td>
<td>$149.95</td>
</tr>
<tr>
<td>MS4 Speaker</td>
<td>$19.95</td>
</tr>
<tr>
<td>MMK-3 mobile bracket</td>
<td>$6.95</td>
</tr>
<tr>
<td>EICO 753 Kit</td>
<td>$189.95</td>
</tr>
<tr>
<td>EICO 753 wired</td>
<td>$299.95</td>
</tr>
<tr>
<td>(Mobile brackets inc.)</td>
<td></td>
</tr>
<tr>
<td>751K AC pow/sup (Kit)</td>
<td>$79.95</td>
</tr>
<tr>
<td>751W pow/sup (Wired)</td>
<td>$109.95</td>
</tr>
<tr>
<td>752K DC pow/sup (Kit)</td>
<td>$79.95</td>
</tr>
<tr>
<td>752W DC pow/sup (Wired)</td>
<td>$109.95</td>
</tr>
<tr>
<td>HALLICRAFTERS SR500</td>
<td>$399.95</td>
</tr>
<tr>
<td>P500 AC pow/sup</td>
<td>$119.95</td>
</tr>
<tr>
<td>P500 DC pow/sup</td>
<td>$149.95</td>
</tr>
<tr>
<td>MR-600 mobile mount</td>
<td>$14.95</td>
</tr>
<tr>
<td>NATIONAL 200</td>
<td>$359.00</td>
</tr>
<tr>
<td>(Mobile brackets inc.)</td>
<td></td>
</tr>
<tr>
<td>AC-200 AC pow/sup</td>
<td>$75.00</td>
</tr>
<tr>
<td>PS150-12 DC pow/sup</td>
<td>$99.95</td>
</tr>
<tr>
<td>SWAN 350</td>
<td>$420.00</td>
</tr>
<tr>
<td>(Mobile brackets inc.)</td>
<td></td>
</tr>
<tr>
<td>117XC AC pow/sup</td>
<td>$95.00</td>
</tr>
<tr>
<td>14-117 DC pow/sup</td>
<td>$130.00</td>
</tr>
<tr>
<td>14X DC Module</td>
<td>$65.00</td>
</tr>
<tr>
<td>SWAN 250 6Meters</td>
<td>$325.00</td>
</tr>
<tr>
<td>(Uses same p/s as 350)</td>
<td></td>
</tr>
</tbody>
</table>

I will ship to you freight free! Write to me for top trade-in allowance!

**MISSION HAM SUPPLIES**

3316 Main Street  
Riverside, Calif. 92501  
Phone 683-0523 (area code 714)

**LINEAR AMPLIFIER**

Complete with Eimac 3-1000Z

**$795.00**

RF section only, with tube **$495**

Power Supply, separate **$300**

Full power input of 2 KW PEP SSB—1000 DC Watts CW-AM-RTTY. More than 20 important advanced features. New HD tank gives more output, especially on 10 meters. More TVI suppression. Most any exciter can drive to full output. 220/115 VAC operation.

**ORDER TODAY**

**MISSION HAM SUPPLIES**

3316 Main Street, Riverside, Calif. 92501

- [ ] Send spec sheet on BTI Linear.
- [ ] QUOTE trade allowance and terms.
- [ ] Please send latest HAM flyer.
- [ ] Put me on your mailing list.

**NAME** (please print)  
**Call**

**Address**

**City**  
**State**  
**Zip**  

(Calif. orders add 4% tax)
Photographing your Electronic Gadgets

Practically every article in radio publications uses at least one photograph. Some of these are good, some are excellent—but a lot of them are poor. Yet I have never seen an article on how to photograph equipment properly, so here goes.

The amateur writing about his electronic gadgets is naturally going to use whatever camera equipment he has. If he did have a choice of equipment what would be best? A large view camera with tilting front and back, even if it is an old one, is tops; with this he is able to correct converging verticals.

The professional photographer uses a 4 x 5 or 8 x 10 inch camera, but it is possible to take good photographs with a box camera. A tripod or camera stand is a must, the heavier and sturdier the better.

Almost any lens will take a good photograph when closed down, as it should be to get everything in focus. For the small camera a long focus lens is best, except for detailed close-ups.

Lights don’t need to be elaborate; photofloods in reflectors, reflector floods and even an ordinary lamp hand held is quite usable, as is the ordinary room lighting. Flash lamps...
Balanced transistor amplifier for photovoltaic cell light meter. This shot was taken with a 4 x 5 inch camera.

aren't very good and electronic flash isn't much better unless you really know what you are doing.

As the camera should be on a stand or clamped to something solid, fast film isn't necessary. For a small camera slow, fine grain film usually makes a better enlargement, although some of the newer fast films, such as Kodak Tri X, are excellent. Don't forget the exposure meter; most camera users have one and should know how to use it.

If you are using a view camera, don't forget that a close-up photo requires more exposure. See your camera manual regarding this. This is needed because of the additional bellows extension.

For a background, use a white card or unwrinkled white paper available from art supply houses.

Most editors like a large print, preferably 8 x 10 inches, so an enlarger is needed unless a friend or drug store is making the prints.

Closeup of a balanced transistor amplifier. The camera—Edixa reflex, with a Novoflex 35 mm lens. Tri X film.

Reflectors to lighten up shadow areas may be white cards or even a newspaper and some diffusing material such as tracing paper or cloth, although glass cloth is the preferred material.

Looking over a number of radio magazines the most common faults in the photographs seem to be blurring, probably due to improper focusing or movement of the camera; and brunt out faces, due to having a flash on the camera too close to the subject. We mustn't rule out poor engraving and printing, over which the photographer has no control. However, if the prints submitted aren't overly contrasty or soft and mushy, but are sharp and have a full range of tones from lights to darks, the chance of good reproduction is good.

Which brings up to the subject of process-

Inside view of the high voltage flash unit. The large connector is used because of extremely high currents which may peak at 800 amperes at 2500 volts. Definitely not for the beginner.
Why Fight Ohm's Law and Lose?

An article by K5HPT in the October 1963 issue of 73 described a simple phone patch. The title was "Why Fight Ohm's Law?" Well, I did—and lost. It was a big hum of a mess. So John WA4CUA and I experimented and came up with the circuit shown. I used two transformers back to back and added rf bypassing. I have had several requests for a drawing of the patch by those who have heard it on the air.

... Roger Williams WA4KWC
Look at your low Monthly Payment

AFTER JUST $50 DOWN

SWAN 350 80-10m Transceiver .................. (14.98) $420.00
SWAN 400 80-10m - No VFO ...................(14.98) 420.00
SWAN 500 80-10m - Deluxe .................... (17.69) 495.00
SWAN 250 6m Transceiver ...................... (11.55) 325.00
Mark 1 10-80m Linear - less tubes .............. (16.79) 475.00
Mark 6 6m Linear - less tubes .................. (16.97) 475.00
Two 3-400Z Tubes for Mark 1 or 6 ....... 68.00
117XC AC Supply for 350/250 ................. 95.00
117XB AC Supply for 400 ........ ............. 75.00
14-117 12v DC Supply w/cable ................ 130.00
405X MARS Oscillator - less crystals .......... 45.00
406B Small Phone Band VFO .................. 75.00
410 Full-Coverage VFO ......................... 95.00
200/6 Meter VFO ................................ 120.00
VX-1 Plug-in VOX for 350 & 400 .............. 35.00
SSB-2 Selectable Sideband kit for 350 ....... 18.00
22 Dual VFO Adaptor for 350 & 400 ......... 25.00
100k Calibrator kit for 350 ................... 19.50
500k Calibrator kit for 250 ................... 19.50
RC-2 Remote Control kit for 400 ............. 25.00
45 Swantenna - Manual ....................... 65.00
55 Swantenna - Remote Control .............. 95.00
Custom Contour Bumper Mount ............... 24.95
Kwik-On Antenna Connector ................... 3.25

NOTE: Above are listed the "Standard - Everyday" Swan products - Below are listed some Special Purpose items:

14X 12v DC Module w/cable ................... $ 65.00
14XP As above, but Positive Ground ......... 70.00
117X Basic 117v AC Supply ONLY .......... 65.00
230X Basic 230v AC Supply ONLY .......... 75.00
117 or 230vac Line Cord (specify) ........... 5.00
8' Cable w/plug (Supply to Transceiver) .... 3.00
Cabinet w/Speaker & AC Line Cord ........... 30.00
230XC 230v AC Supply for 350/250......... 105.00
14-230 12v DC Supply w/230v Basic ......... 140.00
230XB 230v AC Supply for 400 ............... 85.00

SAVE $50

Purchase any new Swan transceiver or linear at the regular price with no trade-in and you may take a $50.00 Credit toward the purchase of any other merchandise.

Order Today direct from this ad!

TRADES ??
GET OUR
DEAL TODAY!

Use Handy Coupon Below

Terry Sterman, W9DIA
Proprietor
Ray Grenier, K9KHW
Mgr. Mail Order Sales

To: AMATEUR ELECTRONIC SUPPLY
4828 West Fond du Lac Avenue
Milwaukee, Wisconsin 53216 #7

I am interested in the following new equipment:

[ ]

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

[ ]

Ship me the following New Equipment.

[ ]

I enclose $ __________, I will pay balance (if any)

[ ]

Name:

Address:

City:

State: Zip:

[ ]

SEND YOUR NEW 1967 CATALOG.

IMPORTANT! - Be sure to send all Mail Orders and Inquiries to our Milwaukee store, whose address is shown above. VISIT - Please do not write the following Branch stores - they are set up to handle walk-in trade only.

CHICAGO, ILLINOIS
6450 Milwaukee Avenue
Phone (312) 763-1030

ORLANDO, FLORIDA
19 Azalea Pk. Shpg. Ctr.
Phone (305) 277-8231

CHICAGO & ORLANDO STORE HOURS: Mon, Wed, Thurs - 12 to 9 pm; Tues & Fri - 12 to 5:30 pm; Sat - 10 am to 4 pm
Panoramic Display from the AN/APA-38 Indicator

A very attractive item for the VHF enthusiast is the AN/APA-38 panoramic indicator. It is an earlier version of the IP-69/ALA-2 indicator whose conversion was described in the June 1964 issue of 73 Magazine and is currently available for under $20.

The APA-38 was originally used with the APR-1 and APR-4 receivers for identifying radar signals. Basically it is a superheterodyne receiver whose output is a video signal applied to the vertical plates of a cathode ray tube. The input center frequency at 30 MHz is heterodyned to the 6.5 MHz if by a sweep oscillator. The frequency limits of the sweep oscillator are controlled by the sweep width control—at its maximum position the indicator will display the spectrum ± 5 MHz of the center frequency.

In addition to the conventional panoramic display, two sweep positions are provided. These sweep ranges (PRF-1 and PRF-2) cover 30 - 1500 hz and permit using the indicator as an oscilloscope for analyzing the modulation of the incoming signal.

Since the indicator was originally designed to operate from a 400 Hz supply, it must be converted to 60 Hz operation. To do this remove the following components: power transformer T-104, high voltage rectifier V-105, low voltage rectifier V-110, and choke L-101. While you are at it, remove the front panel and the power supply cage.

The 60 Hz supply could be built in the space made by removing the 400 Hz components. However, building it on a separate chassis not only makes construction simpler, it reduces the AC coupling problem and shortens the unit so that it will fit into a 16 inch deep rack.

Build the supply as shown in Fig. 1. The need for a special oscilloscope transformer was eliminated by using a voltage doubling circuit for the CRT negative high voltage supply.

Replace the old front panel with standard 8-3/4 inch rack panel. The CRT viewing hole is easily cut with a saber saw. The power supply should be mounted to the panel with a bracket and supported with a shelf. The rf input connector is replaced with a BNC type mounted on the rear of the power supply chassis.

After wiring the power supply, check the indicator for proper operation. Allow it to warm up and advance the brilliance control until a trace is visible. Set the function switch to PAN. Turn the gain control fully clockwise and position the trace along the base line using the horizontal and vertical position controls. Sharpen the trace with the focus control. Couple the output of your signal generator (or grid dip oscillator) to the input connector. With the sweep width control fully clockwise, tune the signal generator from 25 - 35 MHz and observe the pip. Set the signal generator at 30 MHz and center the pip using the center control frequency. The height of the pip should be reduced with the signal generator attenuator until it is not over-loading the display.

Modulate the signal generator with a 400
Hz signal. Place the function switch in the PRF-1 position and adjust the sweep control until the signal locks in, and the modulating sine wave is stationary on the CRT.

The indicator is now ready for use. Couple the 30 MHz rf of your receiver into it and you are ready to go. If you have an rf other than 30 MHz you can construct a simple heterodyne converter to convert it to 30 MHz.

On the air experience is the best way to become familiar with the operation and uses of a panoramic display. The following is a brief guide to signal identification:

1. A CW or unmodulated carrier appears as a pip of fixed height. If it is a keyed CW signal the pip will appear and disappear with the keying. With a little practice you can copy CW visually!

2. AM signals will appear as a pip of fixed height when no modulation is present. With low frequency modulation the waveform will look like a broad response curve. As the frequency of modulation increases you can observe the sidebands moving away from the carrier.

3. SSB two tone test signals appear as two carriers of slightly different frequency. If the tones are closely spaced they will generally appear as a single deflection varying in height.

4. An MCW signal will appear like a CW signal, varying in height as the transmitter is keyed. If the modulating frequency is high it will be possible to distinguish the sidebands.

5. An FM signal appears as a multitude of discrete pips. The amplitude of the pips is a function of the modulation index. The spacing between pips is a function of the modulating frequency.

... W6JTT
RDR Receiver Conversion

A simple conversion of the RDR receiver to cover the 220 MHz band.

Conversion of this receiver to AC operation with crystal or external VFO operation is a worthwhile project for the ham who wants to listen in on the 220 MHz amateur band.

Remove the chassis from the cabinet by loosening the twelve screws around the front edges. Pull out the chassis and by depressing the tabs on the sides, completely remove it from the cabinet. Now, remove everything from the dynamotor compartment, including all wiring, the fuse holder and base by removing four screws along the outside edges. Remove the cover from the crystal and inter-control compartment by removing fourteen screws. Pull out the crystal oven and oven socket, leaving the two heavy wires as long as possible.

Remove all the automatic tuning system except the multiplier and rf dial mechanism. Also remove the two long rods and associated gears that run along the top and bottom rear of the compartment—this has a short shaft coming straight out the front in the middle of the compartment. Add a coupling to this shaft so it will protrude through your new panel and you will be able to tune both the multiplier and rf controls simultaneously.

Cut out a 5 by 12½ inch panel to mount where the former oven, rf and multiplier cables were covered. Cut out holes for the multiplier and rf dials—also the tuning control, crystal socket, B+ switch, AC switch, pilot light and speaker. Cut a panel 6% by 10 inches to fit the dynamotor compartment; this is for the new power supply. Wiring is simple, as all parts are labeled. Cut out R112 on top behind the front panel. The transformer filament windings go to terminal...

Fig. 1. AC power supply for the RDR receiver. The completed supply is mounted on a small panel which is mounted in the original RDR dynamotor compartment.
number 3 on terminal strip E132. The other end of the wiring goes to ground.

Label original pilot light connections for future reference. The B+ connects to terminal number 20 on terminal strip E133. The B- is connected to C511 on the back end of the multiplier section. The speaker and output transformer are connected across the phone jack terminals under the if strip cover. Install a crystal socket (FT243) on the front panel and connect it to the two heavy wires going into the multiplier stage. Install the switches, pilot light and speaker on to the panel—now you're ready for the smoke test.

Tune the receiver as follows: insert the crystal, rotate meter switch to position 1, unlock multiplier dial and adjust for a reading of 5 to 7 on the meter. Turn the meter switch to position 2, readjust multiplier slightly to obtain a reading of at least 4 on the meter. At position 3 unlock the rf dial and rotate for maximum noise and a minimum reading of 7. Position 4 is the plate voltage of receiver—normal reading 7; position 5, filament voltage, normal reading 7.5. The other positions are not used.

Crystal control was desired in my case but the multiplier tuning capacitor has a rather large range which can be used to tune the oscillator. The crystal frequency is doubled, then tripled 3 times—a total multiplication of 54. The if frequency is 30.2 MHz.

To determine what crystal frequency you require, subtract 30.2 MHz from your desired receive frequency and divide the result by 54. For example, to receive 222.5 MHz, 222.5–30.2=192.3 MHz. Dividing by 54: 192.3/54 = 3.561. A 3561 kHz crystal would be required.

... K3HIL
Build a 40-Meter Rotatable Dipole

This shortened dipole is little longer than a 20-meter quad.

A few months ago I built a wooden tilt-over tower, which to my amazement, worked very well. After I completed that project, I worked a few more weeks looking for parts for my “Triband Quad” to put on top. Up to this time I had been using, and very successfully, an all-band antenna.

With the erection of my “Triband Quad” I found that I could not keep the all band antenna up anymore, because there was some interaction with the quad and I could not get the SWR down when the quad was pointed in the direction of the other antenna.

I had to come up with something that I could put up that would not interfere with the quad. My property is not too wide, but it is long. If I put up a dipole it would run in the wrong direction to be effective. To put a half wave rotatable dipole up was out because I could not get past a nearby tree, mostly in my neighbor’s yard. Hence, this shortened version of the 40 meter dipole.

I needed a plate to attach my quad to the mast, and I knew where there was one, which I bought for five dollars. The owner also threw in the rest of the antenna which had come down in a wind storm. After careful observation I noticed that the driven element was in good condition, and that it could possibly be placed in between the quad.

I figured that by placing a bamboo pole into either end and by taping a wire along the pole, it would work but again it could not be over 30 feet. The commercially built four band beams have a 40 meter section close to 39 feet.

Electrical

Fig. 1 shows the idea of the dipole. It consists of a ten meter section of an old driven element—a coil attached to the end of it, and a length of wire attached to the coil, that will resonate at 7.1 MHz.

There are several ways to construct the antenna at the mast. It may be done as seen in Fig. 2, or a dowel may be used as an insulator and the aluminum may be placed over the dowel. Any other way may be incorporated as long as there is a space between one side of the antenna and the other; also one must remember to keep it electrically insulated from the mast.

The length of the wire was 19 feet at the beginning. I also started with 20 turns of 3” coil. My first job was to get the one leg to resonate at 7.1 MHz. This was done by winding four turns of soft drawn wire around a grid dip meter and finding the right spot on

Fig. 1. Construction of one arm of the shortened 40-meter rotatable dipole.
Here's the dipole in place between the two elements of the quad.

the coil. See Fig. 3 The next step was to wind the wire very carefully around the bamboo pole so that each turn was about 1" apart. I did this until the 19' were completely used up. I checked the grid dip meter again to make sure that there was no change in resonance, and there was none.

At the coil I began moving the tap so that I would add two or three turns to the coil, while I snipped the wire at the other end to resonance. You may leave the 19' of wire on the pole. You may also make it shorter by adding more turns to the coil than I did.

Attach the coil with two stand off insulators so that the bamboo pole is approximately in the center of the coil. After I found the length of the dipole I wanted, I soldered the wire to the coil, and I drilled a hole at the end of the bamboo pole, and put a small nut and bolt through it. To this I attached the other end of the wire.

That being completed I did exactly the same thing to the other leg. Knowing the approximate number of turns on the coil, and the number of turns on the bamboo pole it took half the time to fix the second side. After completing the second side I put two coats of varnish on the bamboo poles and over the wire, I coiled over the bamboo pole.

Now that I had both sides completed, I again checked resonance by placing the coil around the grid dip meter, but this time the wire was attached to either side. See Fig. 4 The meter should dip as you move it through the coil without any further adjustments.

Feeding

Feeding the dipole may be done three ways. One, feeding it with balanced twin lead as I did; two, feeding it with 72 ohm coax; or three, any other feed line with a balun. Make sure the feed line runs away from the antenna at a right angle as much as possible. I have mine running right to the ground, a total of 38' before it comes into the shack, where I tune it with a match box.

The SWR seems to rise sharply toward
Fig. 5. SWR of the antenna fed with balanced twin lead through a Matchbox tuned at 7.15 MHz and the transmitter frequency varied.

I found that I can get a one-to-one reading at the transmitter using RG86/U 205-ohm balanced line.

Performance

I found that the quad works perfectly without any interaction between it and the dipole. Don’t try to feed the dipole with the same feed used with the quad; it will not work. You must use a separate feed line.

I also found that there seems to be a slight gain in strength when the dipole is at a slight angle to the person you are working. I have had one DX contact in Venezuela with a 5 x 7 report. I have held my own through the QRM on 40 meters. It’s not a cure-all by any means, but it beats not having any antenna at all on forty. Also you can rotate it along with your quad. Its weight is relative to the weight of the quad. As you can see, I have it up on a wooden tower and it seems to be holding up fine. All in all, I would say it should cost you about $5.00 at the most to build.

Good luck and hope to hear from you on 40 meters.

Is Your Heathkit Transistor Tester Running Wild?

The scene was an industrial electronics laboratory, not so long ago. Our Heathkit Transistor Tester Model IM-30 had been absorbing a considerable amount of skilled engineering talent for almost the entire morning. It seemed perfectly healthy, but gave erratic readings on a batch of expensive new silicon transistors. As the general atmosphere was becoming rather warm, a little bit of the old light began to dawn...

Do you suppose this XXXX thing could be oscillating? It turned out the oscillations could be stopped by applying a fingertip to one transistor lead. The tests were rapidly completed and with a loud roar the focus of attention turned elsewhere.

Recently, I almost failed to recognize this same problem while checking some surplus 25c transistors. Then I realized the difficulty would have to be worked out. Using my James Dandy Mixer (73, August 1966) I spotted the oscillation at about 130 MHz. And after one or two false starts I found an appropriate circuit modification.

Fig. 1 shows how I stopped the oscillations by loading the transistor at rf but not at dc. The components are installed in the best VHF style close to the transistor socket. An extra test socket on short leads required the same treatment although it is used with the modified tester. I hope you’ll put in the emitter-base and emitter-collector branches first time around! It takes both of them to do the complete job.

... James Ashe W2DXH
**Astatic GD-104 desk type push-to-talk microphone and stand.** Regular price $51.20.

Special price $25.00

**AJ-1 Audio Filter. Ideal for CW and SSB transceivers. Variable audio range.** 28 dB down at 100 cps —peaks 200 cps.

4 ohm input and output impedance, built-in in and out switch. 6¼" L x 3¾" W x 2" D.

Special $7.95

**CO-4 4 Position Coaxial Antenna Switch.** Uses low loss connectors and a ceramic switch. Complete with knob. Regular price $9.95.

Special price $6.95

**CO-2 2 Position Coaxial Antenna Switch.** Same construction as the CO-4 switch to the left. Used for switching linear amplifier in and out of the antenna line. Regular price $8.95.

Special price $6.95

**QSL Cards**

2 color chromekote cards

Special price $2.95 per 100 cards

All prices plus postage • Pa. residents add 5% state tax.

Open evenings — Monday, Wednesday, Friday; 9 AM to 9 PM.

Saturday, 9 AM through 5 PM.

**“HAM” Buerger**

Amateur Radio W3BAH

432 York Road • Jenkintown, Pa. 19046 • Phone 215-887-7350
The Vacationer Portable Antenna

How often when checking into a hotel or motel for the night, or if you live in a non-cooperative-landlord apartment, have you wished you could get on the air without causing an upheaval? Well now you can: The Vacationer Portable Antenna is the answer.

The Vacationer Antenna is unique in the fact that this base loaded whip becomes a center-loaded antenna with very low SWR due to the simple wire counter-poise that is clipped onto the window mount and extends inside the room. Places are indicated on the counter-poise wire for the best match on each band. If an SWR meter is inserted into the line, it is possible to get a 1:1 ratio easily.

For use on 20, 15 and 10 meters, suitable loading coils are provided, and are attached to the base of the whip with removable screws. For two and six meters a shorting bar is furnished. The Vacationer is ruggedly constructed. The base is of molded unshatterable nylon; the machined parts are made of nickel-plated brass, and the window mount is weather resistant aluminum.

With this portable antenna, going together quickly and easily, one can be on the air in less than 5 minutes. It is designed to handle any of the 300-watt PEP transmitters, or 180 watts AM or CW.

Come hurricanes, sleet or ice storms, when beams and outside dipoles collapse, The Vacationer, as an emergency antenna, will keep you on the air; very economical insurance. The Vacationer folds down to 19 inches, so it can be packed in a suitcase, it is sold by the DPZ Corporation, P.O. Box 1615, Jupiter, Florida, 33458, and retails for $24.50.

---

AC Ammeter

Have you ever wondered just how much current that transmitter is pulling from the 120 Vac line, but don’t want to get into the expense of a good AC wattmeter? Here is a low cost adapter for making such power measurements with an AC voltmeter. The voltmeter should have a sensitivity rating of at least 1000 ohms per volt. Almost any vom or vtm in the shack should meet this requirement.

The adapter consists of an accurate 1 ohm power type resistor mounted in a ventilated housing provided with terminals for connection to the AC line, voltmeter, and power consuming device. This resistor converts the voltmeter into an AC ammeter. At any deflection of the voltmeter the reading is directly in AC amperes. To convert to watts drawn by the load, multiply the deflection by the line voltage. Example meter reads 0.65 volts and line voltage is 120 Vac. 0.65 x 120 = 78 watts. This is only accurate for a resistive load, but will give a relative reading on others.

Above 500 watts the voltage drop across a 1 ohm resistor becomes large enough to reduce the voltage applied to the device under test. If higher power levels are to be measured, the resistor should be reduced to .5 or .25 ohm.

DC power drain can be measured by substituting a DC voltmeter in place of the AC voltmeter.

... Don Marquardt K9SOA
Operating the BC-611 Walkie-Talkie

BC-611's are now available and are very useful for short-haul communications and locating sources of interference.

The BC-611 is a press-to-talk portable radiotelephone designed to transmit and receive signals over the frequency range 3.5-6.0 MHz. Its range is short because of its low power (¼ watt output), and could be anything from 100 feet to one mile. Over salt water, a three mile range might be obtained. These units are currently available and are being used for short haul work in the MARS circuits.

Power requirements are 1.5 Vdc for the filaments and 103.5 Vdc for the B plus. Originally, the batteries were designated as BA-37 (1.5V) and BA-38 (103.5V). Either the Burgess XX69 or the Eveready W361 are commercial equivalent B batteries but the 1.5 volts may be obtained from two flashlight cells in parallel and an FT-501 adapter.

Extension of the telescopic antenna to its full length actuates a toggle switch to energize the unit. The receiver is a superhet circuit and contains a crystal controlled local oscillator. The transmitter section consists of a crystal oscillator, power amplifier, speech amplifier, and plate modulator. All of the tubes except one serve double purposes. Tube VI (3S4) serves as the rf amplifier in the receiver and as the power amplifier in the transmitter, tube V2 (1R5) functions as the converter-oscillator in the receiver and as the oscillator in the transmitter, tube V4 (1S5) operates as the second detector-avc-af amplifier in the receiver and as the microphone amplifier in the transmitter, and tube V5 (3S4) serves as the output amplifier in the receiver and as the modulator in the transmitter. Tube V3 (1T4) operates as the if amplifier in the receiver.

The push-to-talk switch is a 7-section, double-pole, double-throw switch. Some of the surplus units may be received with broken switch handles. It is possible to fashion a new switch handle made from a piece of plastic.

The transmitting frequency is determined by the particular crystal used; to receive stations operating on the same frequency it is necessary to use a receiver crystal 455 kHz higher than the transmitting crystal frequency.

To tune the receiver for maximum performance on a specific frequency, adjust C7 and L2 for best reception of a received signal. There are two methods for tuning the transmitter's output. The best way is to use a field strength meter and adjust C12 for maximum meter deflection. The second method is to insert a milliammeter in the plate circuit of the rf power amplifier (remove jumper inside bottom cover and insert meter) and adjust C12 for maximum meter deflection (dip).

The BC-611 is part of Radio Set SCR-536-A, -B, -C, -D, -E, and -F and the technical manual is TM 11-235. The test set for the SCR-536 is designated as Test Unit I-135. Loop antenna AN-190 (not supplied with the unit) is a directional loop antenna with a built-in sensing device and can be used for homing purposes in conjunction with the BC-611. When equipped with the loop antenna the BC-611 should make an excellent unit for tracing down local interference sources and should appeal to amateurs possessing fixed direction finding equipment.

. . . W1MEG
A Poor Man's Transmitter Cabinet

Judging by the appearance of some ham shacks, proper packaging of the equipment presents a major problem to the roll-your-own amateur. Many transmitters sound wonderful on the air, but look like something the junior operator dragged in from the junk yard. These eyesores can be dangerous to the operator and to any visitors to the shack.

After putting up with poor packaging at my station for a time, I decided to act. This article describes how the problem was solved; the finished transmitter cabinet meets the following requirements:

1. Complete enclosure to keep children out of the wiring.
2. Adequate TVI shielding.
3. Pleasing appearance.
4. Adequate space for a complete medium power transmitter.
5. Construction possible with only simple tools.

My transmitter cabinet provides 7.5 cubic feet of usable space for less than five dollars; with a little effort the average amateur can duplicate this in a modest workshop. The finished product will adequately house an AM transmitter of several hundred watts or a SSB transmitter running the legal limit.

The basis of this project is a used floor model TV cabinet. Many enterprising amateurs find a wealth of usable parts in old junked TV sets; why not use the cabinet too? There are many old TV sets around with large wooden cabinets available for the asking. A friend gave me the one I used. A plastic cabinet might be usable, but wood is easier to work with. A table model cabinet would be excellent for a small transmitter.

Here's how I converted my cabinet. I lined the cabinet with a heavy grade of aluminum foil on the inside top and sides and a piece of sheet aluminum on the bottom and front. The front panel must be heavy enough to support the weight of any attached equipment. A better job, though more expensive, could be done with lightweight sheet aluminum throughout. In any case, allow generous overlap and metal to metal bonding at the joints. A long crack lets out quite a bit of rf energy. I attached the foil with glue and staples.

The back of the cabinet has a door which is easily removed. In the cabinet shown in the photograph, copper window screen was stretched over a thin wood frame, but a sheet of thin aluminum sheet perforated with small holes would be better. In any case the material must preserve the shielding and permit free circulation of air; for high power transmitters, the use of a blower should be considered.

The best shielding in the world will not
prevent TVI if the leads leaving the shielded enclosure are not filtered. A simple length of shielded hook-up wire bypassed at both ends might provide adequate filtering, but I used the more elaborate filter shown in Fig. 1. I built a metal box from an old tin can with tin ships, pliers, and a propane torch. Although not attractive, it cannot be seen when mounted in the cabinet.

The bypass capacitors might work better inside the box than out, but they perform well in this unit and were more easily mounted on the outside. I mounted them with very short leads close to the point where the coil lead passes through the box. Ceramic feed-through insulators should be used for circuits carrying high voltage.

The coils must be wound with wire adequate to carry the current. The only place where this might present a problem is in the heater leads. The coils were wound on a section of 1/8 inch rod; they are self-supporting when used with very short leads. About one inch of close wound number 20 wire was used for all coils except the one carrying heater current; this coil was wound with number 18.

The bypass capacitors were disc ceramics salvaged from old TV receivers, except as a safety precaution I used new capacitors for the high voltage leads. The photograph shows the filter mounted in the cabinet with five leads rated at below 1000 volts. A high voltage filter will be mounted immediately in front of the present filter when the medium power final is completed.

I feel that I have met all six requirements set forth in the beginning of this article; the transmitter is completely enclosed and quite safe from contact with high voltage. At the present time this cabinet is pretty large for the command transmitter and its power supply, but there is room to expand; I am working on an 813 final for more power.

No trace of TVI is observed on any of the area television stations located 40 miles away. My own TV receiver has no high pass filter and is several years old. When the transmitter was operated outside the cabinet and without lead filtering I experienced severe TVI to both sound and picture.

Do not let the do-it-yourself urge be suppressed by the lack of a proper cabinet. Find an old TV cabinet and package that rig!... WA4RHT
Micro-logic for Non-logical Users

The title is not meant to imply that amateur operators are illogical in any way, but rather to identify this article as one in which integrated circuit (IC) logic elements are used in ways for which they weren't specifically designed. That is, it will attempt to show some of the many ways that amateurs can use digital IC's in circuits that are non-computer oriented.

Historically, there are two reasons why the digital IC (micro-logic) became readily available at low cost before the linear IC. One of these reasons was the rapid growth of the digital computer industry; increasing both individual computer size and the number of computers in production. Size, cost, and reliability requirements of the new digital computers offered a rich prize to the semiconductor industry if it could come up with an IC to suit computers. The second reason digital IC's came first is the fact that logic circuits are easier to make than linear circuits. Logic circuits generally require only that their transistors be in one state or another (for instance, "on" or "off") and this requirement is relatively easily met by mass production units.

Out of all the research that was poured into the realization of the digital IC for the computer industry, several "logic families" of IC's emerged. These logic families have all made successes in computer use to one extent or another and no one family has yet obtained a clearcut advantage over the others on all counts.\(^1,2\) The present major logic families are: Resistor Transistor Logic (RTL), Diode Transistor Logic (DTL) Transistor-Transistor Logic (TTL), and Emitter Coupled Logic (ECL).

RTL Integrated Circuits have become the

Fig. 1. The basic transistor gate.

Fig. 2. Various gate arrangements—two input, three input and four input.
Fig. 4. A monostable multivibrator using the $\mu$L914.

least expensive, most available IC's on the market. In small quantities (1-99) the price of a simple J-K flip-flop has dropped to $1.35 and that of a dual two-input gate to $0.80. A number of semi-conductor manufacturers, Motorola, Fairchild, Sperry, Texas Instruments, and others all make the RTL line; and at least between some units, voltages are compatible. There are two mainly-used packages, the TO-5 can with 8 or 10 pins and the "Dual-Inline Package" (DIP) with 14 pins.

The basic building block of the RTL family is the gate shown in Fig. 1. This gate can be expanded into two, three, and four-input types as shown in Fig. 2. In the gates shown in Fig. 1 and 2, a +1 volt input to any input will saturate a transistor and pull the output down from the +3.5V supply level to saturation.

One of the least expensive and most ver-

---

**Table 2. Comparison of the Motorola HEP line to their MC300 IC elements.**

<table>
<thead>
<tr>
<th>HEP Number</th>
<th>MC-Number</th>
<th>Description</th>
<th>Amateur Use (other than logic)</th>
</tr>
</thead>
<tbody>
<tr>
<td>553</td>
<td>303</td>
<td>Half-adder</td>
<td>Regulator</td>
</tr>
<tr>
<td>554</td>
<td>304</td>
<td>Bias-driver</td>
<td>Schmitt trigger, free-running</td>
</tr>
<tr>
<td>556</td>
<td>306</td>
<td>Three-input gate</td>
<td>multivibrator, amplifier</td>
</tr>
<tr>
<td>558</td>
<td>308</td>
<td>J-K flip-flop</td>
<td>Divider, one-shot multivibrator</td>
</tr>
</tbody>
</table>
Table 1. Basing diagrams, circuit logic and load factors for popular IC packages. The MC-numbered units are manufactured by Motorola; µL-units by Fairchild.
The Fairchild µL914 in a bistable multivibrator circuit.

Although the µL914 is easily used as a type "RS" flip-flop, it is simpler to use the µL923 type J-K flip-flop for most purposes. The real advantage of using the J-K is the simplicity one attains in dividing by different numbers. Even fairly large prime numbers may be divided using J-K's, and no critical feedback capacitors are required. Since the J-K has many ports, there are many ways to divide most numbers. Some examples of dividers using J-K's are shown in Fig. 7.

There are some points of care which must be observed when using these RTL IC's. The individual J-K will draw between 20 and 25 mA of current at 3.6 volts, so use good "fat" supply leads. This care in buss (and ground) lines is essential, because the RTL family has the lowest noise immunity (for spikes on the supply line) of any of the logic families. Also, when in doubt, it never hurts to put a 330 µF-6V tantalytic capacitor right across the IC supply terminals.

The RTL J-K flip-flops require a fast rise-time waveform to trigger them properly. Try to keep your rise-time to less than 1 µsec if possible. For instance, the ÷5 circuit of Fig. 7 was unreliable when the input rise-time approached 3 µsec.

The convention in the Motorola and Fairchild RTL family is to add load factor numbers adjacent to the pin numbers of the IC diagrams. For instance, a µL914 gate input is three units of loading and a µL914 gate output will drive 16 units of loading. This load factor scheduling is completely consis-
tent within the Fairchild µL900 series, even though some members of this family are lower power units than others. The Motorola MC-700P series uses the same supply voltages and logic voltage levels; and the load factor designations are also compatible with...
The Fairchild \( \mu \)L900 family.

The only types of RTL IC's that will appeal to those with low budget projects will be the less-expensive units that are packaged in epoxy or plastic. Three of the Fairchild \( \mu \)L900 family are available in epoxy: the \( \mu \)L900, \( \mu \)L914, and \( \mu \)L923. Also the entire Motorola MC700P family is plastic and available at about the same price level per logic function as the Fairchild \( \mu \)L900 series.

The Motorola MC700P line includes only one single function unit, the MC723P—a J-K flip-flop. The rest of this DIP family consists of multiple function units. The MC790P is an outstanding one; it is a dual J-K flip-flop at \$2.00. This brings the price per J-K down to \$1.00, the lowest in the industry to this author's knowledge.

Table 1 shows the various economy-plastic RTL units available from the two lines discussed, with their loading diagrams and prices. It is important to keep in mind that the pin-numbering of these IC's is as viewed from the top of the package; this is the reverse of the way transistor baring diagrams are usually shown. There are several articles available on these RTL units that can be helpful: references 3, 4, and 5.

Without sounding biased in favor of RTL, the author feels that this family represents the best one to "cut one's teeth" on. The reasons for this feeling are simple: (1) RTL is inexpensive, so first experience comes cheap, and (2) since there is a resistor in nearly every lead to the internal transistors of the IC chip, your mistakes are not likely to destroy the units.

ECL (Emitter-Coupled Logic) is another family that should be of interest to the amateur. Motorola has recently made four types of MECL (Motorola Emitter Coupled Logic) available in their HEP line. This HEP line has the distinct advantage of being available nearly anywhere in the U.S. and also through mail order firms such as Allied Electronics. Table II shows the types of HEP IC's that are available, and the similar industrial versions of each. The HEP versions of the standard Motorola MC300 series are not obliged to have the same specifications as their industrial versions, but the cross-referencing is still helpful. By consulting the Motorola Application Notes for the MC303, MC304, MC306, and MC308, a large body of helpful information can be gleaned on uses for the HEP553, HEP554, HEP556, and HEP558.

The MECL family is unlike most other logic families in that a logic level change does not cause any component transistors to saturate. This means that the MECL family can operate much faster than others, since no saturated transistors have to be pulled out of saturation during switching. The in-

---

**Fig. 10.** Using the HEP556 as a low input impedance, low-level amplifier. The voltage gain of this circuit is approximately 20.

**Fig. 11.** The HEP558 connected as a one-shot multivibrator. The main consideration when using this circuit is to keep the value of \( R \) less than 160 kilohms; the \( t_{on} \) time will be approximately equal to 1.4 RC.

**Fig. 12.** Using the HEP554 and HEP556 as a Schmitt trigger. The 510k resistor should be 510 ohms.
The Theatre Organ starts at $1,350. This price includes a beautiful walnut console or you can save further by building your own from plans. Options available include combination action, genuine reverberation, percussion, and amplifiers and speakers.

You’ve asked for it and here is it — the NEW Schober THEATRE ORGAN that you assemble yourself. For the first time in kit form, a real Theatre Organ with that rich, full, old time theatre pipe organ sound. You create the organ, then you create the music!

The Theatre Organ features special voicing, curved console design, two 61-note keyboards, 2-octave radiating pedal clavier, 8 octaves of tone distributed over 5 pitch registers (including a 1-foot register), 35 speaking organ stops, 8 realistic percussion stops, 4 couplers, and vibrato tablet—48 tablets in all. And all at a truly remarkable low price...you save over $1,500 (well over 50%) from comparable theatre organs.

Just follow easy step-by-step instructions written in everyday language which anyone can understand. You’ll have an unequalled pride when you’re finished that only can come from assembling it yourself.

The Theatre Organ starts at $1,350. This price includes a beautiful walnut console or you can save further by building your own from plans. Options available include combination action, genuine reverberation, percussion, and amplifiers and speakers.

Fig. 13. Connecting the HEP558 IC as a divider—divide by two and divide by five.

Biography

The only
Theatre Organ
available in kit form—for only $1350.

Build it yourself and save over 50%

Combination Action Ten buttons select preset combinations of stops—actually move the stop tablets as in pipe organs.

Percussion Eight percussion stops provide exciting realism. Celesta, harpsichord, piano, mandolin, xylophone, chrysoglot, orchestral bells, single or reiterating, are played just like the real thing—and sound that way—alone or along with regular organ stops.

Free Information. Send today for your copy of Schober's 16-page full-color booklet—plus free 7" recording.

SCHOBER
CORPORATION
43 West 61st Street, New York, N.Y. 10023

The Schober Organ Corp., Dept. D-2
43 West 61st St., New York, N.Y. 10023

[] Please send me Schober Organ Catalog and
Free 7-inch “sample” record.

[] Enclosed please find $2.00 for 12-inch qual-
ity LP record of Schober Organ music.

($2.00 refunded with purchase of first kit.)

Name

Address

City State Zip No.

— W6GXN
Proportional Transistor Control of AC Circuits

Proportional dc control of ac circuits has been one of the sticky problems in electronics since the days of the slop-jar rectifier and the "Edison" storage battery. Most of the successful circuits take the form of a good amplifier, in which the gain is varied by the dc control voltage. Until recently, this was an effective, but highly uneconomical, control method, and was usually limited to low powers.

Since the end of WW II, the situation has been improved by magnetic amplifiers, thyristors, and "back-to-back" configurations of transistors. All of these systems work, and some work very well, but their cost and bulk, not to mention procurement difficulties and delays, usually confine them to large-scale industrial and governmental use.

Relatively recent commercial availability of high-voltage transistors and of silicon bridge rectifiers of high current capacity has simplified high power rectification and control greatly, and has reduced prices enormously. A bit of cogitation, followed by some experiments, indicates that proportional control of any ac circuit by a small dc control voltage, using only rectifiers and transistors, in a simple configuration, is entirely possible.

General control circuit

Circuit for controlling any ac load by means of a dc control voltage, using only a bridge rectifier and a transistor, is shown in schematic form in Fig. 1, with approximate voltage and current values.

In this circuit, everything to the left of the bridge is ac, from the line or other source. Everything to the right of the bridge is pulsating dc, resulting from the full wave rectification of the line power. With the bridge output shorted, current through the ac load is determined by the line voltage and the load reactance (less the very small losses in the bridge). With the bridge output open, voltage across the bridge output is approximately 1.414 times the line RMS voltage.

If a variable resistor is connected across the bridge output, the current through the load can be varied by varying the resistor. If the resistor is replaced by a suitable transistor (note voltage and current relations in Fig. 1), current in the ac load can be varied by varying the dc bias on the transistor. This current is at maximum when the transistor is saturated, at minimum when the transistor is cut off, and at various intermediate values determined by base bias when the transistor is between saturation and cutoff. With a single control transistor, controlled power is from 30 to 50 times controlling power. With a Darlington pair in the control position, control ratios of considerably better than 1,000 to 1 are easily obtained.

Specific circuit data

Using standard and easily-obtained parts, a specific circuit, much like the general circuit of Fig. 1, was constructed and tested.
Results with this circuit, shown in Fig. 2, are tabulated in Table I. Note that in this circuit, polarity of both the bridge and of the transistor have been reversed, so that, in event of failure of the bias source, the load is deenergized.

As will be noted from Table I, performance of the circuit is smooth, there being no serious "boobles" in the control characteristic. It is quite important that the transistor have an adequate heat sink, or its characteristics will change with use—usually not for the better. A 4" x 4" by 1/16" sheet of copper, exposed to free air circulation, was found adequate for the 2N307 here used. The small capacitor shunted across the bridge is a hash filter. Its value depends in part upon the characteristics of the load, and may be anything from .01 to .1 µF per ampere of current without impairing circuit operation.

Extension to higher power

The test circuit shown in Fig. 2 has a power handling capability of 25 volt-amperes. Theoretically, the same circuit can be used for any power by suitable choice of bridge rectifier and transistor. In practice, we are now limited to about 400 volt-amperes because of the limitations of available transistors, the upper limit being attainable with the Delco DTS 423 transistors. By using an elevated line voltage, (above 115), we can squeeze out some more volt-amperes. Watch out for polarity when changing transistor types.

Applications

This control circuit is an excellent replacement for a Variac within the presently-existing power limitations. As the control power is low voltage low current dV, the main elements (rectifier and transistor) can be placed near the load, and the control element, such as an Ohmite AB pot, mounted at any convenient place on the panel.

This circuit permits convenient primary control of power supplies, either manual or automatic, and has a number of possible protective applications, such as shutting off plate power when bias voltage fails.

Life of components, when properly cooled, is problematical, but very long. Silicon bridge rectifiers have service lives measurable in years (5 or more); and modern power transistors, either germanium or silicon, seem to be equally dependable.

Table I. Performance of the circuit shown in Fig. 2.

When the new 10 and 20 ampere high-voltage transistors, now reportedly being developed by at least three manufacturers, appear on the market, we will be able to control more than 2,000 volt-amperes of ac by means of a relatively small dc control power.
It's true. We keep telling you about the inspired simplicity of the 2K-2 design, about its rugged reliable mechanical construction. We've told you many times about the 2K-2's high quality components, its enormous power output, its exceptionally low distortion figure and attendant signal sharpness. Other amateurs have been telling you these same things too! And you have been hearing those BIG, BIG 2K-2 signals on the air. But it's still true, you will never fully appreciate what a superb amplifier the 2K-2 really is until you have owned one for yourself.

And now good news! The 2K-2 is available for immediate delivery. We have expanded production and have amplifiers in stock. Pick up your telephone today. Find out how easy it is for you to own the 2K-2. If you live near a metropolitan area air freight can deliver one to you by tomorrow. Of course if you live in the country you may have to wait an extra day.

If you are still not sure let us send you our descriptive brochure. Remember you are dealing with the world's oldest and most reliable amateur distributor. You can count on the same responsible merchandising program that amateurs all over the world have been relying on for forty years.

ATTENTION! Military, commercial, industrial and scientific users...please write for information on our custom line of high power communication linear amplifiers and RF power generators.

6% FINANCE CHARGE • 10% DOWN OR TRADE-IN DOWN • NO FINANCE CHARGE IF PAID IN 90 DAYS • GOOD RECONDITIONED APPARATUS • Nearly all makes & models.

Our reconditioned equipment carries a 15 day trial, 90 day warranty and may be traded back within 90 days for full credit toward the purchase of NEW equipment. Write for bulletin.

CALL DIRECT . . . USE AREA CODE

Henry Radio Stores

Butler 1, Missouri, 64730 816 679-3127
11240 W. Olympic, Los Angeles, Calif., 90064 213 477-6701
931 N. Euclid, Anaheim, Calif., 92801 714 772-9200
6116 N. 27th Ave., Phoenix, Ariz., 85017 602 AM 4-3895

East Coast Rep.: Howard Laughrey, 2 Elizabeth St., Chappaqua, N.Y. 10514, (914) CE 8-3683

"Worlds Largest Distributors of Short Wave Receivers"
Phone Patching-
More Light in a Gray Area

Litigation presently in the courts may clear up the legalities of phone patches.

More than seven years ago, an eloquent plea for legalizing amateur radio phone patches was made by Mr. C. D. Ehinger, a ham, K9IVY, and also a prominent member of the telephone industry, in an article which appeared in the December, 1959 issue of Electronics World. The article was symptomatic of the controversy that has surrounded the "gray area" of amateur radio phone patching for years and which, at last, appears headed for legal resolution.

A phone patch is, in essence, a device which interconnects the facilities of the telephone company with a two-way radio system. Tariffs filed with the Federal Communications Commission by AT&T and other telephone companies prohibit such interconnections unless the equipment, with a few exceptions, is provided by the telephone company. From the telephone company viewpoint, this restriction is necessary to prevent possible interference to telephone service resulting from the direct or indirect connection of a "foreign attachment" to a telephone line. This viewpoint is defended on the basis of the responsibility of the telephone company to provide dependable land-line communications under federal regulation in return for being granted a monopoly for telephone service in a certain area.

Over a year ago, the Carter Electronics Corp., of Dallas, a manufacturer of a phone patch device called Carterfone, filed an antitrust suit against AT&T, Southwestern Bell, and General Telephone Company of the Southwest. Carter Electronics seeks compensation for damages resulting from an alleged loss of business due to threats by the defendant telephone companies to discontinue service to individuals and firms using the Carterfone. The courts, before handing down a decision in the Carterfone case, have asked the FCC to resolve the question of the "justness, reasonableness, validity, and effect" of the current tariff regulation. Thus, the FCC, which has in the past indicated that phone patches do not violate FCC radio service rules but has avoided the issue of the validity of the telephone company tariffs, must now come to grips with the problem. A hearing before an FCC examiner is scheduled within the next few months.

The arguments in favor of legalizing phone patches are reasonable and persuasive. From the predominant commercial viewpoint, properly designed and effective phone patches can be produced at prices well below the usually prohibitive cost of telephone company equipment offered to provide a similar service. The installation of such phone patches result in more efficient and increased use of telephone facilities. In the non-commercial area of amateur radio, if phone patches were

Fig. 1. Typical "home-brewed" phone patch which was widely used with AM transmitters.
Fig. 3. A typical hybrid phone patch design using special transformers for optimum energy transfer and impedance matching.

an audio output-to-line transformer which at least approximated a match to the telephone line impedance. The center-tapped high impedance winding helped reduce hum pickup which was a real problem in early home-brew patches. Most of us can also recall phone patch circuits which employed power transformers in crude designs which were matched by equally crude performance. One can only imagine the detrimental effect these devices had on telephone service. The circuit in Fig. 1 was, with its attention to impedance matching, hum reduction, and if filtering and bypassing, at least a step in the right direction.

With the increased popularity of SSB by the early sixties, phone patch design was forced to take a giant step forward to satisfy the demand for patch operation consistent with the VOX capability found on most all SSB transmitters. To eliminate the need for manual transmit-receive switching during phone patch operation with VOX equipped SSB rigs, true telephone-type hybrid circuitry was required in patch designs. Thus, more accurate telephone line impedance matching was a necessity and telephone quality transformers were employed. Also about this time, the need for monitoring the input level to the telephone line was realized and VU meters, as employed by the telephone industry, became standard equipment on most hybrid phone patches.

The operation of a hybrid phone patch can best be understood by referring to Fig. 2. The basic requirement of the circuit is to passively couple audio from the receiver into the telephone line without energy being delivered to the transmitter audio input at a level which will cause the VOX circuit to operate. As described in Fig. 2, our old friend, the Wheatstone bridge, provides an effective means of satisfying the basic patch requirement outlined above.

A practical embodiment of this circuit is illustrated in the hybrid phone patch design presented in Fig. 3. In addition to the normal hybrid circuit components, on-off switching functions and appropriate if filtering, several other significant circuit techniques are evident here. A 600 ohm resistive H pad is provided to isolate the telephone line impedance, which can vary from installation to installation, so that a simple balance network can provide maximum transmit-receive isolation at every installation. The VU meter can be switched from its normal line level

Fig. 2. The Wheatstone bridge is the basis for modern hybrid phone patch circuits employed with VOX operated SSB transmitters.

to be removed from the “gray area”, a marked increase in public service phone-patch traffic, particularly with overseas military personnel, would ensue. Telephone companies have in the past indirectly indicated the usefulness of the phone patch by turning their heads the other way concerning amateur radio use of these devices. Nevertheless, the “gray market” has forced all but two amateur radio equipment manufacturers, Heath Company and Waters Manufacturing Company, out of the ham phone patch business. Heath Company reports that despite the “gray area” and to the best of their knowledge, their patch has never been the cause for a complaint by a telephone company against a user. Adequate performance and low-cost therefore appear to be compatible in today’s phone patch designs.

Adequate performance was not always the case with amateur radio phone patches. The type of patch illustrated schematically in Fig. 1 was considered fairly sophisticated fifteen years ago but provided what could be termed only satisfactory performance with AM rigs at that time. This design employed
monitoring function to a null indicating function to permit accurate adjustment of the balance, or null, control. A strong heterodyne is tuned in on the receiver and, with the patch on and a telephone call actually placed, the balance control is adjusted for a null on the VU meter which is measuring the voltage developed across the transmitter input level control. Once set, the balance control usually needs no further adjustment. Notice also that this patch design also employs transformers which match the impedance of the receiver output and transmitter input as well as those of the telephone line to provide maximum overall energy transfer.

Mr. Ehinger's 1959 article suggested several requirements for the design and use of legal phone patches. These were use only with radio equipment and by operators having valid FCC licenses, use only on a private telephone line, location of the telephone at the radio operating position, patch provision for monitoring input level to the telephone line, and payment of a nominal, monthly fee to the telephone company. All requirements, except the last, still seem to be reasonable. If the tariff is revised to permit phone patching, it does not appear that the telephone companies would be justified in charging a fee for use of equipment that belongs to an individual. Phone patches supplied by the telephone company, should they be made available, would be a different matter.

Whatever the outcome of the *Carterfone* litigation, it is encouraging that the question of phone patch legality is finally being scrutinized. At least it indicates that there is a growing interest in legitimizing phone patches and that a demand exists for reasonably priced phone patch equipment. Let's hope a decision favorable to hams will be handed down and result in complete illumination of the "gray area". . . . KSBLL

---

**NEW! IMPROVED!**

**SOLID STATE**

**FREQUENCY CONVERTERS**

**Priced from only** **$14.95** to **$38.95**

**OVER 5000 FREQUENCY COMBINATIONS FROM .45 MC TO 475 MC AVAILABLE FROM STOCK.**

**MANY NEW MODELS TO CHOOSE FROM OFFERING A TOTAL OF THE FOLLOWING:** Crystal control, variable tuning, UHF epitaxial transistors, FET transistors, noise figures as low as 2.0 db, full wave varactor diode transistor protection, sensitivity better than 2/10 microvolt, fully shielded oscillators and band-pass filters to eliminate spurious frequencies, zener diode voltage regulation, 6 to 12 volts positive or negative ground, slug tuned coils, double tuned R.F. stages, tuned mixer stages, wide band I.F. amplifiers. All this plus the highest quality components carefully assembled, tested, and guaranteed.

We have exactly what you want at a lower price and better quality than you can obtain elsewhere. See our new multiple oscillator converters for monitoring two or more frequencies simultaneously!

24-hour special delivery service available on many models.

Send for your free 1967 converter catalog.

**VANGUARD LABS**

Dept. H

196-23 Jamaica Ave.

Hollis, N. Y. 11428

---

**JUNE 1967**
WTW Report

WTW is picking up faster all the time now. If the requests for our new WTW country list/tally sheets are any indication, things will be rolling in high gear for sure in a few months from now. I have been sending out these sheets at the rate of six a day. It seems as if many fellows are interested in WTW—a lot more than I ever thought.

The new WTW country list/tally sheets consist of four pages printed on both sides. Spaces have been allowed so that you can use them for ten years. About every fifth line has been left blank for additions as they turn up or corrections as they are discovered. I will take full blame for the various mistakes that are on these sheets—they were laid out, made up and printed by me so these mistakes cannot be blamed on anyone other than myself. They are free for the asking provided you send along a manila envelope (9 by 14 inches or larger) self addressed and with 10c worth of stamps on it. This will pay the postage for 3 or 4 sets of these forms depending upon the weight of the envelope. One set of these forms must be filled out and sent in with your first batch of cards. We retain this form and file it away to add the countries as you send them in to us. One form is required for each mode on each band. This may seem like a lot of work but later on it will simplify our task of keeping the records straight. This will be especially true when the 5 year period has passed and you begin to lose the countries you worked 5 years ago.

If you are considering trying for WTW, by all means get yourself a set of these forms. It will make your record keeping a lot easier I am sure. A complete list of WTW countries is included so you know what counts and what doesn't. A few of them may surprise you if you have not seen our list recently. Send along a large envelope for your copies and it will be sent out pronto.

We have received many suggestions from different DXers regarding WTW. At this moment we have not decided what changes, if any, will take place. Right now we are “mulling over” the idea of accepting cards in multiples of less than 100. This would keep everyone informed as to how others are doing in their WTW work.

There will be a column in each issue of 73 from now on that's devoted to the progress of WTW. We think it will be of interest to all DXers because competition will become keener as more fellows qualify. The day may come when we will keep a running record of the top 10 or 20 or even 30 who are battling it out for top position. I have had many letters suggesting this and it seems that this would make things more interesting to the fellows. What do you think Mr. DXer?

At this time we still need a DX Club to check WSL cards for these call areas: W/K 1, W/K 2, W/K 5, W/K 8, and W/K 0. We need one or two such check points for Africa, one in the southern part and one in the north. Two are still needed in Asia too—one around Hong Kong or Japan and the other somewhere around western India, Tehran or thereabouts.

Do we have any volunteers for these check points? We furnish the necessary blanks needed for proper record-keeping. We want every checkpoint to use the same kind of record keeping so that we will have a uniform system. The work involved is not too great, at least not at this time, but we hope it will grow as WTW interest grows.

The address of each of the current WTW QSL check points is as follows:

W/K 3—Western Pennsylvania DX Society, John F. Wojkiewicz W3GJY, 1400 Chaplin Street, Conway, Pennsylvania 15027.

W/K 4—The Virginia Century Club, P.O. Box 5565, Virginia Beach, Virginia 23455.

W/K 6—Orange County DX Club, James N. Chavarria, 3311 Stearns Drive, Orange, California 92666.


Canada—The Edmonton DX Club (VE6CX), 12907 136th Avenue, Edmonton, Alberta, Canada.

Oceania—The New Zealand Association of Radio Transmitters, Jock White ZL2CX, Contest and Awards Manager, 152 Lytton Road, Gisborne, New Zealand.

South America—Venezuela Amateur Radio Club, P. O. Box 2285, Attention of YV5CHO DX Committee, Caracas, Venezuela, South America.

Europe—Via R.S.G.B.

Hawaiian amateurs send their cards to the W6 check point.

All others send your cards to: Gus M. Browning, Route 1, Box 161-A, Cordova, South Carolina 29039.

Each group of cards sent to any check point must be accompanied with a remittance of $1.00 to cover costs of certificates and handling—plus postage to cover the return of your cards. Please specify method of shipment and enclose a large addressed envelope. Otherwise your cards will be returned to you via third class mail.

Notice that W5KUC, W4NJF and W3DJZ have qualified for the 200 country certificate for 14 MHz phone. Mind you, these fellows have worked and received QSL cards from 200 countries in less than one year. As you know, WTW only started at 0001 GMT May 1st last year. This should prove to you that it’s possible if you make up your mind that you are going all out. I bet these fellows had a ball working DX all over again. I know these fellows and they are the type who get things done when they make up their mind to do it. We wish to congratulate them on a job well done. They are presently working hard on their WTW-300—WOW— I sure hope they make it. That’s it for this month. If you have any questions please write me and I will try to answer. Please send along a sase. Thanks.


Canada—The Edmonton DX Club (VE6CX), 12907 136th Avenue, Edmonton, Alberta, Canada.

Oceania—The New Zealand Association of Radio Transmitters, Jock White ZL2CX, Contest and Awards Manager, 152 Lytton Road, Gisborne, New Zealand.

South America—Venezuela Amateur Radio Club, P. O. Box 2285, Attention of YV5CHO DX Committee, Caracas, Venezuela, South America.

Europe—Via R.S.G.B.

Hawaiian amateurs send their cards to the W6 check point.

All others send your cards to: Gus M. Browning, Route 1, Box 161-A, Cordova, South Carolina 29039.

Each group of cards sent to any check point must be accompanied with a remittance of $1.00 to cover costs of certificates and handling—plus postage to cover the return of your cards. Please specify method of shipment and enclose a large addressed envelope. Otherwise your cards will be returned to you via third class mail.

Notice that W5KUC, W4NJF and W3DJZ have qualified for the 200 country certificate for 14 MHz phone. Mind you, these fellows have worked and received QSL cards from 200 countries in less than one year. As you know, WTW only started at 0001 GMT May 1st last year. This should prove to you that it’s possible if you make up your mind that you are going all out. I bet these fellows had a ball working DX all over again. I know these fellows and they are the type who get things done when they make up their mind to do it. We wish to congratulate them on a job well done. They are presently working hard on their WTW-300—WOW— I sure hope they make it. That’s it for this month. If you have any questions please write me and I will try to answer. Please send along a sase. Thanks.

Genuine TEXAS "BUG-KETCHER®" KILOWATT 80 THRU 10 MOBILE ANTENNA

You’ve heard them on the air ... Now ... Available for the first time!!!

The Texas "Bug Katcher" has been one of the best radiating antennas on the air for years ... and yes, low power rigs can increase effective radiated power with this high "Q" coil.

"Bug Ketchers" are custom made of top quality materials, engineered to withstand abuse where other antennas fail ... Send For Yours Now ... Be ready for a full season of mobile fun!

Genuine Y ou’ve heard them on the air ... Now ... Available for the first time!!!

The Texas "Bug Katcher" has been one of the best radiating antennas on the air for years ... and yes, low power rigs can increase effective radiated power with this high "Q" coil.

"Bug Ketchers" are custom made of top quality materials, engineered to withstand abuse where other antennas fail ... Send For Yours Now ... Be ready for a full season of mobile fun!

BUG-KETCHER COIL ONLY ...... 19.95

COMPLETE MOBILE PACKAGE INCLUDING

base extension, whip, quiter clip, extra heavy duty ball mount
and spring (your option, bumper or deck mount).

A $48.00 VALUE FOR ONLY . . . . . .

$39.95 COMPLETE

BIG "D" HAMBOREE—DALLAS MARKET HALL—AUGUST 4-5

electronics center, inc.

2929 N. HASKELL
DALLAS, TEXAS 75204
214-LA6-2023
What's New for You?

This column is set aside for short technical notes, comments on 73 articles, information about new and useful components and surplus, and announcements about technical nets and technical clubs. If you've come across something that you think would interest 73 readers, but don’t think it's worth a full article, send it along. We'll give you credit in the column. Send your contributions to Paul Franson, 38 Heritage Road, Acton, Massachusetts 01720.

Don’t forget that we’re looking for a new name for the column, a name that fits the content a bit better than the present one. I've heard two suggestions so far, but I'm not sure whether they’re serious: Technical Trash, and Electronic Eclecticism.

New FET's

There are several new field effect transistors on the market which should appeal to the amateur experimenter. The most exciting of these is probably the 2N4416 from Union Carbide. This device is still somewhat expensive (about $6.00), but displays excellent noise characteristics on 144 and up. Pre-amplifiers built for 432 MHz with the 2N4416 for example, exhibit noise figures on the order of 2.5 dB: gain is 12 dB. On 144 the noise figure is about 2 dB with 18 dB gain. Next month 73 will have a construction article using this FET in both 144 and 432 preamplifiers.

A low cost plastic encapsulated FET which looks quite interesting is the new Motorola MPF-102. This transistor is designed for VHF amplifier and mixer applications and features guaranteed parameters at 100 MHz. Forward transconductance at 100 MHz is 1600 μmhos minimum. The input capacitance is 7 pF and the reverse transfer capacitance is 3 pF. Maximum drain-source voltage is 25 volts.

73 Transistor Circuits

Trouble with FET diagrams again! In WIDTY's article in the March issue there are several errors in the schematics using field effect transistors. The thing to remember here is that the N-channel FET requires a positive drain supply, the P-channel FET, a negative supply. P-channel FET's include the 2N2607, 2N4360, TIM12 and U112. N-channel types are the 2N2943, 2N839, 2N3820, HEP-01, MPF-103, -104, -105 and TIS34.
Diagrams to watch in the circuits article are Fig. 11, 17, 39, 40, 47 and 71.

**Transconductance Tester Troubles**

WA4UZS reports that he had a little trouble with transients in the FET Transconductance Tester he built from WIDTY's article in the January 73, but cured it with a 0.047 μF capacitor across each of the push button switch contacts.

**I-177B Schematic**

A manual, schematic and updating information for the I-177B tube tester is available from the Engineering Department, Daven Division of the Thomas A. Edison Industries, Grenier Field, Manchester, N.H. 03103 for $2.50, reports WIDKG.

**Slide Rule Error**

The conversion of π/2 radians in the article on slide rules in the March issue is wrong. It should be 90° instead of 1.57. If you put 2 on the C scale over π on the D scale, the answer is read on the D scale under R on the C scale. The basic formula for these conversions is π × R = 180, where R stands for 1 radian. Thanks to WASLQS for this.

**Product Detector Circuit Board**

The connections on the right side of the circuit board on page 34 of the March 73 are reversed. The board is for a solid-state product detector. Gregory Ferreault of Glen Rock, N.J. caught this one.

**RTTY Translator Error**

There is an error in the schematic of the RTTY encoder on page 37 of the January issue. The 0.033 and 0.038 μF capacitors in the frequency-determining network are reversed. The component reference numbers were also omitted from the schematics and pictorials, but not the text, causing some confusion. On page 35, R1 and R2 are the 6.8kΩ resistors in the emitters of Q2 and Q3. R12 on that page is the resistor shown in series with the magnet. On page 37, reference is made to an R10 and R12 in the encoder circuit. These two resistors are the 100 kΩ and 6.8Ω resistors attached to the base of Q4. The author of the article, W6AYZ, sent us these notes.

... Paul
The Heathkit SB301 Receiver

The Heathkit SB301 is an updated and improved version of the older SB300 which, in its short history has already earned a well-deserved niche in ham radio. The 301 is a ham-bands-only SSB/AM/CW/RTTY receiver with coverage from 3.5 MHz through 30 MHz, easily extendable to the 2- and 6-meter bands with accessory converters, both of which mount neatly on the receiver's rear apron. A front panel switch concentric with the rf gain control selects either converter and simultaneously switches the input of the receiver from the normal antenna to the converter outputs on 10 meters. Frequency coverage with the converter crystals supplied is from 144 to 146 MHz and 50 to 52 MHz—the tuning range can be increased with accessory crystals.

Power for the converters flows only to the converter which is selected by the panel switch mentioned before. When the receiver is operated on the low bands, no voltages reach the converters.

CIRCUITRY

The incoming signal is amplified by a 6BZ6, the rf stage and capacitance coupled to the grid of the first mixer, a 6AU6, which receives the local oscillator signal from the crystal-controlled 6AB4 heterodyne oscillator. The latter's coils have a small pickup winding which feeds the oscillator output to a jack on the rear apron, where it is available for transceiving with the matching transmitter, the SB401.

The 6AU6 mixer stage mixes the signals, with the sum and difference frequencies being applied to a bandpass coupler having a passband from 8.359 to 8.895 MHz. Emerging from the coupler, the wanted signal is then applied to the grid of the second mixer, another 6AU6. At the same time, the 5.0 to 5.5 MHz output of the LMO is coupled to its cathode. For transceiving, the LMO output is also fed to a jack, through a .01 capacitor.

The second mixer's output at the if frequency of 3.395 MHz passes through a crystal filter to the if stages (you get one filter with 2.1 kHz bandwidth with the kit; AM and CW filters are available as extra cost accessories).

The if amplifiers, 6BA6's are both high gain voltage amplifiers, tuned for maximum gain. The S-meter is connected between the screen of the first if and the cathode of the second, with a chassis-mounted zero-adjust potentiometer providing precise settings.

A new feature of the SB301 that didn't appear in the 300 is a self-biasing, full-wave, shunt-type noise limiter which automatically adjusts itself to the degree of modulation of the incoming signal. This system has the advantage of moving the point where limiting begins up and down along with the signal level. The limiter is either in or out of the circuit, depending on a push-pull switch integral with the AF gain control. The degree of limiting cannot be controlled manually. The system operates in all modes and performs effectively.

AGC voltage is obtained by rectifying a portion of the if output signal, then passing it through a capacitor-resistor network which applies the voltage to bias the rf amplifier and the if amplifiers. This system is of the instantaneous attack type; one of two decay "speeds" is switch selected—slow for SSB, fast for CW and AM. An "off" position is also provided for maximum gain when digging for the weak ones.
A three-section Compactron, a 6AS11, combines the product detector, BFO, and BFO amplifier in one envelope. The BFO oscillates at one of three crystal-controlled frequencies, selected by the mode switch. In the RTTY position, the crystal frequency is 3392.110 kHz, placing the detected signals of 2125 and 2975 kHz in the center of the band pass frequency range of the SSB crystal filter. Narrow band RTTY operation can be had in the CW position of the mode switch. If you're operating SSB and want to change sidebands, here's what happens: the crystal that is switched into the circuit increases the BFO's operating frequency by 2.8 kHz. At the same time, the LMO is automatically shifted 2.8 kHz lower by a diode switch so you've changed sidebands without having to move the dial—you continue to read frequency right off it.

The mixed if and BFO frequencies obtained from the product detector are capacitor-coupled to the grid of the first audio stage, one-half of a 6HF8, which drives the second audio; either high impedance headphones or 8-ohm speaker operation is available. Negative feedback from the output transformer to the cathode of the first audio stage provides low distortion audio.

For AM reception, the BFO is switched off and the if output is coupled to a diode detector instead of the product detector and thence to the audio stages.

The lineup is completed by a 100 kHz calibrator that can be zeroed against WWV's 15 MHz signal. The band switch has a special position for receiving WWV—another new and welcome feature that was missing from the 300.

Assembly

No unusual problems were encountered in building the receiver except one of my own making. I did not observe the cardinal rule of kit building—read the instructions first, and follow them exactly. In blind confidence, I unpacked all the parts and sorted them out, but when I began to check them off against the parts list, I discovered that Heath had made another important advance. There were separate numbered "parts packages" that were called for individually as you begin each stage of assembly. The advantage is, of course, that you don't have a lot of small parts floating around long before you need them. Had I read the manual carefully I would have known this. Take warning, do as I say, and not as I do!

Total assembly time was about 24 hours, and alignment with the built-in crystal calibrator and S-meter went very rapidly. Not a single operating difficulty was found, a testimony to the good design, careful engineering and superb manual that makes it possible for anyone who can solder to build this kit successfully.

In case of difficulty, extensive trouble shooting procedures are carefully outlined in the manual, and complete voltage and resistance charts are included. According to Heath, 90% of the troubles that do arise...
are traced to poor soldering, so check that first.

**Comparing the SB301 to the SB300**

Owners of the older model will be interested in the differences between the two; physical changes are quickly apparent. On the front panel, the function switch and the AF gain control have been moved nearer the top. The AF gain knob also pulls out to turn on the ANL. The mode switch now has RTTY position and the band switch, its opposite number in location, includes the WWV 15 MHz position. At the bottom of the panel the converter switch is concentric with the rf gain control. It was formerly located on the top of the chassis and you had to open the lid to get at it.

Examine the top view photos of the two receivers; the holes in the coil cover indicate two things—coil locations have been shifted and an additional heterodyne oscillator coil appears. It is, of course, for the 15 MHz WWV position.

Three crystals appear in the chassis area of the 301 forward of the power transformer, where the 300 had only two. The extra one is for RTTY reception. Further forward in the same area, the three crystal filters are located. The new ones are not only smaller—but better. The 400 Hertz CW filter is now only 2 kHz wide 60 dB down, compared with 2.5 kHz in the old one.

The VFO in the receiver, which Heath calls the LMO (linear master oscillator), is a slightly modified version of the original model. An industrial grade 6BZ6 has been substituted for the original 6AU6, and there are some minor changes in the values of one or two parts. Its stability is excellent; drift is completely unnoticeable from a cold start.

**Operation**

One of this receiver's outstanding characteristics is its quiet operation, but don't make the mistake of thinking this means it's dead. Far from it—it's got sensitivity to spare. Tuning is smooth and the degree of tension on the dial is adjustable to your own tastes. With the receiver properly calibrated, frequency readout and resetability are outstanding, within a fraction of a kilohertz.

When you wrap the whole works up in the neat two-tone green cabinet Heath favors, you've got a receiver that's an impressive package for the money.

---

**NUVISTOR LOW NOISE PREAMPLIFIER**

For 27 (CB), 28, 50, 144 or 220 MC. (Also available for 150-170 MCS)

Add this Ameco Nuvistor Preamplifier to your receiver (or converter) to improve the sensitivity and noise figure. Two tuned circuits also improve rejection of image and spurious frequencies. Compact, easily connected and low power requirements, wired and tested with tube.

Model PV 27 .................................................. $11.95
Models PV 28, 50, 144 & 220 .......................... $13.95

Write for details on 150-170 mcs and others.

Ideal for improving performance of surplus FM Two-Way equipment for “NET” operation on the 2 and 6 meter bands.

**AMECO EQUIPMENT CORP.**

A SUBSIDIARY OF AEROTRON, INC.  ■  P. O. BOX 6527  ■  RALEIGH, N. C. 27608
I am always on the lookout for electronic components or assemblies which possess potential ham value. I have also been interested in any item which makes it possible for more hams to enjoy sideband. You can, therefore, understand how happy I was when on a recent western trip I found one lot of 225 watt core power transformers and in another area a batch of computer grade electrolytic capacitors. Immediately, I felt that we could put out a darned good universal transceiver power supply and when I got back, the boys in the shop confirmed this.

I say universal because with two of these power transformers and two 500 mil chokes, 12 diodes, assorted resistors and other components, we were able to make up a supply which met the requirements of the latest Swan, Collins, Drake, Hallicrafters, Heath, and National transceivers. Talk about value! We can offer this complete assortment of parts including a 16 gauge steel chassis and bottom plate, a good PM speaker and mating plugs for your particular transceiver for just $50. The transformers in this set weigh 17 lbs. and altogether the completed supply will weigh close to 40 lbs. This is what I call meat and potatoes. The filtering is excellent; the regulation is extremely good, and we have schematics and a printed story to be supplied with each kit, giving detailed information as to how to make the connections for your rig. You will have to tell us what model you own.

This is what the power supply will do:
- 800-1000 V at up to 400 mils on peak
- 285-320 V at up to 300 mils
- Bias of up to 125V at 100 mils
- 12V DC at 1 amperes
- 12.6V AC at 6.5 amps

Remember, this is an assembly of parts. We do not furnish a drilled chassis; we do not furnish the hardware; we do not furnish the solder and the wire but literally everything else is supplied.

Please allow for 45 lbs. shipping weight or otherwise be prepared to accept Railway Express or motor truck shipment.

**HIGH VOLTAGE PLATE TRANSFORMER**

We pulled a booby in our January catalog issue. We did not accurately describe a particularly good plate transformer and the result was that few people bought them. Actually one of the best items we have in stock, this plate transformer provides for 2850V either side of center, is rated for 500 mils of continuous duty, and is insulated for 4286V. The primary is intended for 207, 220, or 225V. This transformer will cost and run cool even with condenser input and a peak demand of your final at close to 4000V and upwards of one amperes. In other words, you can run 4KW PEP. It measures 9½” w. x 7¾” d. x 9½” h. and weighs 60 lbs. Check the price of copper and steel today and see if this isn't a value. Only $35 f.o.b. Harvard. This is brand new merchandise.

**DON'T RUN OUT OF NUTS AND BOLTS**

We have 500 boxes of ½" 6-32 thread nuts and bolts for $1.95 a box. These are heavily plated steel oval head bolts with square nuts to match. Used all the time in ham construction projects. Each box weighs 3 lbs. Please allow for postage.
S Band Transponder. RT-21/APN-21XR Measures 13"W x 13"H x 10"D and weighs 21 lbs. Supplied less tubes. A veritable wealth of S band components—pulse transformers and generally useful components. Basic cavity may be used in amateur microwave work around 3000MC and uses light house tubes. A Shopard McNally Klystron 707B used in 2nd cavity. 12 or 24 VDC and 400 cycle 115V AC single phase. Bargain priced at $15.00.

X-Band Radar. An early airborne radar set for X band includes receiver and pulse magnetron. Allow 100 lbs. $250.00 each. Here's your chance to have your own radar trap or weather eye. Requires 115V 400 cycles and 28V DC.

Bridge Rectifier Transformer suitable for solid-state application. Capable of furnishing 600V at .5 amp; 115V primary; secondary rated at 545V at 365 amps. 5 1/4" square x 5" high. $7.25. 15 lbs.

Solid State or selenium rectifier transformer made by Raytheon, model UX9115-A; primary 69 cycles; secondary tapped, from 28 to 60V; rated 2 amps but good for 4 amps. 4 1/2" high by 3 1/2" wide. $4 each. 1/2 lbs.

G.E. Air Capacitor. 20-400 pf. 7" long x 2" x 2" ceramic end caps with 1 1/2" shaft. Heavy brass construction. .015 spacing. Excellent as a loading capacitor or for general purpose work. $4/ea. 1 1/2 lbs.

Dual Bearing Hammer-fund Capacitor. 100 pf straight line capacity. Excellent for a variety of general uses. 50c each, 10/$4.50. 4 oz. each.

Collins RF Plate choke—good for high-powered final; capable of at least 1/2 amp and suitable for 50-10 meters. $4/ea. 1/2 lb.

Herbert W. Gordon Co.
Woodchuck Hill, Harvard, Mass. 01451
Telephone: 617-456-3548
PHONE PATCH KIT ONLY $5.95

The most popular item that we have ever produced for the ham is our inexpensive phone patch kit. We have received literally hundreds of orders and many hams have taken the trouble to voluntarily write us to describe how pleased they were with the performance of the kit. The electrical values of this kit have been chosen for average volume and average telephone line conditions. Each kit is fashioned around a very expensive Western Electric repeating coil transformer. The transformer has four 600-ohm windings and is toroidally made with a great amount of shielding. Even when purchased in large quantities, the price of this transformer is over $40 and no contemporary phone patch made in this country includes a transformer doing more or costing more than this transformer. Besides the transformer, I supply a 4-pole switch and knob, six half watt resistors, two RF chokes, a blocking condenser, four ceramic capacitors and, naturally, an instruction sheet.

The patch is designed to work from the 500-ohm output of your receiver into a 500-ohm input on your transmitter. If you use a modern transceiver, we can supply two auxiliary transformers that will enable you to use this kit. One of them is a small 500-ohm to grid transformer priced at $2.50. You wire this into the microphone input circuit of your transceiver. The second transformer is a 500-ohm to voice coil transformer and it is used to contact the 3.2 to 8 ohm from your receiver output into the phone patch transformer. Price: $1.50.

A typical transceiver would normally require $9.45 worth of parts—$5.95 plus $2.50 plus $1.50. If you have an older type transmitter such as a Johnson, B&W, or Hallicrafters, you would very likely need only the kit itself. The kit, when packed with the auxiliary transformers, weighs 5 lbs. Those on the West Coast should add $1.70 for postage; those in the midwest, $1.30; those on the East Coast, $1.20.

AMERICAN BEAUTY 100 WATT SOLDERING IRON—$4.95

This famous iron has been standard in our trade for over 25 years. It will operate year in and year out without failure for it is built like the proverbial battleship. Especially well balanced for heavy use. Heavy enough to solder to a chassis and light enough for all general work. The soldering tip is iron plated which greatly reduces pitting and redressing and saves you time if you work with an iron all day long. The casing and body are of one-piece seamless steel. The shatter-proof wooden handle is coated with a durable rubberoid for personal handling comfort. Has a cooling baffle; uses an extra flexible cord which withstands repeated kinking, and bending. Supplied with tip and stand. One of the most useful and best values I have ever offered. Absolutely new. $12.50 value—my net is $4.95. Allow postage for 2 ¹⁄₂ lbs. Only 275 available.
SIGNETTE LOUDSPEAKING INTERCOM
(Master, Remote and 50' of wire — only $20.00)

One of the surprise offerings made me in the past sixty days and which I have accepted for sale, is the small, solid-state intercom powered from the AC lines and made by General Dynamics in Rochester, New York. We offer our ham friends a truly worthwhile item which can be used in a variety of ways. Most hams set their shacks apart from their living quarters—in attic, garage, or basement. A big advantage of this little, inexpensive but high-quality, device is in having the XYL be able to reach you for dinner—or in reverse, during one of those contests when you want another pot of coffee, wouldn't it be nice just to reach over, push the

Radar Echo Box AN/UPM-30. A coaxial type resonant cavity used to monitor radar systems operating in the range of 1150-1350 MC. Decdy 3.5 lb per micro second. Sensitivity 1 db. power loss for 50 yard ringtime. Temperature coefficient .105% ringtime/degree F at 68°. Uses 2-IN21B diodes. New Weighs 25 lbs. Cost uncle $2000.00. Your Cost $70.00.

Oscillator 0-12. This is a signal generator operating between 155 and 235 MHz with a built-in attenuator assembly accurately calibrated to more than 100 db, below 1 volt. It employs a remote cutoff piston attenuator. These oscillators normally provide pulsed RF output but can easily be employed for CW with a simple change. $9.70. 7.1 lbs.

Ferrite Antenna Coil: 6%" long x 5/16 diameter. I bought these at a very low price and found them to be particularly attractive when bunched together as a core for winding filament chokes. Use 4 of them wound with electrical tape as a core for 4-1000. 59¢ each. 4/$2.00. 4 oz. each.

Herbert W. Gordon Co.
Woodchuck Hill, Harvard, Mass. 01451
Telephone: 617-456-3548
button, and ask for some Java without having to get up and lose your chance in the pile-up?

Another interesting application is using this as an automatic babysitter. If you wish, you can wire one through the walls of your home in such a way that people approaching your front door can have verbal entrance to the kitchen where the XYL usually hangs out.

These little intercoms are ideal for stores, professional offices, small business, restaurants, grilles, garages or other office applications. The Master and substation units may be used in a variety of combinations. Instant operation and very low current consumption are features.

We offer, for $20, to supply one 1M Master and one 1R Remote. Also included will be 50' of 3-conductor triplex wire. You can use this little intercom at distances up to 225' as long as the interconnecting cable is made up of at least #22 wire. Technically, each Master comprises two transistors in cascade with a push-pull transistorized output stage. A 45-ohm dynamic speaker serves as a microphone on transmit. A small negative 12V power supply is obtained from a full wave rectifier and a tiny line transformer. The residual hum is negligible; the units are surprisingly clear, and sensitive enough so that a person speaking in a low voice four to five feet from a unit can be heard at comfortable volume at the other end of the line.

A Multi-Master intercom is available using the Model 7M which permits the selection of six stations, either Master to Master, or Master to Remote, or mixed Masters and Remotes. The 7M was originally priced at $50. We offer it for only $22.50. The little Remotes originally sold for $14.50 but when purchased on our special they are available at $6.75 each. The 1M and 1R combination which we sell for $20 can be wired for privacy mode or hands-free operation. In the hands-free position, you have an automatic listening device useful, for example, if you want to monitor the sounds coming from your baby’s room.

Each unit measures 4-3/16" w. x 7-25/32" d. x 2-5/16" h. There is a volume control on the master unit. Operation from either unit is effected by depressing the talk-listen plate or, in the case of the model 7M, by first selecting the remote and then depressing the plate. You may leave them plugged in and turned on all the time since they draw only 2 watts for the complete system. The transistors used are two pieces of 2N1414 and two of the 2N1415. The weight of the 1R and 1M when packed and shipped together is only 6 lbs. Remember to allow enough for postage and please give your street address in the event we can make shipment by United Parcel Service.

Just over 500 sets are available. These should go fast considering their quality and usefulness and the reputation of the original manufacturer. Remember this is new merchandise.

Matching transformers: Here is a very high quality line-to-grid transformer. Primary either 200 ohms or 500 ohms impedance and secondary 30,000 ohms grid-to-grid with a center tap. It may also be used as a low-level plate-to-multiple line transformer. UTC-4050 $2.50.

Toroidal Filter Assembly for RTTY. These new Humphrey units measure only 1¼” x 2½”. We have them complete with their sockets in matched sets tuned to 2125 cycles and 2975 cycles. $5.50 per set. ½ lb.

Herbert W. Gordon Co.
Woodchuck Hill, Harvard, Mass. 01451
Telephone: 617-456-3548
INTEGRATED CIRCUIT SALE
GOOD STUFF YOU CAN AFFORD

IC's, Choice, TO-5 or TO-46 case, RTL Mostly 6 & 8 lead. Includes Gates, Buffers, Flipflops, etc. 50 assorted $5.95
Buy 2 asstd, packs & get 8 pin test socket free.
IC's Flat Packs, DTL, Gates, Flipflops, Buffers, etc. 40 assorted $5.95
100 asstd. $12.95
All IC's sample test over 50% good, unmarked.
Schematics, identification & test info included.
IC's TO-5 or TO-46 Similar to 903 3 input NPN/NOR Gates. Tested __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ _______
IC TESTER

Here's simple little tester capable of testing or identifying a wide variety of logical integrated circuits.

While this was built to test TO-5 RTL units, it can easily be extended to DTL or TTL by increasing the supply voltage (especially with flip-flops; these families require 5 or 6 volts). The use of the "patch board" is the factor that makes this tester so versatile: resist the temptation to use push buttons or switches!

The best way to sort TO-5 cans is to separate them first according to lead configuration. Then go through each set of similar appearance. This minimizes reconnections. A good procedure is to connect +V to pins 7, 6, 5, 3, 2 and 1, in that order. When you find a voltage of about 0.2 or a voltage over 1.3, watch the voltage on that terminal while applying one of the L leads to the blank pins. If you see no change, try applying two L leads at the same time to various combinations of free terminals. Generally, once you get the hang of it, the right (most probable) connections seem fairly obvious. Every now and then a unit requires the use of both +V leads; in this case try one on pin 8 and the other on pin 6.

Most TO-5 cans sold unmarked seem to be the 8-lead cans, although several valuable types come in 10-lead cans. Ten pin test sockets are not necessary if you use separate clips, as in the diagram.

For a complete discussion of the various families of integrated logical circuits, see Electronics Magazine for 6 March 1967 and 73 Magazine for March and June 1967.

In surplus business 21 years now. We guarantee satisfaction on all sales. Please add approximate postage where weight is shown. On other assortments add 10c to each price and we will make up any difference. Minimum cash order $5.00. Minimum COD with $5.00 deposit is $20.00. Minimum School or Company purchase order is $20.00. Minimum foreign order $20.00. California orders, add 4% Sales Tax. Most of our semiconductors are silicon.

We're working on a new catalog and hope to have it ready soon. Send for it; postage appreciated.

In ordering, you can list the items you want or if you wish tear out these sheets, mark them and we will return them with your order.

MIKE QUINN ELECTRONICS
Building 727, Langley Street
Oakland Airport, California 94614

JUNE 1967
NEW CRYSTALS

100 crystals in a case originally for type MAR equipment. These crystals cover the range of 4844.44 kHz to 7778.78 kHz. There are 16 units in the 40 meter amateur band, and an additional 7 units are usable in the 6 meter band. Also 17 are usable in the 10 meter band. Complete with case. Price: $12.95 2 for $25.00

NEW INSTRUMENT OR RECEIVER TRANSMITTER CABINET

Panel space 19" wide x 12 1/2" high with a clear depth of 13". Outside depth is 14 1/2". Partial rear panel. Painted black crackle. Price: $3.95 each

NEW CRYS'TALS

50 crystals in a case originally for type MAR equipment. These crystals cover the range of 4844.44 kHz to 7778.78 kHz. There are 16 units in the 40 meter amateur band, and an additional 7 units are usable in the 6 meter band. Also 17 are usable in the 10 meter band. Complete with case. Price: $12.95 2 for $25.00

ALL TUBES

All rated at 1.5 amps. 200-500 volts $1.00 each 500-750 volts $1.50 each 750-1000 volts $2.00 each 1000-1500 volts $3.00 each

RACK CABINET AND BLOWER

BRAND NEW 19" desk top rack cabinets that contain a NEW Rotron muffin fan with attached cord and plug for 115V 50-60cy, mounted on the rear door. There is also a top door, 2 drawer rails with ball bearing rollers (removable), 3 alignment tools and 2 Allen wrenches. Front panel space is 19" wide x 14" high with a 13 1/2" clear behind panel depth. The outside measurements are 16" high x 21" wide x 15" deep. There are four rubber feet on the bottom, and the color is dark gray. Price $14.95 each

ARC-5 TRANSMITTER LIKE NEW 3-4 mHz

Complete with all tubes. One of the most versatile pieces of surplus equipment ever. Get yours now—not many of these left. Guarantee excellent. Price $12.95

SELECTRONICS

1206 S. NAPA STREET, PHILA., PA.  
HO 8-7891 HO 8-4645
TELETYPE DEMODULATOR UNIT
Northern Radio type 104 model 3
11 tubes
115 or 230 V 60 cy operation
GOOD CONDITION
Price: $49.95 Shipping wt. 50 lbs.

TDA-2 RTTY—TEST SCOPE
The Stelma Telegraph Distortion Analyzer type TDA-2 is a self contained portable unit designed to measure bias and distortion of telegraph start-stop signals. Distortion is indicated by vertical pip display on the face of a cathode ray tube. Measurements can be made while the machine is operating. Measurements can be made on circuits operating at 60, 75 or 100 OPM on 20 or 60 ma neutral circuits or 30 ma polar circuits. Distortion measurements from zero to 50 percent with an accuracy of plus or minus two percent can be made. The set is patched in series with the loop and direct measurements made. No special skills required to make measurements after a few minutes practice. See your distortion, then adjust and watch it disappear.
Price: $49.50 F.O.B.

POWER TRANSFORMER
STANCOR # PC-8412
Primary: 117 VAC 60 cy
Secondaries:
1000-0-1000
1200-0-1200
200 ma, CCS
200 ma, A.C.
300 ma, A.C.
50 ma, A.C.

PRICE: $9.95

WESTON R.F. AMMETERS
A brand new 3½" round panel meter with external thermocouple unit calibrated for 200 R.F. amps. Full scale with the lowest scale reading 20 amps. Weston model 1533 meter and thermocouple. These units are of particular interest to broadcast stations, and induction heater users. There is negligible frequency error up to 30 mHz, and approx. 2% error up to 75 mHz.
Price: $24.95 Shipping wt. 5 lbs.
READ CAREFULLY ABOUT JAN CRYSTALS

All JAN Crystals listed were manufactured for the Armed Services and were made by America's leading crystal manufacturers to the rigid specifications of the government. The specifications in most cases call for .005% or better tolerances over a temperature range of -55° to +90° Centigrade. This means that the crystals must be cut at the proper X-rayed angles and processed to all specifications, many of which are more rigid than those required for commercial crystals.

Every crystal listed has passed these government tests and was accepted by inspectors. You are assured of a quality product when you buy JAN Crystals. We receive crystals in the original packing, unused, as they are released from time to time as excess to the government's needs. Every JAN Crystal is tested for output and frequency using the latest test frequency counters. Many persons do not understand that a crystal may be changed in frequency by adding or subtracting capacitance to the oscillator circuit. Unless otherwise stated the crystals listed were designed for a circuit of 32 mmfd capacity and when operated in such an oscillator JAN Crystals will be on frequency.

This chart shows how far a crystal will change frequency with a change of capacity in the oscillator circuit.

<table>
<thead>
<tr>
<th>MEASURED CRYSTAL FREQUENCY IN KC</th>
<th>STANDARD</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 MMFD</td>
<td>20 MMFD</td>
</tr>
<tr>
<td>2000.00</td>
<td>2000.060</td>
</tr>
<tr>
<td>3000.60</td>
<td>3000.200</td>
</tr>
<tr>
<td>4001.00</td>
<td>4000.400</td>
</tr>
<tr>
<td>7003.30</td>
<td>7001.200</td>
</tr>
</tbody>
</table>

$1.60 EA. 4 for $5.00

NOTICE

Due to the shortage of quartz we will buy all type HC6/U crystals or miniature crystals with 11/2" leads at 15c each, or we will allow you 25c each, credit on your orders, for any crystals listed in our catalog.

Send unusable crystals to:

Jan Crystals
2400 Crystal Drive
Fort Myers, Florida 33901
HOW TO ORDER...
Order your crystals by type and frequency... enclose check or money order (No C.O.D.)... add $4 per crystal for postage, 10c per crystal for airmail... make check or money order payable to JAN CRYSTALS, 2400 Crystal Drive, Fort Myers, Florida.

PHONE AREA 813 WE 6-2397

<table>
<thead>
<tr>
<th>CRYSTAL MATERIAL</th>
<th>TYPE</th>
<th>ORDER BY ASSEMBLY NUMBER</th>
</tr>
</thead>
<tbody>
<tr>
<td>Woodfiled</td>
<td>75c</td>
<td>$1.05</td>
</tr>
<tr>
<td>Immediate</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Immediate</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

LOW FREQUENCY PRESSURE TYPE CRYSTALS

<table>
<thead>
<tr>
<th>FREQUENCY</th>
<th>TYPE</th>
<th>AC &amp; DC CRYSTALS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.05 MHz</td>
<td>243</td>
<td>$1.05</td>
</tr>
<tr>
<td>1.05 MHz</td>
<td>243</td>
<td>$1.05</td>
</tr>
<tr>
<td>1.05 MHz</td>
<td>243</td>
<td>$1.05</td>
</tr>
<tr>
<td>1.05 MHz</td>
<td>243</td>
<td>$1.05</td>
</tr>
<tr>
<td>1.05 MHz</td>
<td>243</td>
<td>$1.05</td>
</tr>
<tr>
<td>1.05 MHz</td>
<td>243</td>
<td>$1.05</td>
</tr>
</tbody>
</table>

PLEASE SPECIFY YOUR SECOND CHOICE IN CASE WE DO NOT HAVE FREQUENCY ORDERED.

SUB-MINIATURE CRYSTALS IN MC-18/70 TYPE HOLDERS MOUNTED ON A WAFER SWITCH ASSEMBLY. HIGH QUALITY TOLERANCE CRYSTALS, MANUFACTURED FOR AVIATION TRANSMITTER USE, ALL CRYSTALS MOUNTED ON A PRINTED CIRCUIT COMPACT SWITCHBOARD UNIT, ALL CRYSTALS FREQUENCIES LISTED IN MEGACYCLES.

<table>
<thead>
<tr>
<th>CRYSTAL WAFER ASSEMBLY # 1</th>
<th>CRYSTAL WAFER ASSEMBLY # 2</th>
<th>CRYSTAL WAFER ASSEMBLY # 3</th>
<th>CRYSTAL WAFER ASSEMBLY # 4</th>
<th>CRYSTAL WAFER ASSEMBLY # 5</th>
<th>CRYSTAL WAFER ASSEMBLY # 6</th>
<th>CRYSTAL WAFER ASSEMBLY # 7</th>
</tr>
</thead>
<tbody>
<tr>
<td>88.00 98.00 108.00</td>
<td>88.00 98.00 108.00</td>
<td>88.00 98.00 108.00</td>
<td>88.00 98.00 108.00</td>
<td>88.00 98.00 108.00</td>
<td>88.00 98.00 108.00</td>
<td>88.00 98.00 108.00</td>
</tr>
<tr>
<td>89.00 99.00 109.00</td>
<td>89.00 99.00 109.00</td>
<td>89.00 99.00 109.00</td>
<td>89.00 99.00 109.00</td>
<td>89.00 99.00 109.00</td>
<td>89.00 99.00 109.00</td>
<td>89.00 99.00 109.00</td>
</tr>
<tr>
<td>90.00 100.00 110.00</td>
<td>90.00 100.00 110.00</td>
<td>90.00 100.00 110.00</td>
<td>90.00 100.00 110.00</td>
<td>90.00 100.00 110.00</td>
<td>90.00 100.00 110.00</td>
<td>90.00 100.00 110.00</td>
</tr>
<tr>
<td>91.00 101.00 111.00</td>
<td>91.00 101.00 111.00</td>
<td>91.00 101.00 111.00</td>
<td>91.00 101.00 111.00</td>
<td>91.00 101.00 111.00</td>
<td>91.00 101.00 111.00</td>
<td>91.00 101.00 111.00</td>
</tr>
<tr>
<td>92.00 102.00 112.00</td>
<td>92.00 102.00 112.00</td>
<td>92.00 102.00 112.00</td>
<td>92.00 102.00 112.00</td>
<td>92.00 102.00 112.00</td>
<td>92.00 102.00 112.00</td>
<td>92.00 102.00 112.00</td>
</tr>
<tr>
<td>93.00 103.00 113.00</td>
<td>93.00 103.00 113.00</td>
<td>93.00 103.00 113.00</td>
<td>93.00 103.00 113.00</td>
<td>93.00 103.00 113.00</td>
<td>93.00 103.00 113.00</td>
<td>93.00 103.00 113.00</td>
</tr>
<tr>
<td>94.00 104.00 114.00</td>
<td>94.00 104.00 114.00</td>
<td>94.00 104.00 114.00</td>
<td>94.00 104.00 114.00</td>
<td>94.00 104.00 114.00</td>
<td>94.00 104.00 114.00</td>
<td>94.00 104.00 114.00</td>
</tr>
<tr>
<td>95.00 105.00 115.00</td>
<td>95.00 105.00 115.00</td>
<td>95.00 105.00 115.00</td>
<td>95.00 105.00 115.00</td>
<td>95.00 105.00 115.00</td>
<td>95.00 105.00 115.00</td>
<td>95.00 105.00 115.00</td>
</tr>
<tr>
<td>96.00 106.00 116.00</td>
<td>96.00 106.00 116.00</td>
<td>96.00 106.00 116.00</td>
<td>96.00 106.00 116.00</td>
<td>96.00 106.00 116.00</td>
<td>96.00 106.00 116.00</td>
<td>96.00 106.00 116.00</td>
</tr>
<tr>
<td>97.00 107.00 117.00</td>
<td>97.00 107.00 117.00</td>
<td>97.00 107.00 117.00</td>
<td>97.00 107.00 117.00</td>
<td>97.00 107.00 117.00</td>
<td>97.00 107.00 117.00</td>
<td>97.00 107.00 117.00</td>
</tr>
<tr>
<td>26 crystals - $ 3.50</td>
<td>19 - $ 2.50 18 - $ 2.40</td>
<td>17 - $ 2.35 16 - $ 2.30</td>
<td>15 - $ 2.25 14 - $ 2.20</td>
<td>13 - $ 2.15 12 - $ 2.10</td>
<td>11 - $ 2.05 10 - $ 2.00</td>
<td>9 - $ 1.95 8 - $ 1.90</td>
</tr>
</tbody>
</table>

CRISTAL Etching and Grinding KIt

<table>
<thead>
<tr>
<th>Kit #1</th>
<th>Kit #2</th>
<th>Kit #3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crystals in misc. holders</td>
<td>12</td>
<td>15</td>
</tr>
<tr>
<td>Assorted crystal blanks</td>
<td>6</td>
<td>12</td>
</tr>
<tr>
<td>Pkg. ammonium bifluoride flakes</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Packets grinding compound</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Plastic containers</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Instructions</td>
<td>$ 3.95</td>
<td>$ 7.50</td>
</tr>
</tbody>
</table>

Send 25¢ for 68 page RELAY SALES catalog
2400 Crystal Drive
Fort Myers, Florida 33901

JUNE 1967
THIRD OVERTONE CRYSTALS — HC6 / U HOLDERS

$1.50 EA.

4 for $5.00

The CR23/U is a third or fifth overtone crystal designed to operate in a series overtone circuit, 3rd overtone from 10 to 52 MC, 5th overtone 52 to 75 MC, 0.005% tolerance, from -55° to +90° C. Maximum drive 5 milliwatts. Listing in MC.

IN STOCK FOR IMMEDIATE DELIVERY

NON-OVEN TYPE HERMETICALLY SEALED CRYSTALS MADE TO ORDER

Gold or Silver plated. Plating acts as electrodes. Spring mounted, sealed under vacuum or filled with inert gas. Max. current capacity 10 milliwatts (3 for overtone type). Very high frequency stability. Conform to military specifications. When ordering for G.E., Motorola, Link, etc. split channel operation, send sample of Xting and Rising crystal known to be correct and specify exact frequency desired. We will correlate and return samples with your order. All are 0.005% tolerance. Fundamental type supplied at 33.4kHz load capacity and overtone supplied for series resonance unless otherwise specified.

1SMC to 50 MC Third Overtone

$3.00 EACH

MINIATURE CRYSTALS

HC18/U

Pin Type

$1.55 EA.

4 for $5.00

Available in following Frequencies

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Pin Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.0 MHz</td>
<td>3.525</td>
</tr>
<tr>
<td>2.075 MHz</td>
<td>3.800</td>
</tr>
<tr>
<td>2.1 MHz</td>
<td>3.980</td>
</tr>
<tr>
<td>2.175 MHz</td>
<td>4.060</td>
</tr>
<tr>
<td>2.2 Mobil</td>
<td>4.207</td>
</tr>
<tr>
<td>2.25 MHz</td>
<td>4.2585</td>
</tr>
<tr>
<td>2.3 MHz</td>
<td>4.293</td>
</tr>
<tr>
<td>2.35 MHz</td>
<td>4.294</td>
</tr>
<tr>
<td>2.4 MHz</td>
<td>4.515</td>
</tr>
<tr>
<td>2.5 MHz</td>
<td>4.700</td>
</tr>
<tr>
<td>2.75 MHz</td>
<td>5.175</td>
</tr>
<tr>
<td>2.8 MHz</td>
<td>5.375</td>
</tr>
<tr>
<td>3.0 MHz</td>
<td>5.675</td>
</tr>
<tr>
<td>3.5 MHz</td>
<td>6.575</td>
</tr>
<tr>
<td>4.0 MHz</td>
<td>7.875</td>
</tr>
<tr>
<td>4.5 MHz</td>
<td>9.375</td>
</tr>
<tr>
<td>5.0 MHz</td>
<td>11.125</td>
</tr>
<tr>
<td>5.5 MHz</td>
<td>12.625</td>
</tr>
<tr>
<td>6.0 MHz</td>
<td>14.125</td>
</tr>
<tr>
<td>6.5 MHz</td>
<td>15.125</td>
</tr>
<tr>
<td>7.0 MHz</td>
<td>16.125</td>
</tr>
<tr>
<td>7.5 MHz</td>
<td>17.125</td>
</tr>
<tr>
<td>8.0 MHz</td>
<td>18.125</td>
</tr>
<tr>
<td>8.5 MHz</td>
<td>19.125</td>
</tr>
<tr>
<td>9.0 MHz</td>
<td>20.125</td>
</tr>
<tr>
<td>9.5 MHz</td>
<td>21.125</td>
</tr>
<tr>
<td>10.0 MHz</td>
<td>22.125</td>
</tr>
<tr>
<td>10.5 MHz</td>
<td>23.125</td>
</tr>
<tr>
<td>11.0 MHz</td>
<td>24.125</td>
</tr>
<tr>
<td>11.5 MHz</td>
<td>25.125</td>
</tr>
</tbody>
</table>

90 73 MAGAZINE
HOW TO ORDER...
Order your crystals by type and frequency... enclose check or money order (No C.O.D.)... add 5¢ per crystal for postage, 10¢ per crystal for airmail... make check or money order payable to JAN CRYSTALS, 2400 Crystal Drive, Fort Myers, Florida.

SEND US YOUR REQUIREMENTS... WE ARE RECEIVING NEW FREQUENCIES WEEKLY... WRITE FOR LISTINGS

PRESSURE TYPE CRYSTALS
75c TYPE 243 EACH

3 for $2.00

Type FT-243. A most rugged type having .093 pins and .486 pin spacing (1/2”). Designed to operate on frequency in 32 mmf oscillator circuit. The quartz crystal in this holder is either 0.5” x 0.5” or 0.6” and is held between two stainless steel electrodes by spring pressure. It is by far the most popular crystal of its type in use.

Some of the government sets in which the FT-243 is used are: (Manchets: 50 milliwatt) BC669, BC661, BC1333, RTT1/TC200, R415/FRC200, B19/TRC-1, RT77/GRC9, BC1360, RT30/PRC1, AN/AMT3, BC1000, AN/PRC8, T87/RT1, R397/TR1, and many others. The following frequencies are in stock for immediate delivery, frequencies guaranteed ±1 KC as listed in kilocycles.

- 4035 5040 5852 6640 7320 7664 8290
- 4046 5070 5860 6640 7320 7664 8290
- 4080 5080 5875 6640 7325 7670 8230
- 4095 5090 5875 6640 7325 7775 8300
- 4115 5127 5880 6650 7327 7675 8300 8380
- 4135 5140 5900 6650 7327 7675 8300 8310
- 4140 5150 5906 6656 7327 7675 8310 8316
- 4162 5165 5907 6650 7327 7675 8320 8316
- 4175 5185 5952 6625 7340 7006 8325
- 4190 5200 5940 6628 7341 7525 8308 8350
- 4200 5255 5950 6640 7350 7530 8310 8316
- 4215 5285 5950 6650 7351 7530 8316 8333
- 4255 5320 5973 6675 7358 7518 8341
- 4270 5325 5975 6675 7361 7530 8350 8380
- 4285 5380 5995 6690 7365 7534 8380 8380
- 4295 5400 6000 6696 7365 7530 8380 8360
- 4310 5527 6025 6625 7370 7670 8380 8570
- 4330 5530 6040 6630 7371 7676 8381 8575
- 4340 5540 6060 6640 7376 7680 8380 8580
- 4350 5560 6060 6640 7376 7680 8380 8580
- 4375 5600 6090 6660 7383 7680 8380 8580
- 4450 5635 6125 6675 7383 7680 8380 8603
- 4490 5657 6140 6700 7383 7680 8380 8616
- 4530 5660 6140 6700 7383 7680 8383 8620
- 4590 5680 6175 6720 7383 7680 8383 8625
- 4650 5700 6200 6750 7391 7680 8380 8630
- 4680 5700 6215 6750 7391 7680 8383 8630
- 4695 5720 6250 6750 7391 7680 8383 8630
- 4700 5720 6280 6800 7405 7680 8380 8670
- 4710 5755 6280 6800 7405 7680 8380 8670
- 4725 5780 6250 6800 7406 7680 8380 8670
- 4740 5780 6250 6800 7406 7680 8380 8670
- 4760 5780 6285 6835 7414 7680 8380 8670
- 4780 5805 6300 6835 7417 7680 8380 8670
- 4810 5805 6300 6835 7417 7680 8380 8670
- 4830 5835 6315 6840 7422 7683 7970 8725

FT-243 AMATEUR BAND CRYSTALS
UNCONDITIONALLY GUARANTEED

$1.50 EACH

4 for $5.00

- 40-meter general: 7000 to 7200
- 40-meter novice: 7131 to 7145
- 2-meter general: 14,000 to 14,250
- 2-meter novice: 21,000 to 21,250
- 10-meter general: 28,000 to 29,700
- 6-meter gen. & tech.: 50 MC to 54 MC
- 2-meter general: 144 MC to 148 MC
- 2-meter tech.: 145 MC to 147 MC

CRYSTALS IN STOCK FOR IMMEDIATE DELIVERY
LISTING IN Kilocycles

- 3525 7075 7203 8033 8120 8186 8408 8508
- 3755 7088 7206 8035 8125 8190 8410 8510
- 3800 7100 7225 8036 8126 8191 8416 8516
- 3825 7106 7240 8040 8128 8200 8420 8518
- 3830 7108 7245 8041 8130 8206 8425 8520
- 3840 7113 7262 8045 8133 8208 8430 8525
- 3885 7125 7273 8047 8140 8220 8450 8550
- 3920 7125 7275 8050 8141 8225 8450 8550
- 3950 7136 7278 8073 8150 8230 8450 8545
- 3970 7140 7281 8075 8153 8235 8450 8550
- 3980 7150 7306 8088 8160 8241 8458 8550
- 3990 7170 8000 8090 8166 8350 8550 8600
- 3995 7170 8001 8091 8166 8358 8540 8550
- 3999 7180 8001 8091 8166 8358 8540 8550
- 7006 7195 8007 8092 8170 8360 8475
- 7025 7252 8008 8100 8171 8370 8480 8570
- 7025 7250 8010 8106 8173 8375 8480 8570
- 7040 7198 8020 8108 8175 8380 8485
- 7050 EVERY 8021 8118 8178 8385 8491
- 7068 1 1.000 8225 8113 8180 8391 8499
- 7073 FT-243 8200 8116 8183 8400 8500

JUNE 1967
For experimentors and labs. These type CR7/U crystals are mounted in hermetically sealed cans similar to type HO/U except can is only ½” high, pins are .050” spacing — made especially for Navy type "MAR", TDZ, and RDZ sets. All crystals are fundamental frequencies and are so stamped on side of can.

All frequencies listed are in stock for immediate delivery. * denotes frequencies we have in quantities of 50 or more each. Every crystal tested and guaranteed to ±0.1% tolerance.

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>4285.19</td>
<td>$520.08</td>
</tr>
<tr>
<td>4329.63</td>
<td>$520.08</td>
</tr>
<tr>
<td>4364.44</td>
<td>$521.56</td>
</tr>
<tr>
<td>4374.07</td>
<td>$521.56</td>
</tr>
<tr>
<td>4403.70</td>
<td>$522.08</td>
</tr>
<tr>
<td>4500.00</td>
<td>$522.08</td>
</tr>
<tr>
<td>4625.93</td>
<td>$525.56</td>
</tr>
<tr>
<td>4660.74</td>
<td>$526.56</td>
</tr>
<tr>
<td>*4655.55</td>
<td>$526.56</td>
</tr>
<tr>
<td>4700.00</td>
<td>$528.08</td>
</tr>
<tr>
<td>4727.93</td>
<td>$528.08</td>
</tr>
<tr>
<td>4774.07</td>
<td>$528.08</td>
</tr>
<tr>
<td>4774.40</td>
<td>$528.08</td>
</tr>
<tr>
<td>4888.89</td>
<td>$528.08</td>
</tr>
<tr>
<td>4902.00</td>
<td>$528.08</td>
</tr>
<tr>
<td>*4905.70</td>
<td>$528.08</td>
</tr>
<tr>
<td>4907.06</td>
<td>$528.08</td>
</tr>
<tr>
<td>4922.22</td>
<td>$528.08</td>
</tr>
<tr>
<td>*4933.33</td>
<td>$528.08</td>
</tr>
<tr>
<td>*4931.85</td>
<td>$528.08</td>
</tr>
<tr>
<td>*4962.96</td>
<td>$528.08</td>
</tr>
<tr>
<td>4987.93</td>
<td>$528.08</td>
</tr>
<tr>
<td>4987.78</td>
<td>$528.08</td>
</tr>
<tr>
<td>5000.00</td>
<td>$528.08</td>
</tr>
</tbody>
</table>

**HOW TO ORDER**

Order your crystals by type and frequency . . . enclose check or money order (No C.O.D.) . . . add 5¢ per crystal for postage, 10¢ per crystal for airmail . . . make check or money order payable to JAN CRYSTALS, 2400 Crystal Drive, Fort Myers, Florida.

**ADD 5¢ PER CRYSTAL FOR POSTAGE OR 10¢ PER CRYSTAL FOR AIRMAIL**

**PHONE AREA 813 WE 6-2397**

**JAN CRYSTALS**

**73 MAGAZINE**

92
LOW FREQUENCY CRYSTALS in HC6/U HOLDERS

ORDER BY FREQUENCY

For Lattice Networks—Single Sideband—
Low Frequency Oscillators—Markers—
Etc. Frequency is fundamental in KC.

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>371 to 540KC</td>
<td>3.95</td>
</tr>
<tr>
<td>730 to 1000KC</td>
<td>3.55</td>
</tr>
</tbody>
</table>

CRYS TAL TYPE FT-164

This rugged type crystal was designed for the U. S. Navy and uses a 1" x 1" AT blank. We can furnish in frequencies from 200KC to 7500KC.

ORDER BY FREQUENCY

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>1601KC to 7000KC</td>
<td>7.50 ea.</td>
</tr>
</tbody>
</table>

CRYSTALS

For B.C.610, etc.,

<table>
<thead>
<tr>
<th>Type</th>
<th>Frequency</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>FT-164</td>
<td>1000KC to 10000KC</td>
<td>3.95</td>
</tr>
<tr>
<td>243</td>
<td>2000KC to 8650KC</td>
<td>2.00 each</td>
</tr>
<tr>
<td>243</td>
<td>4000KC to 10000KC</td>
<td>2.00 each</td>
</tr>
<tr>
<td>243</td>
<td>35000KC to 60000KC</td>
<td>2.00 each</td>
</tr>
</tbody>
</table>

TYPE FT249 HOLDER

(Pin Spacing Standard — Diameter 1.25)

CRYS TALS

Made to Order

This 3 pin Holder can be supplied with either one or two crystals. When ordering specify if crystal is to be used for Transmitter or Receiver or Both.

FT249 with Single Crystal

FT249 with Duo Crystals

MARKER — FILTER SPECIAL USE CRYSTALS

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>3000KC</td>
<td>2.50</td>
</tr>
</tbody>
</table>

PRESSURE-TYPE CRYSTALS

Made to Order

<table>
<thead>
<tr>
<th>Type</th>
<th>Frequency</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>243</td>
<td>2000KC to 8650KC</td>
<td>2.00 each</td>
</tr>
</tbody>
</table>

MC7 CRYSTALS

$2.00 EACH

Available in all frequencies from 2000KC to 8650KC.

CR1A/AR

Pressure type crystal used in SCR-522, etc.

$2.00 EACH

All frequencies from 4000KC to 8650KC available with 1/8" pin spacing and 1/4" pin diam. Specify frequency desired.

93
**CR24/U (BARREL TYPE) CRYSTALS**

Designed for the Armed Services, the CR24/U is a Pressure Type "AT" Crystal which will accommodate more current than the plated crystal. From 15 to 60 MC the crystal is a third overtone—from 23.001 to 60MC the crystal is a fifth overtone.

<table>
<thead>
<tr>
<th>FREQUENCY</th>
<th>19.5500</th>
<th>19.6000</th>
<th>19.6500</th>
<th>19.7000</th>
</tr>
</thead>
<tbody>
<tr>
<td>19.0583</td>
<td>20.0000</td>
<td>20.0600</td>
<td>20.1167</td>
<td>20.1733</td>
</tr>
<tr>
<td>20.250</td>
<td>20.5000</td>
<td>20.7500</td>
<td>20.8000</td>
<td>20.9000</td>
</tr>
<tr>
<td>20.9500</td>
<td>22.2833</td>
<td>22.3200</td>
<td>22.3500</td>
<td>22.3750</td>
</tr>
<tr>
<td>21.0000</td>
<td>22.3500</td>
<td>22.3833</td>
<td>22.4000</td>
<td>22.4250</td>
</tr>
<tr>
<td>21.0500</td>
<td>22.4000</td>
<td>22.4333</td>
<td>22.4500</td>
<td>22.4750</td>
</tr>
<tr>
<td>21.1000</td>
<td>22.4500</td>
<td>22.4833</td>
<td>22.5000</td>
<td>22.5250</td>
</tr>
<tr>
<td>21.1500</td>
<td>22.5000</td>
<td>22.5333</td>
<td>22.5500</td>
<td>22.5750</td>
</tr>
</tbody>
</table>

---

**CITIZEN BAND CRYSTALS**

CITIZEN BAND CRYSTALS WITH PINS FOR TRANS. AND RECEIVING FREQUENCIES LISTED ARE IN STOCK—ORDER BY FREQUENCY.

<table>
<thead>
<tr>
<th>TRANSMIT</th>
<th>REC (G551F)</th>
<th>REC (G6801F)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 24965</td>
<td>27420</td>
<td>28645</td>
</tr>
<tr>
<td>2 26975</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 26985</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 27015</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5 27030</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6 27050</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7 27075</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8 27095</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9 27105</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10 27115</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11 27135</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12 27155</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13 27175</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14 27185</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15 27205</td>
<td></td>
<td></td>
</tr>
<tr>
<td>16 27225</td>
<td></td>
<td></td>
</tr>
<tr>
<td>17 27245</td>
<td></td>
<td></td>
</tr>
<tr>
<td>18 27265</td>
<td></td>
<td></td>
</tr>
<tr>
<td>19 27285</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20 27305</td>
<td></td>
<td></td>
</tr>
<tr>
<td>21 27325</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

---

**SPECIAL CRYSTALS IN STOCK**

- **$3.50 EACH**
  - 1000 KC FREQ.
  - STANDARD IN HC6/U HOLDER
  - NEW MANUFACTURE

- **$4.50 EACH**
  - 100 KC FREQUENCY STANDARD
  - HC13/U HOLDER
  - NEW MANUFACTURE

---

**QUALITY CRYSTALS**

For Every Purpose
**HERMETICALLY SEALED CRYSTALS in Hc6/U HOLDERS**

<table>
<thead>
<tr>
<th>FREQUENCIES LISTED ARE IN Kilocycles</th>
<th>ORDER BY FREQUENCY</th>
</tr>
</thead>
<tbody>
<tr>
<td>1400</td>
<td>7375</td>
</tr>
<tr>
<td>1753</td>
<td>7375</td>
</tr>
<tr>
<td>1763</td>
<td>7375</td>
</tr>
<tr>
<td>1765</td>
<td>7375</td>
</tr>
<tr>
<td>1865</td>
<td>7375</td>
</tr>
<tr>
<td>1875</td>
<td>7375</td>
</tr>
<tr>
<td>1885</td>
<td>7375</td>
</tr>
<tr>
<td>1895</td>
<td>7375</td>
</tr>
<tr>
<td>1905</td>
<td>7375</td>
</tr>
<tr>
<td>1915</td>
<td>7375</td>
</tr>
<tr>
<td>1925</td>
<td>7375</td>
</tr>
<tr>
<td>1935</td>
<td>7375</td>
</tr>
<tr>
<td>1945</td>
<td>7375</td>
</tr>
<tr>
<td>1955</td>
<td>7375</td>
</tr>
<tr>
<td>1965</td>
<td>7375</td>
</tr>
<tr>
<td>1975</td>
<td>7375</td>
</tr>
<tr>
<td>1985</td>
<td>7375</td>
</tr>
<tr>
<td>1995</td>
<td>7375</td>
</tr>
<tr>
<td>2005</td>
<td>7375</td>
</tr>
<tr>
<td>2015</td>
<td>7375</td>
</tr>
<tr>
<td>2025</td>
<td>7375</td>
</tr>
<tr>
<td>2035</td>
<td>7375</td>
</tr>
<tr>
<td>2045</td>
<td>7375</td>
</tr>
<tr>
<td>2055</td>
<td>7375</td>
</tr>
<tr>
<td>2065</td>
<td>7375</td>
</tr>
<tr>
<td>2075</td>
<td>7375</td>
</tr>
<tr>
<td>2085</td>
<td>7375</td>
</tr>
<tr>
<td>2095</td>
<td>7375</td>
</tr>
<tr>
<td>2105</td>
<td>7375</td>
</tr>
<tr>
<td>2115</td>
<td>7375</td>
</tr>
<tr>
<td>2125</td>
<td>7375</td>
</tr>
<tr>
<td>2135</td>
<td>7375</td>
</tr>
<tr>
<td>2145</td>
<td>7375</td>
</tr>
<tr>
<td>2155</td>
<td>7375</td>
</tr>
<tr>
<td>2165</td>
<td>7375</td>
</tr>
<tr>
<td>2175</td>
<td>7375</td>
</tr>
<tr>
<td>2185</td>
<td>7375</td>
</tr>
<tr>
<td>2195</td>
<td>7375</td>
</tr>
<tr>
<td>2205</td>
<td>7375</td>
</tr>
<tr>
<td>2215</td>
<td>7375</td>
</tr>
<tr>
<td>2225</td>
<td>7375</td>
</tr>
<tr>
<td>2235</td>
<td>7375</td>
</tr>
<tr>
<td>2245</td>
<td>7375</td>
</tr>
<tr>
<td>2255</td>
<td>7375</td>
</tr>
<tr>
<td>2265</td>
<td>7375</td>
</tr>
<tr>
<td>2275</td>
<td>7375</td>
</tr>
<tr>
<td>2285</td>
<td>7375</td>
</tr>
<tr>
<td>2295</td>
<td>7375</td>
</tr>
<tr>
<td>2305</td>
<td>7375</td>
</tr>
<tr>
<td>2315</td>
<td>7375</td>
</tr>
<tr>
<td>2325</td>
<td>7375</td>
</tr>
<tr>
<td>2335</td>
<td>7375</td>
</tr>
<tr>
<td>2345</td>
<td>7375</td>
</tr>
<tr>
<td>2355</td>
<td>7375</td>
</tr>
<tr>
<td>2365</td>
<td>7375</td>
</tr>
<tr>
<td>2375</td>
<td>7375</td>
</tr>
</tbody>
</table>

**$1.50 EA.**

4 for $5.00

The CR8/1/U is a hermetically sealed plated crystal fundamental frequency to be used in parallel oscillator circuit of 32 mmdc. Tolerance is +0.05% from -65° to +80°. 650000000. It may be used to double, triple, or quadruple, to any desired frequency. Tolerance is 0.005%. Maximum drive is 10 milliwatts.

**CRYSTALS LISTED ARE FUNDAMENTAL FREQUENCIES. WE WILL MAKE TO ORDER ANY FREQUENCY FROM 2000KC TO 12000KC IN Hc6/U HOLDERS .005% TOLERANCE AT**

$2.55 EACH

BE SURE TO SPECIFY EXACT FREQUENCY AND CIRCUIT IT IS TO BE USED IN TO INSURE CORRECT CORRELATION.

DELIVERY ON SPECIAL FREQUENCIES CAN BE MADE IN 48 HOURS AFTER RECEIPT OF ORDER.
LOW FREQUENCY TYPE CRYSTALS

LOW FREQUENCY OSCILLATORS

LOW FREQUENCY OSCILLATOR:

Any Frequency from 370KC to 540KC in FT241 Holders

LOW FREQUENCY CRYSTALS FROM 729KC TO 1040KC

ORDER BY CHANNEL NUMBER

HOW TO ORDER...

Order your crystals by type and frequency... enclose check or money order (No C.O.D.)... add 5¢ per crystal for postage, 10¢ per crystal for airmail... make check or money order payable to JAN CRYSTALS, 2400 Crystal Drive, Fort Myers, Florida.
## COLUMBIA CLOSEOUT SPECIALS

### COMMAND RECEIvers

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Condition</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>195-550 Kc.</td>
<td>Good condition</td>
<td>$14.95</td>
</tr>
<tr>
<td>550-1500 Kc.</td>
<td>R-22 Exl. cond.</td>
<td>$14.95</td>
</tr>
<tr>
<td>1.5-3 Mc.</td>
<td>Like new</td>
<td>$19.95</td>
</tr>
<tr>
<td>3-6 Mc.</td>
<td>Like new</td>
<td>$14.95</td>
</tr>
<tr>
<td>6-9 Mc.</td>
<td>Good condition</td>
<td>$14.95</td>
</tr>
</tbody>
</table>

### COMMAND TRANSMITTERS

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Condition</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.1-3 Mc.</td>
<td>New</td>
<td>$9.95</td>
</tr>
<tr>
<td>3-4 Mc.</td>
<td>Excellent</td>
<td>$9.95</td>
</tr>
<tr>
<td>4-5.3</td>
<td>Excellent</td>
<td>$4.95</td>
</tr>
<tr>
<td>5.3-7 Mc.</td>
<td>Good cond. No xtal</td>
<td>$4.95</td>
</tr>
<tr>
<td>5.3-7 Mc.</td>
<td>Good, No tubes, xtl</td>
<td>$2.95</td>
</tr>
</tbody>
</table>

### TRANSCEIVERS AND TRANSMITTERS

<table>
<thead>
<tr>
<th>Model</th>
<th>Frequency</th>
<th>Condition</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>RT-18/ARC-1</td>
<td>100-156 Mc</td>
<td>Good</td>
<td>$24.95</td>
</tr>
<tr>
<td>T-47/ART-13</td>
<td>100W</td>
<td>Good</td>
<td>$24.95</td>
</tr>
<tr>
<td>BC-640 Transmitter</td>
<td>2-18 Mc less tubes</td>
<td>Good</td>
<td>$24.95</td>
</tr>
<tr>
<td></td>
<td>50W 100-156 Mc</td>
<td>Good</td>
<td>$150.00</td>
</tr>
</tbody>
</table>

### RECEIVERS

<table>
<thead>
<tr>
<th>Model</th>
<th>Frequency</th>
<th>Condition</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>R-105/ARR-15</td>
<td>1.5-18 Mc</td>
<td>Exclnt.</td>
<td>$49.95</td>
</tr>
<tr>
<td>ARB 195-9000 Kc.</td>
<td>Good condition</td>
<td>$24.95</td>
<td></td>
</tr>
<tr>
<td>RBS 2-20 Mc.</td>
<td>Good cond.</td>
<td>$49.95</td>
<td></td>
</tr>
<tr>
<td>RAK 15-600 Kc.</td>
<td>Good cond.</td>
<td>$49.95</td>
<td></td>
</tr>
<tr>
<td>RDZ 225-400 Mc</td>
<td>Good cond.</td>
<td>$39.95</td>
<td></td>
</tr>
<tr>
<td>RBA 15-600 Kc.</td>
<td>Excellent</td>
<td>$99.50</td>
<td></td>
</tr>
<tr>
<td>RBB 600-4000 Kc.</td>
<td>Excellent</td>
<td>$99.50</td>
<td></td>
</tr>
<tr>
<td>RBC 4-27 MC same</td>
<td>Excellent</td>
<td>$99.50</td>
<td></td>
</tr>
<tr>
<td>R-444/APR-4Y AM &amp; FM</td>
<td>Like new</td>
<td>$49.95</td>
<td></td>
</tr>
<tr>
<td>RDO Less plug-in tuners</td>
<td>Excellent</td>
<td>$149.50</td>
<td></td>
</tr>
<tr>
<td>CV-253/ALR Plug in tuner for APR-1, 4, 4Y and RDO Receivers, 38-1000 Mc, 4 bands</td>
<td>xinct.</td>
<td>$199.50</td>
<td></td>
</tr>
<tr>
<td>BC-683 27-40 Mc AM &amp; FM</td>
<td>Excellent</td>
<td>$39.95</td>
<td></td>
</tr>
</tbody>
</table>

## COLUMBIA ELECTRONIC SALES INC.

4365 W. Pico Blvd.
Los Angeles, California 90019
Phone (213) 938-3731

JUNE 1967
COLUMBIA TEST EQUIPMENT SPECIALS

TEK 51/AD 5cps to 10Mc
TEK 514/DC to 10 Mc
TEK 513D
DuMont 303A
DuMont 322
DuMont 322A
TS-34/AP Look good

SIGNAL GENERATORS
Meas. Corp. Model 65B
Meas. Corp. Model 80
Meas. Corp. Model 82
Meas. Corp. Model 84
TS-497/URR Mil. Model 80 2-400Mc
General Radio 1001A
General Radio 805C
TS-419/U 900-2100Mc
Navy LP 9.5-50Mc
TS-413/U 75Kc-40Mc
H-P 608A 10-500Mc
H-P 212A Pulse generator
H-P 202B Low Freq. Audio Osc.
H-P 201B Audio Oscillator
A.R.C. H-14A Omni Generator
SG-1/ARN Omni generator
MD-83A/ARN Omni Generator
SG-2/GRM Boonton 232A Glide slope

FREQUENCY METERS
BC-221 125-20,000 Kc
LM 125-20,000 Kc
TS-174/U 20-280 Mc
TS-173/U 90-480 Mc
TS-175/U 85-1000 Mc
TS-323/U 20-450 Mc
TS-186/U 100-10,000 Mc
AN/URM-32 125Kc-1000Mc
H-P 524B Counter with 100 Mc plug-in
FR-4/U 100Kc-20Mc

MISCELLANEOUS SPECIALS
IP-69A/ALA-2 Panadapter 30 Mc input with schematic & conversion information for 60 cy use

Like new

Like new

Like new

Like new

Like new

Like new
**TUBES AND ACCESSORIES**

<table>
<thead>
<tr>
<th>Item Description</th>
<th>Condition</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eimac socket &amp; chimney for 4-400A</td>
<td>New</td>
<td>$14.95</td>
</tr>
<tr>
<td>Socket for 4x150A</td>
<td>New</td>
<td>$3.95</td>
</tr>
<tr>
<td>4-400A tubes</td>
<td>New</td>
<td>$29.95</td>
</tr>
<tr>
<td>4CX300A tubes</td>
<td>New</td>
<td>$19.95</td>
</tr>
<tr>
<td>RA-62 AC P/S for SCR-522</td>
<td>Good</td>
<td>$17.95</td>
</tr>
</tbody>
</table>

If you don’t see what you want, send us a note with your exact requirements. Columbia has one of the world’s largest inventories of surplus military, communications and test equipment.

**COLUMBIA NEEDS YOUR SURPLUS EQUIPMENT**

WE PAY MORE, WE PAY FREIGHT, AND YOUR MONEY IS SENT OUT AIRMAIL IMMEDIATELY.

CALL US COLLECT OR WRITE US YOUR BEST OFFER AND WE WILL TOP THAT OFFER. WE ALSO MAKE TRADES FOR ANY GEAR YOU MAY NEED.

WE NEED THE FOLLOWING EQUIPMENT:

- AN/ARC-27, 34, 38, 44, 45, 52, 55, 58, 73, 84, etc.
- AN/ARN-14, 21, 59, 67, 70.
- AN/APS-42, 81, 85, etc.
- AN/TRC-1, 24, 35.
- TRC equip.
- AN/PRG-8, 9, 10, 25, R-108, 109, 110/GRG.
- RT-66, 67, 68/GRG.
- AN/APR-9, 13.
- AN/URR-13, 27, 35.
- VRC equip.
- TED, AN/URT-T.
- AN/URC equipment.
- Test equip. with ARM, SG, URM UPM, APM, TS, GPM and other prefixes.
- Also Tektronix, Hewlett-Packard, Boonton and General Radio equipment.
- Aircraft instruments and radio and navigation equipment.

**COLUMBIA ELECTRONIC SALES INC.**

4365 W. Pico Blvd.
Los Angeles, California 90019
Phone (213) 938-3731
INTEGRATED CIRCUITS

SR Clocked Flip Flops ........................................ $1.15
JK Flip Flops ..................................................... $1.15
SRT Flip Flops .................................................. $1.15
Dual Nand Nor Gates .......................................... $1.00
Dual 4 Input Or Gate ........................................ $1.00

TO-85 flat pack guaranteed to work. They come complete schematic, elect characteristic sheet & some typical applications. $9.00—$15.00 value from original manufacturer. We have other types of IC's in these categories available, send requests.

Silicon Controlled Rectifiers

<table>
<thead>
<tr>
<th>PRV</th>
<th>7A</th>
<th>20A</th>
</tr>
</thead>
<tbody>
<tr>
<td>50</td>
<td>.50</td>
<td>.80</td>
</tr>
<tr>
<td>100</td>
<td>.70</td>
<td>1.35</td>
</tr>
<tr>
<td>200</td>
<td>1.05</td>
<td>1.90</td>
</tr>
<tr>
<td>300</td>
<td>1.60</td>
<td>2.45</td>
</tr>
<tr>
<td>400</td>
<td>2.10</td>
<td>2.85</td>
</tr>
<tr>
<td>500</td>
<td>2.80</td>
<td>3.50</td>
</tr>
<tr>
<td>600</td>
<td>3.20</td>
<td></td>
</tr>
<tr>
<td>700</td>
<td>3.50</td>
<td></td>
</tr>
<tr>
<td>800</td>
<td>4.00</td>
<td></td>
</tr>
<tr>
<td>900</td>
<td>4.50</td>
<td></td>
</tr>
<tr>
<td>1000</td>
<td>5.00</td>
<td></td>
</tr>
</tbody>
</table>

Silicon Power Rectifiers

<table>
<thead>
<tr>
<th>PRV</th>
<th>3A</th>
<th>20A</th>
<th>40A</th>
<th>240A</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>.10</td>
<td>.40</td>
<td>1.00</td>
<td>5.00</td>
</tr>
<tr>
<td>200</td>
<td>.20</td>
<td>.60</td>
<td>1.50</td>
<td>7.50</td>
</tr>
<tr>
<td>400</td>
<td>.25</td>
<td>.80</td>
<td>2.00</td>
<td>15.00</td>
</tr>
<tr>
<td>600</td>
<td>.35</td>
<td>1.20</td>
<td>2.50</td>
<td>20.00</td>
</tr>
<tr>
<td>800</td>
<td>.55</td>
<td>1.70</td>
<td>3.00</td>
<td>30.00</td>
</tr>
<tr>
<td>1000</td>
<td>.65</td>
<td>2.00</td>
<td>3.50</td>
<td>35.00</td>
</tr>
</tbody>
</table>

Top Hats and 1.25A Glass Epoxies 750 MA Amp. Diode

<table>
<thead>
<tr>
<th>PRV</th>
<th>30</th>
<th>350</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>.07</td>
<td>.30</td>
</tr>
<tr>
<td>200</td>
<td>.09</td>
<td>.50</td>
</tr>
<tr>
<td>300</td>
<td>.10</td>
<td>.70</td>
</tr>
<tr>
<td>400</td>
<td>.12</td>
<td>.90</td>
</tr>
<tr>
<td>500</td>
<td>.15</td>
<td>1.00</td>
</tr>
<tr>
<td>600</td>
<td>.20</td>
<td>1.25</td>
</tr>
<tr>
<td>800</td>
<td>.25</td>
<td>1.40</td>
</tr>
<tr>
<td>1000</td>
<td>.30</td>
<td>1.60</td>
</tr>
<tr>
<td>1200</td>
<td>.35</td>
<td>1.80</td>
</tr>
<tr>
<td>1400</td>
<td>.40</td>
<td>2.00</td>
</tr>
<tr>
<td>1600</td>
<td>.45</td>
<td>2.20</td>
</tr>
<tr>
<td>1800</td>
<td>.50</td>
<td>2.40</td>
</tr>
</tbody>
</table>

A controlled avalanche rectifier in which the rated PRV may be exceeded without the rectifier breaking down.

OUR TRANSISTORS AND RECTIFIERS ARE GUARANTEED TO WORK

All transistors are checked for minimum voltage and gain, insuring our customers a good transistor within the category we advertise. All rectifiers costing over 10c are checked for forward voltage and leakage, as well as PRV. The gates on our SCR's are also checked. All non-operable units will be refunded or exchanged immediately. We stand on our reputation for quality products and service.

DO NOT CONFUSE OUR PRODUCTS WITH THOSE OF SOME OF OUR COMPETITORS

A defective semiconductor is worthless or worse.

Large quantity users of the above items send us your specifications. We feel we can meet them at a competitive price.
**TRANSISTORS**

**A)** Similar to 2N2185 (PNP). A silicon epitaxial low leakage transistor in TO-18 package, to 30 volts at 150 mw. 3/$1.00

**B)** Similar to 2N329A (PNP). A general purpose silicon epitaxial transistor in a TO-5 package, low leakage, to 30 volts and $\beta$ of 30-80. Compare with $9.00 value. 3/$1.00

**C)** Similar to 2N3060 (PNP). A 60 volt silicon transistor in a TO-46 pack with a $\beta$ of 30 at .4 w dissipation. These transistors are used in DC amplifiers, audio systems and in high voltage work. 3/$1.00

**D)** Similar to 2N1640 (PNP). A bi-directional transistor in which the emitter and collector are interchangeable. This is a silicon unit in a TO-5 package. $75 ea.

**E)** Similar to 2N339-2N341 (NPN) etc. A high voltage, medium power (5 watts) silicon (NPN) transistor. 5/$1.00

**F)** Similar to 2N547A, B and C, etc. A silicon transistor in a TO-5 package mounted in its own heat sink. 3/$1.00

**G)** Similar to 2N728 (NPN). A high frequency silicon unit in a TO-18 package extending to the UHF range. 3/$1.00

**H)** Similar to 2N995 (PNP) silicon unit with 1.2 w dissipation in a TO-18 package. This transistor has cut-off frequencies to 180 mc. 3/$1.00

**I)** Similar to 2N699 (NPN). A 5 watt silicon, high voltage transistor in a TO-5 package used for fast switching. Ultra high frequency. 3/$1.00

**J)** Similar to 2N2875 (PNP) silicon 20 watt power transistor with a cut-off frequency to 30 mc. $75

**K)** Similar to 2N1648 (NPN) silicon high voltage, 20 watt unit used in output stages and power transistor drivers. $75

**L)** Similar to 2N2885 (NPN) and TMT-8035 (PNP) microtransistors, they are high frequency transistors which dissipate 75 mw. of power. Both units $1.00

**N)** Similar to 2N155 (PNP), a 20 watt germanium power transistor in a TO-3 package used in audio work. 4/$1.00

**O)** Similar to 2N327A (PNP) silicon transistor in a TO-5 package used in audio work. 4/$1.00

**P)** Similar to 2N519 (PNP), a TO-5 germanium transistor used in RF circuits. 6/$1.00

**Q)** Similar to 2N389, 424 (NPN) etc., an 85 watt, 60-100 volt transistor with many high voltage power applications. $75 ea.

**R)** Similar to 2N1209, 2N1212, etc. These transistors have the same electrical characteristics as the 2N389's, but are stud mounted. $75

**T)** Similar to 2N497 (NPN), a silicon transistor in a TO-5 package for general purpose use. 5/$1.00

**S)** FET's, N channel type similar to C610 used in amplifiers, switches, and choppers—very high input impedance. $1.50

**U)** NPN dual transistors. A TO-5 package (2N2060) which contains 2 NPN silicon transistors. $1.50

**V)** PNP dual transistors. This package (2N2607) contains 2 PNP transistors in a TO-5 can. $1.50

**W)** Similar to 2N117 (NPN), a silicon transistor, used as a small signal transistor in a flat package. 4/$1.00

**X)** Similar to 2N1131 (PNP) silicon TO-5 transistor used for VHF, oscillator, audio and DC work. 3/$1.00

**Y)** High Voltage 150V VBCBO at 2.5A High HFE in TO-66 Pack $7.5

**Z)** High Voltage 200V VBCBO at 2.5A High Gain in TO-66 Pack $1.00

**RECTIFIERS**

**A)** 10 watt ZENERS. 2-180 volts. STATE DESIRED VOLTAGES. $75 ea.

**B)** COLOR CODED GLASS DIODES. Si. 20/$1.00 Ge. 30/$1.00

**C)** Similar to 1N251, a high frequency diode used to 1000 Mc. PIV. of 20 volts. 10/$1.00

**D)** Similar to S284. A 30 PIV unit with characteristics similar to 1N251. 10/$1.00

**E)** Silicon bilateral switch. Replaces SCR's by firing in either direction when the breakover voltage is exceeded. It is used as a light dimmer, etc. with schematic. $75

**F)** 1N429. A 6 VOLT DOUBLE ANODE REGULATOR, 2 WATTS. 5/$1.00

**G)** 5V176. A 7 VOLT REFERENCE DIODE, 2 WATTS. 5/$1.00

**H)** High Voltage Assemblies. 6000V at 200 mils. These Silicon Assemblies may be put in Series to Achieve Higher Voltages. $1.50

**I)** Microdiodes, similar to MD27, etc., up to 200 PIV at 100 $\mu$ a. These are switching diodes with a short recovery time. The size of the body is only .05" in diameter. 6/$1.00

**J)** GA AS VARACTORS, SIMILAR TO AP-1, AP-6, etc. 70 KMC at 160 mw. $4.00 ea.
RECEIVERS · TRANSMITTERS

ARR-15—Collins receiver, manual or auto tune, covers 1.5 to 18 MHz, has built in crystal calibrator also permeability tuned oscillator $49.50
APR-4 Receiver—11 tube superhet, uses tuning units to cover 38-4000 MHz. Receiver less tuning units $59.50
AMT-4 Weather balloon transmitters, compact and light, new $3.95
ART-13 Transmitter—100-watt new $29.50
ARC-1 Transceiver—100-156 MHz, uses 832A in final $29.50
Be-1000 Transceiver—IS tube portable, 2-way radio, 40-48 MHz, can be used on meters, less tubes $29.50 with tubes $39.50
ARR-26—FM receiver, 152-174 MHz not mounted in case. Some with tubes, Has 30-MHz IF strip. Will make good 2-meter receiver. In as is condition $4.95
URC-19—Mobile FM in two bands, 25 to 50 MHz and 152 to 174 MHz. Good for 6 and 2 meters. Comes in 3 separate units: transmitter, receiver and power supply. Beautifully constructed and delivers 30 watts. Can be converted to A.M. $49.50
TSC Receiver & Transmitter Set—Includes TSC remote control, 12 VDC power supply and antenna loading coil. Covers 1500 to 12,000 MHz. All for $149.50

TEST EQUIPMENT

URM-26—Navy version of Model 80 or TS-497. More compact and later style. Covers 2-400 MHz $250.00
TS-148—Spectrum analyzer, X band, $129.50
TS-186—Freq. meter 100-10,000 MHz $149.50
UPM-8—Signal generator, 980-1230 MHz. Also used as pulse generator $39.50
TS-13—X band signal generator $49.50
I-222—Signal generator, 8-15 MHz & 45-77 MHz $39.50
TS-14 Signal generator 3200-3370 MHz $39.50
Binary Radiation Counter for research $29.50
TS-35—X band signal generator $34.50
TS-345—Noise and gate generator $24.50
TS-250—Altimeter test set $12.50
TS-155—Signal generator 2700-3400 MHz for testing receivers and transmitters and for supplying trigger pulses $97.50
TS-230—Power meter. Designed to measure frequency of unmodulated and pulsed signals in the range of 85-9700 MHz. New, with fittings $49.50
TS-573/UP—Radar range calibrator, portable used calibrating pulse radar systems used for tracking or automatic signal. Range strobe output. Variable from 100 yds. to 200 miles $97.50
TS-8/U Oscilloscope, has 3” cathode ray tube. Compact sweep circuit osc. 3 Hz to 50 KHz. Weight approx. 15 lbs. $97.50
Tektronic 511 Scope—Good for wide range wave shape observance $195.00
UPM-4—Precision scope, 3” tube type, and can be triggered internally or externally, and can be delayed by either. Has high voltage supply but needs additional voltages for operation. Complete with tubes $225.00

TUBES

3C22—new boxed. $2.95 each or 2 for $5.00
100TH—new boxed, each $4.95
1625—new boxed each $1.49
807 each 97c
707B—1200 MHz klystron $3.00
717A—Direct replacement for 6SK7, 6SH7, 6S7J, 6AK7, 6S6G7, also used for octal 6AK5. Good for reduction in noise level, and IF gain $10/$2.95
Bulk Packed—5814—Same as 12AU7 $1.00
6J6 $1.00
6H6 $1.00
6AC7 $1.00
902A—Scope tube 2” with octal base new, each $2.95
1P28 Photo multiplier tube, each $3.95

TELETYPES

Model 14 reper with sync motor less base and cover, as is condition, Each $19.95
88 mH coils, potted for easy mounting, 5 for $1.49
Paper, model 15, carbon type, 10 rolls to a case, per case $9.95
Paper, model 14, 11/16”, 40 rolls to case, $7.95 per case, or 2 cases for $15.00
Special Power Supply for model 15 and model 19, mfgd by Teletype, Each $9.50

Terms: All items subject to prior sale. FOB our warehouse, Los Angeles, Calif. 25% deposit with COD order. Calif. buyers add 4% sales tax. Minimum order $5.00

J. J. Glass Electronics Co.
1624 S. Main St.
Los Angeles, California 90015
Phone: 213-749-1179
POWER SUPPLIES

RA-62—Used with SCR 522, 110 V 60 cy input. Can easily be adjusted to operate ARC-5, 3, 4 etc. Each $19.95

TCS—12 volt dynamotors_assym. 4 transmitter & receiver. Completely filtered, can also be used to operate SCR-522, ARC-3, 4, 5 etc. New, each $9.95

Converter-Rotary type—12-24 volts to operate 24 volt equipment without any internal changes in the equipment. Will deliver 24 volts at 4 amps. Each $9.95

PE-125—12 volts, 15 amps input. Output 425 volts DC at 200 ma. Has starting relay, fuses and completely filtered, Each $9.95

24-Volt generator at 25 amps, new $8.95

Laminated core for 275 watts power supply. Stack 2 for 375 watts. (QST Dec. 1964 for details), Each $1.95

Power Supply for BC-603 or BC-683, 110 VAC, Each $9.95

RA-43 Power Supply, Input 110 volts 60 cycle Output 110 volts 525 watts, in excellent condition. Weighs 165 lbs, Each $14.95

RA-94 Power Supply, for Super-Pro receiver, New, each $14.95

COMMAND EQUIPMENT

SPECIAL

4-5.3 MHz transmitters, as is. Most are complete with tubes, Each $1.95

3-4 MHz transmitters, Each $9.95

ARC-5/VHF transmitters, 100-150 MHz, new condition, with tubes, Each $14.95

3-6 MHz receivers, exclnt cond, Each $12.95

6-9 MHz receivers, good cond. Each $9.95

BC-459 ARC-5 modulators, Each $5.95

BC-442 Antenna relay, new $2.25

MISCELLANEOUS

Acrylic Spray: Supplies a protective cover for equipment, diagrams, maps, meters, etc. Brings out luster and makes sprayed area look like new, Case of 12 cans, $3.95/case

Stereo Phones: Mfr. by Monarch. New $9.95

Dial telephone For extension or 2-way use, each $4.95

TSC Remote speakers: Ideal for tweeter, flat to 16,000 cy $4.95

Geiger Counter: Compact type, uses Geiger-Mueller tube, New $4.95

2 Volt Rechargeable Battery: New, $2.49

Counter: for use with computer electronic counters etc. 12 VDC coil, counts 0-9 in large 1-inch figures $1.95

Styrene Tubing: 48" corrugated 2" diameter. Can be used to cover fluorescent bulbs for indirect lighting, or to wind coils, or antenna loading or ant. mast. 5 tubes $2.49

Navy Beam Filter: 1020 cy, same as FL-8 New each $1.95

Grey Aluminum boxes: Beautifully constructed lined with sponge rubber. 8½" square by 3¼" thick, now, only each $1.95

RM-52 Phone Patch Special: Comes complete with UTC8371 transformer $1.95

RM-53 Phone Patch Special: A more elaborate unit with sensitive 4 ma plate relay. This unit can be used for phone patch as is, without any changes $2.95

Technical manual for above $0.49

Terms: All items subject to prior sale. FOB our warehouse, Los Angeles, Calif. 25% deposit with COD order. Calif. buyers add 4% sales tax. Minimum order $5.00
SELL YOUR OLD GEAR TO GET BIG CASH DOLLARS NOW

We have immediate customers for your old equipment in any condition. We'll pay guaranteed highest price, shipping, insurance, etc. We'll pay in 24 hours, write or call collect for our high offer. P.S. We'll trade or swap equipment too.

MILITARY ELECTRONICS, CORP.

DIVISION OF SPACE ELECTRONICS CO.
4178 PARK AVENUE • BRONX, NEW YORK 10475
212-299-0300

Please rush me a quote on the following gear that I have to sell:

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

Name
Address
Zip  Phone
GET HIGHEST PRICES

NAVY "TED" TRANSMITTERS AN/URR-13,17,35,36, etc.; AN/URA-6,8,17; AN/SPA-4,8,9.
AN/GRC-3,4,5,6,7,8,9,10, 19,25,46; RT-66,67,68,69, 70,77; AM-65/GR,
T-368/UR, PP-112/GR, RT-174/PRC-8, R-108,9/GR, RT-175/PRC-9,
R-110/GR, RT-176/PRC-10, T-195/GR, AN/PRC-25, R-125/GR, T-217A,
T-235/GR, R-278B, SB-22/PT, MD-129A/GRC-27, AN/VRC-12, etc.
AN/URM-4,8,9, etc.
TS-723/U
OS-8E/U
TV-2C
TS-621
TV-7
TS-710
AN/URM-44
TS-683
TS-510A
AN/URM-52
AN/USM-44
AN/TRM-3
AN/PSM-68
AN/GPM-15
AN/PSM-48
We also buy all H-P, Boonton, ARC, GR, Bird, Measurements, TEK, etc.

COMMERCIAL AIRCRAFT COMMUNICATIONS:
Collins: 17L-4,7, 51X2, 51V3, 618S, 618T, 18S-4, 621A3, 860E-2, 618M,
51R3, 578D, 578X, 479S-3, 479T-2; ARC: R-30A, R-38A, R-34A, RT-11A,
T-27A, T-25C, R-31A,
T-27A, T-25C, R-31A,
INDICATORS: ID-250,1
ID-387, ID-257, ID-663,
ID-1103, ID-637, etc.; all Collins, Weston, and A.R.C. indicators and
control units.

TEST EQUIPMENT
SG-12A/U
AN/URM-25
AN/URM-26
SG-1A/ARN
SG-2A/GRM
AN/URM-80
SG-13/ARN
AN/URM-81
AN/ARM-8
AN/URM-32
AN/ARM-25
AN/ARM-68
AN/URM-48
AN/ARM-22
AN/ARM-66
AN/USM-26
AN/ARM-65
SG-66A/ARM-5
AN/URM-43
AN/URM-98
AN/ARM-68
MD-83A/ARM
AN/UPM-99
AN/USM-16

RECEIVERS: AN/APR-13,
14, 17, R-388, R-388A,
R-390, R-390A, R-391,
R-392, R-220, R-399;
R-1125, R-1051, CV-253/
ALR, 51J-2,3,4; AN/
URRE, AN/FRR, etc.

AIRCRAFT EQUIPMENT:
AN/APR-27,33,34,38,44,
45,52,54,58,73; AN/ARN-
14,21,54,56,59,65,67,52V.

MILITARY ELECTRONICS, CORP.
Division of SPACE ELECTRONICS, CO.
4178 Park Avenue, Bronx, New York 10475 • (212) 299-0300

JUNE 1967 105
G.E. PROGRESS LINE, 30-54 mc 6/12 volt mobile transceivers. 60 watts RF output. Absolutely mint condition. These were removed from service in Jan. 67 in perfect operating condition. They are complete in every respect except for the antenna. Narrow Band. FCC type ET23A. Now on 47mc. Tunes to 54mc with no modifications. Your purchase price refunded if not satisfied for any reason! This is the lowest price anywhere.

Single freq. trans. & rec. Only $100.00
*Two freq. trans. & rec. Add $ 10.00
*Four freq. trans. & rec. Add $ 30.00
*Limited quantity, give 2nd & 3rd choice

MOTOROLA 150mc mobile transceivers FMTRU5V, with case, control head, cables. Some small tubes missing, dirty, but apparently in good cond. Only $29.00 ea.

RCA 150 mc Transistorized pocket receivers good cond., complete less on batt. (RCA VS320) $25.00 ea

G.E. 450MC 6/12v mobile transceiver 20 watts output. Rec. sens., less than 1 uv. transmitter tunes to 432.0 with no modifications, rcvr requires 2 padders in osc. section. Complete with all acc., guaranteed in A-1 cond. Only $65.00 ea

For complete list of FM equipment and accessories, send large sase.

WE WILL PAY CASH OR TRADE FOR FM EQUIPMENT, LATE MODEL MILITARY & COMMERCIAL COMMUNICATION EQUIPMENT, AND TEST EQUIPMENT. Motorola, G.E.-RCVRS, R220, R5200, R389. Also any facsimile equipment, parts, acc. made by Electronic Comm. or Stewart-Warner. If you have equip. to sell or trade, please name your cash or trade price.

MIN. order $5.00 .25% deposit on COD orders. Prices subject to change without notice. Prices are FOB Trenton, Mich. Res., add 4%. Include postage for parcel post items only.

NEWSOME ELECTRONICS
Hours: by appointment only
2670 Pinetree, Trenton, Michigan 48183
Telephone 313-676-7460

JUNE 1967
RECEIVE PICTURES FROM APT WEATHER SATELLITES

Late model commercial facsimile transceivers. The finest available on the surplus market. Commercial units, not military. Employs electrolytic method, which is the type of reception used in modern AP & UPI machines, replacing the older photographic equipment. These machines are like new and in perfect condition. Ideal for the reception of pictures from the various weather satellites. Pictures received from the

BERKLEY ELECTRONIC COUNTER

Freq. range—0-99,999 cps. Time base 1/10 sec & 1 sec. We have about a dozen of these. All are clean and in excellent operating condition. Only $150.00 ea

CAVITY, silver plated brass, brand new, lots of uses. For two meters & up. 2x12". $2.95 ea

CARTER 6/12 volt Dyna-motor, brand new unused. output is 400-vdc at 400ma. $17.50 ea

NEWSOME ELECTRONICS

Hours: by appointment only
2670 Pinetree, Trenton, Michigan 48183 Telephone 313-676-7460
satellites are 8 x 8.5 inches. For additional information on receiving pictures from the Automatic Picture Taking satellites, see: QST, Nov. 65, p. 11. CQ, Sept. 66, p. 44. Electronics World, March 67, p. 23. CQ, Aug. 66, p. 25. Electronics, July 27, 1964 p. 81 & 99. These machines will send and receive pictures, schematics, etc., up to 8.5 x 14". They can be used on the 2 meter band and up without any additional equipment other than your AM or FM receiver and xmt. When transmitting, it provides a monitor copy which is an exact reproduction of the picture being transmitted. 100Ft rolls of recording paper are readily available at a cost of less than 2 cents per picture!

**SPECIFICATIONS**

<table>
<thead>
<tr>
<th>Drum speed</th>
<th>240 RPM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subcarrier freq.</td>
<td>2400 cps</td>
</tr>
<tr>
<td>Modulation</td>
<td>VSB—AM carrier</td>
</tr>
<tr>
<td>White</td>
<td>26 DB below black level</td>
</tr>
<tr>
<td>Input/output</td>
<td>600 ohms(Audio)</td>
</tr>
<tr>
<td>Recording</td>
<td>100 ft.</td>
</tr>
<tr>
<td>paper capacity</td>
<td>continuous</td>
</tr>
<tr>
<td>Receiving level</td>
<td>No less than -35 DBM</td>
</tr>
<tr>
<td>Start/stop</td>
<td>Automatic (auto-start)</td>
</tr>
<tr>
<td>Received</td>
<td>85 Lines/ inch</td>
</tr>
<tr>
<td>Vertical resolution</td>
<td>Phasing</td>
</tr>
<tr>
<td>Receive AGC</td>
<td>20DB Dynamic range</td>
</tr>
<tr>
<td>Bandwidth</td>
<td>900-2700 cps</td>
</tr>
<tr>
<td>Carrier freq.</td>
<td>2400 cps</td>
</tr>
<tr>
<td>Black signal to noise ratio</td>
<td>receive term.</td>
</tr>
<tr>
<td>Power req.</td>
<td>115vac, 60 cps</td>
</tr>
</tbody>
</table>

Additional information and prices available on request.

**TOROID** power transformers. (2) in mini-box. Wind your own primary. Toriod dim: 2¾ OD x 1¼ ID x ½", 2 stud type rect. Brand new. **$2.95 ea**

**MOTOROLA** fully transistorized 150mc pocket transmitters, ½ watt output, less batt. **$25.00 ea**

**MEASUREMENTS** model 58 field strength meter, 15 to 150-mc. A-1 cond. **$95.00**

**COLLINS R425B UHF** receiver, on 420mc, brand new, unused! **$60.00**

**LAMPKIN 205 A FM modulation meter, ser. no. 2018. Excellent cond. **$175.00**

**NEWSOME ELECTRONICS**

Hours: by appointment only

2670 Pinetree, Trenton, Michigan 48183 Telephone 313-676-7460
The TS 34/AP Oscilloscope is one of the best buys on the surplus market today but, due to its World War II vintage, it is sometimes by-passed for other equipment. When you look at a TS 34/AP it reminds you of the old kaleidoscopes found in penny arcades at amusement parks—the kind you squint into to see the girlie pictures. The TS 34/AP is something on that order but a face lifting will make it look like a million dollars.

This oscilloscope is a real fine instrument and has many excellent operating characteristics. It's light weight and small size make it an excellent portable or fixed station scope. The TS 34/AP operates from 110 volts at 50 to 1200 Hz and draws 90 watts. The sensitivity is .1 to 100 volts and sine waves are observable from 30 Hz to 1 MHz.

The first job is to bring the 2AP1 tube up forward. This simple modification makes better viewing of the cathode-ray tube from all angles so you don't have to squint into the scope to view the test pattern. Remove the top cover of the cabinet and take out the long black Armco-iron shield over the CRT. Save the small shield which is inside the long one. Next measure 7½ inches in from the socket end (rear) and cut off the shield with a hack saw. This short shield will be used when the tube is moved to the front.

Next we work on the front end of the top cover to prepare it for insertion of the 2AP1 tube. The eye-shade or hood should be removed, leaving an oval hole. This hole must be enlarged to take a round meter bezel, 2 to 2¼ inches in diameter. I used a meter bezel which I found in the junk box. Prepare a new sub-panel 7 x 3¾ inches which is to be fitted over the enlarged hole. Do-it-yourself aluminum was used here. Cut out the hole in the center of this panel for the bezel; fasten panel and bezel to the top cover.

The top cover needs more surgery, so cut out a hole 10 x 5 inches right in the center. Start 2¾ inches from the front edge. This hole will be used later for adjusting the installation of the 2AP1 tube. You will also need it to replace tubes. Next make a cover or lid to fit over this hole using do-it-yourself perforated aluminum and fasten it with self-tapping screws. Allow at least a one inch margin around this lid so it will be secure when fastened to the cover. When this is finished, paint the new and old parts of the top cover with a spray-can.

Our next job is to move the 2AP1 tube forward by lengthening the wires going to the tube socket. The present socket will be moved forward about seven inches. Allow enough wire when splicing the additional wire to the original leads. To get an idea of the length of the required splices, place the 2AP1 temporarily in the bezel and measure the additional wire length to each pin of the socket. It is a good idea to lace and bind these wires together when splicing is completed. A bracket must be made to hold the shield, similar to the original bracket at the rear of the chassis. It can be made from a small piece of aluminum shaped like the letter Z. It is then fastened to the screw just in front of the 6AG7. This screw and washer hold down the phenolic tie point board. The bracket should have a nut and screw attached to it so that the little fork on the rear of the shield fits down on it and holds secure.

Now the final adjustment of the face lifting. Fasten the socket into the Armco-iron shield. Take the small shield and insert it inside the larger one. The 2AP1 tube is then pushed down through the shield until it fits into the socket. Then the tube and shields are placed through the bezel. The small fork on the outer shield is fastened to the screw and nut on the bracket. To keep the tube rigid, put a piece of rubber around the edge of the 2AP1 tube.

If you have followed these simple instructions you will have a scope of modern design and you can enjoy the capabilities of this $1,000 instrument—that's what the government paid for it.
Climbing the Novice Ladder

Part VII: Judy and Joe take their written exams and report on their transmitter hunt.

By the following Saturday neither FN nor Larry had received the sheets for the written portion of the novice exam for Judy and Joe from FCC but the two youngsters had not wasted any time during the week. In addition to cramming for the exam they had made the rounds of the local ham stores and accumulated some ideas for their transmitters. FN had accordingly invited them to drop out and discuss what they had found, so early that afternoon they peddled out to his shack.

Judy opened the discussion; “Gramps, we saw quite a bit of some pretty nice gear down-town but those we think we’d like to have were way out of our price class. Joe starts working at the supermarket on Saturdays right after school opens and with what he’ll make there and what he has saved from his paper route, he figures he can go about $60 for a rig. Me, I’m not quite so flush; I don’t have any job prospects except occasional baby-sitting and I don’t have too much left in my piggy bank . . . about $20 is all.” Joe then chimed in with “Well, I’m luckier than Judy as I already had a receiver and didn’t have to buy one; what I saved there can go on the transmitter. I saw a couple of jobs I’d like to have but they’re a bit complicated for me. Jim Turner has a Viking Ranger for $65.00 but it’s priced that low because the modulation section is burned out. Larry took a look at it with me and said, from the looks of it quite a bit of work would be necessary and I’d have to buy a new modulation transformer and maybe both tubes. I’d like to have phone after I get my General ticket but Larry advised against tackling the repairs on the Ranger; what you think?”

“I think Larry is right, Joe. If the modulation section is gone it’s very possible that you’ll find more trouble in the rf portion. Generally, when the major portion of a transmitter goes out, it carries other things along with it and you may bite off quite a frustrating job if you go for that one.
A Ranger is a swell little job when it’s operating normally but if it has been abused, it isn’t exactly child’s play to restore it; I believe I’d forget it if I were you. What was the other one you saw Joe? “Well, it was a military surplus job . . . a TCS with an AC power supply and it had been modified and fixed up so it would handle 20, 40 and 80 OK . . . no 15 though. Jim was asking $45 for it which Larry says is a good price but he wasn’t too keen about it. The modifications weren’t too well done and the power supply was a home-brew job and kinda sloppy although Jim said the set-up worked very well; he tried it out before he took it in on a trade. I might be getting a bag of lemons though if I bought it off the shelf”.

“Neither the Ranger nor the TCS sound like very good bets to me Joe,” FN replied, “I think you can do better than that. What about a new kit job? You’ve had enough electronic building in school so that you shouldn’t run into any great amount of trouble putting one together and then you’d have something modern and new so you shouldn’t experience any grief there. Did you look over the kit catalogs?” “Yes, FN, I did” Joe returned, but I just kinda thumbed through ‘em . . . didn’t really come up with anything; I thought I’d see what you thought about the Ranger or the TCS first”. “All right, Joe; suppose you take a good look at what Heath, Knight, Eico and others have to offer. Read the dope thoroughly on each one and drop back in a few days and we’ll talk about it. Now Judy, $20 isn’t going to get you much of a transmitter although if you want to, you can get a time payment deal on something pretty good.” “No, Gramps, my little income is too unstable to sign up for something maybe I couldn’t pay for. I don’t think Dad would want me to either; he’d have to guarantee it you know at my age” she laughed. “Joe and I are going to the club with Larry tonight though and they’re going to have an auction; maybe something will turn up there for both of us . . . let’s wait and see Joe, OK?” “Sure” said Joe, “another day or two won’t hurt us and I’d rather get something I want than take a chance”. “Good idea kids” FN put in, “sometimes these club auctions offer some pretty fair pieces of gear . . . it’s worth a try”. “OK Gramps, we’ll take in the auction and I’ll let you know tomorrow how we made out. Larry said he’d pass on anything that looked good before we went for it” and with those parting words, Judy mounted her bike and led off with Joe following on his Honda.

The following day Judy’s family made the trek out to FN’s place where they were joining the older folks for Sunday dinner. Judy immediately cornered FN and said somewhat dubiously but with obvious excitement, “Do you know Gramps, there was only one transmitter offered at the auction and it was a six and two meter transceiver; nice looking job but it was nothing for Joe and me to start our novice career with; it went for $85 to the highest bidder which was out of our class anyway. “But” and Judy glowed but still looked a bit dubious, “one of the hams at the club told me that he just got the latest “Blue Book” listing of re-conditioned equipment from World Radio Labs and as there was nothing that he wanted this time, he gave it to me as it had several nice little transmitters on it. I brought it along Gramps; there’s one that sounds pretty good to me but it’s $35. Dad said though that if you approved it, he would give me the other $15 I’d need, for a birthday present . . . I’ll be 17 Wednesday you know!” “Let’s have a look Judy; maybe you’ve hit a jack-pot; WRL generally have a pretty good assortment and you can’t go wrong dealing with them . . . they’re good people. Ah, there’s seven transmitters on here; four of those you could use . . . the others’ are kinda in the money; which one were you thinking of?”. I kinda like that little Viking Adventurer; Larry had one once and said it’s a dandy little rig and an FB novice transmitter; has all of the bands and is crystal controlled . . . runs about 50 watts. Larry gave me a catalog sheet on it and I read it over . . . here it is . . . what do you think of it?” “Judy, maybe you have hit a jackpot here. As I remember, those little jobs cost about $65 or $70 as an unassembled kit and WRL is offering it completely wired, reconditioned and tested for $35. Not bad . . . not bad at all. Let me read this description sheet to refresh my memory; I knew these little rigs once but some of the details escape me now. Uh, huh, crystal control for your novice start and when you get to be a General you can build or buy a VFO to plug into it; fine. Also, if you want to take a crack at radiophone, a simple little modulator is not hard to build for a rig of this power. The circuit is conventional, the keying is clean and it has band switching . . . no.
plug-in coils to monkey with. Here's something too that I bet you overlooked on WRL's list; your Dad won't have to put up as much dough as he thinks ... you get a 10% discount if you don't offer a trade-in to partly pay for it; costs you only $31.50 that way! "Gee Gramps, I did miss that ... it sounds better yet ... what do you say?" FN took a couple of deep drags on his pipe, removed it from his mouth and said, "OK Judy; I'll give you a green light on that one; don't see how you can go wrong. I'd move fast though for someone may snap it up if you delay. If WRL pronounces it OK, that's good enough for me and they're not very far from here ... just over in Iowa ... so your parcel post cost won't be very great. Let's talk to your Dad now ".

Bubbling over with excitement, Judy shouted to her Father, "Wait up Dad; we've got something to talk to you about". Tom Mansfield, who was examining a new colt in the corral, turned and smiled as he saw Judy's eager approach. "I know," he said, "and I'll bet it'll cost me money". "Remember Dad, you said you'd pay off what I needed if FN said I should get that transmitter. Well he did and it's not going to cost you so much either; we get 10% off as long as we don't have anything to trade in on it". Laughingly Tom turned to FN and

The next little re-conditioned transmitter which Judy chose for her initial station.

said, "I knew you'd scheme between the two of you to take me to the cleaners but I'm a man o' my word you know. You think it's OK for her to buy this little transmitter then, eh FN?" "Yes, Tom", his Dad replied, "it's a good little rig made by a well-known and reliable manufacturer and offered by an equally reliable mail order firm. It's really a good buy and I'd say go for it." "OK" replied Tom, "we'll make out an order tonight Judy and I'll mail it in town first thing in the morning." With stars in her eyes Judy exclaimed, "Well, that takes care of me; I beat Joe to it anyway ... wonder what he'll come up with".

The morning mail brought Judy's FCC examination papers to FN and he phoned to let her know that he had received them. Naturally anxious to get her license as soon as possible Judy asked, "Gramps, would it be OK if I peddled over this afternoon and you gave me the exam?". FN chuckled, realizing her eagerness but replied, "I'm sorry Judy but I've got a man coming out to figure an irrigation deal for me this afternoon. I'll be free in the morning though and you'll be fresher; why don't you come out then?" "OK Gramps, I'll be there at 9 o'clock ... OK?". FN assured her that it was and then asked, "Do you know if Larry got Joe's papers this morning too?" "Oh yes" replied Judy, "I nearly forgot; Joe phoned and said Larry called him and said he had his papers now but he is going to examine Joe right at home this evening; Larry works weekdays you know until college starts". "Fine" said FN, "we'll each examine our own candidates separately then; you be out here in the morning and I'll put you through the hurdles." "OK Gramps, bye-bye and '73"
SALE

MODEL 400 AND 501
TV CAMERAS

From $125.00

Each month we have a limited quantity of used TV cameras which we make available to hams at greatly reduced prices. Some cameras were used as demonstrators by our salesmen; others like our Model 400 were traded in for our 501. A few are back from being rented out on special temporary surveillance jobs. Some were modified slightly to fit the particular job and may have extra holes or vary slightly in appearance from the photos. All have been checked out and are guaranteed for 90 days. Complete with vidicon and lens.

Model 400 sale price $125.00 FOB Hollis
Model 501 sale price $160.00 FOB Hollis

These used cameras are for sale to radio amateurs only. Include call letters with your order.

DON'T DELAY. ONLY A FEW ARE AVAILABLE EACH MONTH.

For specifications on the 501 see our other ad elsewhere in this issue. For specifications on the 400 see 1965 issues of 73.

VANGUARD LABS
196-23 Jamaica Ave.
Hollis, N.Y. 11423

and Judy hung up.

When she arrived next morning, FN told her that Joe had called and said that Larry had examined him the previous evening. Joe hadn't found it too difficult and Larry told him that while he could not give him an official opinion it appeared to him that Joe had made the required percentage nicely and probably with some to spare; the real decision would come from FCC of course. Joe had also discussed kits with FN and seemed to have more or less settled on one and would be out the next day to talk with him about it.

FN, complying with the instructions on the examination paper envelope, opened it and passed the contents to Judy, asking her first to read the envelope instructions which were directed to the applicant and to follow them to the letter. After doing so, Judy carefully read over the questions, pondering a few of them with furrowed brow and then carefully marked off what she considered the correct answer on the formal answer sheet supplied. She had completed all of the answers in little more than half an hour while FN read the morning paper and smoked his faithful briar. Being a thorough-going youngster, Judy carefully went over all of her answers, pausing at two points to do a bit of deep thinking and then carefully and completely erasing two answers and substituting new marks. "There Cramps," she finally announced, "that's it; I think I've got most of them correct, at least according to the way I understand it; what now?" "That's all of it girl; the rest is up to me and the FCC. I have to sign the statement on the back, stick the whole business in the envelope you brought with you and drop it into the post-office when I go down for the mail this evening. From then on it's waiting game for you. You'll either get a notice of failure from FCC or a brand-spankin' new license and a set of call letters. Don't be in a dither though until you get word; may be in two weeks, maybe three, possibly six or eight. The FCC is efficient but remember they have lots of other divisions besides amateur and they are far from overstaffed. It is anybody's guess when you'll get the word. Don't try to rush 'em by sending an inquiry; you'll more than likely delay rather than help, whatever action they take. Just be patient; FCC has just recently mechanized their license processing which should speed up the
issues but you’ll not be a licensed operator until you get that all-important little card in the mail. Meanwhile, you’re waiting for your transmitter to arrive too so why don’t you just go play with your dolls or make mud pies or whatever you girls do to pass time!” “Oh Gramps, “dolls . . . mud-pies . . . what you think . . . I’m still five years old?” she laughed. “Don’t worry, between Dad and Mom they’ll dream up enough chores around home to keep me occupied. What do you think I did with the exam though?” “Well Judy,” FN replied, “I’ll give it the once-over but just as Larry told Joe, there can be nothing official about what I say . . . all I can do is express a personal opinion; the FCC will give you the answer straight across the board; just a minute now”. FN then carefully ran his eyes down the question sheet mentally checking each answer as he went. In a few minutes he said, “I’m going to say that I’m pretty sure you’ll make it. There were a couple of places where I think you could have done a bit better but to me it appears that you have more than an adequate number of correct answers to make the grade. We’ll just seal it up now so I can mail it this evening and wash our hands of the whole biz till the magic word arrives”. Judy was already atingle with hopeful anticipation as she mounted her bike and peddled swiftly homeward.

The next morning Joe appeared at FN’s place ready to discuss his thoughts on a transmitter. He lost no time in announcing, “FN, I think I’ve found it. The more I studied
CAMP ALBERT BUTLER INVITES
HAM RADIO ENTHUSIASTS OF ALL AGES
TO TRY FOR YOUR
GENERAL CLASS TICKET
THIS SUMMER! OUR 8th SEASON
NOVICES, TECHNICIANS AND C.B.'ers
ESPECIALLY TAKE NOTE

This co-ed Amateur Radio Camp, Y.M.C.A. owned and operated, can accommodate 60 campers. There is no age limit. We have had campers from 7 through 74 years of age. It is very helpful if you can copy 5 wpm or have a Novice or Technician ticket, but it is not necessary. Time is divided between radio classes in code and theory and the usual camp activities, such as swimming, archery, rifle, hiking, etc. Gold privileges are included at the beautiful New River Country Club course.

Entire staff consists of licensed hams who are instructors in electrical engineering in some of our finest colleges and universities. Camp opens August 5 and closes August 19. Tuition of $175.00 includes all camp expenses: room, meals, notebooks, textbooks, and insurance. Send for our brochure.

C. L. Peters, K4DNJ
General Secretary
Gavin Roth Y.M.C.A., Elkin, North Carolina

Please send me the Booklet and Application Blank for the Camp Albert Butler Radio Session.

NAME
CALL
ADDRESS
CITY STATE ZIP

SPRING DEMO SPECIAL
SAVE SAVE SAVE

Drake TR4 ........ $149
Drake 84A ........ $230
Drake TX4 ........ $350
Swan 250 .......... $190
GalalJ 2000 ........ $400
Galaxy TR4 ........ $190
Galaxy 5000 ........ $385

See Bill Opp W4RMO or Dave Clarke W4RFP

EVANSVILLE AMATEUR RADIO SUPPLY
1306 E. Division St. (812) 422-4551
Evansville, Indiana 47717

MACO QUAD — FOR 10-15-20
Uses SHAKESPEARE FIBERGLAS WONDER-SHAFT? Optimum spacing is on all bands except 80. (1) RG-8/u quad complete—$99.95—WRITE FOR FREE BROCHURE

Maco Products
165 E. Cornell Ave. Spartanburg, Illinois
See our previous ad in April, May and June 1956 T/R.

RADIO TELETYPE EQUIPMENT

ALLTRONICS-HOWARD CO. Box 19, Boston, Mass 02101 Tel: 617-742-0048

the catalogs the more I kept coming back to the little Knight-Kit T-60. Lots of kits were pretty keen deals but the Knight-Kit seemed to hit me just about right. Larry says I can’t go wrong on that . . . what you think about it?” “Well son, Larry is right; the T-60 is a neat little package and not too difficult to put together and get on the air. You know of course that it also has modulation in it which involves a bit more work than just a straight CW kit assembly but not at all beyond you. You’ll probably want to work a bit of phone after you get your General license so you’re that much ahead. About all you’ll need to add when you get the higher grade ticket is a VFO and you can pick one up at a modest cost or you can build one if you’re so inclined. I’ll go along with you on the T-60 and I’m sure you’ll find it a dandy little rig. I’m sure you won’t have any trouble putting it together and wiring it but if you need any help, drag it out here and we’ll both get on it”. “Thanks FN,” replied Joe, “but you’ve already done a lot for us kids and Larry has offered to give me a hand if I need it so I think I’ll tackle it on my own and bring it out for you to look over and test when I’m through with it. The little thing is just within my budget so I’m going to order it from Allied tonight as long as you’ve OK’d it. It only has to come from Chicago so I should have it in a week or less”. “OK lad, go ahead and buy it; I’ve seen and tested quite a few of those little rigs and if you do a reasonably good job in putting it together and follow the book right to the dot, you’ll have yourself a nice piece of gear. Like I told Judy, I’d like both you kids to let me know two things; tell me when you get your transmitters and let me know when you hear from FCC. You probably will both be ready to go on the air by the time your license is in your hands. Larry told you I suppose, that it takes more than a few days to hear from FCC?” “Yeah, FN; waiting will be a bit rough but nothing we can do about it; we’ll let you know when word from FCC and our transmitters shows up”. So saying, Joe hopped his Honda and took off, stopping at Judy’s on his way home to compare examination reactions. As their session lasted all afternoon, obviously it was not entirely concerned with electronics!

W7OE

Next installment: Judy and Joe reach the top of the novice ladder!
In any major town there is certain to be a broadcast station specializing in spot news. Such stations have both phone patch and phone recording equipment. They welcome phoned-in tips and recorded news stories.

Here in Huntsville, Alabama, as a part of the Huntsville Amateur Radio Clubs program of public relations and public service, spot broadcasts giving hurricane news picked up by ham radio are broadcast regularly during the hurricane season. If other clubs decide to do this, here are some tips:

Care should be taken to confine broadcasts to specific hurricane information, omitting names and reports of damage, injuries and other such "scare" items. Such items are usually exaggerated and often completely false. Leave that type information to the news gathering agencies.

Following is the script of one of the broadcasts made here, which others may use as a guide:

(BACKGROUND MORSE CODE ON RECEIVER LOUD THEN FADE)

"This is Ross Sheldon, an amateur radio operator, relaying to radio station WAAY the latest hurricane Alma information as received by amateur radio from amateurs in the Caribbean area.

"The amateurs from Puerto Rico to the Canal Zone and along our gulf coast report that Hurricane Alma is now 230 miles SSW of Ft. Myers, moving at 16 miles per hour in a northerly direction. It should pass abreast of Ft. Myers, moving at 16 miles per hour in given as to when or where it will strike the central gulf coast.

"Winds at the center are 110 mph with gale force winds spreading out 250 miles in all directions.

"Shortwave listeners wishing to hear up-to-the-minute information on the hurricane should tune to the amateur radio hurricane net now in operation on 14,325 kHz where tape recorded weather bureau reports and other hurricane information is being relayed to isolated areas by amateur stations engaged in hurricane duty.

"This is amateur radio station K4HKD re-turning you to WAAY."

(BACKGROUND CODE UP AND OUT)

Note the favorable publicity given amateur radio by these broadcasts which are a public service to the people in the threatened area and to relatives and property owners outside the area.

To get information, tune to, but do NOT transmit on, the hurricane net frequencies. Relay stations will repeat weather bulletins several times, so you do NOT have to ask for fills. PLEASE DO NOT TRANSMIT!!

Note the stated time of the weather bulletin. If it is an hour old and the hurricane is traveling 20 mph, the center is obviously 20 miles farther along. Correct for this in your report. WARNING! Do NOT forecast the eventual route the hurricane will take. Hurricanes change direction quickly and unpredictably, hence even the weather bureau will not predict the complete path. Damage suits from those claiming the wrong forecast lulled them into a false sense of security are possible. Just stick to the facts and DON'T SPECULATE OR TRY TO INTERPRET.

Lay your groundwork in advance by finding out which stations will accept information by amateur radio. (Showing them this article might be a good idea.) Ask whether they just want the information, or wish to tape broadcasts by phone.

If they have a teletype which gives them the same information you hear the hams passing on the air they will be interested primarily in the "color" of the spot broadcast from a ham, plus whatever additional information you may pick up.

Type up a complete broadcast, leaving blanks to fill in with the changing data in pencil. (distance and direction from what city, wind velocity, direction and speed of travel, etc.). Read it aloud at least twice at newscast speed to see how it sounds and times before calling the station to record the tape. The shorter the tape, the better. I aim for 50 seconds with a minimum of 30 and a maximum of 90 seconds.

It's a public service— and darn good public relations. If you can swing it. . . . K4HKD
**THE R. & C. WILSON COMPANY**

**THE LM FREQUENCY METER... AN UNUSUAL VALUE.** Why pay more for the army's version (BC-221) when this will do the same thing, is smaller, and has modulation unit built in? The unit contains an accurate two-frequency oscillator which covers from 125 kHz to 20 MHz or more. The basic frequencies are 125-250 KHz and 2-4 MHz. Calibration charts may be made by simple interpolation according to instructions we will send you if you need them. Power supply requirements are broad: fil. 12 or 24 volts, B+ from 200 to 475 volts according to internal taps. Also contains two internal voltage regulator tubes. Works well on battery or AC power supplies. Let us pick you out a unit from the large stock... the sooner the order the more plusher the unit. Complete with universal calibration chart $34.50

**NOW... A SCOPE AND RECEIVER COUPLED FOR THE MOST EXACTING FREQUENCY CALIBRATIONS!** A receiver which is crystal controlled on 2.5, 5, 10, 15 and 20 MHz allows instant selection of the National Bureau of Standards station WWV on the optimum frequency. Output of the receiver is coupled to a scope which allows a local crystal standard to be set not just to "zero beat", which may be 20 Hz off, but to "zero phase" with the Bureau of Standards. In addition there are filters for the one-second ticks, 440 Hz standard, 600 Hz standard or voice announcements. Rack mounted, 5 inches tall, contains speaker, scope controls, receiver controls, Collins filter, AC power supply and more. Made by Specific Products, model WWVC... $148.95

**BUY AN ARC-1 AT THIS LOW PRICE.** 100-156 MHz, easily converted for ham use. Lots of space to build in power supply. Uses heterodyne exciter. A single crystal or VFO tunes both transmitter and receiver $25.00

**SAVE YOURSELF ABOUT $2000 ON A PRECISION FREQUENCY METER.** The Lavoie LA-6 meter is a rugged heterodyne-style unit that covers from 100 to 500 MHz with an accuracy of 0.001% or better. It contains a very accurate crystal in a high quality oven for a reference source. Dial read-out is a new style tape dial. Calibration tables and instructions are built in. Reference frequency is 4 MHz and interpolation frequency is 166 to 340 MHz; modulation frequency is 800 Hz; RF output is 50 microvolts or more; sensitivity in the receive mode is 10,000 microvolts; power required 115/230 volts @ 50 to 1000 Hz. Has full complement of 25 tubes: 6X4W, OA2, OB2, 6BN6, 6BA6, 5814, 12AT7, 6AU6, 6A6H, 6AQ5, and a CR-28/U crystal. NOW REDUCED TO OUR LOWEST PRICE EVER... $445.00

**AN ELECTRONIC FAVORITE: DUMONT 340 SCOPE.** Universally popular, requires 115 V, 60 Hz, 100 Watts. Tubes: 2-6BK7, 1-12AT7, 5-12AU7, 1-12AX7, 1-OA2, 1-1X2A, 1-5AQPI, 1-5Y3CT. Fairly recent design and manufacture (about 1955) and are not World War II surplus...

**UNIVERSALLY POPULAR TOP GRADE SCOPE!!** Tektronix 514D is the finest available for this price range! Contains well known features such as DC to 10 MHz operation; scope picture is delayed ¼ microsecond so that the start of a fast pulse may be viewed; well calibrated as only Tektronix scopes are; gain may be set so that true voltage measurements may be made; sweep speed is widely adjustable; has a flat faced tube, two inputs, internal calibrator and so on. It is said that this unit has the best triggering circuit of any Tektronix ever made. Fine for any type of service shop, industry, school or home lab...

**TOP QUALITY SHORTWAVE RECEIVER, UP TO DATE DESIGN ARR-36 covers high frequency bands, about 2 to 18 MHz, with frequency synthesizing oscillator control and digital tuning systems; uses 45 modern subminiature tubes which are easily replaceable. Weight about 100 lbs. We are selling at this low price because we don't have a manual on this piece of late equipment. Very few have ever been placed on the market, so order now while they last... $295.00

**RCA 9 kHz MECHANICAL FILTER, FREQUENCY 300 kHz, resonating capacity is internal; ripple less than .9 dB; 3 dB points 8 to 9 kHz; 50 dB points 17 KHz; coil resistance about 18 ohms. Perfect for use where 10 KHz channels are used such as CB band. Cuts out the interference from adjacent channels and crud from wide selectivity skirts... $5.95

Stapled, self-addressed envelope brings latest LIST. Our guarantee: If you are not satisfied, return the equipment within 10 days in its original condition, unmodified, and receive your full money back. Simply pay only the shipping charges. (What could be more fair than that?) We buy and sell quality surplus.
At the end of the last chapter I had just entered the Union of South Africa from Bechuaniland, one of the most desolate spots I have ever seen—or at least the portion I saw. At least the good roads I found in South Africa made the rattly old bus a lot easier to ride on and I could again open my mouth without fear of my upper plate falling out, and this was good!

We stopped at the little Customs House at the border and in we all went, me and those genuine Africans (I was the only European on the bus, and I did look sort of “out of place”). I guess I had even soaked up some of the usual “aroma” that the Africans have. I noticed that the Customs Officials did not get too close to me for some reason; I guess that “aroma” caused it. I guess he had me tagged as some crazy American, poor as a church mouse, riding that African bus (he had me tagged right too). He must have figured that it was not possible for someone like me to have anything of real value since the questions he asked went something like this: where were you born, what nationality and color were my mother and father, (maybe I had gotten a little suntan by this time making me look somewhat off-color to him), did I have any fire arms, any ammunition, any transistor radios, or political affiliations and with whom? He made a few tick marks on the customs forms and said sign here—this I did gladly. As there was no inspection of anything on the bus, the Africans and I piled back on and away we went for what they call Jo-burg (Johannesburg to you fellows).

I was met by ZS6IF, Lamberth; everything was loaded in his car, and away we went for his QTH. I headed to the shower to change my color and smell; I really needed that shower and when I emerged from it I felt like a changed man. Boy, it was wonderful! We went to Lamberth’s shack to the rear of his garage. Lamberth is a Dutchman who QSYed to ZS land some years ago; I think he said about 1955 or so. By the time I arrived he had changed 100% from being a Dutchman to a South African.

His was just about the cleanest, smoothest, slickest ham shack I have ever seen. Everything was home built and I mean beautifully built. Everything looked as if it was just finished, cleaned up and polished yesterday—it might have been too. Lamberth was one of those typically thorough Dutchmen in his job and you could see it was finished by a master craftsman right down to each screw being tightened up so the screw slots were even lined up; each solder connection was one of the wiped jobs, the kind most hams don’t have the time or inclination for anymore. His keyer, key lever, etc. were all home constructed. It made me glad to know that there are fellows in the ham world who still go to all the pain and strain to do such masterful work as Lamberth had done there.

We sat in his ham shack and had one of those fine business eye-ball QSO’s—the kind any of you fellows would like to have with some of the DX stations in distant parts of the world. He wanted to know about any number of W/K DXers he had heard and been working all these years and all about their rigs. He wanted to know the type of bottles, plate voltage, and current they used; also, all about the kinds of antennas the top boys were using in the States. Luckily, I think I personally knew every fellow he asked me about and I even knew something about many of their rigs. I could never be sure of the exact plate voltage or current they ran; most of them did use a kilowatt more or less when I visited them, but at that time nothing rare was coming through—you might say the going was not on the rough side at that moment
MESHNA SURPLUS BARGAINS

REFLEX CAMERA American made, takes 16 pics 127 film $1.50
GEIGER COUNTER complete w/meter. $50 volt transistor supply, less probe tube. #410 $4.00
ANALOG TIMER w/sync motor, DC motor, 8 hr. input to 10K output via gear train. Made by Veeder Root. #VR $1.50
POLICE-FIRE converters, Kit when wired makes your car radio into short wave receiver. High band 100-200 mc or low band 25-100 mc. Either kit $5.00 or both kits $9.00
FET transistors w/spec sheets. "N" channel junction FET $1.00 ea 6/$5.00
240 AMP SILICON DIODES 100 PIV $5.00
MICROAMP METER, brand new 100 microamps GE. #435 $1.50
METER w/thermocouple & sun cell demonstrates electricity from sun or heat. #435K $3.00
COMPUTER PC Salvage Boards 6/$1.00

IC INTEGRATED CIRCUITS TO-85 flat pack with special sheet $1.00 ea. 2 for 1.75
Ni-CAD battery cell 1.25 volt 6 amp hours $2.00
POLAROID FILTER, demonstrate polarizing theories 2 sheets 5x5 inch $1.00
BATTERY CHARGER kit, 3 amps & 12 volt output. #207 $4.00
FAIRCHILD CAMERA F-56, 20 inch focal length, In trunk w/film mask, cables, viewfinder, etc. Manual or electric. Package weighs 150 lbs., cost Gov't $2,500.00 each. $100.00

POWER SUPPLY KIT output 6-12-24 volts DC 6 amps from 115 volt house current. Used for powering surplus gear, plating. #340 12.00

GUN CAMERA, standard Air Force AN-6. Takes 50 ft. 16 mm. Xint. #447 $17.50
MEMORY FRAMES, wired core frames from computers, xint condition, w/specs $6.00
... 180 core $4.00 * 1,000 core $10.00
4096 core $12.50 * 8192 core $15.00
SNIPERSCOPE M-3, complete, operational, less battery. See in dark ... $225.00
LENS KIT, 12 Eastman Kodak cells with experimenter's sheet. #222 $1.00
PUSH BUTTON tuner assembly from Car Radios w/osc.-RF-Ant coils $2.00
REED SWITCHES, triggered by magnet or coil, used in burglar alarms $6/$1.00
SNOPERSCOPE TUBE see in dark, late model 6032 w/spec sheet $6.50

SUN CELL, make electricity from the sun, jumbo size w/leads & sheet $75
FIRE ALARM HEAT SENSOR, any setting from 50 to 300 F. Make your own alarm system for fire alert. ... 75¢ ea. 6/$3.00

EXPERIMENTERS RELAY PACKAGE, 4 relays with instructions using as RF noise gen., telephone ring-blank indicator, AC buzzer. #418 1.00

The above listings shows only a few of the hundreds of items available in our 64 page catalog crammed with fantastic & unusual electronic & optical equipment purchased from govt. and other sources. We have a most unusual & varied stock for the photo-bug, R & D lab, amateur radio, etc.

All material shipped FOB Lynn, Mass. (you pay shipping). Minimum order $5.00

JOHN MESHNA JR.
19 ALLERTON ST. LYNCH, MASS. 01904

29 VOLT 50 AMP DC REGULATED
Operate on 115 volt 60 cycle input with output of 29 volts DC 55 amps filtered and regulated. Solid state components with standard 19 inch rack panel mounting. Excellent condition. Shipping wgt. 175 lbs. $75.00

29 VOLTS DC 35 AMPS REGULATED
Same type power supply as above with lesser output of 35 amps. $65.00

1600 VOLTS DC 1.8 AMPS REGULATED
Solid state circuitry, 115 volt 60 cycle input, rack panel mounting, filtered with 0.5% ripple. Only a few of these on hand. Shipping wgt. 175 lbs. $75.00

5 VOLT FILAMENT XFMR 12 KV INSULATED
Unused government surplus. 120 volt 60 cycle input with 2 isolated secondaries. 5.1 volt at 43 amps and 5.1 volts at 14.5 amps. Use them back to back for a high powered line isolating transformer. $5.00
4X250 TUBE, used, OK $5.00
4X250 SOCKET w/chimney & plate ring $4.00

One only ... COLLINS KINEPLEX RCVR/XMTR TE-202F-5 & TE-202E-1, $200 takes all.
Don't have any info on this but it's racks of transistorized equipment & with power supplies. If you know what it is you can steal it for $200.00

IBM WIRED MEMORY FRAMES
Removed from high priced computers. Extnt condition.
4,000 core $12.50
8,000 core $15.00
16,384 core $35.00

LIGHT ACTIVATED SCR (LASC.R)
Function of an SCR triggered by light thru the glass window top of the TO-18 unit. Various applications in tape readers, character recognition, logic circuitry, relay replacement, night lighter brain. Offered at a fraction of list price ... only small quantity available.

25 PIV $.75 200 PIV $2.30
50 1.00 300 2.70
75 1.35 400 3.20
100 1.60 500 4.00
150 2.00 Under 25 V .50

New winter catalog hot-off-the-press. We keep no mailing lists. Send 25¢ for the best 80 page catalog we have ever printed. More bargains than ever before.

73 MAGAZINE
—so just one kilowatt. You can’t be too sure of what might happen to the voltage and currents later on!

Lamberth and I sat there and yakked away, drinking some wonderful Dutch coffee his wife brought in to us every now and then. Lamberth still had some of that Dutch accent and his wife’s accent was very strong. His children spoke perfect English and I think all of them spoke the native language they call Afrikans, which is a combination (I think) of Dutch, English, Flemish and maybe even a few other European tongues mixed with some native South African dialects. They say it’s a very difficult language to learn. I don’t know because I don’t think I ever learned more than two or three words of this complicated, tongue-twisting way to speak.

The next morning we went out in his back yard and looked over his beam—I think it was a quad. He showed me the moon bounce dish he was constructing—it was a real beauty, absolutely perfectly built. I hear now that Lamberth’s interest is moon-bounce or tracking satellites and other UHF activity; since I have not been hearing him on the bands, I suppose this may be true.

Lamberth and his wife were very FB hosts to me. Lamberth drove me around Jo-burg quite a bit, showing me the various sights there. One of the oddest things to be seen are those huge mountains of earth in and around Jo-burg. We stopped beside one of them and I got out of the car to look at it closely. It seemed as if it was almost as hard as cement—not a blade of grass was seen growing on these hills. I asked Lamberth why this was and he told me the chemical process they used to extract the gold made it impossible for anything to grow.

I talked to a ZS station a few years after my visit there and he told me that some chemist had found that it was now possible for grass to be grown on this rock by some kind of treatment to the soil. I think he also said that a special grass seed was used to seed the tops of some of these mounds. He told me that someone had built a drive-in theatre on top of one of them, so I guess they won’t be absolutely useless from now on.

Lamberth drove me out to spend the night with Brian, ZS6ANE (America North East as he calls it). He lived all way across town from Lamberth. Brian is a young married chap with one little girl who was about 3 years old. He is a very likeable fellow with a wonderful wife. We went to his hamshack and sat up quite late having a good eyeball QSO; there were even Cokes in the Fridge, which made the stay with them that much better. The next few days were spent visiting a number of ZS6 fellows and seeing their hamshacks. All were very well equipped and had good antennas; they all seemed to be good operators.

Oh yes, Lamberth asked me if I had declared my gear to Customs when I had entered the country; I told him I had not. That’s when he said that it was going to be very difficult trying to get it out of the country when I was ready to depart. I told him I had never had any trouble getting things out—getting them in yes, but not getting them out. He said, “Well, you have never tried getting things out of South Africa yet.” I did find a solution to this problem later on but that’s another story and will be dealt with in full at the point where it enters the story. It worked out quite well in the end.

I really got to see some of the country around Johannesburg, spending about 5 or 6 days there, sort of biding my time for the departure date of the ship to Tristan, Gough and Bouvet Island. I found I had a few more days to spend between Jo-burg and Capetown so I got in touch with Sid, ZS4MC, in Kroonstaid (about one-third the distance from Jo-burg to Capetown). I gave him a DX phone call and made arrangements for him to meet me when I arrived there via the train from Jo-burg.

The train arrived in Kroonstaid about 1 AM and there was Sid at the railway station in his little car—with his little goatee and all. When he arrived at his home his very sweet wife was still up—she even had a big supper on the table for me. I could see immediately that my stay with them was going to be one of the stops where I could pull off my shoes, roll up my pants, and dive into the Fridge when I wanted to.

They told me to make myself at home while there and that’s exactly what I did, every minute of my stay. I was even allowed to operate from his station—up to then I had not done very much operating from ZS land. I had a number of FB rag chews with Gus Watchers, as some of them called themselves. I told them how things were progressing towards my forthcoming trip to the islands. I always believe in keeping the
fellows back home well informed so they can be on the air when you arrive at a rare country.

I knew all about some of the fellows taking days off from their work to contact me. I knew many of them would want to know which day they should play sick. I had even heard of one of them flying back to his home in Ohio from his Texas vacation spot just to work a new one. There is, I am told, a doctor in NYC who will leave his patient on the examination table when one of the fellows gave him the land-line buzz that I was on the air. Bill Eitel of Eimac told me that so many of his crew got sick on the first day I landed at some spot and got going, that their production was very drastically cut! Of course, I think he was pulling my leg.

I can’t see any real reason why, under normal conditions, a fellow can’t tell you where and when he will be at such and such a spot, provided he knows when it will be. You go on a DXpedition to work as many fellows as possible and this is one way to make sure you get plenty of callers when you get going from a “gud one”. Sometimes I know it’s not a good policy to announce too far in advance where you are planning on going; there is the possibility of some eager beaver beating you there or maybe getting telegrams or air mail letters to London to stop you. Under these circumstances it’s always best to play it cool and keep your mouth shut. I learned this the hard way on the Chagos trip. This might explain why Don Miller stays real quiet most of the time as to where he is going or planning on going.

Sid had a very nice peach orchard right in his back yard, the peaches were about one to two months from being fully ripe, and that’s when I told him and his wife I most certainly would stop by and see them on my return from the islands. I told them about my being from the part of the USA where peaches and watermelons grew the best and how I loved to wrap my lips around peaches and whipped cream (um umm). He said he would hold a few treefuls just for me to eat upon my return.

I sure hated to leave Kroonstad with all that fine home cooking and the real friendship that both of them extended to me, but I kept looking at the calendar and saw “D” day for the ships departure from Capetown creeping up on me.
Late one evening I boarded the train for Capetown; Sid and his wife and daughter saw me off, and away I was for Capetown. A really smooth ride all the way down. Those South African trains are very plush and smooth riding and the food in the dining cars is very good and reasonably priced. The cost of the fare was reasonable too.

Arriving in the vicinity of Capetown at sunrise the next morning I could see that it was quite hilly around the country and city.

Marge and Jack—ZS1RM and ZS1OU—met me at the railway station. They had the mayor of the city along with them, and after a very fine welcome, they insisted we stop at a cold drink bar for a Coke (it took practically no convincing, I must say). As usual when we sat down and ordered the drinks, (we all ordered Cokes) I told the waitress to be sure to bring mine in the bottle, please. She said OK, and as is usual, she brought it to me in a glass.

I refused the drink and told her I wanted it in the bottle; with a half frown she then brought me another, this time in the bottle. The mayor said, “There is no difference,” and that’s when I said, “Oh, yes there is, I am a connoisseur of Cokes, I know when they are best.” He and Jack and Marge had theirs in a glass, then they all ordered another Coke in the bottle. Right there in the drink bar they had a sip and smack test of Cokes—they would sip a little from their glass, then take a swig from the bottle; after a little of this testing all three decided that there is a difference. They all said it was much better directly from the bottle.

If I did nothing else in South Africa, I converted three people to drinking Cokes the right way—directly from the bottle! After this little episode the mayor departed, I guess for his office, and Jack, Marge and I departed for The Strand where they lived in an upstairs apartment overlooking the beach. The Strand of Capetown is a beach-side resort area, a sort of holiday spot, where everyone goes on the week ends to swim, fish, golf, etc. Marge works in a beauty parlor and Jack sells insurance. They are not in the wealthy class at all; they are regular down to earth kind of people and their’s is not a fancy apartment. They had held a bedroom especially reserved for me, and their Fridge was jammed full of Cokes, fresh figs, Cape grapes, cantelopes, watermelons, and other goodies.
WANTED
SALES ENGINEERS
EARN
$20,000 per year
Based on commission from sales and installation of just 3 Vanguard TV cameras per week!

Full or Part Time

Closed circuit TV is recognized as a definite necessity for many businesses to combat rising costs. Thousands of factories, office buildings, banks and schools will welcome your demonstration.

Using our list of applications as a guide you will be able to show how any establishment can use several cameras and how each one can save thousands of dollars through the resulting increase in efficiency and security.

If you are over 21, have a working knowledge of TV and are financially responsible, we need you as a sales engineer to demonstrate our Model 501 in your area. To receive your application and additional details, send us a resume of yourself and include a self-addressed, stamped envelope.

VANGUARD LABS
196-23 Jamaica Ave.
Hollis, N. Y. 11423

They took me into the radio shack (which is not unusual you know) and I was shown how to turn on the rig, turn the beam, and they said, “Gus, the rig’s yours as long as you are here with us. Make yourself right at home and sleep as late as you wish.” After a good many hours of eye-balling they departed for bed, leaving me in the shack. I immediately went on the air, getting on 14065, my DXpedition frequency; called a CW CQ and had quite a ball working the boys in the States, telling them that Tristan da Cunha and Gough and Bouvet were getting closer and closer all the time.

I stayed up until about 3 AM having myself quite a ball I must say. I dragged myself away from the pile-up that was still calling me and slept until 10 AM the next morning. When I got up, Marge and Jack had left a note on the rig, so I would be sure to see it I suppose, telling me to go right ahead and fix my own breakfast; they had to go to work. This was really making me feel right at home—they had turned the whole house over to me and they again said I could use the rig as much as I wanted to.

I had a very leisurely breakfast of coffee, cantelopes, even ate a big slice of watermelon—for breakfast. Man, this was like being back in South Carolina eating watermelon for breakfast. I did miss my grits and sausage and eggs and Peggy’s cooking though.

... W4BPD

VK7TR

VK7TR, Ray Conrad of Hobart, Tasmania, was completely burned out in the great fire which recently swept the South Australian Island. His home and all contents including all his radio gear, QSL’s and logs were completely destroyed. Ray and his XYL escaped in their car from the fire which descended on their home at 75 mph. If those to whom VK7TR owes QSL’s will send new cards to his old QTH or to VK7CK, he will attempt to QSL from memory. Ray and his XYL are leaving April 22 for an extended trip stateside via England. He expects to hit New England and Pennsylvania after August 20, then on west across the USA and back home. Don’t be surprised to hear his melodic accent from G3LSF, W1BCR and W3CES and others.
BLACKLITE KIT FOR ULTRA-VIOLET FLUORESCENCE

For qualitative work in infrared, or shop for mineral identification and display. The long-wave ultra-violet with additional colors that can be seen. The 4-watt or 8-watt lamp in a long range of from 350° to 3600 A. Lamps contain a high-emission phosphor in the above range. Lamps are of the blue-glass type for filtering out most visible light. KIT CONTAINS: Ultra-violet tube, brackets, ballast, starter, wire, plug, and wiring diagram. 1710 VAC operation, long-wave, 4-WATT KIT (5½ tube) $3.50 KIT, 8-WATT KIT (12 tube) $4.50 Ppd.

NT-8 WILLARD 6-VOLT STORAGE BATTERY

Rated 17 volt DC, br. Approx. dimensions: 3 1/8 x 2 1/2 x 2 1/8 in. Weight: 1 lb. 6 oz. (plastic case) Dry-charged $2.50

POTTER & BRUMFIELD RELAY 24 hr. $8.00

6,000 ohm 11/16" x 11/16" long. Approx. weight 1 lb. Hermetically sealed. Standard 7-pin miniature base. $2.00

MINOR SWITCH

16-pole, 200 amp with stopper coil and reset coil. Rated 6000 volts D.C. off-normal non-bridging wiper approp. dimensions: 3 1/2 x 3 1/4 x 7/8 in. Weight: 1 lb. $9.95

GENERAL ELECTRIC FULL WAVE BRIDGE GERMANIUM RECTIFIER

Idet 59/50-AP/11. Identification provided. Modular subassembly construction. All parts are identifed and flat 4 in. SRPI presentation. Test-scope sawtooth 25-20,000 Hz. Has all normal test-scope controls. As synchro scope and pulse analyzer, accuracy positive or negative pulses. Video delay circuit permits leading edge of pulse to be seen. Calibrated-dial horizontal shift measures pulse durations up to 100 milliseconds. Sine-wave-oscillator calibrator measures frequencies from 1 cycle per second to 6000 cps accurately within 5%. Built-in power supply requires 115, 600, 190 watts. 6000 volt power supply may be made to furnish plus 350 and 1500并 at 6.3 volts. In excellent condition, with all 19 tubes, schematic with parts values, parts location pictures, special instructions, theory explanation, and maintenance charts. Shipping weight 6 lbs. Used, good. Price $19.50 each.

RF 50A COAX CABLE

52 OHM, 100 ft. lengths $3.95

NICKEL CADMIUM BATTERY

Rechargeable thousands of times. Altura stores battery stores charge, and is recharged by being placed in a charger. Will hold a charge for long periods of time. Rechargeable charge rate up to 50 amperes. Still-proof, may be used in any position. Approx. 6-ampere-hour capacity. Dimensions: 2½ high; 2½ wide; 3½ thick. Approx. wt. 8 oz. Uses potassium hydroxide (30%) Electrolyte. $1.75

8-DAY AIRCRAFT CLOCK

24-hr. dial and civil date indicator. Center sweep second hand, luminous figures and hands on black face. Case is made of black plastic 3½" mounting. Manufactured by Waltham Watch Co. $29.95 Postpaid

POWER TRANSFORMER

Output: 12, 24, 36 volts. 2500 volts input. 60 cycles. single-phase. Will handle 2½ amps. Electro-cast hermetically sealed. $2.95

DIRECT-READING MAGNETIC TACHOMETER

Full-floating card compensating magneto, and dial guard. Available in 6- or 12-volt bulb. Dimensions: 3½ x 3½ x 1/4 in. $39.95 postpaid.

TCS DYNAMOTORS

12 volt D.C. input, 9.9 amps; output 416 volt D.C. at 50 ma new $7.95

12 volt D.C. input, 2.8 amps; output 225 volt D.C. at 100 ma used $2.95 each.

RADIO COMPASS RECEIVER

BS/ARKT Frequency 100 to 1700 KC $17.95

RIA/ARKT Price $27.20

Loop LC11 LM Price $12.50

Control Box 63/ARKT Price $12.50

Indicator 181A Price $4.85

BC88 FM RECEIVER. 27-30 MC continuous tuning and 27-30 MC center push-button tuning. Will handle 12 volt D.C. input and 300 milliamperes at 12 volt D.C. $39.95

DMS4 dynamotor for 12 volt D.C. operation of the above receiver $3.95

R/C SERVO MOTOR DRIVE ACTUATOR

Controls 2-6 volt permanent magnet motors. Current consumption approx. 100 ma., 2.5 volt D.C. DL100 Relays. Many gears. Unit completely enclosed in aluminum housing. $4.00

ARC RADIO EQUIPMENT

ARK receiver #113B: VHF, 109-135 mc $19.95

ARK receiver. H10A/ H10B 209-1800 KC $22.00

ARK transmitter 2096A 28 volt D.C. 160-190 mc $19.95

10A 300 volt D.C. $24.95

D-10A 4V/DCV dynamotor used w/shore receiver $24.95

Controls: C-18, C-22, C-37 and G48. $37.50

CV-260/ARK-50A Controller $29.50

E-18/ARK-30 Back $7.50

A-13A Antenna $5.90

TS-102/AP RANGE CALIBRATOR

This crystal controlled pulse generator produces a square-topped, 50-volt synchronizing pulse of 8 microseconds, at a p.f. of 450, 800, 1600 c.p.s. and a triangular magnet pulse of 0.1 microseconds duration at a p.f. corresponding to a pulse-echo distance of 1500 ft. The plate between the marker and sync pulses is continuously variable from 180 to +180. Price $120.00 each

TYPE AN/ARN-6 RADIO COMPASS

Receiver R1/61/ARN-6, 000-1750 Mc. In 4 bands. Excellent condition. Price $34.50

Loop AS2-H. Excellent Condition. Price $27.50

Indicator ID91/B/ARN-6 Excellent Condition. Price $9.95

Mounds MT-0/73 or MT-0/74 Excellent Condition. Price Ea. $10.00

Control Box C-14/A. Price $20.00

MANUAL

Handbook of operating instructions, general installation adjustment plans, diagram and schematics. Price $3.50

250-WATT SOLDERING IRON


12 FT. TELEPHONE STRETCH CORD

Copper wire w/JK-51 and 14 ft. $1.49 ea.

RT-82/AXP-6 TRANSEIVER

Easy to connect to 1215 Mc Ham Station. Good Condition. Less Tubes $9.95

U. S. NAVY 145-DAY TIMER

This unit was used by the Navy to activate and deactivate mines at sea. Has a starting rate of 0 to 145 days.


POWERSTAT TYPE 20

Input 120 volts, 50/60 cycle output range 0-140 volts AC, 3 amperes. 7.95

POWERSTAT TYPE 116

Input 120 volts, 50/60 cycle output range 0-140 volts AC, 7.5 amperes. $16.50 each

COAX CABLE RG59/U $0.65 per foot roll complete with coax fittting and 100% copper wire. Price $.24 ea.

All prices FOB Pasadena unless otherwise noted. No COD's.

C & H SALES CO.

2176 E. Colorado St., Pasadena, Calif.

Murray 1-7393

JUNE 1967
MORE TALK POWER
WITHOUT DISTORTION

SPEECH COMPRESSOR CSP-11
A New and novel design provides instantaneous peak limiting with no distortion. The unit installs in microphone leads and provides an effective average power gain of 10 dB relative to the peak output. Its usefulness applies to all forms of voice transmissions including and especially single sideband.
Price: $111.00 Postpaid in U.S.A.
(Add 3% Tax in Mass.)
Write For Free Brochure
COMDEL, INC.
218 Bay Rd., Hamilton, Mass. 01982

10 - 15 - 20 METER MONOBEAMS
FOR MORE DX PUNCH

Cush Craft Monobeams combine superior electrical and mechanical features with the best quality materials and workmanship. They will provide reliable day to day amateur communications and that extra DX punch, when needed, for contest work or emergency communications.

A28-3 10 Meter, 3 Element, Boom 10' $31.95
A28-4 10 Meter, 4 Element, Boom 18' 42.95
A21-3 15 Meter, 3 Element, Boom 12' 39.95
A21-4 15 Meter, 4 Element, Boom 22' 59.95
A14-2 20 Meter, 2 Element, Boom 10' 49.95
A14-3 20 Meter, 3 Element, Boom 20' 77.50

SEE YOUR DEALER OR WRITE FOR CATALOG.

Letters

Dear 73,

Your March issue of 73 Magazine with the 73 transistor circuits is by far the best issue I've ever received. I work the Air Force MARC CW Transceiver Network and used the audio passband filter described in Fig. 14 between the headsets and the receiver. It sure does the trick at 7332 kHz which is close to the CHU lime signals. It completely eliminated CHU and brings CW signals up no end—hence I am figuring on setting the thing between the first audio and second detector of my receiver. This way I won't have to wear a set of "cans" all the time.

With this filter in my receiver I am able to give all the fellows a QSA5 QRK5 signal report, but when I take it out there is so much crud on the darned frequency that it knocks 'em down to 2/2 for sure.

Charlie Holstrom WA0GYK
Fairbury, Nebraska

Dear 73:

I am particularly interested in transistors and while all those are good, this one is the goodest—uh huh. So send 3 copies of March please. I have some kids I'm getting started in transistors too.

Walt Bordin W8ZCV
Waynesville, Ohio

Unhappy

Dear 73:

I have just one fault to find; the magazine gets here very late . . . very fine on everything else. I think you are putting out a fine magazine and I will support it all I can.

Glen Wilson WA6ORZ
San Pablo, California

This issue was mailed on May 20th. The July issue will be mailed on the 10th of June. After that all magazines will be mailed by the 10th of the preceding month.

Kudos

Dear 73:

I just had to sit down and write you a letter. What about? Many things—first of all, about the quality of 73's articles. Superb! In the past eleven years of hamming I know of no magazine that equals yours.

Scanning a typical issue of 73, the transistor articles immediately catch my attention—I usually spend at least an hour on these gems—next a quick trip to the back, the best place to begin reading any mag, plus I always find something interesting in New Products and Books.

Whenever Jim Fisk describes some phase of hamming through his high quality booklets—he receives my vote every time! More of the same Jim! The technicians up here found the Coastal Handbook invaluable, but myself—being a solid state nut—devoured "73 Useful Transistor Circuits".

Roy Schoonover 3CASG/VES
Winnipeg, Manitoba, Canada

Dear 73:

More than 50 years ago I purchased my first ham radio equipment. The receiver was slider tuned with an electrolytic detector using a Wallaston spring wire contacting an acid solution in a carbon cup. The transmitter used a spark gap.

Today I'm still enthused as I read your selected articles on new equipment and how to build one's own.

Phil Shigley WB6JSJ
Redding, California

(contin'd from page 4)
Dear 73:

For the past several years now, I have enjoyed receiving my copy of "73 Magazine". I look forward to seeing many new and different approaches to construction articles and feel that this magazine keeps me more than adequately supplied.

Incidentally, I also write a weekly column for one of the local newspapers and find this very rewarding with respect to the interest generated in 'the hobby'.

Hoping to build up the Transistorized Digital Identification Generator and have already written to Barry Todd regarding the diode matrix. Last summer I got "hooked" on the integrated circuit keyer, and can only say that it works like a champ.

RTTY is my chief interest these days, would sure like to see more articles in this vein. Possibly I can add my two cents worth at some future date.

James H. Sayer, VP9BY
Smiths Parish, Bermuda

Dear 73:

I saw a March 1967 issue of 73 magazine last night at our ham meeting and it sure did impress me. All those real interesting transistor circuits. I don't see how you can put so much good information in one publication.

I have been taking the ARRL QST, but my subscription is up and I am going to take 73.

You may be interested to know that one of our ham friends who is well educated in electronics made the statement last night at the ham meeting, "I have been taking QST magazine, and I am so far behind I was unable to read 73." That is how much he has been missing my not subscribing to your magazine earlier.

Please start my subscription with the March 1967 issue—I sure do want that book.

Levy Belcher K4TSX
Glasgow, Kentucky

Dear 73:

Congratulations on the February 73 which arrived here today. I have been a subscriber of 73 from issue number one and have written publicly about it in our Break-In—you have now hit the jackpot with the new binding. Of the material inside, there is always much of interest for me so I continue to rate the magazine number one...

Jock White ZL2GX
Contest and Awards Manager
New Zealand Association of Radio Transmitters

Dear 73:

I've been wanting to tell you how much I, a non-ham, enjoy much of 73. I'm not qualified to comment on the technical articles (my husband says at least once a month, "73 sure has hit it over the other two"), but I certainly find the overall magazine much more appealing than CQ or QST. I've taken a "beginning beginner's" course in electronics and absorbed quite a bit by osmosis (what wife could avoid that when her husband is afflicted with the disease of ham radio?) and occasionally I even find a technical or general information article I can muddle through.

I don't want to ramble on, so I'll just say that in this household 73 is considered tops.

Mrs. Heather Jorgensen
XYL of KIDCK

73 Magazine
CUMULATIVE INDEX
October 1960-December 1966
Now available for 25¢
73 Magazine
Peterborough, N.H. 03458
**GET IT from GOODHEART!**

EVERYTHING UNCONDITIONALLY GUARANTEED!

(C) means with Cert. of Calibr. traceable to N.B.S.

**If item isn't already cert.,
we can get it done at
5% off with 10% down.**

**SELL IT to GOODHEART!**

WE PAY HIGHEST AND FASTEST!

Collins Radio "ZIFOR" Test Set brand new $475.99

A.R.C. H-14, UPM-68, Testam Testers, I.L. &

Omnit. etc., $100.00 - $500.00-

P.U.R.

Amplifiers, DC thru Microwave

Too many to list here; send for list or ask for needs.

Jackston #50 Oscillator 20-300,000 $40.95

Hewl-Pack #356A $295.00

Hewl-Pack #356R Distortion Analyzer like new $320.00

Hewl-Pack #200A Harmonic WaVe Analyser (A) $190.00

Gen Radio #376A WaVe Analyzer (V) $175.00 value $200.00

Gen Radio #786A Audio Wattmeter 2 mw-100w $190.50

Bridges & Other Precision EauP

Boleton #10A 50-Meter 50 to 75 $405.00

Beaton #100A 50-Meter 20 to 200 $355.00

Dodeca Boxes for H, C & L. Too many to list here—P.U.R.

Galoithmeters, Pointed. Digital

Gen Radio #521A Twin-T Imp Bridge 0-400 mc $77.00

Gen Radio #240A Gain & Sens. Gain 2-90-900 $195.00

Hewl-Pack #2450 Distortion Analyzer $295.00

Hewl-Pack #2455 Blocking Oscillator $325.00

Hewl-Pack #2458 Harmonic WaVe Analyser $195.00

Hewl-Pack #2459 Audio Wattmeter (V) $175.00

Hewl-Pack #2461 Audio Wattmeter 2 mw-100w $190.50

SWL NEWS DURHAM, N. C. Monthly use W6E, BAI/BET-T

rct. 500 kc-6 Mc coax, crystal tuning 3 RF & 2 TF

Separate mixer with plug-in, if desired. Select-choose

Has B-Meter & test Couples $119.00

SYNCHRO/KO/MO, AP. RP Gen 30mc/CW/MCW, Pitch,

ANL New or like new, aligned, grd, (needs 200v. 600v. $149.00

Pwr Sply w/coax. plugin...$30.00. If we add SSB, add... $29.00

R-29/ARC-5 Control Combiner 100-550 kc. Q-S. $795.00

Check $18.00

5-10 cc-1000 mc graph $17.95

DF-1 Superhet Lo-Freq Rcr $10.00 & 150-1500 kce New $89.95

4000 kc. 100-1500 $10.50 each $199.50

SP-400XJ for rack mate exc., $54.00

SP-444-APR for rack ex. exc., $49.00

S-4 & S-444-APR for CV-285 or TNN's, 38-400W, P.U.R.

Communc. Xitrs & Pwr Supplies

AN/FRC-6A 50-150 mc 500 mW 105 $149.00

TDX 232-440 mc AM 20 W P0, Mon 60 $85.00 w.P.U.R

Communi. Xitrs & Pwr Supplies

AN/FRC-6A 50-150 mc 500 mW 105 $149.00

TDX 232-440 mc AM 20 W P0, Mon 60 $85.00 w.P.U.R

TDX Pwr Sply finishes all H's for ALT-15. New $49.95

H.A.6-F2 supplies all voltages for R9R-G2. Checked...

1. $149.00

Counters

Hewl-Pack #3228 Universal (freq. & Period) 120 kc. $395.00

Burk. #27568 or CMC #256A universal, to 1 Mc...

North, Engla. like HP #2240, quite readable, 10 mc. $118.00

PRO-230 & 330 & 250 & 350 Dc (Sch)

H.P. #5499A Trans. Oct. extends 300 to 5000 mc (C) $175.00

Direction Finder

DU-I Loop w/preamplifier chassis 3.1 kc. unidirectional...

$26.95

Frequency Metors

LM-15-20 osc. 0.1% ckl. checked, grd, w/data... $57.00

L.M. 10-30 mc. 0.1% checked, grd, w/data... $57.00

PRD #204 100-1000 mc. better than .05%, $258.00

Leak Detector

Bekman Mod. 140 $1,100 Mass Spectrometer, Helium...

$1,000

Meggers

Hand-Crank & 120 r 60 $19.95 too many to list here—P.U.R.

Meter Calibrators, Precision Pwr Splys

Flink, Kistel, etc., DC, sq-wave, too many to list—P.U.R.

Power, Water, Temperature

Switching & Integrating, DC & AC, too many... P.U.R.

Meters, Phase, Multi-, Precision

Axtar #230A, 10,000 ohms, Geneva box, etc... $89.95

Weston #432 Wattmeter 1/8% 1 ph DC to 1 kg.

to 1550 W $148.50

Seng. HS 0.05% 1V 1500 W $138.95

Seng. RS 0.05% 1V 1500 W $138.50

Greishall 5% 10 at 400 $19.95

Hewl-Pack #2004 B, 0.5%, 400Y, $149.00

P.U.R.

This page shows only a small part of our Inventory, and our entire inventory keeps changing; so Catalogues are only a guide. Specific needs! WE ALSO BUY TELL US WHAT YOU HAVE!
The World's First 117V/12V All-Transistor Communications Receiver Is Available Now In 150 Radio Shack Stores Coast to Coast!

THE REALISTIC® DX-150

- Over 30 semiconductors — no tubes, no nuvistors — the DX-150 is 100% solid state!
- SSB/CW/AM reception, covering 535KC through 30MC in 4 slide-rule bands!
- Product detector for SSB/CW, plus fast and slow AVC; variable-pitch BFO!
- Illuminated electrical bandspread fully calibrated for the Amateur and CB bands!
- Cascade RF stage: ANL for RF and AF; zener-stabilized; OTL audio; illuminated "S" meter!
- Built-in monitor speaker plus front-panel jack for external (optional) matching speaker!

THERE'S A STORE NEAR YOU!

ARIZONA — Phoenix
ARKANSAS — Little Rock
CALIFORNIA — Anaheim, Bakersfield, Covina, Downey, Garden Grove, Inglewood, La Habra, Long Beach, Los Angeles, Mission Hills, Mountain View, Oakland, Pasadena, Pomona, Reseda, Sacramento, San Bruno, San Diego, San Francisco, Santa Ana, Santa Monica, Torrance, West Covina
COLORADO — Denver
CONNECTICUT — Hamden, Manchester, New Haven, New London, Orange, Stamford, West Hartford
FLORIDA — Jacksonville, Orlando
GEORGIA — Atlanta
ILLINOIS — Chicago
KANSAS — Wichita
LOUISIANA — New Orleans
MAINE — Portland
MARYLAND — Langley Park
MASSACHUSETTS — Boston, Braintree, Brockton, Brookline, Cambridge, Framingham, Lowell, Medford, Natick, Quincy, Saugus, Springfield, Walpole, West Springfield, Worcester
MICHIGAN — Detroit
MINNESOTA — Minneapolis, St. Paul
MISSOURI — Kansas City, St. Joseph, St. Louis
NEBRASKA — Omaha
NEW HAMPSHIRE — Manchester
NEW JERSEY — Pen nsauken
NEW MEXICO — Albuquerque
NEW YORK — Albany, Binghamton, Buffalo, New York, Schenectady, Syracuse
OHIO — Cincinnati, Cleveland
OKLAHOMA — Oklahoma City, Tulsa
OREGON — Portland
PENN SYLVANIA — Philadelphia, Pittsburgh
RHODE ISLAND — Providence
TEXAS — Abilene, Arlington, Austin, Brownsville, Corpus Christi, Dallas, Fort Worth, Houston, Lubbock, Midland, San Antonio, Sherman, Waco
UTAH — Salt Lake City
VIRGINIA — Arlington, Virginia Beach
WASHINGTON — Seattle

ONLY 119.95

New, big, exciting, professional — the Realistic DX-150 obsoletes tube receivers and warm up, banishes forever your dependence on house current to stay in operation. For example: the DX-150 will run 100 hours on 8 D-cells if current fails, or isn't available, or on field day. Additionally, it will operate from a car's cigarette lighter or any other mobile or base 12VDC source! Of course a 117VAC power supply is built in. DX-150 is a husky brute: 14 1/8 x 9 1/4 x 6 1/2", with a massive silver extruded front panel, solid metal knobs, grey metal cabinet, 14 pounds of quality.

A NEW STANDARD OF RECEIVER VALUE!

Priced Radio Shack's way (factory-to-you) the DX-150 saves you about $100 off traditional pricing methods. Yet it offers 11 front controls; dual power supply; 12V/4-diode bridge in 5 colors; continuous coverage from 535KC through 30MC; including 160 through 10 meters; separate detector circuits for AM (diode, and SSB/CW (4-diode bridge); sensitivity good to 0.5µV at 30MC. Nobody but nobody but 44-year-old Radio Shack could have created this unique product for $119.95. You better believe it!

REALISTIC DX-150 CUSTOM ACCESSORIES

Exact-match external Voice-Frequency speaker cuts out built-in monitor, includes lead and plug. 20-1500: $7.95 (4 lbs.)

12VDC portable pack with all cables, plugs, 8-long-life batteries; includes plug-to-plug and plug-to-lighter cord sets. 20-1501: Only $7.95 (4 lbs. w/batteries)

ORDER BY MAIL! IN PERSON! FREE FOLDER!

RADIO SHACK

East: 730 Commonwealth Ave., Boston, Mass. 02215
West: 1515 So. University Dr., Ft. Worth, Tex. 76107

Please rush me the item I've checked below:

I enclose $ — plus 50c for postage and handling:

☐ FREE 1968 Catalog
☐ FREE DX-150 Folder
☐ FREE DX-150 Folder

☐ Matching Speaker. 20-1500, $7.95
☐ 12 VDC Power Set. 20-1501, $7.95*

☐ Receiver. 20-150, $119.95*  * Plus Shipping Cost: 14 lbs., 4 lbs., 4 lbs.

Name (print) ____________________________
Street __________________________________
City ___________________ State ___________ Zip ________

© 1969 by Radio Shack.
HEATHKIT SB-301

The new Heathkit SB-301 Amateur Band Communications Receiver is an improved version of an already famous pacesetter, the SB-300. Some of the new features of the SB-301 are increased sensitivity, full RTTY provisions, 15 to 15.5 MHz coverage for WWV, built-in automatic noise limiter, and front panel switching of the optional six and two meter converters.

The SB-301 covers 80 through 10 meters with provisions for AM, CW, upper and lower sideband and RTTY. It has a crystal-controlled front-end which provides the same tuning rate on all bands. The pre-assembled and calibrated Linear Master Oscillator (LMO) features linear tuning and excellent stability. The sensitivity of this new receiver is better than 0.3 microvolts for 10 dB signal-plus-noise to noise on all bands. The built-in crystal filter exhibits selectivity of 2.1 kHz at the 6 dB points for SSB and RTTY. Optional filters are available for AM (3.75 kHz) and CW (400 Hz).

The SB-301 is fully capable of transceive operation when operated as a companion to the SB-401 transmitter. When the optional six and two meter converters are plugged in, the SB-301 provides full amateur band coverage from 80 through 2 meters complete with front-panel switching. Look for a complete review of this versatile new receiver in this issue. For complete specifications and the schematic diagram, write to the Heath Company, Benton Harbor, Michigan 49022.

HEATHKIT SB-401

The new Heathkit SB-401 80 through 10 meter SSB Transmitter is an improved version of the widely chosen SB-400. The engineering department at Heath has added many new features to this rig to make it even more versatile that its predecessor. The new SB-401 offers a front-panel control to switch from independent to transceiver operation when used with the Heathkit SB-301 (or SB-300) communications receiver. This control and the allied circuitry that go with it also enable the SB-401 to be operated as an independent transmitter with any communications receiver—all you need is the Heath SBA-401-1 crystal group.

One of the amazing things about this new transmitter is its cost—its forty dollars less than the preceding model! Even with the optional crystal group installed the new SB-401 is ten dollars less. The specs of the new SB-401 are just about the same. It still runs 180 watts PEP on SSB on 170 watts CW. Linear tuning is provided by the Linear Master Oscillator and the 1 kHz dial calibration permits frequency repeatability within 200 Hz. It features a built-in antenna change-over relay, a relative power meter, VOX and PTT control, and LSB, USB or CW.

In addition, Heath has changed their assembly plan to “sub-pack” packaging. Now basic portions of the transmitter are assembled as individual units. The builder opens only the packages of components necessary for that part of the SB-401 he is about to assemble. Unit by unit he progresses toward completion. In this way, the number of components involved at any sequence is cut down and there is less chance for error. Besides, it’s easier.

For more information on this new transmitter, and a complete set specifications and the schematic, write to Heath Company, Benton Harbor, Michigan 49022.

(Turn to page 132)
Beautiful Binders

Fantastic Full Years—$3.50
Missed any full years of 73? Like a new set of any years to replace those old, worn-out, ragged, dog-eared 73’s you keep using for reference? We can supply all 12 issues of 1962, 1963, 1964, or 1965 in good, unused condition at less than 30¢ per copy when you buy all 12. We reserve the right to substitute if any issue runs out. The price for one year, 12 issues, is only $3.50.

Special Sales! Binders and Back Issues! Save!

Back Issue Special—20 issues for $5
We’re offering a special on back issues: 20 good back issues of 73 (our choice) from before 1965 for only $5.

Individual Back Issues—50¢
All back issues of 73 are still available except January 1961. They cost 50¢ apiece except October, November and December 1960, which are $1 each.

PLEASE INCLUDE POSTAGE ON ALL ORDERS.

73 Magazine
Peterborough, N. H. 03458
New Products
(from page 130)

Poly Quad Antenna Kits

The Polygon Plastic Company has entered the amateur radio field with a unique fiberglass cubical quad antenna kit. Already a nationally known manufacturer of industrial fiberglass products and the “Glas-Lite” fiberglass sporting goods line, Polygon has adapted a three piece tube with strength equal to, or even greater than, the best 13 foot continuous length pole.

The entire kit is mailable, thus reducing shipping cost and time. Most important is the sky-blue epoxy paint used on the standard kit spreader. This paint protects the fiberglass from weather and ultra violet ray deterioration adding years to spreader life. It also tends to make the mounted antenna less conspicuous and therefore, less objectionable to neighbors. The most advanced and economical feature of the kit is the spreader mount—called the Starmount. Using only a wrench and screwdriver, the amateur can adjust the Starmount to fit booms from 2 to 3 inches in diameter. He can go from dual to multi-element arrays without buying all new hardware. The Starmount is diecast of proven corrosion-resistant, high strength aluminum alloy. The boom-to-mast adapter is also fabricated from a high quality aluminum alloy.

A comprehensive and illustrated 28 page manual offers simple instructions enabling the average Ham to construct the Poly-Quad in a matter of hours. Selection of boom, wire and reflector tuning methods is left to the individual customer. Kits are available with 2, 3 and 4 elements in the and duo-band series. Components are also sold separately. For more information, write to Polygon Plastic Company, 7 Industrial Park, Walkerton, Indiana 46574.

Amperex Linear IC’s

Amperex has announced the availability of five new linear monolithic IC’s. The most advanced type in the line is the TAA320, an optimum performance audio frequency semiconductor device. Trade-named the BiFET, it is the world’s first bipolar/mosfet integrated circuit amplifier. This new design concept enables the unit to take 100 volt transients, features a Cm of 40,000 μmhos and has an input resistance of 10,000 megohms.
The new model TA310 is designed specifically as a record/playback preamplifier. It provides 100 dB gain with less than 4 dB noise. The TAA293 features complete accessibility to all internal connections to provide wide application flexibility. It is ideally suited for audio and if applications, or as an amplifier, oscillator and multivibrator in other low-frequency functions.

The new Amperex TAA103 is the smallest linear integrated circuit amplifier presently available. The plastic flat-pack in which it is packaged measures a scant 0.002 cubic inches. This IC features 75 dB gain and is ideally suited for amplifier applications from dc to 600 kHz.

For more information on this new line of integrated circuits, write to Amperex Electronic Corporation, Semiconductor Division, Slatersville, Rhode Island 02876.

Aerovox RF Suppression Filters

Although these filters were designed for the military market, they should find use in amateur equipment where severe rf suppression requirements exist. These miniature ceramic filters come in twelve different models for rf suppression from 150 kHz to 10 GHz (10,000 MHz). For more information write to Aerovox Corporation, Olean, New York.

WRL 1967 CB Catalog

Although this new catalog from World Radio Labs was put together specifically for the citizens band operator, there are many items included which are of interest to the amateur. Test equipment, antenna accessories, feedline, rotors, tools and components are included as well as a full line of CB gear. For your free copy write to World Radio Laboratories, 3415 West Broadway, Council Bluffs, Iowa 51501.

(Turn to page 134)
**New Products**

(from page 132)

**Top Tuning Piston Capacitor**

The Components Division of the JFD Electronics Company has just announced a universal top tuning assembly which adapts all JFD piston capacitors for top tuning and vertical mounting. These units are ideal for applications in equipment where space is at a premium and top tuning is required.

These components are available in two wire and pin or four wire configurations for printed circuit use. The unit shown here has a range from 2 to 25 pF, a working voltage of 500 Vdc, and Q of 600 at 20 MHz. For further information, write to JFD Electronics Company, Components Division, 15th Avenue at 62nd Street, Brooklyn, New York 11219.

**Amperex Semiconductor Catalog**

Amperex has just announced the latest edition of their condensed Semiconductor Catalog. This new catalog contains the basic specifications and related material on the full line of Amperex semiconductors. It serves as a quick reference guide and includes specification lists and associated applications references on transistors, diodes, audio amplifier assemblies, integrated circuits, heats sinks and audio kits. In addition, there is a list of Amperex Application Reports. Free copies may be obtained by writing on your company letterhead to Amperex Electronic Corporation, Advertising Department, Hicksville, Long Island, New York 11802.

**1967 EICO Catalog**

EICO has just announced publication of their new 1967 catalog. This new catalog features EICO’s complete line of 200 electronic kits and factory assembled instruments for hams, electronic technicians, hobbyists, CB’ers and audio buffs. Among the new EICO items included in this catalog are their 717 Electronic Keyer, 711 Shortwave Receiver, 888 Engine Analyzer and “Cortina” solid-state stereo. Also included are the EICOCAST Solid State electronic kits—seventeen different units for many applications. For your copy of this new catalog, write to Electronic Instrument Company, Inc., 131-01 39th Avenue, Flushing, New York 11352.
**WANTED!**

**YOUR MILITARY SURPLUS EQUIPMENT**

**BUY - SELL - TRADE**


Test Equipment: Surplus with ARC, ARM, SG, GPM, GRM, URM, UPM, USM, MD prefixes. Commercial H-P, GR, Tektronix, Boonton, Measurements.

Tubes: New boxed receiver and transmitter types, buy and sell.

**Tech Manuals: We Buy, sell and trade.**

**TRADE YOUR GEAR FOR THE FOLLOWING**

<table>
<thead>
<tr>
<th>Technology Type</th>
<th>Description</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ameco TX-62, 6 &amp; 2 mtr transmitter</td>
<td>$149.95</td>
<td></td>
</tr>
<tr>
<td>Ameco VFO-621, 6 &amp; 2 mtr VFO</td>
<td>$59.95</td>
<td></td>
</tr>
<tr>
<td>Drake R-4A, receiver</td>
<td>$399.95</td>
<td></td>
</tr>
<tr>
<td>Drake T-4X, transmitter</td>
<td>$399.95</td>
<td></td>
</tr>
<tr>
<td>Drake T-4X, AC power supply</td>
<td>$99.95</td>
<td></td>
</tr>
<tr>
<td>Drake TR-4, transceiver</td>
<td>$599.95</td>
<td></td>
</tr>
<tr>
<td>Drake AC-4, TR-4 AC power supply</td>
<td>$99.95</td>
<td></td>
</tr>
<tr>
<td>Drake DC-3, TR-4 DC power supply</td>
<td>$149.95</td>
<td></td>
</tr>
<tr>
<td>Drake MS-4, speaker</td>
<td>$19.95</td>
<td></td>
</tr>
<tr>
<td>Drake RV-4, TR-4 remote VFO</td>
<td>$99.95</td>
<td></td>
</tr>
<tr>
<td>Drake 2-C, receiver</td>
<td>$229.00</td>
<td></td>
</tr>
<tr>
<td>Drake 2-NT, CW transmitter</td>
<td>$129.00</td>
<td></td>
</tr>
<tr>
<td>Drake L-4, linear amplifier</td>
<td>$695.00</td>
<td></td>
</tr>
<tr>
<td>Drake SW-4, general coverage receiver</td>
<td>$289.00</td>
<td></td>
</tr>
<tr>
<td>Eimac 3-400Z tube</td>
<td>$34.00</td>
<td></td>
</tr>
<tr>
<td>Eimac SK-410 socket for 3-400Z</td>
<td>$6.50</td>
<td></td>
</tr>
<tr>
<td>Eimac SK-416 chimney</td>
<td>$6.50</td>
<td></td>
</tr>
<tr>
<td>Eimac 3-1000Z tube</td>
<td>$78.00</td>
<td></td>
</tr>
<tr>
<td>Eimac SK-510 socket for 3-1000Z</td>
<td>$6.50</td>
<td></td>
</tr>
<tr>
<td>Eimac SK-516 chimney</td>
<td>$12.00</td>
<td></td>
</tr>
<tr>
<td>Eimac, send your needs; others in stock.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>E-Z Way towers, write for prices.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Other manufacturers in stock. Send your needs. Also lists of what you have to trade.**

**Surplus Special:** Jennings vacuum variable capacitors, UCS 10-300 mmfd, 7.5 kV, complete with gear drive train, mounting bracket, brand new, $27.50 postpaid, insured.

**Write, wire, phone 813-722-1843, Bill Slep, W4FHY**

**SLEP ELECTRONICS COMPANY**

Drawer 178P, Highway 301
ELLENTON, FLORIDA 33532

**JUNE 1967 135**
Hundreds of Bargains

...SO WHY PAY MORE FOR THE BEST!

Instant Credit, Instant Shipment On Time Payments & Cash Orders

Why It Will Pay You To Deal With Trigger

- Amazing Trades
- No Down Payment Required
- Low Budget Terms
- Midwest Bank Credit Cards Accepted
- Fast, Efficient Service
- No Waiting
- 20 Minutes From Downtown Chicago Or O'Hare Airport
- Near Junction Of Routes 64 & 43
- Plenty Free Parking
- Open Weekdays Until 8:00 PM
- Come in, Browse and Get Acquainted, And See The Most Complete Inventory of Ham And CB Gear—Attractively Displayed.

Why It Will Pay You To Deal With Trigger

- Amazing Trades
- No Down Payment Required
- Low Budget Terms
- Midwest Bank Credit Cards Accepted
- Fast, Efficient Service
- No Waiting
- 20 Minutes From Downtown Chicago Or O'Hare Airport
- Near Junction Of Routes 64 & 43
- Plenty Free Parking
- Open Weekdays Until 8:00 PM
- Come in, Browse and Get Acquainted, And See The Most Complete Inventory of Ham And CB Gear—Attractively Displayed.

New Equipment On Low Budget Terms

- Ameco
- Hallicrafters
- Regency
- Numecron
- Astatic
- Hammarlund
- SBE
- B & W
- Hy-Gain
- Trimmer
- CDR
- Johnson
- Shure
- Cush-Craft
- Mark Mobile
- Swan
- Dow Key
- Millen
- Waters
- Drake
- Mosley
- Vibroplex
- Eico
- National
- Weller
- Finco
- New-tronics
- and many other major brands

Like-New Equipment On Low Budget Terms

- Ten-Day Trial
- 30-Day Guarantee
- Tops in performance and appearance, thoroughly and beautifully reconditioned, and clean as a pin. Alignment, calibration as good as new, and frequently better. Listed below are but a few of the hundreds of items and accessories currently available. Write for complete listing and prices.

Another important TRIGGER service:

WE BUY USED HAM GEAR FOR CASH

PROMPT SERVICE... PROMPT CASH!

No company processes foreign orders and inquiries with greater dispatch than Trigger

TRIGGER Attn: W91VJ
7361 North Avenue
River Forest, Illinois

RUSH THE FOLLOWING: Amount Enclosed

NAME ________________________
ADDRESS ________________________
CITY ____________________ STATE ______ ZIP ______

ORDER BLANK TO: trade ur present gear, order equipment, sell ur gear for cash.

STORE HOURS Weekdays 11:00 A.M.—8:00 P.M.
(CENTRAL TIME) Saturdays 9:00 A.M.—3:00 P.M.

ALL TELEPHONES (312) 771-8616

SUNDAY TELEPHONE SERVICE 11 A.M.—3 P.M.
Caveat Emptor?

Price—$2 per 25 words for non-commercial ads; $5 per 25 words for business ventures. No display ads or agency discount. Include your check with order.

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

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

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

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

WANTED IP-501 receiver write box 77 Savannah, Georgia, 31402.

WANTED SW-3 receiver write box 77, Savannah, Georgia, 31402.

NEW T-4X, $325, AC-3, $85, unopened factory cartons, warranty, new, sealed. 3-400Z tubes, pair $55, singles $28, warranty. W4HKQ, Don Payne Box 525, Springfield, Tenn. 37172.

NEW SWAN 500, 117XC speaker, supply unopened factory cartons, warranty, $475. HQ-170, clock, manual, mint condition, $115. W4HKQ, Don Payne, Box 525, Springfield, Tenn. 37172.

TRANSFORMERS: Filament-transistor power supply: 6.3 VAC at 1.5 A, 115 VAC, $1.00 each pp anywhere in U.S. No minimum order. Electro Systems, 3496 Zisch Dr., San Jose, Calif. 95118.

RECORDING TAPE: Name brand splice free, 1.5 mil mylar, 1200 ft, $6.50 for 5 reels; 1.0 mil mylar, 1800 ft, $9.00 for 5 reels, pp anywhere in U.S. Electro Systems, 3496 Zisch Dr., San Jose, Calif. 95118.


ALUMINUM TOWER, never rusty. Easy to erect. Crank up, tilt over. Mail postcard to Ralph, Gate­ way, Exeter at Big Bend, Shrewsbury, Mo. 65119.


RF SIGNAL GENERATORS: F-122, $24; LAE, $8; HB superhet, $18; TS-24 scope, $20; uncalibrated LM-14, $21; also have CQ, QST, books, TM's, parts and other test equipment. Send for free list. John R. Yurcik, K2EMF, 510 Conklin Place, Linden, N.J., 07036.


SIMPSON MULTIMETER, (VTM) model 266, $19; Heathkit signal generator, $18; Heathkit VTM, $18. Good working condition. H. Goldman, 43 Clinton Ave. Rockville Center, N.Y., 11570.

HEATH SB-300 with filters, $250; SB-400, $295; SB-301-3, $19; Table top KW linear, $125; others. Shideler, 2812 Tenth, Arcadia, Calif.


VIKING VALIANT, $170. HRO-50 with crystal calibr­ ator and 5 coils, $125. Central Electronics 16-B, $45. Albert Thomas, W8DTI, 2645 Forest Grove S.W., Wyoming, Michigan 49059.

HEATH solid state multiplex twins, AA 14 and AJ 14 with bookshelf speakers, all in oiled walnut. Ranger 1 and Vanguard 6 mtr converter w/10 meter out. Sell or trade for transceiver. Robert F. Cann, W4GBB, 815 Ben Franklin Dr. Sarasota, Florida 33577.

SWAN 120 with mike, $120. Topaz mobile 800 V power supply, $50. Will ship. H. A. Hindert Star Route 2, Fischer, Texas 78623.

HEATH SB-300 receiver, cleanly wired, excellent operation, like new condition, used 6 months during novice period. Will ship FOB for $175. D. W. Frye, WA3CKZ, 328 Castleigate Rd. Pittsburgh, Penna. 15221.

HQ-170-C, $175; DX-60, $55; HG-10 vfo, $25; 10-D mike, $15; HM-11, $10; Matching speaker for 170, $10. Also key, etc. First certified check for $250 takes all. Singly as listed. D. Callaway, Rt. 1, Box 303, Durango, Colorado 81301.


DUMMY LOAD 50 ohms, flat 80 thru 2 meters, coax connector, power to 1 KW, kit $7.95, wired $11.95, pp Ham Kits, Box 175, Cranford, N.J.

CLIFF DWELLER 75/10 meter rotatable dipole. First owner, not rusty, $50; HT32A immaculate condition, $250. Want transceiver. Marty WB6­ NWW, 5349 Abbeyfield, Long Beach, Calif. 90815.


FOR SALE: Swan 350 w/AC power supply, $375.00; SB-300, 1200 W PEP linear, $175.00; HA-525 6-meter portable xceiver, $100.00. All equipment mint, perfect working order. Ken Feldman WB6FRP, 705 Gayley Ave., Los Angeles, Calif. 90024.

SELECTRONIX AUDIO FILTER, use between re­ceiver and speaker or phones, cuts monkey chatter and narrows band pass to about 1000 Hz. Some QSO's possible only with this in circuit. $24.95 pp. W0RA/1 Box 115, Greenfield, N.H. 03047.


A. R. C. Sales

Variable Capacitor. Four section, 7.5-425 mfd. per section, 30-1700 mfd. overall. 31/2" w x 17/6" h x 63/4" long plus 3/4" for 1/4" shaft. Wt. 3 lb. $4.95

Filament and Bias Transformer. Pri. 560 vac. sec. 12-6v. C.T. @ 75 amp. Sec. 2-15v @50 ma. Wt. 7 lb. $4.50

Plate Transformer. Pri. 117v. 60 cye. Sec. 600v. @ 450 ma. No C.T. Will double to 1700 volts. Wt. 19 lb. $3.35

Heavy Filament Transformer. Tapped Pri. 115-125v. 57-63 cye. Sec. 1-6-3v C.T. @ 5 Amp. Wt. 19 lb. $3.35

All items are new and F.O.B., Worthington, Ohio.

A.R.C. Sales
P. O. Box 12, Worthington, Ohio 43085

PLATE TRANSFORMERS—$39.95
3600-0-3600 VAC @ 1000 Ma., C.C.S, with 120/240 VAC 60 cps primary. Commercial quality transformers manufactured by Wagner Electric Co. measure 13" high, 12" wide, and 9" deep. Net weight is 85#. Price $39.95 F.O.B. Minneapolis. One year unconditional money back guarantee. Terms: Check or M.O. with order. Immediate delivery. Write or phone:

PETER W. DAHL CO.
3314 Diamond Drive
El Paso, Texas

* TWO-WAY *

COMMUNICATION CRYSTALS

AMERICAN CRYSTAL CO.
PO BOX 2366 KANSAS CITY, MO.

CQ de W2KUW
5% BONUS!!

Paid over any top offer for any piece of aircraft or ground radio units, also test equipment. All types of tubes, capacitors, relays, etc. $331A • 304TL • 4-1000A • 4CX5000A et al. 17L • 5IX • 390A • ARM • GRM • GRC • UPM • URM • USM units.

TED DAMES CO. • 310 Hickory St., Arlington, N.J.

COLLINS VFO’s

Units are less Dial Assembly with leads ready to install in your equipment. These are new units or like new, carefully checked and satisfaction guaranteed.

See Schematic and pictures in Collins Receiver Handbooks.

Type Used In tuning Range Dimensions Price
70K-24 7SA-4 1.95 to 2.90 MHz 5 x 2 5/8" diam $49
70K-23 KWM-1 7.75 to 3.75 MHz 5 x 2 5/8" diam $69
70K-1 KWM-1 2.85 to 1.65 MHz 2.87 x 2 1/8" $59

Terms cash, full refund if not satisfied within 16 days.

RICHARD E. MANN
430 Wilmot Road, Deerfield, Illinois 60015

MILITARY TEST EQUIPMENT DATA HANDBOOKS


RITCO Electronics, Box 156, Annadale, Va. 22003. Phone (703) 566-5460.

TRANSISTORS. Had baby so he took over shack. Have transistors plus many associated parts. Send for list. Ralph Miller, 15 Arbutus St. Dorchester, Mass. 02124.

HY-GAIN 18-AVQ, brand new in original box. Going for full size 80-meter vertical. Delivered prepaid, $29.50. W0RA/1, Box 115, Greenfield, N.H. 03647.

PIPE SMOKERS: Three 1 1/2 oz. sample pouches of the world’s finest pipe tobaccos. $1.50 plus $0.50 handling charges. SMOKE RISE, W4NL, 13118 Thompson Rd., Fairfax, Virginia 22030.


WANTED: TEST EQUIPMENT. Laboratory quality such as Hewlett-Packard, General Radio, Tektronix, etc. Electronicraft, Box 13, Binghamton, N.Y. 13902. Phone: (607) 724-5785.

RTTY GEAR FOR SALE. List issued monthly. 89 or 44m Htoroids, five for $1.75 postpaid. Elliot Buchanan, W6VPC, 1067 Mandana Blvd., Oakland, California 94010.

WANTED: Teletype 28a, parts, what have you. SELL—machines, parts. Fred Schmidt, W4NYF, 465 NW 30th Ter., Ft. Lauderdale, Fl. 33311. 305-583-1340 (9 P.M. EST.)

TOOOOBS: 811A—$4.25; 7094—$26.90; 6146A—$2.25; 6CW4—$1.40; 389—$13.50; Extra power 6146B—$4.00; 63H0—$3.45; 8528—$9.50. All new, boxed, guaranteed. FREE catalog. VANBAR Distributors, Box 44XY, Stirling, N.J. 07980.


WANT: R780/GR, or R787B/GR: Also R391 receivers. Thompson, 5 Palmer, Gorham, N.H.

WANTED: Tubes, transistors, lab instruments, test equipment, panel meters, military & commercial communications equipment and parts. Bernard Goldstein, Box 297, Canal Station, New York, N.Y. 10013.


DUMMY LOAD 50 ohms, flat 80 thru 2 meters, coax connector, power to 1 kW. Kit $7.95, wired $11.95. pp HAM KITS, Box 175, Cranford, N.J.

PLASTIC HOLDERS—each display 20 QSL cards. For $1.00 or 10 for $3.00 prepaid and guaranteed. Free brochure of other ham goodies included. Tepabco, Box 198N, Gallatin, Tennessee 37066.

138

73 MAGAZINE
SIX ASSORTED ISSUES at ATV Experimenter, circa '64-'65, $1 from 73 Magazine, Peterborough, N.H. 03458.

SCHEMATICS FOR either the ARC-508, or the ARR 15, both described in June '65 issue of 73, only 50¢ each. 73 Magazine, Peterborough, N.H. 03458.

1963 BOUND VOLUMES OF 73. $15 each from 73, Peterborough, N.H. 03458.

25 WORDS FOR $2. Sell or buy through these want ads, a terrific bargain. Caveat Emptor, 73 Magazine, Peterborough, N.H. 03458.

NOVICE AND TECHNICIAN HANDBOOK by W6SAI and W6TNS. Limited quantity for only $2.50 each. 73 Magazine, Peterborough, N.H. 03458.

COMPLETE CONVERSION instructions for the AN/VRC-2, just $1 while the supply lasts. 73 Magazine, Peterborough, N.H. 03458.

HALLICRAFTERS HT-22B like new $280.00; Teletype Model 19, fine shape, $95.00; Model 15 with table, $75.00, both Bell units with sync motors. No ship. New TT63A, $25.00; GBS-201 Linear, $160.00; Scope H-110, $45.00, Hy-Gain 181T vert, $50.00. W4VBBO, Redlands, Calif., (714) 792-7037.

COMPLETE STATION—must sell. Heathkit DX-60 transmitter with HG-10 VFO; Hallicrafters SX-71 receiver with matching speaker; Hy-Gain 14-4VS four-band vertical and tripod roof mount; Turner 22X microphone, and Dow-Key coaxial relay. $200 takes all. Maurice Elias, 170 Spruce St., Burlington, Vermont 05402.

QLS CARDS???? “America's Finest.” Samples 35¢. Sakers Printery, W6DED, Holland, Michigan.

PRINTING PRESS for sale. Excellent for QSL printing. Write Box 218, Holland, Michigan.

CHRISTIAN HAM FELLOWSHIP now being organized for Christian fellowship among hams and for gospel tract efforts. Christian Ham Callbook $1 donation. Free details. Write Christian Ham Fellowship, Box 218, Holland, Michigan 49423.

JOHNSON KILOWATT MATCHBOX. In like new condition. First certified check for $85.00. You pay shipping. Cecil E. Menold, WA8HLD, 915 Garfield St., Struthers, Ohio 44471.


SELLING OUT—SB-400, SP-600UX, Mobile supply, QST's, much more. Stamp for list. W3CNS, 21 Terrace La., Elizabethtown, Penna. 17022.

BC-22L-P, AC and book, $60.00; SX-100 & spkr., $125.00; DX-60 & HG-10, $65.00. FOB. W9JOX, Box 65, Avoca, Wisc. 53506.

APR-4 WITH TU's, $175.00; URA8 RTTY converter, $150.00; 450TH, 450TL, each $15.00; Trade. Want TR3, linear, rotor, G-76, TA-33. K4UEB, 7807 N. Davis, Pensacola, Fl. 32504.


WANTED MILITARY, COMMERCIAL, SURPLUS: Airborn, Ground, Transmitters, Receivers, Test sets, Accessories, Especially Collins. We pay freight and cash. RITCO Electronics, Box 156, Amandina, Virginia. Phone (703) 580-5490 Collect.

COLLINS 251I, 755I, Waters Q multiplier, 500 cycle filter, 312B4, 516F2 all FB. Trade for 350 or TR3 and $450. K5DPZ, San Angelo, Texas 76901.


SONAR 80-10 METER TRANSCEIVER, with matching VFO. Uses efficient 5894 in final. $75 with power supply. 73 Magazine, Petersborough, N.H. 03458.

HALLICRAFTERS HT-45 linear 2 Kw excellent, $275. W3CEX, 301-761-7119 Baltimore, Md.

WANTED HEATH MARAUDER. Will pay depending on condition. Call after 6 PM or write: Judd Goodman, WB2VOG, 101 Hillwood Ln., Plainview, L.I., N.Y. 11803. 516-935-5726.

BACK ISSUES 73 March 1963 to March 1967, except December 63 $10.00 Postpaid. John Catron, W5DZA, 826 Ranchitos, Santa Fe, N.M. 87501.

SELL OR TRADE COLLINS 3OL-1. Trade RCA WR-99A marker generator for Q meter like value. WB6BLF 1036 Carol Lane, Lafayette, Calif. 94549.

FT-243 CRYSTALS: 3500 to 8700 kHz. 0.1% setting $2.00 each. Novice $1.00 each ± 2 kHz. Denver Crystals, 776 S. Corona, Denver, Colo. 80209.


HAM TUBE SPECIES BRAND NEW—GUARANTEED

3C24 $ 5.50 416B $20.00
4CX250B 20.00 417A 3.75
4X150A 9.50 811A 3.50
4-65A 8.50 866A 1.50
4-125A 19.00 972A 4.75
4-250A 26.50 5881 1.75
4-400A 30.00 8949 14.00
4-1000A 85.00 6360 3.00
FG17 4.50 6939 5.00
404A 3.80 8008 5.50

G-E 12BA6-50C5 Kit (5 tubes) $1.50

Send for free catalog listing thousands of similar items at lower-than-fair prices. We thank you now—you'll thank us later.

ARCTURUS ELECTRONICS CORP.
502-22nd St., Union City, N.J. 07087, Dept. ST-6. Phone 201-864-5568
RTTY

A portable teletypewriter signal distortion test set arranged to transmit normal or distorted signals for testing teletype writer circuits and equipment. $67.50

G.H. 1803-8H Lionel trans. 1.49

$49.50

COAX RELAY

SPDT Relay has 2-12 volt coils wired in series for 24 V operation. Parallel these for 12 V. 30235 connectors for standard VHF use at 300 watts. New $3.95

With 3 PL259 connectors $4.95

Coaxial Cable

FOR LESS THAN 30 PER FOOT! MG-34 AU CABLE.

50 OHMS 1" OD.

70 Feet $1.35

370 Feet $6.95

COAXIAL CABLE

RG 3/8 (50 ohm) 15 foot patch cord with PL259 each end. New $1.49

RG 9/8 (50 ohm) 18" patch cord with 2 PL259 $0.98

RG 9/8 7 foot patch cord with 2 PL259 $0.98

TUNING FORK FREQUENCY STANDARD

500 cycle—.001% accuracy—operates from 24VDC at 12A. Removed from new equipment. $7.50

OIL-FILLED CAPACITORS

2 Mfd, 2000 VDC $1.95

2 Mfd. 3000 VDC $2.95

2 Mfd. 4500 " $3.95

2 Mfd. 10,000 " $29.95

6000 $29.95

15000 " $49.95

15000 " $69.95

20,000 " $49.95

A. R. C. TYPE 12 RECEIVERS

R 10—520 to 1500 KC $43.50

R 11—180 to 560 KC $24.50

R 12—108 to 150 MC $29.50

R 19—118 to 148 MC $35.00

These receivers are continuously tunable over the ranges indicated and are furnished with tubes in either new or very good condition.

Panoramic Indicator

This panoramic adapter was written up in the June 1964 issue of "73" Magazine. It is a 14 tube scope using 7 or more of each of the following tubes: 3BP1A, 686G, 686A, 6AL5, 6G6, 6G7A, 6GB7, 6SR7, 6AC7, 884, U6A, 18A, and 6X5.

Nickel-Cadmium BATTERY

Considered a 144 time battery, they may be recharged indefinitely and may be left charged or discharged with no ill effects. Rate of discharge in many times the rated AH and is almost flat at rated AH.

Four sizes presently available all in excellent guaranteed chargeable condition. All are 1.2 volts.

A.R.C. TYPE 12 RECEIVERS

New $1.49

Coaxial Cable

K.G. 8/4U (52 OHM) 15 foot patch cord with PL259 each end. New $1.49

K.G. 9/8 (50 ohm) 18" patch cord with 2 PL259 $0.98

K.G. 9/8 7 foot patch cord with 2 PL259 $0.98

ARROW SALES-CHICAGO, INC.

2534 South Michigan avenue, Chicago, Illinois. CA 5-4750
TCS EQUIPMENT

NAVY TCS RECEIVER AM
1.5 MC to 12 MC in two (2) bands. Variable freq, oscillator & crystal control on four (4) preset channels in the entire freq range. Audio output 1.5 watts into 500 ohm load; uses tubes 12AK7 RF A, 12AT7A converter, 212AK7 IF A, 12SG detector BFO, 12AS oscillator, 12AS audio Amp, 456 RC IF Preamp. Large vernier & 6th dial, audio gain. AVC, BFO and all voltages re-leafed. 15 VDC & approx. 220 VDC 160 MA. Price: $113.9 x 15%. Wt.: 57 lbs. USED: $44.95.

NAVY TCS TRANSMITTER AM-
1.5 MC to 12 MC in three (3) bands, CW 69 watts, voice modulation 20 watts. Master oscillator variable and crystal control on 4 preset channels in the entire freq range. Uses 3/12AS in oscillator & buffer-multiplier, 4/1625 in modulator & power amplifier stages, 26" meters for PA Plate 6-280 DC RF meter 0-3, all tuning and operating controls on front panel. Voltages required: 12 VDC & 400-410 VDC 290 MA. W/tube/Sizes: 11% x 11% x 15½". Wt.: 42 lbs. USED: $34.50.

Antenna Loading Coll #72005 Used: $6.95
Remote Control Box w/Speaker #32000 Re-New: $9.95
Dual Dynamotor Power Supply 12 V. #11982 Re-New: $14.95
D-401 Transmitter Dynamotor 12 V. New: $6.95
D-402 Receiver Dynamotor 12 V. New: $6.95
CABLE—Receiver to Power Supply New: $2.75
CABLE—Transmitter to Power Supply New: $2.75
Converter Flaps for Remote Control Box New: $1.25
Shunt Mounding for Receiver or Transmitter...Used: $2.95
Noise Limiter Conversion Kit—W/4016 tube. Used: $1.00
Parts available for Rec. and Trans. Advise us of your needs.

Prices F.O.B. Lima, O—25% Deposit on COD*—BIG CATALOG—Send 25c (stamps or coins) & receive 56c CREDIT on your order.

FAIR RADIO SALES
DEPT. 73 — P. O. Box 1105 — LIMA, OHIO 45802

WE PAY CASH FOR TUBES
Lewispaull Electronics, Inc.
303 West Crescent Avenue
Allendale, New Jersey 07401

TRANSCIEVER SALE

SWAN 350's in NCX, NCX-Mark II $95
KWM-2 $75
75S-1 $295
25S-1 295 SW-120 $125
375S-1 $795

SWAN 500's NOW—in STOCK—$495

FRECK RADIO & SUPPLY CO. INC.
38 Biltmore Ave., Asheville, N.C. 28801, Phone 786-2852 x-204

Propagation Chart

JUNE 1967
ISSUED APRIL 15
J. H. Nelson

EASTERN UNITED STATES TO:

ALASKA 14 14 14 14 14 14 14 14 14 14 14 14 14
ARGENTINA 14 14 14 14 14 14 14 14 14 14 14 14 14
AUSTRALIA 14 14 14 14 14 14 14 14 14 14 14 14 14
CANAL ZONE 21 21 21 21 21 21 21 21 21 21 21 21 21
ENGLAND 14 14 14 14 14 14 14 14 14 14 14 14 14
HAWAII 14 14 14 14 14 14 14 14 14 14 14 14 14
HAYAN 14 14 14 14 14 14 14 14 14 14 14 14 14
INDIA 14 14 14 14 14 14 14 14 14 14 14 14 14
JAPAN 14 14 14 14 14 14 14 14 14 14 14 14 14
MEXICO 14 14 14 14 14 14 14 14 14 14 14 14 14
PHILIPPINES 14 14 14 14 14 14 14 14 14 14 14 14 14
PUERTO RICO 21 21 21 21 21 21 21 21 21 21 21 21 21
SOUTH AFRICA 78 78 78 78 78 78 78 78 78 78 78 78 78
U.S. S. R. 14 14 14 14 14 14 14 14 14 14 14 14 14
WEST COAST 14 14 14 14 14 14 14 14 14 14 14 14 14

WESTERN UNITED STATES TO:

ALASKA 14 14 14 14 14 14 14 14 14 14 14 14 14
ARGENTINA 21 21 21 21 21 21 21 21 21 21 21 21 21
AUSTRALIA 21 21 21 21 21 21 21 21 21 21 21 21 21
CANAL ZONE 21 21 21 21 21 21 21 21 21 21 21 21 21
ENGLAND 14 14 14 14 14 14 14 14 14 14 14 14 14
HAWAII 21 21 21 21 21 21 21 21 21 21 21 21 21
HAYAN 14 14 14 14 14 14 14 14 14 14 14 14 14
INDIA 14 14 14 14 14 14 14 14 14 14 14 14 14
JAPAN 14 14 14 14 14 14 14 14 14 14 14 14 14
MEXICO 21 21 21 21 21 21 21 21 21 21 21 21 21
PHILIPPINES 21 21 21 21 21 21 21 21 21 21 21 21 21
PUERTO RICO 21 21 21 21 21 21 21 21 21 21 21 21 21
SOUTH AFRICA 78 78 78 78 78 78 78 78 78 78 78 78 78
U.S. S. R. 14 14 14 14 14 14 14 14 14 14 14 14 14

A. Next higher frequency may be useful this hour.
B. Very difficult circuit this hour.
Good: 1-8, 10-13, 15-17, 19-21, 23-30
Fair: 9, 14, 18, 22
VHF: 5-7, 10-13, 15, 20, 24-27

WE PAY CASH FOR TUBES
Lewispaull Electronics, Inc.
303 West Crescent Avenue
Allendale, New Jersey 07401
TELEMARINE CLEARANCE BARGAINS!

POWER TRANSFORMER FOR 12V DC TRANSISTORIZED POWER SUPPLY
450 VDC at 200 MA.
From 12.0 VDC
Build your own transistorized mobile power supply for less than $15.00, and cut down battery drain 65% or more. Power transformer employs power-rated iron core (approx. 1000 cpsi), with feedback winding, and at 560 ma load still delivers 410 volts. Dim: 2 5/8” L x 2 1/8” H x 2 1/4” D. We furnish diode, transformer and construction details. New units, ship wt. 1 1/2 lbs. EACH... $6.95

LIMITED QUANTITY BARGAINS

BC-602 RECEIVER, excellent for marine use. Two tunable bands cover 20-22.5 and 22.5-25 mHz. With automatic noise blanker and other features. New, ship wt. 5 lbs. EACH... $29.95

BC-1335 FM TRANSCEIVER....

GO-9 TRANSMITTER: 125 watts output, low and high frequency (200-500 kHz, 1.5-18 MHz), consists of 3 sections: low freq. unit, high freq. unit and 900c AC power supply, which are assembled in one piece. All-aluminum construction, with 7 meters (including RF), matching, var. and caps, and all new parts. Ideal for modification or for parts for new transmitter. Shipping wt. 25 lbs. EACH... $59.95

551 PHOTOMULTIPLIER TUBE, complete with circuitry, and encapsulated in metal shield. Ideal for flying spot scanning TV. Shipp wt. 3 lbs. EACH... $6.95

BC-594 FM TRANSMITTERS. 10-channel, push button selection, 20-40 mHz complete with tubes, excellent for mobile conversion. Less Dynamotor. Used, very good. Ship wt. 75 lbs. EACH... $6.95

PHILCO 30-40 mHz FM MOBILE TRANSMITTER, Model PHT-232T. Single channel, crystal controlled, with power output tube, and 6 VDC dynamotor power supply output of which is 500 VDC at 175 ma. Excellent for conversion for ham, CB emergency and other applications. Used, good condition, with tubes, but less accessories. Shipp wt. 30 lbs. Bag price only... $9.95

TYPE VRC-2 FM TRANSCEIVER.. Transmitter output 45 watts. Crystal controlled, single channel unit, built in 6 VDC power supply, can be used for NBFM amateur transmissions, or may be applicable to fire, police or other use. Used, excellent condition units, with schematic. Ship wt. 69 lbs. EACH... $10.95

T-G-34 CODE PRACTICE SET
Learn to copy code and improve your speed with this unit. For individuals, schools, etc. Complete, portable automatic unit for reproducing audibly (built-in loud speaker) code signals recorded on disk on paper tape. Pre-recorded tapes, lessons 1-15 (on 15 reels) available from many other surplus houses. Also useful for practicing "sending" by means internal oscillator, keyed by external hand key. Operates from 90 to 120 V or from 110 to 240 V 60 cy AC. Units are used. Very good condition. Ship wt. 2 lbs. EACH... $15.95

PLEASE DO NOT REQUEST CATALOGS! MATERIAL LISTED IS "HERE TODAY, GONE TOMORROW", AND CATALOGS WOULD BE USELESS.

All above material subject to prior sale. 25% minimum deposit on all COD's. Minimum order $5.00. All prices FOB our address.

TELEMARINE COMMUNICATIONS
142 West Broadway, New York, N. Y. 10013
Phone: 212-267-5444

JUNE 1967

143
LIBERTY ELECTRONICS WANTS TO BUY FOR CASH

Electron tubes and semiconductors

Most any type or quantity. Receiving, transmitting, special purpose, magnetrons, klystrons. We will make you an immediate offer in cash.

Special sale

HP-2008R audio oscillator $65

Surplus communication and test equipment

AN/GRC-3, 4, 5, 6, 7, 8, 10, 19, 26, 27, 46, VRC-12

AN/PRC-8, 9, 10, 25

Test equipment with ARM, SG, URM, UPM, USM, and TS prefixes

Communications: AN/TRG-1, 24, 35, 36

Receivers: AN/APR-9, 13, 14, R-388A, R-274, R-390A, R-391, etc.

Indicators: ID-250, 251, 387, 287A, etc.

Aircraft: AN/ARC-27, 34, 38, 44, 45, 55, 57, 73, 84

AN/ARN-14, 69, 61, 70

AN/APS-42, 81

AN/APN-1, AN/OPN-2A

Also: Tektronix, Hewlett Packard, Boonton, and General Radio equipment, etc.

Liberty Electronics, Inc.
548 Broadway, New York, New York 10012, Phone 212-925-6000

PRICE BREAK

Latest type 196 to 500 KC, receiver, with 35 KC IF. Very excellent used, with all tubes, Internally complete, less drum. Extremely excellent used. See Sept. 1963 issue, of 75, "Q-Ser. Receiver".

Dual 300 pf/sec, 4000v variable capacitor, 2 3/4" w x 7 1/2" h x 13" i, plus 1 1/4" for two 5/8" shafts. Has 50's right angle drive, easily removed. 11 pounds, shipping weight, NEW.

$8.00

2 3/4" to 14 1/2" of differential, miniature. 3/16" shaft. NEW. 4 for $3.00

79¢ ea.

5 1/2 to 18 1/2 of miniature trimmer. 3/4" dia. .125 thick. Two solder terminals. NEW.

$5/$1.00


All orders, except in emergency, or I'm at a hamfest, shipped same day received. For the "GOODDIP" sheet, send self-addressed, stamped envelope—PLEASE, PLEASE INCLUDE sufficient for postage, any excess returned with order. I carry private (Traveller) parcel post insurance for domestic parcel post. For items too heavy, or too large for parcel post, I suggest bus parcel express. Please advise name of bus line, and city, where you can pick up the shipment.

B C Electronics

Telephone 312 Calumet 5-2235

2333 S. Michigan Avenue Chicago, Illinois 60616

INDEX TO ADVERTISERS

Altronics-, Howard, 116

Amateur Electronic Supply, 45

Ameen, 78

American Crystal, 138

Am-I-Tron Associates, 14, 115

Amrad Electronics, 123

A. R. G. Sales, 136

Arcturus Electronics, 134, 140

Arnold's Engravings, 133

Arrow Sales, 141

A. T. V. Research, 132

B & G Electronics, 144

Camp Butler Butler, 116

Ceco, 146

C & H Sales, 132

Cleveland Institute, 15

Columbia Electronics, 87-99

Comdel, Inc. 126

CushCraft, 126

Dahl, Peter W., Co., 136

Dana, Ted, Co., 136

DPZ Corp., 14

D'X'er Magazine, 128

Editors & Engineers, 75

Electronic Center, 73

Epsilon Records, 123

Estes Engineering, 127

Evan's Radio, 127

Evansville Amateur Radio Supply, 116

Fair Radio Sales, 142

Federation of L. I. Radio Clubs, 67

F's Ham Sales, 134

Freek Radio, 142

Glass, J. J., Co., 102, 103

Gateway Tower, 127

Gordon, H. W., Co., 79-83

Goodheart, R. E., Co., 128

Gutham, 123

Grantham Schools, 122

Ham" Rooter, 58

Hayden, E. C., 140

Henry Radio, 68

International Crystal, 3

James Research, 133

J A N-88-96

Liberty Electronics, 144

Linear Systems, 35

Mano, 116

Marin, R. E., Co., 138

Mesheh, 129

Midway Antennas, 132

Military Electronics, 104, 105

Missouri Ham Supplies, 41

Mosley Electronics, 22

National Radio Co., Rack Cover

Newsome Electronics, 107-109

Palmar Engines, 115

Parks Electronics, 123

Polar-Press, 139

Quenett, 49, 57

Quinn, Nikes, Electronics, 84, 85

Radio Amateur Callbook, 40

Radio Shack, Inc., 129

Risto Electronics, 138

Rohn Mfg., Co., 4

Saleh, Herbert, Co., 133

Scheber Organ Co., 65

Selectronics, 66, 67

Siel Electronics, 135

Solid State Sales, 100, 101

Southwest Semi-Condutors, 134

Swan Electronics, 24, 25

Sydmor Elec. Spec., 122

T & B, 196

Telemaq, 143

Telegram, 134

Telrex, 36

Trigger Electronics, 136

Tri Ria, 135

Unity, 115

Vanguard, 71, 74, 114, 124

Ventu, Cover 11

VHF'er Magazine, 132

Waters Mfg. Co., 5

Wilson, R. & C., Co., 118

World Radio Labs, Cover 111

73 Magazine, 127, 181
"Just found out how much I could have SAVED by buying a WRL Duo-Bander 84!"

THREE Great Package Options!

ECONOMY FIXED STATION PACKAGE

INCLUDES
DUO-BANDER 84 AC48 Power Supply

$199.95 10 DOL coolS MONTHLY

FIXED STATION PACKAGE

INCLUDES: WRL Duo-Bander 84; Model AC-384 Power Supply; WRL 3N1 Mike w/stand; WRL 80-40 Meter Doublet; (100') RG58/U Coax; All plugs.

$265.00 14 DOLLARS MONTHLY

MOBILE PACKAGE

INCLUDES: WRL Duo-Bander 84; DC Power Supply with cables; WRL 3N1 Mike; Body Mount; New-Tronics RSS2 Spring; MO-1 Mast and 40 & 80 Resonators; (25 ft.) RG58/U Coax; all plugs.

$305.00 15 DOLLARS MONTHLY

WORLD RADIO LABORATORIES
3415 West Broadway, Council Bluffs, Iowa 51501

Please ship me the following:

- Duo-Bander 84 - $159.95
- Economy Fixed Station Pkg. - $199.95
- Fixed Station Package - $265.00
- Mobile Package - $305.00
- Information on Duo-Bander 84
- Check or Money Order Attached
- Charge it.

Name ____________________________ Call ____________________________

Address ____________________________

City _________ State _________ Zip _________

"The House the HAMS Built!"
Join the National 200 club

Own the most versatile 5-bander on the market...priced even lower than a kit rig!

National's new 200 is fast becoming the most popular 5-bander on the market...and it's no wonder! Here's an ideal rig for mobile, portable, or home operation...the fastest way to move up from single band or triband. The price?...an amazingly low $359! Performance?...here's what Jim Fisk WIDTY said in a recent issue of a noted amateur radio publication: "When National came out with their new model 200 transceiver a few months ago at a lower cost than any other five band transceiver on the market, I just couldn't believe that it would perform as well as the more expensive models. But — after using it for several weeks in chasing DX, I find that they have done a superb job and it performs right along with the best of them. The sensitivity is fine, the selectivity afforded by the steep-sided crystal filter is excellent, and the audio reports, if I am to believe the fellows on the other end, have all been good. Reports of, 'tremendous audio quality,' 'really sounds good,' and 'very clean and crisp,' have been normal reports during the time I have had the 200 on the air.'

Feature this for $359! ■ Complete coverage of the 80 through 10 meter bands. ■ 200 Watt PEP input on SSB, plus CW and AM. ■ Separate product and AM detection plus fast-attack slow-release AGC. ■ Crystal-controlled front end and single VFO for high stability, and identical calibration and tuning rate on all bands. ■ Crystal lattice filter for high sideband suppression on transmit, and rejection of adjacent QRM on receive...plus solid-state balanced modulator for "set-and-forget" carrier suppression. ■ Operation from new low-cost AC-200 supply or from NCX-A or mobile power supplies. ■ ALC. ■ 45/1 planetary/split gear tuning drive. ■ Automatic carrier insertion in AM and CW modes. ■ Panel meter automatically switched to S-units on receive. ■ Universal mobile mount included.

Only $359.

National Radio Company
37 Washington Street, Melrose, Massachusetts 02176