hambrew

FOR AMATEUR RADIO DESIGNERS AND BUILDERS

Neophyte Roundup Part One

Di-Conical Monopole Antenna

WINTER 1994

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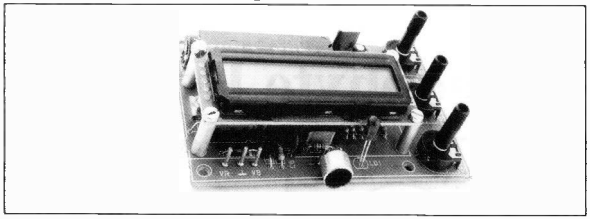
TAPTO ELECTRONIC KITS

Everybody who owns a shortwave receiver may already have tried to decode those mysterious morse messages...

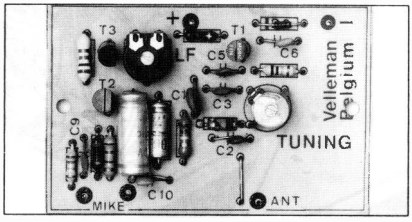


Morse Decoder Kit

$109.95

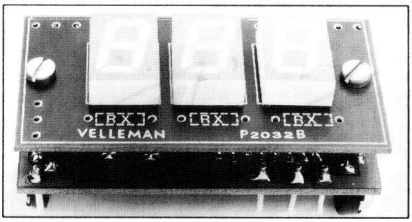
This decoder easily keeps up with the quickest signallers, and neatly "notes" everything on a display. You can easily read all messages, even if you are not familiar with morse at all! Alphanumeric LC-display * 1 line of 16 characters * Power supply: 2x7 to 8 VAC/150 mA or 9 - 12VDC/100mA * PCB dimensions: 70x115mm.

K1771 FM Transmitter $16.95



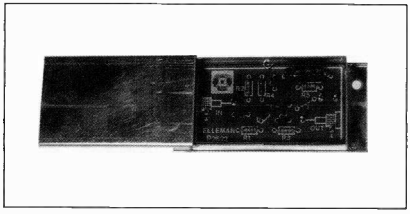
Mini FM transmitter (100-108 MHz). Integrated pre - amplifier (sensitivity 5 mV), to which any type of microphone may be connected. Power supply: 9 -12 VDC.

K2032 Digital Panel $39.95



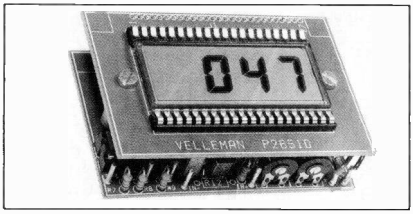
Power supply: 5VDC, 250 mA (regulated) * Read out: -999 mV to + 99 mV, 1mV resolution * Overload indication (positive and negative) * Linearity 0.1% * Input impedance: 100 mohm.

K2622 Antenna Amp $15.95



Do away with noisy signals! The K2622 gives you 22dB gain where it's needed. DC supply direct or via the coax cable (50-75 Ohm impedance), metal box included.

K2651 LCD Panel $39.95



This kit provides an easy-to-read display. Because of the simple power supply requirement and compact size of the kit, it can easily be incorporated into a variety of applications.

ORDER INFORMATION

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FAX : (303)-480-7552
1-800-453-2919
Mail: Tapto Corporation
2650 18th Street
Denver, CO 80211

• Contents •

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hambrew

FOR AMATEUR RADIO DESIGNERS AND BUILDERS

WINTER, 1994 • VOL. 2, NO. 1

Publisher.....George De Grazio, WFØK

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Special thanks to The NorthWest QRP Club for reprint on N7MFB article, page 19

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We welcome submission of articles, photos and manuscripts (S.A.S.E. for return).

• LETTERS •

From The Publisher

Since we went to press with the inaugural issue of **Hambrew**, many comments have come this way, some directly, some by multi-path. Most of what we have heard has been extremely gratifying and most welcome. For those good wishes and positive comments, I am very grateful.

But of course we are not perfect - there is much room for improvement, and we are listening to the constructive criticism very closely. We will provide etching patterns and parts-placement diagrams whenever possible in the future - they really help, I know. If we go to press without one, it will be for a good reason.

Murphy himself must have been in publishing, because proofreading beckons him like the sirens of Odysseus! We strive always to eliminate the typos.

Now something central to the philosophy of **Hambrew** as a publication needs to be voiced: The magazine is intended to be a collector and disseminator of information for hams who build and *experiment*. While noone has criticized us for not having the laboratory resources to do massive documentation on every project, I think it important to clarify the point.

If someone builds a transmitter and sends us the information as to how they proceeded, we intend to publish that information with the intention that any reader who is interested can also attempt to build it and enjoy experimenting and learning in the process. While we make every effort to substantiate designs and claims, we cannot guarantee every statement or design that appears on these pages.

What we trust is that experimentation will solve most of the problems that arise, and that the solutions will be relayed to the readership.

My heartfelt thanks again to those who support us and have helped spread the word that we do exist, as we don't have big ad bucks.

We strive to improve for you.

Sincere 73 To All, George

...Please enter a *two year* subscription for me. My check ...is enclosed.
Good Luck on your venture. Let's bring back home construction!
73, Al Hammond, KØHWE
Atkins, IA

I sure do wish that you would layout a SSB 2 or 3 watt rig that would run on 40 meters and if possible also on 15 meters.
73, Ken Mahoney, K6OPG
San Francisco, CA

We would very much like to publish the schematic and plans for such a rig, Ken. Perhaps there is one out there now, or this will be the call to arms for a design from an exceptional reader who has the expertise to make it a reality.

Dear Sir:
I would like to subscribe...I think I am the first BV reader, HI! So far I'm a member of the ARRL, QRP ARCI, G.QRP, Michigan QRP, and (soon) Low Key VK QRP and J.A.R.L. QRP.
73 From Formosa, Taiwan
Larry Lai, BV2BJ

We are sincerely honored to have you with us, Larry! And yes, you are our first "BV"! We hope you enjoy the magazine, and will send us some news of hambrewing in Taiwan!

A magazine devoted to construction? Sounds great! Heres my $20.
Thanks,
Glenn Buxton
Seattle, WA

First, let me say that I think your magazine could prove to be very useful for "non-cookbook" hams - I like it!
A question, and a suggestion:
First, your Autumn issue contains, I believe,

some inconsitencies in the article on the NWQRP "30-30" Transmitter:

1. The fixed resistor in the Q2 bias path is shown as 22k on the schematic, but 2.2k in the parts list (R6). Which is it?
2. The inductor in Q1's emitter path is shown as 18 microhenries on the schematic, but 18 millihenries on the parts list (L1). Which is correct?
3. Is the 33 ohm resistor value correct for the Q1 emitter resistor element?

Two suggestions:

First, errors like the above are inevitable in any technical magazine like yours. DON'T do what *QST* does, namely, print corrections to past articles scattered throughout the magazine as "strays"; instead, follow the *73* lead and have corrections to previous articles listed in the table of contents as "corrections".

Second, consider an article with not just photos, but improvements to the "neophyte" receiver. I've enclosed a sample which you are welcome to use.

Congratulations on a great start on your magazine!

Sincerely,
Mike Dinolfo, N4MWP
Fairfax, VA

We responded to Mike personally, and we thank him for the SASE sent with his request for clarification. Our section devoted not only to corrections, but also elaborations, begins in this issue under the heading "20/20 Hindsight" (ouch, so true). It contains the answers to the questions posed concerning the "30-30".

Mike, your schematic with mods to the Neophyte front-end looks just great! Thanks so much for this contribution. We have put them in the Neophyte Roundup section of this issue. One other mod which we would really like to see would be one involving the addition of an "S" meter to either the audio chain or, ideally but probably not realistically, to the front end near the RF transformer. Anyone solving this gets the "Brains To Spare" Award.

Again, our thanks to you, Mike, for the good suggestions and the great Neophyte mod!

Dear George,

...After admiring the extremely attractive front and back covers, I sat down and read Vol.1, No. 1 from cover to cover. All I can say is, well done!

...If you inspire hams, especially newcomers, to get involved in building their own transmitters, receivers and ham gadgetry, you will have made a major contribution to the cause of amateur radio.

I agree with your comment concerning the awesome power of ham networking. To that end, I have mentioned **Hambrew** in my QRP column which appears in *Spec-Com Journal.* Also, in a letter to The NorthWest QRP Club of Seattle, thanking them for a complimentary copy of the excellent newsletter, I strongly recommended that they subscribe to **Hambrew**.

...I look forward to receiving subsequent issues in the coming months. No doubt about it, I'll be polluting the air with solder flux fumes, trying to breathe life into some neat new circuit dreamed up by one of your talented contributors.

Again, thank you and all the best for the gang at **Hambrew**.

Yours very truly,
George F. Franklin, WØAV
Kansas City, MO

When we receive a letter such as this, George, we read it over and over, savoring the content. It helps us to confirm that we are on the right course. And, continuing the analogy, as we really are not a giant corporate-type publisher, it does not take a span of time for the ship to respond to the wheel: we can turn on a dime, and we listen to what we hear from our readers!

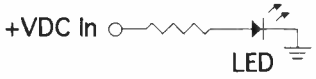
If there is one concept that could be stressed, it is that everyone is welcome to contribute; noone is "unworthy", no project is too small or insignificant to consider for our pages. We want input, lots of it, and we notice that the flow is increasing as the word about us spreads, thanks to good guys like you who believe in us and put us into the "loop". For this, our gratitude is unbounded!

QRP FREQUENCIES

CW	SSB
1810 kHz	-
3560 kHz	3985 kHz
7040 kHz	7285 kHz
10,106 kHz	-
14,060 kHz	14,285 kHz
21,060 kHz	21,385 kHz
28,060 kHz	28,885 khz

LED Resistor Chart

Operating an LED without using a series resistor may cause damage



Voltage	10ma	20ma
24V	2.2kΩ	1.1kΩ
15V	1.3kΩ	680Ω
12V	1kΩ	500Ω
9V	750Ω	360Ω
5V	300Ω	150Ω
3V	100Ω	51Ω

Use 1/2 watt resistors. Most LEDs operate at 2 volts DC and draw 10 to 20 MA
(Courtesy of Gateway Electronics)

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THE BEST ARTICLE/DESIGN FOR A MONOBAND TRANSMITTER EARNS

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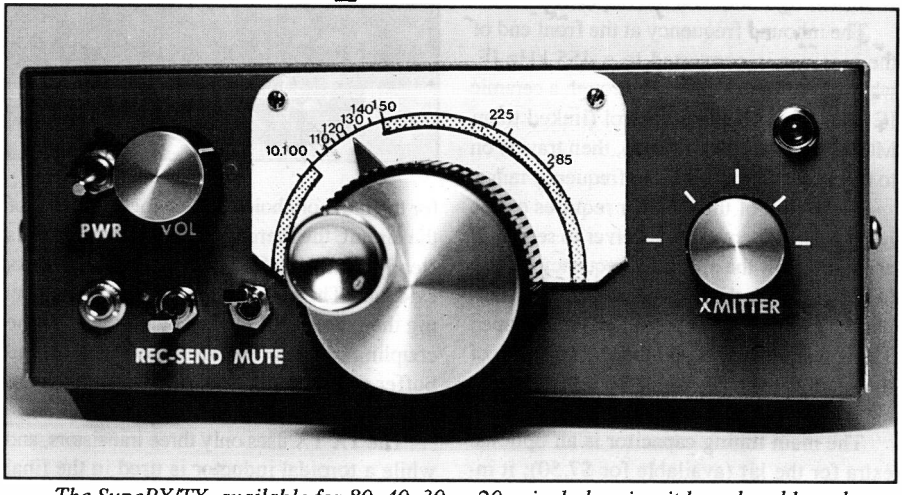
Decision of the judges is final. All submissions are subject to publication by Hambrew. Manuscripts returned if S.A.S.E. included. Void where prohibited by law. Not void where not prohibited by law. Subject to whim. Have fun or don't bother!

KIT REVIEW

The MXM Industries SupeRX/TX



The SupeRX/TX, available for 80, 40, 30 or 20m, includes circuit board and board components (see text).

From deep in the heart of Texas comes a kit that combines The Simple Texas Transmitter and the SupeRX receiver in a truly compact package. As advertised, the circuit board measures 3 1/2" X 3", and comes nicely tinned and ready for parts placement and soldering.

Building the kit is a breeze, thanks to the parts-identification printed on the top of the board. Each component is indicated by part number and placement (e.g., R1, etc.), and after checking to determine that all components are accounted for in the package, the builder can read through the instructions to make sure that the construction procedure is understood.

In building the receiver section first, it was fun to follow the instructions: "Install and solder all resistors" - what could be more direct and to the point? By looking at the placement indicators on the top of the board, there is little chance for error in placement, though as in all kits, polarity of diodes and polarized capacitors must be observed.

One of the great design features of the SupeRX section is that it requires no tedious toroid winding whatsoever. There are four slug-tuned coils to install, which provide no problems in placement.

Once all the parts are in place and the board is checked for unwanted solder bridges and incorrect polarities, the fun really begins! In our case, when the receiver was powered up for the first time, all that was heard was a faint hum and a slight click when the power was turned off. Not immediately daunted, we checked continuity and found a cold joint in the IF section. Once this was repaired, the receiver jumped to life, and we were amazed at the extremely high sensitivity, selectivity and audio volume at our fingertips!

The double conversion (Cont. pg. 8)

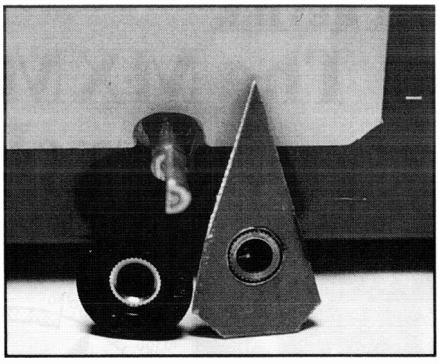
(Continued from page 7)
superhet design provides a signal to the listener which is clear and strong. The sensitivity is great, as became evident when we used a Ten Tec transceiver to calibrate the tuning dial. Signals received on the commercial rig were also right there on the SupeRX.

The inbound frequency at the front end of the receiver is converted to a 455 kHz IF, which ingeniously is routed through a ceramic IF filter to the volume control (linked to an MC3340 variable attenuator), then travels on to be converted into an audio frequency range.

Alignment of the receiver requires only a ham or general coverage receiver to set the IF above or below the operating frequency (above, in our case, with the 30 meter version), accomplished by tuning the appropriate transformer. The signal is peaked and the tuning range of the main tuning capacitor set by the same means.

The main tuning capacitor is an optional extra for the kit (available for $7.50); it includes a vernier drive, for which MXM had a neat idea concerning the addition of a pointer for a frequency dial plate: by removing the 1/4" collet and set screw from an old knob (we used a small knob and accomplished the removal with lineman's pliers), and soldering a pointer (made from double sided PCB) to it, the pointer may be attached to the shaft of the tuning cap (see photo above).

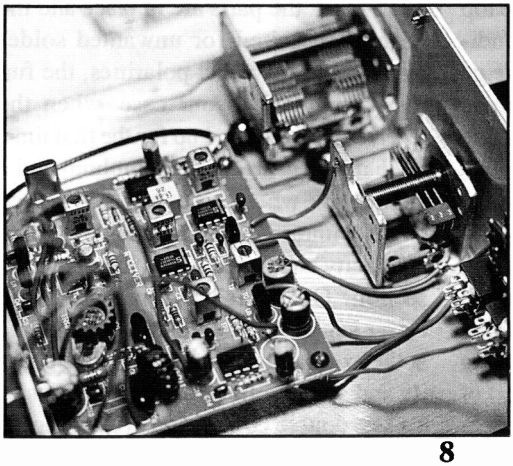
The transmitter section of this kit comes with a crystal for the QRP calling frequency



for the band of choice. Given the simplicity of the circuit, the Pierce type crystal oscillator is steady and chirp free, and has no key clicks evident.. The power output is adjustable during the building of the kit by selection of the coupling capacitor between the oscillator and buffer stages (from less than 1 watt to more than 3 watts).

The TX TX uses only three transistors, and while a toroidal inductor is used in the final filter, it is not a bear to wind, and the binocular toroid transformer between the buffer and the final stages is not problematical either. The remainder of coils are miniature RF choke types - plug in and solder.

Bruce Williams, the creator and force behind MXM, is a very talented and creative designer who has a considerable following in ham circles. Upon listening to the SupeRX receiver, and putting this kit on the air, we can certainly see why. The cabinet in which we chose to present the SupeRX/TX is a bit larger than most backpackers might prefer. We wished to incorporate a large dial plate, and to add a tuning capacitor to "rubber" the crystal somewhat to provide a modicum of tuning latitude.



A final note: MXM stands behind its kits; should a kit not work, MXM will make it work for $10 (assuming no replacement of the circuit board is necessary) - certainly a reasonable offer! The kit is $79.95 + $4 S&H from MXM, Rt. 1, Box 156C, Smithville, TX 78957 (512) 237-3906. Great kit, great price!

Amateur Radio QRP Design and Construction, Part I

Soldering and Parts Identification

Bruce O. Williams, WA6IVC

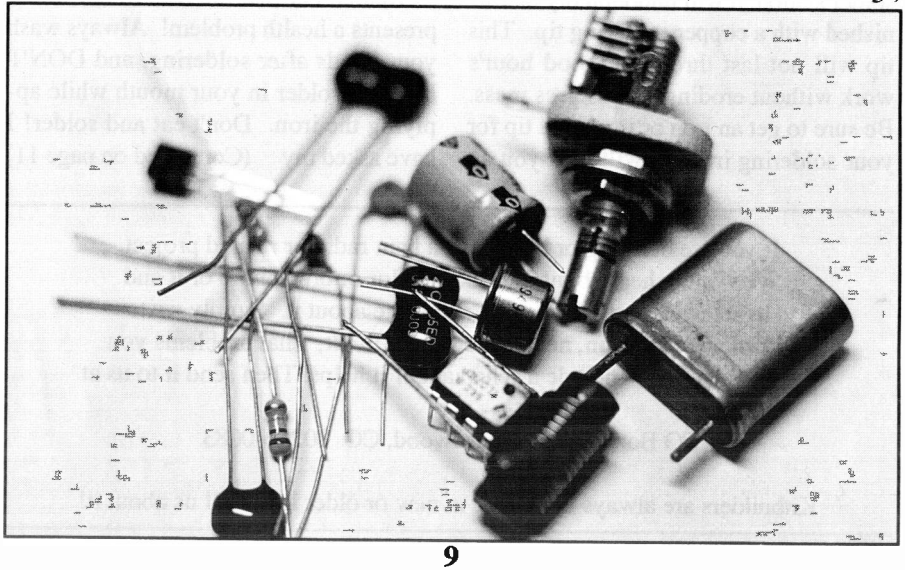
MXM Industries, Smithville, Texas 78957

One of the joys of QRP operating is that the equipment requirements are simple enough to allow the average operator to homebrew much, if not all, of his station equipment. There are several QRP kits available that are designed to permit the average kit constructor to quickly put a commercial-quality rig on the air at minimum cost. Here are a few hints and kinks to help make your construction simpler and less frustrating.

SOLDERING

The secret to successful soldering is *cleanliness*. Although your circuit board may look new and shiny, *always* cleanse the foil side of the board, and then take care not to touch the circuit traces with the bare fingers. No matter how often you wash them, your fingers carry skin oils that will interfere with the soldering process. Wash the foil side of the board with a soap-filled steel-wool pad, or a non-metallic soap-filled pot scrubber until the traces are bright and shiny. Be sure to rinse well, removing all traces of the soap from the connection pads and holes in the board. The board should be "water-break" clean. Make sure that the component leads are clean, scraping them with a hobby knife or small fine file, if necessary.

(Continued Next Page)

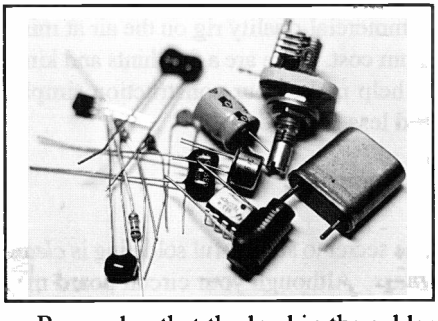


(Continued from page 9)

Use a good grade of solder - the small rolls available from hardware and the chain home-electronics stores are suspect. I recommend using the same solder that military construction specifies. Although a type of solder called 60-40 (60% tin-40% lead) is the most common type available, I recommend using SN63 (63% tin-37% lead). SN63 has a low melting point (less damaging to components) and is eutectic (has no plastic phase, it is either molten or solid). This makes the chance of cold solder joints less possible. Both 60-40 and SN63 are available in good electronics stores for about $10-12 per pound roll. Bite the bullet and buy a pound of good solder. It will last you for years, and is the best investment you can make for your work bench.

Use the smallest soldering iron available, not more than 25-watt rating. A larger iron can be used for tube-type construction, but for solid-state construction, the smaller the iron, the better. There are several styles of soldering tips available, but I recommend a small chisel tip. When you buy your soldering iron or solder station, it will undoubtedly be furnished with a copper soldering tip. This tip will not last through a good hour's work without eroding to a useless mess. Be sure to get an iron or iron-clad tip for your soldering iron; it will cost you an additional $5, maybe, but this is a good investment!

When soldering a connection, place the tip of the soldering iron on the pad to which the component lead is to be connected, just touching the component lead. It is absolutely mandatory that the component lead and the pad be at the same temperature for a good solder joint. Apply just a touch of new, clean solder to the interface of pad and lead, and allow enough time for the solder to "flow" into the joint. When you remove the iron and allow the joint to cool, be sure that the solder has flowed around the joint and presents a smooth and shiny appearance. If it looks dirty or crystalline, reheat the joint until it is smooth and shiny.



Remember that the lead in the solder presents a health problem! Always wash your hands after soldering, and DON'T hold the solder in your mouth while applying the iron. Don't eat and solder! I have asked my (Continued on page 11)

If you are building or have built a ham radio or related project, we want to hear about it! Take a color or b/w photo of it and its relevant parts if you can, and write about it. Simply write down what was fun, new, different, difficult, what problems you had to solve, etc. Include a schematic if it helps. Then send it to us at

PO Box 260083 • Lakewood, CO 80226-0083

Kitbuilders are always interested in new or older kits - tell us about it!

(Continued from page 10)
physician about inhaling the solder fumes, and he feels there is no risk of lead poisoning, but it's probably a good idea to ventilate the soldering area so that the fumes won't cause a problem.

COMPONENTS

Now that you're ready to apply heat and solder, we better spend a little time determining if we have the proper parts. Over the years you will build up a "junk box" of spare parts. Many writers will tell you to salvage parts from old CBs, TVs, etc. I have never found this approach to be practical. When you are experimenting with new designs or equipment, you don't need the uncertainty that comes from using salvaged or junk parts. Components such as resistors or capacitors are not expensive, although they may be hard to locate, sometimes. Take every opportunity possible to acquire parts at swap fests, bargain tables, etc. Buy 100 each of several values of resistors and capacitors from mail-order houses. Common 5% resistors can be had for a couple of cents apiece, and capacitors are not much more expensive. Radio Shack sells assortments of several values at fairly reasonable prices. The important thing to remember is that you want to use NEW parts wherever possible.

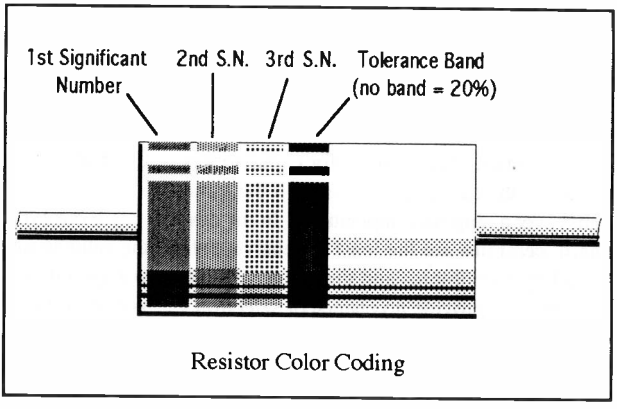
COMPONENT IDENTIFICATION

Component manufacturers in the U.S. and abroad use several different methods to identify parts values. Become thoroughly familiar with the following simple hints so that you don't have to read a book or find this article whenever you start to put something together.

RESISTORS

Almost all resistor manufacturers use the standard resistor color code that uses color bands on the resistor body to specify the value, the tolerance, and the voltage rating. For most amateur solid-state work, a 5%, 1/4 watt is adequate. Populate your junk box with these resistors, and you should not have a problem with these parts.

The standard color code for 5%, 10% and 20% resistors consists of three bands on the resistor body. The first band, on the extreme left, specifies the first significant number. The second band specifies the second significant number. The third band specifies the number of zeros to be added to the significant numbers. If there is no fourth band, the tolerance is 20%. If the fourth band is gold, the tolerance is 5%, and if it is silver, tolerance is 10%. The coding system for 1% resistors adds an additional significant number, and thus will have five bands.



Resistor Color Coding

Years ago, in the U.S. Navy, I learned the codes with a simple, but maybe raunchy mnemonic aid:

COLOR	VALUE	MNEMONIC
Black	Zero	Bad
Brown	One	Boys
Red	Two	Ravish
Orange	Three	Our
Yellow	Four	Young
Green	Five	Girls
Blue	Six	But
Violet	Seven	Violet
Grey	Eight	Goes

(Continued on page 12)

(Continued from page 18)

White Nine Willingly

Remember: Bad Boys Ravish Our Young Girls But Violet Goes Willingly.

CAPACITORS

We generally use four different types of capacitors in solid-state construction - small monolithics, ceramics, silver-micas or electolytics. Some designs specify polyester types, but these are so expensive and hard to find in the right values that we won't discuss them here. Generally, tolerance values of capacitors are not too critical in Ham Radio work, and the production tolerances of a well-designed kit will provide sufficient adjustment range to accomodate wide tolerance values. The important characteristic for capacitors is stability - the capacitor must exhibit the same value over a range of temperatures. In the cost chain, ceramics are the least expensive, followed by monolithics and then silver-micas. Electrolytics provide no chance of selection - we need the large values and can't substitute another type. In most kits, silver-micas are used in tunable resonant circuits, and changes in values can be accommodated.

Monolithic and Ceramic Capacitors

Monolithic and ceramica capacitors are generally marked with a three-number system. The first two numbers are significant and the third number specifies the number of zeros to be added. The value is always specified in picofarads (pF). Thus, a capacitor marked "104" has a value of 10 followed by four zeros, or 100,000 pF or 0.1 microfarads (uF or μF). A capacitor marked "270" has a value of 27 followed by no zeros, or 27 pF. An alternate method may just specify the value, such as 0.1 uF, etc.

Silver-Mica Capacitors

Silver-micas may be marked in a manner identical to monolithics or ceramics. Some silver-micas may specify the value and the tolerance, such as 420+/-5%.

Electrolytics

Electrolytic capacitors are marked with the value in microfarads (uF), together with a voltage rating. An electrolytic with a higher voltage rating than specified may always be substituted! REMEMBER that most electrolytics are polarized and MUST be installed in the circuit in accordance with their polarity. Installing electrolytics wrong may cause them to explode and shower you with caustic electrolyte. The polarity is indicated on the side of the capacitor and generally the positive lead is longer than the negative. • • •

Next Installment: Transistors and IC's

Capacitor Values

1000 pF	**1n**	**=**	**.001μF**
	1000n	**=**	**1μF**
	2n2	**=**	**.0022μF**
	22n	**=**	**.022μF**
	220n	**=**	**.22μF**
102 = 10(2)	**1000pF**	**=**	**1n = .001μF**
103	**10000pF**	**=**	**10n = .01μF**
104	**100000pF**	**=**	**.1μF**
105		**=**	**1μF**

472	**4700pF**	**=**	**4n7 =.0047μF**
473	**47n**	**=**	**.047μF**
474	**470n**	**=**	**.47μF**

2n2 = .0022	**pF**	**=**	**picofarad**
102 = .001	**nF**	**=**	**nanofarad**
472 = .0047	**μF**	**=**	**microfarad**

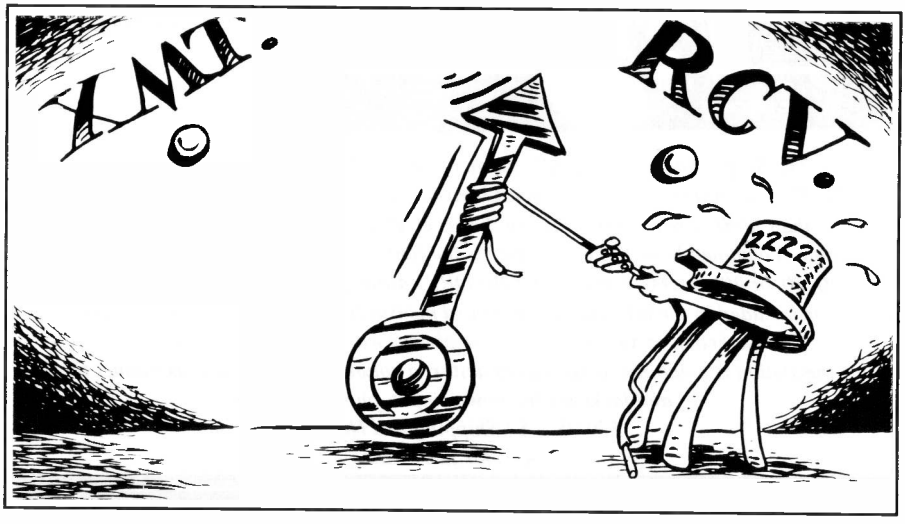
From Lo-Key, compilied by Don, VK5AIL

A Trio of T/R Switches

Fred Bonavita, W5QJM

PO Box 2764

San Antonio, TX 78299



While looking for ways to mate my old reliable Drake 2B receiver with a QRP transmitter I'd just built, I came across several kits and circuits for transmit/receive switches, and three of the kits will be discussed here.

These units -- commonly known as T/R switches -- allow for full- or semi-break-in operation. Two employ relays for the switching chores, offer sidetone oscillators so keying can be monitored, and have an adjustable break-in delay. The third is full break-in (QSK) with diode switching but without a sidetone oscillator.

My need was for a T/R switch that would shift the antenna, mute the receiver, apply voltage at the right time and sequence in the process, and possibly do other things. The literature has several T/R circuits available[1], and the designs are easily duplicated or modified without costing the builder an arm, a leg or another part of the anatomy.

I opted for those for which circuit boards were available as a convenience. I bought kits with two of them because I have found it less of a hassle.

Kits provide the components for which the boards were laid out. Relays are the chief worry when buying only the board, since the designer calls for a specific unit, and relays come in a staggering array of sizes, pin spacings, field coil resistances and power-handling capabilities. Of course, building from scratch bypasses that problem.

The third T/R switch also ducks that problem, since it uses no relay. Only the p-c board is available, and the other components likely are in the well-appointed junk box.

The T/R switches involved here are: The full QSK diode circuit by Doug DeMaw in his "W1FB's QRP Notebook," a switch-and-sidetone circuit by Oak Hills Research, and a transmitter control system by 624 Kits.[2] All went together with no major problems and in short order.

The DeMaw QSK switch can handle up to 5 watts of RF power, (Continued on page 15)

[1, 2:] See footnotes at end of article

Murphy Loves.....

...No diode-protected power polarity

Send us a "Murphy Loves"...We'll cartoon it for you!

(Continued From Page 13)
so it's fine for QRP's "legal limit". The board is available from FAR Circuits, and as noted above, it calls for no hard-to-find components. While it is the least-expensive of the lot to build, the DeMaw T/R circuit is not without its drawbacks, and builders should read carefully his explanation of the design before starting the project.

Doug calls for four 2-amp, 50-volt silicon rectifier diodes for switching, but he does not otherwise identify them, and they are not to be found in the usual readily available sources. The board is laid out for these diodes.

I wound up having to use 1N5400s (3 amp, 50 volt), and standing them on one end rather than soldering them flush with the board. They are larger physically than the diodes Doug used, and as a result, the FAR p-c board has to be drilled out to handle their heavier leads.

When quizzed about his choice of diodes, Doug replied "The ones that I used are mini units that I bought some years ago. I no longer recall the brand or source...You can use 3 amp diodes if you wish, and they can be stood on end if need be. It is unfortunate that most vendors sell only the larger 1000 series rectifier diodes..."

Otherwise, this T/R switch performs as specified in the QRP Notebook. Heeding Doug's warning about the current this unit consumes, I have not tried it in a battery-powered QRP operation. In addition to this QSK unit, Doug's book details a semi-break-in circuit in the same chapter.

Although the Oak Hills T/R switch and sidetone kit is a discontinued item, it is a good example of a combination break-in delay and sidetone oscillator circuit. Dick Witzke, KE8KL, the company's guru, was kind enough to permit reproduction here of the circuit (Figure 1). Dick says he dropped the unit because of little builder interest in it.

The Oak Hills T/R switch uses a single DPDT relay in a 16-pin DIP socket to change over the antenna, voltage, or whatever is needed. It can handle up to 20 watts of RF, and the sidetone oscillator can be fed into the receiver's audio or into a separate audio amplifier to drive a small speaker to keep track of keying.

The T/R by 634 Kits is another versatile switch. Pat Bunn, N4LTA, the guiding light of the company, wrote about it in CQ Magazine for February 1992 in an article that recites the instruction sheets.

Rather than a single relay, this kit has two SPDT units, one of which is an option. Two relays do not conserve power, but they do isolate RF-switching from other chores (voltage switching, receiver muting, etc.). Pat says this T/R switch can handle up to 100 watts; I have not put more than 20 watts through mine.

A word of caution: there was a conflict between the schematic and the parts overlay provided with the kit I got and repeated in the CQ article. D1 and D2 are shown in the schematic with their respective cathodes connected to the key input, but D2's polarity is reversed in the parts overlay. Price is $20, plus $3 for a mute relay, and $3 postage. • • •

See schematic on page 18

Footnotes:

1. DeMaw, Doug, "W1FB's QRP Notebook," ARRL 1991, pp 140-144.

Hayward, Wes, and DeMaw, "solid State Design for the Radio Amateur," ARRL 1986, pp 174-180.

Dobbs, the Rev. George, ed., "G-QRP Club Circuit Book", G-QRP Club, 1983 (later edition published by RSGB) pp 68 and 85.

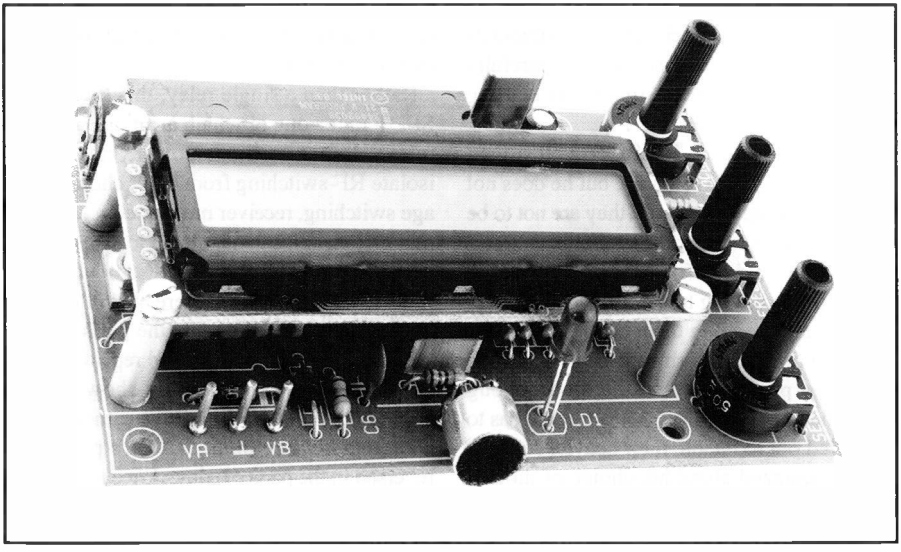
2. FAR Circuits, 18N640 Field Court, Dundee, Illinois 60118. Free catalogue. P-c board is $3.50 plus $1.50 postage for up to four boards. Specify QSK T/R Switch, Fig. 4-24, from "W1FB's QRP Notebook" when ordering.

Oak Hills Research, 20879 Madison St., Big Rapids, Michigan 49307. Catalogue $1.

624 Kits, 171 Springlake Drive, Spartanburg, South Carolina 29302. Free catalogue.

The schematic reproduced in Figure 1, page 18 is reprinted here through the courtesy of Oak Hills Research, Big Rapids, Michigan.

• New Products •



Velleman Kits of Belgium has in its line a Morse Decoder kit which we found to be exceptional in several features. The components are very high quality, including the display. The PCB is one of the best we've seen, with understandable parts-layout design and location, though some very close soldering is required in some instances.

This decoder kit should not be undertaken by a beginning kit-builder, and there are some pitfalls to avoid: the instructions can be difficult to understand on a couple of points, due perhaps to the fact that they were written (translated?) in Europe and incorporate some phrases which can leave an American builder wondering as to the intended meaning. For example, "screen" is used to mean "ground".

But none of the ambiguities were enough to prevent successful completion of the decoder, and though the soldering of the leads to the display became a bit tedious, it is a unit which you can take much pride in assembling.

There is one feature which deserves mention. There is a microphone, rather than line-based, input, which works much better than expected! The unit decoded signals which were very close to noise level across the room from the receiver!

Other features include sensitivity and filter width controls (the filter is super - allowing extremely broad to very narrow width adjustment). The unit is designed for battery operation.

A suggestion: place the parts first, and double check position and component identification, etc., before soldering. Once affixed, the parts will be extremely difficult to desolder and relocate. Watch out for the signal diode: the yellow band is the cathode end , unlike the other two diodes in the kit which are of American manufacture.

This kit took only about four hours to construct, compared to others which have taken up to eight! In short, you can expect to be

challenged by this kit, but it is well worth the effort, and the performance of the unit is truly exceptional!

Summary (Scale of 1 to 10):

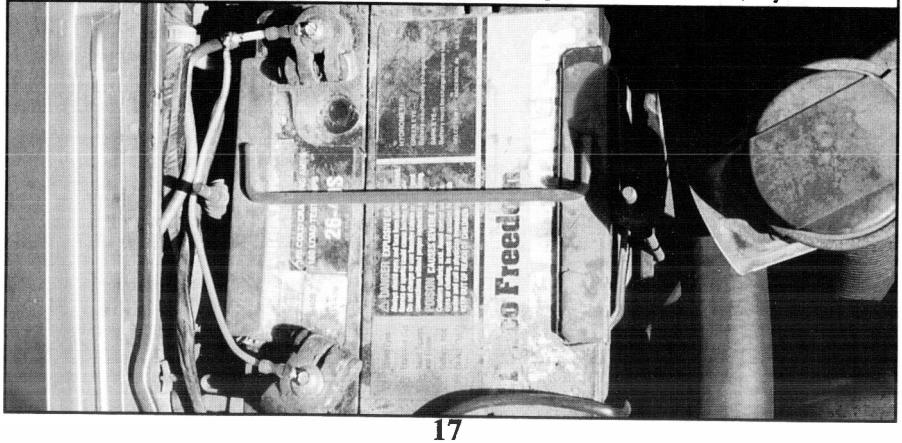
PCB	10
Parts	10
Performance	10
Instructions	5
Difficulty	8

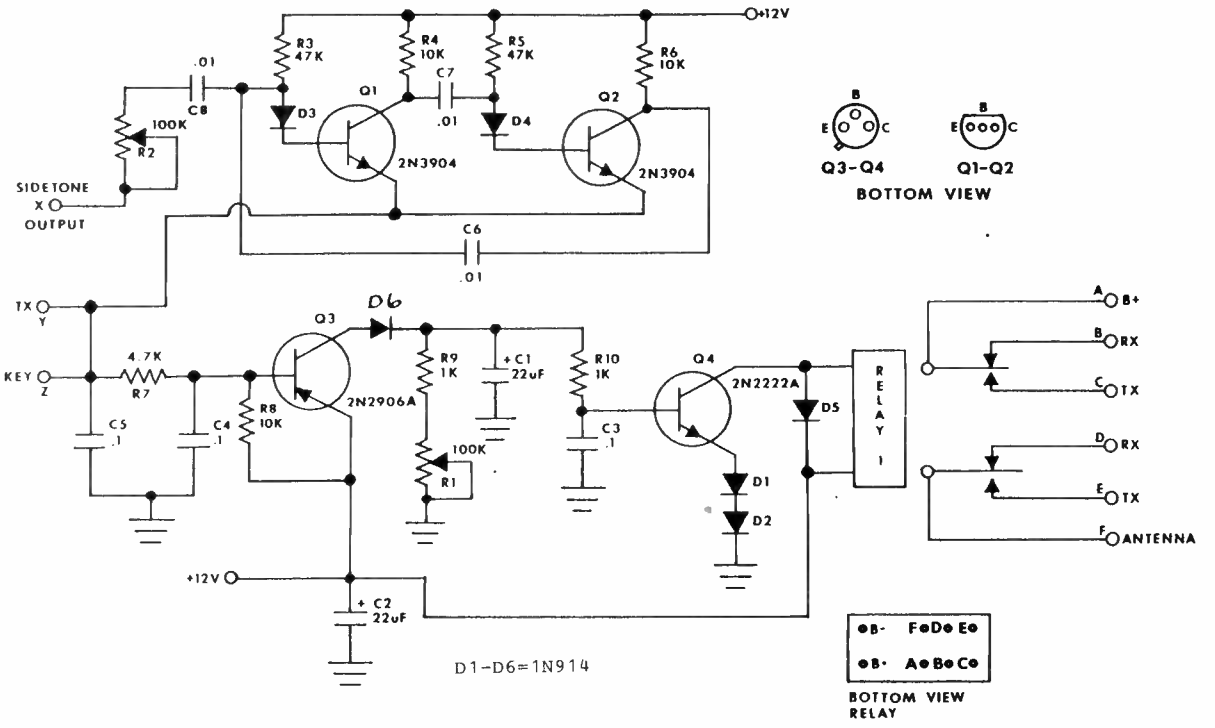
This Velleman kit is available from
Tapto Corporation
2650 18th. Street
Denver, Colorado
80211
(303) 480-7544

Retail price $109.95 • • •

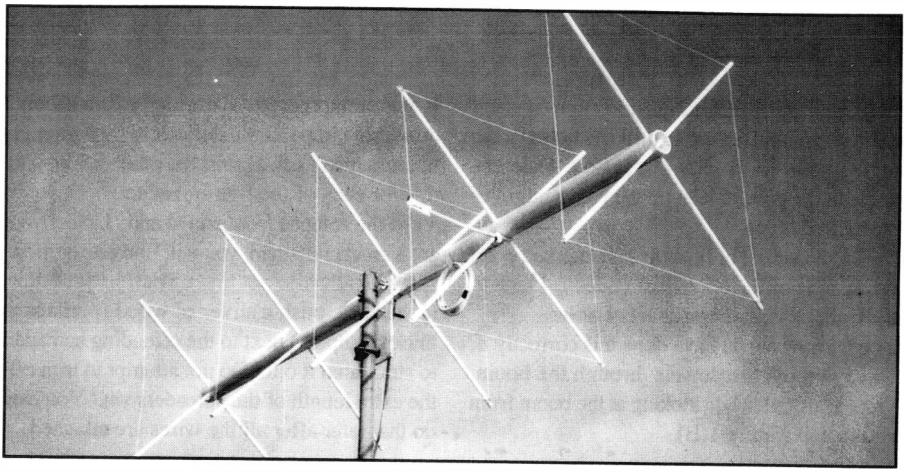
Bingo!

Here's another little gem from Bill Mason, NØKEP. A more sturdy, heavier-duty version of RG-58 coax used to ferry power from the car battery to the 2 Meter rig - the shield is used for the negative feed, keeping noise out of the line! Good up to around 20 watts, says Bill.





SCHEMATIC FOR T/R SWITCH WITH SIDETONE



A 2 Meter 5 Element Quad

(or How To Make Your 5 Watts Sound Like 45)

Bill Todd, N7MFB

(with help from Monty Wales, W7EVS, and Lightning Bolt Antennas)

The Field Day just past should remind QRP'ers that 2 meters is becoming more and more important as part of a concerted QRP contesting effort. Since 2 meters is considered a "free" station during Field Day, a good antenna is essential.

I was inspired to build a five element quad from rough notes supplied by Monty Wales, W7EVS, along with *proven* fine-tuned measurements from Mike Duddy of Lightning Bolt Antennas of Voland, PA.

According to Mike, this five element quad is capable of 12 Db forward gain. My own experience shows that a signal on 2 meters will increase about 6 Db over a vertical.

From start to finish, the antenna project took about four hours to build, and cost me less than $20 for parts.

Required Parts

Boom: Schedule 40 PVC pipe (1 1/4" outside diameter) Length = 5 1/2 feet

Spreaders: (10) 1/4" wooden dowels 4 ft. long (Oak is best)

Wire: Stiff bare copper 18 gauge unbraided wire is best. It is easy to shape into a square form for placement on the spreaders. You'll need about 35 feet of wire for the project.

Coax: A 4 foot length of RG-8 or RG-58 (make it 5 feet long if you want an RF balun).

Boom Construction

After you cut the PVC pipe to size, mark off the various distances between the elements of the quad; start at least 2 inches from the end of the boom for the reflector.

Mark the boom at the following points:

Reflector	2 Inches
Driven Element	15 Inches
1st Director	27 Inches
2nd Director	39 Inches
3rd Director	51 Inches

If you do not have a drill press, borrow one. It's a heck of a lot easier to drill accurately with a drill press than doing it by hand.

(Continued on page 20)

(Continued from page19)
Boom Assembly, cont.:

Drill a 1/4" hole through the pipe at each marked point. Be sure to drill the holes in the exact middle of the pipe at a perfect 90 degree angle to the pipe. Clean up the rough edges of the drilled holes.

Drill a second set of holes at each marked point on the side of the boom just under 1/4 inch to the right of your original set of holes.

You'll know if you have done this correctly if, when you put the dowels through the boom, you see an "X" while looking at the boom from end to end (figure 1-B).

Spreader Assembly

Before you push the dowels through the boom, treat the wood first with some kind of water sealant so the dowels do not warp due to moisture. I tried building a quad once for 440 Mhz without doing this, and after a few weeks the spreaders warped so badly that it actually de-tuned the antenna.

Push one dowel through the boom, and then push the dowel just to the right (on the side of the PVC) of the first dowel.

If you have measured correctly, the second dowel should be a little difficult to push through because it will rub against the other dowel. Do this for each of the five spreaders.

View the antenna from end to end. Unless you are a great craftsman, you will find one or more spreaders that do not line up perfectly. If this is the case, push a sliver of wood (perhaps a thick toothpick) next to the offending spreader to straighten it out. Do not attempt to trim off the extra length of the spreaders yet. You can do that later after all the wires are attached.

Wire Assembly

I chose to cut the antenna for 145 Mhz, and used the following lengths of wire. The antenna works great on 145 and 147 Mhz as well.

Reflector	86 5/8 inches
Driven Element	82 5/8 inches
1st Director	80 inches
2nd Director	80 inches
3rd Director	80 inches

(Continued on page 38)

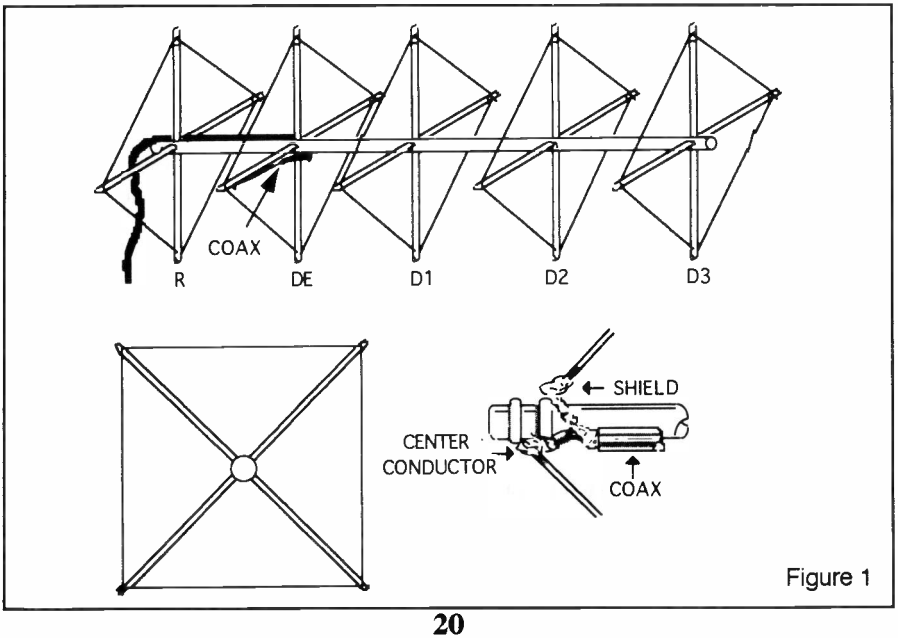
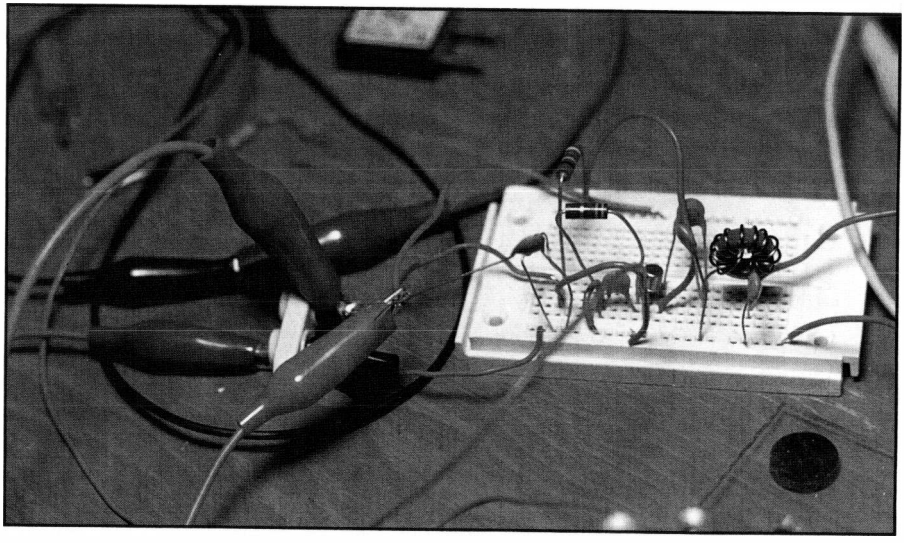


Figure 1

The 40 Meter *Pipsqueak*



The Pipsqueak Speaks!

Here's a QRPp toy we can all have some fun with, if you like. Discovered buried in an avalanche of old notes and odds n' ends, we thought it an elegantly simple circuit where some components must do double-duty in service to the oscillator/transmitter.

Originally designed for 30 meters, we modified it to squeak on 40, and really cannot place where it came from originally! Have you seen it before? Anyway, like a baby left on a doorstep, we hereby christen it "Pipsqueak", and offer it up for some experimentation.

We haven't the foggiest notion of how much power the 'Squeak is pouring into the antenna, though we suspect somewhere in the microwatt range. Will anyone out there in Hambrewland build it and measure its wallop? We'd sure like to know. It is capable of lighting a wheat lamp in series with a 2 megohm resistor now, so some RF is leaking from its lil' mouth, evidently.

How about an afterburner of sorts, perhaps to jack it up a bit in power - maybe with a buffer? A bell or whistle or two? You must agree that, in its present form, it *is* preeminently buildable at, shall we say, affordable prices?

Well, have fun and let us know what you find out and contrive!

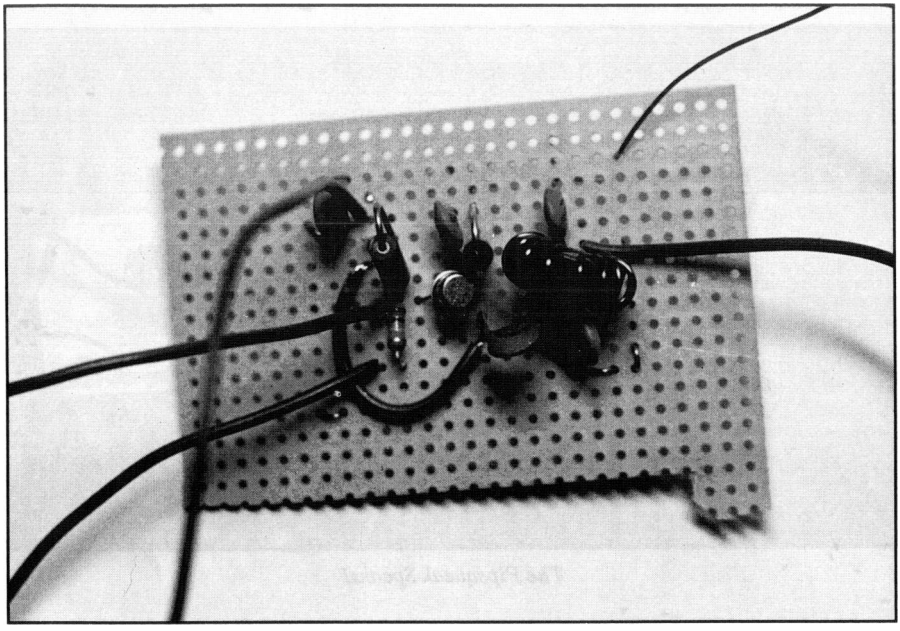
The Pipsqueak Saga will be continued...

See the schematic on the page 22. • • •

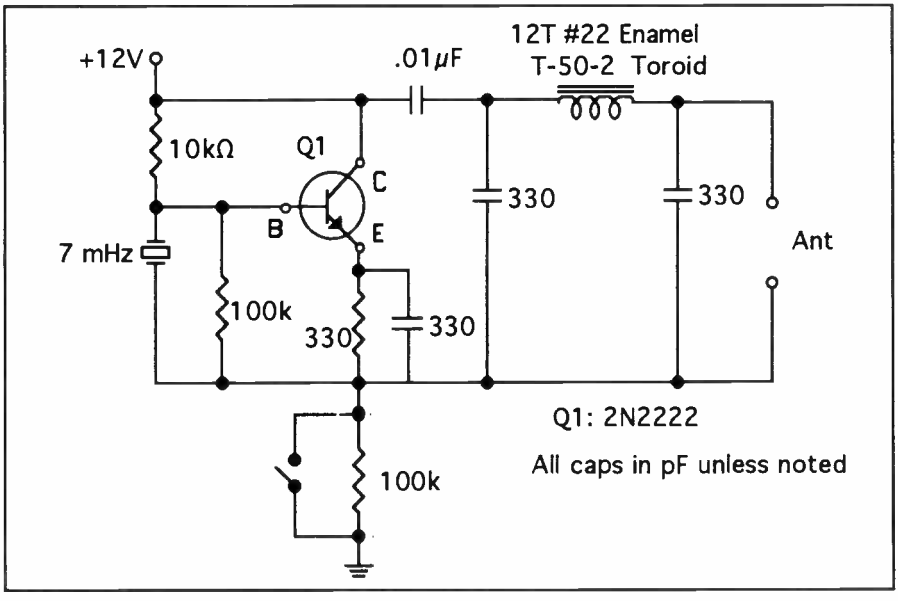
Not A Great Photographer?

If you have a project and would like to send a photo to us to be published, but you are put off by thinking that we need black and white photos, *don't worry*! Our press has a very high-quality twin-laser panchromatic scanner which handles color photos magnificently! So send color polaroids, prints from disk-wheel film, etc. - No problem!

(Continued from page 21)



The "Squeak" on perfboard

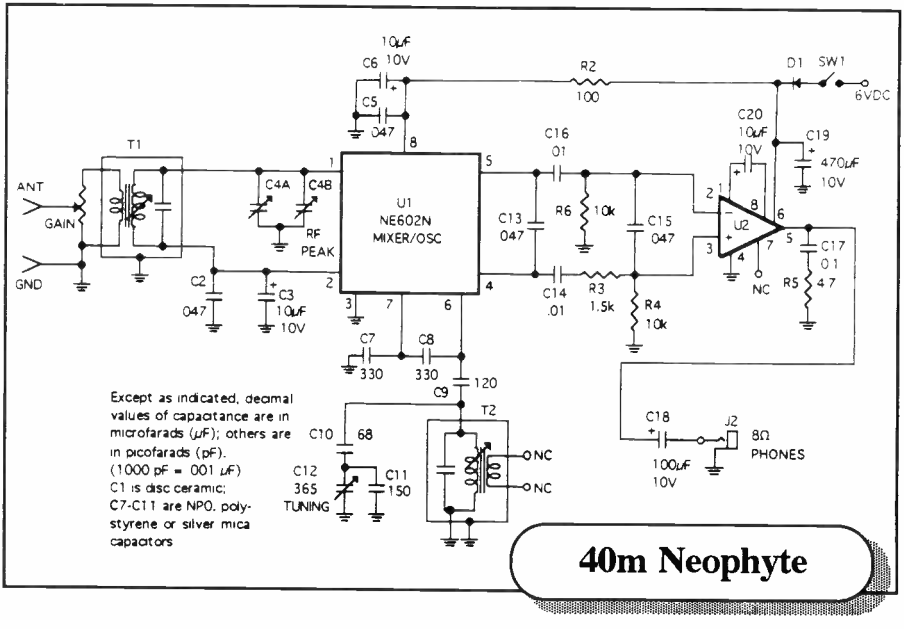


Pipsqueak schematic: simplicity personified.

Neophyte Roundup

The First Report In An Ongoing Compilation Of Neophyte Information

The Neophyte was designed by John Dillon, WA3RNC of Lewistown, PA. A direct-conversion type receiver built around the Signetics NE602N mixer/oscillator IC, and originally conceived for 80 or 40 meter operation, it previewed in the February, 1988 issue of QST, and stimulated much interest in the ham-builder community. Low noise, good sensitivity and lack of hum/microphonics, along with good frequency stability made it a contender to function on a communications level.



40m Neophyte

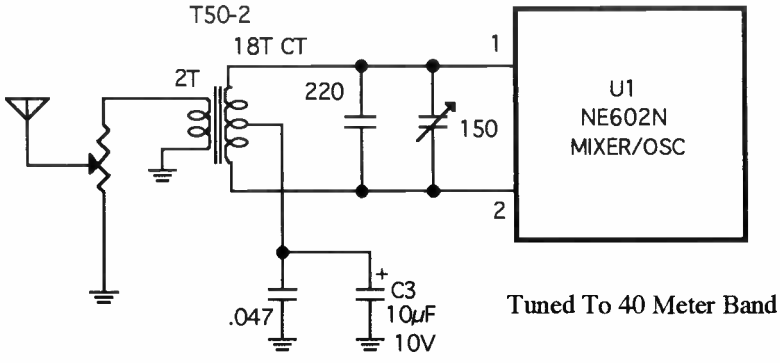
C2, C5, C13, C15: 0.047µF ceramic or polyester film
C3, C6, C20: 10µF electrolytic, 10 to 25V
C4: Two-section, polyethylene-dielectric variable; sections 59.2 and 141.6pF (Mouser 24TR222)
C7, C8: 330pF NP0
C9: 120pF NP0
C10: 68pF NP0
C11: 150pF NP0
C12: 365pF variable
C14, C16, C17: 0.1µF
C18: 100µF electrolytic
C19: 470µF electrolytic
D1: 1N4001
J1: Two position terminal strip (or standard ant. jack)
J2: Phone jack
S1: SPST switch
T1, T2: 10.7 MHz IF transformer, 7:1 turns ratio (421F123)
U1: NE602N
U2: LM386

(Continued on page 24)

(Continued from page 23)

Modification to Improve AM-Broadcast Signal Rejection

Revise RF input circuit for "true" balanced RF input:



This revision reduces (but does not eliminate) AM broadcast station pickup. I believe the reduction is due to the balanced input, but it might be due to the new High-Q input circuit.

Mike Dinolfo, N4MWP

The Neophyte: An Audio Amp Chain, Bandpass Filter and Frequency Dial

Stock Neophyte with audio afterburners, frequency dial & reduction gear tuning

(continued next page)

Wanting to put the Neophyte to good communications use, I added what I felt could benefit the audio portion of the circuit without major experimentation and mods. The stock kit utilizes an RF gain control as an audio gain device. By adding an LM386 in a commonly-used configuration (see fig 1), the audio came up to a speaker level. I found that leaving the RF gain control in the front end helped to eliminate broadcast interference without totally eliminating the desired signal(s).

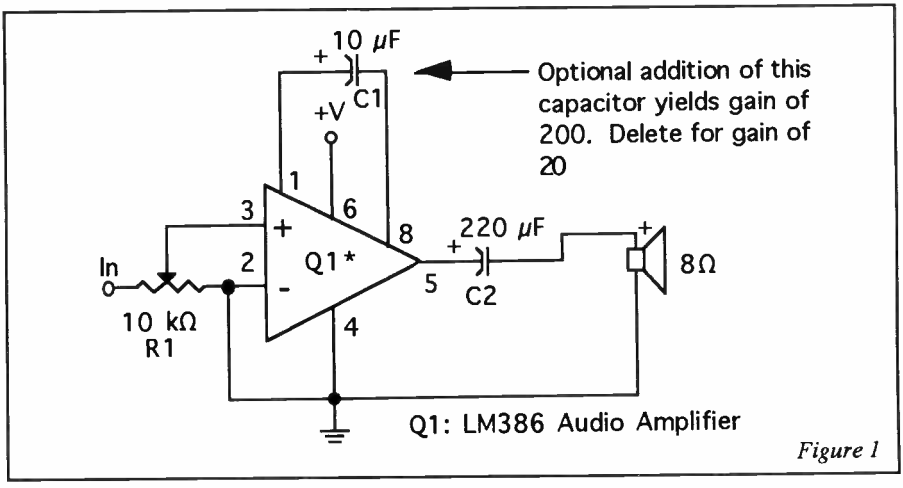
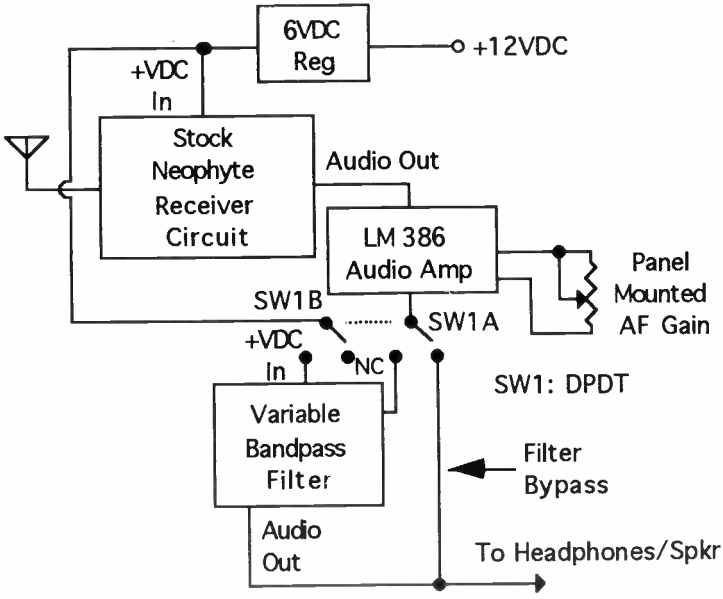


Figure 1

I also added the variable bandpass audio filter as shown in the Autumn, 1993 issue of **Hambrew**. The total scheme is outlined in the block diagram below:



I've worked a lot of stations with this arrangement, and the results have been satisfactory. The vernier drive is a 6:1 from Ocean State (see ad, inside back cover of this issue) - a scrap plastic pointer was added. Some great Neophyte stuff is rolling in for the next issue! -WFØK

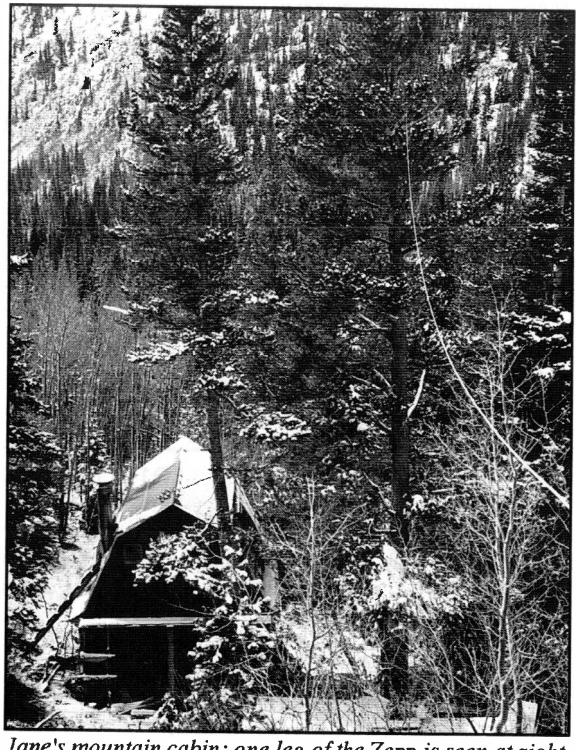
The Right Stuff

Larry Feick, NFØZ

If this article were merely another "Decoupling Loop" success story, it would only serve to clarify the way we view the invisible world of RF. Much more than that, it is a tale about an enchanting hermitage deep in the mountains of Colorado, where Jane Wodening, KBØHPH, writes exciting novels and makes QRP a way of life.

If one were flying over Klondike Mountain in a light aircraft, they would be more likely to spot the sun's reflection from Jane's solar panels than to spot her small two room, two-story cabin which is perched inconspicuously among the pine trees at 9750 feet above sea level.

Several miles removed from electric power and telephone lines, Jane dwells luxuriously in nineteenth century comfort among the mountain beasts and the clamoring quiet.



Jane's mountain cabin: one leg of the Zepp is seen at right.

Cozy and contented, Jane sits in her favorite chair, immersed in the radiant heat coming from her wood stove. Jane reaches for her speaker mike.

"This is KNØHPH, Hermits Prefer Hilltops, monitoring on the Castle Rock Repeater."

"KBØHPH, this is KEØNH, Good Morning, Jane."

"Good Morning, Wes, how are you this morning?"

"I'm just fine. What's new with you in the Fourth of July Canyon?"

"Well, Wes, maybe I should give up on HF. This is the second winter that I have been pumping a full two watts from my Hot Water 8 into the All Band Zepp, and still nobody answers me."

"Fear not, Jane, your problem is the lousy ground condition that exists on that mountain. The aggregate rock and clay is failing to present a counterpoise for your signal. I plan to send Bill and Larry up that mountain of yours to build a decoupling loop for your Zepp."

"Oh, my. That's wonderful. Will I be able to make QSOs then?"

"You bet you will. But promise me one thing..."

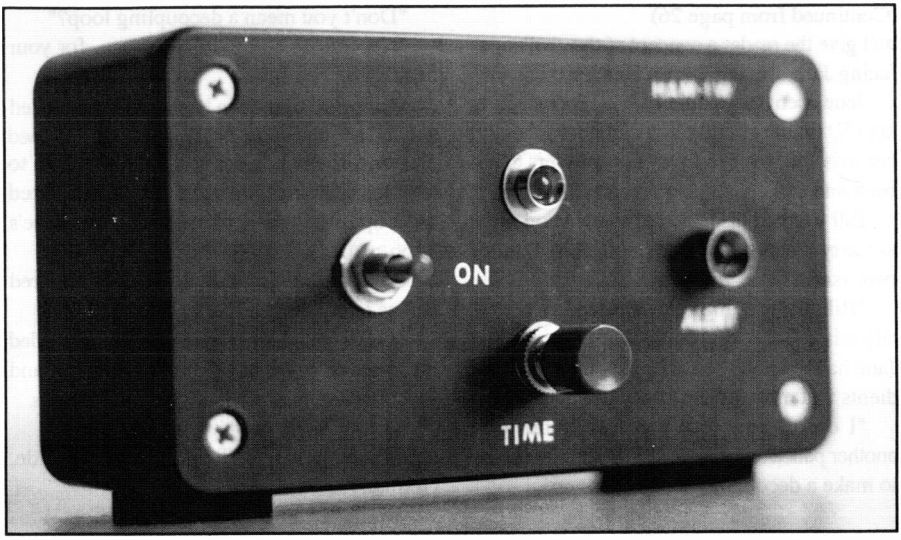
"Anything! What?"

"Keep a close eye on Bill and Larry, because they will have sharp tools. I don't want them to hurt themselves."

•—•••

Even if soil conditions in this canyon were excellent, a quick glance at the photo above

(Continued on page 28)



8 Minute I.D. Timer

George De Grazio, WFØK

Ever find yourself identifying your station more often than necessary because you feel a sense of uneasiness at not knowing how long it's been since the last ID, or because the station with whom you are communicating just identified and you aren't sure?

Here's a simple circuit using a 555 timer IC that will blink an LED at you roughly eight minutes after you reset the timer. The heart of the circuit is the handy 555, which can time from microseconds through hours, depending on the relationship between C1 and R1 (see schematic, page 40), and the value of C1.

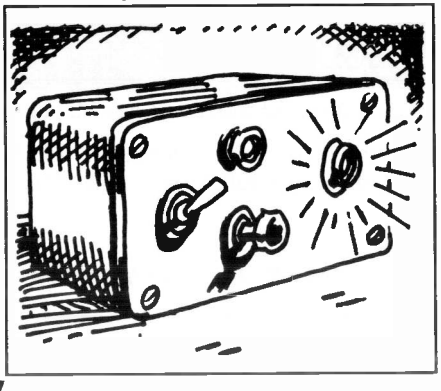
The rule of thumb: the more capacitance at C1, the longer the time delay. I selected 220 μF in parallel with 100μf because it activated the LED at a little over 8 minutes, and I wished to have a couple of minutes of buffer between the alarm and the end of the ten-minute time segment.

A power-on indicator LED was added as a reminder that the unit is on, since it is easy to walk away from the shack while still timing and the alert LED is off, only to return to a dead battery.

In addition to the adjustable duty cycle, the 555 output can source or sink 200 mA, and the output and supply are TTL compatible. In this application, the chip is configured as a one-shot monostable operation. The chip itself can be operated to +18VDC.

The notion occurs that it would be possible to install a circuit such as this in a homebrewed transceiver to remind the operator of his or her time status - on the panel! However, portability allows use on the dashboard while mobile.

This can be a handy little timer, and is fun to use and very dependable. Just don't forget to reset it after your last ID! (Cont. on page 40)



(Continued from page 26)
will give the reader a concept of the challenges facing Jane and her 2-watt Heathkit.

Jane spent the winter of '92/'93 perfecting her CQ on the straight key and strengthening her wrist, but received very few answers to her beck and call.

Bill warmed his hands over the wood stove as Larry reached for another of Jane's famous pancakes.

"Bill, do you think these pancakes are really this good, or do you think it's the idea that Jane had to snowshoe six miles for the ingredients that makes them special?"

"I don't know, but you had better save another pancake for me or I will show you how to make a decoupling noose!"

"Don't you mean a decoupling loop?"

"No, I mean a decoupling noose...for your neck!"

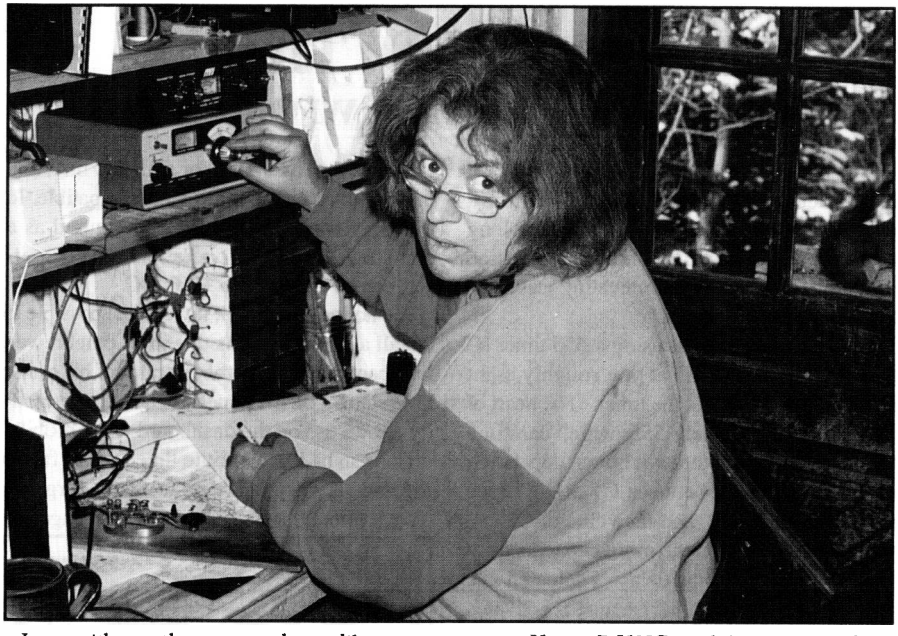
Using 300 ohm twin lead, Larry proceeded to wind a 7-turn loop, 18" in diameter. He used plastic garbage bag ties and electrical tape to hold the windings together. Bill then spliced the loop into the 300 ohm feed line on Jane's Zepp.

"We're ready for the smoke test," hollered Bill as Larry reached for another pancake.

Jane assumed the operating position, loaded the antenna with her MFJ antenna tuner, and began to hammer out a "CQ" on 15 meters.

KBØHPH de DJ9NG DJ9NG DJ9NG

GM Jane....Ur RST is 559 559 in Heide, Germany.



Jane, with mouth agape and eyes like saucers, greets Horst, DJ9NG, with her nervous fist.

"What is your secret ingeredient?" asked Larry as he reached for another pancake.

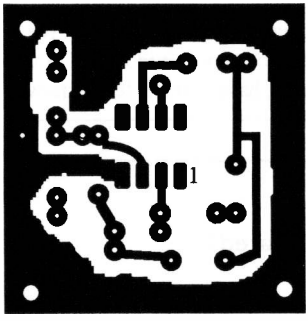
"Just the right stuff," replied Jane. "Just the right stuff."

For a diagram of Jane's Zepp and decoupling loop, see page 43

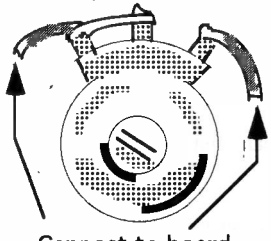
20/20 Hindsight

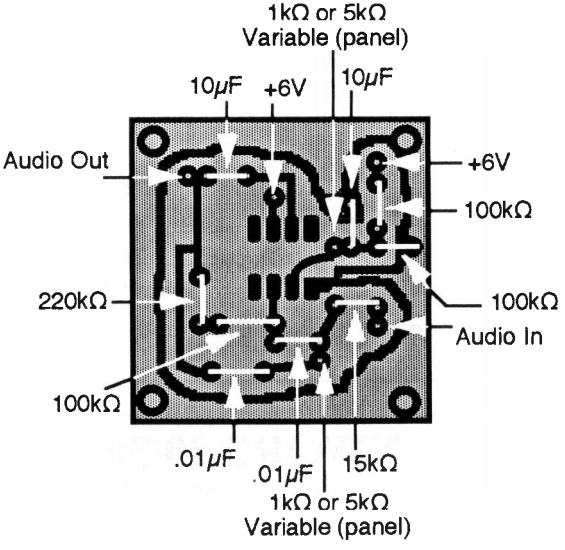
Looking Back Into Past Issues • Updates & Elaborations

Autumn, 1993 Issue, Variable Bandpass Filter, page 12:
Etching pattern and parts placement diagram



Viewed from bottom





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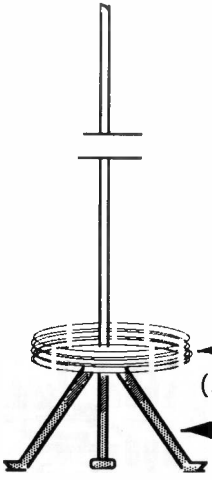
Dynamite DX Dipoles Update

(Autumn, 1993 Issue)

Wes Farnsworth's (KEØNH) article on decoupling antennas from ground to provide a proper counterpoise, along with our interview with NØKEP, Bill Mason, illustrating some practical extensions of same in the form of low-angle radiating parallel dipoles, are elaborated upon by Larry Feick, NFØZ, and Bill, who travelled to Jane Wodening's (KBØHPH) mountain home. Larry tells the story in this issue, relating the application of the loop to Jane's Zepp antenna. If you enjoyed the previous articles, be sure to note the article on page 26 herein. And in case you were wondering about installing a decoupling loop on a vertical antenna, we have provided a suggestion on page 30.

(20/20 Hindsight, Continued from page 29)

Installation of Decoupling Loop on a Vertical Antenna



Wes, KEØNH, tells us that this configuration of the decoupling loop on a vertical antenna will work just fine, and that the radials may be eliminated! We have yet to prototype this idea, so if you are interested, have at it and let us know the results!

NWQRP 30/30 Transmitter

Autumn, 1993 Issue

R6 in the schematic is listed as 22kΩ, but in the parts list as 2.2kΩ;
The correct value is **2.2kΩ**

The inductor L1 is shown as 18μH on the schematic, but 18MH in the parts list;
The correct value is **18μH**

WUPS!

Yup, we goofed...the deadline for the RIG-O-RAMA Contest is not really 10 months *prior* to the date of our last issue! Soooo, we extended the deadline to allow time for interested parties to cook up a winner! See page 6 for the *correct* info.

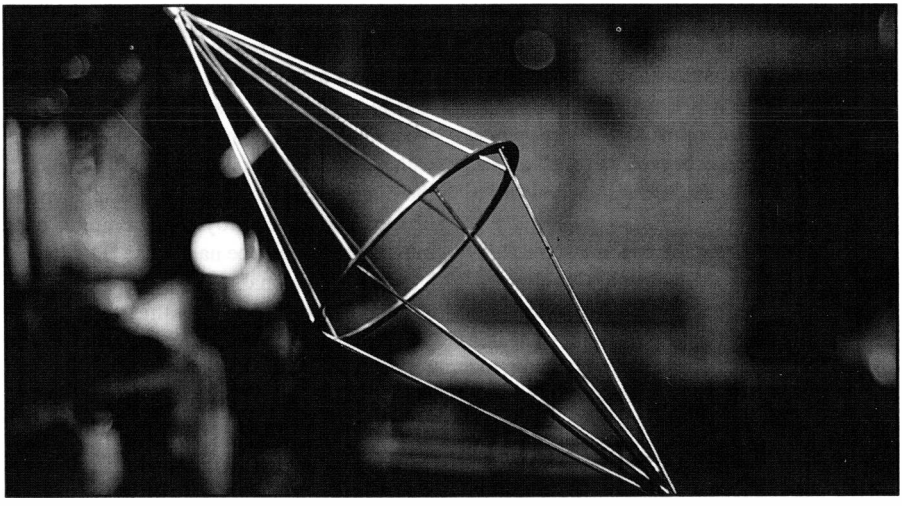
Moving?

Please notify us of your new address - the Postal Service will not automatically forward your copies of **Hambrew**!

The Di-Conical Monopole Antennna

Dave Clingerman, W6OAL

Olde Antenna Lab, 4725 W. Quincy, Denver, CO 80236



The Olde Antenna Lab from time to time is commissioned to design and create some rather unique and innovative antennas to meet customer requirements. The most recent bit of innovation was a request to engineer a simple, unobtrusive antenna that would respond to both vertical and horizontal polarization in the VHF band (30-300 MHz), specifically 146 MHz. An antenna designed to meet these specifications is destined to reside on the after portion of a balloon-borne payload. The payload will circle the polar region of Antarctica early in 1994. This project is under the leadership of Dr. Norm Kjome, Physics Professor, University of Wyoming. Dr. Kjome has been creating and flying balloon-borne scientific payloads for years and has to his credit numerous successes.

Now, not all of us fly payloads around the continent of Antarctica, but such an antenna may still have application to the everyday ham. Mobiling around the Front Range of Colorado, there are many times our signals bounce off the mountains and give us some weird sounding signals or even a loss thereof. Some of these effects are due to multipath. A signal that has just rattled on down a canyon may not come to your vehicle with the same polarization by which it was originally propagated. This is also the case in the HF band: (3 -30 MHz). Once the wave front of a certain polarization has been refracted by the ionosphere, it is anyone's guess what the polarization will be once it returns to Earth.

An antenna that is sensitive to only one polarization, in many instances, is at a loss. An antenna that exhibits sensitivity to both vertical and horizontal polarization, providing it is no more obtrusive than a dual band vertical or a Halo, should certainly find application with the above-cited VHF situation. An added benefit is that only one antenna would be required to support operations using the multimode rigs of today. When operating in the SSB mode on VHF/UHF, almost all of the fixed (home QTH) (Continued on page 32)

(Continued from page 31)
stations are horizontally polarized, while our FM repeater operation is just the opposite. A single antenna that will allow you to operate both modes while mobile has to be cost-effective and maybe even wife-approved. This brings us back to Dr. Kjomes' request for his spacecraft VHF antenna. Just how did such an antenna come about?

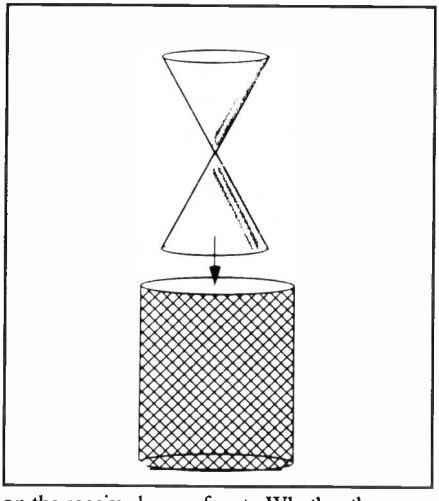
A research effort was undertaken to find an antenna that would meet the requirements which led to the exploration of Tri-plane Orthoginal Turnstiles, Entwined Loops and a myriad of other configurations. Since vertical and horizontal had to be received at all angles, it seemed to us that the device somehow had to be round in structure.

At one time when I was doing some R&D work in the field of Electronic Countermeasures, we had a requirement to develop a special Direction-Finding System; special in that it not only DF the signal of interest, but also indicate if the signal was vertically or horizontally polarized. We had a spinning reflector system that we used for some X-band work, consisting of a "spade"-looking reflector that directed energy into an open-ended waveguide, so we used this as our starting point.

Next, we needed some sort of geometric shape that would have a little bandwidth and be sensitive to vertical and horizontal wavefronts. We experimented in two-dimensional figures to try and visualize something that would be suitable. What looked feasible was a couple of equilateral triangles configured with a common base. If the apex of one of the triangles was the feedpoint and one of the sides was placed near a ground plane but slightly elevated from the horizontal, the object would have not quite a perfectly horizontal component and not quite a perfectly vertical component. This would be great for certain angles but not all. We saw that if the triangles were to become cones, the base became a diameter, thus we had almost vertical and almost horizontal components at all angles. One was constructed that was a quarter wavelength apex to apex, at S-band (2 GHz region), so that we could do an evaluation. The response was great, so one was constructed for X-band (10 GHz region), and it was placed at the focus of the spinning spade. We found it to work quite satisfactorily.

The little object just created resembled a toy "top" in a way. Referring to this object as a "Top Antenna" didn't sound like a very technical name, so a search of math books on conic sections was undertaken, followed by a search in antenna reference books, but neither suggested an apt name. I decided to try a logical approach to describe the object which went something like this: Since a pair of cones with a common apex is known as "Bi-conical", the diametrically oppositional displacement of those cones employing a common base must then logically be named the "Di-Conical Monopole Antenna".

The theory behind the Di-Conical Monopole Antenna and why it works requires a paragraph or so of explanation. Employed at the National Laboratories in Boulder, Colorado, I soon became acquainted with a mode of operation used to receive vertical and horizontal polarization called "slant right". this is achieved through the use of a vertically polarized bi-conical array. The array is then outfitted with a slanted polarizing grid (see figure below). The grid causes a venetian blind effect



on the received wave front. Whether the wave front is vertical or horizontal, it will be af-

fected by the polarizing grid. This effect will cause the incoming energy to arrive at the biconical's receiving element in an attitude to transfer a maximum level of energy to the transmission line and ultimately the receiving system.

The Di-Conical Dipole Antenna uses the slant right principle for its mode of all-angle reception of vertically and horizontally polarized energy by employing the physical configuration of the receiving element itself. A point to be made here is the fact that a vertical monopole antenna will receive a maximum of vertically polarized energy when it is aligned perpendicularly to its ground plane. If that monopole is bent out of the vertical, the received signal will decrease at a level consistent with the cosine function of the angle between the receiving element and the angle of the wave front E-field polarity. Only half the power of a vertically polarized wave front will be received when the receiving element is at an angle of 45 degrees:

Cosine 45° = .0707

20 Log 0.707 = -3 dB.

Any straight length of the Di-Conical Monopole observed from any angle never reaches a sine angle of 45° or a cosine angle of 45° when the equatorial ring or base of the device is 45° to a horizontal ground plane.

A monopole perpendicular to a ground plane will exhibit a terminal impedance of 36 ohms. To cause the impedance to approach 50 ohms, the best and most direct way is to stub-tune the radiating element at the feedpoint. Another method is to bend the radiating element toward the ground plane, increasing the capacitance of the circuit. Nw besides destroying an already poor pattern, the increased capacitance lowers the resonance point of the antenna. The Di-Conical Monopole, being broad in the middle, has a reduced Q and therefore a broader bandwidth than a skinny radiator,

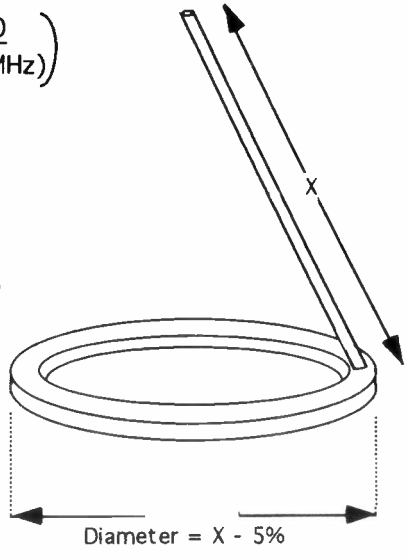
$$Q = (X_L \text{ or } X_C) / R.$$

The geometry of the Di-Conical causes the pattern to not be perturbed when leaned toward the groundplane as would be a skinny radiator. The impedance is very close to 50 ohms over a broad band, allowing a 1.0 : 1 VSWR over about 30 MHz in the VHF band, or a 20% bandwidth. Construction of a Di-Conical Dipole requires the construction of a pair of cones with a common base (see figure below). The base is made of a flat ring of copper or brass about (Continued on page 34)

$$\text{Length of X in inches} = \left(\frac{2800}{\text{freq. (MHz)}}\right)$$

Example: X for 146 MHz = $\frac{2800}{146}$

X = 19.18"



(Continued from page 33)

3/8" wide (a big washer). The length of the side of the antenna in inches is found by

2800 / F MHz.

The diameter of the base should be approximately 5% less than the length of the side of a single cone.

The base may be constructed by first laying out the circle for the outside of the ring on a sheet of copper or brass, then scribing the inside circle with 3/8" less radius. A fly cutter can be used for the cutting, but great caution must be exercised with this method: use of vises and clamps to secure the work, and a safety extender bar on the lever of the drill press are recommended. An alternate method is to drill three or four small holes to insert a coping saw metal blade, whereupon the circles can be sawed by hand.

The cones are of skeletal construction (spines/rods). I recommend no less than eight spines to be used in the construction of each cone. Making a paper template of the flat ring facilitates using a protractor to divide the circle for layout of the rods. The side of each cone will be approximately 1/8 wavelength at the lowest frequency of contemplated operation.

After the spines are soldered to the base ring, the apexes of the spines can be soldered together into a small copper end cap. I used a 3/8" plumber's copper cap. Construct a ground plane that is 0.5 wavelength at the design frequency:

Diameter (gnd plane) = 5880 / F MHz.

Mount a coaxial connector of choice in the center of the ground plane or center of a vehicle roof. Solder one of the end caps to the coax fitting center pin, making sure that the plane of the base ring is 45° to the ground plane. This positioning will allow the antenna's vertical plane(s) at any angle to never be exactly vertical nor exactly 45 degrees out of vertical. The same will apply for the horizontal component.

Use dielectric material between the base ring and ground plane to hold the antenna in place. This "prop" can be made of nylon, teflon® or durall®; check with a local plastic supplier. The prop is notched at the top to attach to the antenna ring, and is secured with a screw. A hole is drilled through the ground plane, and the prop is secured to it with a screw from the bottom.

The original creation of this antenna had a designed center frequency of 146 MHz and exhibited a flat VSWR response of 1.0 : 1 from 130 to 170 MHz. The pattern is hemispherical with very little degradation in signal level between vertical and horizontal.

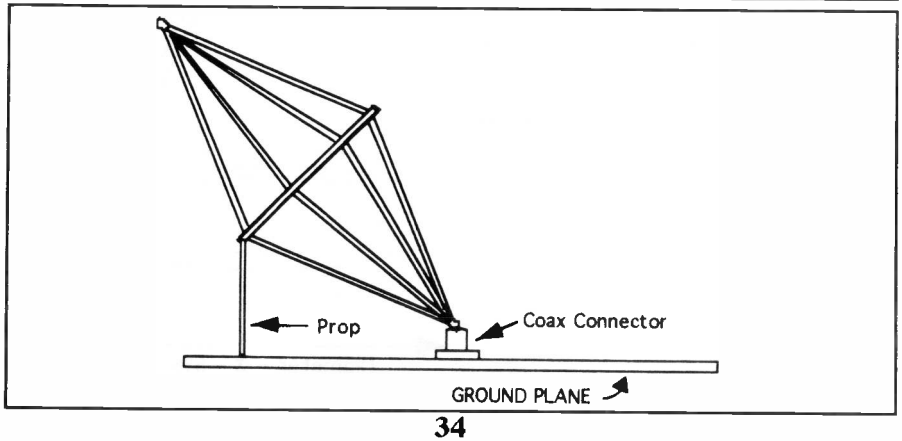
73,

Dave - W6OAL

Note: If you would like to have a Di-Conical Monopole but don't wish to build one, contact Dave at

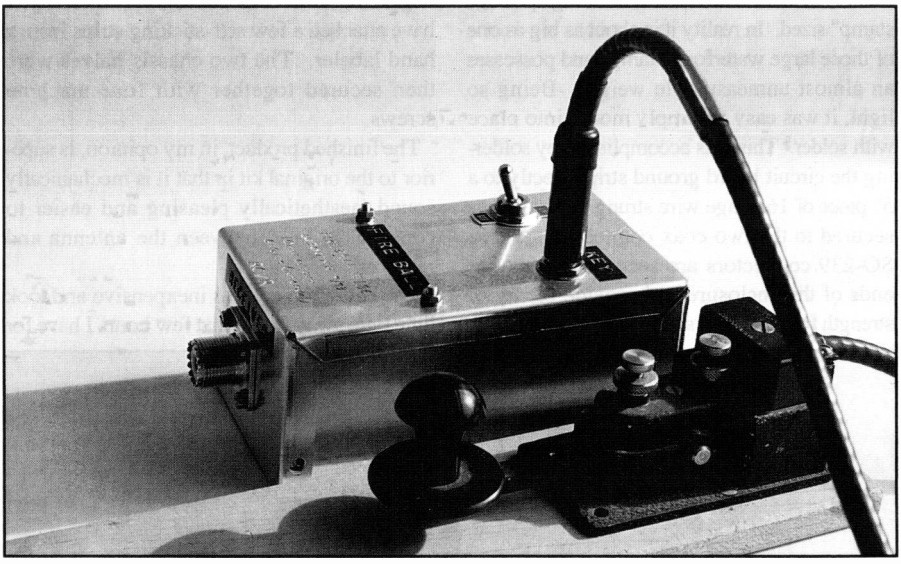
The Olde Antenna Lab
4725 W. Quincy, Denver, CO 80236
(303) 798-5926

• • •



Modifying The Fire-Ball

Roger J.Wendell, WBØJNR



Having always been fascinated with QRP (less than 5 watt transmissions), I decided to get involved at much lower levels of power in early '93. I began by concentrating my efforts at output levels of less than one watt (designated QRPp).

After a while, I found that contacts were becoming relatively routine, even with a downturn in propagation. At power levels of 250 to 500 milliwatts, I was working most of the U.S., Canada and Mexico on a variety of HF bands with a trapped vertical.

The time had arrived for even more serious QRPp levels. Perusing the various ham magazines, I stumbled across an ad for a transmitter kit that boasted 10 milliwatts (that's one hundredth of a watt) of output power. This "postage stamp"-sized transmitter called the Fire-Ball was being offered by Smith Enterprises[1] at a reasonable price. I quickly ordered one.

The transmitter, along with a sequentially numbered membership certificate, arrived unassembled as advertised. It took about an hour to solder the coax connectors, T/R relay, 10 turn pot, and transmitter module (an oscillator used in personal computers) to the pre-etched circuit board.

In ordering the kit, I selected a crystal frequency of 28.060 Mhz to put my flea-powered transmitter on the "international" QRP CW calling frequency. By simply plugging the transmitter's supplied cables between my transciever (the Fire-Ball's T/R relay will pass 100 watts through for QRO operating) and the coax to my vertical - I was on the air.

The setup worked great, except that the dangling wires, connectors and battery pack "power supply" (not included in the kit) were a bit unsightly, in addition to being mechanically fragile. To clean things up a bit, I decided to mount everything, including the four AA cell power supply, into an old 5 X 3 X 2 inch aluminum chassis box.

With a full time job, wife, kids and graduate school, I had little time (Continued on page 36)

[1] See end of article for address

(Continued From Page 35)
for construction "art". Nevertheless, I was able to quickly and tastefully mount the Fire-Ball transmitter and its associated peripherals into the box in a matter of hours.

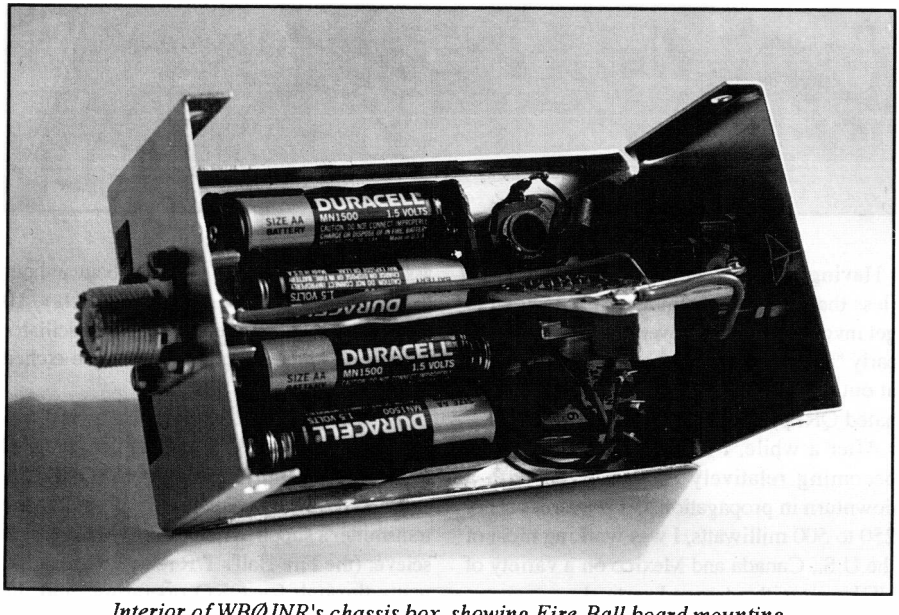
The Fire-Ball is advertised as being "postage stamp" sized. In reality it is about as big as one of those large waterfowl stamps and possesses an almost unmeasurable weight. Being so light, it was easy to simply mount into place with solder. This was accomplished by soldering the circuit board ground strip directly to a 5" piece of 16 gauge wire strung between lugs secured to the two coax connectors. These SO-239 connectors are secured at opposite ends of the enclosure and provide plenty of strength for mounting such a lightweight board.

ing to the chassis wall. The On/Off switch, key jack, and SO-239 were all mounted to the chassis box using conventional methods.

Labeling was also accomplished in an easy and inexpensive fashion with the use of an engraving pen. For photographic clarity, I have attached a few self-sticking strips from a hand labeler. The two chassis halves were then secured together with four machine screws.

The finished product, in my opinion, is superior to the original kit in that it is mechanically sound, aesthetically pleasing and easier to connect "in-line" between the antenna and receiver.

The entire project was inexpensive and took little time away from what few hours I have for



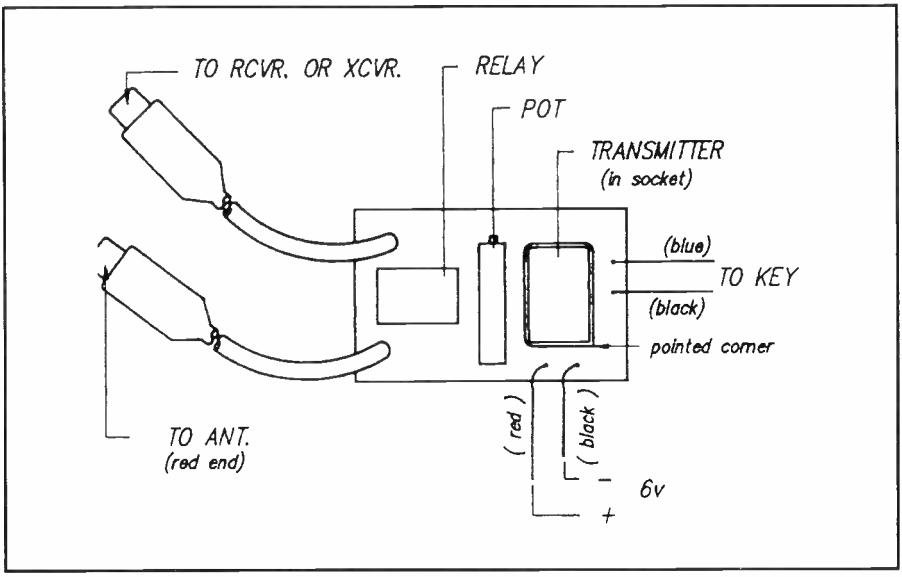
Interior of WBØJNR's chassis box, showing Fire-Ball board mounting

Further mechanical stability was provided by using similar wire (and technique) between the circuit board's RF connections and the SO-239s' center posts. It is interesting to note here that my RF connections are actually shorter than the cables supplied by Smith Enterprises - a benefit for those purists in the audience.

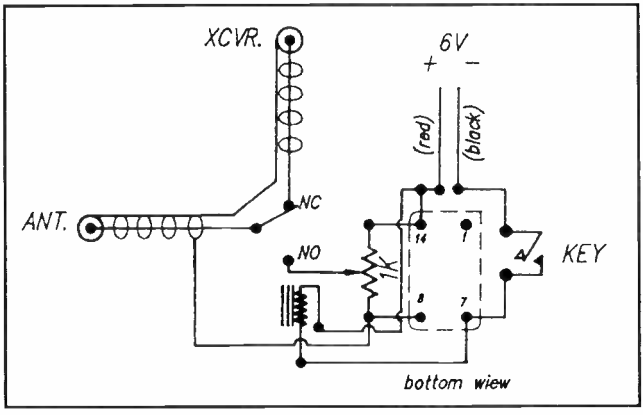
The 6 volt "power supply" (four AA cells inserted into a Radio Shack battery holder) was a bit heavier, and required direct mount-

operating. To date, I have completed a couple of local prearranged contacts. While studying my homework in the ham shack, I set my memory keyer for a series of CQ's with long pauses after my call sign. I am confident that a random, over the horizon QSO at the 10 mW level is just around the corner.

The possibilities for modification of the Fire-Ball are almost endless. Better enclosures (or permanent mounting (Continued on page 37)



Stock Fire-Ball layout, showing antenna leads supplied by the manufacturer



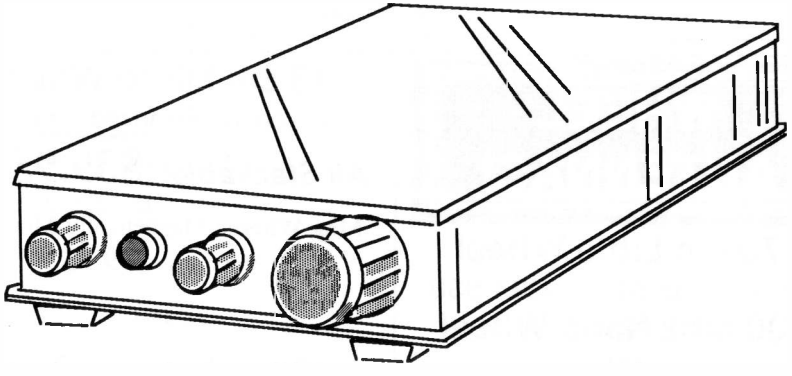
Fire-Ball Schematic; Article concludes on page 42

(Continued from page 20)
The measurements are taken after the wire has been cut, twisted together and soldered. *Therefore, add about two inches to these lengths when you cut the wire.*
Add four inches to the length of the driven element wire for future adjustment.
Before attaching the various wires, form the wires into a perfect square. When attaching the wires to the spreaders, start with the reflector first, then attach each of the various directors. It takes a little patience, but be sure to place the element wires so that all four corners of the square are the same distance from the boom. The driven element wire should be attached at one corner of one of the driven element spreader arms. The extra two inches of wire on each end of the driven element will be used to wrap around one of the spreader arms.

Construction Notes

When attaching the wires to the spreaders, you can use any method you wish, but I found that small finishing nails pushed through the spreaders made for a solid fit.
Make a pigtail lead at one end of the coax and solder it to the driven element (see figure 1-C, pg.20). Seal the connection with RTV silicone or coax seal. Place a coax fitting at the other end of the coax. Run the feed line from the driven element all the way down past the end of the reflector. Then leave a few feet of coax for a rain drip and attach the feedline to the mast.
If you plan to use the quad for simplex 2 meter FM contacts, be sure to mount the quad to your mast or pole so that the feed point is on the side of the antenna rather on the top or bottom.
I hope you have fun building the quad, and that you are happy with the results! • • •

How about a very inexpensive solution to the age-old cabinet/case dilemma for that not-too-tall project?
A VHS video cassette storage box can look pretty slick with white transfer type control labels (a coat of hair spray makes them more permanent) and it has a pop-top! A great idea from KEØNH.

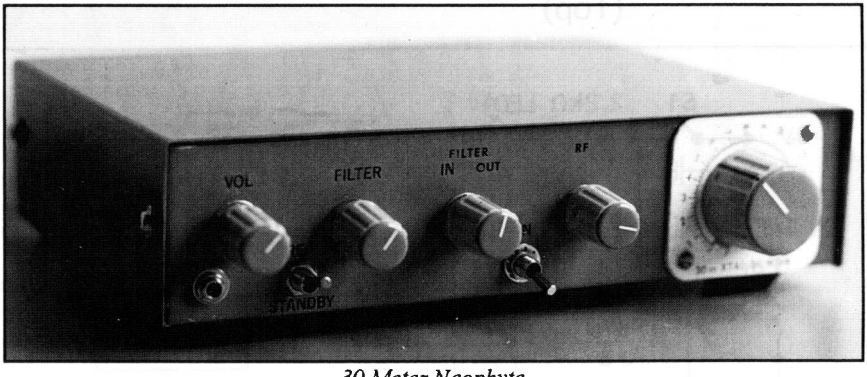


Free Hambrew Classified Ads

We've Expanded This Service To Commercial Subscribers!

Hambrew will provide one classified ad per issue *free of charge* to ANY **Hambrew** subscriber up to 15 words (see page 46). It's a great way to buy, sell or put out an all-points bulletin for that elusive manual or schematic for which you have been looking. We're glad to publish your ad as a reader service, and we welcome your taking advantage of the opportunity. We simply ask that you be honest about the condition of any equipment which you offer for sale, and that you submit all ads in writing in time for the deadlines listed in the classified section. Thanks For Being A **Hambrew** Subscriber!

Neophyte Roundup

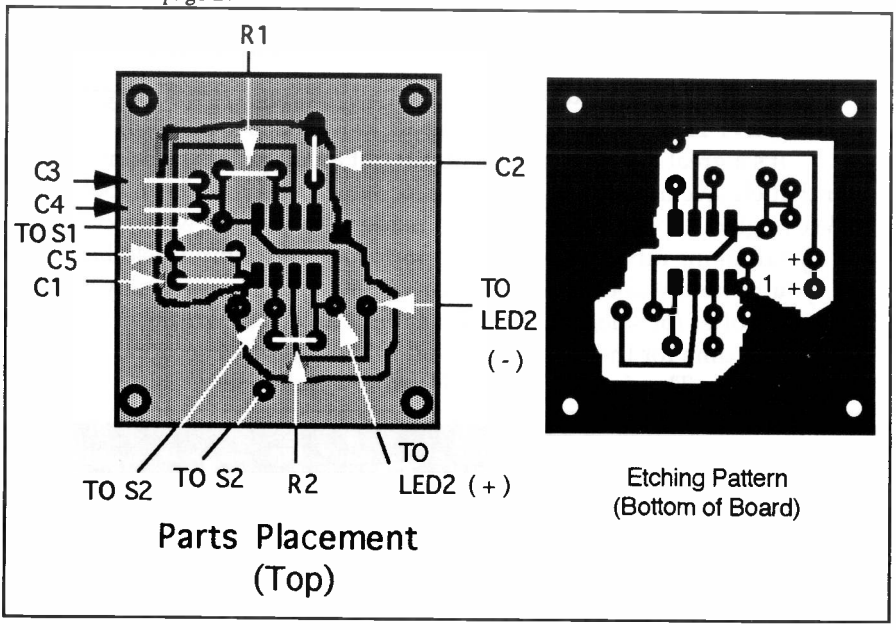


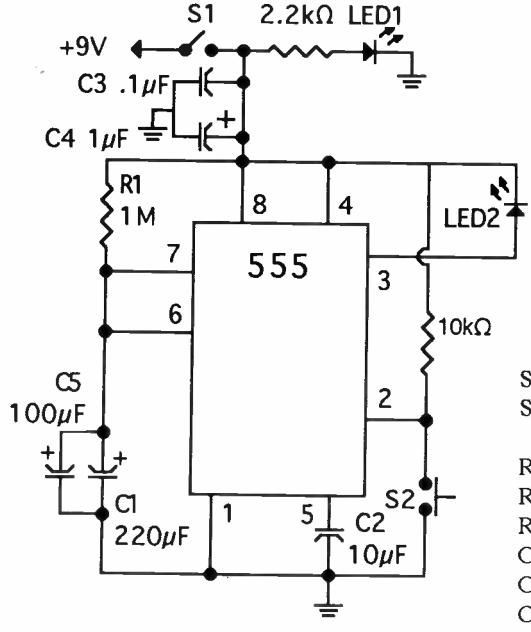
30 Meter Neophyte

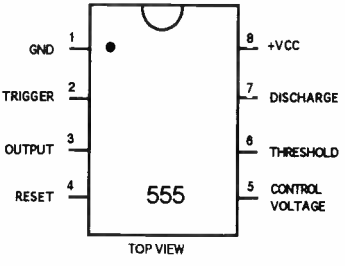
You are cordially invited to send along any photos and/or information on mods made to your **Neophyte Receiver** to be shown in our Neophyte Roundup in 1994! Even if you built a stock kit without modifications, our readers would like to see how you chose to package it, so send along a photo and tell us about it!

And be on the lookout for the Neophyte Roundup in **Hambrew** in '94!

Continued from page 27







8 Minute ID Timer

S1	SPST Switch
S2	Momentary contact switch, normally open
R1	1MΩ
R2	10kΩ
R3	3.3kΩ
C1	220μF electrolytic
C2	10μF
C3	.1μF
C4	1μF electrolytic
C5	100 μF electrolytic
LED1	Green LED
LED2	Blinking-type red LED

The Hambrew Dash Is Coming!

Hambrew will be conducting a CW Contest later this year! There will be bonus points for homebrewed (including kit) gear used in the contest, natch! We need a Contest Editor who can handle the data and compile the totals...if you are that editor, let us know soon! Details on this event, including prizes, will be announced in the Spring, '94 Issue!

(Continued from page 37)
inside of the receiver!), VFOs, power indicators and amplifiers are all within the realm of the homebrewer. Have fun, and give me a call on 28.060 - a pleasant break from studying is always welcomed!

The Fire-Ball is available from:
Smith Enterprises (619) 257-3366
48788 Silver Valley Road
Newberry Springs, CA 92365
SASE for information •••

Parts List

Radio Shack Parts:

SO-239	#278-201
SPDT miniature toggle switch	#272-1154
1/4" open frame key jack	#274-252
6 Volt 4 "AA" battery holder	#270-391
5 X 3 X 2 inch project box	#270-238

Earth Friendly Technologies

QRPp Low Power Award

PURPOSE: To promote the enjoyment of low power operating while demonstrating its usefulness and practicality.

AWARD: Successful applicants will be issued an Award Certificate and a unique registration number assigned to them for life (regardless of call sign changes).

BENEFITS: By encouraging low power operations, it is believed that the art, hobby, and professions associated with RF communications will have a greater number of skilled and competent operators at their disposal. In addition, lower levels of QRM and RFI will be experienced while less pressure is being placed on the Earth's resources.

RULES: Any authorized amateur frequency and legal mode of communications may be utilized. The person/station applying for the award must demonstrate, to the satisfaction of the Certificate Manager, the following:

1. That the applicant's transmitter output power during the period of qualifying communications, was accurately measured to be less than one watt (QRPp).
2. That the distance between the applicant's transmitting antenna and the receiving station was over 100 kilometers (63 miles).
3. That no artificial means of active relay was used to complete the communications (i.e., repeaters, satellite transponders, digipeaters, land-lines, etc.). However, reflections off of the ionosphere, mountains, tropospheric ducts, auroral curtains, meteors, the moon, satellites, buildings, aircraft bodies and other passive reflectors are acceptable and encouraged.

APPLICATION: A. Send a signed statement to the Certificate Manager affirming that the transmitter power was less than one watt, the distance was greater than 100 kilometers, and that no artificial means of active relay was utilized.

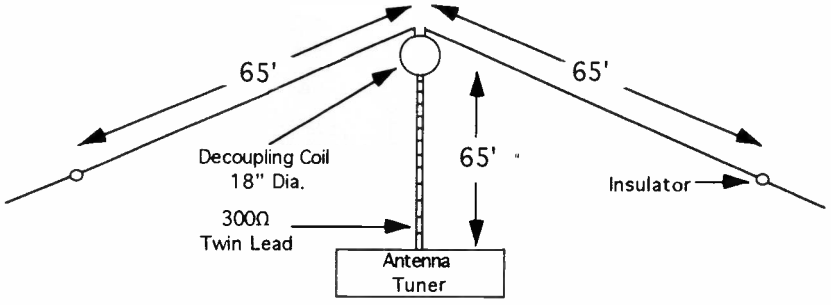
B. Provide the Certificate Manager with a photocopy of either the station log or the confirmation QSL card, clearly showing the date, time, mode and frequency that the qualifying communication took place on.

C. If desired, provide the C.M. with information concerning any endorsements (such as longer distances, WAC, WAS, WAZ, Solar, etc.) that you may want listed on your certificate.

D. Mail $4 U.S. ($5 Foreign) along with application materials A, B and C to:
EFT LOW POWER AWARD, POB 460101, Aurora, CO 80046-0101

(Reprinted as a service to QRP and EFT)

(Continued from page 28)



The Right Stuff

- 130 feet of single-conductor antenna wire
- 100 feet of 300 ohm twin lead (65' lead-in + approximately 35' for the coil)

(Note: Position the decoupling coil in the same plane as the antenna)

A Sentimental Journey

Chuck Albrecht, NØCKW

On the high plains just a short drive east from Denver in the town of Byers, Colorado, stands the Colorado Bighorn Amateur Radio Club Museum of Amateur Radio. The curator, Don Zielinski, KØPVI, has been licensed and active in ham radio since 1957 and pretty much grew up with the earlier tube-type (hollow-state?) vintage equipment of yesteryear. He has amassed a very extensive collection of gear. Aggressive "RF Bullies" with names such as VIKING, MARAUDER, APACHE, INVADER, THUNDERBOLT, WARRIOR AND CYCLONE adorn the impressive display.

The museum contains, for the most part, a Don's personal collection, but donated items are also in abundance. As of this writing, there are over 200 items on display, with about 140 awaiting restoration. I feel that newcomers to the hobby owe it to themselves to visit the museum to see some of the "roots" and how far ham radio has evolved. And to the old-timer it is most definitely a very nostalgic journey down memory lane, complete with Big Band World War II era music playing in the background!

Normal hours for the museum are 8 am to 8 pm weekends, but special times and tours are available. Don says it is best to contact the museum either by phone (303) 822-9868, by writing Box 229, Byers, CO 80103, or check on the 146.67 or 449.45 repeaters. Local talk-in is on 145.655 simplex. All the above frequencies are monitored 24 hours daily.

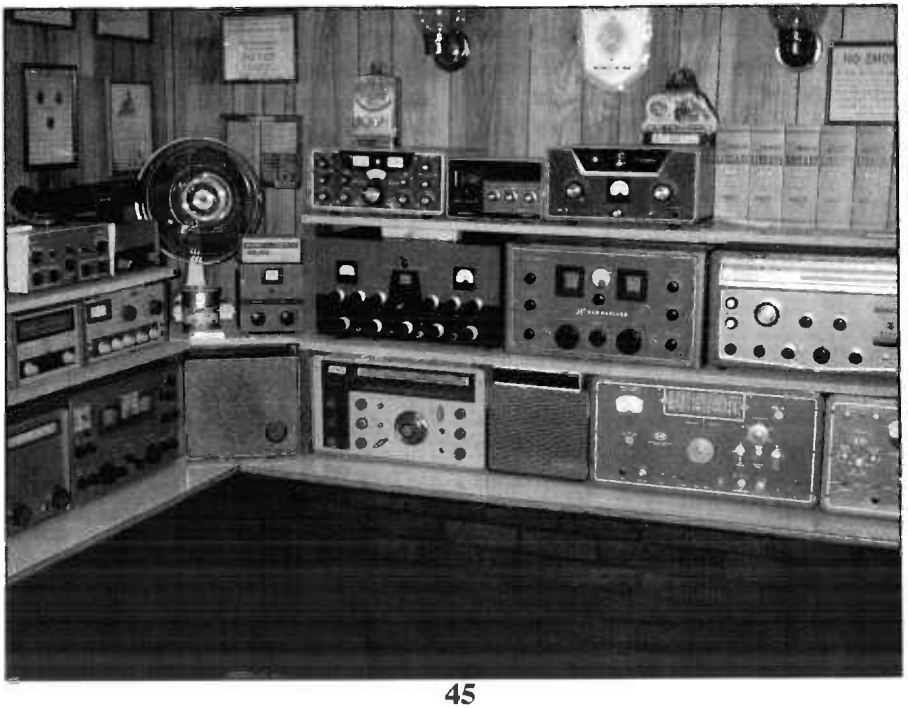
The visit requires no admission fee, however donations are very much appreciated, as this is upon which the museum existence depends for maintenance and inventory. • • •

NØCKW is the former editor of the 10-10 International News. He currently writes a quarterly column dealing with 10-10 paper-chasing in that publication.

Readers may spot some now moderately rare classic kits evident in the photos.

Photographs on this and the following page courtesy of Don Zielinski, KØPVI, Curator.

(Colorado Bighorn Museum of Amateur Radio, Cont.)



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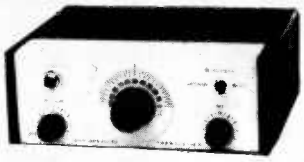

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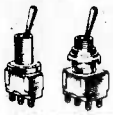

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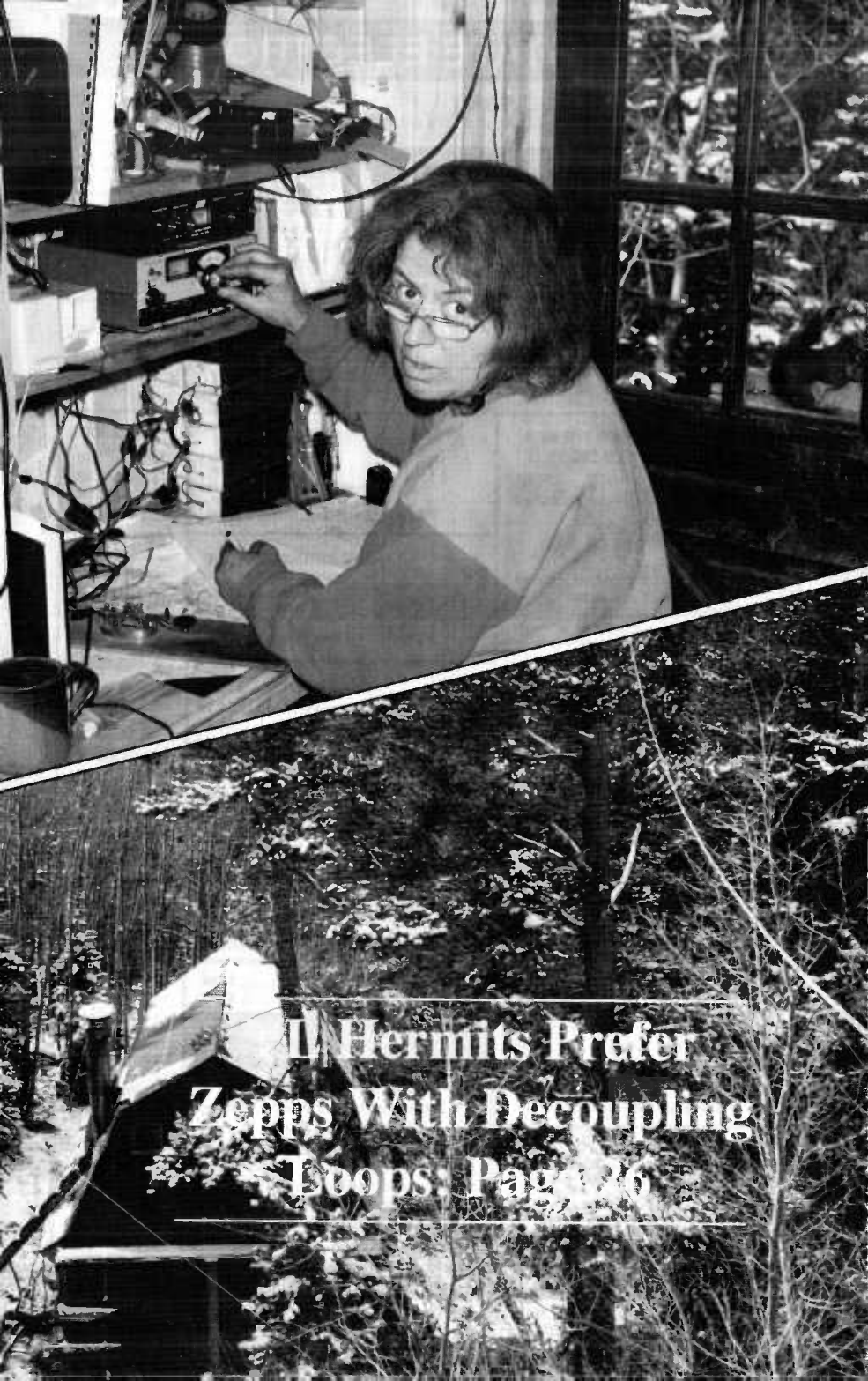

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