A Stacked Rhombic Array for 1296 Mc

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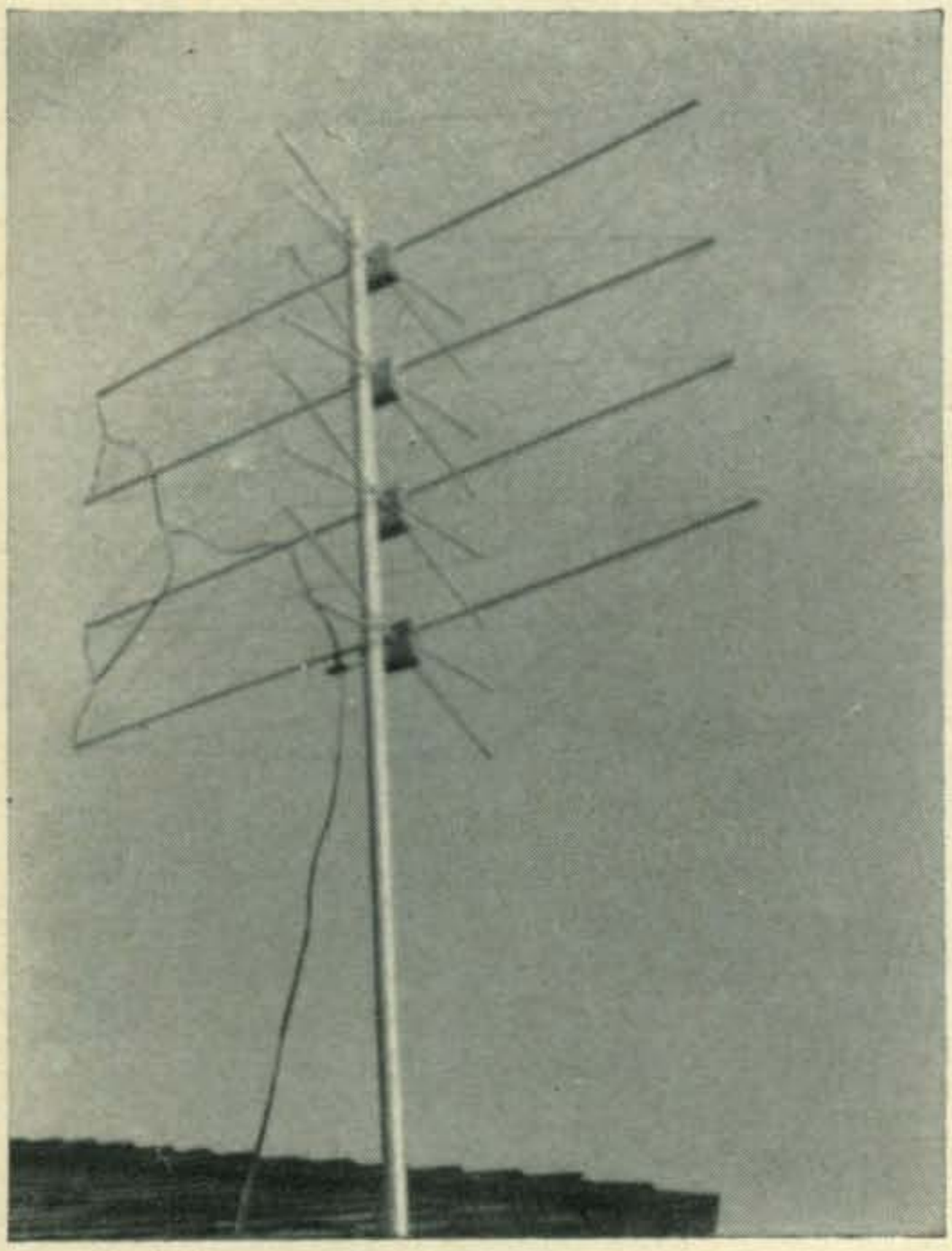
Ease of construction and low wind resistance are essentially the advantages derived from this high gain 1296 mc stacked array.

At 1296 mc, a wavelength is so small that practically any form of antenna becomes feasible and a multitude of types have been developed that could be used. The main problem is to choose the most practical form. From the amateur viewpoint, the most desirable characteristics of a 24 cm antenna would be: (1) high gain, (2) low wind resistance, (3) low cost, (4) light weight, (5) ease of construction, (6) "loose" dimensional tolerances, (7) small over-all size. Obviously, some of these requirements are mutually conflicting; for instance, the requirement for high gain usually conflicts with all of the others. By far the most popular communications antenna in the microwave region is the parabolic dish, but in terms of the above requirements it is not a particularly high performance antenna.

Most antenna types may be placed in one of two categories; the aperture type, or the end-fire type. Examples of the aperture type antenna are the dish, the horn, the bedspring array, etc. The end-fire class may be represented by such forms as the Yagi, the Polyrod antenna, the Cigar antenna, etc. The Rhombic, along with the V is somewhat unique in that it finds a home in neither category, but is kind of a hybrid between the two. The H-plane (vertical plane for a horizontal rhombic) directivity is achieved entirely by end-fire means, whereas the E-plane beamwidth is determined by a combination of end-fire and broadside directivity. For this reason, a typical rhombic will have an H-plane beamwidth about twice as great as in the E-plane. In the case of a horizontally polarized rhombic, this is just the opposite of the desired pattern since only that power confined to within a few degrees of the horizon is useful. Power radiated at a large angle with respect to horizontal is wasted into outer space or into the ground nearby. At the same time, a narrow azimuthal beam has the disadvantage of less angular coverage (fewer people will hear your CQ and conversely). Of course, reducing beamwidth is the only way we can increase gain (assuming small minor lobes), and for the above reasons, it would be much wiser to reduce the beamwidth in the vertical plane. This is readily done by stacking vertically. In the case of rhombics, the spacing between bays need not be large because of the broad H-plane lobe to start with.

The stacked rhombic in action at W6HPH.



This array consists of 4 identical rhombics, each patterned after the antenna described by Triolo.[1] The gain of each is about 13.5 db and four, stacked, gives about 19.5 db, nearly as much as a four foot dish (with considerably less wind resistance). Front-to-back ratio is about 5 db, and may be increased to at least 12 db by terminating each rhombic with a 620 ohm, ½ watt carbon resistor. The termination does not affect the gain however, since it merely absorbs the power that would otherwise be radiated to the rear. QRM is not a problem on the u.h.f. bands, so it is just as well to leave the array unterminated, and theoretically this results in a slightly lower antenna noise temperature.

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[1]Triolo, F. J., "A Novel Antenna For Mobile Radio Relay Operation in the UHF Range." 1958 IRE *National Convention Record,* Part 1. pp 183-192.

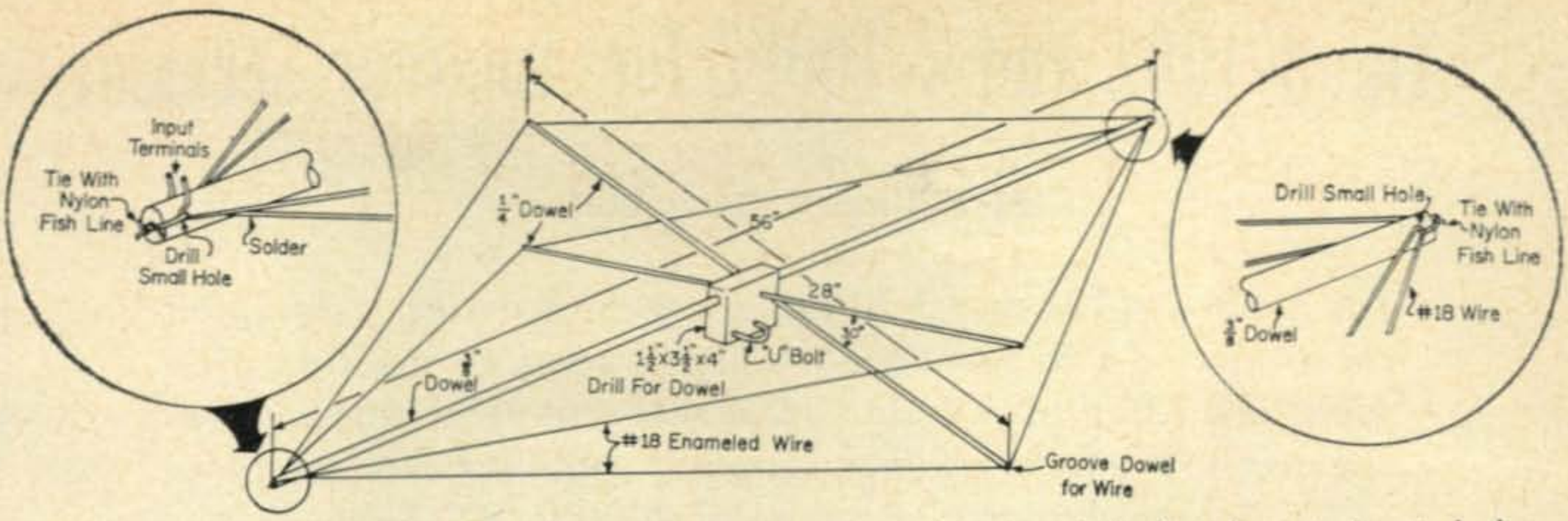

Fig. 1—Construction details for a 1296 mc rhombic. Pictured is one of the four bays to be stacked vertically.

Construction

Dimensions and necessary construction data for each rhombic are given in fig. 1. The block in the center is a piece of 2×4 drilled to take the dowel supporting members. Try to select dowel with a straight grain to minimize warpage. All wooden parts should be given two coats of premium quality house paint (any color) to protect them from the weather. The cost per rhombic, neglecting the U-bolt is about 30 cents.

The spacing between bays is 12 inches. Correct phasing is insured by feeding pairs as in fig. 2. The phasing harness may be made of 300 ohm ribbon. Matching is achieved by wrapping the twinlead transmission line with a small piece of aluminum foil near the point where it connects to the phasing harness. This is the simplest, quickest, and probably the most efficient way to match a u.h.f. antenna. Both the position and length of the foil section must be adjusted for minimum s.w.r. After the correct adjustment is found, the foil is wrapped with masking tape and doped with house paint to make it water tight.

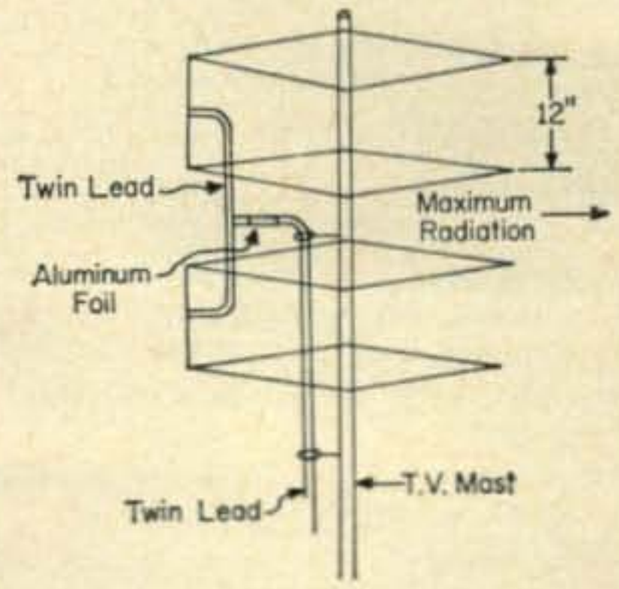

Fig. 2—Method of stacking and phasing the rhombics. The aluminum foil wrap on the feedline is adjusted for a proper match.

Transmission Lines

A word is in order about transmission lines at this frequency. Twinlead or open wire line is recommended, unless some very low-loss coax is available. Even ordinary dime store twinlead has much lower attenuation than RG-8/U. The radiation losses are negligible and are independent of the length.[2] Also, most antennas have balanced temminals which are more adaptable to parallel wire line. A balun is needed at the station end of course, and a half wave coax balun at 432 mc will work fine as a 3/2 wave balun at 1296 mc.

This array, being extremely broad-band, will show some gain (about 9 db) at 432 mc. Results on 1296 have been highly rewarding, measurements indicate the gain to be at least 19.5 db, and on-the-air reports confirm this. ■

[2]Skilling, *Electric Transmission Lines*, McGraw-Hill, pp 329.

RESULTS VK/ZL CONTEST 1960

C.W. WINNERS

No. America		So. America		Europe	
W1GYE	495	HK7ZT	176	DL1FF	2054
W2EQS	2639	CE3AG	1575	EA3CY	72
W3RNY	45	YV3AS	240	F2MA	221
W4FIJ	3535	Asia		G4CP	1176
W5KC	4104	JA1VX	4824	HB9MO	392
W6LDD	5120	BV1US	216	IT1AGA	32
W7IMA	2720	MP4BCV	126	OE1RZ	768
W8JIN	4176	VS9ADL	72	OZ7OMR	40
W9WNV	3344	XZ2TH	400	OK1LM	624
WØBMM	336	UAØAG	310	PAØTAU	108
KL7ALZ	792	Oceania		OH5RU	152
VE3BWY	779	FK8AH	1675	ON4LX	352
KP4CC	390	KØSLD/		LA8GF	15
TI2CMF	96	KW6	5670	SP6FZ	640
XE1PJ	424	VR1B	4294	SM5LL	1000
Africa		ZK1AR	836	SVØWZ	9
FA8RJ	210	KH6DMW	616	UB5KAB	1430
				UR2BU	9
				UA1DZ	1440

PHONE WINNERS

No. America		Europe		Asia	
W1WY	15	DL3LL	511	JA3AA	72
W4SIB	162	EA3JE	250	BV1US	184
K5KBH	2176	G5HZ	128	OD5CT	84
K6RTC	520	CT1EY	216	9M2DQ	2250
W8JIN	480	OE1RZ	55	UAØKIA	28
K9ECE	96	OH5SM	230	Oceania	
VE3DDI	96	SM5ACC	90	KH6DLD	611
VE6TF	15	UR2BU	112	KØSLD/	
TG9CP	560	Africa		KW6	1200
TI2CMF	10	ZS6NE	338	ZK1AR	630
				So. America	
				YV1EE	126

VK/ZL LEADERS

C.W.			Phone		
VK5NO	14,045	ZL1AH	13,535	VK5MS	13,790
VK2GW	12,495	ZL1AIX	11,705	VK5NQ	7450
VK9XK	9815	ZL1AJU	11,240	VK9NT	3880
VK2ADE	9490	ZL1APM	10,960	ZL1AIX	11,755
VK3DQ	8415	ZL1HS	10,365	ZL1KG	8540
VK7SM	6505	ZL2AWJ	10,275	ZL1AH	6350