The F.B. Antenna

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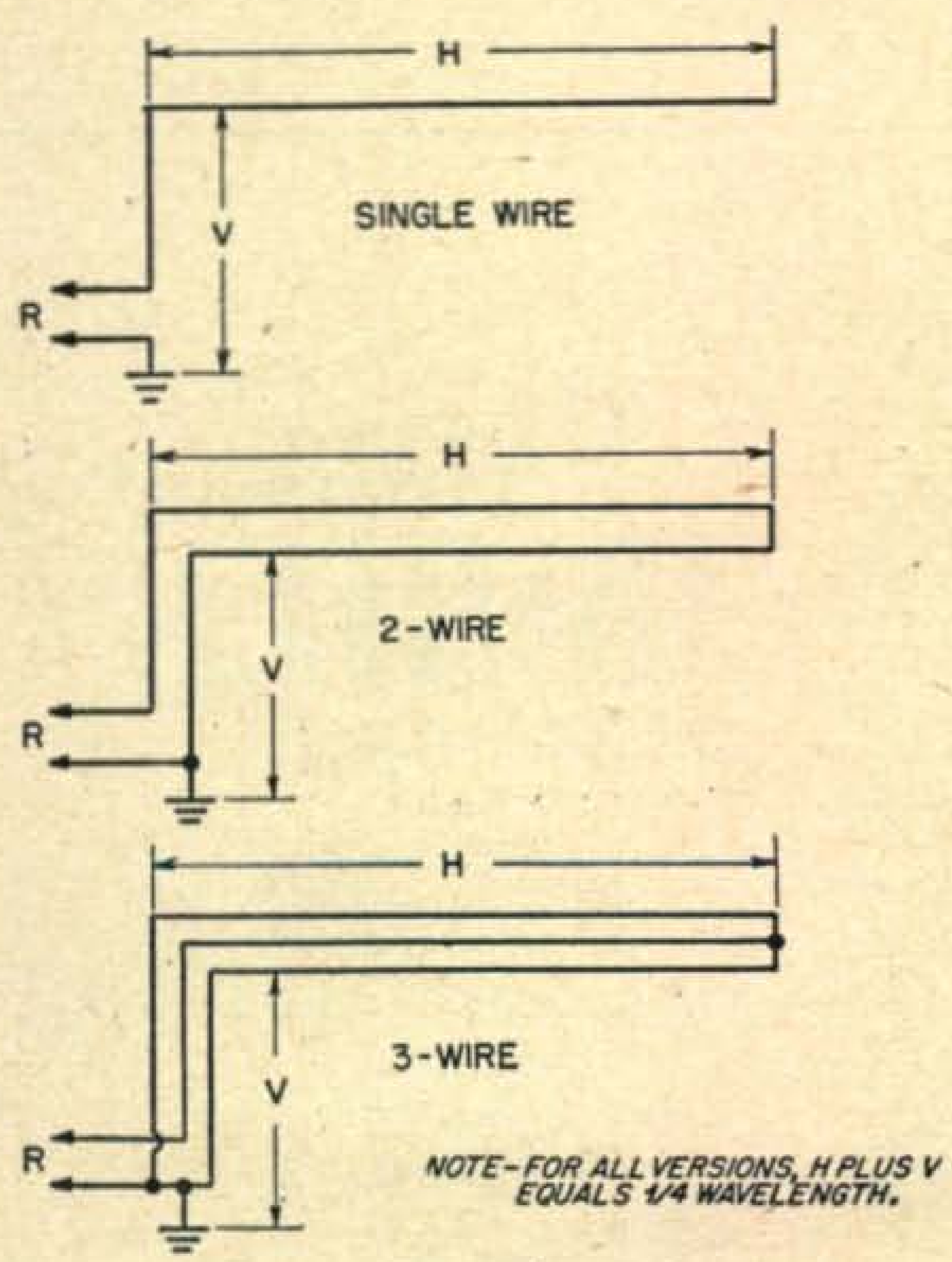
This Article Brings to Light Some Important Information on the "Folded-Bent" Type of Antenna for the 80 and 160-Meter Bands.

Extensive use has been made of multi-wire antennas of the "folded" type. The most common is the half-wave folded dipole. Although this antenna is quite simple and effective, its physical dimensions for the 80 and 160-meter bands are greater than the average householder can lay title too—unless it is straight up.

A number of publications[1, 2] and articles[3, 4] have appeared in the literature describing multi-wire, quarter-wave vertical antennas. These are also known as folded "unipoles" or "monopoles." Generally speaking, a two-wire antenna is recommended for matching a 150-ohm line and a three-wire antenna is recommended for matching a 300-ohm line. Since the quarter-wave antenna is not recognized as a worthy horizontally mounted radiator the question falls back to finding a suitable vertical support—Once again, something that the average Ham is hard put to find.

1. John D. Kraus, **"Antennas,"** McGraw-Hill Book Co., first edition, articles 14-14, 14-15.
2. W. W. Smith, **"Antenna Manual,"** Editors & Engineers, Ltd., p. 174.
3. W. van Roberts, "Input Impedance of a Folded Dipole," **RCA Review**, June 1947, p. 289.
4. James W. Hunt, "Grounded Folded Dipoles," **QST**, April 1949, p. 28.



NO. WIRES IN ANTENNA	FEEDER LINE	VERTICAL DIMEN. AS % OF TOTAL LENGTH
3	52 OHM COAX	22%
3	72 OHM COAX	27%
3	300 OHM TWIN-LEAD	78%
2	52 OHM COAX	36%
2	72 OHM COAX	44%
2	150 OHM TWIN-LEAD	100%
1	TWO 52 OHM COAX LINES IN PARALLEL	60%
1	TWO 72 OHM COAX LINES IN PARALLEL	100%

Table I. Suggested antenna and feedline combinations.

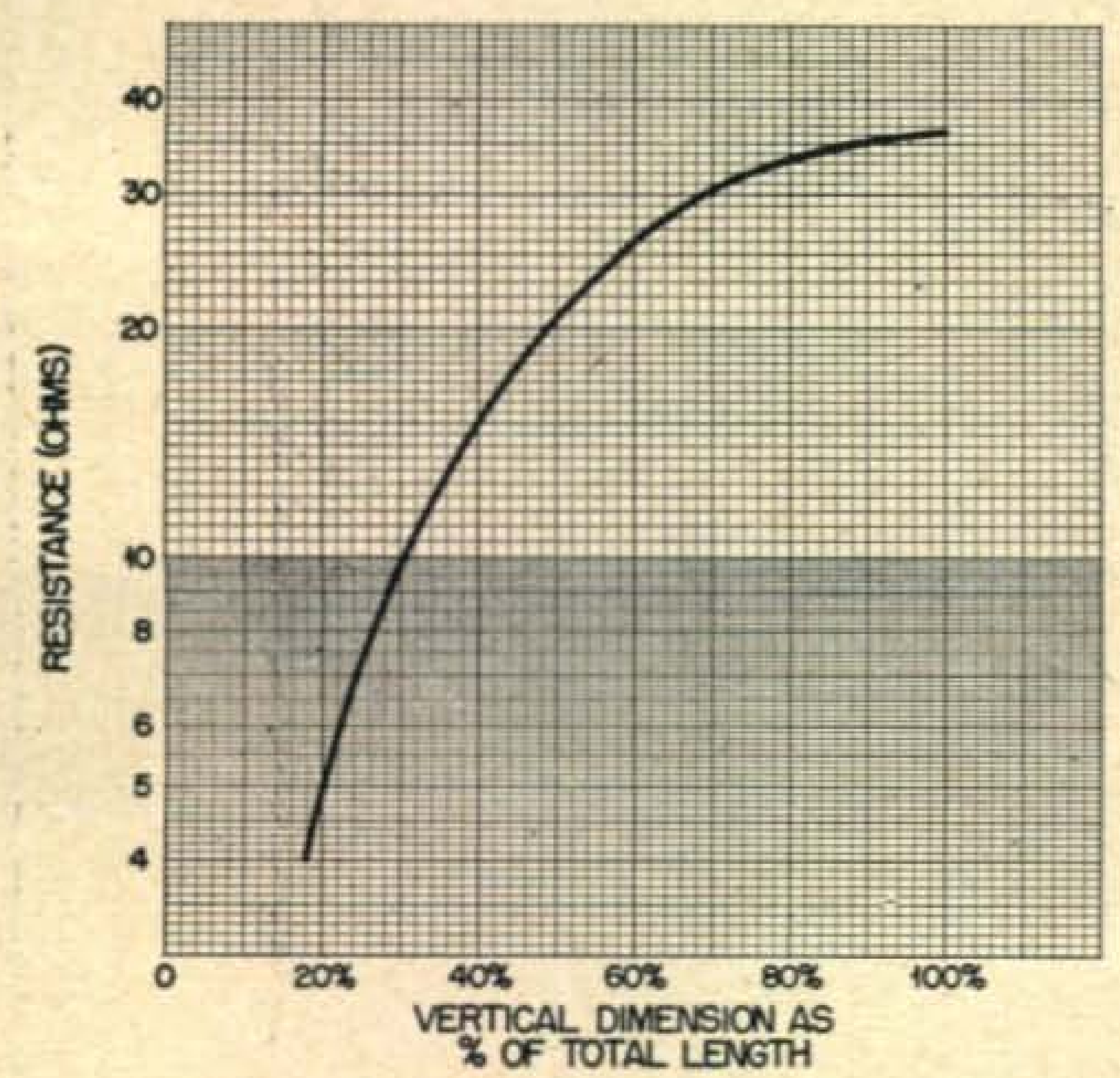


Fig. 1. Theoretical base resistance of a quarter-wave antenna as a function of its total length.

The Bent Antenna

Several years ago, W. C. Babcock[5] discussed the effect on antenna radiation resistance when a vertical antenna is bent into an inverted-L shape. The graph shown in *Fig. 1* summarizes

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5. W. C. Babcock, **"Mobile Radio Antennas for Railroads," Bell Telephone Laboratories Record, May 1949, pp. 172-175.**

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his findings. Briefly, the antenna radiation resistance at the feed point is a function of the

RESONANT FREQUENCY \ RESISTANCE	TOO HIGH	CORRECT	TOO LOW
TOO HIGH	LH	LH LV	LV
CORRECT	SV LH	* *	LV SH
TOO LOW	SV	SH SV	SH

L--LENGTHEN
S--SHORTEN
V--VERTICAL PORTION OF ANTENNA
H--HORIZONTAL PORTION OF ANTENNA

Table II. Once the value of radiation resistance has been determined the remedial step to correct any mismatch is shown above.

percentage of the total vertical length. When 100% of the antenna is vertical, the resistance has a theoretical value of 36 ohms. As the antenna is bent to a horizontal position, the resistance is gradually lowered.

Although Babcock's work was done in the v.h.f. portion of the spectrum there is every reason to believe that principles involved may be applicable to lower frequency antennas. In fact, it is worthy of consideration that a number of recent antenna developments were based upon "models" and experiments in the u.h.f. range.[6]

Matching Techniques

In order to match our more-or-less standard transmission line impedances to "bent" antenna, we should be prepared to take advantage of the impedance multiplying features of the multi-wire antennas. For example, a two-wire folded antenna will give a 4:1 impedance ratio, while a three-wire folded antenna will provide a 9:1 impedance ratio. The combination of both "bending" and "folding" the antenna should furnish us with a wide range of values with which we can match the impedance of many different types of transmission lines. An antenna employing these features has been christened the "FB" (folded-bent) antenna.

Various combinations of antenna dimensions and feedlines are suggested in *Table I.* It should be remembered that the theoretical dimensions are based upon the assumption of a perfect ground plane. In practice, the virtual ground plane may be some distance below the soil surface. Also, the associated losses in the ground system may add to the radiation resistance and produce a value higher than the theoretical value.

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6. D. C. Cleckner, "Parasitic Beam Patterns," CQ, July 1948, p. 25.

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Any antenna derived from the data in *Table I* must be checked for its value of radiation resistance with an *Antennascope*[7] or *Matchmaker*.[8] Once the resonant frequency and radiation resistance are known, appropriate remedial action may be taken by consulting *Table II*. For example, an antenna is intended to have a resistance of 72 ohms at a frequency of 3680 kc. Measurements show that the resistance is 100 ohms at the resonant frequency of 3490 kc. The action indicated by *Table II* is to shorten the vertical portion of the antenna (about 5% would be a good guess) and then take a new set of measurements. Continue until the desired values are reached.

The spacing between the elements in an "FB" antenna does not appear to be critical. At W4LW a six-inch spacing has been used in open wire two- and three-wire versions. Probably the familiar twin-lead could be used as well in the two-wire configuration.

The principal merit in the "FB" antenna lies in its convenient dimensions for the 80 and 160-meter bands. It is also somewhat broadbanded and affords a degree of lightning protection because of its grounded construction.

7. W. Scherer, "Building and Using the Antennascope," CQ, Sept., 1950, p. 13.
8. W. I. Orr., "The Matchmaker," CQ, December 1951, p. 27.

Our Cover

The ultra-suave station at the QTH of W6GVY, Paul Giganti, of San Carlos, California. The body of the cabinet was built of plywood, and the doors of combed Philippine mahogany, for about $100.00. Housed within is PP oscillator (6L6's—CQ, March '53) driving a pair of 807's in PP final with 6Y6 clamper tube, for input of 135 watts on 40 CW. This decor was necessary to establish complete rapport with XYL.