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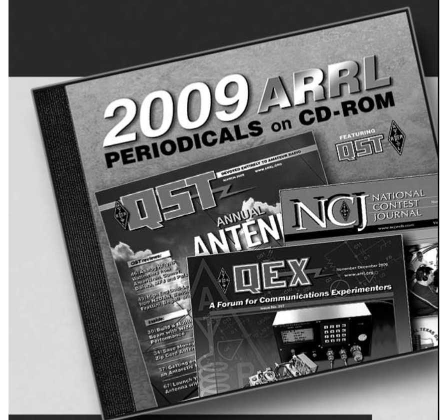

Technical Correspondence

Conducted By Paul Pagel, N1FB
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HART'S LOOP ANTENNA

☐ In their article describing the recent ARRL antenna-design contest, Hall and Schetgen stated that the gain of the loop antenna entered in the contest approaches that of a dipole.[1] In Technical Correspondence for July, Ted Hart, W5QJR (who entered the loop in the contest), claims his loop has a gain figure that considerably exceeds that of a dipole.[2] However, Hart's claim is not valid, as I will explain.

Hart stated that in free space the patterns of the loop and dipole are the same. This is fundamentally true for the *shape*, or directivity of the patterns, but only if their electrical lengths are similar. As the lengths become very short, the patterns approach a cosine plot, and the familiar "figure 8" pattern becomes two circles tangent to each other. However, the *size* of the patterns will be the same (and thus the gain) only if the I^2R losses in the two antennas are also the same. Hart's claim is that the loop gain increases to 8.16 dBi (6 dBd) when it is mounted close to perfect ground. This is a theoretical gain figure obtained from the vector addition of the fields associated with the direct and ground-reflected waves in the far field in the directions where the two fields are in phase (6 dB results from field doubling because of the addition of the two *equal* fields of the direct and ground-reflected waves when there is no loss of field because of ground absorption on reflection).

What Hart seems to have overlooked is that the ground affords the same gain treatment on reflection for the dipole as it does for the loop. So, if the free-space gains of the dipole and loop are identical, and if the two antennas are mounted so that their respective fields are oriented identically relative to ground, then their gains resulting from ground reflections are also identical. Thus, the loop gain is 0 dBd, not 6 dBd. Since Hart's loop is electrically short (except on the higher HF bands), however, its pattern approaches the cosine shape, with somewhat less gain than that of a half-wave dipole. Hall and Schetgen's statement that Hart's loop gain *approaches* that of a dipole is evidently correct.

Hart also contends that with horizontal polarization there is little difference (in gain) between good ground and poor ground, and that with vertical polarization poor ground provides increased signal relative to good ground for elevation angles above 18°. His contention concerning horizontal polarization is overly simplistic and misleading, and that concerning vertical polarization is incorrect. With horizontal polarization the height of the antenna and the angle of incidence at the point of reflection are crucial to reflective gain. For heights less than 0.25 λ, the gain with real ground is degraded at all angles of incidence relative to that with perfectly conductive ground, because of direct absorption of energy from the induction field as it intersects the ground—the poorer the ground (and the lower the antenna), the greater the degradation. At heights of 0.25 λ and greater, the reflective gain at high angles of incidence is also less with poor ground than with good ground because of the greater absorption. However, at heights greater than 0.25 λ with low, grazing angles of incidence, there is some truth in Hart's statement that there is little difference in gain between good and poor ground. With vertical polarization, I can find no evidence in the professional literature to support Hart's contention that poor ground provides a greater signal than good ground at elevation angles greater than 18° (or for any elevation angle). On the contrary, the literature I've researched indicates just the opposite. Radiation patterns appearing in Jordan and Balmain are typical examples.[3]—*Walt Maxwell, W2DU, ARRL TA, 243 N. Cranor Ave., Deland, FL 32720*

[1]J. Hall and B. Schetgen, "Six Winners Emerge from the ARRL Antenna Competition," *QST*, February 1985, pp. 44-47.
[2]T. Hart, "The Loop Transmitting Antenna," Technical Correspondence, *QST*, July 1985, p. 42.
[3]Jordan and Balmain, *Electromagnetic Waves and Radiation Systems* (Englewood Cliffs: Prentice-Hall, 1968), Figs. 16-3, -4, -7 and -8 through -11.

CW SHAPER UPDATE

☐ It's relatively easy to adapt the CW Shaper for use with grid-block-keyed systems.[4] All that is required is to use a positive-ground hookup as shown in Fig. 1(B). Connect the key ground as shown and use a PNP transistor for Q1. Q1 may be any small-signal transistor with a V_{ceo} greater than the grid-blocking voltage to be keyed. Note that the functions of the RELEASE and ATTACK potentiometers will be reversed.

I know of one individual who attempted to use the CW Shaper to key a transceiver with a built-in keyer. Such an arrangement will not work; the Shaper must be placed after the keyer—between the keyer output and the keyed line.—*Eric P. Nichols, KL7AJ, P.O. Box 0, North Pole, AK 99705*

[4]E. P. Nichols, "Try This Versatile CW Shaper," *QST*, December 1984, p. 29.

SUPER-DUPER BUBBLE

☐ I would like to suggest a more efficient bubble-sorting algorithm be used in place of the one offered by George Allison in his article, "Super Duper" (*QST*, September 1985). Mr. Allison's sort requires repetitive

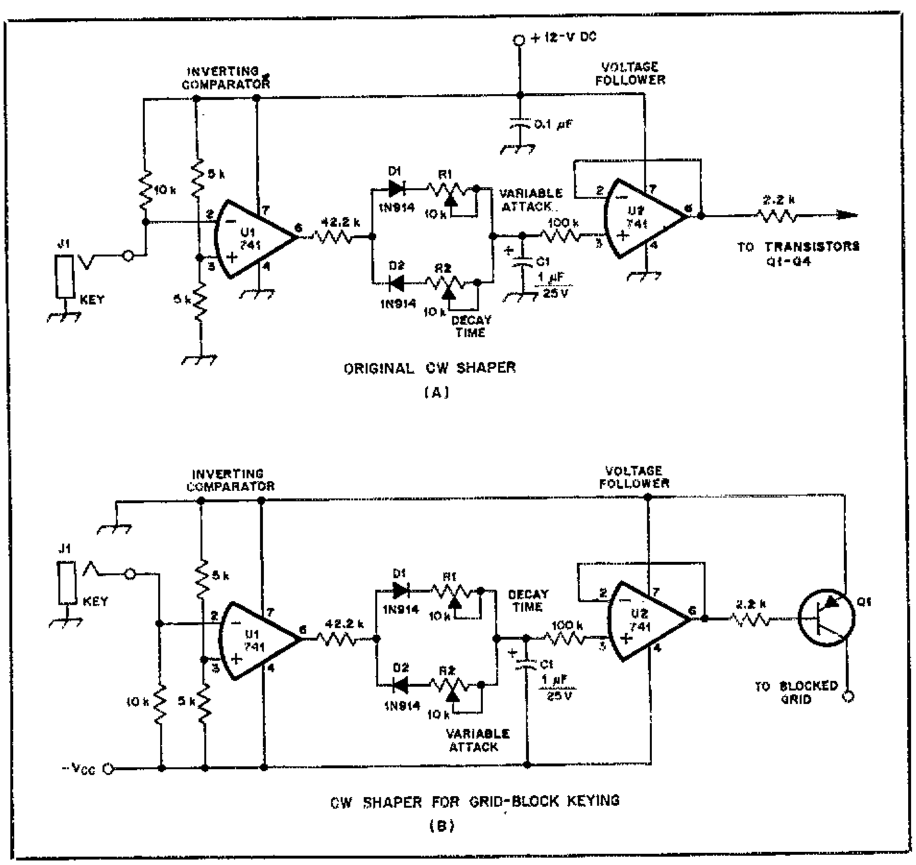

Fig. 1—The basic circuit of the original CW Shaper at A. At B, the CW Shaper configured for use with grid-block-keyed systems.