The Connecticut Longhorn

The "Connecticut Longhorn" is a horizontal roof-top car antenna with a matching system at the base, remotely controlled for shifting frequency over a 200-kc. range on 75 meters. The station-wagon roof, along with the rest of the car body, is the counterpoise for the quarter-wave antenna.

Horizontal 75-Meter Mobile Whip with Remote Tuning

BY ANDREW PFEIFFER*, K1KLO

THE 75-meter transceiver that Santa Claus brought all the way from Michigan worked fine on the regular station antenna — but the idea was to go mobile! I backed the 1964 Ford Country Squire out of the garage — 209.9 inches of uncompromising antenna platform. Couldn't mount a vertical whip on the rear bumper because the rear deck wouldn't fold down; couldn't move it over in front of the taillight because the State Police take a dim view of such modifications to safety devices. Mounting the whip on the hump over and above the taillight would have started it some 30 inches above ground, making it a prime target for the garage opening, trees, low bridges, and low-flying UFOs.

I decided to take advantage of that aforementioned 209.9 inches and go horizontal. The antenna described and pictured is the fourth one built and tested in about as many months. It can be resonated over the 200-kc. transceiver range from the driver's seat, and can cover the low end of 80 merely by adjusting the setting of the capacitive hat near the end of the antenna. The best testimonial to its effectiveness as a radiator was the accusation: "You ain't mobile, ya clown; an' yer runnin' a kilowatt!"

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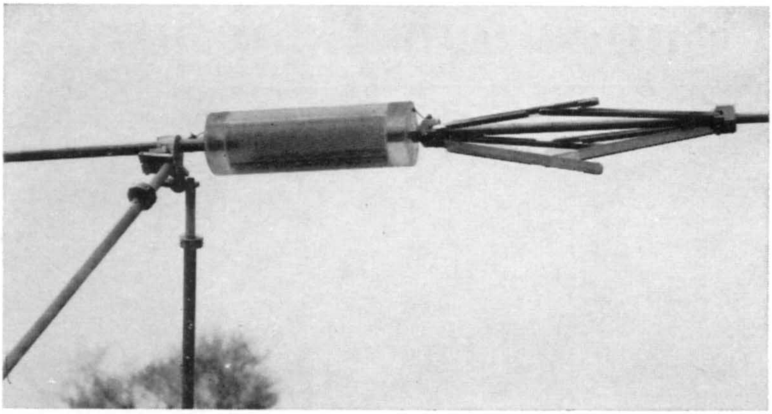
Some of today's station wagons offer a good-sized platform for an antenna, but how to take advantage of it without going to unrealistic heights? K1KLO solved the problem with a horizontal whip.

The secret of the wide frequency range is a remotely-tuned coil at the base of the antenna. Referring to Fig. 1, most 75-meter mobile antennas consist of a loading coil, L_3, a capacitive extension, l_1, and the support whip, l_2. The three combine to resonate the antenna to the desired frequency. It is generally considered section l_2 does the radiating; L_3 and l_1 are there to tune out the reactance, and contribute practically nothing to the outgoing signal. Obviously, the longer one can make l_2 the more effective the antenna.

The writer's antenna is shunt fed, as also shown in Fig. 2. The value of this shunt, L_1, is very critical if a proper match is to be obtained between the output of the transceiver and the very low impedance offered by the radiator. A quarter of a turn, plus or minus, makes a considerable difference in match, as indicated by an s.w.r. bridge.[1] A small adjustable ferrite slug inside L_1 makes this critical adjustment a simple matter.

The Q of this antenna is high. An excursion of 10 kc. or less was all that was possible, while

[1] The installation includes an s.w.r. bridge which is in the line at all times, and is used to determine exact resonance and maximum output. Actual tests run at a distance of about two miles have indicated maximum power output when minimum reflected power showed on the s.w.r. bridge indicator.



The rear support for the antenna consists of two rods clamped to the roof-top carrier. Nylon inserts at the top insulate the rods from the antenna. Three hinged pairs of rods, operated umbrella-fashion, serve as a capacitive hat immediately next to the loading coil. At each end of the Lucite tube containing L_3 there is a 1-inch thick Lucite disk, threaded at the center. The coil is mounted on a mating threaded end on the antenna, and the extension rod, with hat, screws into the disk at the other end. Connections to the ends of the coil are brought through the disks.

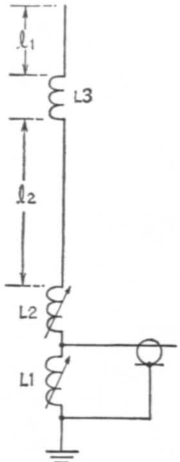


Fig. 1—The schematic of the conventional vertical whip antenna is the section above L_2 in this drawing. L_1 and L_2 are adjustable inductances used for shunt feed, L_2 for resonating and L_1 for matching.

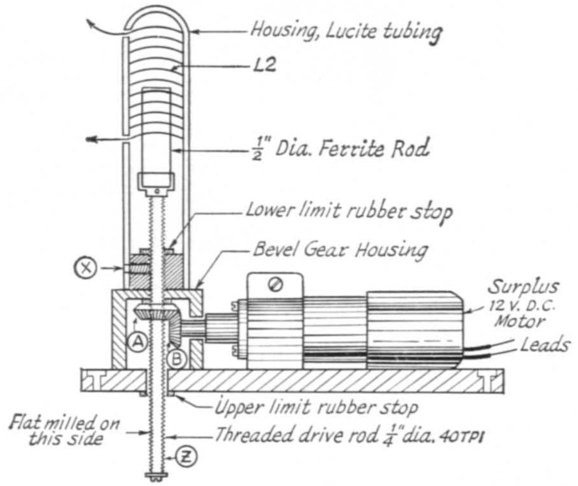


Fig. 3—The remote variable-inductor assembly. The threaded drive rod, *Z*, has a flat milled its full length and is prevented from rotating by means of a nylon set screw at *X*. The hole in bevel gear *A* is tapped for ¼-40 threads per inch and mates with the drive rod, *Z*. Energizing the motor drives bevel gear *B*, which in turn drives the "captured nut" bevel gear *A*, raising or lowering the ferrite rod inside L_2.

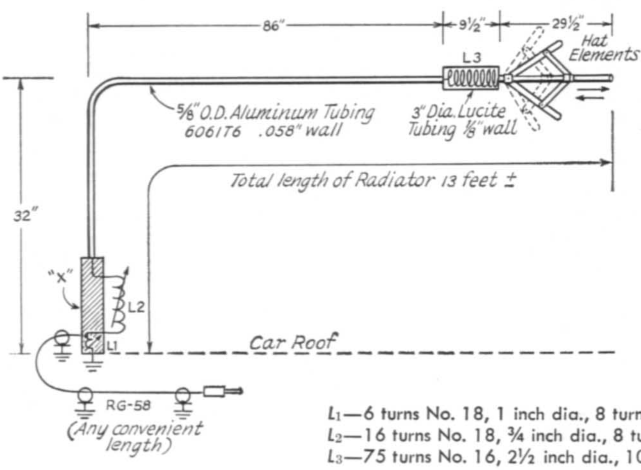
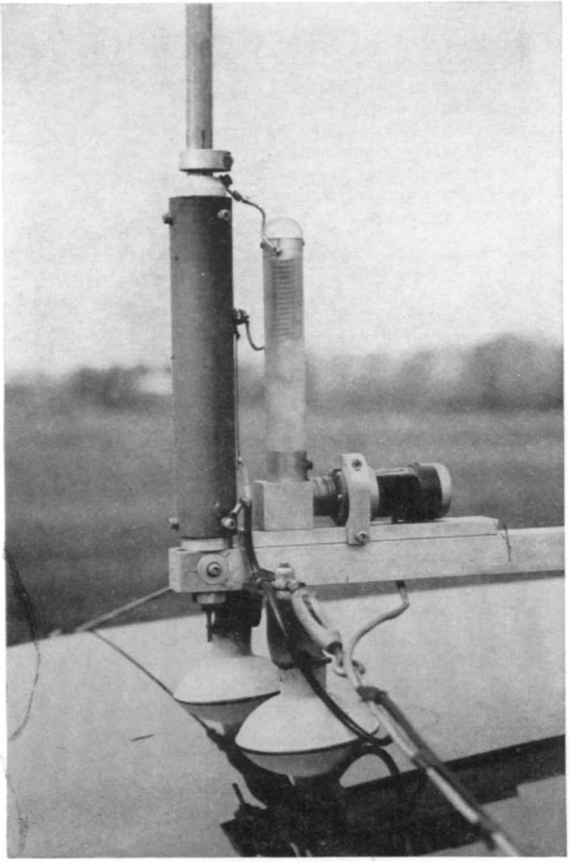


Fig. 2—Mechanical layout of the Connecticut Longhorn. "X" indicates an 8-inch length of 1½-inch diameter linen Micarta tubing. The "hat" elements, totalling six, are each 8 inches long, ½ by ¼ inch aluminum.

L_1—6 turns No. 18, 1 inch dia., 8 turns/in. (Polycoils 1746 or equivalent).
L_2—16 turns No. 18, ¾ inch dia., 8 turns/in. (Polycoils 1740 or equivalent).
L_3—75 turns No. 16, 2½ inch dia., 10 turns/in. (Polycoils 1776 or equivalent).



Close-up of the feed end, which is supported by suction cups on the car roof just back of the windshield. L_1 is inside the micarta tube at the left; the adjusting screw for the ferrite slug can be seen just above the far suction cup. The remote variable inductor and driving motor are to the right of the micarta tube. The horizontal support is a 1 × ½ inch aluminum bar which runs to the luggage carrier near the rear of the car.

still being able to tune the output pi network of the transceiver. The physical position of the capacitive hat made it impractical to make the necessary QSY adjustments at that point; aside from this, it is the mobileer's ideal to be able to work any segment of the band from the driver's seat. The remote variable-inductor unit, L_2 (see Fig. 3 and photograph), serves this purpose. Inside L_2 is a ½-inch diameter, 2-inch long ferrite rod that can be remotely moved in and out of L_2 by a small reversible 12-volt d.c. motor mounted on the car-top carrier assembly. The in-line s.w.r. bridge indicates the proper positioning of this ferrite slug, and minimal reflected power can be maintained from 3.8 to 4.0 Mc. In this connection, it is interesting to note that the setting of the ferrite rod in L_2 is greatly influenced by the road surface; for example, the settings will differ when the car is on a concrete highway reinforced with steel as compared with an oiled surface.

Is the thing directional? I have run a number of tests where I have been in a large parking lot and driven in a complete circle while transmitting, and the indications are that with the model in question the antenna does not seem to be directional. In some of these contacts, a large group was on at locations at all principal compass points. An early model, sloping from front to back at an angle of about 40 degrees, did have definite directional characteristics.

The Connecticut Longhorn antenna described and shown in the sketches and photographs is presented only as a guide to those who may wish to "go horizontal"! The overall height of the radiator above ground was determined only by the author's garage-door opening.

I wish to thank sincerely the many radio amateurs both in this country and in Canada whose patience, helpful comments, and suggestions during the early frustrating phases made possible the final development of this antenna system. QST

Strays

For Tesla fans, there is available literature from "The Tesla Society", Box 4058, Minneapolis, 14, Minnesota. Write for Tesla Bibliography and list of all new Tesla Books. We recommend *Prodigal Genius* by J. J. O'Neil, especially. Tesla was quite a guy.

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If you will send your QSL to VE3GG, 20 Byng Ave., Willowdale, Ont., Canada he will send you a copy of the poem, "Silent Keys."

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The Post Office Department promises faster mail service with the new Zip codes. Use yours when you write League Headquarters. Use ours, too. It's 06111.

Stolen Equipment

Recently the Stanford Radio Club station W6YX, was broken into and the following pieces of Collins Radio equipment were stolen:

Type	*Description*	*Serial No.*
32S-1	Transmitter	10790
75S-1	Receiver	3018
312B-4	Station Control	293
516F-2	Power Supply	3611
75A-4	Receiver	5091

The cabinets of the S-line equipment were sprayed with red and orange paint. The 75A-4 receiver had a home-built crystal filter in place of the mechanical filters.

Strays

Feedback

In the article on K1KLO's "Connecticut Longhorn," August *QST*, the coil mentioned as being affected by the road surface should have been L_1, the shunt feed inductance, not L_2.

Technical Correspondence

ABOUT THE "CONNECTICUT LONGHORN"

Technical Editor, *QST:*

The article "The Connecticut Longhorn" by K1KLO in the August issue of *QST* describes an interesting application to amateur use of a type of antenna that has been discussed in detail in the technical literature during the past few years. The earliest article I am familiar with describing the antenna is by King, Harrison, and Denton, but there are many other discussions.[2–6] The Northrop Corporation has done a great deal of work on the antenna as the DDRR antenna and in this form it has been discussed in several popular magazines.[7,8]

The author describes the antenna as "going horizontal" which is correct as a geometrical description, but actually the antenna radiation is vertically polarized. The antenna is nondirectional as indicated by the author. The short vertical section does the radiating and is tuned to resonance by the capacitive reactance of the short transmission line formed by the horizontal portion of the antenna and its image in the car top. Since the car top is not a perfect ground plane, the antenna is affected by the road surface on which the car is driven.

K1KLO seems to have done an excellent job of empirically determining the properties of the antenna, including the high *Q* and narrow bandwidth, which are adequately explained by theory. Variations on the antenna are possible; the horizontal portion can be bent into a circle, curled into a spiral, or distorted in other ways with no great effect on the antenna performance. This accounts for the names *ring antenna* and *hula hoop* found in some of the references, but the more general term is *transmission-line antenna.* The antenna is seen to be a version of the short vertical antenna, familiar from the earliest days of radio, and is distinguished principally by the method of obtaining the capacitive top loading to bring it to resonance. — *Wade Blocker, K6CAF, 17221 Osborne, Northridge, California 91324.*

[1] Ronold King, C. W. Harrison, and D. H. Denton, "Transmission Line Missile Antennas," *IRE Transactions on Antennas and Propagation:* January 1960, p. 88.

[2] R. W. Burton and R. W. P. King, "Theoretical Considerations and Experimental Results for the Hula-Hoop Antenna," *Microwave Journal*, November 1963, p. 89.

[3] R. C. Fenwick, "A New Class of Electrically Small Antennas," *IEEE Transactions on Antennas and Propagation*, May 1965, p. 379.

[4] M. Boella, C. Cergiani, A. Villa, and R. Zich, "Thin Wire Loop Antennas," *Electronics Letters*, September 1965, p. 183.

[5] M. Boella, C. Cergiani, A. Villa, and R. Zich, "Low Gain Ring Antenna, Input Impedance Properties;" *Alta Frequenza;* 1966, *35*, p. 620.

[6] M. Boella, C. Cergiani, A. Villa, and R. Zich, "Low Gain Ring Antenna, Radiation Properties on a Ground Plane;" *Alta Frequenza;* 1967, *36*, p. 408.

[7] J. M. Boyer, "Hula-Hoop Antennas; A Coming Trend?;" *Electronics*, 11 January 1963, p. 44.

[8] Roy E. Pafenberg," The Hula-Hoop;" *Popular Electronics*, July 1963, p. 25.