C100 FM ANTENNA
INSTRUCTION BOOK

Report C100g

ENGINEERING SERVICES
2300 N. New York Ave.
Evansville, Indiana

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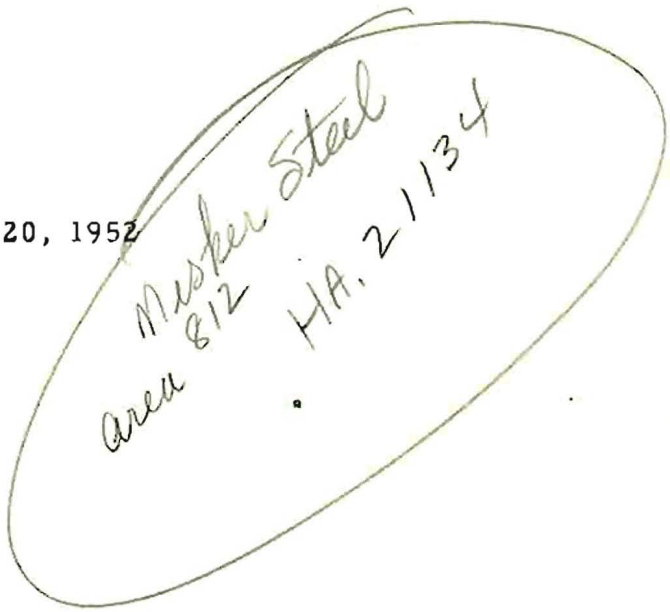

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Report by: H. KEES

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ILLUSTRATIONS

GENERAL DESCRIPTION

The C100 FM Antenna is an array of shunt-fed loops mounted on the transmission line which feeds them, which in turn may be supported by a suitable tower or pole. Each loop is tuned to half-wave resonance by an adjustable top-loading capacitor, the loop circumference being approximately 3/8 wavelength. Standard loops are available to accommodate the FM band of 88 to 108 megacycles.

The loops are usually mounted a wavelength apart to provide an antenna system with a power gain approximately equal to the number of loops employed. The gain of this type of array is given in Table I. When required, antenna systems employing other than full-wave spacings between loops can readily be designed.

The horizontal field pattern of the C100 loop is approximately circular, maximum radiation being in a direction outward from the condenser plates. See Table I. The pattern is virtually unaffected by the proximity of such structures as large poles and towers of small cross section.

The bandwidth of the C100 antenna is approximately one megacycle to the 2/1-vswr points, and several hundred kilocycles to the 1.1/1-vswr points. All antennas are tuned at the factory to obtain a vswr of better than 1.1/1 on 51.5-ohm transmission line.

Field experience indicates that it is desirable to employ heater elements in the loops in installations at locations where icing can occur. Standard heater units for de-icing purposes are available at extra

cost.

The main advantages of the C100 Antenna are its mechanical and electrical simplicity and its small size. Its narrow bandwidth, which is fully adequate for FM service, is an unwanted by-product of its compactness.

INSTALLATION

Mechanical

Essential details for mounting a C100 antenna on a tower or pole are given in the INSTALLATION DETAILS drawing. In general, the procedure for installing the loops is similar to that for the feeding transmission line, solderless connectors being provided at each loop to accommodate standard FM transmission lines.

The following points are important:

(1) The spacing between the circular condenser plates on the loops and the location of the feeding clamps should not be altered since these are critical factory adjustments.

(2) All loops should be mounted similarly on the supporting tower or pole, with all feed straps on the same side and with the condenser plates as far as possible from the tower. The two small drain holes on each loop should face downward.

(3) Supporting clamps should be located approximately 30 inches above and below each loop.

(4) All support clamps except the bottom one are of a sliding type which allows for vertical thermal expansion. The bottom clamp should be clamped rigidly to the transmission line so that it supports the entire vertical weight of the antenna array.

(5) Junction boxes are provided on the rear of each loop to

accommodate a-c heater wiring and standard conduit. A 60-volt, 100-watt heater element is located in each half of each loop and the two elements should be connected in series for 110-120-volt operation.

(6) To minimize the effects of moisture condensation, the feeding transmission line should be kept filled with dry gas at pressure of about five pounds. The shorting plate at the top of the quarter-wave section may be loosened temporarily to facilitate the draining of residual air from the transmission line.

(7) Occasionally, during shipment and handling, the nuts on the feeding studs are shaken loose, causing an air leak at the center hole of the insulator bowls on the loops. After an installation is completed, these nuts should be checked and tightened gently, care being taken to avoid damage to the sealing lead washers.

Electrical

Before the antenna and associated transmission line are put into service, tests should be made to insure that the over-all system is operating properly. This is extremely important because errors may have been made in installing the transmission line, and/or the loops may have been detuned by the supporting structure or mechanical damage.

It is recommended that a slotted line, high-frequency bridge, or other impedance-measuring device be connected to the transmitter end of the transmission line to check the entire installation. A vswr of better than 1.5/1 at the operating frequency is to be expected. A mechanical defect in the transmission line or antenna is usually indicated by a vswr of worse than 3/1.

If vswr's in the range of 3/1 to 1.5/1 obtain, it is probable that

the loops are slightly off resonance. The spacings between the condenser plates on all loops should be checked, at the centers, to insure that they are all the same. Then, all plates should be turned in or out simultaneously, in steps of approximately a quarter turn, until a vswr of less than 1.5/1 is obtained at the operating frequency. This method of retuning the antenna is usually satisfactory only when the total change in plate spacing is less than about two turns.

If it is necessary to make radical changes in antenna tuning, the manufacturer or an engineer thoroughly familiar with high-frequency techniques should be consulted.

As mentioned previously, provisions have been made for de-icing heaters in the loops. A junction box is located on the back side of loops supplied with heaters to accommodate standard power wiring accessories. The de-icers consist of a 100 watt, 60 volt, element in each half of each loop, and the two elements should be series connected for 115-volt operation. Inasmuch as the heaters are designed to compensate for very severe icing conditions, it is advantageous to provide some means, such as a tapped transformer, for normally operating the heaters at reduced voltages. Approximately 60 to 75 volts is usually adequate.

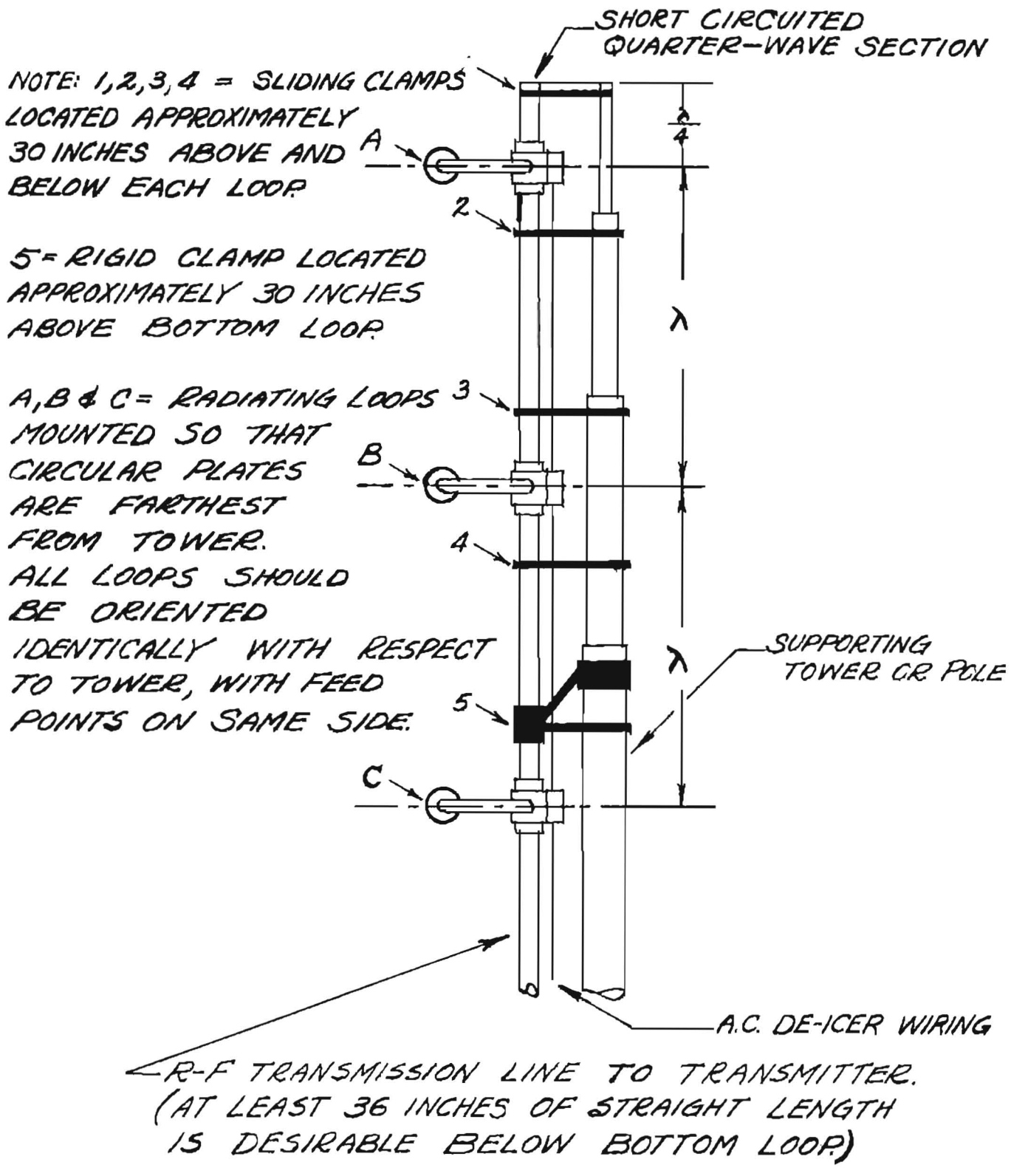
MAINTENANCE

All parts of the antenna, except the circular capacitor plates and the insulator bowls, may be painted periodically to prevent oxidation. The antenna loops should not be painted until final tuning on the customer's tower is complete, as, in some instances, it may be necessary to change the feed-clamp locations to obtain a satisfactory SWR.

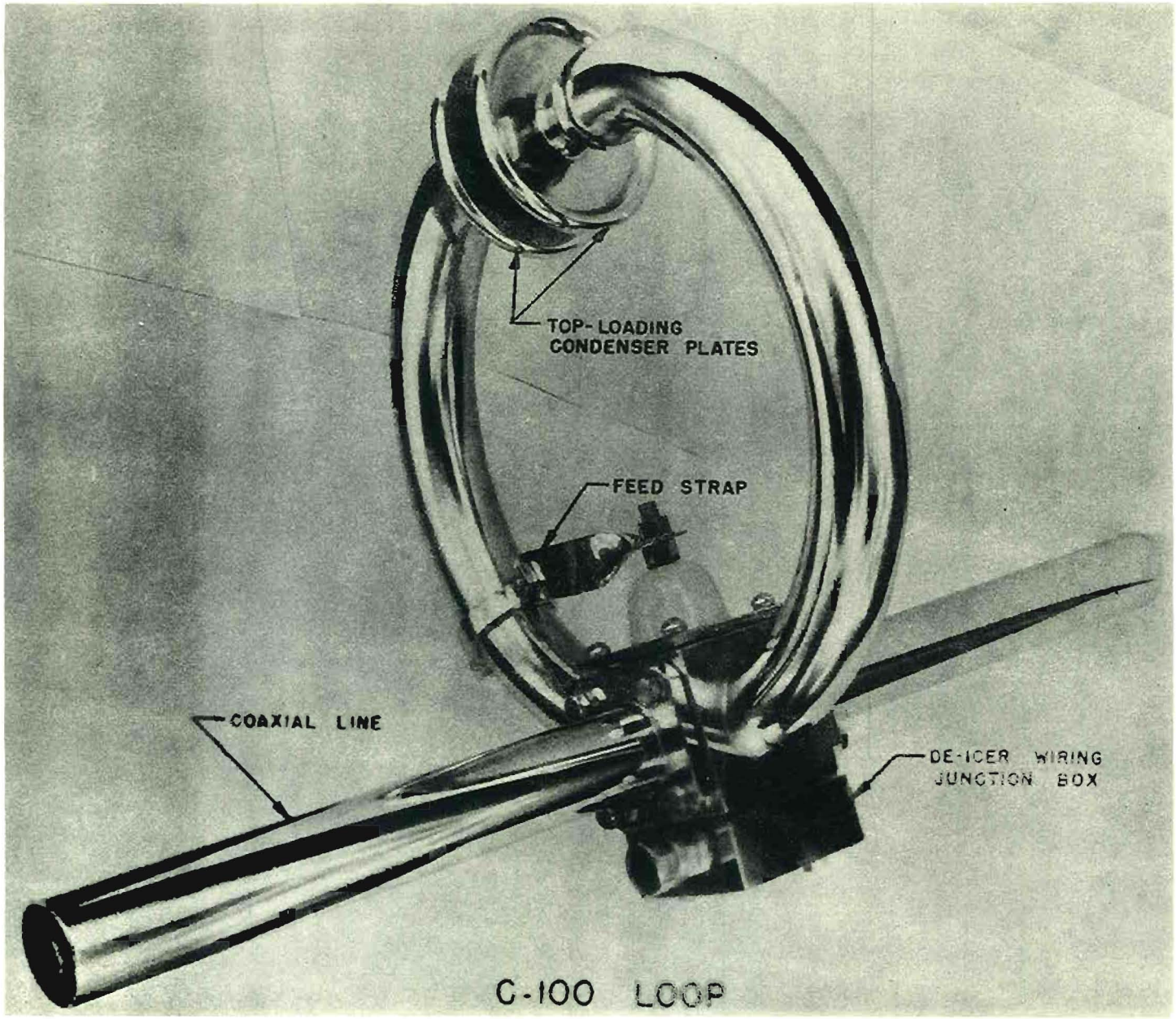
TABLE I - GAIN AND PATTERN DATA

No. of Loops	Power Gain*	Field Gain*	Field, (Mv/M/KW @ One Mile) Vs. Rotation					
			0°	45°/315°	90°/270°	135°/225°	180°	Average
1	0.9	0.95	146	133	119	130	137	131
2	2.0	1.41	217	197	176	193	203	194
3	3.0	1.73	266	242	216	237	249	238
4	4.1	2.02	311	283	252	277	291	278
5	5.2	2.26	348	316	282	310	326	311
6	6.3	2.51	386	351	313	344	361	345
7	7.3	2.70	416	378	338	370	388	372
8	8.4	2.90	446	406	362	397	417	399
10	10.5	3.24	499	454	405	444	466	446
12	12.7	3.56	548	498	445	488	512	490
14	14.8	3.85	593	539	481	528	554	530
16	17.0	4.13	636	578	516	566	595	569

*Gain over a dipole antenna having a radiation of 137.6 Mv/M/KW @ 1 mile.



INSTALLATION DETAILS


TOP-LOADING
CONDENSER PLATES
FEED STRAP
COAXIAL LINE
DE-ICER WIRING
JUNCTION BOX

C-100 LOOP