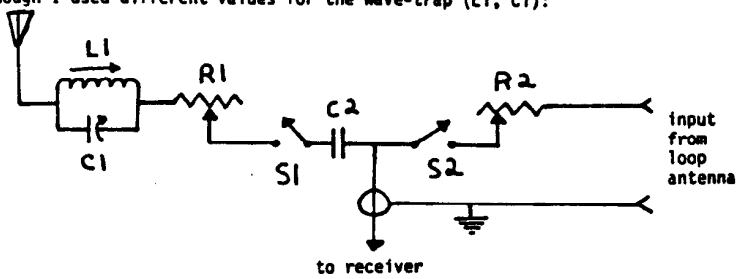
A LOOP-LONGWIRE COMBINATION

It is possible to use a loop antenna with a longwire to create a one-sided receiving pattern, unlike the bi-directional receiving pattern of a loop antenna when used alone. Ron Schatz described "Loop-Sense Cardioid Arrays" in articles which appear as reprints A5, A7, and A18. These are elaborations on the basic circuit that I will describe, and are an effort to make easier the notoriously touchy nulling on the loop-longwire arrangement. The simplest circuit I've seen is on page 257 of the 1979 World Radio TV Handbook. Matthew Shugart has used this circuit with some success in nulling his local--it is made up of a loop antenna, a longwire antenna and a wavetrap consisting of a coil and variable capacitor.

The classic cardioid pattern receiving antenna uses an omnidirectional (vertical) antenna, but on BCB, a longwire on a city lot hasn't really sharp directivity and can create a reasonably one-sided pattern in the circuit to be described. It doesn't create the heart-shaped receiving pattern which the true cardioid antenna has, but, theory aside, the fact remains that you can get a solid null on a station, yet hear another station 180° away--an unusual feat with a straight loop antenna. As with the loop, the circuit works best when nulling a station received on groundwave alone. It might be interesting to use an "active antenna" like the Dymek DA-100 vertical whip, and see if a better one-sided pattern results.

Here's the circuit. It was originally presented by Paul Swain in Medium Wave News, though I used different values for the wave-trap (L1, C1):



L1 - slug-tuned coil (BCB loopstick or Miller #6300 or 300 uH (approx) shielded, slug-tuned coil.)
C1 - 365 pF variable capacitor. A vernier drive or 15 pF "bandspread" variable capacitor in parallel with C1 will be necessary, as tuning can be quite tight.
C2 - any fixed capacitor in the 300-500 pF range
R1, R2 - 10 or 20 kΩ linear potentiometers. Again, adjustment can be tricky with these; 1 kΩ pots could be placed in series with R1 and R2 as fine-tuning.
S1, S2 - SPST switches

Note that both sides of C1 are ungrounded. It's probably best to place this entire assembly in an aluminum mini-box but the capacitor must be mounted on a piece of wood or plastic inside the box. It's suggested that the shaft of the capacitor be isolated from the tuning knob or vernier control, so that the effects of hand capacity don't throw out a touchy null. These same restrictions apply if you're using a small variable to "bandspread" C1.

To use this set-up, close S2, open S1, set R2 about mid-range. The loop is then tuned for maximum signal from the undesired station, and rotated until the signal peaks. Then open S2, close S1, set R1 at half scale and tune C1 for a dip in signal strength from this station. (Incidentally, L1 must originally be adjusted so that C1 will show a dip over its tuning range for stations at both the top and bottom of the band). Now switch S2 back on and adjust C1 for a dip in signal strength. If this null is poor or non-existent, swing the loop around 180° and try again. Having found a null with C1, carefully adjust your loop's tuning capacitor for a deeper null. R2 and R1 should now be adjusted for a deeper null. I found R2 most effective until the null was already quite deep when R1 had more of an effect. Continue to adjust C1, your loop's tuning capacitor, R2 and R1 until you obtain a satisfactory null. Try to minimize R2's resistance while maximizing the null, as this will give you the most signal from the loop. In some cases you will find that the null is so sharp that it eliminates the carrier of the offending station while leaving its upper sidebands to create havoc with your desired signal.

This is a time-consuming exercise, but if you're lucky and develop the skill, you can get quite spectacular nulls. Within two hours of building this, I logged a new country --Tahiti-738. This station is normally impossible here due to CKLG-730 splatter approximately 180° away from Tahiti. With this circuit, Tahiti was poor but audible //6135. With the loop alone, not even a carrier could be picked out of the CKLG garbage. If you use the circuit to null splatter this way, null the offending station first, then tune to the desired frequency, and readjust C1 (gently!) for minimum splatter. The null is very frequency selective and tuning even 8 kHz away from the offending station seems to give a different null pattern using this arrangement.

Selectivity of the null is a problem which has also cropped up particularly when attempting to null locals. You can often null the carrier to virtually nothing, but the sidebands of the offending signal remain at a good strength and, sounding like a SSB signal, still obliterate a weak signal trying to creep through. This means that the circuit must still be regarded as experimental in many cases.

There is some signal loss using this set-up, as nulling a station may require detuning the loop which will reduce signal strength on desired signals. Some signal is also lost in R2; I never have it at minimum resistance. Additional receiver gain should be able to make up the loss however.

For further information on loop/longwire combinations, see the above mentioned IRCA reprints A5, A7 and A18 by Ron Schatz, and A6 "Some Comments on the Loop-Sensor Cardioid Array" by Gordon Nelson. Also NRC reprints A2 "A zero sharpening device for a BCB loop" by T. Holmes, and A6 "Pattern-Controlled Loops, I & II" by Gordon Nelson. --NHP