THE ELECTRIC WAVE

BALUNS AND COAXIAL AERIALS

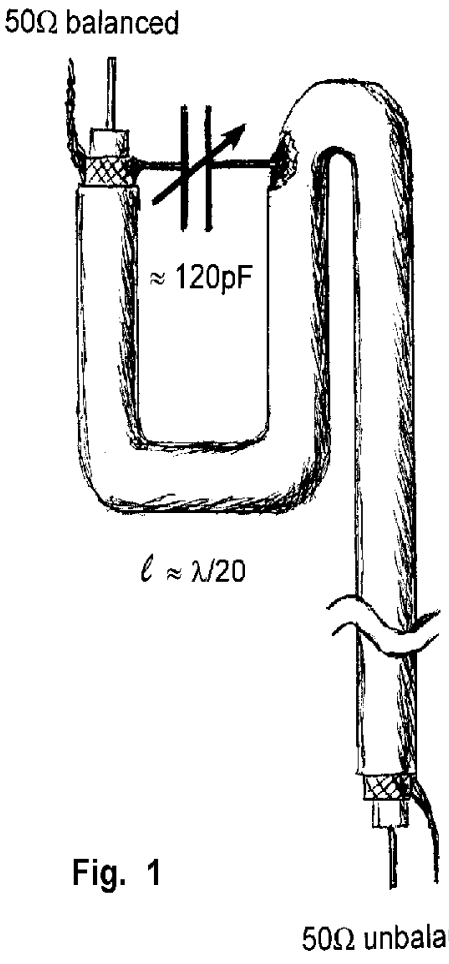

Fig. 1

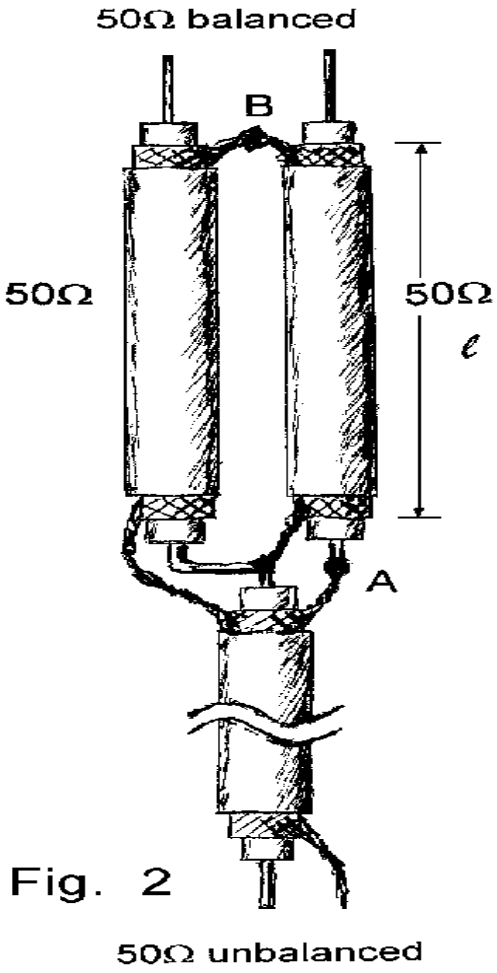

Fig. 2

If you are dealing with radiofrequency aerials you might like to experiment with the configurations proposed. In fig. 1 there is a balun which transforms an unbalanced line into a balanced feed. You need to connect a variable capacitor, typically a trimmer capacitor, between two points on the braid of the terminal part of the coaxial cable as shown in the drawing. The length and the capacitor value are optimized for operation in the Citizen Band and 50Ω cable but the set up is not critical at all and should work at other frequencies as well. The advantage of this balun is that you can provide a perfectly balanced feed to the

aerial thus compensating for any unbalance introduced by the topography of the ground around the same aerial. Another interesting application for this balun is to use it as a power splitter: if you measure the output power relative to ground (i.e. the cold side of the capacitor), you may adjust the power fed to the two terminals by simply operating on the capacitor. The phase relationship has not been investigated. Fig. 2 is a more classical approach to the problem: two quarter wavelength sections of the same coaxial cable give a balanced output with the least of trouble, but it must be mentioned that it works well only around the designed frequency, it is not a wideband balun. Length l is equal to $(\lambda/4)xP$ where λ is the operating wavelength and P is the propagation factor which depends on the type of dielectric material used in the coaxial cable as shown in the table:

Dielectric	P	Typical Cable
Solid polyethylene	0.665	RG 58 / RG 11
Polyethylene/air	0.835	RG 62 / RG 79
Fluorocarbon (Teflon)	0.675	RG 94 / RG 209
Foam polyethylene	0.816	TV cable

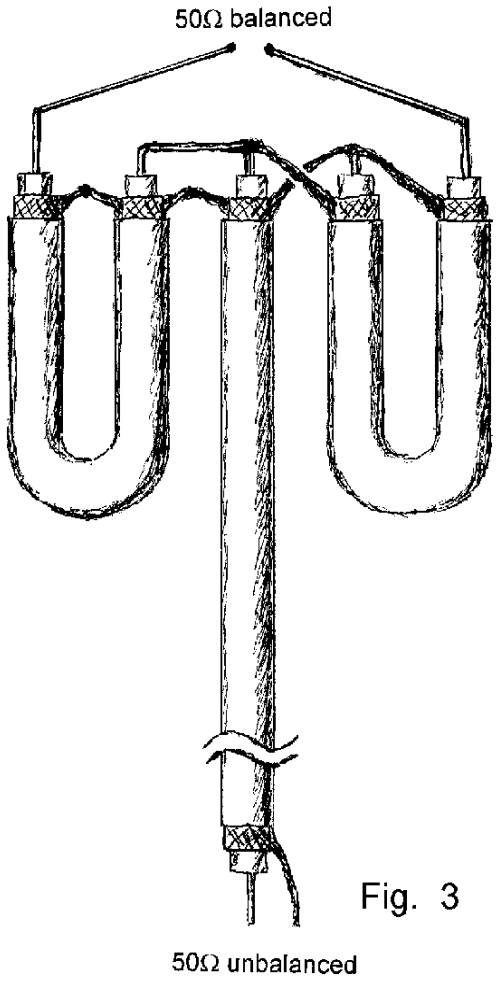

Fig. 3

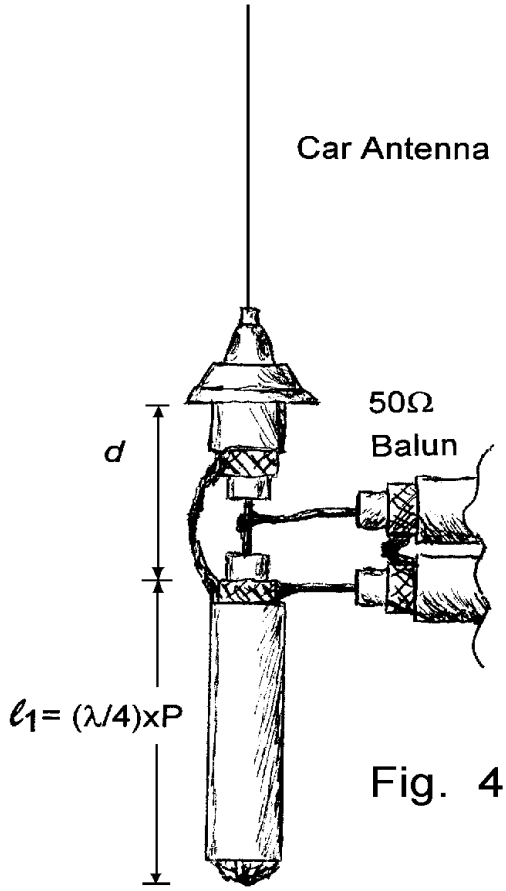

Fig. 4

The balun in fig. 2 can be wired also as in fig. 3. In fact, points A and B are at the same potential and can be connected together. Nothing changes from the electrical point of view but it can make a more compact construction in certain circumstances. The first application will allow you to install a CB car aerial in any other place without the need of the metal body of the car (fig. 4). The vertical section of the coaxial cable is short-circuited at the lower end. You might need to adjust the length of the whip, once in its final place, because distance *d* is to be subtracted from the total length of the car aerial.

The typical application is shown in fig. 5. Two different lengths are given: one applies to 50Ω cables and baluns and the other applies to 75Ω cables and baluns (fig. 7), these values are good for the design of receiving FM or TV aerials right up to UHF. It must be said that these designs are narrow band aerials and are not suitable to cover a wide frequency range. This means that if you tune to a specific TV channel you will get a performance that could be better than a Yagi but gives

poor results at other channels. One way around is to purposefully mismatch the design in order to cover a wider range but I was unable to assess how good this solution was.

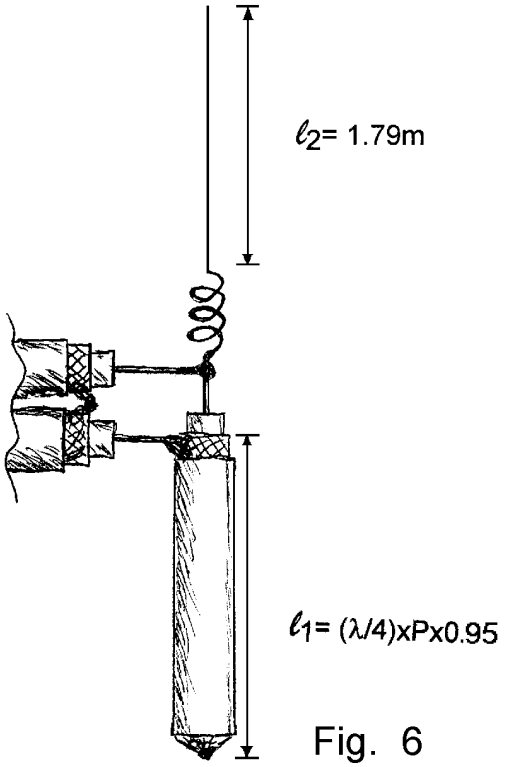

Fig. 6

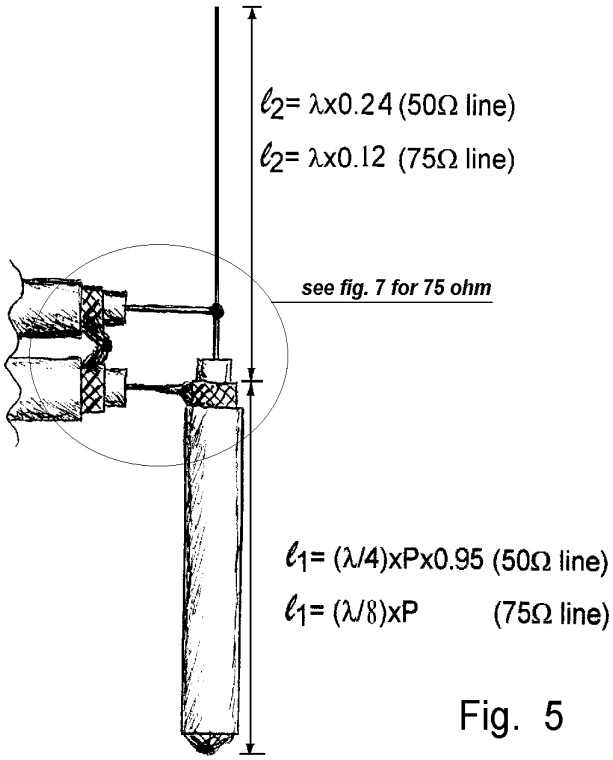

Fig. 5

If you find that the aerial is too long at the working frequency, you could apply the design of fig. 6 where a coil is inserted at the base of the aerial. The coil is made with 17 turns of 2mm electric wire on a 17mm form. These data are valid for the 27Mhz band and must be properly scaled at other frequencies. In all cases the vertical coax must be shorted at the far end because it works also as an impedance matcher for the rest of the aerial. Installation can be vertical, as shown in the drawings, or horizontal.

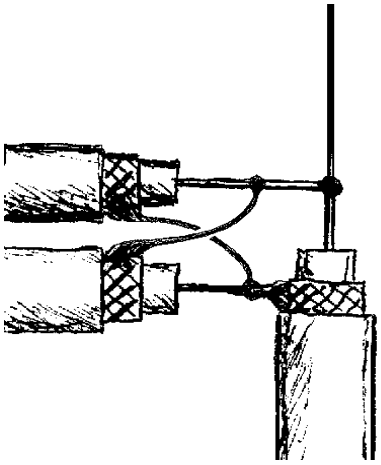

Fig. 7

For the 75 ohm line the antenna shows a low impedance and the balun will match it by wiring the two coax in parallel giving around 19 ohm.

All the mentioned aerials were tested in the 27Mhz band with satisfactory results: best performance being from the design of fig. 5. Gain was measured between 6 and 9 dB but the instrument available was not very accurate and I cannot bet on the number reported. As a receiving aerial it was tested in the FM range, VHF and UHF: in the VHF range I could see a TV channel that I was unable to see with a 4 element Yagi; in the UHF range the mechanical construction is rather critical due to the small size and the need of a wideband aerial becomes a major drawback.