FLEXIBLE BAZOOKA BALUN

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1 Claim. (Cl. 333—26)

This invention relates to line balance converters and more particularly to baluns or bazooka type of line balance converters.

It is well known that standing waves are detrimental to the satisfactory operation of a radiation system. Balance converters have been developed which permit the connection of an unbalanced circuit such as a grounded transmission line to a balanced circuit such as an antenna. One of the most commonly employed line balance converters for use with a coaxial transmission line is a bazooka type line balance converter or balun. Conventional baluns are basically sections of rigid hollow cylinders having a length of approximately one quarter of the operating wavelength. The hollow cylinder or pipe is concentrically disposed about the coaxial transmission line. One end of the pipe is in line with the termination of the transmission line and the other end of the pipe is conductively connected to the outer conductor of the transmission line. Such baluns are both bulky and heavy and do not lend themselves to positioning on a curved transmission line.

It is accordingly an object of the invention to provide a line balance converter which is very compact and light in weight.

It is another object of the invention to provide a flexible balun which can follow a curved section of flexible coaxial transmission.

It is another object of the invention to provide a balun which is flexible, inexpensive, light in weight, and easily maneuverable on a transmission line of curved configuration.

It is a general object of the invention to satisfy the other objects of the invention with a balun which is flexible, inexpensive, light in weight, and easily maneuverable on a transmission line of curved configuration.

Other objects and various further features of novelty and invention will be pointed out or will occur to those skilled in the art from a reading of the following specification in conjunction with the accompanying drawings which show, for illustrative purposes only, a preferred form of a line balance converter in accordance with the invention. In said drawings:

Figure 1 is a longitudinal section of a coaxial transmission line and the inventive balance converter.

Figure 2 is a perspective view of the line balance converter of Fig. 1 operatively positioned on a section of coaxial transmission line.

Figure 3 is a schematic diagram of the line balance converter and its associated section of coaxial transmission line.

Figure 4 is the equivalent circuit diagram of the line balance converter of Fig. 1.

Briefly, the invention contemplates a coaxial transmission line having an inner conductor and an outer conductor. Associated with the transmission line are a transmission end for transmitting signals along the line and a termination end for receiving signals transmitted along the line. A flexible sheath of conductive material is concentrically disposed about a length of the transmission line. One end of the flexible sheath is secured to the insulation surrounding the outer conductor of the transmission line adjacent to the termination end. The other end of the flexible sheath is conductively coupled to the outer conductor of the transmission line at a point spaced from the termination end.

More particularly, referring to Figures 1 and 2, a line balance converter 10 is shown operatively disposed with respect to a coaxial transmission line 12 for coupling an unbalanced circuit to a balanced circuit. The coaxial transmission line 12 comprises an inner conductor 14 concentrically encased by a tube 16 of an insulating material such as polyethylene. The outer conductor 18, concentrically disposed about the tube 16, is, in general, every dense braid of thin wires. A casing 20 of an insulating material concentrically envelops the outer conductor 18. Terminals 22 and 24 associated with a conventional R-F connector 26 (Fig. 2) respectively couple the inner conductor 14 and the outer conductor 18 to an unbalanced load. Similarly, the terminals 28 and 30 (Fig. 1) associated with a conventional R-F connector 32 (Fig. 2) respectively couple the inner conductor 14 and the outer conductor 18 to a balanced load circuit.

The balanced line converter 10 is characterized by a flexible braid sleeving 34 woven of fine wire conductors. A collar 36 attached to one end of the braid sleeving 34 is slidably, but tightly, secured to the casing 20 at the termination end 38 of the coaxial transmission line 12. The braid sleeving 34 is stretched to hug the casing 20. A circumferential gap 40 in the casing 20, exposing the outer conductor 18, accommodates a section of the braid sleeving 34 to provide an electrically conductive connection therebetween; metal collar 42 maintains the connection.

As shown in Fig. 2, a plurality of gaps may be provided selectively to locate the sleeve 34 along given different lengths of the line. Further, an elongated gap may be utilized to provide a slidable adjustment along the line. When the impedances of the balanced and unbalanced circuits are already matched, no impedance transformation is required and the balanced line converter 10 acts as a 1:1 transformer as shown in the equivalent circuit diagram of Figure 4.

Basically, the line balance converter 10 (Fig. 3) is a quarter-wave shield which is placed around the termination end 38 of the coaxial transmission line 12. A new section of coaxial transmission line is formed. This new section is a closed-end quarter-wave section 44 of coaxial transmission line whose inner conductor is the outer conductor 18 and whose outer conductor is the braid sleeving 34. In general, the outer conductor 18 is grounded. Therefore, since a high impedance exists between the braid sleeving 34 and the outer conductor 18, the section of the outer conductor 18 in the region of the termination end 38 is at a high impedance with respect to ground. Since the inner conductor 14 is already at a high impedance with respect to ground, the terminals 28 and 30 are at high impedance with respect to ground. If the terminals 28 and 30 are connected to a balance circuit, the inner conductor 14 and the outer conductor 18 will assume equal impedances with respect to ground and the braid sleeving 34 will be at ground potential.

It should be noted that the length of the sleeving is given as a quarter of an operating wavelength (λ). An effective quarter wavelength is the product of a quarter wavelength in free space and the propagation factor of the intervening medium. For common plastic insulations, such as polyethylene, the propagation factor is 0.52. Thus the axial length of the braid sleeving 34 is approximately an eighth of an operating wavelength.

Further, since the braid sleeving is not a continuous conductor, it has higher resistive losses than a conventional pipe type bazooka. In other words, it has a lower...
Q than the conventional line balance converter. It should be noted that a lower Q permits the transmission of a wider band of signal frequencies; in many applications, therefore, where the added bandwidth is required, the lower Q is an advantage.

There has thus been shown a line balance converter which is on the one hand light and compact and on the other hand flexible enough to follow a curved section of flexible transmission line. Furthermore, the disclosed balanced line converter is inexpensive, extremely easy to construct and easily maneuverable on the transmission line.

While the invention has been described in detail in connection with the preferred form illustrated and disclosed, it will be understood that modifications may be made within the scope of the invention as defined in the claim which follows.

I claim:

A coaxial transmission line balance converter to provide a flexible connection between a balance circuit and an unbalanced circuit comprising a central conductor of flexible electrically conductive material having a predetermined length, a first sleeve of flexible electrically insulating material disposed about said central conductor and extending continuously throughout its length, a second sleeve of flexible electrically conductive material disposed about said first sleeve and extending continuously throughout its length, a third sleeve of flexible electrically insulating material disposed about said second sleeve and having a plurality of gaps spaced apart and extending a predetermined distance along said length, a fourth sleeve of flexible electrically conductive material disposed about said third sleeve and extending continuously along said predetermined distance, and removable clip means to connect said fourth and said second sleeves electrically at a selected one of said gaps.

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