a coreless balun

1:1 impedance-matching transformer using RG-8X coaxial cable

What's a *balun*? What good is it? Why use it? These are questions often heard among Amateurs. *Balun* is an acronym for balanced-to-unbalanced transformer. The balun is used predominantly in rf transmission lines. A balun placed between an unbalanced feedline (such as coax transmission line) and a balanced antenna (such as a dipole or Yagi-antenna driven element) will eliminate or reduce antenna currents on the transmission line, which could cause radio-frequency interference (TVI, BCI).

Much controversy exists in Amateur circles concerning the usefulness of the balun. Some Amateurs swear by it. Others swear at it, claiming that the balun is an unnecessary nuisance and expense. Be that as it may, good engineering practice says that a transition between an unbalanced transmission line and a balanced load is, indeed, necessary. We therefore present this article by Roy Lehner, WA2SON, on a coreless balun for Amateur transmission lines. **Editor**

In pursuit of a balun for my new triband Yagi antenna, I found Badger's article[1] informative and encouraging. Attempting to adapt the design principles outlined in his article into a finished transformer was somewhat difficult for several reasons. The RG-141/U (Teflon dielectric) coaxial cable is extremely difficult to obtain and its cost is more than $3.00 per foot. How do I make the connections to the antenna and feedline that are waterproof and electrically sound? How can the finished unit be mounted on a Yagi-antenna boom in a neat and orderly manner? The following article discloses my resolution to these problems.

The coax I chose is the newly introduced RG-8X, a 52-ohm cable that's inexpensive (about 25 cents a

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foot) and capable of handling one kW. It is also easy to work with and coils neatly into a 4-inch (100-mm) diameter coil. (The coil diameter should be 15 to 20 times the coax diameter.)[1]

RG-8X cable can't withstand the same electrical stress as RG-141/U, because of its lower power rating. Using a badly mismatched antenna could ruin the RG-8X coax in the same way that coaxial feedlines may be ruined under high SWR conditions. In terms of balun efficiency and performance, both cables are equal and do a superb job — much better than the popular ferrite or air-wound enameled wire baluns on today's market.

construction

The balun consists of two equal windings of RG-8X coax, each 42 to 48 inches (1.07 to 1.22 meters) closewound into a single-layer coil (**fig. 1**). Although the exact length isn't critical, it's important that the two windings be equal in length to preserve electrical balance. Termination points **A-E** can be neatly made through use of No. 10 (M5) machine screws and eye-type wire terminals. Keep the connections as short and direct as possible. By keeping jumper **B-E** on the outside of the housing, the shield side of the input may be readily identified without having to remove the top cover once it is cemented in place (after, of course, the U-bolt is tightened to the supporting antenna boom).

The balun enclosure (**fig. 2**) should not be made of metal because of possible detuning effects on the resonant transformer. A functional and inexpensive container may be fashioned from a 4-inch (100 mm) PVC pipe coupling cut down to 2-1/2 inches (65 mm) long. Alternatively, a short length of acrylic tubing, or even some plastic freezer containers, may be used. In any case, be certain that the housing is watertight and that the top and bottom covers have no gaps, once cemented into place.

Placing the tube on a piece of sandpaper and slowly rotating it will help ensure a flat and even edge. Two 1/8-inch (3-mm) drain holes should be drilled into the housing bottom.

Similar baluns may be constructed for the 160-40 meter bands; however, a longer winding of coax will be required. (See reference 1 for details.) With a little mechanical ingenuity, there's no reason why this type of balun couldn't be used for flat-top wire dipoles, so long as the enclosure is capable of withstanding the stresses imposed.

What more can be said — good balun, good price, good luck! See you in the pileups.

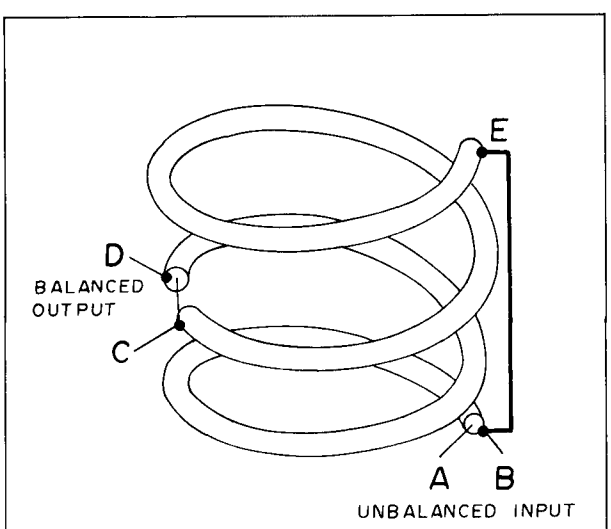

fig. 1. The 1:1 broadband coaxial balun. Actual transformer consists of seven turns closewound (3½ turns either side of the output) of RG-8X coax approximately 4 inches (100 mm) diameter. Center conductor in upper winding is not used.

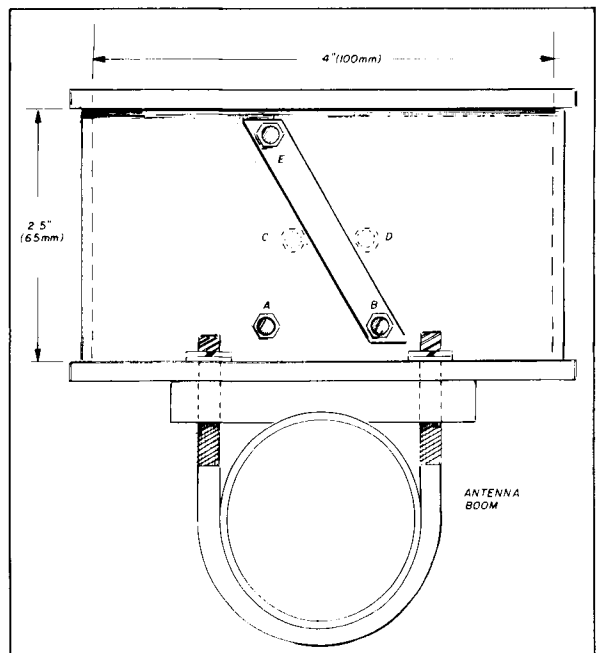

fig. 2. Physical layout of cylindrical balun housing. Output termination points *C* and *D* are located on the opposite side of the container. Top and bottom covers are epoxied in place. *B-E* jumper is mounted on outside of housing to identify shield side of input.

references

1. George Badger, W6TC, "New Class of Coaxial-Line Transformers," *ham radio*, March, 1980, pages 18-29.
2. *Fundamentals of Single-Sideband*, Third Edition, September 15, 1960, Collins Radio Company, Cedar Rapids, Iowa, pages 10-11.

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