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Ribbon Cable Loops

Mark Connelly - MAIION - 06 AUG 1992

A cheap, but effective, alternative to ferrite loop heads is a loop constructed of ribbon cable of the type often used for computer interconnections. This cable consists of a group of parallel insulated conductors formed onto a single flat strip. Wire gauge for each conductor is typically #28 (AWG) and the distance between adjacent conductors is 0.05" (1.27 mm). By using a number of the ribbon cable's conductors wired in series, a loop coil may be formed. This coil may then be mounted on a suitable crossarm support assembly. The customary loop configuration is square (/ diamond), but circular, triangular, and other layouts could be used instead with no great change in performance. If the support assembly can be quickly disassembled and re-assembled (or folded and unfolded) and if the ribbon cable can be easily detached and re-attached to the support assembly, an effective loop for DXpeditions and other travel can be made.

My experiments were done with a 5 ft. / 1.52 m. length of ribbon cable sold by Radio Shack (part number 278-772, US price $3.59). This initially has 25 parallel conductors. Cut-and-try experimentation determined that a 10-conductor piece gives the correct inductance for a medium wave loop compatible with operation in Palomar, Quantum, and RTL-2 bases. These base units are characterized by fairly high tuning capacitances - on the order of 440 to 940 pF low band (e. g. 500 - 750 kHz) and 30 to 530 pF high band (e. g. 700 - 1800 kHz). Other tuning capacitances will mandate different ribbon cable lengths and/or different numbers of conductors.

Construction of the ribbon cable loop head assembly is straightforward. A "DB25" computer connector is used for the required junctions at the ends of the ribbon cable. Figures 1, 2, and 3 illustrate the necessary connections.

The support frame arrangement of Figure 4 was used for quick testing. My main application is remotely-tuned loops used in a phased configuration (loop vs. loop, or loop vs. whip, via the DCP-1 Dual Controller / Phaser). Nulls are established electronically; therefore, the need to tilt and rotate the loop manually is not a high priority. For easy tilting and rotation ("normal" loop use), a more sophisticated loop support assembly would be required. NRC loop antenna manuals and Ken Cornell's "Medium and Low Frequency Scrapbook" present many worthwhile mechanical construction details for loop support frames.

*** Test Results ***

Sensitivity, with the 10-conductor ribbon cable formed into a diamond approximately 15" (0.38 m.) on a side, was comparable to that of the Quantum and Palomar medium wave ferrite heads. I had thought that the close conductor spacing could wreck Q (tuning sharpness) and severely limit the tuning range. This did not seem to be the case: Q and tuning range were only SLIGHTLY greater with the ferrite heads. The cost-conscious should note that Palomar gets $79.95 for its "BCB" loop head (Universal Radio catalogue 91-06); a ribbon cable head of equivalent, or better, sensitivity can be thrown together for less than $10 - FAR less if you go to ham "flea markets".

The cheapness of this method allows for much experimentation including loops for other frequency ranges, tapped-down (low-impedance) outputs, etc.

To operate on a lower frequency range, the use of more conductors and/or a longer piece of ribbon cable is suggested. Initially, I had used 24 of the original 25 conductors and I tuned in on robust signals from longwave aerobeacons and Trans-Atlantic broadcasters around 250 kHz. Fewer conductors and/or shorter lengths of ribbon cable will raise the operating band: this leads to thoughts of tropical-band and 160/80/75 meter ham use.

Figure 5 illustrates the schematic of an active loop for use with ribbon cable loop heads. The base unit will also work with ferrite heads such as Quantum and Palomar. Base circuitry should be assembled in a metal box. For BUF-A documentation, see my article "BUF-A Buffer Amplifier Card: A Valuable Building Block for DX Projects" (15 JUN 1992). For BBA-C1 documentation, see "RTL-1A: Improved Version of RTL-1 Remotely-Tuned Loop" (15 APR 1992). For ease of tuning, it is recommended that R2 of Figure 5 be a 10-turn type. A single-turn pot could be used, but tuning would be touchier.

As active air-core loops are more susceptible than ferrite loops to shortwave mixing spurs, series inductors (RFC1 & RFC2 = 33 uH, in this case) should be used. If spurs persist, increase these to 100 uH each.

Because a varactor is used for tuning, the problems of variable capacitor availability, complicated mounting schemes, and hand capacitance are eliminated. In the worst strong-signal environments, the varactor might create spurs; if that's the case, replace it by a variable capacitor with a range of approximately 30 to 530 pF (placed across the loop head coil) and delete the varactor-tuning-related components - Figure 5: C1, C5, C6, D1, D2, R2, R7, R8, RFC3, and RFC4.

Passive Loops

Tapping down allows for passive loop operation. This is typically done by bringing out 2 tap leads; these should be 1 turn away from the center tap (ground) in each direction. See Figure 6. Passive loops are, of course, much less sensitive than active loops but they have the advantage of no distortion products from overload; this is especially the case with air loops with no ferrite core material to saturate. A passive loop is the only workable medium wave antenna at some urban locations. A larger loop (e. g. 3.3 ft. / 1 m. on each side of the square) will probably be necessary. Add or remove conductors from the ends, as required, to establish the correct tuning range.

FIGURE 2: STEREO PHONE PLUG CONNECTIONS
(PLUG SHOWN WITH SHELL REMOVED)

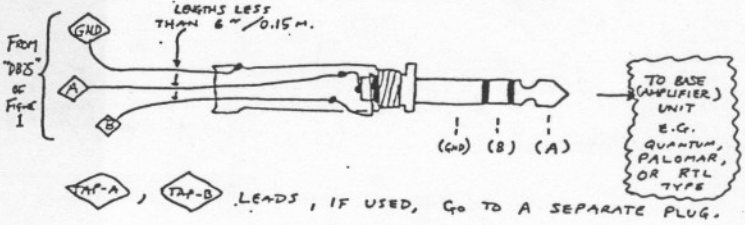

FIGURE 1: JUNCTION AT ENDS OF RIBBON CABLE

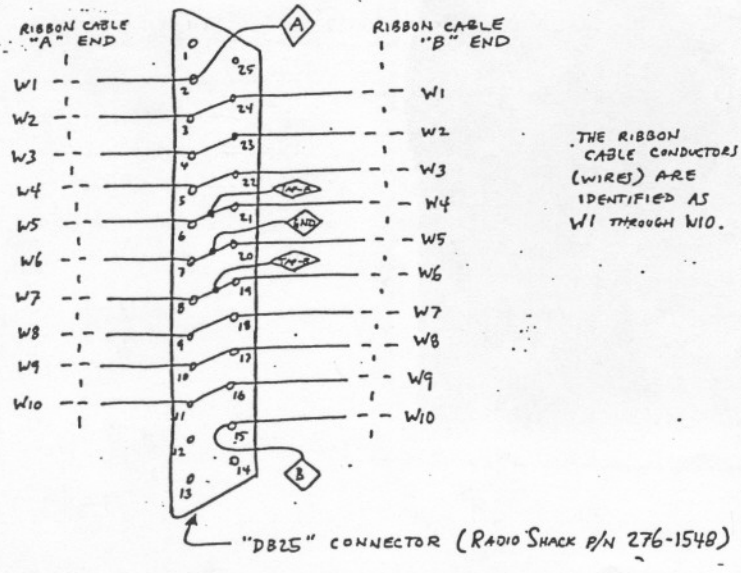

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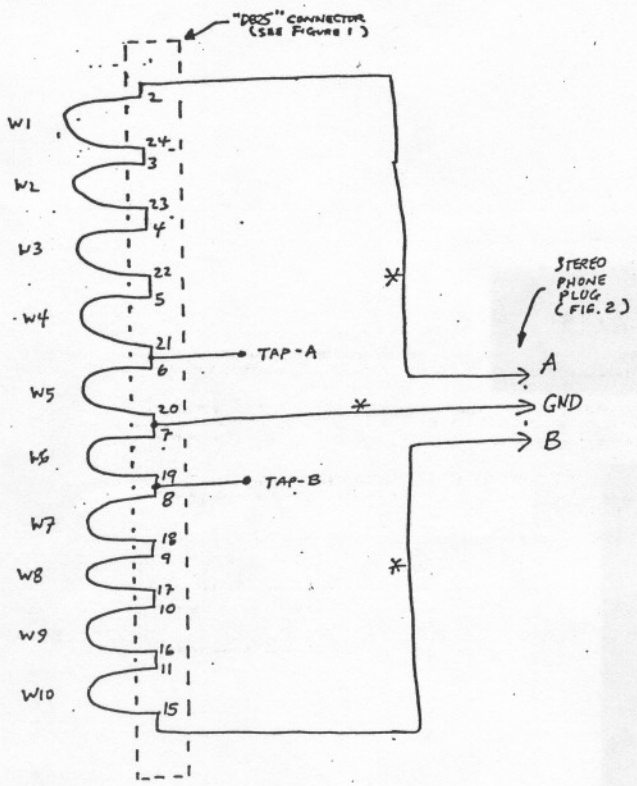
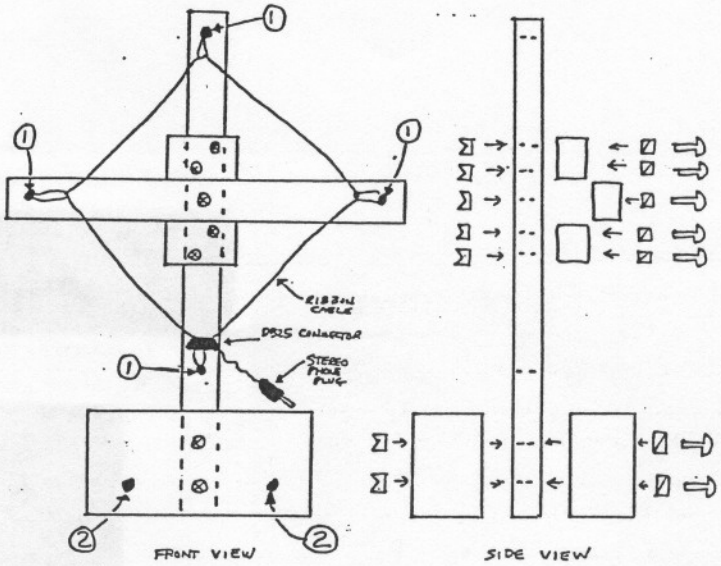
FIGURE 3: HEAD SCHEMATIC



* = LEADS INDICATED SHOULD BE LESS THAN 6" / 0.15 M. IN LENGTH

FIGURE 4: LOOP SUPPORT FRAME

NUMBERS WITH ARROWS REFER TO NOTES.



NOTES

MATERIAL: WOOD OR OTHER STURDY NON-CONDUCTIVE SUBSTANCE

DRAWING IS SKETCH ONLY. DIMENSIONS ARE TO BE DETERMINED BY THE REQUIREMENTS OF THE END USER.

Σ = WING NUT

⊠ = SPLIT LOCKWASHER

⇨ = SCREW

① HOLES FOR WIRE SUPPORT — PLASTIC TRASHBAG TIES MAY BE USED TO ESTABLISH PROPER TENSION.

② HOLES TO BE USED TO MOUNT SUPPORT FRAME ONTO AMPLIFIER BASE UNIT.

FIGURE 6: PASSIVE LOOP

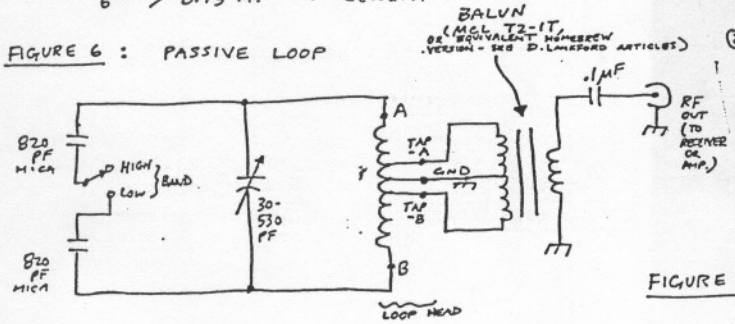
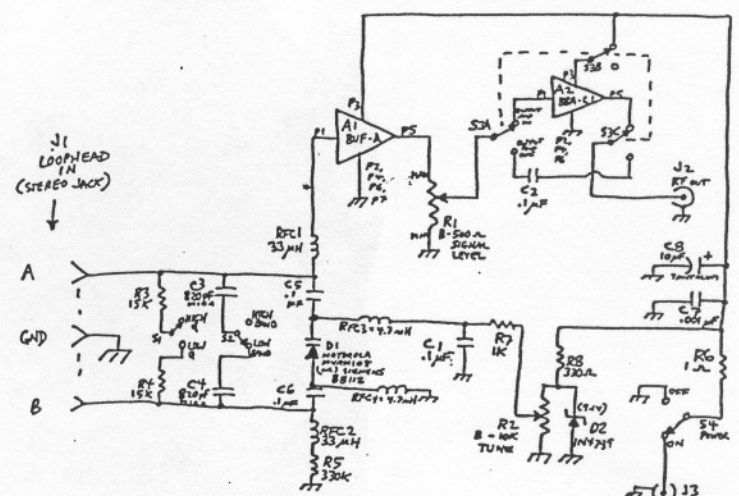


FIGURE 5: SCHEMATIC OF A BASE (AMPLIFIER) UNIT



A1 (BUF-A BUFFER AMP.) AND A2 (BBA-C1 BROADBAND AMP.) ARE DESCRIBED IN OTHER ARTICLES, AS NOTED IN THE TEXT OF THIS ARTICLE.