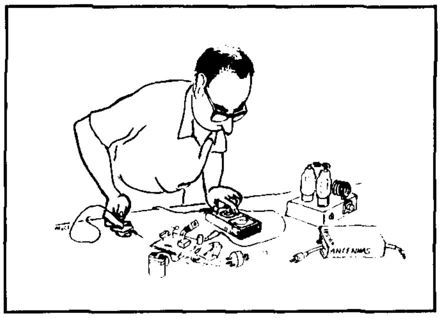
Ham Radio Techniques



Bill Orr, W6SAI

INTERESTING ANTENNA FEED SYSTEMS

In my August column, I discussed the gamma match — a convenient and easily adjustable device for matching a coax line to the driven element of a Yagi beam. Many commercial beams use this system.

Other interesting but less well-known matching systems exist; I'll cover a few that the homebrewer can use. Some of the matches will function with a multi-band antenna, while others are single band devices. All of them deserve consideration for your next antenna project.

The W6GKM matching system

Back in 1950 Dale Frink, W6GKM, devised a match for his 10-meter beam.[1] The arrangement is shown in **Figure 1**. The driven element is split with a 2-inch gap at the center, and excited by a length of 50-ohm coax. The inner and outer conductors are shorted together at each end of the coax, and the shield braid is broken and fed with the transmission line at the center. The "matching coax" is about one-quarter wavelength long.

Dale taped the matching coax to the driven element, taking care that the ends of the coax didn't short to the driven element. He found the SWR was low over the entire 10-meter band. Dale told me that he'd also placed the matching coax inside the driven element, instead of taping it to the outside. It seemed to work equally well either way.

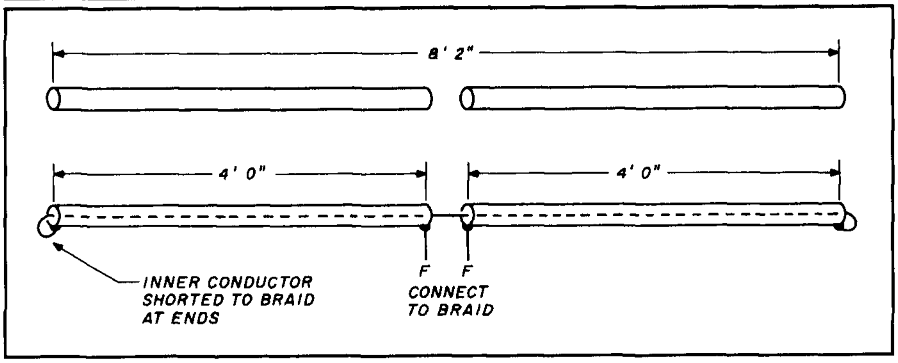
How does this device function? The driven element is split and there are no electrical connections to either half. The simplest explanation is that the capacitance between the matching coax and the dipole halves does the job.

The Mosley "Classic" match system

The Mosley "Classic" series of antennas use a similar matching scheme.[2] This device is shown in **Figure 2**. The Mosley advertisement calls it a "balanced capacitive match." The Classic match resembles the system used in W6GKM's design. Even though Dale uses coax in his match, the only meaningful part of the match is the outer shield of the coax — the inner conductor contributes nothing. By substituting a single insulated wire for the coax, you have the Classic system instead of the W6GKM match.

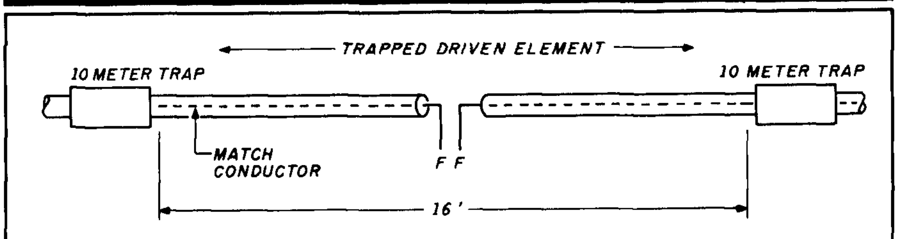
With the Classic-33 tribander, the match conductor is about a quarter wave long on 20 meters. It's placed inside the split driven element. I'll accept that; but how does the match function on the 15 and 10-meter bands, where the match wire is longer than a quarter wavelength? Is the length of the match wire unimportant, or does it bear a specific relationship to the operating frequency? I know the match works because I have a Classic-33 beam. It has a good front-to-back ratio, a good operating bandwidth, and exhibits a low SWR value at resonance on each of the three HF bands (10, 15, and 20 meters). Those are the principal attributes of a good match-

FIGURE 1



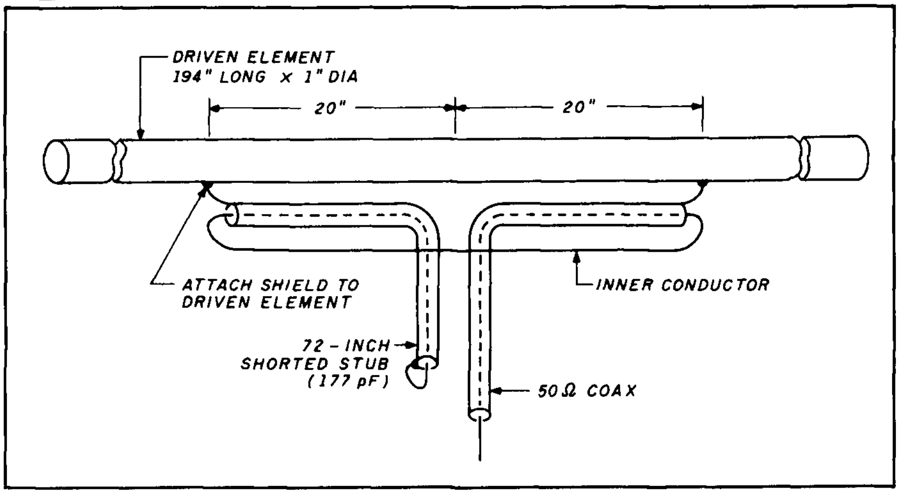
W6GKM feed system. Matching coax is taped to element. Feedline is connected to braid at F-F.

FIGURE 2



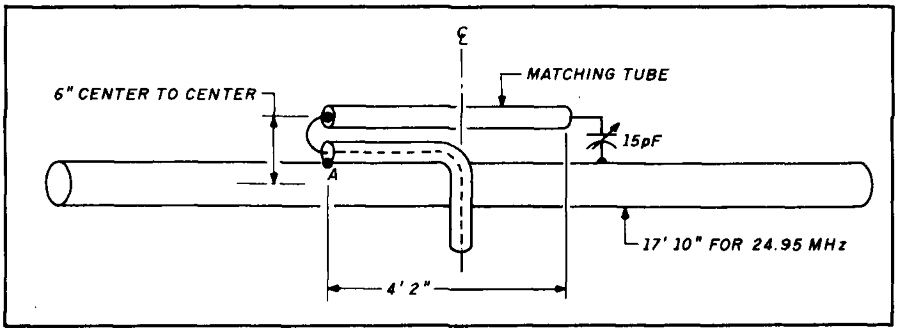
"Classic" feed system consists of coaxial wire placed in each half of trapped driven element.

FIGURE 3



"Clemens match" for 29 MHz. Two gamma matches back-to-back?

FIGURE 4



ZL2ANT version of Clemens match. Coax is taped to driven element. Shield is attached to driven element at A and center conductor is attached to matching tube. Tony says system works best when both tubes are the same diameter.

ing system. Is it purely a capacitive match, or do the match wire and the split element form some kind of a coaxial matching transformer?

The Clemens match

In 1951 John Clemens, W9ERN, published a novel match system he had adapted from a television antenna matching scheme.[3,4] He applied the match to a three-element 10-meter beam (**Figure 3**). This wild-looking device taps the outer conductor of the coax feedline on the driven element at a point that provides a good match to the line. The inner conductor is brought back along the driven element to an equivalent point on the opposite side of the element. It's connected to the element at this point through a series capacitor. The capacitance is made up of a section of coax line. The tap points and capacitance value are varied until unity SWR is obtained at the design frequency.

If you use your imagination, you can think of this device as two back-to-back gamma matches. The gamma capacitor is moved from the base of one gamma to the antenna end of the gamma conductor. The gamma "rod" is the 40-inch length of coax conductor running from one tap point to the other. What an interesting idea!

The Clemens match sank into oblivion for decades. I forgot about it completely until I worked Tony, ZL2ANT, a few days ago. He had taken the 1951 design and modernized it (**Figure 4**). Tony jettisoned the coax and substituted an aluminum tube. He fed the tube and one side of the driven element with the coax feedline taped along the driven element. With the dimensions shown, his series capacitor was 15 pF, as opposed to the 177 pF of the W9ERN design. He feels the 6-inch separation between the matching tube and the driven element accounts for this difference. Tony says the match is very broad and he can work the dipole on both the 10 and 12-meter bands, with low SWR on each band.

All of these designs show the promise of multiband operation. In fact, multiband operation is proven with the Mosley Classic match. Perhaps one of these ideas is the one for you!

The Weinschel matching system

In 1972 *QST* published a triband beam that uses a trapped 20/15 meter driven element connected in parallel with a 10-meter element placed about 18 inches away (**Figure 5**).[5] The elements are connected by double wires, and the combination is fed at the center of the 10-meter element. The product review reported very low SWR on all bands, and the antenna exhibited good front-to-back ratio. I don't know of anyone who has tried this multiband matching system. I'm eagerly awaiting a missive that will inform me of the actual operating results achieved with this simple design.

The open sleeve dipole system

An unusual dual frequency antenna was developed at Stanford Research Institute in 1950. Its operation was described in a paper by H. B. Barkley.[6,7] Roger Cox, WBØGDF, gives a good decription of the device in Amateur terms in *CQ* magazine.[8]

The device is called an "open sleeve dipole." It consists of a conventional center-fed dipole with two parasitic elements spaced close together on each side. The parasitics are cut to a half-wavelength at some higher frequency (**Figure 6**). The ratio of high to low frequency can't exceed 2:1.

You can make a practical open sleeve dipole for 20/17, 20/15, 15/12, 20/10 meters, or other combinations of frequencies between 14 and 29.7 MHz. The drawing gives dimensions for a 20/10 dipole.

This scheme looks like a quick and painless way to add second band capability to an existing beam. In addition to the "sleeves," you can interlace the parasitic elements for the higher band between the existing elements. It's worth a try!

The Telex/Hy-gain para-sleeve matching system

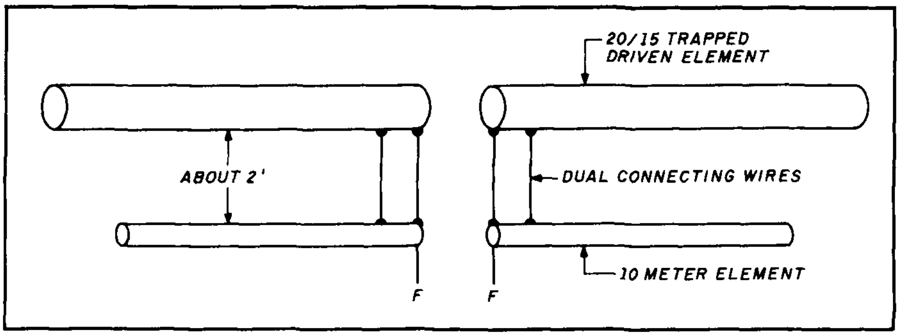
Here's a triband antenna which uses the open sleeve dipole concept. A product review[9] says the driven element of the "Explorer 14" beam consists of three elements insulated from the boom. The longer element is trapped for 20 and 15-meter operation. The two short sections spaced close to the driven element act as an open sleeve dipole for 10 meters. The short elements are optimized to provide the best SWR across the 10-meter band. The 15/20 meter element is fed with a "hairpin match," balun, and 50-ohm line. According to the product review, the SWR is quite low at design resonance and the front-to-back ratio is good on each band.

The Telex/Hy-gain TH7DX drive system

This top-of-the-line triband beam has two trapped, driven elements for 20, 15, and 10 meters. **Figure 7** shows the feed arrangement. The elements are cross connected at the centers and the rear element is fed with a hairpin match, balun, and 50-ohm line. The TH7DX drive system also has very low SWR and good front-to-back ratio at design resonance on each band.

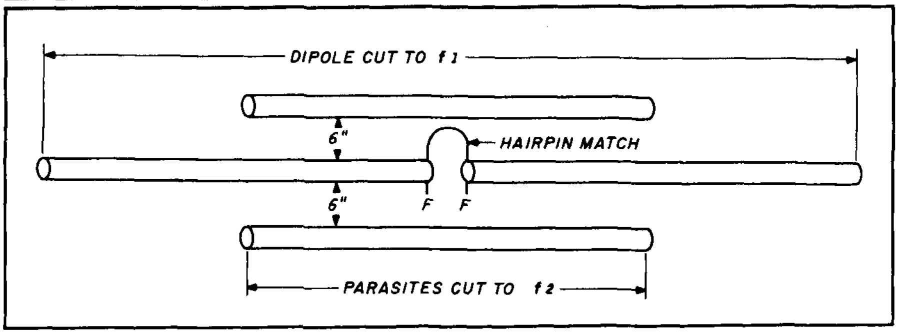
This matching idea resembles the Weinschel system, but uses a crossover connection instead of a parallel connection between the elements. I wonder about the significance of this difference in connections. The crossover scheme reminds me of the feed system used on a log-periodic array. Hopefully, someone will come up with a computer program that analyzes these interesting matching systems.

FIGURE 5



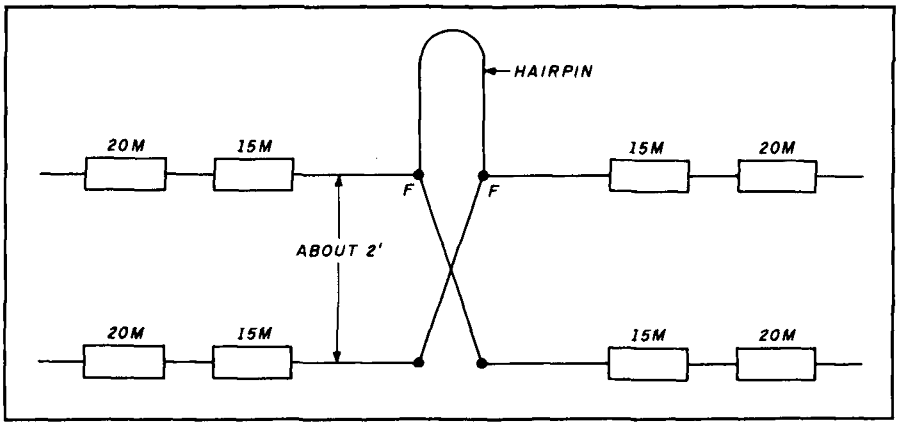
The Weinschel match. Coax balun is used at F-F. Later model beam used "hairpin" match at feedpoint in addition to balun.

FIGURE 6



"Open-sleeve" two-frequency dipole. Spacing between driven element and parasitic element is about six inches.

FIGURE 7



Telex/Hy-gain triband match system using two trapped elements.

The Log-Yagi design

The matching systems I've discussed work on one or more Amateur bands, but it doesn't look as if any of them will cover the five bands between 14 and 29.7 MHz. The log-periodic antenna is the only device that will do this in an acceptable manner. This design trades power gain for bandwidth, and you must put a lot of log-periodic aluminum up in the air to provide equivalent Yagi performance over a wide bandwidth.

There's an interesting derivation of the log-periodic antenna that provides good gain over a single Amateur band when used in combination with Yagi-type parasitic elements. This idea uses a single band log-periodic "cell" of three or four elements, with extra parasitic elements. The technique has been used with single channel TV antennas and is now gaining popularity in Amateur Radio's HF and VHF circles. I discussed this interesting antenna concept in last month's column.

Next month (if I don't forget), I'll review the hairpin (inductance) matching technique. It's another way of matching the coax line to the driven element of an array.

The Dead Band Quiz

I thought I had you confounded with the April Quiz about the coax line sections, but a lot of you realized the answer was "zero ohms:"
N1EVN, AB1K, K1REC, WA2DWV, KC2KB, WB2KHE, W2LYH, WB2NTQ,

W2RJW, N3GDE, NK3Z, WX4D, N4DX, W4EIN, WB4HXF, W5DS, K5ESV, K5GV, KA5MXX, W5PEK, K5RA, WB6AWM/7, W6BDN, WB6BYU, WD6DUD, KJ6GR, W6HDO, W6KEZ, ND6M, W6NTX, WA6ZOU, K7FC, W7FSP, WD8KBW, WA8KNE, W8YFB, W9BTI, N9HWC, KS9J/Ø, W9NGP, AAØB, KØLSJ, GØFAH, G4TDJ, VE4KZ.

Congratulations to all!

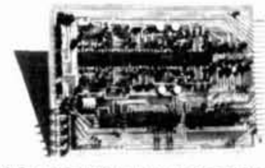
A thought about the "no-code" license

The May 1989 issue of *The Old Timer's Bulletin* (a publication of the Antique Wireless Association, Inc.) had an interesting comment on the no-code licensing proposal. Bruce Kelley, W2ICE, quotes a reader's suggestion. He makes the argument that the FCC and the ARRL are going about the *license enhancement in the wrong way* — the code requirement should be retained but the theory should be eliminated! The great majority of hams use factory-made equipment and wouldn't dare touch it if something was wrong for fear of voiding the warranty! They send it back to the maintenance center, and let factory-trained technicians repair it. So why is there a need for technical know-how? Take a look at the February 1988 *Ham Radio* cover, and you'll know what Bruce is talking about! hr

REFERENCES

1. Dale Frink, "Something New in Matching Devices," *QST*, April 1950, page 64.
2. Mosley Electronics, Inc. advertisement, *QST*, August 1969, front inside cover.
3. John Clemens, "The Clemens Match," *QST*, February 1951, page 26-28.
4. John Clemens, "A Coaxial Feed System for Antennas," *Electronics*, October 1950, page 154-55.
5. "Recent Equipment: The Weinschel System 1 Triband Yagi," *QST*, December 1942, page 41-42.
6. H. Barkley, "The Open Sleeve as a Broadband Antenna," U.S. Naval Postgraduate School, Monterey, California.
7. H. King, "Experimental Antenna Development at the Aerospace Corporation," *IEEE Antennas and Propagation Newsletter*, Vol. 24, No. 2, April 1982, page 5-8.
8. R. Cox, "The Open Sleeve Antenna," *CQ*, August 1983, page 13-18.
9. J. Schultz, "The Telex/Hy-gain Explorer 14 Triband Beam," *CQ*, April 1985, page 18-21.

THE MULTIPLE RECEIVER SOLUTION



4 Channel Signal-to-Noise Voter

- Expandable to 32 Channel by Just Adding Cards
- Continuous Voting
- LED Indicators of COR and Voted Signals
- Built-in Calibrator
- Remote Voted Indicators Pinned Out
- 4½ x 6 Double Sided Gold Plated 44 Pin Card
- Remote Disable Inputs
- MORE

Built, tested and calibrated with manual

$350.00

Telephone interface now available
For more information call or write:

DOUG HALL ELECTRONICS
Voter Department
815 E. Hudson Street
Columbus, Ohio 43211
(614) 261-8871

✓ 137

PC Slow Scan $149.95

A complete slow scan television station for your IBM PC or compatible. Send and receive images in up to 10 shades of gray depending upon your graphics card and printer.

Includes:
Demodulator Modulator 75 Page Manual
Software Tutorial Cassette

Requires:
Ham transceiver PC with 640K Parallel Port
Graphics Card Tape Recorder Serial port

Slow Scan Formats: 8,12,17,23,34,36,48,72 sec.

Software Systems Consulting
1303 S. Ola Vista
San Clemente, CA 92672
(714) 498-5784

✓ 138

LOW BAND DX-ING COMPUTER PROGRAMS

by John Devoldere, ON4UN, for Apple IIe/c, MS-DOS, Commodore C-128 Apple Macintosh and Kaypro CPM Computers

Here's a collection of 30 super programs written by ON4UN. Just about every interest or need is covered—from antenna design and optimization to general operating programs. Antenna programs include: shunt and series input L network design, feedline transformer, shunt network design, SWR calculation, plus 11 more! General Ham programs include: sunrise/sunset, great circle distances, grayline, vertical antenna design program, sunrise calendar plus 9 more! Phew. When you sit down to use these programs you'll be amazed at what you have. The best value in computer software available today. © 1986.

☐**UN-Apple IIe/IIc**	**$39.95 ea.**
☐**UN-MS (MS-DOS)**	**$39.95 ea.**
☐**UN-CPM/Kaypro**	**$39.95 ea.**
☐**UN-C-128 (COMMODORE)**	**$39.95 ea.**
☐**UN-MAC (MACINTOSH)**	**$49.95**

LOW BAND DX'ING
by John Devoldere ON4UN

Now Available! The new, 2nd edition of the definitive book on Low Band DX'ing. Based upon years of practical on-the-air experience, learn the secrets of how ON4UN has been so successful on the low bands. Extensive coverage is given to transmit and receive antennas with clear concise explanations and plenty of illustrations—dipoles, inverted V's, slopers, phased arrays and Beverages—they're all in this book. Also covered: propagation, transmitters, receivers, operating, software and an extensive Low Band bibliography. Going to be a best seller! Get yours today. © 1987 2nd Edition 200 pages

☐**AR-UN** **Softbound $9.95**

BUY'EM BOTH SPECIAL OFFER

Book & Software Reg. $49.90
($59.90 for Mac)

Just $44.90 ($54.90 for Mac)

☐**UN-SO (specify computer) $44.90**
☐**UN-MSO Macintosh Special $54.90**

SAVE $5

Please enclose $3.75 shipping & handling

HAM RADIO BOOKSTORE

ham radio
GREENVILLE, NH 03048 603-878-1441

NEW!

The classic "Antenna Bible" now in a thoroughly-revised, much-enlarged edition

ANTENNAS
2nd edition
by John Kraus, W8JK
Ohio State University

Covers both theory and its applications to practical systems. With design formulas, tables and references. Over 1000 illustrations.

"Modern, complete, a classic", *Microwave Journal*.

917 pages, hardcover. $51.95

Add $2.50 per book for shipping and handling U.S., $5.00 elsewhere.

CYGNUS-QUASAR BOOKS
P.O. Box 85, Powell, Ohio 43065
Tel. 614-548-7895

✓ 139