The Square Pancake Antenna

The indoor marvel.

by Ken M. Doolittle W2SMR

Apartment dwellers, ATTENTION!! Here is a limited-space, simple, and inexpensive inside antenna that works. I've made hundreds of complete QSOs with this little 20-inch square that hangs from the ceiling over my rig. I can reach up and tune it in a few seconds. Frequency coverage is 80, 40, 30, and 20 meters.

For comparison, I often switch to my 40 meter center-fed Zepp. With 1–50 watts into the antenna, signal strength reports vary from 0–5 S-units below the Zepp. Not bad for an inside antenna only 10 feet above the ground.

There's nothing magical about this antenna. The basic design has existed in various forms for many years, but it has seen little use for transmitting because of high losses. However, in spite of losses, you will be amazed at the results you can get. Twenty meters, for example, has yielded many DX stations. On 3537 kHz, I worked YU7WW in Belgrade.

Originally, I built this small antenna for local schedules on 80 meter CW, using less than 1 watt of power. Then, one night in November 1988, I was surprised to hear a Connecticut station calling me. Subsequently, I found that many distant stations could be worked on 1 watt. This led me to redesign the antenna, using thicker wire, and adjusting it to cover the other bands.

One time I was using this antenna in a three-way QSO on 30 meters. One of the stations became really hostile when I described my antenna, and did everything but call me a liar. He threatened to come to my home from Massachusetts and see my antenna himself. I told him to come along, but he finally got so upset he quit talking. It was one of the strangest things!

Construction

See Figure 1 for details. The plywood bottom piece is glued and nailed to the bottom of the vertical, 30-inch-long cross-piece. The vertical piece is 1 inch longer on the bottom to space it away from the plywood bottom piece. Attach the 29-inch cross boom to the vertical support piece. Starting from the edge of each support piece, cut seven ¼-inch deep grooves spaced about ¾-inch apart (see Figure 2). Angle the grooves so that the bottom of each groove is closer to the center point of the antenna. That way when the wire is wound around the support pieces, the grooves will keep the loop tight.

Drill a ⅛-inch hole ¼ of an inch above and below the seven grooves on the bottom portion of the loop. These holes are used to anchor the beginning and end of the wire loop. Cut a 37.5-foot length of #16 copper wire and loop one end through the bottom hole and run it down to the bottom attachment plate. Now loop the wire around through the grooves until you have 7 full turns in place. Run the end of the loop wire through the top support hole on the bottom support leg and tie it in place. A small wire loop can be placed through a hole in the very top piece of the antenna so that you can hang the antenna from the ceiling.

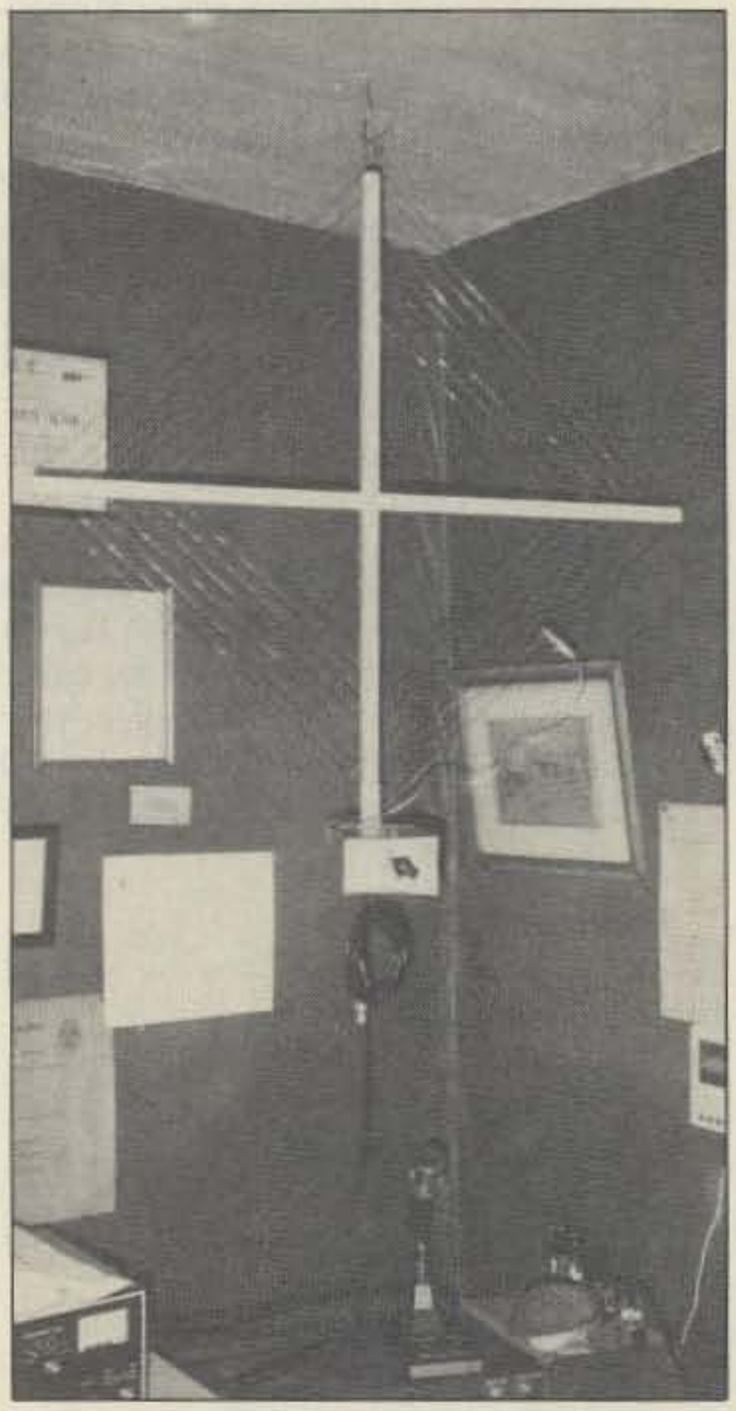

Photo B. The Pancake, over the operating desk. The tuning clip is in the 30m position.

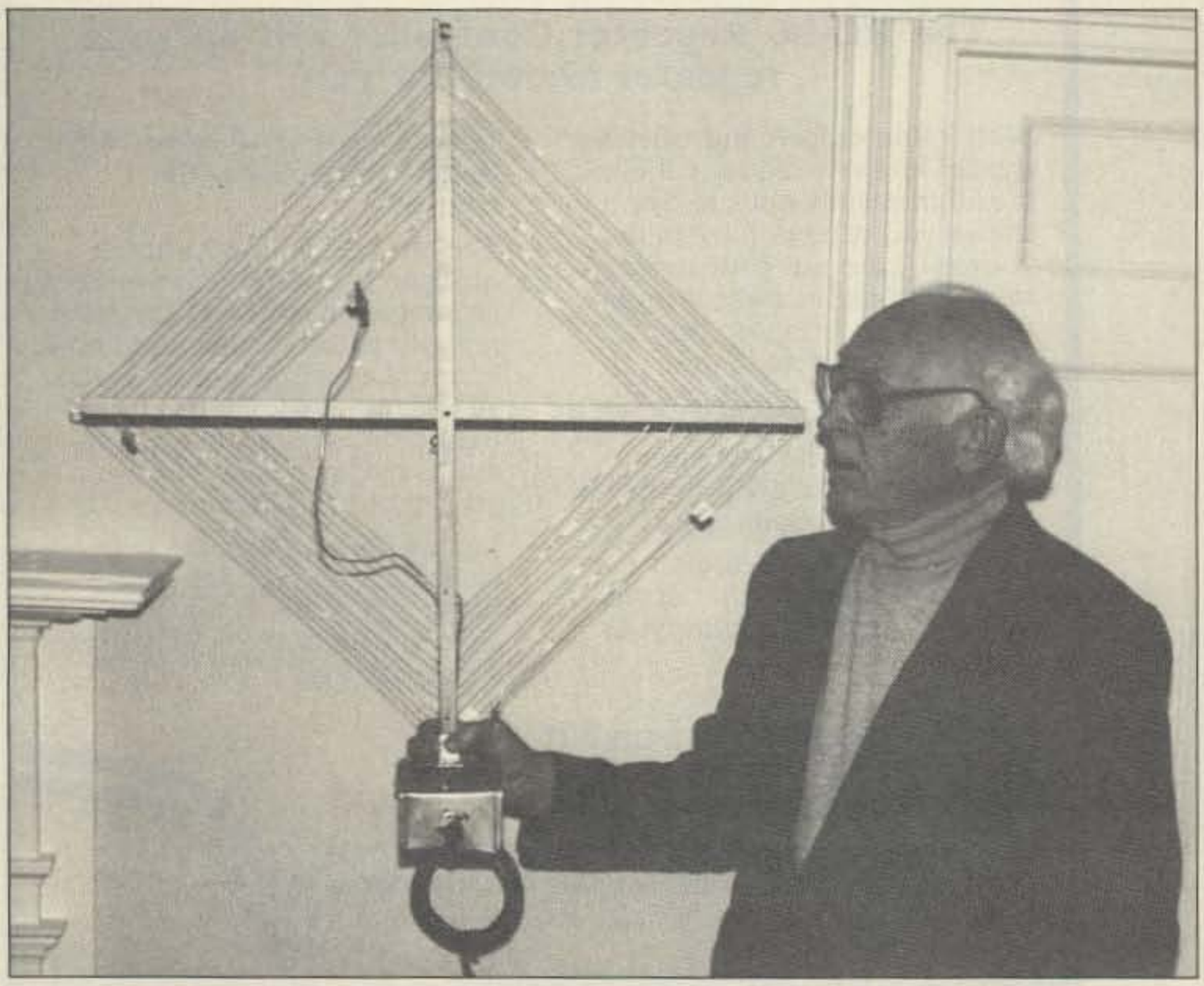

Photo A. The Square Pancake Antenna is a convenient indoor size.

The Tuning Capacitor

See Figure 2 for the tuning capacitor mounting details. Cut out a plywood support plate large enough to attach your tuning capacitor and the coax connector and mount it to the bottom of the vertical support piece. Mount the tuning capacitor to the bottom of the support plate and attach an SO-239 coax connector next to the back of the capacitor.

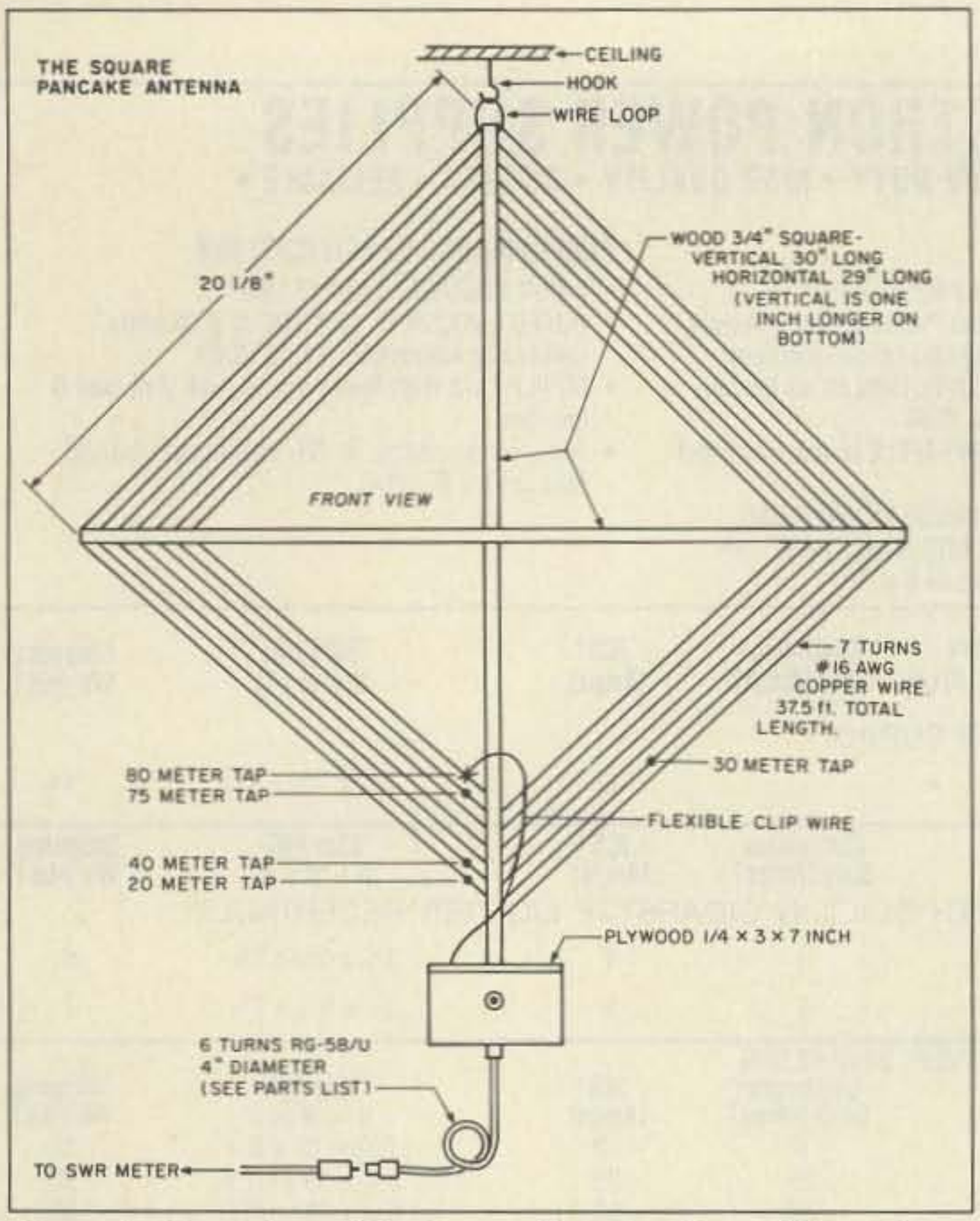

Figure 1. Front view of the Square Pancake. Note: If there is any problem when tuning a specific band, try adding the optional jumper (dotted line on the figure) to the end of the loop wire.

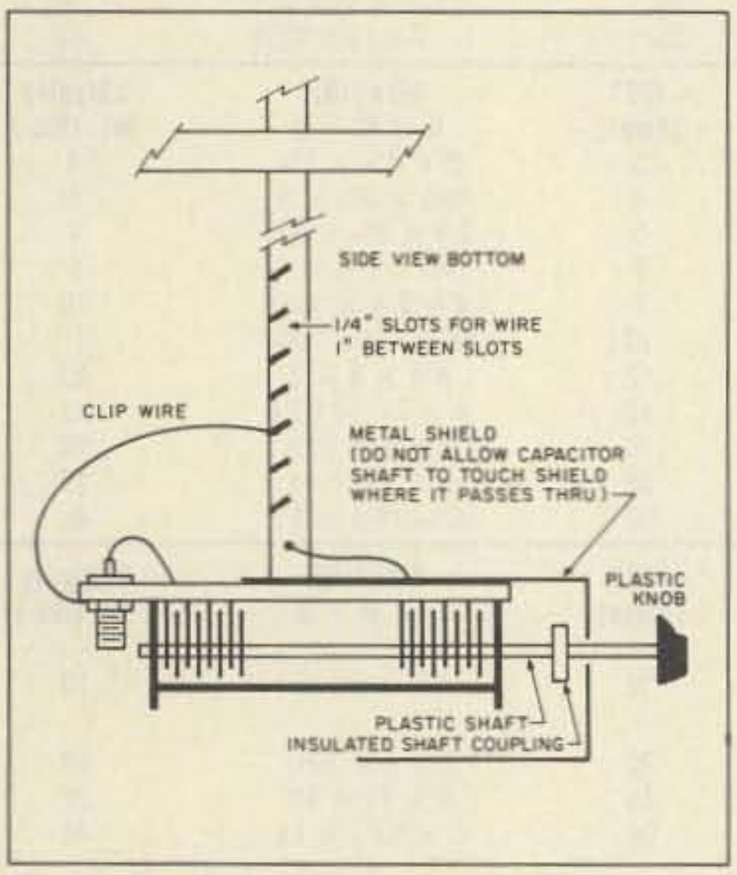

Figure 2. Side and bottom view showing the tuning capacitor arrangement.

Wire the center pin of the connector to one end of the capacitor and hook up a 2-foot clip wire (alligator clip attached on the end) to the shield of the connector. This clip wire is used to tap the loop for the various bands of interest.

Make up a shield around the front of the tuning capacitor. (DO NOT allow the capacitor shaft to touch the shield. I coupled a plastic shaft and knob to the capacitor where it passes through the shield.) You can make the shield out of a piece of aluminum or tin from a coffee can. Cut a ¾-inch slot in the shield so that it can straddle the vertical stick. I drilled four small holes in the shield and used four small bolts to fasten it to the plywood piece. Very small wood screws would also work. Attach the bottom end of the wire loop to the front end of the capacitor.

If you don't want to hang the antenna from the ceiling, you could build a small, table-top cabinet for it; but you'd have to be careful to keep children and pets away from it when using it to transmit.

The 150 pF split stator capacitor is placed in series by allowing the rotor to float. This reduces the capacity to 75 pF and doubles the voltage. If you do not plan to run over 10 to 20 watts, you could use a wide-spaced single capacitor of 75 to 100 pF. If you can't find the capacitor at a hamfest, you can use a Millen #284130 dual section variable (12–115 pF); for lower power operation (under 50 watts) try a single section Millen #23100MK (7–100 pF). Both are available from Radiokit, P.O. Box 973, Pelham NH 03076. Phone: (603) 635–2235.

Reducing Loss

You can do several things to reduce the losses of this antenna.

Use larger wire. This will, however, change the tuning.

Look for a capacitor in which the plates are welded to the mounting bars and shaft. (I am not presently using a capacitor of this type, however.)

Place a rotary switch in the middle and wire it to the tap points. The switch contacts will still cause some losses.

My feeling regarding losses is to do the best with what you have, and give it a try. All antennas have some losses.

Tuning Up

The taps shown agree with my setup. Yours will probably be different. You'll have to find them during the tune-up process.

Do all your tune-up at as low an RF power as possible.

Attach the alligator clip to the 80 meter position (at the far end of the wire). The coax from your antenna should go to your SWR meter, and from the meter to your receiver or transmitter. Set the frequency desired. In this case it would be 3500 kHz. Another tap will be required for 3750 and 4000 kHz.

Slowly adjust the antenna capacitor until the noise or a signal increases in volume. If this doesn't occur at any capacitor setting, check your wiring. If this is OK, move the tap until it does take place.

Apply as small an amount of power as

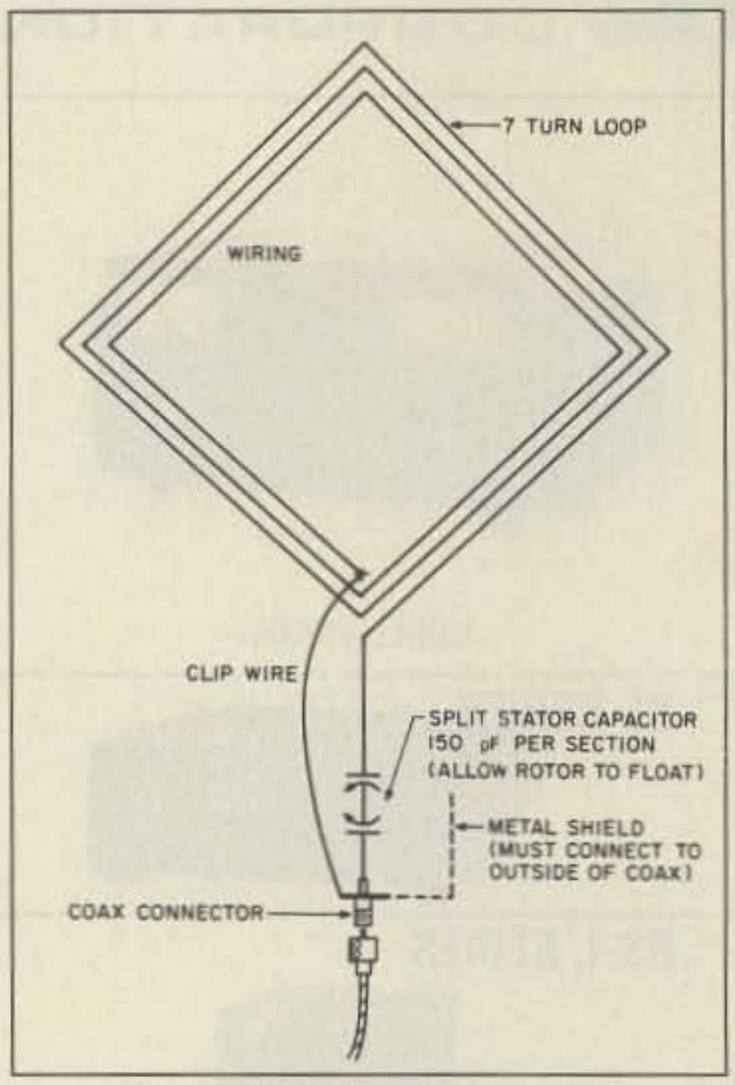

Figure 3. Wiring the Pancake.

possible, and adjust the capacitor until the SWR is as close to 1:1 as you can get. The SWR should not be more than 1:2. If necessary, move the tap wire and tune for lowest SWR.

Once you find the tap point, you should only have to use the tuning capacitor to lower the SWR from about 3500 kHz to 3750 kHz. A new tap point will be necessary for the rest of the band.

Follow the same procedure for the rest of the bands.

If you make a frequency change of over 20 kHz, you'll have to use the capacitor to tune for lowest SWR; however, you shouldn't have to move the tap until about 3750 kHz, or when you can't achieve an SWR below 1:2 by use of the capacitor only.

Once the tap points have been found, mark them for future use.

Remarks

This design is not for outside use. A very high *Q* antenna such as this is not practical outside unless it's well-protected from the elements and you use some type of motor tuning.

There are HIGH VOLTAGES present on this antenna when transmitting. Keep this fact in mind at all times.

This antenna will arouse controversy among the VIPs of antennadom. Regardless of this, give it a try and decide for yourself. You can build the whole thing in about three hours with very little expense. 73

You may contact Ken M. Doolittle W2SMR, Box 553, Newark Valley NY 13811.

The Square Pancake Antenna

1	SO-239 coax socket	RS 278-201
6 ft.	coax and connectors	RS 278-975
38 ft.	#16 wire	solid copper
30 in.	¾ in. sq.	wood supports (2 pieces)
1	150 pF variable capacitor	split stator
1	Alligator clip	
1	Metal shield piece	

Misc: Plastic shaft and knob, coupler sleeve and necessary hardware.