# Magnetic Loop Antenna's.

Why is an Magnetic Loop antenna so special, this antenna is picking only the MAGNETIC part of the ELEKTRO MAGNETIC radio wave. The big advantage of this antenna is that the electric interference from the big city (streetlights, television's , cars etc...) have no influence on the received signal. With the loop you can hear other stations that you can't hear if you use a DIPOLE, with a dipole the stations are buried in the noise.
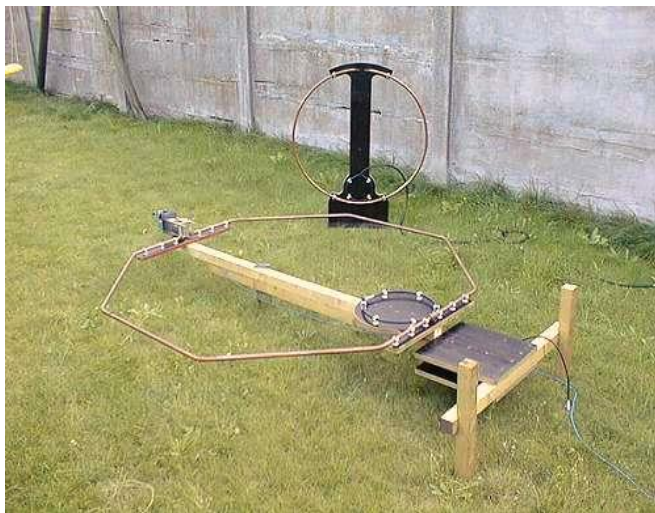

Multi Turn Magnetic Loop.

This is the first loop I build from a article in the QST from February 1996, it's 30 Inch-diameter, and it's designed by G2BZQ/WØ for 80 M.
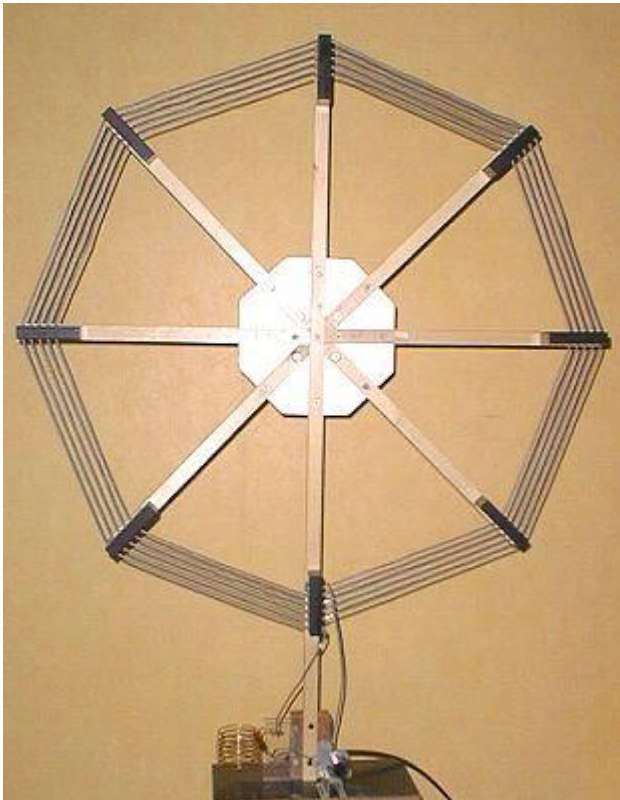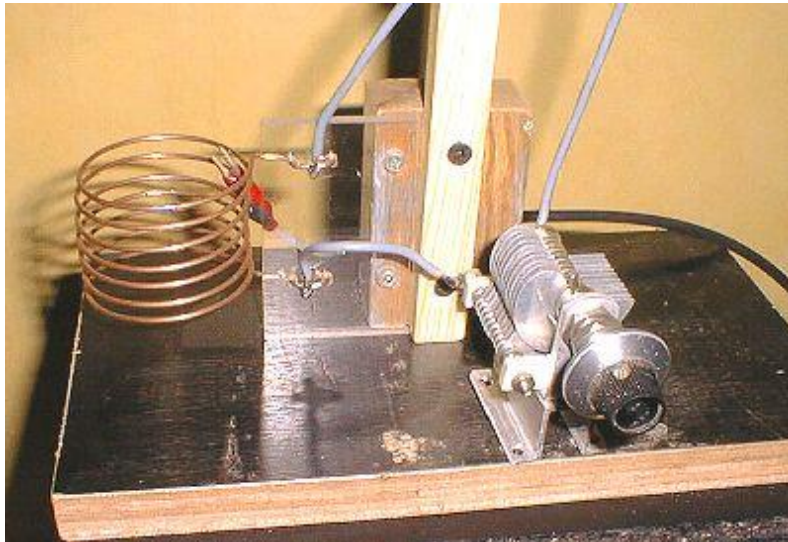
Single Turn Magnetic loops

The first one turn loop that I built was made from 75 Ohm TV Coax and with a small explanation in the RSGB handbook for radio amateurs. I used the outer screen from the coax and the results of the loop

where good. The next loop I built is a octagon loop in 15mm copper tube with a circumference of
4.8 meter (16 feet).
The frequency range of this loop goes from 14 MHz to 7 MHz and works fine. The biggest problem is the tuning capacitor, if you transmit with a power
of 100 W you need a capacitor with a voltage rating of 5000 Volt.
A capacitor which can handle this voltage is hard to find over here and if you find one they are very expensive.
The first capacitor I built was a design from GW3JPT from a article in the RADIO COMMUNICATION from February 1994. It is a split stator capacitor with a capacitance of 140 pF and with a voltage rating of 6000 Volt.
The capacitor is remote tuned with the use of a small BBQ spit motor.

The second capacitor I built is my own design and it's a butterfly capacitor because the losses are lower than a split stator.
The capacitance is 5-65 pF and the voltage rating is 7200 volts. I used
it for the small loop with a dia. of 800 mm (2.66

feet) and the frequency range of this loop is from 28 MHz to 14 MHz. The Aluminum plates of 1 mm for the capacitors are cut with a JIG SAW.

Most asked Questions:

I`d like to talk a little more on your setup. it seems like something whichI could get together if only some more data was available. do you have anynotes etc still laying about since its build ?

The theory for calculating the loop is very simple.The circumference of a magnetic loop is 1/4 wave of the designfrequency.

Example for 14 MHz.

        300 / 14 MHz = 21.428 m is 1 wave

        21.428 / 4   = 5.357 m is 1/4 wave
circumference

        5.357 / 3.14 = 1.706 m diameter.

The recommendations are that you can tune the loop from the design frequency to the frequency divided by 2 to keep the effiecency acceptable.

14 MHz / 2 = 7 MHz

I made the small loop (800mm / 31.5 ") from soft copper tube on a role that you can buy in a plumbershop and it's easy to make a nice circle if you draw on the ground a circle with a rope and a piece of chalk.

For mounting the loop to the hardboard I used plastic clamps
that they use for mounting copper tube on the wall.

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why is a butterfly capacitor better?

For high voltages and currents the use of Capacitors
with wiper contacs is not recomended. That's why
they use capacitors in serie's.The pro for serie's
capacitors is that the voltage rating is doubled.The
anti is that the value of capacitance is divided by
2.

For the split
stator capacitor
the 2 capacitors
are connected in
series
by the shaft (bleu)
and the red spots
on the first
drawing are losses.
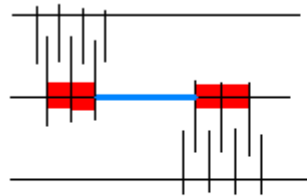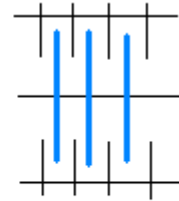
Split stator   Butterfly

For the butterfly capacitor the 2 capacitors are
directly connected
in series by the rotors and gives less losses.

Do you know of anyone that has built a similar loop that
outperformed a garden variety dipole?

Compare antenna's is very difficult , sometimes I
have for 60 % better signals in RX and TX on the
loops then on the dipole.

In Theorie is the performance of a magnetic loop –
0.4 dB lower then a dipole or a vertical .

I have over here a homebrew trap dipole from 40-20-
15-10m and the height aboveground is only 7 m(23
ft), for a good performance on 40 m the dipolemust
have a height of 1/2 wave above ground (66ft). I
don't have a radiation angle on 40 m and it's only
good for contacts in Europe and not good for DX, now
the 1.5 m loop tuned to 7 MHz with a effiecency of
38 % (38 w ERP) and a angle radiation of about 20

degrees performs
better than the dipole because the vertical magnetic
loop only 1 M above
ground as a angle radiation and the dipole don't.

Another advantage is that the reception on a loop is
mutch better,
on 20m I have with the dipole S5 noise from the big
city, if I switch to the
loop I have S1 noise and hear stations who are
buried in the noise when
I use a dipole.

Coupling loop dimensions?

I find that the best way to feed the loop is with
the shielded 1/5 Faraday loop made from coax RG213
or RG8, I tried the gamma match bud I had problems
to keep the VSWR low on all Bands, the shielded loop
gives on all bands VSWR 1.1 and reduce more noise
pick-up then the gamma match.

I found out that
if you use a 1/5
Faraday loop,
that the loop is
to big, making
the loop smaller
with 0.5 inch by
the time in
circumference
and checking
with a field
strength meter
you can see that
the radiated
power increase.

Solder Outher on Outher

Dia. LOOP / 5

Solder outher on inner
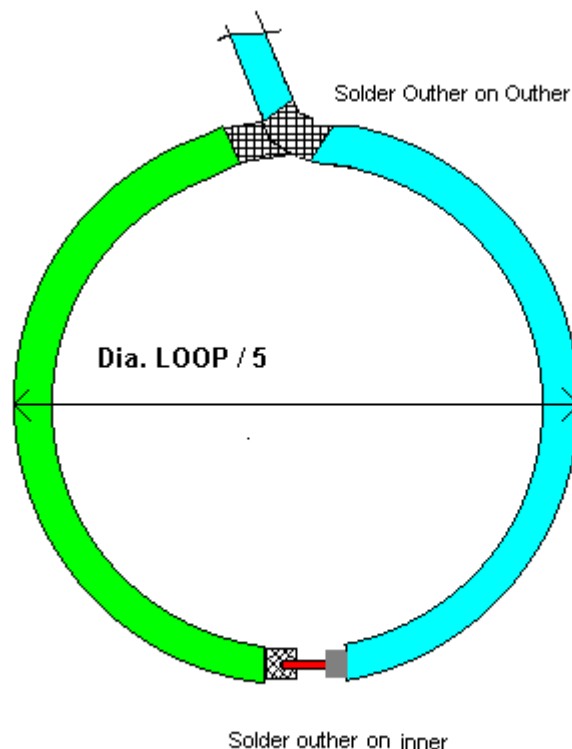
The place off
the feeding loop
is placed at the
electrically neutral point on the loop and that is
180° from the capacitor and I have the best results

with the feeding loop close to the ground and the capacitor far from the ground.

I was wondering if you worried about the resistance of the mechanical joints (copper pipe bolted to the capacitor) significantly reducing your radiation efficiency as I think the radiation of these antennas can get as low as .01 ohms

Soulder or weld the capacitor plates is always the best, but I'm afraid if you make the spacers and the plates in ALU that with welding everything is gona bend from the heat and I know from practice (I work in a maintenance workshop) that welding ALU is coarse. Another possibility is using all brass or copper and solder, there are hams that using double PC board for the plates.
I made a QSO in phone with Florida, RPRT 5-5 and the other station used a vertical antenna, with the small loop (800mm and theoretical effiecency 41 % on 14 Mc) vertical in the garden and the states side is through the house. I was very happy with the results , so I think that a capacitor
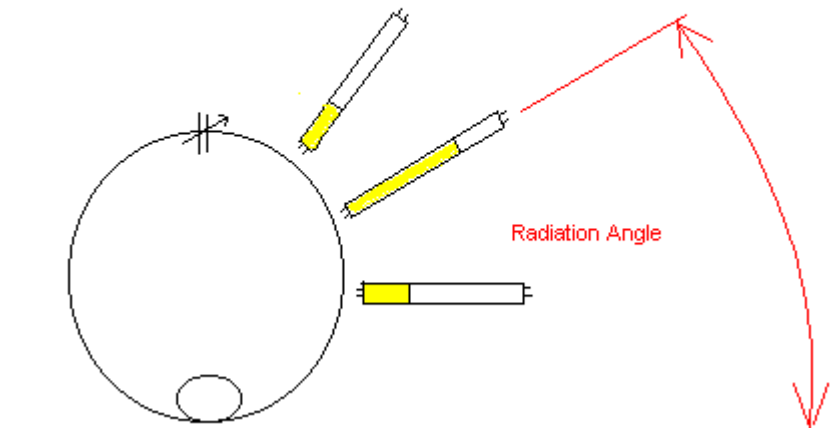maded with torqued compressed joints is good enough for using 100 W.

Have the dissimilar metal joints weather well?

To keep the oxidation low on the dissimilar metals I used a thin coat of vaseline after assemble the capacitor and with the tupper ware a like plastic box it is good protect against all wheather conditions.

How to find the radiation angle of the antenna?

Can it be found practically?

Finding the radiaton of a magnetic loop is very easy, with a TL-lichgt tube you can see it, with abt 10 w power on the the loop with the TL-tube in the plain of the loop at right angle to the circle you see the tube lightning, there where the the light is the farest on the tube thats the radiation angle.

Radiation Angle

When you refer to washers, nuts and rods you use the term "M6".Please forgive my ignorance, but to what does "M6" refer? Does this mean 6mm?
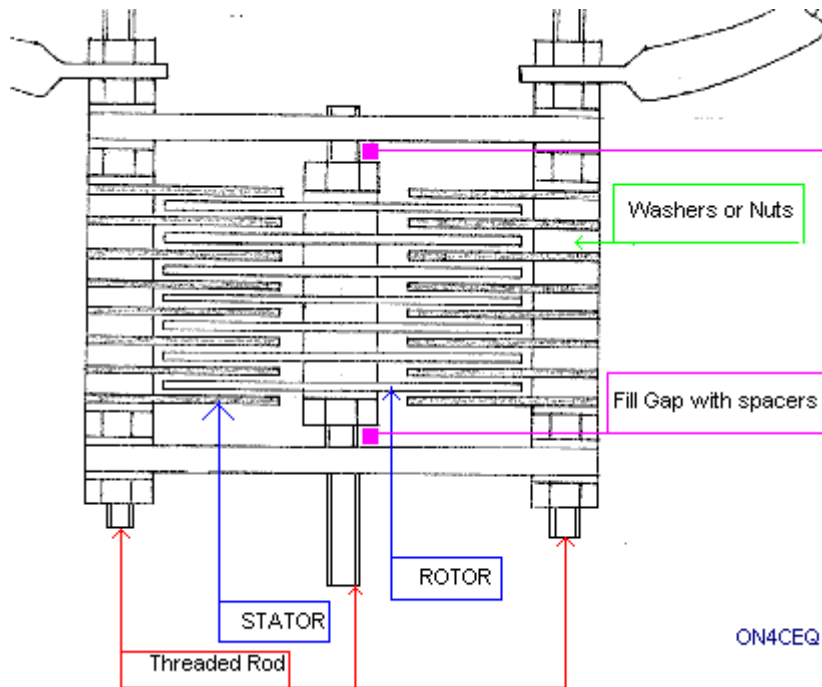
M6 is (M=metrical) and 6 is indeed 6 mm threaded rod and
you can compare the size with W1/4" (6.35mm) .

A very easy to build Piston Capacitor.
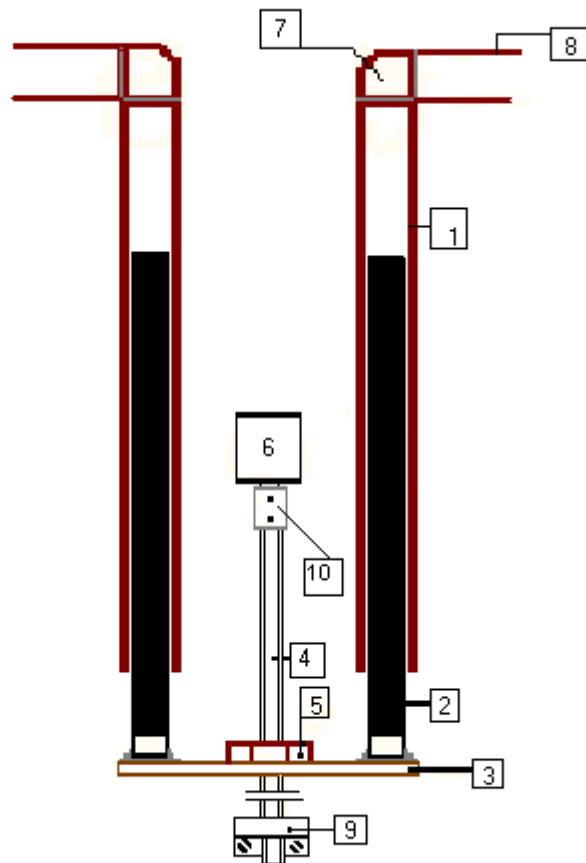
1) Copper tube

2) Coax RG8 or 213

3) Double PCB

4) Threaded Rod 1/4"

5) Brass nut

6) Motor with reduktion or stepper motor

7) Copper Elbow 90°

8) Loop

9) Bushing from old var resitor

10) Couple shaft (PVC)

How to build your own Butterfly Capacitor.

The best material for the front and the back is
CLEAR PVC 3 or 5 mm thick as alternative you can use
GREY PVC or 2 sheets pcboard together with the
copper removed .

The best material for the washers, nuts (M6) and
threaded rod (M6) is brass or stainless steel,(NON
MAGNETIC MATERIALS for the losses).

For the spacing of the vanes you can use 2 washers
M6= (6Kv) or a nut M6 =(12 Kv) if you use aluminum
plate 1 mm thick.

If you use a nut then the best thing to do is remove
the thread by drilling withØ 6.2 mm.
The effective area for the vanes is 11.7 cm² and
with the formula

for 2 washers = (0.0885 x 11.7 cm²)/ 0.1 cm = 10.35
pF for 1 air gap.

for 1 nut = (0.0885 x 11.7 cm²)/0.2 cm = 5.17 pF for
1 air gap

Example:

If you you make a capacitor with 2 washers as
spacing and you make
5 rotor vanes and 6 stator vanes then you have 10
air gaps.

10.35 pF x 10 = 103 pF + 10 pF stray capacitance =
113 pF / 2 = 56 pF

The final result is a capacitor with a value from 5
- 56 pF.

ø6,2

50

ø5,9

64

80

40

8

88

6

100