ATUs - ANTENNA TUNING UNITS

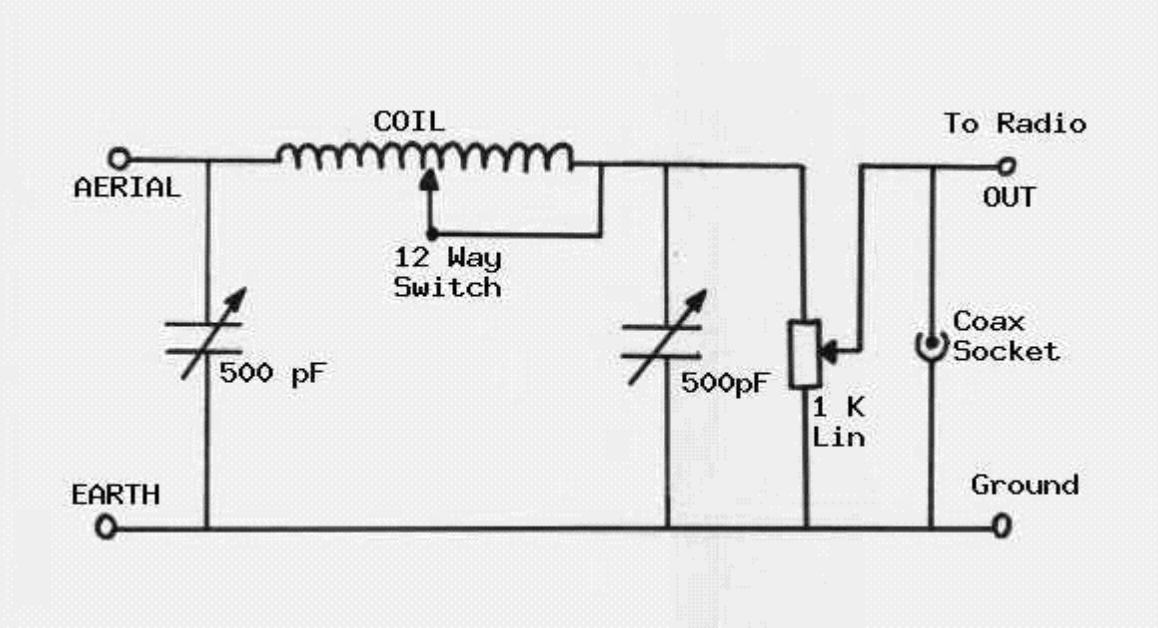
THE ATU

An Antenna Tuning Unit

MAKE YOUR OWN ATU

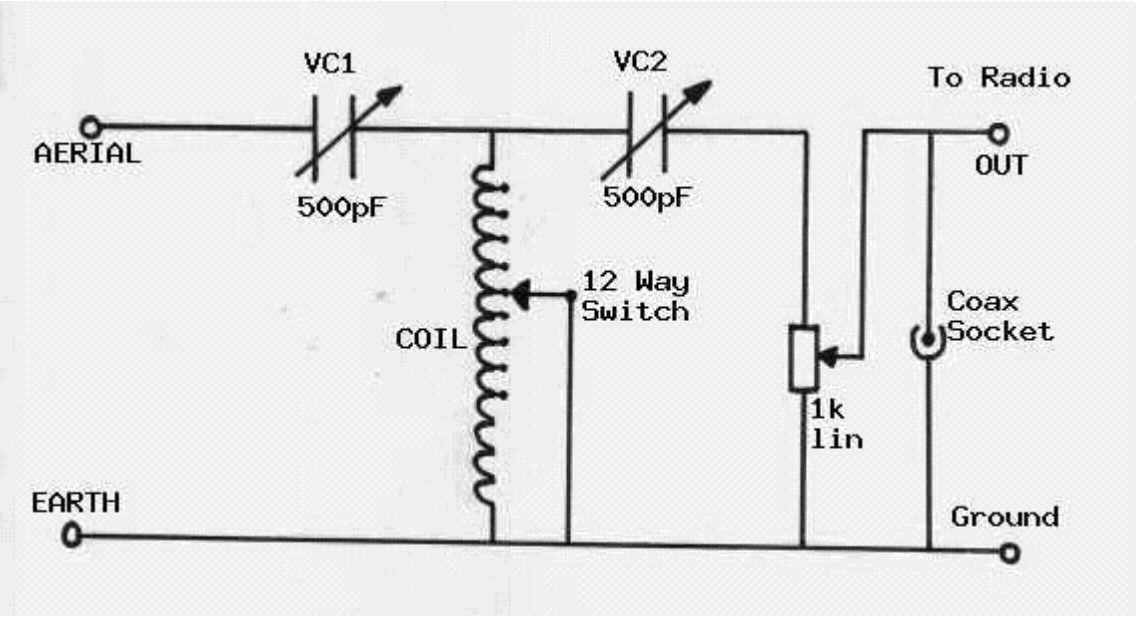
The circuit diagram below shows the circuit for a typical Pi type ATU which seems to be a popular arrange ment for many ATUs. I have built ATUs using this Pi arrangement and although they work quite well and are certainly a useful improvement over no ATU at all, I have found in my own experience that the 'T' arrangement in the next circuit works even better, matching more easily over a wide range of frequencies and also seemingly offering improved filtering in my own circumstances.

Each aerial arrangement is different and you may find that this circuit performs best of all in your circumstances:



Pi type circuit - Very popular for many ATUs

Below is the circuit diagram for my preferred choice of a T type circuit which includes a variable attenuator and which could not be simpler to construct. This circuit, with the coil described, covers from 500kHz medium wave to 30MHz short wave. Tuning capacitor VC1 is adjusted to match the aerial side while tuning capacitor VC2 is adjusted to match the receiver side. This circuit is often referred to as a TRANSMATCH, particularly in the USA.



T type circuit, which I have found to be more effective than the Pi type at my listening post, possibly because this design acts as a 'high pass' filter, and is therefore very useful for filtering out interference to short wave reception caused by high power medium wave transmitters that can overload the short wave radio
All that is needed is:

1	Self wound coil with 12 tapping points. See below

1	Reel of 22 s.w.g enamelled copper wire for coil
1	Coil former, eg the inside of a fax roll (30 mm diam approx)
1	12 way switch to select tapping pints on coil
2	500pF tuning capacitors
1	1 k ohm linear potentiometer for attenuator
2	Red terminal posts
2	Green terminal posts
1	Coaxial socket, e.g. 3.5mm jack (as used here) or SO239
1	Case 150 x 100 x 60 mm + with rubber feet

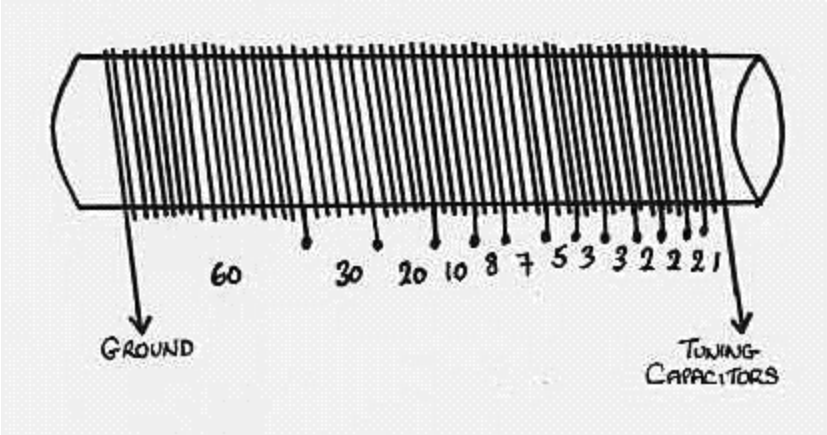
SOURCES FOR TUNING CAPACITORSOld broken radio sets - but don't smash a nice one up for the sake of a capacitor! Old radio sets, especially the old 'valved' wirelesses are very interesting and often sound superb and could be quite rare.

J BIRKETT RADIO COMPONENTS,. 25 THE STRAIT, LINCOLN, LN2 1JD. telephone (uk) 01522 520767 http://www.zyra.org.uk/birkett.htm

MAINLINE GROUP http://www.mainlinegroup.co.uk/jacksonbrothers/index.htm

COIL WINDING DETAILS
The coils that I have made for my ATUs have been wound around formers made from the plasic tube found inside a typical fax roll. This can be cut to a suitable length to fit inside the enclosure, in this case 150mm long with a 30mm diameter. If a plastic fax roll is not available then a strong cardboard tube could be used instead.

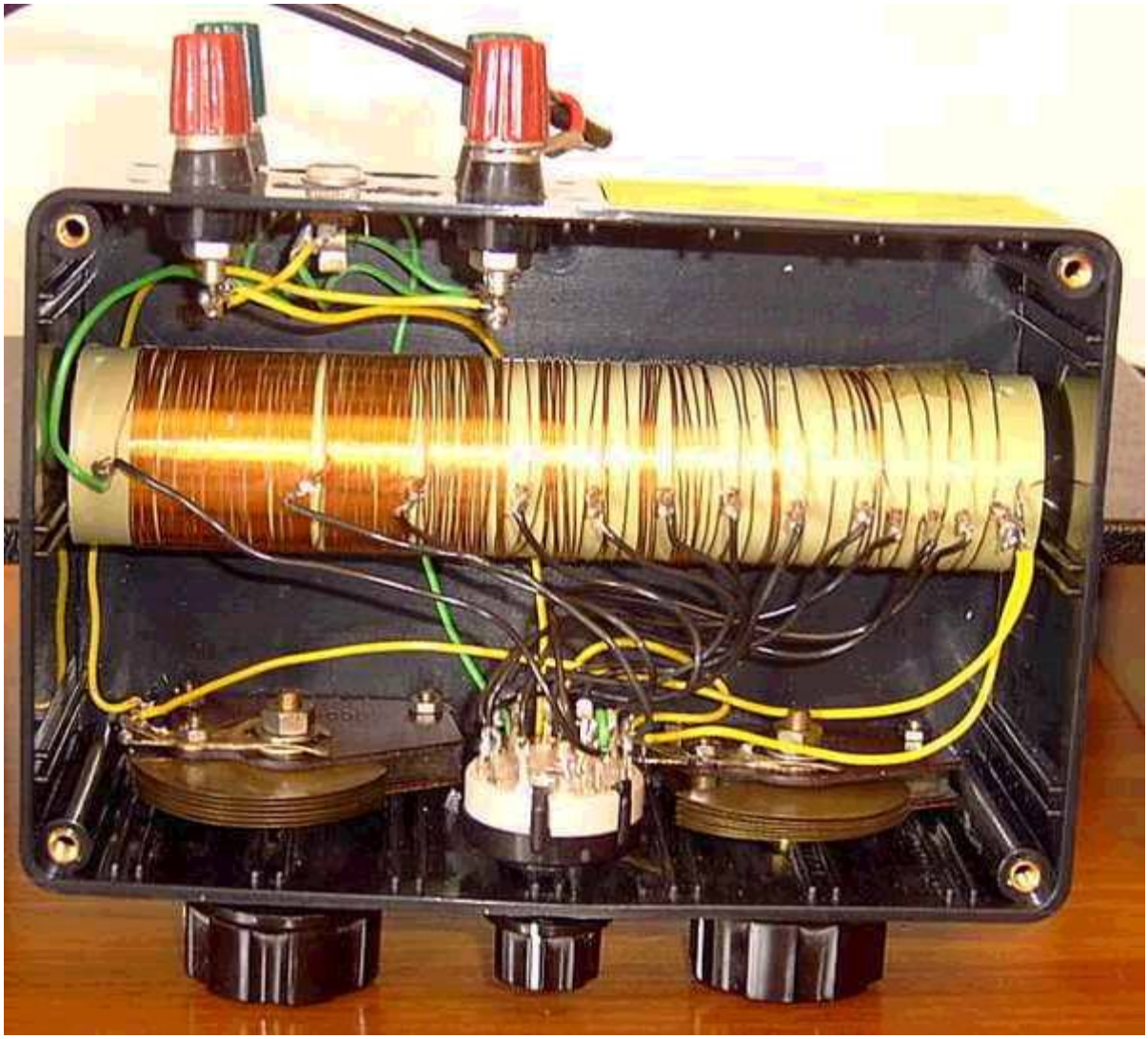
Two small holes can be drilled at each end of the tube to feed the start and finish portions of the 22 swg wire through in order to secure it. Then wind the required number of turns, putting a tight twist in the wire at each tapping point, taking care to scrape off the enamel so that the connecting wire can be soldered into place. Alternatively, as I did in my first coil, I inserted printed circuit board (PCB) terminal pins into the tube to secure the wire to at the start and finish points of the coil and at each tapping point, as you can see in the photograph below. This involved drilling a hole in the soft plasic of the tube slightly smaller than the PCB pin and forcing the first pin in for a tight fit. The enamel must be scraped of the wire, wrapped arount the pin with a single turn and then soldered in place - quickly to avoid melting the plastc! Then the first turn of the coil is made, another hole drilled and pin inserted and wire scraped clean of enamel and soldered to the pin. Proceed until all the turns and tapping points have been made according to the diagram.The diagram below shows the number of turns between each tapping point:



Once the coil is complete the tapping points can be wired to the 12 way switch by using short lengths of hook-up wire (e.g. 7/0.2mm pvc covered), being careful to wire the into the circuit exactly as in the diagram.

The Mk1 ATU using the T type circuit

The rear panel of the Mk1 ATU showing the aerial input and output terminal posts. A 3.5mm jack socket is also included as an alternative output socket for convenient connection to a portable radio via a length of flexible 50 ohm coaxial cable

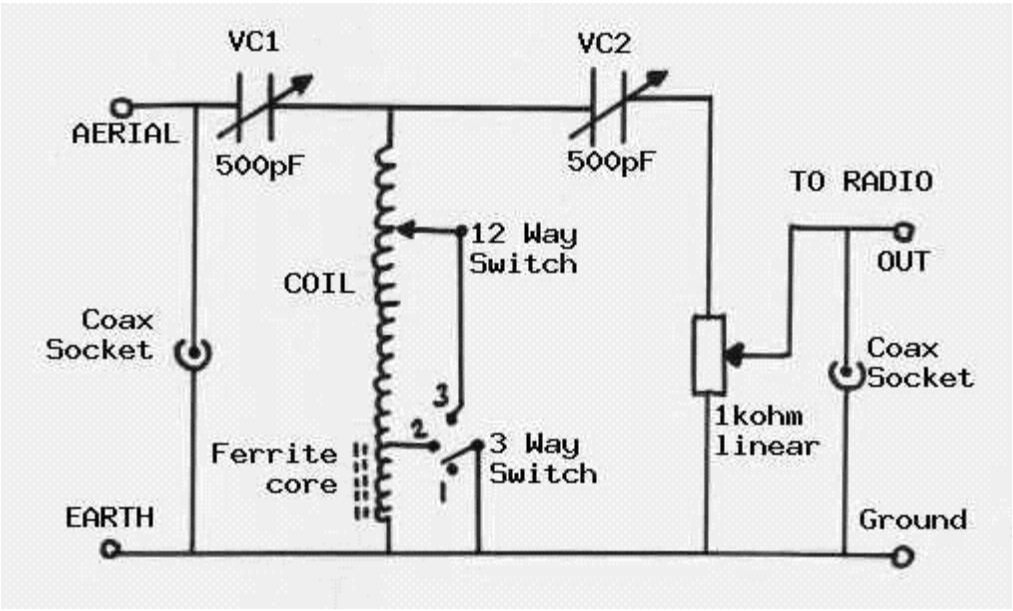


Internal view of the Mk 1 Antenna Tuning Unit showing the coil and its 12 tapping points, the range switch and two space-saving Jackson type solid dielectric tuning capacitors. The potentiometer that forms the variable attenuator is hidden from view by the range switch.

The Mark 2 Aerial Tuning Unit

The Mark 2 Antenna Tuning Unit

The Mark 1 ATU described above was initially made using the Pi match circuit and when I made this, the Mark2, I used the T match circuit design and when I found that it worked even better I modified the Mark 1 to also use the T match circuit layout. The Mark 1 is used for a portable radio and therefore is more compact, the Mark 2 is used for the HF-150 so can be a bit larger. It is housed in an aluminium case and uses the larger air-spaced tuning capacitors and also has SO239 sockets are fitted for the input and output. The coil is larger too, using the same former made from the centre of a fax roll but longer at 220mm to accommodate additional windings to enable coverage of long wave frequencies. An additional switch is also included to give plenty of adjustment while including the long wave range.



The circuit diagram showing the coil and the 12 way switch to adjust the Short Wave ranges and the additional 3 way switch to change to Medium Wave and Long Wave coverage*. The attenuator is simply a 1k ohm potentiometer.*Position 1 is Long Wave; 2 Medium Wave; 3 Short Wave ranges - adjusted with 12 way switch

PARTS REQUIRED:

1	Self wound coil with 13 tapping points
1	Reel of 22 swg enamelled copper wire
1	Reel of 30 swg enamelled copper wire (for longwave part)
1	Coil Former 220mm long & approx 30mm diameter
1	12 way switch
1	3 way switch
2	500pF tuning capacitors
1	1 k ohm linear potentiometer
2	Red Terminal posts
2	Green terminal posts
2	SO239 sockets
1	Aluminium case 220 x 130 x 65 mm + rubber feet

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COIL WINDING DETAILS

The coil is essentially the same as the coil described above being wound on the centre of a fax roll or any similar former approximately 30mm in diameter, but slightly longer at 220 mm long. In this case I secured the start and the finish of the windings by simply looping the 22 swg enamelled copper wire through two small holes at each ends of the former to secure it in place. The taps are formed by simply twisting the wire into a loop at each specified interval, to form the connection points to the range switch, making sure that all the enamel is scaped off so that the connecting wires to the switches can be properly soldered in place.

One difference with this coil is that it is designed to cover the Long Wave band too, and the final 110 turns are wound from slightly thinner 30 swg enamelled copper wire, this was done simply to save space. Inside the tube at this end are placed a couple of short lengths of ferrite rod, no longer than 50mm. These are then adjusted, once the ATU is functioning, to give the required tuning range. Alternatively more windings could be added to the final winding to increase its inductance until the desired range is achieved.

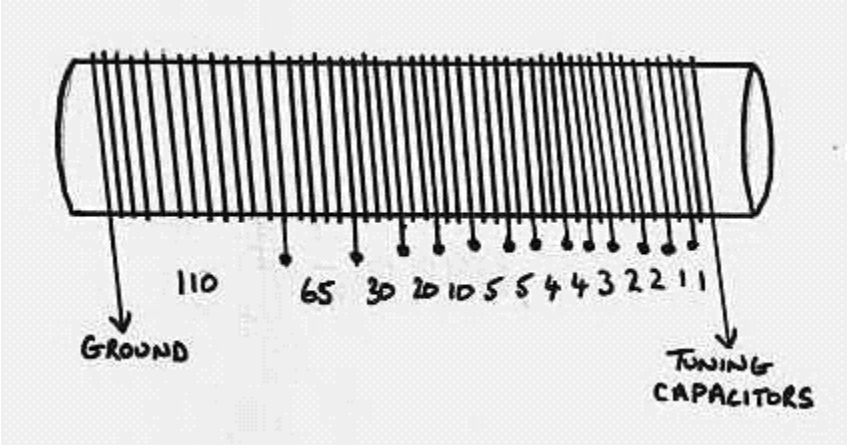
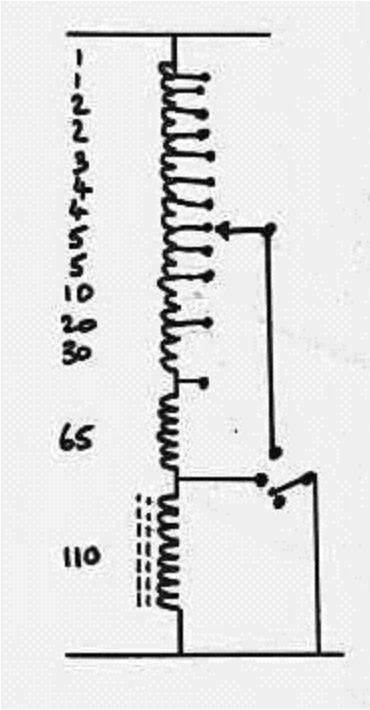


Diagram showing the number of turns between each tapping point



Detail of tapping point intervals and how the coil is wired into the circuit
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The rear panel. On the left the input terminal posts for the aerial and earth wires, with the addition of a SO239 socket for the connection of coaxial cable. On the right the SO239 coaxial output socket for connection to a radio with a coaxial input socket also provided are the alternative terminal posts for single wire output and ground connections to the radio.

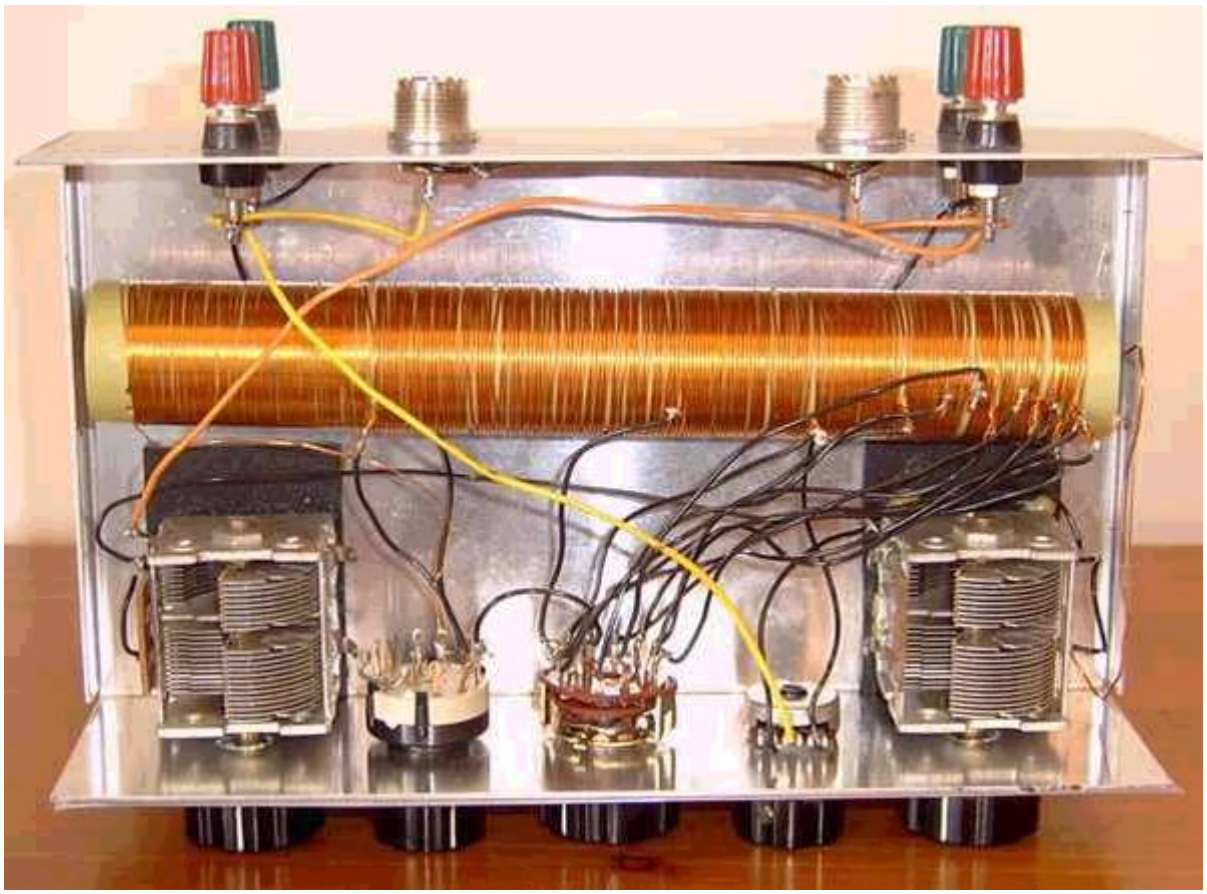

Photo showing the relatively straightforward internal construction of an ATU. 2 large air-spaced tuning capacitors, range switches, potentiometer, and coil with 14 tapping points.

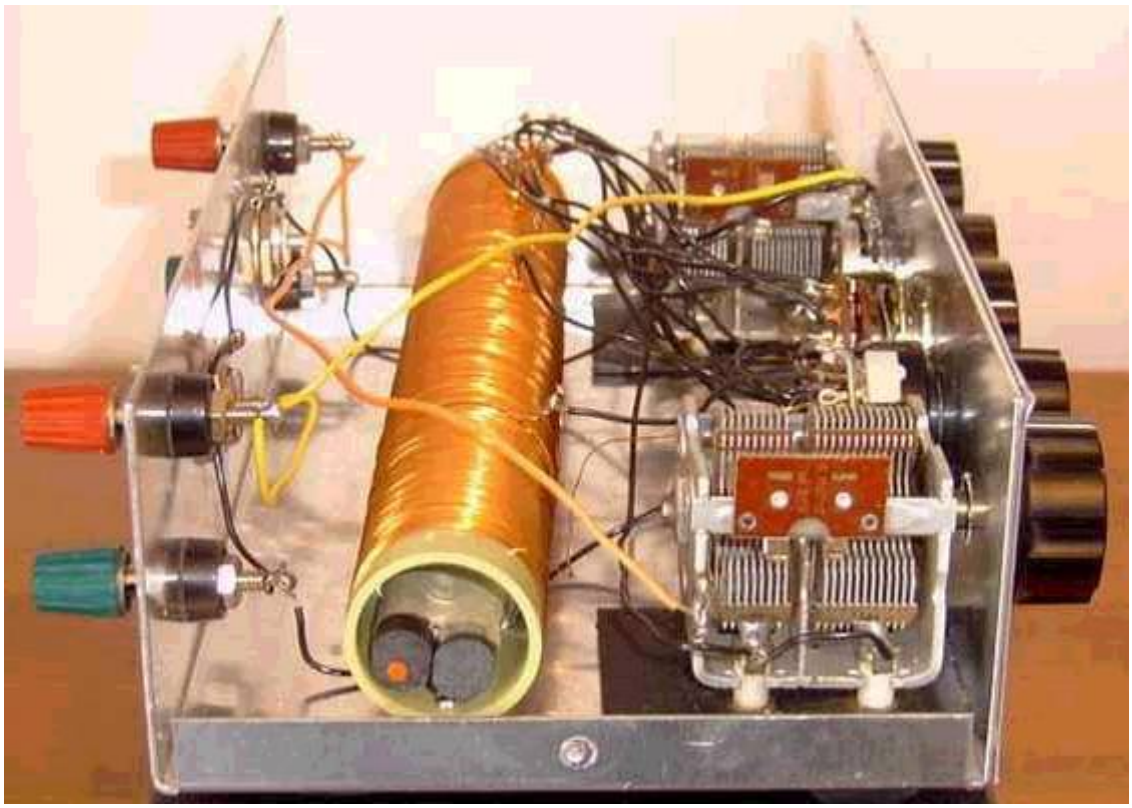

Photo showing how two 2 inch lengths of ferrite rod are put inside the coil at the longwave end of the coil to provide coverage of these low frequencies