G8JNJ ‘Fat-Max ® ’ HF Antenna - 6m to 40m

You may have heard of a 2m J pole antenna called a 'Slim Jim' which is made from 300 ohm ribbon feeder - well here's the G8JNJ ‘Fat-Max ® ’ HF Antenna - 6m to 40m - a poor man’s Steppir.

I got the idea for this antenna when I wanted to make some field strength measurements, and needed to be able to quickly set up a number of ¼ wave vertical antennas in order to make reference measurements.

The basic idea is to use a retractable steel tape measure as the radiating element, so that the length can be continuously adjusted to achieve resonance. This principle is used in the Steppir range of antennas which can be seen at this website http://www.steppir.com

Several people have tried to make retractable antennas using a steel tape measure, but most have taken the design decision to mount the case of the tape measure at the bottom end of the antenna. The disadvantage of this method is that some way has to be found of providing a sliding contact with the steel tape as it spools out, as the wound steel tape on the internal reel does not provide a low enough impedance connection. The coiled construction also adds a large inductive reactance which is not desirable in this application. Purists may argue that a steel tape is also likely to have high losses when used for ant antenna; however I was not able to measure any difference between the steel tape and a copper wire, so this does not seem to be a problem in practice. I suspect this may be due to the broad width of the tape, but so far I have not been able to test this theory.

During my tests I attached the case of a tape measure to one of the top sections of a 10m fibre glass fishing pole. And connected to the steel tape by means of a nut, bolt and solder tag at the start of the tape. I extended the tape from 8.5m to approx. 10m by adding an additional length of wire to connect it to the coax. I choose this length so that I could get the antenna to tune from 6m though to 40m by simply extending the tape.

The tape measure I used was a cheap 8.5m long one which I had obtained from a pound shop (Dime store). Although there are any number of tapes which could be used, including the Stanley FatMax ® Range (hence the title) which are available in lengths up to 100ft long.

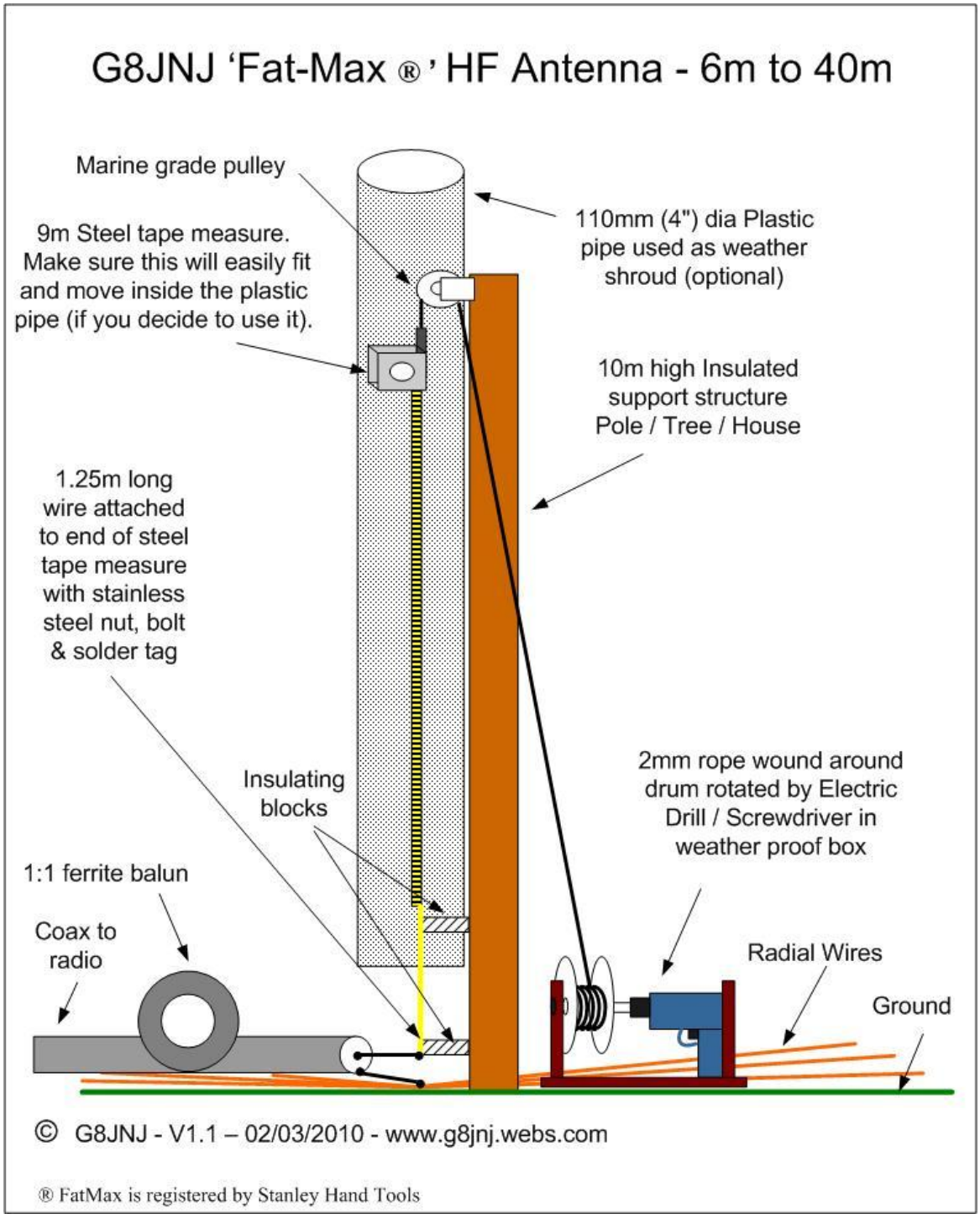
This arrangement worked very well, and I quickly realised that it would be possible to operate it remotely by attaching a rope to the casing of the tape, which I could use to raise and lower it as required. The rope would run over a pulley which could be suspended from a non-conductive support pole, tree limb, house or anything else that was approx. 10m high. The other end of the rope could be brought into the shack and simply tied off at the required lengths, using loops or knots tied into the rope. Alternatively it could be wrapped around a cable drum which is arranged to be rotated by a surplus electric drill or screwdriver. Ideally one which has a mechanical torque adjustment.

The only slight problem I encountered was that in high winds the tape could be blown sideways, so it would be best to use this antenna in a sheltered position. Alternatively it could be housed inside a 10m length 110mm (4") diameter plastic drainpipe, which could be painted to make the whole antenna much stealthier.

If you do decide to use the pipe, make sure that the tape measure will fit inside it and move freely. Some tape measures are larger than others, so you have to choose carefully. You may still have to remove part of the casing and add guides in order to make it fit and run smoothly.

Note that the antenna doesn't have to be used as a 1/4 wave, with a suitable switched matching network at the base it could also be used as a 1/2 or 5/8 wave.

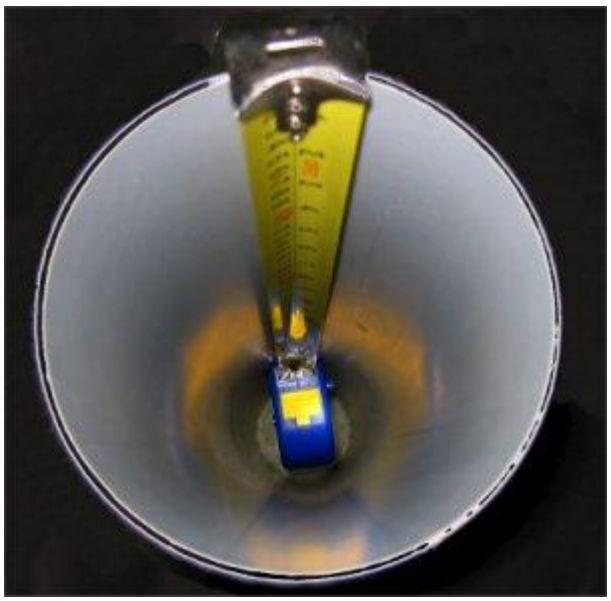
Here’s a drawing showing the basic idea



Spraying the tape a less distinctive colour with some car paint also helps to reduce visibility and improves durability. A rain cover made from the end of a plastic bottle slipped over the case of the tape also helps. If the tape proves reluctant to retract, adding some additional weight to the tape body may help.

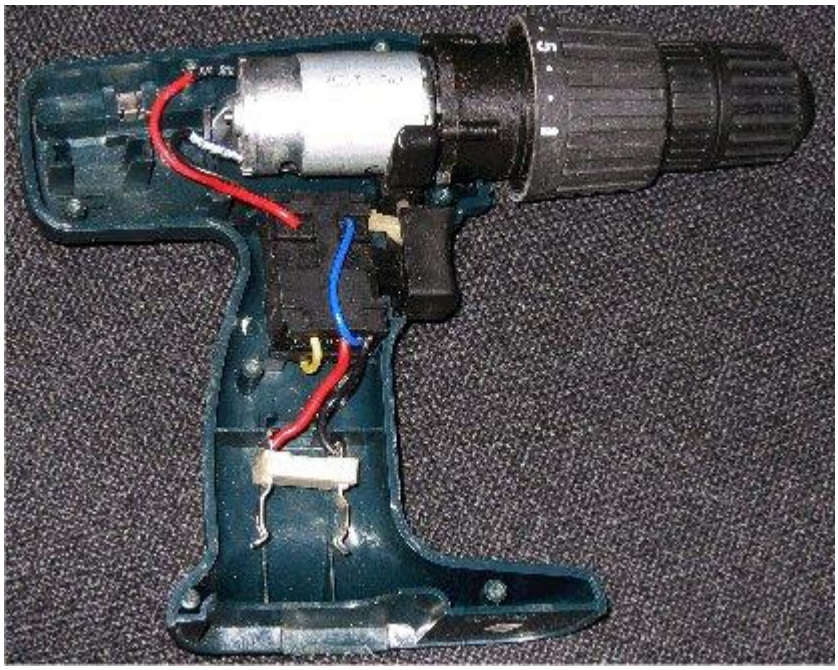
Since my initial experiments I have now found a cheap 'Toolzone' 10m tape, which fits nicely inside 110mm pipework (if the outer rubber protective jacket is removed).

http://www.amazon.co.uk/Toolzone-Rubber-Coated-Tape-Measure/dp/B002NH6LJC



The following picture shows the construction of a rope winding drum, made from some M8 studded rod, two CD's and a short length of plastic conduit.

You may wish to make the whole motor assembly more compact by removing the drill case.

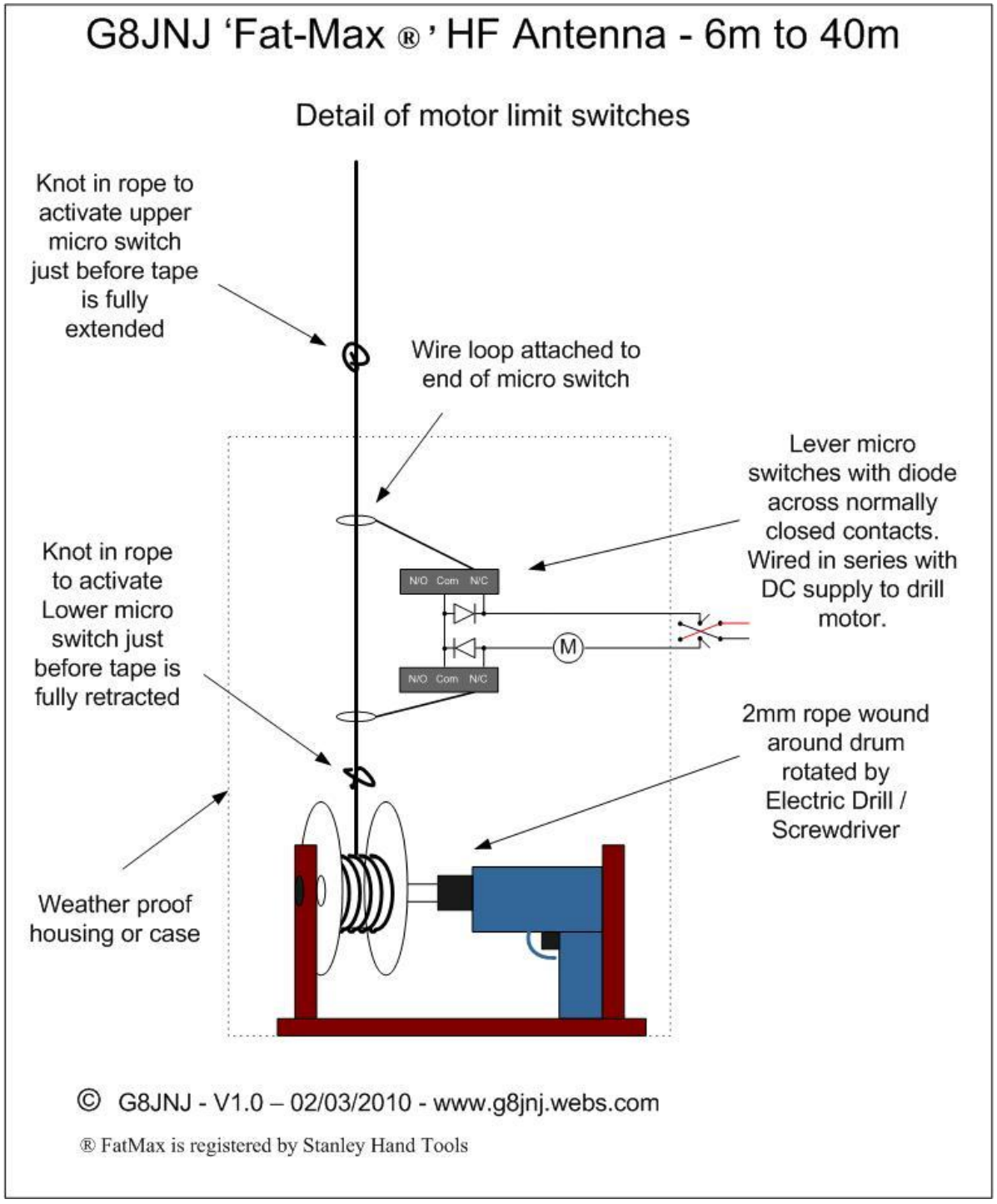


With a 12v Drill motor and 1" spindle the rate of cord movement was about 1m per second. At 5V it was about 0.5m per second.

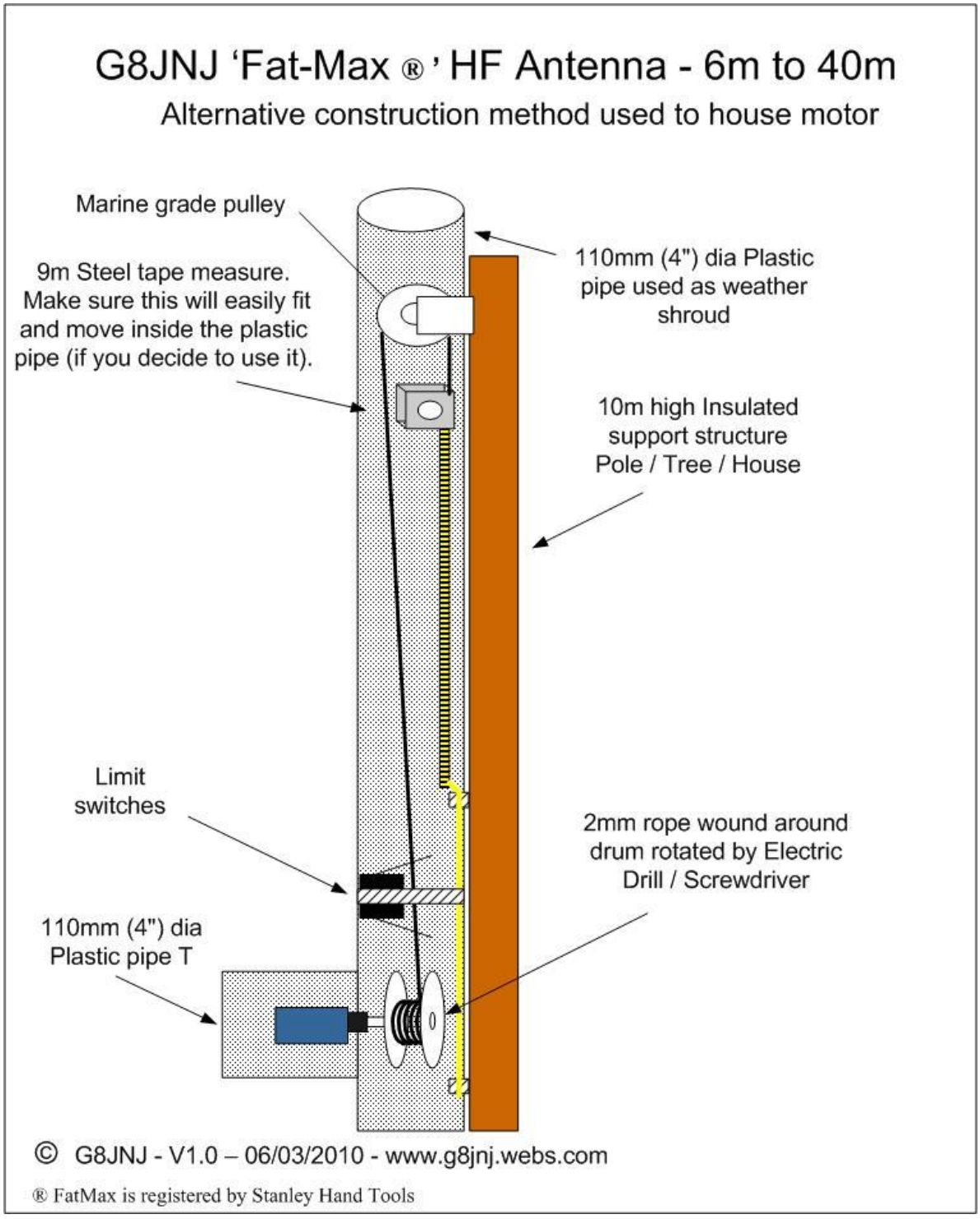
3V gave about the correct winding speed, which was slightly faster when lowering the tape, due to the assistance of gravity.

A power supply capable of delivering at least 5 amps is required.

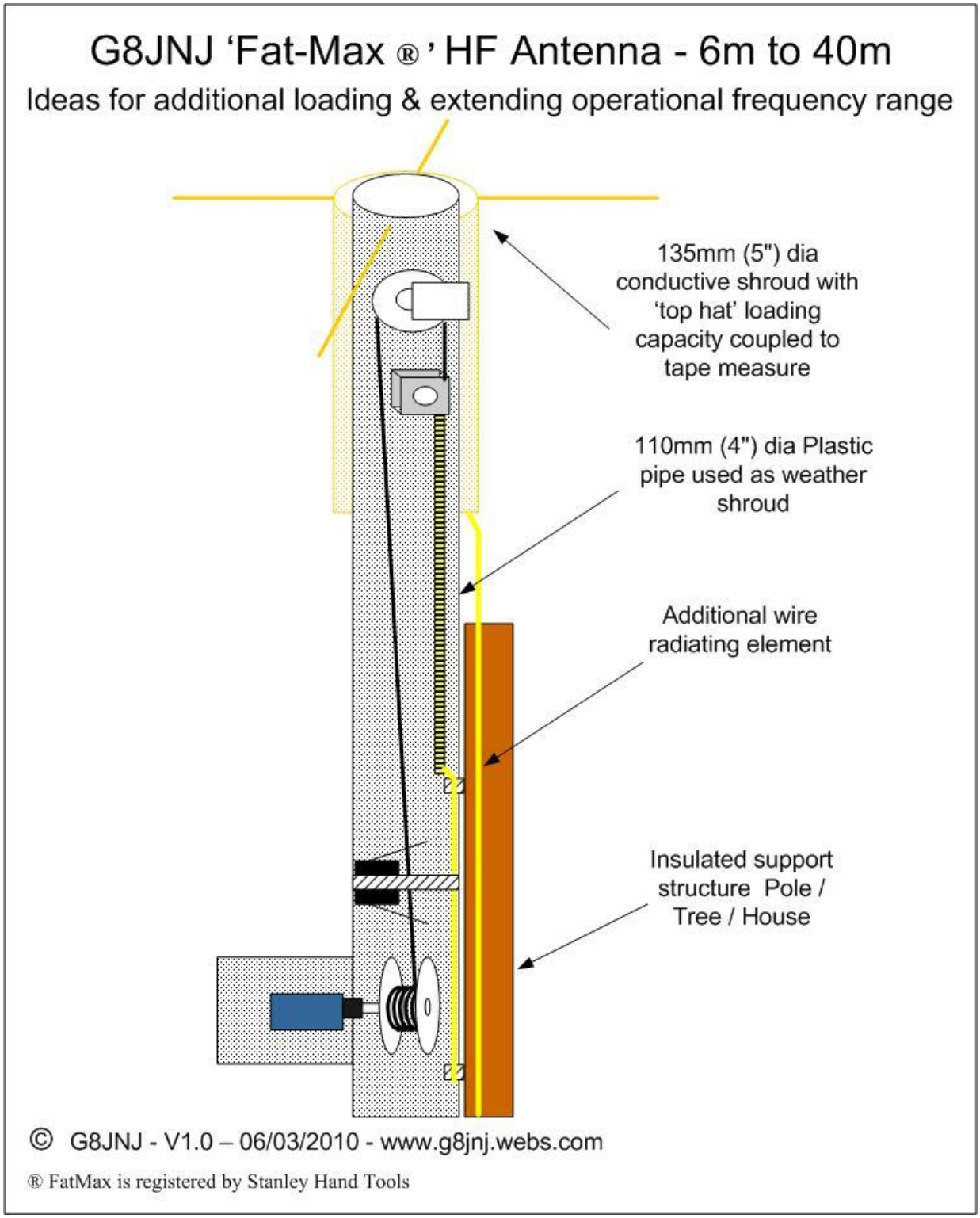
If you wish to motorise it as shown above, it may be worthwhile adding some limit switches. The purpose of these is to interrupt the supply to the motor when the antenna is fully extended or retracted. When the switch operates it leaves a diode in circuit so that the motor can still be run in the opposite direction by reversing the polarity of the DC supply. I initially used an adjustable bench supply with an over-current limit. But if the drill or screwdriver has a built in speed control, it should be possible to remove it and connect it to a changeover switch in the shack to make a simple control box.



Here's an alternative method of housing the motor and limit switches if you choose to use plastic pipe.



Installing the tape measure in a plastic pipe will reduce the length of tape required for the vertical element slightly, due to its dielectric loading properties. However it may be possible to either shorten the antenna, or make it resonant on lower frequencies by adding additional loading. One way to do this may be by adding a capacitively coupled 'top hat' which only starts to interact with the tape measure when it is nearly fully extended. In addition to top loading it may also be possible to use the tape measure as a variable length matching section, which is used in conjunction with a vertical wire running the whole length of the antenna (or beyond).



And finally - here's a whacky idea for those of you with HOA restrictions on antennas.

Why not build the base of this antenna into a bird table. Have the tape raised by some thin cord or fishing line, run though a pulley attached to a tree branch.

At night simply let the tape rise from the 'bird house' in the style of 'Thunderbirds' secret island base !

I hope this has provided some food for thought, I'd be pleased to hear from anyone who tries out any part of this design.