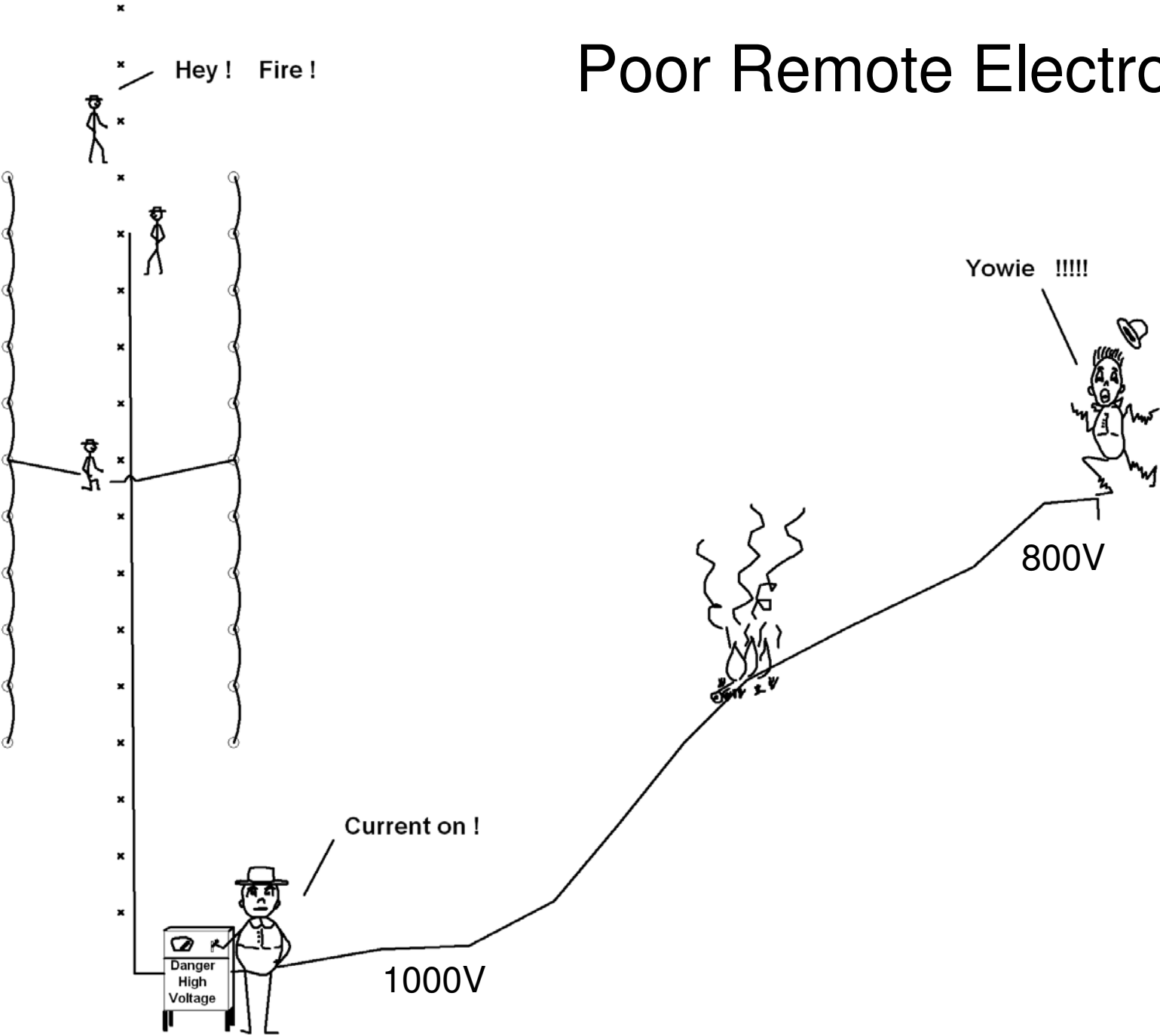


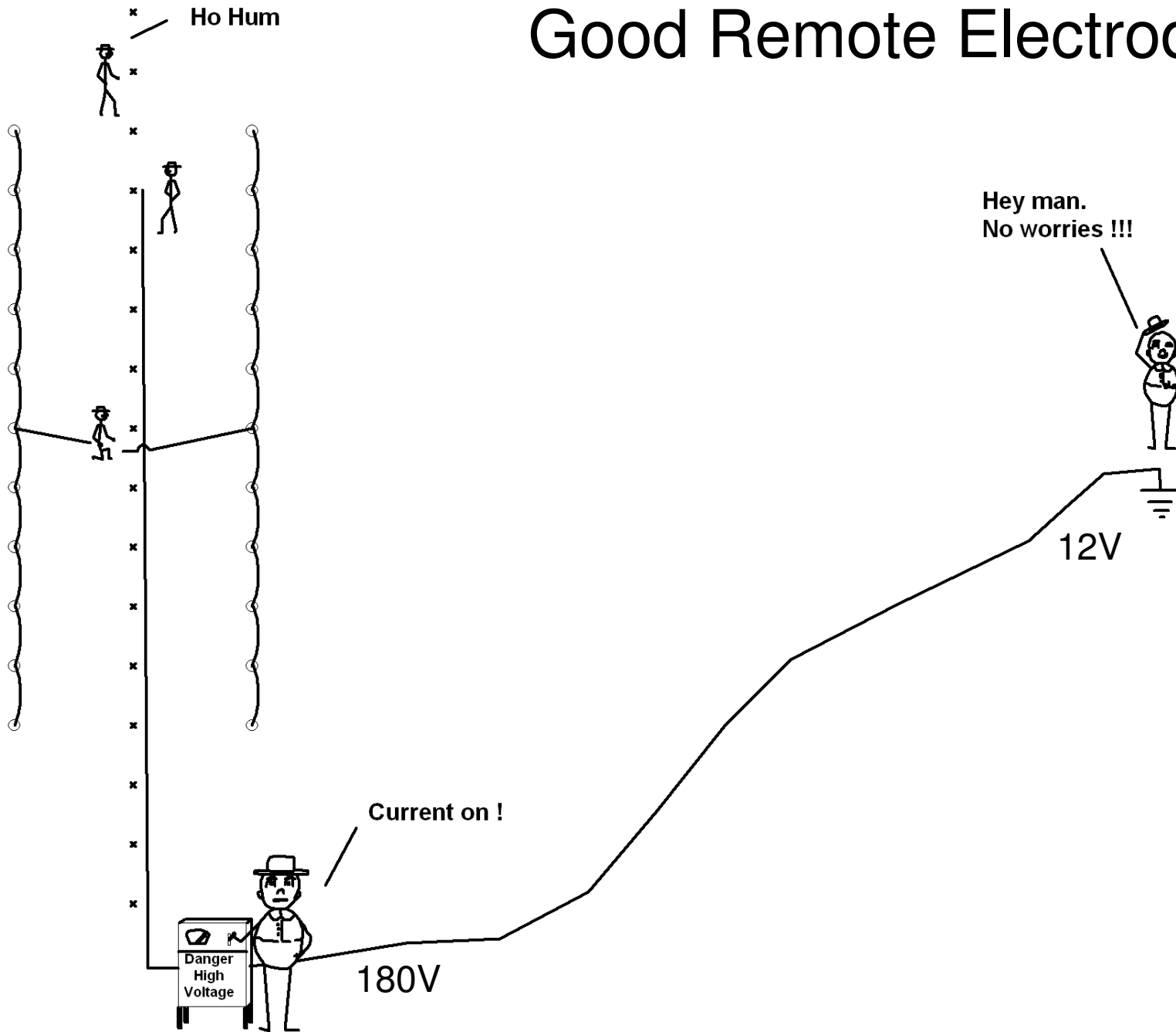
Electrical conduction in 3D
Common misunderstandings
Transmitter setup considerations

Steve Collins

Poor Remote Electrode



Good Remote Electrode



**Good Electrode
or
Bad Electrode**

**Which do you prefer?
Why?**

The answer is obvious – but....

**How do you know how good
an electrode is?**

What can you do to improve it?

Make a bigger or deeper electrode?

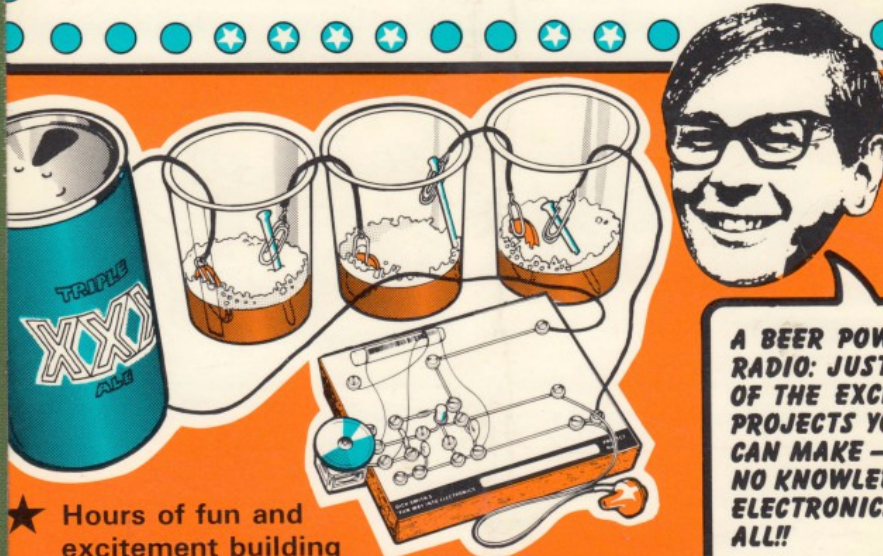


“Is this deep enough yet?”

The problem is....

**We are all brought up to think that
electricity flows along wires in one
dimension.**

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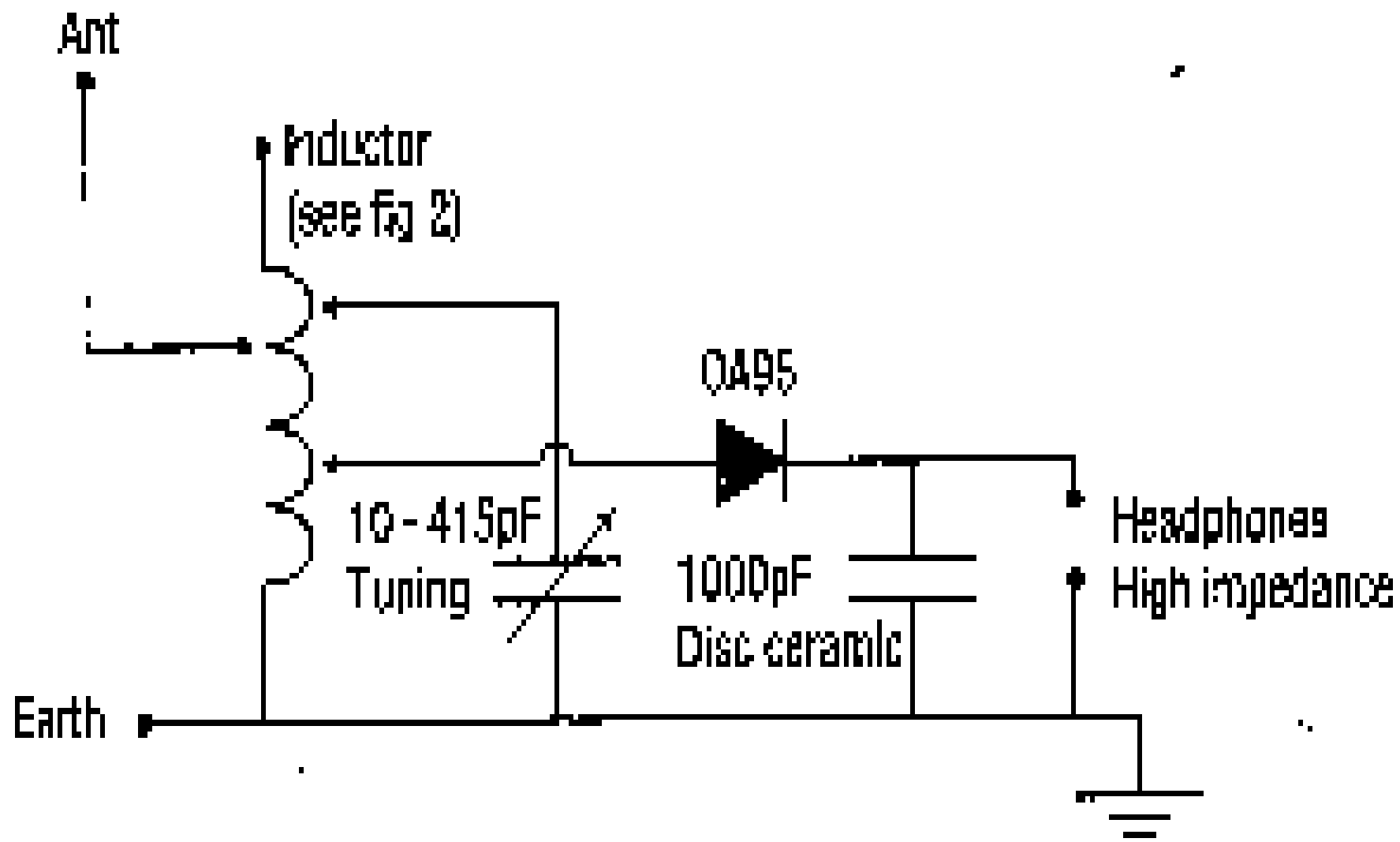
written by **DICK SMITH**

2nd PRINTING!

**NO SOLDERING
REQUIRED**



goughlui.com



But the real world is not like that

Consider the following electrodes.

Which is the better?

Significantly less
than 300 ohms



V
E
R
S
U
S



The sign says 'High Voltage'.

**But how dangerous is it to swim in this
water?**



**How can we measure electrode
resistance in real situations?**

Very, very simply!

**We need to measure the resistance
between the electrode and infinity.**

**We know the current going in but what is
the voltage between here and infinity?**

In practical terms – How far is infinity?

If for simplicity, we assume the electrode is a hemisphere 2m across. The ratio of the potential as we move away from the electrode to the potential at the electrode is just the reciprocal of the distance.

In other words at **100m** from the electrode you are **99%** of the way to infinity (electrically that is!).

And for a smaller electrode you are further still.

**An aside....
Other implications of this.**

99% of the power of your transmitter is
dissipated within 10 metres of the
electrodes.

**Putting a second electrode 10 metres
away has the same effect as doubling
your transmitter power.**

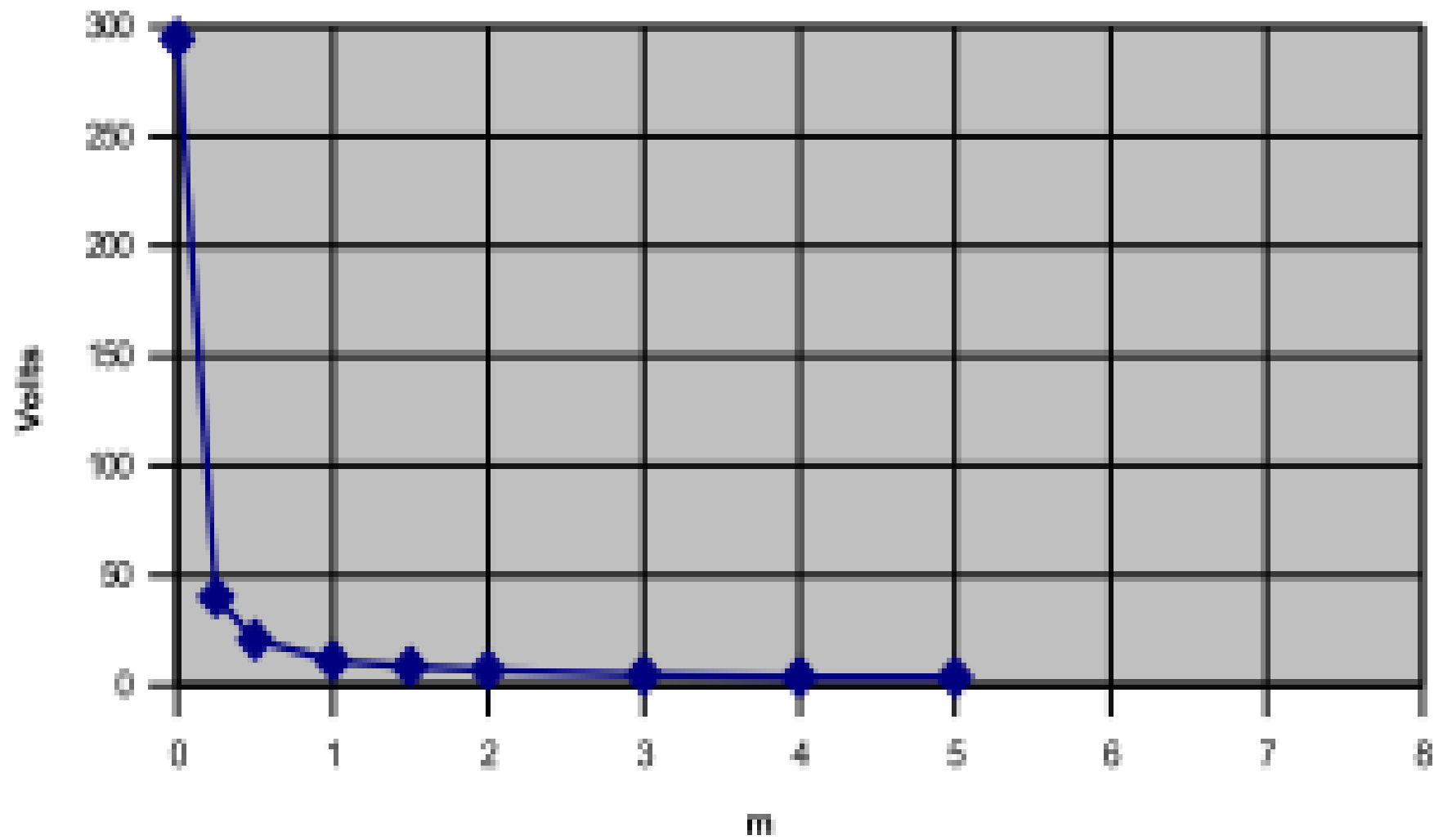
**So we set out to measure the resistance
of real field electrodes**

**First we plotted how the potential falls off
with distance
(relative to a point at least 100m away).**





Site 2, 1 electrode



We measured the resistance of real electrodes in the field

Some were outstanding having very low (and safe) potentials.

9 ohms

15 Volts



4 Plates in Dam Mud
Total 8 ohms

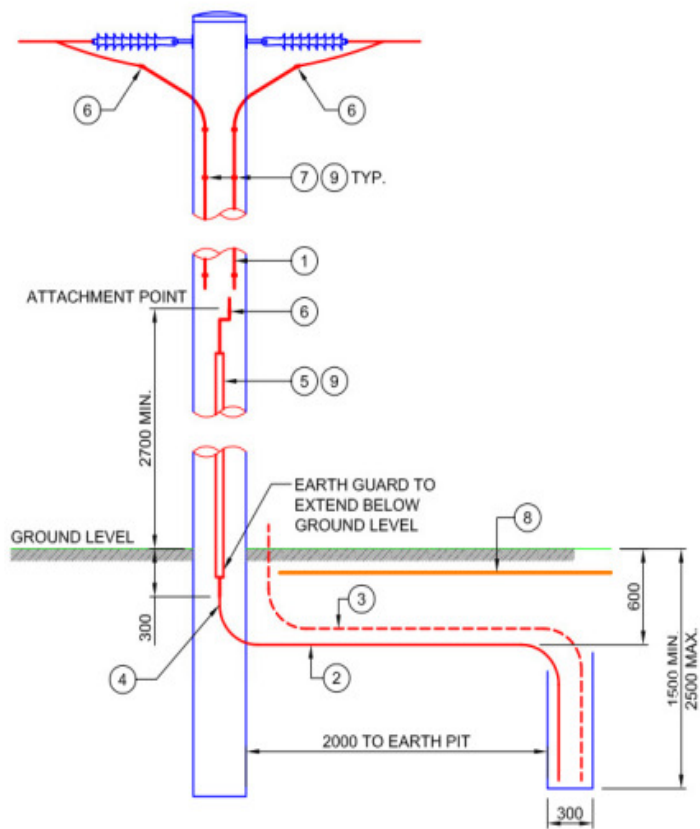


Including....

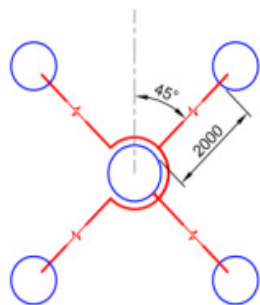
**Possibly the world's first (and last?)
engineer designed transmitter electrode**

8-12 ohms





EARTH SYSTEM LAYOUT
ELEVATION



EARTH SYSTEM LAYOUT
PLAN

NOTES:

1. FOR DEEP DRILLED EARTHING USE BARE EARTHING CONDUCTOR IN HOLE INSTEAD OF EARTH STAKES WHERE POSSIBLE.
2. DISTANCE BETWEEN ELECTRODE SETS TO BE AT LEAST EQUAL TO (PREFERABLY TWICE) TOTAL DEPTH OF ELECTRODES.
3. JOIN BARE TO INSULATED EARTH WIRES TOGETHER AS CLOSE AS POSSIBLE TO POLE.
4. JOIN EARTH WIRES TO EARTH ELECTRODES WITH 'C' CRIMP CLAMPS.
5. ALL EARTH CONDUCTORS ON POLE AND TO FIRST ELECTRODE ARE TO BE INSULATED TO MIN. 300mm COVER
6. INSTALL MARKER TAPE 150mm BELOW GROUND LEVEL FOR ENTIRE LENGTH OF INSTALLATION.
7. TOTAL RESISTANCE TO BE LESS THAN 5 OHMS. EXTEND EARTH GRID IF NECESSARY.
8. HOLES TO BE BACKFILLED WITH SALT AND EARTH.
9. GROUND TO BE SATURATED USING PERFORATED AG LINE PRIOR TO TESTING.

MATERIALS LIST

No.	DESCRIPTION	QUANTITY REQUIRED
1	INSULATED 50mm ² Cu CONDUCTOR	14m
2	BARE 50mm ² Cu CONDUCTOR	20m
3	50mm PERFORATED AG LINE	20m
4	CLAMP 'C' CRIMP	3
5	BATTEN 3m PVC EARTH COVER	1
6	CLAMP PG 7/1.75 - 7/4.50	3
7	SADDLE 16mm GALV	10
8	TAPE 500mm x 40mm SOFT ORANGE ELECTRICITY	8m
9	SCREW 12G x 40mm TEK GALV H/H	AS REQ'D

ACTIVE ENERGY ACTIVE ENERGY

WORK AS EXECUTED

WORK COMPLETED _____
NAME (Block Letters)

SIGNED _____

DATE COMPLETED _____

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Ph (02) 6362 8708 Fax (02) 6363 1663
Email: design@activenenergy.com.au

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GOLD & COPPER EXPLORATION
VARIOUS SITES
EARTHING SYSTEM - OPTION A
FOR C. KELLY

AE Project No:
10068 A4
SHEET 1 OF 2

Figure 1
Electrode Design Schematic

AMENDMENTS

1. ORIGINAL ISSUE 07/10/10



Some surprises

A surface (alfoil) pit had a lower resistance than a nearby augured plate electrode of about the same area.

70 ohms



114 ohms



And...

**A much lower resistance than a plate in
an augured hole in more porous ground.**

310 ohms



As expected

**Using salty water makes a significant
difference.**

**With salt
140 ohms**



**With salt
35 ohms**



No salt
118 ohms



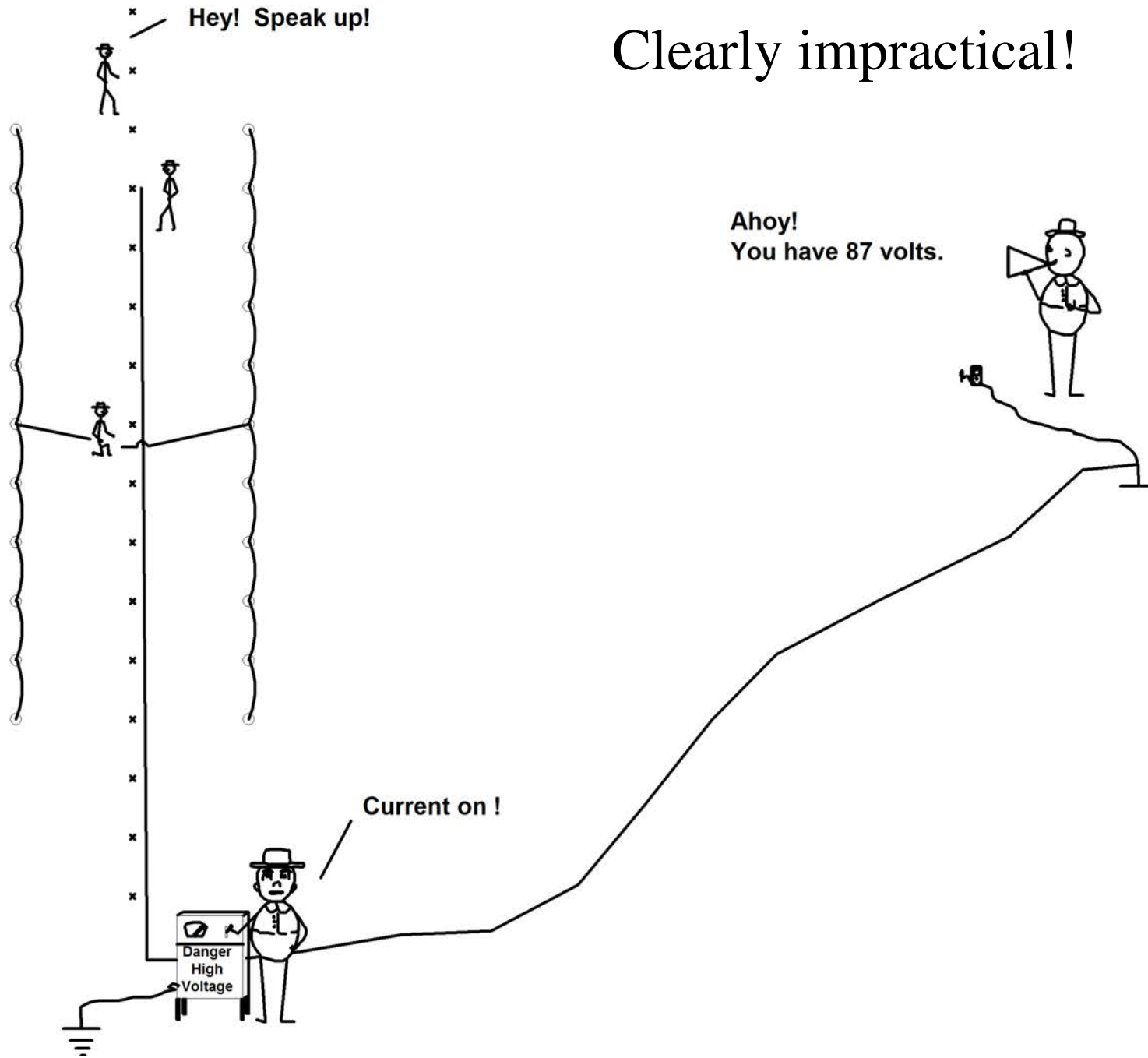
The wooden spoon goes to...

Single stakes – quick but deadly!

3000 ohms
Rewatered 1800



Clearly impractical!



It is impractical to measure the potential at each electrode.

But it is very easy to measure it at the transmitter and subtract off the wire resistance.

The transmitter already has a local earth that is more than 100m from the transmitter electrode

Measure the potential between the wire going to the electrode and the local earth. Divide by the current and subtract the wire resistance.

Hey presto – you have a quantitative measure of your electrodes' quality.

If you don't measure it

You don't know!

So you can't improve it.