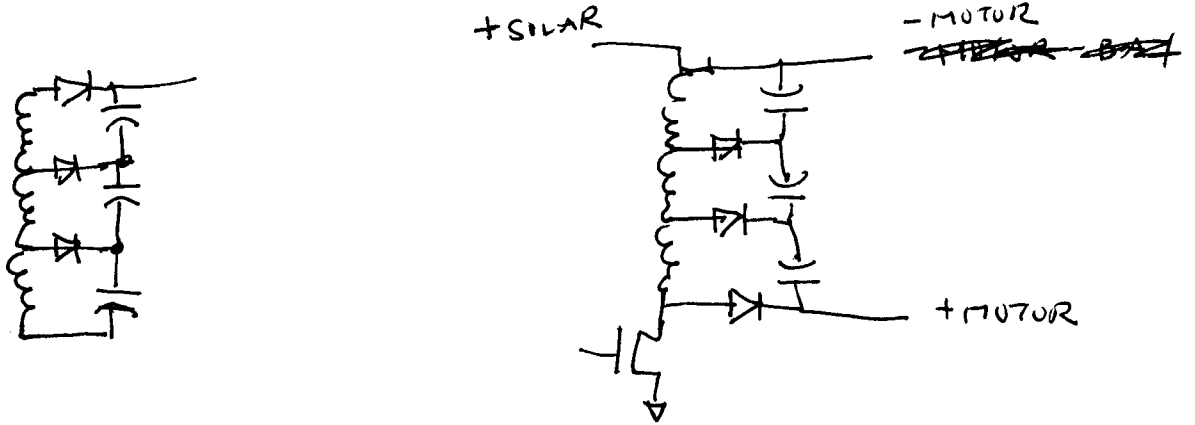
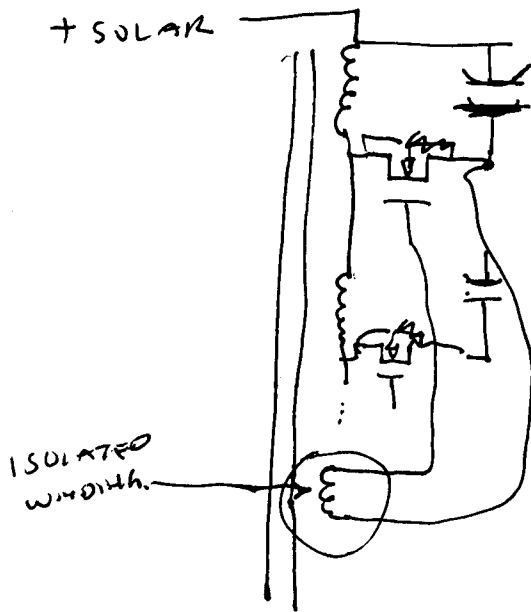


12 OCT 2014; Roderick,

NEW CONCEPT FOR SUPERCAP EQUALIZATION IN PTC. USE EQUAL TURNS IN TRANSFORMER WINDING TO GENERATE EQUAL VOLTAGE THROUGH CURRENT HOODING.

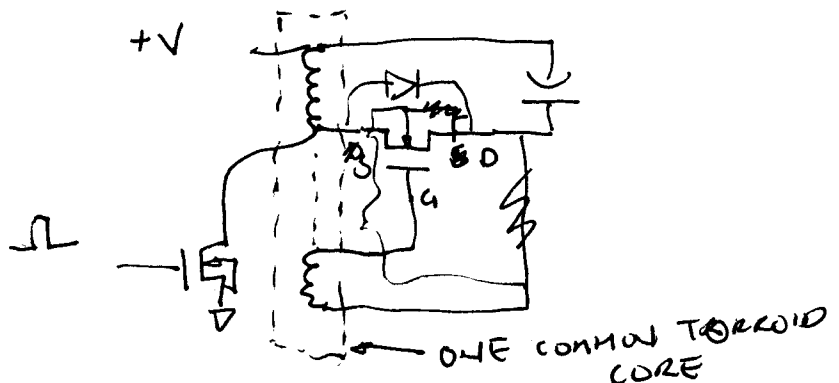


AS LONG AS DOING SO MANY WINDINGS, MIGHT AS WELL GO SYNCHRONOUS



GRACEFUL.
 INHERENTLY FAIL-SAFE.
 ON OVER VOLTAGE -
 EVEN IF ONE CAP
 GETS DISCONNECTED,
 OTHERS STILL CONNECTED
 KEEP FLYBACK VOLTAGE
 FROM ZOOMING UP.

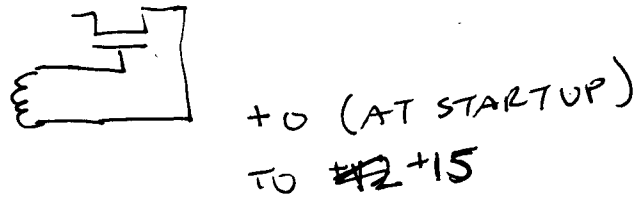
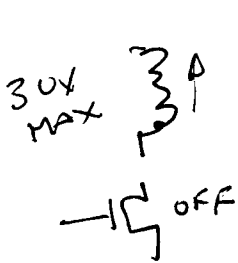
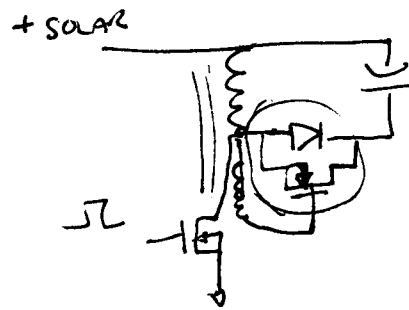
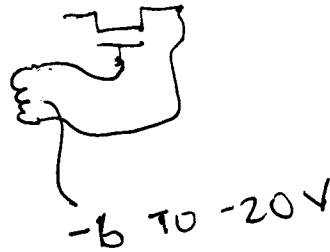
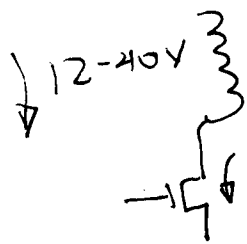
EXPERIMENT:



12 OCT 14; Roderick.

WENT TO HALTED. A MAKER THERE HAD A TORROID ABOUT 4-5" IN DIAMETER. SAID HE WAS MAKING A BUCK CONVERTER. ESTIMATED 160 μ H, PULSED 160 A. LOOKED LIKE HE WAS USING JUST 14 GA WIRE, BUT I DIDN'T SAY ANYTHING. HE SAID HE GOT THE CORE OFF EBAY, 2/815.

SYNCHRONOUS RECTIFIER DRIVE TURNS RATIO



GATE DRIVE AT $\frac{1}{2}$ VOLTAGE OF INPUT.

12 SUPERCAPS, SO PRIMARY TURNS MUST BE MULTIPLE OF 12.

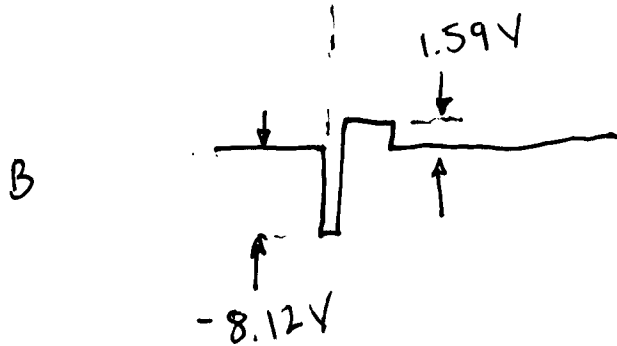
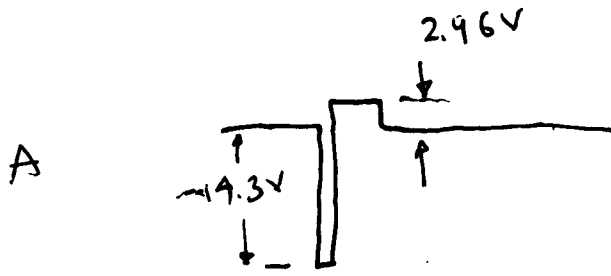
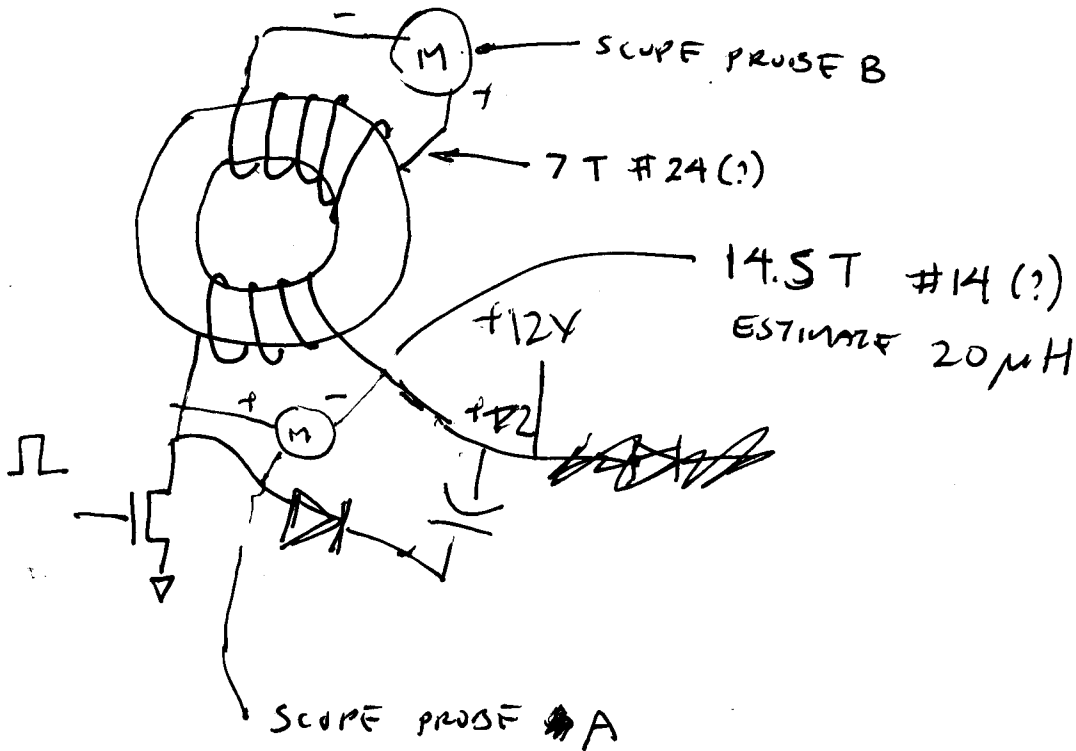
24 T ON PRIMARY, TAP EVERY 2 TURNS,

12 T EVERY GATE DRIVE COIL

OR 12 T PRIMARY, TAP EVERY TURN

6 T EVERY GATE DRIVE

EXPERIMENT: VERIFY WHICH DIRECTION CURRENT FLOWS WHEN PULSE GOES THROUGH ONE WINDING OF TOROID.





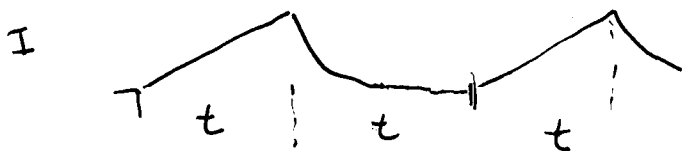
GOT 3" DIA TORROIDAL TRANSFORMERS FROM HALTED, ON BARGAIN RACKS, \$3. MAY BE ABLE TO USE CORE.

ALSO GOT DM4070 LCR METER. TEST OF 4 TURNS WRAPPED AROUND TORROID SHOWED ALMOST EXACTLY 40 μH.

$$A_L = \frac{40 \mu H}{N^2} = \frac{40 \mu H}{16} = 2.5 \mu H / N^2$$

12 TURNS WOULD BE $12^2 \cdot 2.5 = 12 \cdot 3 \cdot 4 \cdot 2.5 = 36 \cdot 10 = 360 \mu H$

AS THE MOTOR WILL NATIVELY DRAW FAR MORE THAN THE SOLAR PANEL CAN SUPPLY, MUST ASSUME DISCONTINUOUS OPERATION OF THE PTC. BIG INDUCTOR ~~IS~~ MEANS LOW FREQUENCY - GOOD FOR SWITCHING LOSSES, BUT WOULD NEED LARGE CAPACITORS ON SUPPLY SIDE.



SUPPOSE I WANT POWER P, TIME t TO BUILD CURRENT IN INDUCTOR.

$$I = \frac{V}{L} t$$

ENERGY

POWER STORED IN INDUCTOR $E = \frac{1}{2} L I^2 = \frac{1}{2} L \frac{V^2}{L^2} t^2 = \frac{1}{2} \frac{V^2}{L} t^2$

POWER $P = \frac{E}{2t} = \frac{V^2}{4L t} t^2 = \frac{V^2 t}{4L}$

$$E = \frac{1}{2} \frac{576}{100 \times 10^{-6}} \times (138)^2 (10^{-6})^2$$

$$f = \frac{1}{2t}$$

$P = fE$ ~~$f = \frac{P}{E}$~~ $t = P \frac{4L}{V^2}$

~~$\frac{576}{2 \cdot 138^2} \cdot 138^2$~~

SUPPOSE 100 μH, 24V, 200W

$$t = 200 \cdot \frac{4 \cdot 100 \cdot 10^{-6}}{24^2} = \frac{8 \times 10^{-2}}{24^2} = \frac{1}{72} \cdot 10^{-2} = 139 \mu S$$

$\frac{1}{2t} \approx 3.6 \text{ kHz}$

~~$\approx 7.2 \text{ kHz}$~~

12 DEC 2014

Roderick.



Vanguard®

TRY CALCULATIONS AGAIN: POINT IS TO SIZE INPUT CAPS.

$$I = \frac{V}{L} t$$

V = INPUT SUPPLY

L = INDUCTANCE

t = CHARGING TIME, HALF OF PERIOD

ENERGY STORED PER CYCLE

$$E = \frac{1}{2} L I^2 = \frac{1}{2} L \frac{V^2}{L^2} t^2 = \frac{1}{2} \frac{V^2}{L} t^2$$

ASSUMING 50% DUTY CYCLE,

$$P = \frac{E}{2t} = \frac{1}{2t} \frac{1}{2} \frac{V^2}{L} t^2 = \frac{1}{4} \frac{V^2}{L} t \quad t = \frac{4PL}{V^2}$$

This page was intentionally left blank.

$$E = \frac{1}{2} \frac{V^2}{L} t^2 = \frac{1}{2} \frac{V^2}{L} \left(\frac{4PL}{V^2} \right)^2 = 8 \frac{P^2 L}{V^2}$$

DISREGARD THAT SOLAR PANEL PROVIDES ENERGY DURING CHARGING.

ASSUME ALL ENERGY COMES FROM CAPACITOR,

V = STARTING VOLTAGE OF CAPACITOR $V_F = \text{END VOLTAGE}$

$$\text{ENERGY FROM CAP} = \frac{1}{2} C (V^2 - V_F^2) = 8 \frac{P^2 L}{V^2}$$

$$V^2 - V_F^2 = 16 \frac{P^2 L}{C V^2}$$

$$V_F = \sqrt{V^2 - 16 \frac{P^2 L}{C V^2}}$$

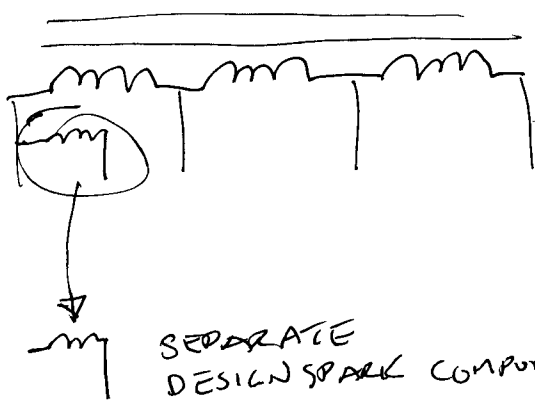
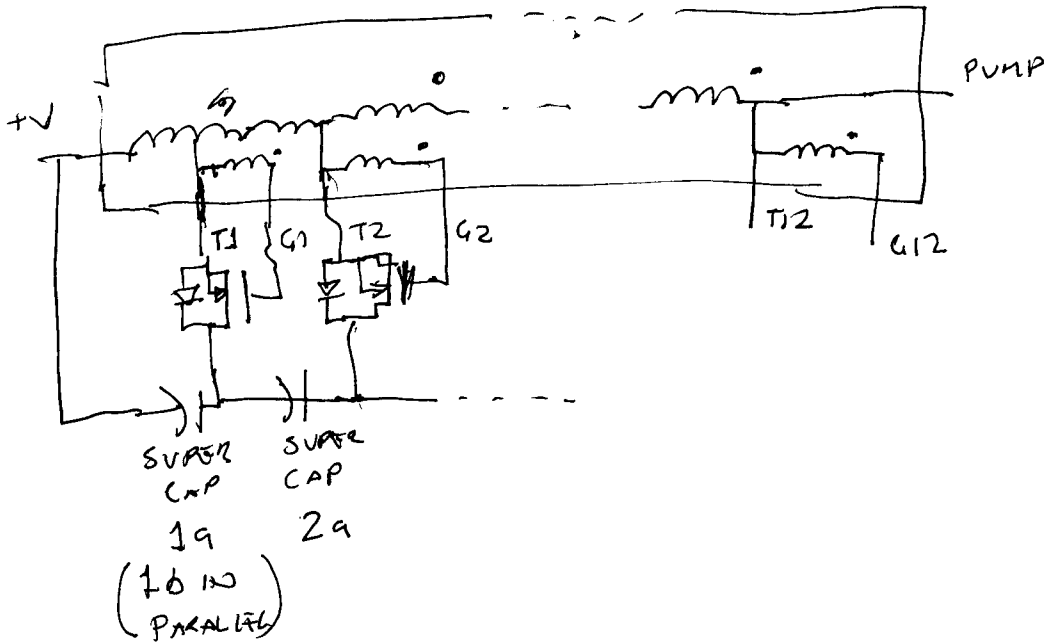
CASE OF 100 μH, 1000 μF, 24V

$$V_F = \sqrt{576 - 16 \cdot \frac{200^2 \cdot 100 \cdot 10^{-6}}{1000 \cdot 10^{-6} \cdot 576 \cdot 24^2}} = \sqrt{576 - 16 \left(\frac{25}{3} \right)^2 \cdot \frac{L}{C}}$$

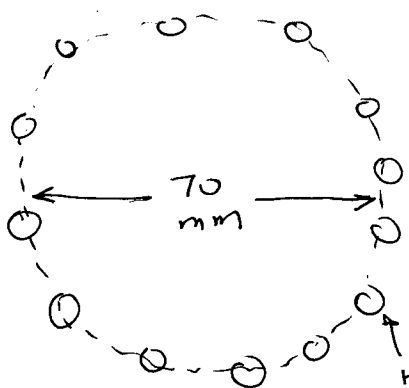
$$= \sqrt{576 - 1111 \cdot \frac{L}{C}}$$

$$\left(\frac{100}{3} \right)^2 = \frac{10000}{9}$$

NEED TO MAKE DESIGN SPARK COMPONENT



1 in = 25.4 mm
1000 mil = 25.4 mm



HOLE FOR #12 WIRE
2mm = 0.078"
IDEAL FINISHED HOLE
SIZE = 78 + 6 = 84 mil

RADIUS OF PATTERN = 35 mm
IF CENTER IS ON ORIGIN (0,0)

FOR (i=0; i<13; i++)

```
{ printf("hole @ %f, %f\n",
```

```
35*cos(360.*i/13),
```

```
35*sin(360.*i/13));
```

#44 DRILL IS 86 mil, 83 PHS