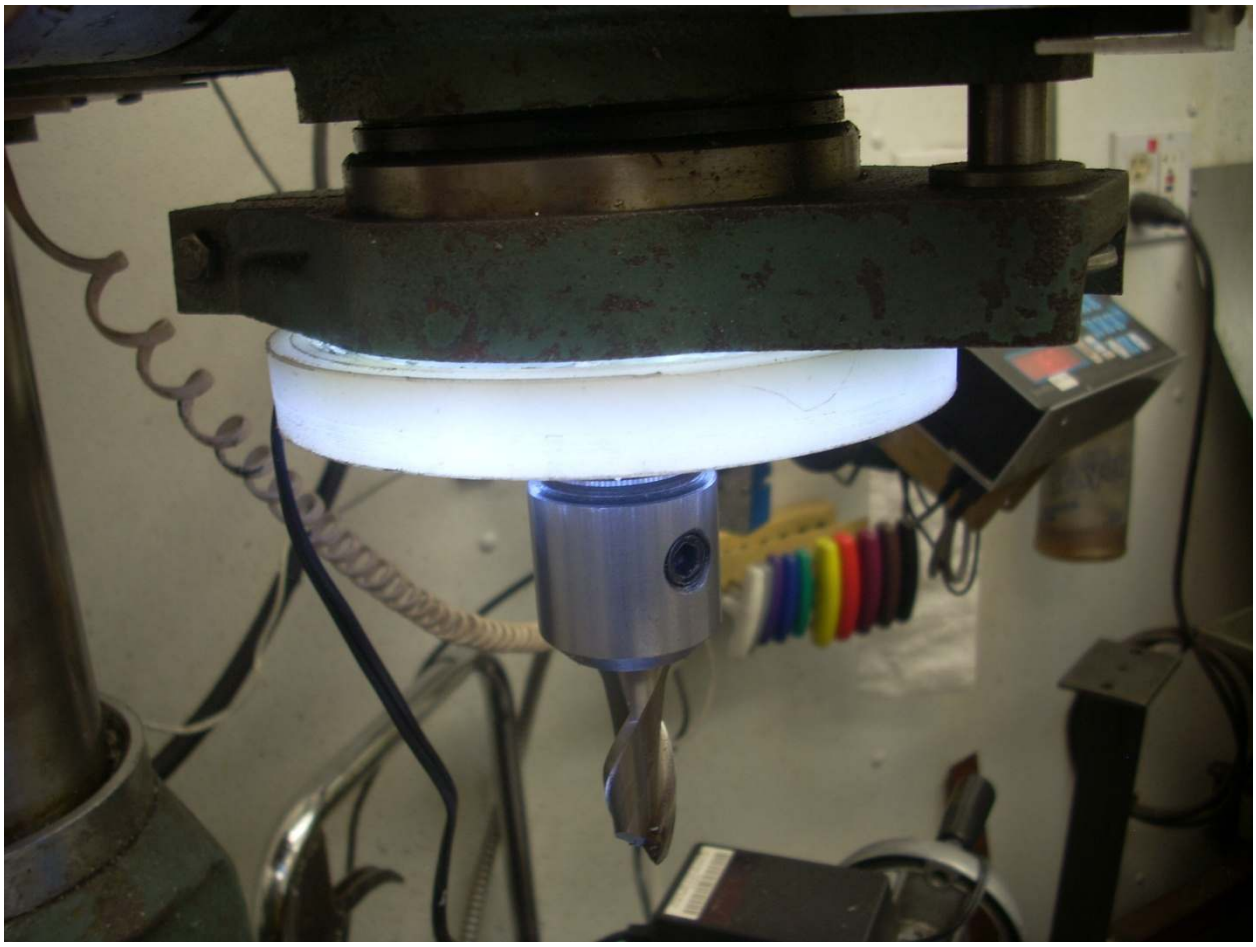
A Ring Light for a Mill/Drill, version 2

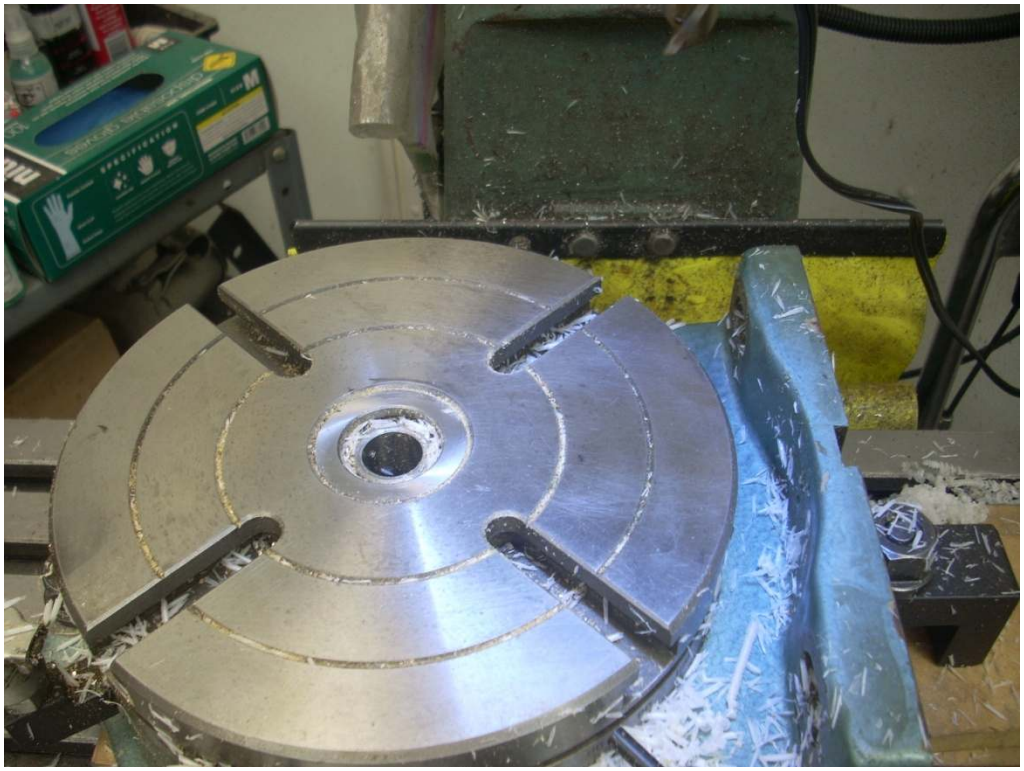
By R. G. Sparber

Recently I bought 100 Superbright LEDs from a vendor[2] on eBay. It cost me $4.20 including shipping. I used 54 of these 20,000 milli-candle lights in a ring that goes around my spindle. I figured that 8 LEDs would have been enough but decided to go a little crazy.



I think I have finally eliminated all shadows around my cutter.
The ring is made from nylon.

[1] You are free to copy and distribute this document but not change it.
[2] I bought from **led.shop*2010**.



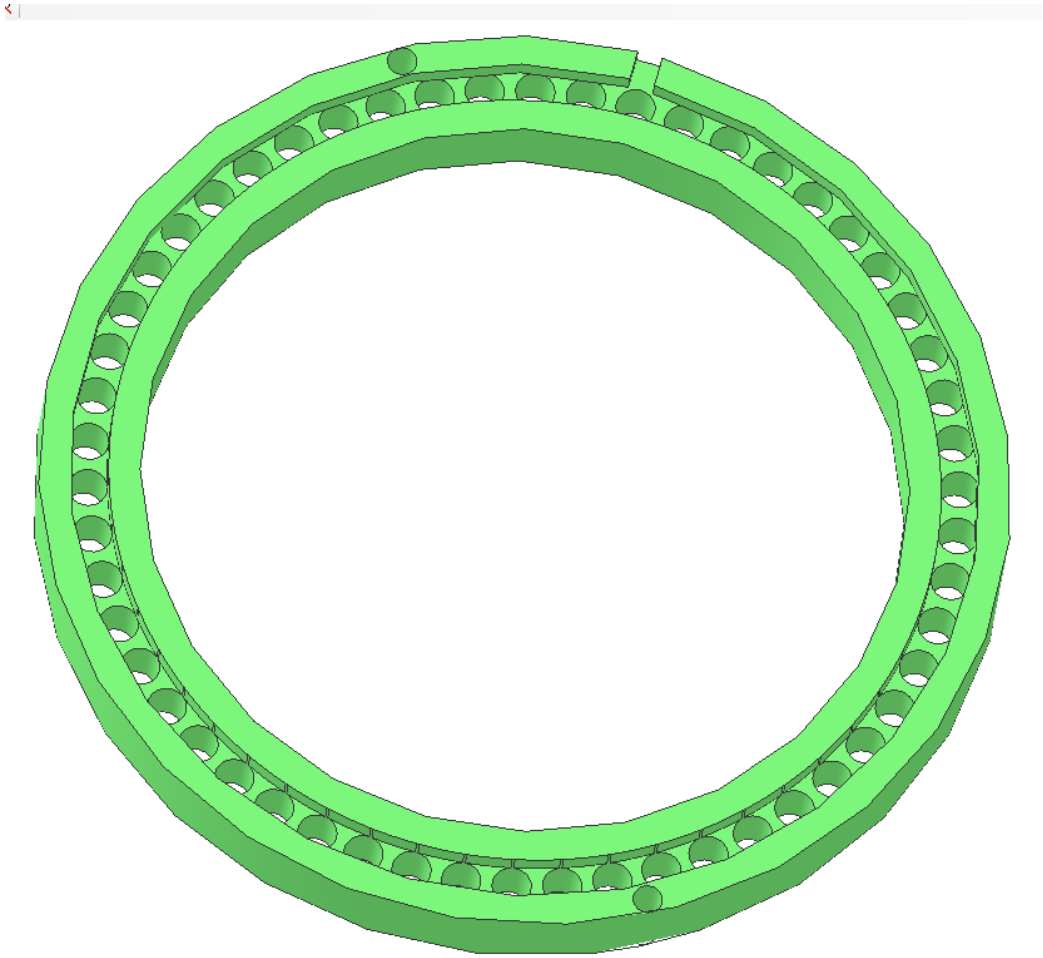
The light is uniform around the spindle and plenty bright.

The ring was press fit onto the lower spindle bearing in this picture but I will add two screws into the bearing support very soon.

Here is the ring with the power just turned off. The power supply[3] that I used has a lot of energy storage inside of it so the LEDs stay on for about 30 seconds after I unplug it. You can see a few of the 54 LEDs still faintly lit.

My power supply puts out about 35V at up to 400 mA. I grouped the 54 LEDs into 6 sets of 9 LEDs each. The 9 LEDs were put in series along with a 470 ohm limiting resistor. Then the 6 sets were put in parallel. This arrangement sets the current in each string to about 18 mA which is slightly below the recommended maximum steady state value.

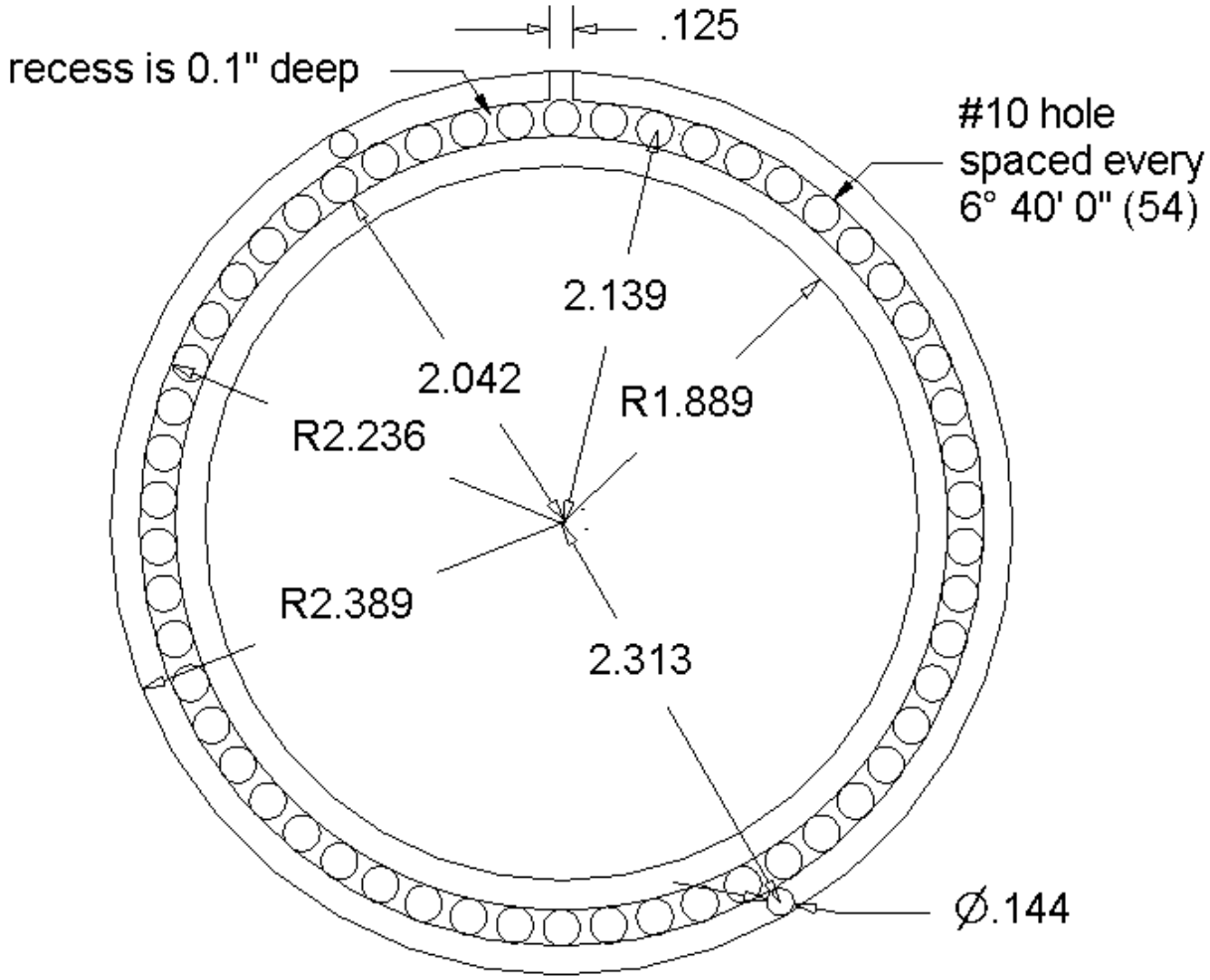
[3] Periodically I visit my local Goodwill Store with a voltmeter and sort through their "wall warts". At about $3 each, they are a great deal but only if they are operational.



The ring was machined from nylon. There are 54 holes drilled with a #10 drill spaced equally around the bore. I originally planned to use a ring 3/8" thick but the piece I found in my scrap pile was 0.6" thick. This let me cut my channel a lot deeper and made it easy to put all resistors and connections inside. I then used heat glue to pot it all after testing.

Spindle Light

matieral: nylon
3/8" thick



Ring holds 54 LEDs. The LEDs are grouped in sets of 9 in series with one 470 ohm resistor. All 6 strings are in parallel and powered by a 35V wall wart. Total current drain is about 100 mA

The channel is cut such that the ends of the LEDs just stick out of the opposite face of the ring.

*** 100% Brand New High Quality ***

Description	QTY	Emitted Color	Lens Color	View Angle
5mm Round LED	100PCS	white	Water clear	20-25

5mm Round LED Description

	Forward Voltage(V) If=20mA		Dominant wavelength(mm)K If=20mA		MCD If=20mA		Reverse current(uA) Vr=5V	Power Angle (deg)
	Min	Typ	Min	Typ	Min	Typ	Max	
Red	2.8	3.0	620	630	4000	5000	10	20-25
Yellow	2.8	3.0	580	590	4000	5000	10	20-25
Orange/Amber	2.8	3.0	515	520	5000	6000	10	20-25
Green	3.2	3.4	520	530	12000	14000	10	20-25
Blue	3.2	3.4	460	465	5000	6000	10	20-25
White	3.2	3.4	5000	6500	16000	20000	10	20-25
Warm- White	3.2	3.4	3000	3500	13000	15000	10	20-25
Pink	3	3.2		X=0.35 Y=0.37	8000	9000	10	20-25
UV/Purple	3	3.2	390	400	800	1000	10	20-25

Given the diameter of an LED and a reasonable diameter for the light ring, I came to the conclusion that 54 LEDs would comfortably fit.

The spec sheet for this LED shows a forward voltage of between 3.2V and 3.4V at a forward current of 20 mA.

The power supply I had on hand put out 35V at up to 400 mA.

I planned to put a number of LEDs in series along with a limiting resistor. My first cut at the design assumed 5V across the resistor. This leaves 35V - 5V = 30V for the LEDs. 30V/3.3V = 9.1 LEDs. So I picked 9. This puts 35V - (9 x 3.3V) = 5.8V across the resistor. Given a forward current of 20 mA, this means that the resistor should be 5.8V/20 mA = 290 ohms. Unfortunately, I had already sealed up the 470 ohm resistors before I discovered this error. Not a big deal because the LEDs were plenty bright. But my forward current was only 5.8V/470 ohms = 12 mA.

With 9 LEDs in each string, I made up 6 strings. All of these strings were put in parallel and fed by my power supply.

Total nominal current drain is 9 x 12 mA = 111 mA.
Maximum current drain given an LED voltage drop of 3.2V is 119 mA.
Minimum current drain given an LED voltage drop of 3.4V is 84 mA.

I welcome your comments and questions.

Rick Sparber
Rgsparber@aol.com
Rick.Sparber.org