

Tesla CD Turbine, Steampunk Pumpkincutter Gadget

Bill of Materials: Basic CD Turbine:

8 CD discs, (re-used/recycled CD's or DVD's are ok as long as no cracks, warpage or labels.)
free

1 inch thick CD spindle and cover (called a "CD cakebox") free? or \$ 8.00, Wall-Mart

42 of 3/8 inch x 1/32 inch N42 Neodymium magnets \$10.16 at K&J Magnetics

6 of 1/2 x 1/8 inch N50 Neodymium magnets \$4.50 at K&J Magnetics

Orbit WaterMaster Extension Nozzle Model 91129 (Home Depot, \$5.95, or a \$1.80 Water Nozzle from Holland GreenHouse.)

1 small piece of tubing to just fit inside water nozzle, above. (Plastic insulation from a 10 ga. wire)

18 inch section of 3/4 inch PVC tubing, free or \$ 2.00

3/4 inch PVC adapter, PVC Pipe to Garden Hose, Male, to fit Water Nozzle Inlet end. \$2.85, Home Depot

3/4 inch PVC adapter, PVC Pipe to Garden Hose, Female, connects to shut-off, below. \$ 2.85, Home Depot

Garden Hose Shut-off Valve, male garden hose end and male pipe thread for air compressor fitting, below. \$4.55, Home Depot

Air compressor coupler, connect to above shut-off valve with adapter \$3.25 Home Depot

10 - Heavy Duty Hot Glue Sticks \$5.95, Hardware Store

PVC Pipe Primer, on hand, or borrow it

PVC to ABS cement (or PVC cement depending on water nozzle type) on hand, or borrow it

Crazy glue \$6.50,

Cost for above Basic CD Turbine: \$55.56

Bill of Materials: Magnetic Coupler

3 CD Discs, free

12 of 3/8 inch x 1/32 inch N42 neodymium magnets \$ 2.76, K&J Magnetics

12 of 1/2 inch x 1/8 inch N50 neodymium magnets \$ 9.00 K&J Magnetics

6 of 1 inch x 1/8 inch teflon furniture pads \$1.00, Dollar Store

Cost for above Magnetic Coupler: \$12.76

Bill of Materials: SteamPunk Pumpkincutter Mods

7-1/4 Inch Skilsaw Blade (Note: Please substitute safe replacement such as Nerf disc or Frisbee.) \$ 5.00

Skilsaw Guard, used, from old skilsaw, free

1/2 inch brass barbed female garden hose fitting (Blade Holder Part) \$1.99, Home Depot

1-1/2 inch x 3/4 inch x 1/8 inch steel hold-down plate (Blade Holder Part) free scrap

Large coin of choice(Canadian "Looney" was appropriate), welded to set screw to hold above plate (Blade Holder Part) \$1.03

Garden hose to 1/2 inch pipe fitting, brass (Blade Holder Part) \$2.89, Home Depot

1/2 inch pipe thread brass sight-glass (Blade Holder Part) Expensive decoration!(but cool!)
\$19.95

1-1/2 inch x brass drainpipe \$5.00, on sale Home Depot.

Laser pen, small keychain type (for Laser Attachment) \$5.95, Dollar Store

5/8 inch garden hose male brass fitting,(slips over laser pen and turns on the switch.) \$ 1.95,
Home Depot
3 inch x 1/4 inch brass screw (for Laser adjustment) \$.22 Home Depot
1 inch x 1/4 inch brass screw w/ nut (for Laser adjustment) \$.32 Home Depot
Cost for above PumpkinCutter Mods: \$44.30

Totals:

Cost for Basic CD Turbine:	\$ 55.56
Cost for Magnetic Coupler:	\$12.76
Cost for Steampunk PumpkinCutter Mods:	\$44.30

Total \$112.62

**Total Cost for Tesla CD Turbine, Steampunk PumpkinCutter Edition,
\$112.62**

Build Instructions: Tesla CD Turbine, Steampunk Pumpkincutter Edition

step 1 Background Info

The Tesla CD Turbine is based on the [Tesla Turbine](#), invented in the early 1900's by the great inventor [Nikola Tesla](#). The Tesla Turbine is peculiar in that it uses flat discs in the turbine rather than blades or cups. It relies on the adhesion and boundary-layer effect in the thin space between the discs for the motive force. The fluid enters the turbine through a nozzle, and then moves through the discs in a spiral motion to the centre exit hole, imparting motion to the discs. For more detailed info on Tesla Turbine, go to <http://www.frank.germano.com/>.

This [Tesla CD Turbine](#) is unique in that it uses no shaft, no shaft bearings, and no shaft seals. It's magnetic coupling allows useful work to be transferred outside of the sealed CD Turbine case, in this example to a skilsaw blade.

step 2 The basic parts

- 1.) CD Turbine Disc Pack
- 2.) CD Spindle Modification
- 3.) CD Cover and Nozzle
- 4.) Magnetic Coupler and blade
- 5.) Guard
- 6.) Laser Parts
- 7.) Brass handles and fittings

step 3 Make the CD Turbine Disc Pack

Assemble CD Disc Pack :

Working with a CD Spindle and your favourite useless CD's, open Spindle Cover and remove CD's from the Spindle. Carefully crazy-glug six 5/16 inch x 1/32 inch neodymium disc magnets in appropriate locations, evenly spaced, at the edges of one CD. Make sure all the same poles of the magnets are facing up; I use North poles up. Use a piece of medium sandpaper to rough up both the surface of the CD where the magnets will sit, and also roughen the mounting surfaces of each of the magnets. Use only a tiny drop of superglue for each magnet.

Flip over CD and carefully glue six more magnets onto CD to correspond with previously glued magnets on the other side. They will tend to pop into place at the correct locations "automagically". Make sure they don't overlap the edge of the disc.

Now put this first CD onto the Spindle of the CD Case. Put a small drop of glue on each magnet, and place another CD on top of the first. Glue on 6 more magnets to that CD. Put small drops of glue on the magnets. Place another CD on top of them. Continue in this manner until you build up a CD

disc pack with 8 discs using 42 magnets as spacers. Then glue on the 1/2 inch x 1/8 inch top magnets onto the top of the disc pack.

step 4 CD Spindle Modifications

The Spindle must be modified to allow the fluid pressure to escape. Carefully drill 1/8 "holes in the centre spindle shaft. Allow room between each hole to keep the spindle shaft strong, but put in as many holes as you can easily fit. I used 25 holes (3 high x 8 around, plus one at the top). You will have to clean up the inside of the spindle of shavings, and smooth off the spindle shaft of burrs. Make sure the CD disc pack spins freely on it. An outlet on the bottom of the CD Spindle is optional and especially recommended for water-powered runs.

step 5 CD Cover Mods and Nozzle

First prepare the nozzle by making the tip exit hole smaller. This will increase the pressure and give better performance. Water nozzles typically are about 1/8 inch tip diameter. We need to make it about 1/16 inch. I used a short piece of 10 ga wire insulation and crazy-glued it into the nozzle tip. The tube can stick out a bit and be cut off after the nozzle is hot-glued to the cover.

This is how to to modify the CD cover to accept the inlet nozzle. It takes a little finesse, but hot-glue works well to stick the nozzle onto the CD case. Carefully cut a small hole in the side of the case to accept the nozzle,(or simply use the tip of the glue-gun to melt a hole through), then position the nozzle at approximately the same angle as shown in the pictures. It should aim at the very outer edges of the discs. Start building up the hot-glue, while keeping the nozzle in position. Take your time and allow the glue to cool somewhat as you go, so as to not warp the case. Avoid air bubbles that may start leaks.

Cut or grind the nozzle end flush with the inside of the CD case. Allow everything to fully cool and cure.

Glue on PVC pipe adapters using PVC glue, and install pipe by screwing into the nozzle with rubber gasket in place.

Put the previously completed CD Disc pack on the spindle, and install the modified cover. The CD pack inside should freely rotate. If not, find out what is binding and grind or cut to suit. The cover needs to be sealed to the spindle for best performance, so use the glue gun and lay in a bead between the cover and the spindle to join them together.

step 6 Make a Magnetic Coupler

Now you need to make a Magnetic Coupler to enjoy getting useful energy out of the Tesla Turbine device. We'll use the same technique as making the above CD Disc Pack.

Start by placing a CD on top of the previously made CD Disc Pack. Line it up with the other CD's. Next, place a small drop of glue lined up to a magnet point on the CD. Take a 1/2 inch x 1/8 inch neodymium disc magnet and place it at the magnet point, on the glue. It will self-position quickly; just be sure not to let it hang over the edge of the CD as the glue sets. Repeat at the other 5 magnet points, so that you end up with a CD with six magnets glued to it. Flip it over and glue on six 3/8 x 1/32 inch disc magnets, allowing them to attract and align with the previous six magnets. Again, be sure magnets don't overlap the edge of the CD as the glue sets.

Place this 12-magnet CD on the CD spindle to keep things lined up, then put a small drop of superglue on each of the the six visible 3/8 x 1/32 magnets. Place a CD on top of this and glue it to the magnets. Glue on six more 3/8x 1/32 magnets, and then another CD. Glue on 6 more magnets, this time use the 1/2 inch x 1/8 inch magnets.

By now you have a 3-disc pack with magnets on both sides of it. This is the Magnetic Coupler. I added some stick-on Teflon pads to the Turbine side for smoother running,

Be sure the North-South polarity is the same for each glued magnet. In other words, you should end up with all south poles on one side of this Magnetic Coupler and all north on the other, similar to

the CD Disc Pack previous, but upside down. The Magnetic Coupler magnets should tend to repel the magnets in the CD Disc Pack, when placed on the top of the CD cover. Note that repel mode works for the coupler, attract mode does not.

The Skilsaw Blade Attachment is very dangerous to actually use, but it demonstrates the power and versatility of the Tesla CD Turbine. Use a Nerf plastic blade for safety. Other attachments, implements, or tools are readily adapted, instead of the Skilsaw Blade. For example, an auto alternator could be adapted, which will be the topic of a new Instructable.

The basic idea of the Skilsaw Blade Attachment is to use the Magnetic Coupler to magnetically clamp on the blade (glue it as well), while keeping it lined up at the centre hole. It is preferable to put a cut-off 5/8 inch bolt or pin in the centre to keep the blade centered at high speeds. (any off-center wobble would be sheer disaster!) I used part of the 1/2 inch Garden hose fitting, and soldered that onto a small plate that screws to the guard. This arrangement keeps the blade in place.

That's it...the blade just clamps on magnetically to the Magnetic Coupler. The Magnetic Coupler just rides on the top of the CD case, while engaging the magnets in the CD Case. Scared enough yet??

Well, ok, I did originally test run the blade without a guard and without a shaft to hold the blade on; I lived through it, I won't do that again! My new setup is much more robust, with little or no possibility of blade fly-off. There is both a guard, and a stationary shaft attached to a screwed-in plate. It all worked really well during the PumpkinCuttin Ceremony, other than the guard got plugged up with pumpkin guts and slowed the blade down!

But really, a Nerf foam blade with magnets glued on would be best instead of the Skilsaw blade. I just wanted to be extra scary at Halloween!

step 8 Build the Guard

Having a guard with a spinning saw blade is very important! (thanks to everyone who kept reminding me of this idea.)

I started with a 7-1/4 inch Skilsaw inner guard and hack-sawed a piece off to make it conform roughly to the CD Case. Then I hot-glued it onto the CD cover, using lots of hot-glue, slowly building it up layer-by-layer. Keep re-checking blade clearance when gluing, adjust if necessary.

step 9 SteamPunk It !!

Ok now that the basic Tesla CD Turbine is built, we can add details to give it a great SteamPunk look.

I started by adding a brass drainpipe, cutting off the end so it would conform to the turbine case and cutting it to fit over the fluid inlet/handle. This piece was hot-glued securely in place and it becomes the handle. (make sure there is room for fittings, shut-off valve, etc.) into position where it touched at various points of the CD Case, and at the connector that goes to the PVC inlet pipe. Check clearances as you go so the blade is centered in the guard.

step 10 Add A Brass Outlet Port

I used the cut-off piece of brass pipe to make a brass outlet. I smoothed the edges with a sanding drum on the Dremel Tool, then mounted it to the bottom of the CD Case, using hot-glue. It points roughly away from the operator.

step 11 Install the Laser Cut Illuminator

Note: Don't point the pointy end of the laser into peoples' eyes. Also, don't point the pointy end of the Blade near people at all. Especially if it is running.

The Laser Cut Illuminator is basically a laser pen, with a pipe fitting sliding on the pen body acting as a switch. A brass screw is elevation adjuster. Hot-glue parts in as needed!

step 12 Install the Special Really Important Blade Guide

The Special Really Important Blade Guide is a recent welcome addition to the Skilsaw Attachment of the Tesla CD Turbine. It has two purposes. It's main purpose is to guide the blade should it have a sudden desire to want to leave the Magnetic Coupler. A second purpose is to attach a handle so both hands can be used. And because it looks cool, and is a brass piece, I just had to use somewhere on the machine. (hehe)

step 13 Finishing Touches

Finish up by making sure there are no sharp edges(!), that the glue is well reinforced, and that the Blade and Magnetic coupler move freely with the Magnetic Disc Pack, which is inside the CD Case. I connected a brass garden hose shut-off valve at the air inlet PVC tube and used an pipe adapter to go to garden hose from an air chuck. With two fittings, I can easily convert from water to air pressure and back.

Please remember that running this turbine on air pressure is a very dangerous thing...it will certainly BLOW UP, like a bomb with shrapnel, if used on straight 120 psi without a load. If conditions are perfect, this magnetic version may withstand 11,000 rpm or more before blowing. But conditions are seldom perfect, and chances are that the CD's in the Magnetic Disc Pack could separate at lower rpm than 11,000. Try to design the guard and CD Case to take this into account. Don't do demos of this turbine and expect it to be safe each time just because it was the last few times. Plastic discs can both flow and stress-crack and can fly apart at any time. Use safety gear including face shield, heavy gloves, heavy clothes, boots, etc. Use an enclosure or barricade for protection. Avoid onlookers. Use a pressure regulator or orifice restrictor. Sometimes fun is scary! Just be sure to know risks and take precautions.

For further build instructions, pictures, and further warnings, see my Instructable at <http://www.instructables.com/id/Tesla-CD-Turbine-With-Scary-Steampunk-Laser-Pumpki/> Visit my Tesla CD Turbine Web site at http://www.cdturbine.com/CD_Turbine/Welcome.html