

YEAST STIRRER

CHRISTOPHER SWINGLEY

18-APR-2005

INTRODUCTION

Using a magnetic stirrer while building up yeast populations has been shown to improve yeast health and population size for better starts when the yeast is pitched. Commercial magnetic stirrers, even used ones from eBay, are more than \$40. I decided to build one using surplus computer equipment, epoxy, and a few parts from an electronics store.

On this page you'll find a brief description of how I built my stirrer, and some of the issues that came up as I was building it. The trickiest part of the design is getting the fan to spin at the proper rate so that the stir bar remains connected to the magnet, but is still moving fast enough that it doesn't stall the motor. You will probably need to experiment with your combination of power supply, fan, stir bar, and regulator until you have the correct range built into the regulator.



stirring yeast

On the right is an image showing the stirrer in action with two quarts of starter wort and a single tube of yeast. With this setup I got an active start four hours after pitching the slurry into five gallons of cooled wort.

Other pages showing their designs include: SosMan's stirrer^[1],

^[1] [hsmhttp://brewiki.org/StirPlate](http://brewiki.org/StirPlate)

^[2] [hsmhttp://www.fjallenco.com/stirplate/](http://www.fjallenco.com/stirplate/)

^[3] [hsmhttp://www.users.on.net/~pfitzsimons/MagStirrer/Magnetic%20Stirrer.htm](http://www.users.on.net/~pfitzsimons/MagStirrer/Magnetic%20Stirrer.htm)

the_stain's stirrer^[2], Peter Fitzsimons' stirrer^[3].

CONSTRUCTION DETAILS

The stirrer is a wooden box holding an AC / DC power converter, power switch, regulator circuit and a DC fan with a magnet glued to it. For my stirrer I used the power supply from the inside of an old external hard drive enclosure. It converts 120 volts AC into 12 volts DC, and in it's original application it powered a hard drive and small fan.

The fan I chose is a computer case fan that runs off 12 VDC and draws 0.33 amps. That works out to be 4 watts of power, which is easily within the power output of most AC / DC power converters. The magnet was harvested from the inside of a broken, out-of-warranty hard drive. The nice thing about these magnets is that they are very powerful, and are glued to a metal that shields the magnetism, so the magnet won't affect the fan or electronics in the stirrer.

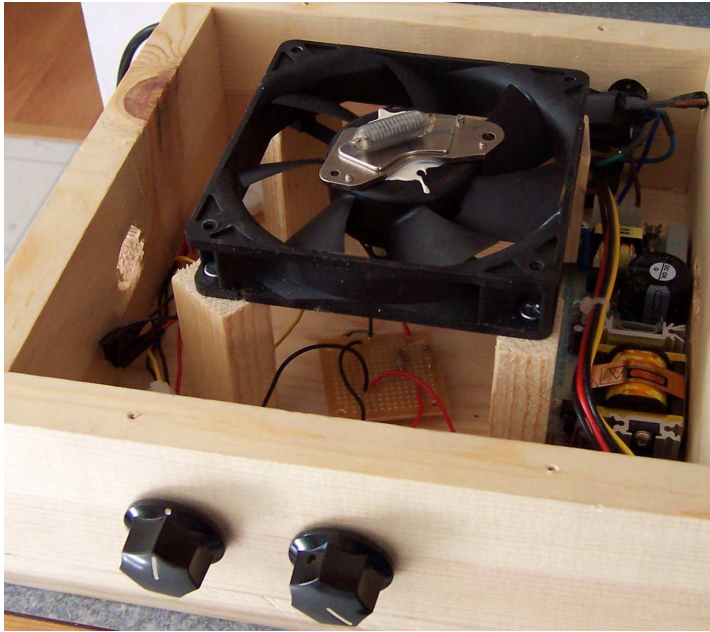
You could purchase a stir bar on the Internet, but I cut the ends off a bolt, inserted it into a piece of vinyl tubing and melted the ends together until the bolt was sealed inside. A large bright nail would probably be better, but I didn't have any that were large enough. I used a lighter to heat the vinyl tubing and carefully (it's hot!) pinched the melting tubing together to form a seal. You should make a series of stir bars in different lengths and diameters. Some will work better than others with different containers and fan speeds.

To attach the magnet to the fan, find the center of the magnet by balancing the magnet on the end of a pen. Mark the center on the top of the magnet and then glue it to the center of the fan using epoxy. I used a 15-minute set, two-part epoxy. When the epoxy starts to set up, spin the fan by hand and adjust the magnet to get it as close to the center as possible. The fan will draw less current the better it's balanced, and if it's too far out of balance, your stirrer could crawl across the counter the way a poorly loaded washing machine does.

Once the epoxy dries, it is time to start testing the combination of fan, magnet, stir bar, and power supply. I built my box big enough to house all the components, wired the power supply to a power switch and power cord, and connected the ground lead from the power supply to the fan. I soldered a long lead from the positive terminal of the power supply, and another long lead to the positive terminal of the fan (which terminal doesn't matter, but the fan will spin different directions depending on which way you wire it). These two leads were snaked out of the case.

You want the magnet as close to the bottom of your yeast culturing container as possible. Since I do all my culturing in a 1 gallon cider jug with a concave bottom, I raised my fan to

the level of the top of the box, which placed the magnet above the box by the thickness of the magnet and the metal it's glued to. If you used a flat bottomed flask, you'd need the top of the magnet to be just below the surface.



inside the case

Finally, drill a hole in the front of the box large enough to support a potentiometer (or small enough to allow the two leads to pass out of the box for testing). With this setup, it's possible to test your equipment and find out how to regulate the speed of the fan. I bought a little breadboard from Radio Shack, as well as some jumper wire, two 25 ohm potentiometers, and a sampling of resistors.

In my case, the power supply spun the fan much too quickly to keep the stir bar connected to the magnet below. I slowed down the fan by introducing resistance in the positive lead to the fan. After some experimentation using different resistors in series with the potentiometers, I found that I needed about 50 ohms of resistance. With two 25 ohm potentiometers, I'm able to vary the resistance to the fan between 50–100 ohms. This gives me a lot of control, which is helpful when you're trying to get the stirrer started, and then keep it going for a few days without losing the connection between the magnet at the stir bar.

The circuit I used is in the figure on this page. I used two ½ watt resistors in parallel to help keep them running cooler. The fan, by itself, will draw 4 watts of power and the individual resistors I'm using are rated much lower, but they don't get so hot I can't

touch them. A friend of mine told me that the acid test for resistors is the “spit test”—if a bit of spit immediately boils on the resistor, it won't be able to handle the power and should be replaced with a higher rated one. He also suggested replacing the resistors with an appropriately rated automotive light bulb, but I didn't want to add to the cost by getting a socket and bulb. I would have needed a 0.25 amp, 12 volt bulb to replace the 50 ohms of resistance in my circuit.

Once you have the regulator all set up and working on the breadboard, you can wire it up (inside the box!), and affix the potentiometers to the case. I used a small circuit board and wired the components on the underside with 22 gauge wire.

USAGE

To use the yeast stirrer, sanitize the culture jar, yeast stirrer and the foil cover all at the same time by cleaning with an oxygen cleanser, followed by two minutes of contact with Star San or an iodophor compound. It's handy to keep the other half of the hard drive magnet to hold the stir bar at the bottom of the container when you're draining the sanitizer, or when you want to remove it before actually pitching the yeast.

I use canned wort as a culture medium, so I flame the outside of the canning jars, pop the lids, and pour the wort into the cider jar over an alcohol flame. The outside of the yeast tube also gets flamed, and then poured into the vessel over the flame. Flame the inside of the foil, and place it on the jug.

Actually getting the stir bar to spin in the center of the jug when you can't see it through the haze of the yeast and wort can be a challenge. Find the stir bar at the edge of the jar, move this to the middle of the magnet and carefully pull the jug until it's centered on the fan. If you're lucky, the stir bar will be carried along with the magnet and will be in the middle of the jug. Turn the dials so the fan will spin at it's fastest speed, flip the power switch, and as soon as there is motion in the liquid, reduce the speed to a stable setting identified earlier. Repeat this process until a vortex appears in the middle of the liquid and the stirring motion appears to be stable.

With a full vial (or packet) of yeast, and two quarts of sterile wort, the yeast will finish in three or four days. Put the jug in the refrigerator overnight to drop the yeast, and in the morning, pour off all but a cup or so of the beer. It's worth tasting this to make sure that you've just cultured yeast and not bacteria. It won't taste great, but it shouldn't taste bad, either. By the time it's time to pitch the yeast, it will have warmed up to room temperature and should give a nice fast start.

Copyright © 2005, Christopher Swingle, cswingle@iarc.uaf.edu

Permission is granted to make and distribute verbatim copies of this document, provided the copyright notice and this permission notice are preserved on all copies.

Permission is granted to copy and distribute modified versions of this document under the conditions for verbatim copying, provided that the entire resulting derived work is distributed under the terms of a permission notice identical to this one, and that credit is given to the original author.