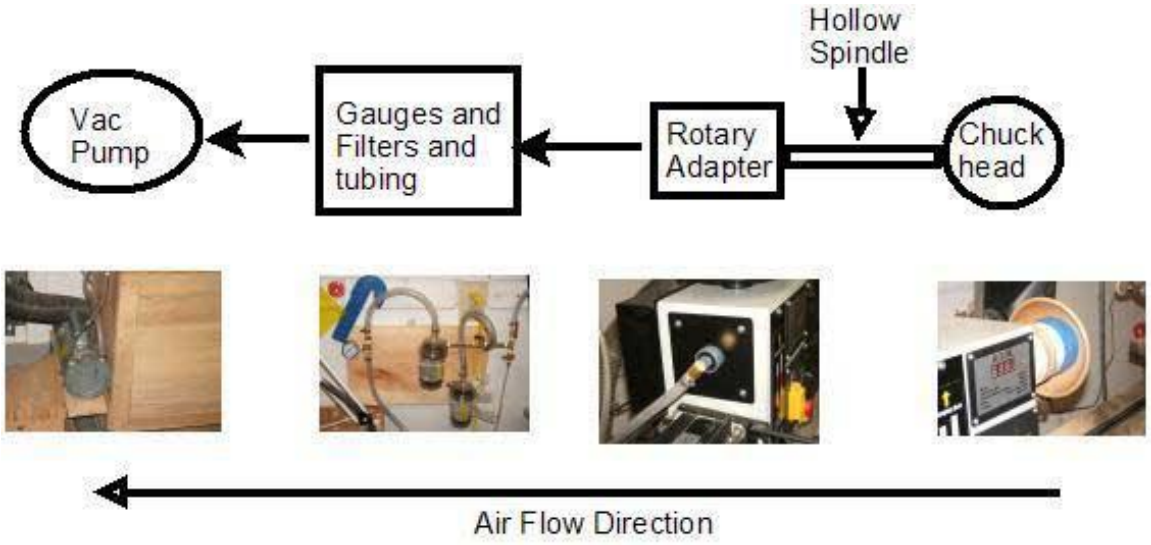
Vacuum Chuck Implementation on a Laguna 18/47 and Jet Mini

By Earl Timmons

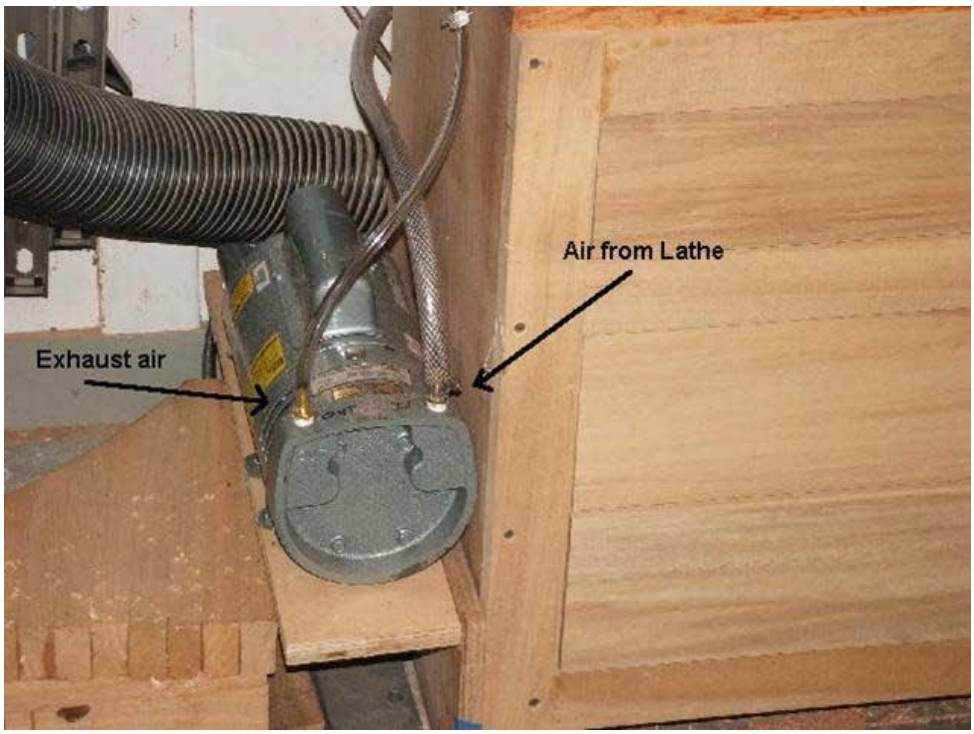
I have had a Jet Mini for about four years and recently (Feb 2008) purchased a Laguna18/47 lathe. The Laguna is a lathe with which you are probably not familiar. It is a pretty straight forward 2HP, 18 inch swing, sliding headstock lathe. The Laguna has indexing and reverse turning capability. It does not have a hand wheel and the vacuum chuck implementation I have does not use one. The Jet mini is a Multi speed 1/2hp mini and does have a hand wheel. These days it does a lot of buffing duty. However the cost and effort to implement the vacuum chuck on it was minimal given I was doing it on the Laguna.

In its simplest form a vacuum chuck system looks something like the following:



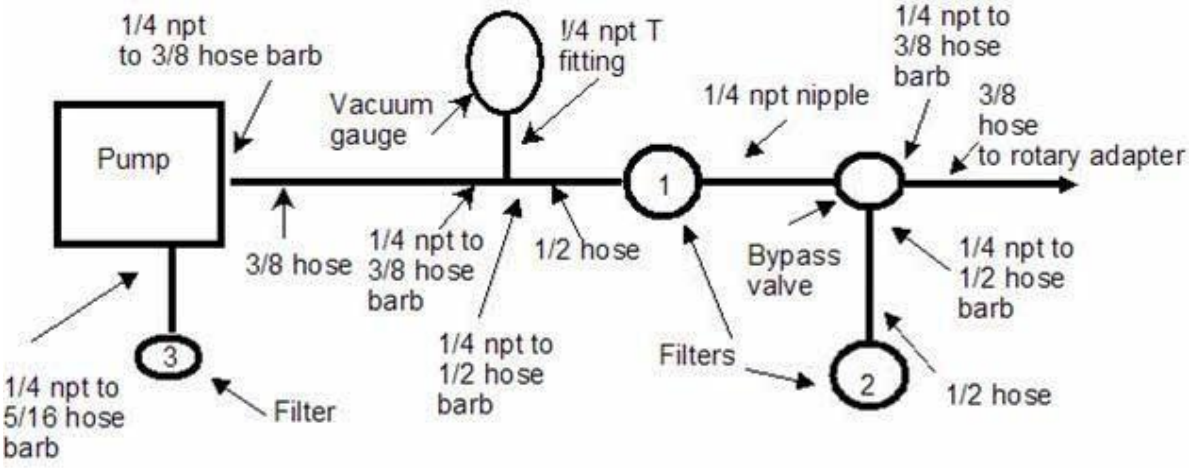
Vacuum Pump

Mine is a Gast 240 volt 1/4 horse power carbon vane pump from Surplus Supply (PN 4-1540). I have it situated near the floor and mounted on the side of the stand for the Jet Mini



Gauges, valves and filters

The following drawing details the previous picture and includes the pump and small filter that is on the exhaust side of the pump.



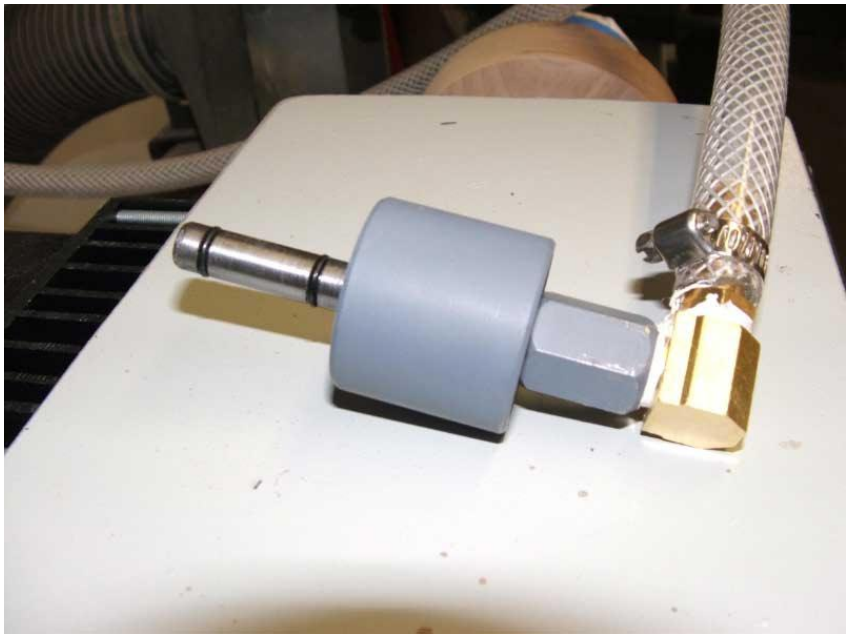
In my setup I have three filters, in the drawing they are numbered 1.2.3. Filter 2 is redundant and can be left out. Filter 3 is not realy needed and is simply filtering any carbon wear particles from the pump veins so they do not exhaust to the shop air. Filters 1 and 2 are supplied with 1/2 hose barbs. This is the reason for the 1/2 hose and barbs. Filter 3 is a small "Fram" automotive fuel filter.

In my system (at the spot where this drawing ends (to rotary adapter) there is a T and two valves allowing me to go to either of two rotary adapters, one for the Jet one for the Laguna. The drawing above depicts a system setup for one lathe.

Filters 1 and 2 are available from surplus supply as PN 4-1565. The gauge is from surplus supply and is PN 21-1583-CA. everything else can be purchased at any store selling plumbing and air handling supplies (Menards/Home Depot/etc.)

Rotary adapter/spindle and chuck head

Some device is needed to prevent the hose (connecting the vacuum system to the spindle) from becoming twisted as the spindle turns. This is called a rotary adapter. Mine is custom made for the Laguna by Tom Steyer (tomsteyer@cox.net). It has ¼ npt fitting pressed into a housing to receive the vacuum hose. I have installed a 90 degree fitting and a 3/8 hose barb to attach the hose. Within the housing is a bearing. Pressed into the center of the bearing is a hollow shaft sized to fit snug into the bore of the Laguna spindle. This shaft has o-rings to ensure a snug fit. The shaft carries the vacuum into the spindle.

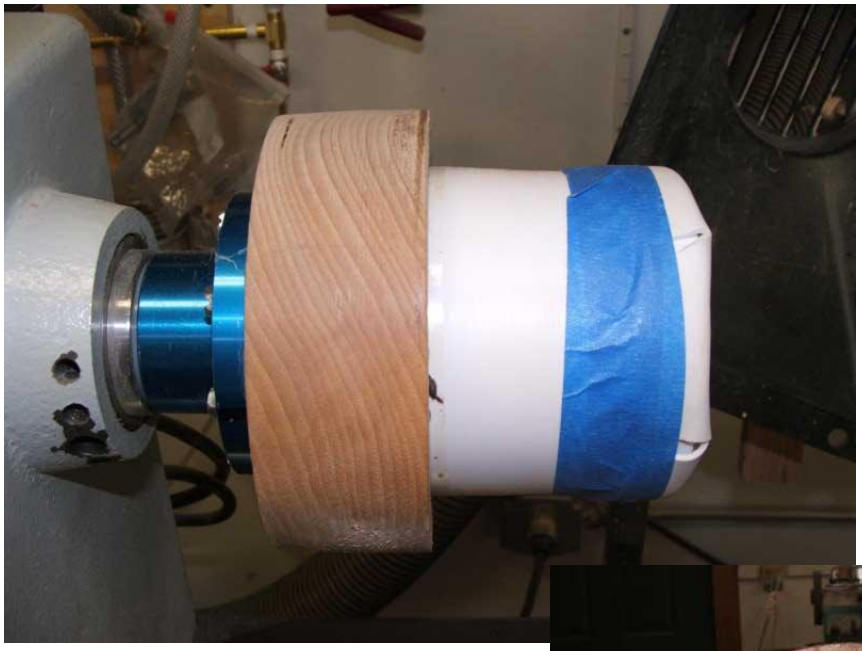


The adapter for the Jet is called a Holdfast Adapter. It and similar ones may be purchased from Packard and CSUSA as well as many other turning equipment suppliers. It consists of a housed bearing with a pressed in ¼ hose barb and the other end is threaded to receive a standard lamp rod. The lamp rod is then inserted through the hollow Spindle and captured by a plastic fitting that has an opening to allow the vacuum into the vacuum chuck head. The fitting snugs the whole assembly just as a draw bar would.

Vacuum chuck head

The chuck head consists of a faceplate with an attached turned disc. The disc has a through hole bored into it. Epoxied into a groove cut into the face of the disc is a PVC plumbing fixture. The end of the PVC fixture is padded with a closed cell foam to protect the turning. If you own a tap that will match your spindle (Beale probably sells one) you can eliminate the face plate. The chuck head described here costs two to three dollars plus a faceplate. Commercially manufactured chuck heads are available ranging from 50 to several hundred dollars.

The closed cell foam is self adhesive and sells under the brand name "Foamies" at Michaels and Hobby Lobby. The fancy blue tape just keeps me from snagging the edge of the foam when I am handling the assembly. Oh one more tip, DO NOT USE red oak for the disc unless you want to seal the edge and the internal bore. Don't ask me how I know this.



Vacuum chuck holding power

In order to help understand the amount of force that the vacuum chuck assembly is causing to hold the turning to the chuck keep in mind that what you are actually doing is removing the air in the housing that is sealed by the turning. This causes the outside air to press the bowl against the chuck head at the nominal air pressure per square inch times the area of the chuck head sealed by the turning. This pressure is affected by the barometric pressure that day, the tightness of the seal, your elevation relative to sea level and most importantly the diameter of the chuck head and the vacuum pumps ability to remove air measured in inches of mercury (Hg). The following information is a good way to calculate the force.

VACUUM CHUCK HOLDING POUNDS*
In Round Numbers

2 INCH CHUCK -------	**31 lbs. @ 20 hg**	**45 lbs. @ 28 hg**
3 INCH CHUCK -------	**70 lbs. @ 20 hg**	**100 lbs. @ 28 hg**
4 INCH CHUCK -------	**125 lbs. @ 20 hg**	**170 lbs. @ 28 hg**
5 INCH CHUCK -------	**190 lbs. @ 20 hg**	**275 lbs. @ 28 hg**
6 INCH CHUCK -------	**280 lbs. @ 20 hg**	**395 lbs. @ 28 hg**
7 INCH CHUCK -------	**380 lbs. @ 20 hg**	**540 lbs. @ 28 hg**
8 INCH CHUCK -------	**500 lbs. @ 20 hg**	**700 lbs. @ 28 hg**

(π X r^2 X ½hg = pounds of force)

The pressure exerted by the atmosphere is about 1/2 pound of force per sq. in. for every in. of mercury

Area in Square Inches of a Vacuum Chuck = π r^2 (3.14 X Radius Squared)
Inches of Mercury = hg

*** This information is taken from the Loess Hills Wood turners website**
http://www.lhturners.org/modules/news/article.php?storyid=14

When you're all in and all done you can do this. Look Mom no tail stock!

Thank you for taking the time to read this and if there is anything I can do to help you build a system or you would like to try one out before deciding to do it just call me at 507 358 1142 or send me an email to etimmo@charter.net.

Earl Timmons