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A Poor-man's Cyclone

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A few years ago, soon after I bought my planer-thicknesser, I bought a dust collector to deal with the large volume of chips generated. However, this was not a satisfactory solution, as the grid covering the input would rapidly choke with shavings, and the suction would rapidly drop to zero. The shavings would then back up in the planer, which would then spew shavings from every orifice, with the dust collector humming away uselessly in the corner. This article discusses some of the local options available in the line of dust collection and my solution to the choking problem.

Vacuum cleaners provide low volume, high suction dust collection. They also make a lot of noise and can't deal with shavings and chips through their small hoses. The fan is driven by a high-revving universal motor that does a fair imitation of an air-raid siren. (Certainly the old one I have in my workshop does.)

Dust collectors provide high volume, low suction dust extraction. The suction fan is driven by an induction motor, which is much quieter and probably longer lasting too. Strictly speaking, dust collectors should be rated in terms of airflow at a particular suction pressure, but this doesn't seem to be standardized. A more crude rating of motor power is commonly used, which seems to be good enough for most purposes. General consensus seems to be that one horsepower is a practical minimum to use with a planer, due to the volume of material that needs to be dealt with and the suction needed to keep adequate velocity to stop the chips settling out in the hose.

There are a number of dust collectors available locally. I looked at units with a 100 mm diameter inlet. I selected a one horsepower model on offer from SAM – at the time, it seemed to offer the best value. A dust collector is a fairly simple device, with not too much to go wrong, so I wasn't concerned about the limited spares availability for this model. The only moving parts are the motor and impeller, and these carried a one-year guarantee. The unit is quite heavy, so it has castors to help with moving it around the workshop. It assembled with no difficulty, and has worked well since. It comes with cloth bags, top and bottom, but with no indication of the filtering capability – I suspect the bottom size is probably greater than 25 micron. This could be better, but I haven't attempted to find bags that filter below one micron, which is apparently best for prolonged occupational exposure. As the bags clog up, apparently, they filter out more dust in the smaller size ranges.

The one problem I encountered was the hang up of shavings on the inlet grid of the fan. For safety, the 100mm inlet to the fan has a coarse grid, to keep fingers and large objects out. However, shavings quickly become entangled with the grid, and then rapidly accumulate to block off the inlet pipe. This is particularly a problem when collecting shavings from my planer – the pipe can back up within a minute or two and has to be cleared out by hand.

It occurred to me that I could cut out the grid, but I didn't because I was concerned about a large object finding its way into the fan. I spoke to somebody who had removed the grid, and it didn't solve the problem – the shavings wrapped themselves around the fan rotor and in the end still clogged up the fan. It took longer to clog up, but also longer to clear out.

The answer to the clogging problem is some sort of pre-filter to catch the larger shavings. Several different solutions have been described for this ranging from a simple drop box to a fancy cyclone.

There is a local product from Demoina Cyclones (you may have seen their advert) that contains a cyclone with a fan on the exhaust, followed by a large pleated paper filter. This is an excellent idea – the cyclone traps all of the large material and most of the fine dust, leaving very little dust for the filter to deal with. The filter can trap even the finest dust, making the unit suitable for occupational use. The unit

is quite tall, as a sealed bin needs to be placed beneath the cyclone, however the footprint is small. It comes in a variety of sizes, and the fan motors are generously rated to give good airflow. I think the unit is good value and if you don't already have a dust collector, is worth considering.

However, I already have a dust collector, so I started looking at cyclones. I found a couple of designs on the Internet that could be appropriately sized to deal with the approximately 600 cubic feet per minute (cfm) that my one horsepower dust collector was claimed to suck. To make one would have required some sheet metal work, which I thought I could cope with. However, a sealed dustbin is required for the underflow discharge to contain the oversize material (the chips and dust).

Another alternative is a special dustbin lid that can be fitted in place of a normal dustbin lid. The basic one shown on the left from Axminster in the UK serves as simple drop-box – the drop in airflow speed causes most of the shavings to fall to the bottom of the dustbin.
On more sophisticated models, the incoming pipe feeds shavings at the circumference of the lid tangentially to the circular edge of the bin, creating a swirl. The shavings spin outwards due to centrifugal force, slowing down due to friction against the side of the can. Also, the sudden increase in the cross section for the airflow reduces the velocity substantially, so the dust is no longer entrained in the air. The shavings and dust settle out in the can and the air is exhausted from the center of the lid where the air is relatively still. Only the fine dust which has a long settling time will still be sucked out by the dust collector and dealt with in the filter bags. These lids are reasonably priced, but I hung up on the size – what is a standard sized lid? The chances were it wouldn't fit my dustbin.

I decided to make my own. The design is very much as I have described – see the sketch below. I used a 120-liter plastic dustbin and made a tight fitting lid from 22mm thick MDF (which I had available – thinner will probably do as well). I painted the MDF lid, so that I could stick foam sealing-strip around the circumference to prevent leaks. I used 110 mm PVC sanitary fittings. A 90° bend on the inlet takes the incoming air and shavings and directs them tangentially to the inside wall of the bin. The outlet is another fitting that accepts a 100 mm flexible hose to the dust collector. The PVC sanitary fittings are designed to push together, so they have rubber ring seals between them. The rubber rings bridge the gap between the 110mm fittings and the 100 mm flexible hose, to make an airtight seal. The hoses are a push fit, so they can easily be removed when required. I was surprised how well the rubber seals seem to work, considering they weren't expressly designed to seal 100mm flexible hose.

I cut out the lid on my band saw, with the table set to an 8° tilt to match the taper on the dustbin. The inlet hole was cut with a circle cutter on my drill press. The outlet in the center was cut with a jigsaw because the lid is too large to fit on my drill press. Both holes were adjusted with a half round file to form a close fit to the PVC fittings. I added two handles so the lid can be easily removed when required. The inlet fitting is a 90° bend with one end cut off, so that it will fit through the hole.

I bought my 100 mm flexible hose from Chick Henderson at 30 New Goch Road, Benrose (011) 624-1400 at R53-/m in 1999. There may be other sources. My hose is blue, but first prize would be clear hose, so any blockages can be seen - I wasn't able to find any. (Sources anybody?)

In use, the dustbin seems to collect all the larger stuff. I haven't actually measured how much of the fine material stays behind in the bin and how much goes to the dust collector to end up in the filter bag, but a lot does stay in the bin. I haven't found any shavings collected around the input grid, so it meets the main requirement. One limitation: the bin shouldn't be allowed to fill up; otherwise there will be no space for the dust to settle before the air continues to the dust collector – shavings are then likely to go the dust collector fan and collect around the input grid. Even if the bin is kept below half full, 60 liters is a lot of material. Very little seems to stick in the pipe now – even long curly shavings from hand planing and leaves go straight through the pipe and collect in the bin.

If I recall correctly, the PVC fittings were about R100- and the dustbin about R110- from Dion, so with some effort, I guess one could put one together for R250-.

Although I haven't noticed any problems with static electricity, it can build up and give you a shock. Fire risks and dust explosions are also the subject of much speculation on the rec.woodworking Usenet news group. (See also www.hsebooks.co.uk/index2.html and search for woodworking) If you wish to play safe, run a thin copper wire inside the hose and earth the end – this will prevent any significant build up of charge on the surface of the plastic pipes.