

## What You Want to Know about Hand-turned Grain Mills (Finally all in one place!)

Note, elsewhere, I've written about why you should make your own bread, pasta, and pastries, etc.; why you should mill your own flour; why you should mill by hand; when to sift or not; and why metal burrs are better.

Here I'll tell you which mills to buy and which mills not to buy. And it turns out the choice is easy. Read on...

For people wishing to mill wheat, corn, other grains and/or corn, soybeans and other larger materials using a hand-turned mill, there are many choices on the market, ranging in prices from about \$70 for the Back to Basics mill to over \$1200 for the European-made Diamant D.525 mill. I have extensive experience with those as well as with an inexpensive cast iron mill similar to the Corona or Porkert (no longer available), the Country Living mill, and the GrainMaker mill.

Trying to keep costs down, I started by buying inexpensive mills, being disappointed, and gradually working my way up the ladder of features (and cost), I spent nearly as much money on the bad ones as I would have if I had just bought a good mill from the start. If you are thinking about buying a mill, reading this article can get you where you want to be in less time and for less money.

When I started on the journey to make my own flour, I wasn't sure I would want to keep doing it in the long term, so I didn't want to spend a lot of money on the mill. I bet a lot of you are saying the same thing to yourselves. Now, after a very satisfying several years of making my own bread, pasta, and pastry from my own flour, and then peanut butter, tofu, sunflower seed butter, etc., using an inexpensive mill, I knew I deserved a better mill, one that could grind more finely when I wanted it to, one that processed faster, one that was easier to turn. What did I buy? I'll tell you right here, for the benefit of those that don't care about the details: the GrainMaker mill, made by a very capable machine shop in Stevensville, Montana. If you want to know why I chose that one, read on.

### The First Mill

My several years of hands-on experience has proved this fact: any mill costing less than \$400 (2010 prices) is not a good choice for serious milling. I'll tell you why. My first mill was \$15 at the local resale shop. It was missing an important part, but I studied it enough to believe I could get it going. At first I manufactured a version of the needed part. It worked but not very well. Then later I found the mill was very similar to the Porkert grain mill (no longer available), and I was able to buy the part through a Porkert distributor. I wasn't satisfied with my \$15 used mill because it could not grind fine flour at all. It could turn oats into oatmeal, wheat into cracked wheat, popcorn into coarse meal, and seeds and nuts into butters, but even set to the finest grind, the mill didn't make a flour fine enough to make bread. I then bought a similar mill on eBay. It was ugly with a huge hopper, but it made better flour, and it used the same 3" steel grinding plates ("burrs" from now on) as my \$15 mill.

So I made a Frankenstein mill, installing the better burrs from the ugly mill onto my nicer looking \$15 mill. This was a benefit to a little bit of standardization in parts between a few of the cheap cast iron mills. I put the low-performance burrs onto the ugly hopper and gave it to a friend who wanted it to be able to grind her own polenta meal. My new improved cheap cast iron mill could make medium fine flour, but it was really hard to turn, it heated the flour, and it was not very fast. Still, I was able to make bread with it, and that's what I did, but I kept looking for a better mill.

Total cost so far: \$15 for the first mill, \$30 for the missing part, \$40 for the eBay mill = \$85.

### The Porkert Mill

Then I found the Porkert Grain Mill. In retrospect, I can say it was the best value of the inexpensive mills, selling for well under \$100. It was made of cast iron, had an integral screw-type augur that could feed any type of material, and had two sets of burrs, metal and ceramic, which you could change without too much trouble. The metal burrs were well-suited for grinding coarser materials, but like the first set of burrs that came with my \$15 mill, they didn't make very good flour. However, the ceramic burrs did make good flour. I worried that the ceramic burrs would break down over time, adding little bits of ceramic to my flour. I worried about damaging my teeth. And the Porkert mill was not without problems.

### Porkert Mill Problems

It was very similar to my \$15 mill, in that it was very hard to turn when set for a fine grind, and it heated the flour. Unlike the \$15 mill, the Porkert could NOT be bolted down. I found its integral clamp was not strong enough to keep it from wiggling around when I ground flour. I gave the Porkert mill away to introduce a bread baking friend to the joys of grinding flour, and I was back to my problem of finding a better mill for me.

Total cost so far: \$85 from above + \$78 for the Porkert = \$163, and still no good mill.

### The Back to Basics Mill

Meanwhile, we have another residence in Europe, and I also needed a mill there (I take my sourdough starter with me back and forth each year). I knew the Diamant mill was made somewhere on that continent, but I wasn't ready to spend that amount of money (it was selling for about \$595 in the USA at the time). I had also seen reference to the tiny Back to Basics mill. It was inexpensive, supposedly capable, and very transportable. I bought one for about \$70, and I took that with me, hope against hope, on the next trip overseas.

### Back to Basics Mill Problems

I made flour with it, but it wasn't a very fine flour, and the mill sure wasn't very fast. It was easy to turn, but the 2" stainless steel burrs just couldn't crank out the volume. I was able to sift out the coarse stuff to get enough finer flour to make bread, but I wasn't satisfied for long. That mill clogs easily, and you need something long like a table knife to clear the jam. That mill cannot mill large materials, like nuts or beans, and its hopper doesn't hold very much compared to larger mills. However, it does a nice job of turning oats into oatmeal. That is all it does for me now. If flaking soft oats and/or grinding small seeds is all you need to do, you are done; get the Back to Basics. Otherwise, keep reading.

Total cost so far: \$163 from above + \$65 for the Back to Basics = \$228, almost as much as the cost of a good mill at the time, except I still didn't have a good mill.

Further research took me far and wide, but the pattern emerged: all the mills costing less than \$400 were more like toys. They had small burrs in steel, cast iron, or even stone or ceramic, and they were usually hard to turn for fine flour, and some didn't hold their settings well. I'll save you some time and money by writing this right now: if you are serious about grinding your own flour, forget all of the cheaper mills. Don't waste your time, and don't spend your money. Get a serious mill, one that has these qualities:

- Serious mills have serious burrs: well made in tool-grade steel or iron, having larger diameters, 5" or

more. These massive burrs absorb heat generated during milling, and that helps keep the flour cool so as not to spoil the natural oils. The size gives a much greater grinding surface, so they mill much faster. Other things being equal, 5" burrs grind nearly 60% faster than 3" burrs;

- Serious mills have large cast iron flywheels with comfortable wooden handles. The diameter of the flywheel (or the length of the bar holding the handle) determines the length of the lever arm. The longer the arm, the easier it is to turn the mill. A heavy flywheel helps you keep going when the grain is really hard, like hard wheat or popcorn;
- Serious mills have large grain hoppers that don't need to be refilled several times during the milling process;
- Serious mills may have clamps for light temporary duty, but they can be bolted down for stability during higher volume production;
- Additionally, serious mills have been made for years by established companies, and most or all of the bugs have been worked out.

In short, the serious mills work. The serious mills can reduce the hardest grains to a much finer flour much more easily and much faster than the "toy" mills. I know of only three serious hand-turned mills in the world, and I'll list them in the order that I came to know them: the Country Living mill, the Diamant mill, and the GrainMaker mill. Read on for a review of each of them.

### The Country Living Mill

I still hadn't settled on a workable mill for our home overseas. A friend here in the USA received a gift of a Country Living mill. We tried it and found it could grind a fine flour. It was attractive, seemed well-made, my artist friend was impressed with the mill's "sand-cast" burrs, and the mill was sold by a wide variety of outlets on the Internet -- although there didn't seem to be any price competition between them. Don't waste your time looking for the best buy. In my search, they were all within about \$5 of each other, when you included shipping. I made bread and pasta with this mill, when I could borrow it from my friend for a weekend or so. If you want to grind other materials than wheat and similar grains, you need to buy the optional nut and bean augur for about \$36 extra. And don't buy the mill without the extension bar for the handle, what they call the "power bar", costing about \$25 extra. And unless you have a rectangular pan of some sort, you'll need something like their special flour bin to catch the flour, costing an outrageous \$25 (See Problem 1, below). The mill can be hard to turn on a fine grind without it. For example, I cannot turn the mill with one hand when it is set for a fine grind with hard wheat in the hopper. The standard setup has the handle mounted on the outer edge of the flywheel, but the flywheel isn't large enough in diameter to give you much leverage, and it isn't heavy enough to have much momentum.

The cast body is handsome and has no sharp corners or edges. Yes, it is made of aluminum, but don't let that scare you away; it has been powder coated. The mill has replaceable sealed ball bearings for easier turning. Under normal hand use, you will probably never need to replace them, but if you do, you can. The wooden handle is comfortable and long enough for two hands. The cast iron flywheel has a "V" to accommodate a belt from a motor, so you can switch to a motorized set-up in the future. Besides being able to make a good quality flour, those are the good points. However, now that I know it intimately, I recognize several frustrating bad points of this mill:

### Country Living Mill Problems

1. The overhang isn't large enough to get a standard bowl underneath the burrs to catch the flour as it is ground. Some of the sales outlets offer a special rectangular plastic bin to use with the mill, but who wants another single-purpose plastic thing around? I like to grind the flour right into my round mixing bowl as I am making bread, but I cannot do that with this mill. A round bowl just won't fit under the

burrs, and I can't make bread in a rectangular bin.

2. The dust cover being fixed in place over the burrs means that oily materials such as peanut butter make a mess. You can't use your spatula to scrape off the oily materials as it exudes around the perimeter of the burrs, since the dust cover is in the way. When you get out your screwdriver (you have a screwdriver handy, right?) to remove the burrs to be able to clean them with detergent, you are still left with a hard-to-clean sticky mess inside the dust cover, and that messy area is too confined to get a spatula in there. Good luck.

3. I mention again that the standard mill doesn't have enough leverage for grinding hard materials finely (corn, hard wheat, etc.) It would probably be fine for soft grains, like oats, rye, and certain soft varieties of wheat. An extension bar for the handle called the "power bar" is available, but costs extra. I think it should be part of the basic design.

4. The grinding chamber is painted inside, making me wonder if I'll be eating some of that paint as it slowly breaks down over the years. I wouldn't worry about the inside of the hopper, also painted, because it won't be subject to much wear and tear like the inside grinding chamber will be.

5. A nut/bean augur, necessary to grind materials any larger than wheat, like corn, beans, nuts, etc. is available, but costs extra. If you are only going to grind wheat and similar grains, you won't need it. But with a mill this capable, wouldn't you want to use it for everything you can? Peanut butter comes to mind.

6. The standard augur is a spring that doesn't reach the bottom of grinding chamber. Consequently not all the material you have dumped into the hopper gets pushed out to the burrs. Thus when you stop grinding, there is a layer of grain left in the bottom of the mill. How are you supposed to get it out when you change materials, say from wheat to sunflower seeds? Well, either you unbolt the mill (no clamp is available) and turn it upside down and shake it, put it back up, and rebolt it, or you take off the adjustment screw, take off the outer burr (watch out for the tiny metal key that holds the burr to the shaft! It is easily lost), get a screwdriver, and take out three screws that hold the inner burr, remove the inner burr, remove the spring augur, now try to dig out the stuff you don't want mixed into your sunflower butter, then put it all back together. Careful, don't strip the threads of the aluminum body when you tighten the steel screws to hold the rear burr. Do you still have the tiny metal key? Good, put it on the shaft, then slide the other burr onto the shaft with the slot going over the key, now screw back on the adjustment screw, and voila! Does that seem like too much trouble? It is, since there is a better choice that I will tell you about later. It wouldn't be too much trouble if this were the only mill out there, but it is not.

7. The 5" grinding plates do a very good job. They have enough surface area to have a good throughput, they are massive enough to absorb the heat, keeping it away from the flour, and they seem sharp enough when new. The problem is they have an estimated life of only 3-4 years under normal one-family use, they are warranted for only one year, and it will cost about \$100 to replace them. I foresee a mill that keeps costing more and more over its lifetime.

8. The adjustment knob can slip, and that fine flour you started to grind is suddenly coming out as cracked grain instead. There is a fix that involves sanding the shaft to give it more friction. That fix won't last long, and then you'll have to start using an extra nut as a locknut on the end of the shaft (requiring a wrench to set it). That makes the adjustment process cumbersome. Who wants to keep a wrench handy to change the grind? But I guess you already have a screwdriver handy, so why not a

wrench, too?

9. The two-fisted wooden handle can actually be too long. Depending on where you mount a Country Living mill, that handle can stick out into traffic patterns. It doesn't feel good to catch that handle with your groin.

10. Finally, a minor problem of aesthetics: the Country Living mill uses two common hardware store washers behind the fineness adjustment knob. They are supposed to help keep the fineness setting from slipping, but as I wrote in problem 8 above, this washer system has problems. Moreover, they are not an elegant solution.

So I was disappointed in the first of the Big Three serious mills. I decided not to buy a Country Living mill to take overseas. Yes, it could do the job, but isn't there something better? Yes, there is: the Diamant D.525.

#### The Diamant D.525 Mill

Back overseas, I still wanted and needed a good mill. With a kind tip from Lehman's Hardware, who sell the Diamant in the USA, I was able to contact the Diamant D.525 mill manufacturer in Denmark (this was in 2003; now the Diamant is made in Poland and is sold by a different outfit overseas. Lehman's still carries them in the USA, but at over \$1200 plus shipping! The price is so high because of the dollar being currently weak against the Euro. In 2003, I was able to buy the mill in Europe for about \$350, when the dollar was much stronger against the Euro.

It is a monster of a mill, the largest of the Big Three. It has the largest burrs at 5.25". That doesn't sound much bigger than 5", but that equates to 10% more grinding surface, which means 10% more throughput in theory. The whole mill is cast iron, designed and built to last forever, as far as I can tell. The cast iron has been painted inside and out, and the mill is attractive, in an old-fashioned way. The flywheel is the largest of the Big Three, and by far the heaviest. The mill has no ball bearings, but it doesn't seem to need them. It seems to be the easiest of the Big Three to keep it going, probably because of the leverage of the large diameter flywheel and also because of its weight, which gives momentum. I can grind hard wheat into a fine flour with one hand, but I have to change hands every 25 revolutions. With two hands, I can grind all day. In practice, the mill has very good throughput, and it only takes a few minutes to get enough fine flour for a loaf of bread or a batch of pasta.

The Diamant allows easy and precise adjustment of the grind, and there is a positive, hand-operated lock ring that keeps the setting right where you set it. There is no slippage on this mill. The only augur is a large grain-busting screw augur. It seems to work fine for all materials, and it moves everything out towards the burrs. No material is left in the bottom of the grinding chamber, so it is easy to start grinding another material without contaminating it with the former material. The cast iron burrs grind flour as finely as any of the Big Three. One can buy specialty burrs; in addition to the standard (fine) burrs, you can get coarse and extra fine, each at extra cost, about \$130 (2010 prices). I have no experience with coarse or extra fine burrs.

The dust cover that covers the burrs and contains the setting mechanism comes off in seconds after loosening two thumb nuts. The front burr slides off the main shaft, then three screws hold the rear burr, as in the Country Living mill. If I ever wanted to give the inside a good cleaning, I'd need a screwdriver handy. The mill comes with a free screwdriver, so that's not a problem. I don't do peanut butter or grind other oily materials with the Diamant, so I haven't had to clean it. It would easily do those materials, but I can't get organic peanuts over there, so I don't. Like the Country Living mill, the Diamant's

flywheel has a "V" to allow you to motorize it some day. I hope I never have to, but I can.

### Diamant D.525 Problems

There are a few problems with the Diamant. It has a comfortable two-fisted handle, but as I wrote above under the Country Living mill, you have to watch where you put the mill to avoid catching the handle in your groin as you walk past. The mill is very heavy, so you need something substantial to bolt it to (no clamp is available, nor could I imagine one strong enough to hold it down). It is also the largest of the Big Three, meaning a little more trouble finding a spot for it. Lastly, it is impossibly expensive in the USA. Except for the cost, these few problems are surmountable, and I am very happy with the Diamant. It can grind anything to fine powder, it is easy to turn, and it just keeps going and going.

So, I had my good mill in the overseas house, but I still needed a good mill here in the USA apartment. I wasn't excited about the Country Living mill for the reasons mentioned above, and I couldn't afford the cost or the space requirements of the Diamant. I thought I was stuck. I borrowed my friend's Country Living mill and tried it again. I wanted to like it; what other choice did I have? It still made good flour, but now, a few years after I first used it, the mill was getting harder to turn at the fine setting. I looked at the burrs, and they were showing some wear. That wear translates to more friction, which means more effort to turn the handle and more heat generated during grinding. Heat is our enemy when grinding fresh grains. Enough heat can denature the natural oils of the grain. I also got reacquainted with the problems I mentioned above. So, I wanted to like this mill, but I couldn't. I started another search, and I found my answer: The GrainMaker mill!

### The GrainMaker Mill

I had stumbled across a reference to the GrainMaker a few years ago. I visited the website of the manufacturer, but the site was not convincing back then. I came across an independent review, and it was not very favorable. The reviewer mentioned several problems. However upon closer reading, the reviewer didn't seem to understand the mill, and he or she was not able to explain the problems well. So maybe there was hope?

Indeed there was. I revisited the revamped GrainMaker website. I was much more convinced that this was the mill I had been searching for. Their website now had some high quality videos that showed the mill being manufactured, tested, and used in a kitchen. The advantages seemed numerous, the problems non-existent. I telephoned the company. My questions were answered by Bonnie, the wife of the genius who had designed and builds the mills. She was as kind as a person could be. She told me about how the mill comes standard with a nut/bean auger called the "grain-breaker" in addition to the standard spring auger, and it comes standard with a long arm for easy turning. The mill had a 30-day no questions asked money-back guarantee, and then a lifetime warranty -- even on the burrs! She told me about the special package that included the mill and an ingenious and beautiful clamp that looked and sounded like just what I needed in this small apartment. And she explained a holiday sale that gave me a discount that more than covered the shipping costs. The whole package was less expensive than the Country Living product. I ordered it, and couldn't wait to receive it.

My mill arrived about two weeks later. It was as good looking in real life as it was in the photos and videos. My impression was that Bonnie's husband is a design and technological genius. The machined parts, including the burrs, are works of art.

The overall design is well thought out. I can get standard big round bowls under the burrs to catch the flour. The fineness setting is held by a clever system of three spring-loaded ball bearings that give a

positive click, click, click, as you change the setting. No cheesy hardware store washers, extra nuts, or slipped settings as on the Country Living mill. The dust shield comes off in a snap for easy access to the burrs and when making peanut butter and similar things.

The burrs themselves can be removed in about 10 seconds with no tools, the rear burr snapping into place rather than being held with multiple screws. This makes changing the augur a snap (from the default spring-like augur for small grains to the massive "grain breaker" nut and bean augur or vice versa), and there are no small parts to lose. That feature makes homemade nut and seed butters a reality. All other mills are too difficult to clean, except maybe the Diamant.

The clamp is an amazing piece of engineering, worth the nominal extra cost if it works in your situation (see below). With it you should be able to mount the mill to many possible work surfaces, and then the mill can be easily removed and put away if you don't want it out all the time. Otherwise, the base of the mill has 4 bolt holes to permanently mount the mill somewhere. The clamp locks elegantly into the base of the mill using two of the bolt holes. I think this is shown in one of the videos on the GrainMaker website.

I assembled the mill in 30 seconds with just the Allen key that comes with the mill (only having to use two screws to mount the bar that holds the wooden handle). I noticed that the flywheel doesn't have much mass and thus not nearly as much momentum as that of the Diamant, but when I tried it, I found the mill to be relatively easy to turn, even on a very fine setting. I could easily turn the handle with one hand. I guess the internal sealed ball bearings and precision engineering make sure the mill is easy to turn.

The comfortable hardwood handle was shorter than the Country Living and Diamant mills. That keeps it out of traffic, saving me from bumping into it, and I can still grab it with both hands if I want to, so there would be no advantage to a longer wooden handle. Like the Other mills of the Big Three, the GrainMaker can be motorized. But unlike the others, GrainMaker sells the complete motorization kit. They've done all the hard design work and engineering. They even have a kit to hook it up to bicycle power. I don't think any of that is necessary, but it's available if you want it.

One other thing I like that is unique among the Big Three: The GrainMaker is not painted inside the grinding chamber. Looking inside from the burr end, I see shiny machined steel. There is no paint to eventually chip off and get into the flour. The rest of the mill, other than the burrs, the adjustment knob, and the hardwood handle, is nicely powder coated in fire engine red.

The proof of a mill is in the result: the flour from the GrainMaker could be extremely fine. When I used a medium fine sieve to sift the flour of the GrainMaker, there was nothing left in the sieve! It had ground everything to a fine powder, even the bran. When I similarly sifted the flour of the Country Living mill, I got a fair amount of bran, similar in quantity to the much less capable mill I have been using for 10 years. If I sieve the flour from the Diamant, I get some bran (in an extremely fine sieve that I have in my home over there). Based on this I would say the Diamant can grind more finely than the Country Living, but the GrainMaker can grind even more finely than the other two. The GrainMaker's burrs are machined, and they seem sharper than the cast burrs of the Country Living mill and the Diamant. That may be why it can grind so finely. Of course, the GrainMaker can be set for a coarser grind that would keep the bran intact enough to sift it out.

#### GrainMaker Mill Problems

Are there any problems with the GrainMaker? Yes, but only a couple of minor ones.

1. The clamp, while beautiful and ingenious, turned out not to work well in our apartment. It might work fine in yours, but our kitchen counters are 2" thick, Formica-covered, with a "waterfall" edge. On this sort of counter, the clamp couldn't hold the mill firmly enough to dare turn the crank. Note: by "waterfall" edge, I mean that the edge is rounded off with about a 3/8" radius, about the same shape as "quarter round" trim often used at the joint of baseboard trim and a floor). To work on my kitchen counter, I guess the clamp needs to have a deeper throat to extend further under and over the counter-top edge. The other possible place I could use the mill with the clamp would be on a surface that is 3/4" thick, but I quickly discovered the clamp cannot close that far.

So, reluctantly, I wrote to Bonnie and asked for instructions to return the clamp. (This was a good test of their customer service). She was very understanding and was very willing to take the clamp back and issue a refund. She even sent me a UPS label to make the return painless. I described the clamp problems in detail to Bonnie, and I suspect her clever husband is working on a solution already.

2. The other "problem" isn't really a problem. The hopper, well-crafted in rather thin steel, has corners that are sharper than those of the Country Living and Diamant hoppers. No, I can't cut myself on them, but it would probably hurt if I were to accidentally bang my hand against one of those corners.

Meanwhile, I've bolted the GrainMaker down, and it is making a very good quality flour of even the hard Kamut grain that I am using as one of the grains in my bread these days. I have tried both the spring augur and the grain breaker augur. Both seem to work well. I suspect the spring augur works better when wanting very fine flour, because it does not force the material into and through the burrs, rather drawing it in gently. The grain breaker augur was designed to force material through the burrs, and it is a good choice for coarser grinds and for larger materials that don't need such a fine setting or for softer materials that would tend to clog the burrs. For fine flour, you want the hard wheat to make its way through the burrs slowly, not forced through. That way, the grains remain in contact with the burrs longer and thus get ground more finely.

The GrainMaker's spring augur is similar to that of the Country Living mill. That is, it leaves some material in the bottom of the grinding chamber. So if you don't want your peanut butter to have chunks of wheat in it, you need to clean out the chamber before grinding the peanuts. You must do this cleaning operation whenever you change to the grain breaker augur. Why? With grain or other material left in the grinding chamber, you can't get the grain breaker into the mill. The tolerances are too tight (this precision machine is manufactured to very close tolerances).

But cleaning isn't a problem, since of the three good mills that I've talked about here, the GrainMaker is the easiest by far to take apart and clean. It can literally be done in less than a minute, and off you go, making peanut butter with plenty of time to have it ready to put on the bread that'll be out of the oven before you know it.

My advice: get the GrainMaker mill, and get cranking.

I'll summarize all the above very simply:

- If you are serious about making your own high quality flour, don't waste time or money on any mill costing less than \$400 (2010 prices).
- Any of the Big Three high-quality mills (Country Living, Diamant, GrainMaker) will serve you well. All of them can grind every material at any degree of fineness you want, (but you must buy the three extra-cost options sold with the Country Living to equal the performance of the other two). All of these mills can be motorized later if you decide you want to, but motorizing the GrainMaker won't require



any work. Just buy the kit.

- For far less cost than the Diamant and significantly less upfront and lifetime costs than the Country Living mill, the GrainMaker mill offers equal or better performance, and it has a lifetime guarantee.

So the choice is easy, and because the manufacturer can ship to anywhere, the choice is true for wherever you live, USA, Europe, or elsewhere: Get a GrainMaker mill, and get cranking.