

How to build a human powered belt sander

By Jeremy Svehla

To many woodworkers, a belt sander is a very important and useful tool that is typically found in woodshops throughout the world. Belt sanders come in all different sizes, models, and styles depending upon the preference of the user. A Pedal Powered belt sander seen below as Figure 1 (the drawing is currently unavailable due to problems with translating from one program to another, sorry), provides a method of sanding and shaping wood for many different sanding jobs. It will produce a smooth surface on a wood board in much less time than hand sanding. The following design has the basic woodworker in mind, wanting to complete small, non-sophisticated operations, plus the advantage of conserving electricity. In the past, other power tools such as the band saw, the drill press and the table saw have been proven to work under pedal power. These designs require a combination of a DC motor producing electricity from a mechanical pedaling system, or they just require mechanical pedal power. The design below does not require electricity, only mechanical pedal power.

Components needed to build a pedal power belt sander

Before attempting to gather parts or begin assembly of this design, pay close attention to Figure 1, and the detailed components listed below.

1. Exercise bike or stationary pedaling system:

Preferably a stationary pedaling system which includes the seat, an adjustable seat tube, two cranks each with pedals, and a large 52-tooth chainring all of which is mounted to a metal frame base. Refer to Figure 1 for proper mounting of the pedaling system to the frame. Included in the pedaling system should be a set of handlebars.

2. Metal frame and base:

The metal frame must be constructed to accommodate both the pedal system and the belt sander unit. The frame displayed in Figure 1 is a very appropriate design to support all the components. The base of the frame should be able to support up to 300 pounds, approximately 4 feet long and 2 feet in width consisting of 2"-2" metal framing material.

3. Connecting middle sprocket assembly:

A standard bike chain must connect the 52-tooth chainring of the stationary bike to a

middle mounted 15-tooth sprocket. The 15-tooth sprocket is attached to another 52-tooth chainring, enabling both to spin in the same direction. The length of the chain is important for a good fit, but has no bearing on the gear ratio. No matter how short or long the chain is, the sprockets will turn only as fast as the rider can pedal. Figure 1 displays the ideal location to where the assembly is mounted to the metal frame.

4. Sander sprocket:

From the 52-tooth chainring on the Middle Sprocket Assembly runs another bike chain that is attached to a 15-tooth sprocket on the sander. This 15-tooth sprocket is mounted directly to the side of the front drive drum of the belt sander. Refer to Figure 1 for exact location of where the sprocket should be attached. Here again, the length of the chain is important for a good fit, but has no bearing on the gear ratio as explained above.

5. Sanding deck:

A preferable sanding deck can be taken from a belt sander with a 6" by 40" belt, similar to that of the Mark V series. Within the sanding deck unit there is a driving drum, an idler drum, a tension knob and the sanding belt. The sanding deck is attached flat side up, in a horizontal mount to the frame, allowing the top of the belt to turn in the direction away from the rider. Figure 1 depicts the proper location of where the sanding deck should be attached to the metal frame.

How to assemble your pedal power belt sander

Using the components above, follow these directions and pay close attention to Figure 1 for best assembly outcome.

- The metal for the frame can either be welded or bolted together, depending on preference.
- The stationary pedaling system must be mounted by bolts to one end of the metal frame. Handlebars can also be easily attached to the frame to fit the rider.
- In front of the stationary pedaling system on the frame must be mounted a small bike axle to accommodate the connecting middle sprocket

assembly. Figure 1 depicts the exact location of this unit.

- On the opposite end of the frame from the pedaling system, must be mounted the sanding deck. The sanding deck can also be bolted very securely to the metal frame. Refer to Figure 1 for proper position of the sanding deck.

- The two bike chains can now link the three sprockets, to conclude the assembly.

Now that we've seen the components and assembly directions, let's see how useful this design can be, compared to a standard electrical sander. As discussed in Power-Tool Woodworking for Everyone by R.J. DeCristoforo, the speed of a belt sander is measured by how fast the abrasive belt travels in a circular motion, or revolutions per minute (RPM). An average electrical belt sander has the potential to run anywhere from 700 to 1900 RPM depending on the job that needs to be done.

To compute the RPMs of the sander, we can conclude from the following. Pedaling on a bicycle that consists of a front 52-tooth chainring to a rear 15-tooth sprocket and an 82-inch circumference bike wheel, at an average pace, a rider can pedal the bike on flat ground, turning the wheel approximately 260 revolutions in one-minute (RPM). The standard circumference of a belt for a sander is 40 inches, or almost half the circumference of the bike wheel. By using the same 52-tooth chainring to 15-tooth sprocket bicycle set up for the design of the sander, we can compute how many RPM an average rider at an average pace can pedal by simply multiplying 2 times 260-RPM of the bicycle wheel. The product of the two is 520-RPM which is the average amount of turns the belt makes in one minute on the sander. With the 520-RPM being only an average pace, it is possible for a faster pace rider to produce up to 700-RPM and higher on the sander. By comparing RPM of a standard electrical sander to the RPM of this pedal power design, it is obvious that if a fast rider pedals quick enough, producing 700RPM, the pedal powered belt sander would perform comparably to the lower speeds of an electrical sander.

How to use your pedal power belt sander

Now that the sander is completely assembled and in good working order, before attempting to sand wood, keep in mind several important elements discussed below.

1. The sandpaper belt that turns on the drums and sands the wood, can be purchased at any hardware store in different grits. The grit number represents how abrasive the belt is going to be when touched to the wood. The belt sander explained above performs best with 30 to 100 grit, 30 being the most coarse and 100 being more fine. When attempting a particular job as shown in Table 1, be certain to use the proper grit as also shown in Table 1.

Table 1: Choosing the proper grit of sandpaper for the job

Particular Job	Grit of Sandpaper
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Making a board extremely smooth removing very little wood from the board, usually the final product.	100 to 80 grit
Shaping and smoothing a board, removing quit a bit of wood from the board.	75 to 55 grit
Removing a lot of wood from the board, still leaving it somewhat rough to the touch.	50 to 30 grit

2. Now that the grit of the sandpaper has been chosen for the particular job, the next important aspect to sanding is choosing a target speed to pedal. Of course the faster one pedals the faster the belt will travel around the drums. The pace at which one should pedal depends on the hardness of the wood, and the size of the area of the piece of wood. Table 2 incorporates these two main factors that should be considered for ideal pedaling speeds.

Table 2: Pedaling speeds

Sanding Area	Hardwood	Softwood
Large	Slow	Slow-Medium
Medium	Medium	Medium-Fast
Small	Medium-Fast	Fast

*For best results sand with the grain, not against unless needed.

Safety!

This belt sander was designed for the belt on the sander to travel away from the rider, (on the top sanding surface), incase of the event where the rider looses grip of the wood while sanding, ejecting it away from the rider. However, there are still other safety precautions that should be considered while operating the pedal powered sander.

1. Hold the piece of wood with blocks on the top edge of the wood to

avoid sanding your fingertips.

1. When sanding a small piece of wood, grip the wood with blocks to avoid contact to the belt with your fingers.

3. Recommended wearing goggles and a respirator while sanding.

4. Begin pedaling before placing the wood on the sander.

1. Always stay in control while pedaling, for fear of losing balance and falling off.

Though the ability for one person to pedal and sand simultaneously may seem difficult, it would probably be most appropriate for one person to pedal and one other person to sand. Considering this design can perform at best, comparable to a lower end performance of an electrical sander, it is not practical for all sanding jobs. However, for the energy conservation minded wood worker, this design offers a unique, but realistic and safe way to sand or sculpt wood.

Other references and recommended readings:

Alth, Max. All About Bikes and Bicycles. 1972, pg. 40-42

Ballantine, Richard. Richard's Ultimate Bicycle Book. 1992

DeCristoforo, R.J. Power Tool Woodworking for Everyone. 1984, pg. 285-302

Hammond, James. Woodworking Technology. 1966, pg. 198-202

McCullagh, James C. Pedal Power. 1977

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