

Pedal Powered Mill/Degrainer



Design & Realisation by Carlos Marroquin

Instructions by Henry Godfrey

Produced by Maya Pedal 2010

Version 1.0

Pedal Powered Mill



Maya Pedal's best selling "Bicimaquina". This design provides a stable, sit-on pedal power system to drive numerous types of appliance. In Guatemala it's used primarily to thresh and grind corn utilising two locally available, hand powered appliances. Each appliance must first be adapted to pedal power by modifying the drive shaft to incorporate the end of a cottered bottom bracket axel.

The pedal motion is aided by a flywheel made from a bicycle wheel weighted with concrete. The wheel itself is adapted to accept drive sprockets on both sides of the hub.

The main frame is made from steel and a section cut from an old bicycle frame incorporates the crankset. Derailleurs keep the chain in tension as well as providing a method to change gear.

The machine is easy to operate, easy to maintain and reasonably portable. It can be used anywhere by virtually anyone. It's also a simple matter to switch from degrading to milling by unbolting one appliance and attaching the other.

The Mill function has the capacity to mill 3 lbs. per minute of any type of grain or coffee beans. The most common use is for milling yellow maize, soya beans, and other elements that make up animal feed.

The Corn Degrainer is used post-harvest and easily degrades 12 to 15 quintales (1 quintal = 100 lbs.) per day.

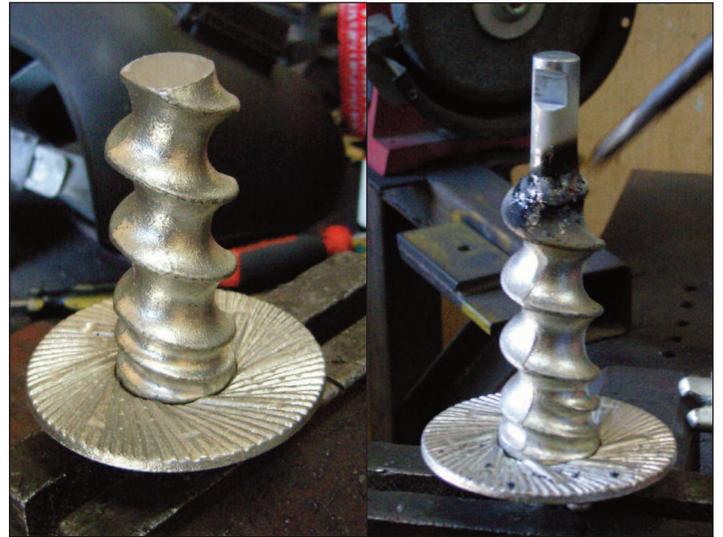


Credit to
Eric Canueze: Construction and drawings
Carlos Marroquin
Carlos Marroquin Jnr

Adapting The Hand Mill



The mill itself is hand operated and table mounted. Remove the central spindle. One end accepts the handle, the other end forms part of the grinding mechanism. The handle part is cut off completely...



...and part of a "cotted"* crank axle is welded on in it's place. It must be square. We use electrodes designed for cast steel to weld this part.

* Cotted axles are old fashioned but still widely available. They are more convenient for this task than a modern tapered type.



The mill will eventually bolt onto the frame. Remove the table mount as shown, leaving a square, flat edge.

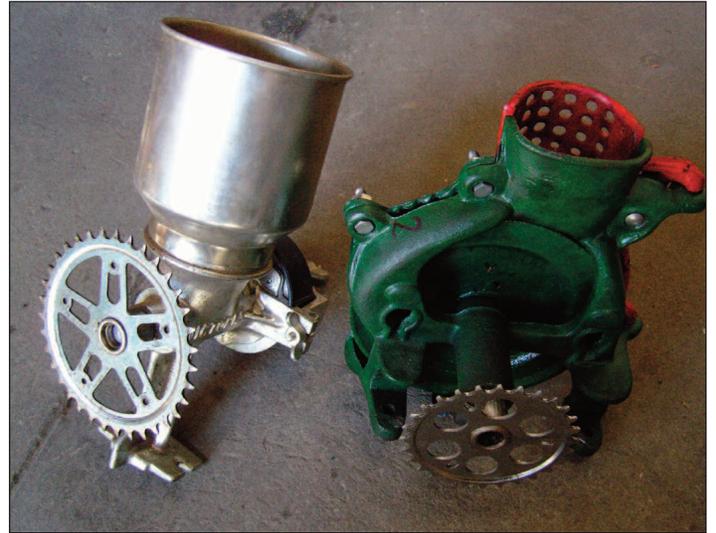


Our adapted axle needs a pipe shim. Insert one if required and trim any excess.

It's now ready to accept a cotted type sprocket with it's crank removed.

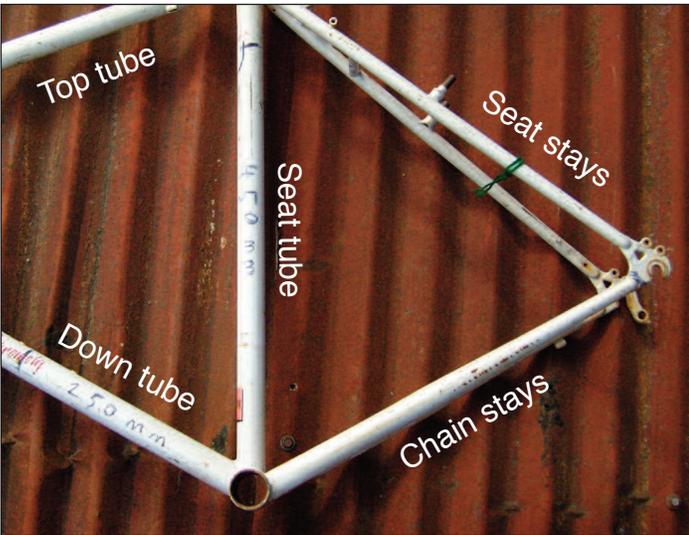


The corn thresher is adapted in a similar way.



Here we have the interchangeable thresher and the degrainer, adapted to pedal power.

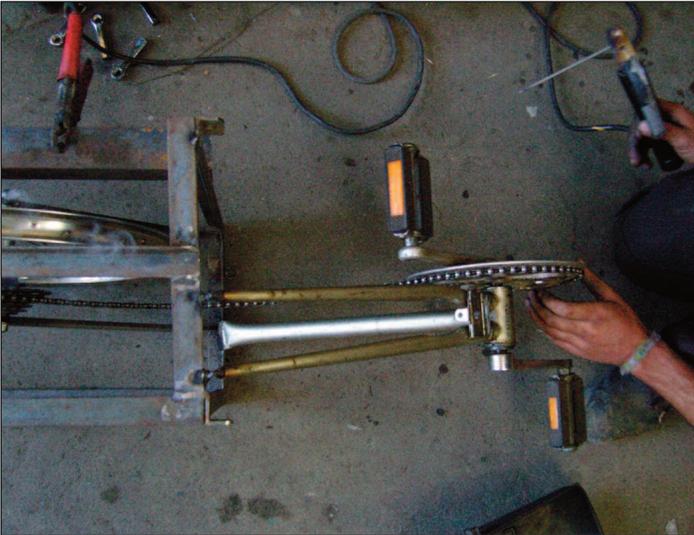
Making The Chassis



The bike frame is cut as above. About 450mm of seat tube, 250mm of down tube and the full length of chain stays.



Form the 90 degree corners as shown, cutting, folding and welding the angle iron.



Weld the bike frame in place, lining up the sprockets so the chain will run straight. You will need to bend the drive-side chain stay in order to clear the chain.

To form a better bond, the frame is flattened and bent before welding to the chassis .



The completed chassis, with the bike frame in place. Construction drawings are provided on the final page.

File any sharp edges and paint.

Making The Flywheel



The Flywheel is made from a 20" wheel. Both ends of the hub must be threaded to accept sprockets. This can be achieved either by cutting and welding the threaded end from another hub, or by replacing one side of the hub and rebuilding the wheel. The welding option is easier but prone to causing undesirable wobble in the cassette.



This split image shows the two options. Above is welded, below is a rebuilt hub. The hub is a push fit construction so it's possible to prise off the redundant unthreaded piece, and tap on a threaded one from an identical hub. Fit spokes using a screwdriver, rather than a spoke tensioner for speed.



The mould for the concrete is made using a child's bike wheel cover. These are hard to come by, so you may need to improvise. It's kept in place with a cassette and packed with newspaper to prevent leakage.



Mix the cement with two parts sand. Place the wheels on a bucket to provide support.



Once filled and smoothed over, place in the shade to dry overnight.



The concrete is painted to protect from moisture. One side accepts a multi speed cassette, the other a single speed sprocket. The axel position will need to be adjusted accordingly.

The Seat



The seat is recycled plywood. The support is made from thin box section steel. See construction drawings for more detail.



In order to make the seat position adjustable, there is a simple bracket. The nut is welded in place for easy tightening.

The seat can then be painted.

The Handlebars



We use steel dropped racer bars. Cut them in half.



In order to bolt on the handle bars, we weld 8mm bolts onto 20mm washers.

The Chain Assemblies



These are then welded onto to cut ends of the handlebar and filed smooth. They are then ready to be bolted onto the chassis.



The drive side derailleur is bolted in place as it would be on the bike. However it will need to be filed to fit flush with the frame. We use the old style of derailleur that bolts onto the axel rather than the bike frame.



Now you can add a gear shifter. A simple friction type is best than an index shifter. Use the adjustment screws on the derailleur to make sure it selects all gears without the chain coming off.

Now you can add the 2nd derailleur and the grinder.

This derailleur is upside down and it's position is fixed. Adjustments are made using the screws.

Attach the grinder with clamps to locate it's position before drilling the frame and bolting. Aim to have the chain run as straight as possible.

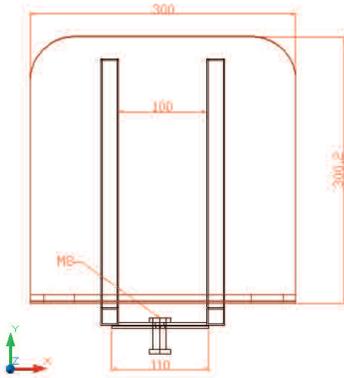
The Finished Mill



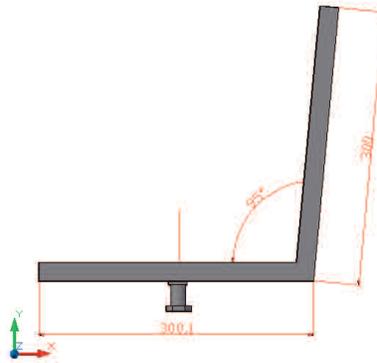
Construction Drawings

All dimensions are in millimeters

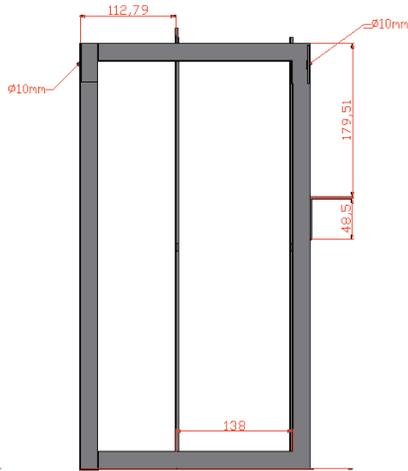
Seat: Front View



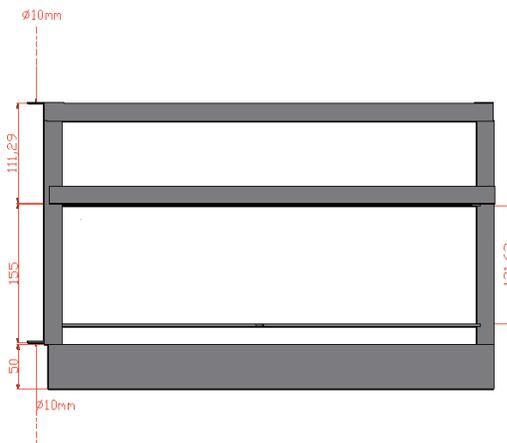
Seat: Side View



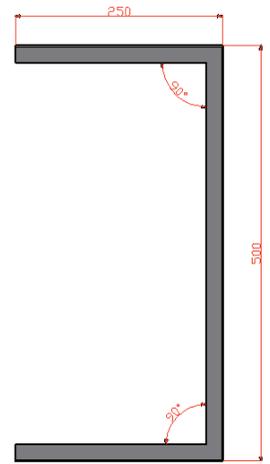
Frame: Front View



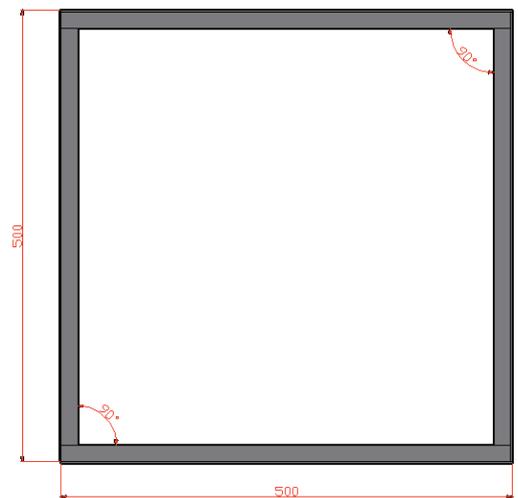
Frame: Top View



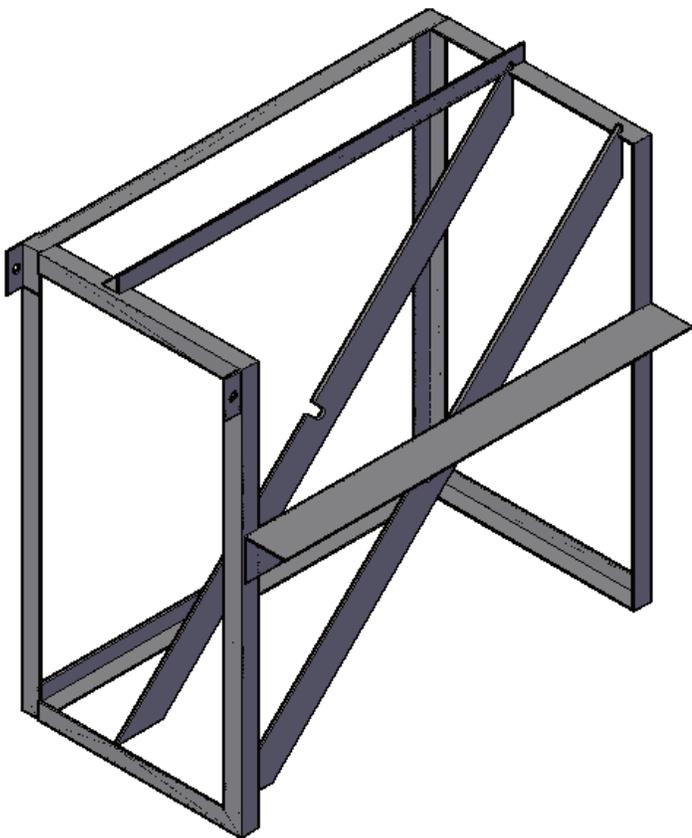
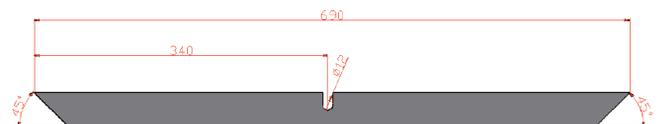
Sub Assembly 1



Sub Assembly 2



Sub Assembly 3



About Maya Pedal

Maya Pedal is a Guatemalan NGO based in San Andreas Itzapa. We accept bikes donated from overseas which we either recondition to sell, or we use the components to build a range of "Bicimaquinas", (pedal powered machines).

Pedal power can be harnessed for countless applications which would otherwise require electricity (which may not be available) or hand power (which is far more effort). Bicimaquinas are easy and enjoyable to use. They can be built using locally available materials and can be easily adapted to suit the needs of local people. They free the user from rising energy costs, can be used anywhere, produce no pollution and provide healthy exercise.

We make water pumps, mills, tile makers, nut shellers, blenders (for making soaps and shampoos as well as food products), trikes, trailers and more.

In Guatemala

We have a busy workshop staffed by locals and by volunteers from around the World. As well as building Bicimaquinas, we offer a bike repair service and sell used bikes.

The project is managed by Maya Pedal founder Carlos Marroquin, a skilled engineer and the inventor of many Bicimaquinas.

We also work with a number of local partners, NGO's, agricultural cooperatives and organic producers.

Internationally

We are supported by a number of international organizations. We also accept volunteers with a range of skills and interests.

Contact us for more details.

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