



The Appropriate Technology Collaborative

Bici-Technologies Project Report 2015

Contact: info@apptechdesign.org

Design by Carlos Marroquín

Fabrication by Nadine Pirker

Bike-powered corn grinder

Designed by: Carlos Marroquín



This bike machine facilitates the grinding (taking off the grains from the mais cob) of around 12- 15 quintales of corn per day (1 quintal = 100 lbs = 45 kg → 540-670 kg per day). It provides an easy and effective way for a job which is often still done by hand or with very basic tools.

The setup can also be used for different purposes. For example a corn mill can be attached instead of the grinder.

The flywheel provides the momentum necessary to operate the grinder (or mill).

1.	Hacer el doble eje.....	3
2.	Hacer la rueda volante	Error! Bookmark not defined.
3.	Hacer el cuadro	Error! Bookmark not defined.
4.	Preparar y colocar el marco de la bicicleta	11
5.	Preparar la desgranadora.....	14
6.	Armar la tracción	16
7.	Hacer la silla.....	17
8.	Hacer el manubrio	19



Material and tools

	metal	per unit	total		bicycle parts				
2	1 x 1/8 angle profiles	65	130		1	20" rear wheel	75	75	
1	1 1/2 x 1/4 plane profile	150	150		1	rear hub	25	25	
1	2 x 1/8 angle profile	25	25		1	crank set 12	45	45	
1	1" tube profile, chapa N° 20	45	45		2	pins	3	5	
for welding									
2	electrodes for cast iron	25	50		1	crank axis	20	20	
1	pound of electrodes, green point	20	20		1	pinion with 6 gears	45	45	
components									
1	corn grinder	450	450		1	sprocket	20	20	
1	bike frame 26"	300	300		2	derailleurs	20	40	
additional material									
3	cans of spray paint	20	60		2	MTB chains 1/2" x 3/32	20	40	
	cement	15	15						
	sand	10	10						
	electricity	100	100						
	screws, nuts	20	20						
	rivets	10	10						
2	cutting discs for the buzz saw	25	50		1	BMX chain 1/2" x 1/8"	20	20	
1	grinding disc for the buzz saw	25	25		1	cable and cover	15	15	
	2 days work	200	200		1	gear lever	15	15	
	total		2025						



Tools

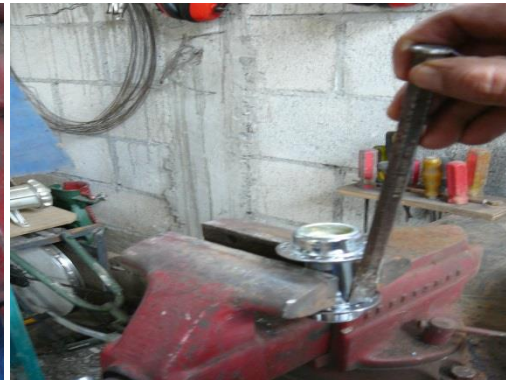
welding machine (with up to 160 A)
welding helmet
bench vice
buzz saw (with cutting and grinding disk)
ear protectors, eye protectors
screw wrenches
hammer
spoke spanner
riveting machine
jigsaw
hand saw
drill
boring bits
oil

1. Making the double-traction hub

- Loosen the spokes and take them off



- Unscrew the hub and take off the “cap” from the side without traction (the one without thread)



- Take the extra hub and get off the cap with thread. Put this on to the other hub. Make sure the holes are aligned in parallel.



- Reassemble the hub
- Reassemble the wheel with the spokes and align the rim centrally.



2. Making the fly wheel

1,5 l of sand

0,75 l of cement

➔ Mix and add water (~ 1 l)

- Mount a piece of cardboard to the wheel. You can use the sprockets to hold the cardboard.



- Fix the cardboard to the spokes using wires, so that the cement will not escape



- Cover the hub to protect it from the cement



- Fill in the cement and spread evenly

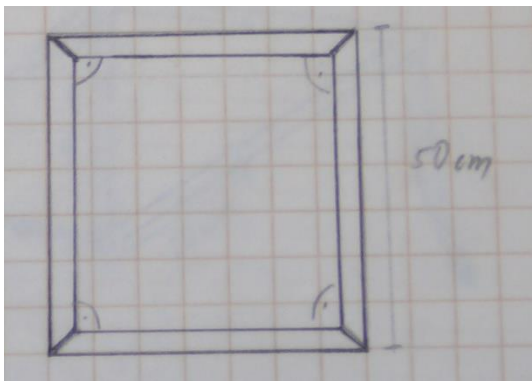
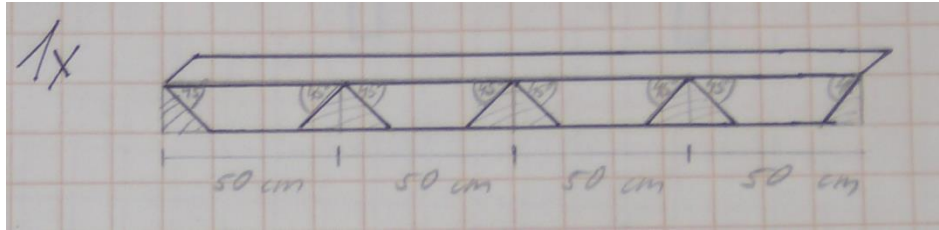


- Let it dry for about 1 day
- The next day take off the concrete where it overlaps the wheel and spread symmetrically using some water

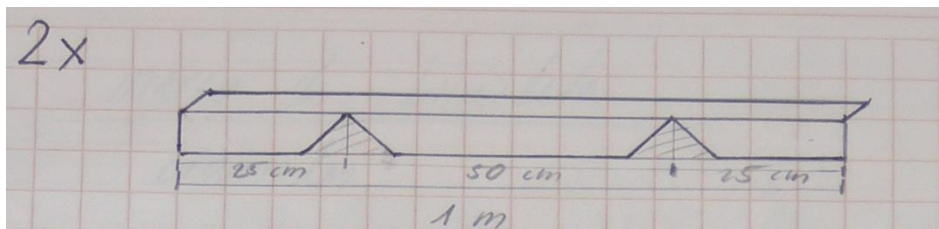


3. Making the frame

- Cut 1 piece of 2 m of the 1 x 1/8 angle profile and make a mark at every 50 cm. Then cut in an angle of 45° at each mark, bend orthogonally and weld



- Cut 2 pieces of 1 m of the 1 x 1/8 angle profile, mark 25 cm from each side, cut and bend so that you will have a “U” shape. Don’t weld the corners yet!



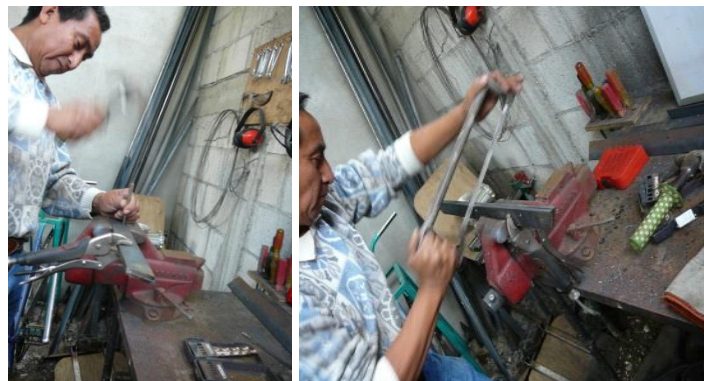
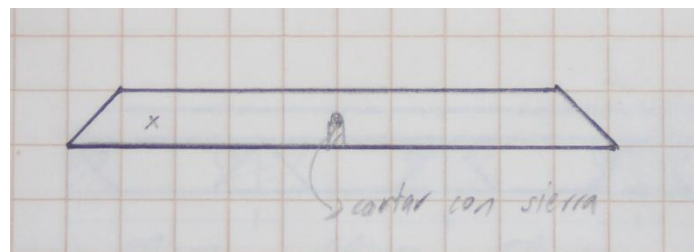
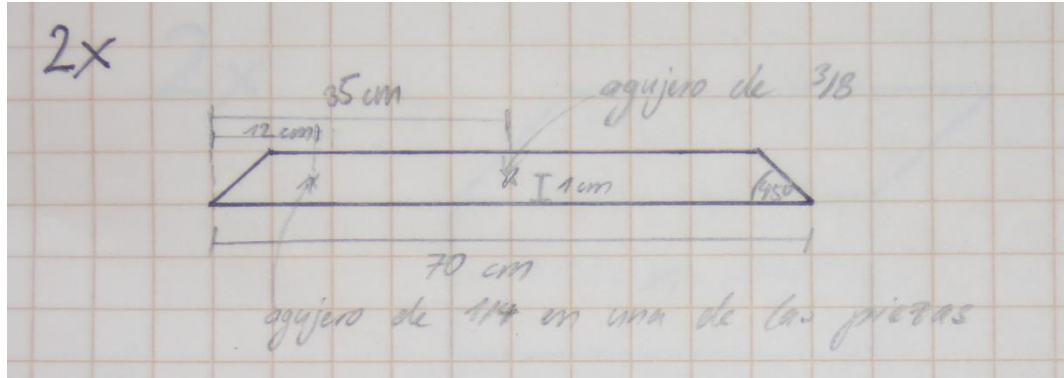
- Connect these two “U” shapes to the frame and pay attention that it aligns orthogonally.
- Afterwards weld the corners of the “U” shapes



- Cut 2 pieces of 70 cm of the flat 1 1/2 x 1/4 profile, mark 45° at each corner and cut.
- Then mark the holes in the middle (at 35 cm and 1 cm from the edge) and then drill with a 3/8 bit to make the hole for the axle. First mark the hole with a marker and hammer, then

start drilling with a smaller bit, adding oil. Make sure the two holes are aligned perfectly since this will be holding the hub of the fly wheel. Then use the hand saw to cut from the edge to the holes. (Don't use the buzz saw as this would crystalize the metal!)

- Mark and drill another hole (1/4") at 12 cm from the edge for the derailleur.



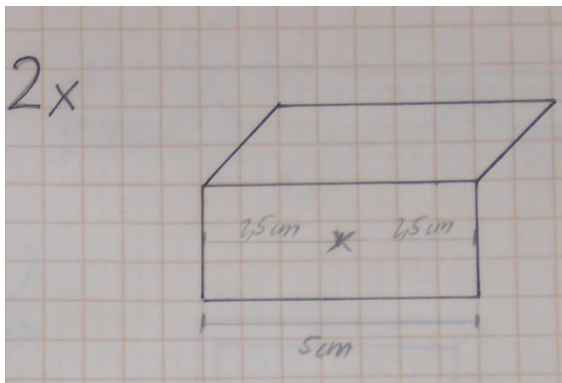
- Connect the two plain parts to the frame keeping a distance of exactly 14 cm and align them in parallel to the frame. Again pay attention to detail here, as this will influence the fly wheel.



- Cut 0,5 m of the 2 1/8 angle profile which will serve as mounting base for the grinder or mil. Cut a grade of about 3 cm at both sides to mount this part to the frame, then weld.



- Cut 2 parts of 5 cm of the 1 1/8 angle profile and drill a 3/8 hole in the middle (at 2.5 cm to both sides). Weld these “ears” to the front part of the frame where you will later attach the handle bars.



- Smoothen all the edges in order to minimize the risk of injury.

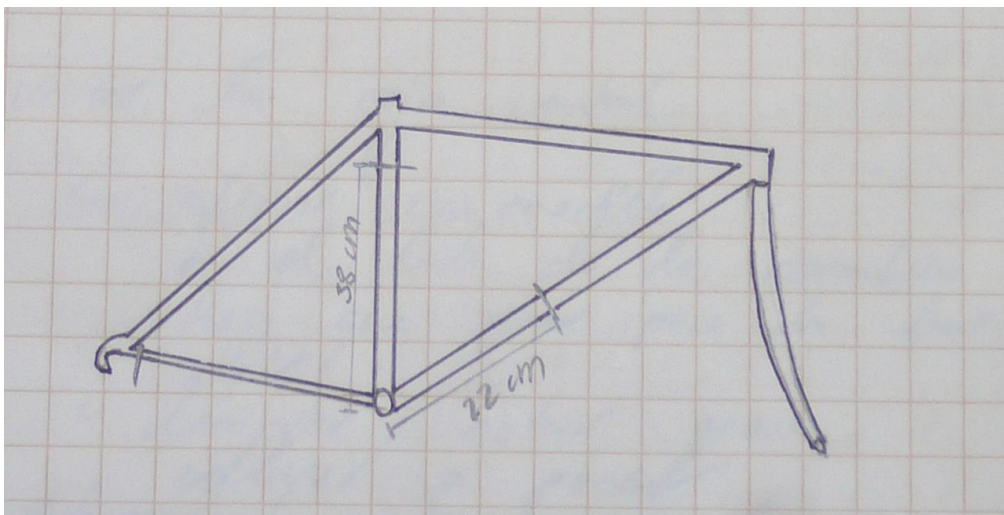


4. Prepare and attach the bicycle frame

- When choosing a bicycle frame pay attention to the material (it has to be made out of steel) and that the bottom bracket is in good condition.
- Clean and grease the bottom bracket.
- Take off all parts (brakes, cables, rack, handle bars, fork, etc.)



- Cut up the frame



- Then flatten the end of the seat tube using the bench vise and hammer. This will make it easier to weld it to the frame.



- Cut off the tension part of the chain stays. Now you can deform the chain stay (on the side of the derailleur) using your foot. Bend it so the chain passes outside of the bike frame and does not cross into the chain stay.



- Screw the sprocket on to the hub of the fly wheel, on the opposite side to the pinion.



- Mount the fly wheel and the bicycle frame to the frame, aligning the chain on the outer chainring in front and the third gear of the pinion. The frame has to be up-side-down, with the seat tube stabilizing the machine on the ground.



- Connect the bike frame by welding.
- Spray paint the whole set up to protect it from corrosion.



5. Preparing the corn grinder

- Take off all the screws and level the lower part of the grinder which later will serve as base for installing the grinder on the bike machine.



- Cut the axis of the grinder at 7 cm using the hand saw. (Don't use the buzz saw as this would lead to the crystallization of the metal!)
- Now cut the crank axis at 3,5 cm.



- Smoothen the cut surfaces of both parts so that they form a perfect line when collocated onto each other.
- Now weld the 3,5 cm part to the axis of the grinder using the electrode for cast iron.
- While the metal is still hot, align the axis into a straight line using the hammer.



- Put chalk onto the weld seam, smoothen edges



- Make a bushing using the tube of a handlebar, for example, and insert it into the bearing of the grinder. This will make it more stable. Oil



- Cut off the crank arm of the crank set



- Put the crank set on the grinder axis and fix it using a pin.



6. Assembling the traction system

- Install a derailleur on the side of the pinion to change gears. The derailleur needs to be flattened on the side where it connects to the frame.
- Put on the bike chains. You need to connect 2 MTB chains and tighten them so that the derailleur is under just a little bit of pressure when the chain is on the outer chainring and the highest (i.e. smallest) gear on the pinion.



- Screw the other derailleur to the 1/4 hole in the second plane stay. This derailleur will keep the chain tight and compensate movements by the grinder.



- Fix the grinder to the frame using screws. Drill holes into the 2 1/8 angle profile and make sure the crank set aligns with the sprocket. In case the grinder does not align, the basis needs to be smoothed and leveled more, using the buzz saw. It is very important that this set up aligns perfectly.



- Put on the BMX chain. Tighten it so that the derailleur is just under just a little pressure.

7. Making the seat

- Cut 4 30 cm pieces of the tube profile (chapa N° 20) and cut off an angle of 30° at one side of each piece, then weld together as shown below



- Cut 1 piece of 50 cm of the 1 x 1/8 angle profile and place it on the upper part of the frame, at 16 cm distance to the side opposite to the grinder.



- Cut an 11 cm piece of the 1 x 1/8 angle profile and drill a 3/8 hole in the middle. On top of this hole weld a 3/8 nut. For welding place a screw with a nut through the hole and screw on another nut from below to fix it in the right position.



- Now weld this part in between the two seat bars
- Cut 2 30 x 30 cm pieces of wood and soften the edges
- Fix them to the seat bars, by using riveting bolts for example



- Weld a handle to a 3/8 screw (for example using the original handle bar of the grinder)



- Cut a piece of flat profile and make a 3/8 hole in the middle. This, in connection with the 3/8 screw and nut, will serve to fix the chair to the frame.
- Arrange everything on the frame. The seat can be positioned more to the front or to the back, according to the size of the person using the bike grinder. You only need to loosen the screw with the handle and move the seat.



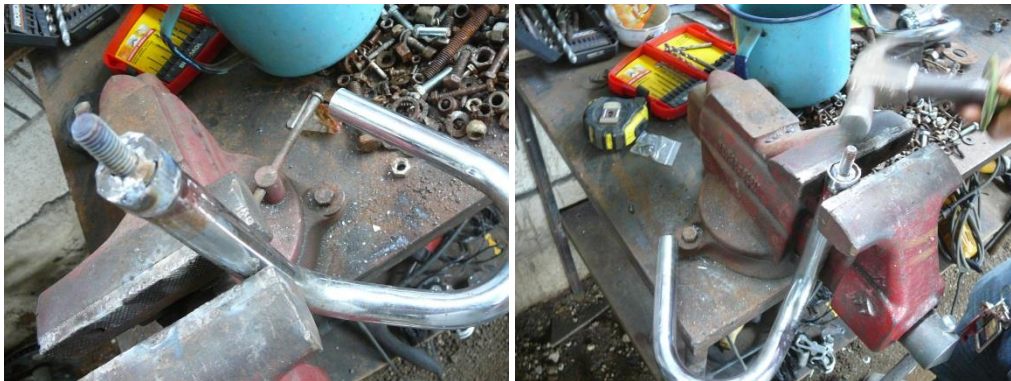
- Paint

8. Making the handle bars

- Cut through a road bike handle bar in the middle.
- Connect two screws to a washer each by welding



- Then weld these two parts to the handle bar and smoothen. Try to keep the screw threads intact.



- Then screw the handle bars to the “ears” and fix them with nuts



- Install a gear lever and connect it to the derailleur (the one connected to the pinion)
- That's it! The bicycle corn grinder is ready for use!
When grinding corn try to keep up a constant pedalling so that the corn cobs don't get stuck in the grinder.