

Desktop trebuchet from bicycle frame

by [Visitor](#) on January 24, 2007

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Intro: Desktop trebuchet from bicycle frame

How I created a desktop trebuchet (also known as a counter weight catapult) from the rear fork of a bicycle.

List of parts:

- One unserviceable bicycle frame (rear fork must be good).
- 4kg of lead (two 2kg diving weights).
- 10mm bolt or threaded rod and nuts.
- 12mm metal pipe (10mm inner diameter).
- 5mm screws and nuts.
- Wood.
- Scrap metal.
- Thick cloth (a pair of old jeans, perhaps).
- Old leather belt.
- Some fishing equipment (they are really practical).
- Wood glue.

You will also need basic wood and metal working tools, like a drill, drill bits, hack saw, file, etc. The bicycle frame is the only mandatory part. You can improvise pretty much all the other parts. My parts don't actually match the list exactly, because I used all kinds of leftover stuff I already had.

Keep in mind that a trebuchet with 4kg weight is really not a toy for small children. The sling release pin is practically a metal blade that reaches a very high velocity. It will tear skin badly. When firing, keep in mind that the ammo will probably be thrown to the exact opposite direction than where you aimed. So make sure everyone stands next to the trebuchet (not in front of it, not behind it). USE AT OWN RISK!

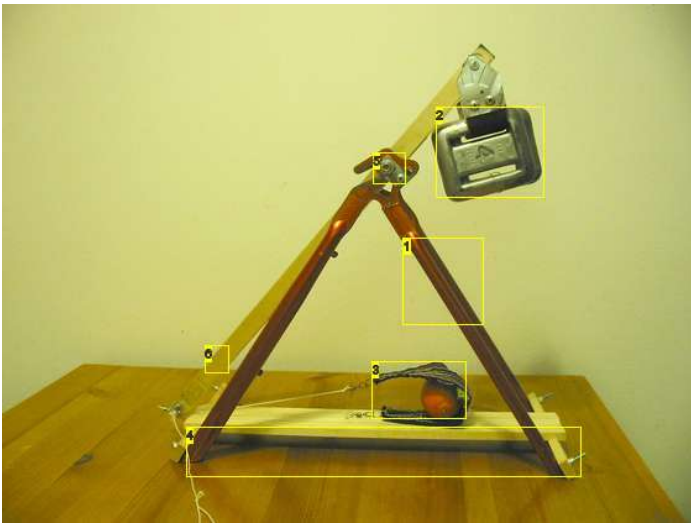


Image Notes

1. Frame.
2. Weight.
3. Sling.
4. Base.
5. Axle.
6. Throwing arm.

step 1: Frame and axle

My first step was to cut the rear fork from the bicycle and construct the axle. I cut the chain stays as close to the bottom bracket as possible and performed a similar operation on the seat stays. This leaves some room for shortening and trimming the stays later.

The axle consists of a threaded rod, a metal spacer pipe, washers and nuts. My spacer is 55mm wide. The width of the spacer determines the width of the throwing arm. For this throwing arm design the spacer should be slightly narrower than the weight. Note that the chain side fork has an odd kink that is supposed to give room for the freewheel (a really odd 70's design). Your forks will not have those and you may need to add a few nuts inside the forks to give more space for the weight. So leave the axle a bit longer so you can experiment. It is easier to remove the excess width later than it is to add more.

If you look closely you will notice that I used an 8mm rod and 10mm pipe for spacer. This is not as good as 10mm rod and 12mm spacer because the drop outs in the fork are designed for a 10mm axle.

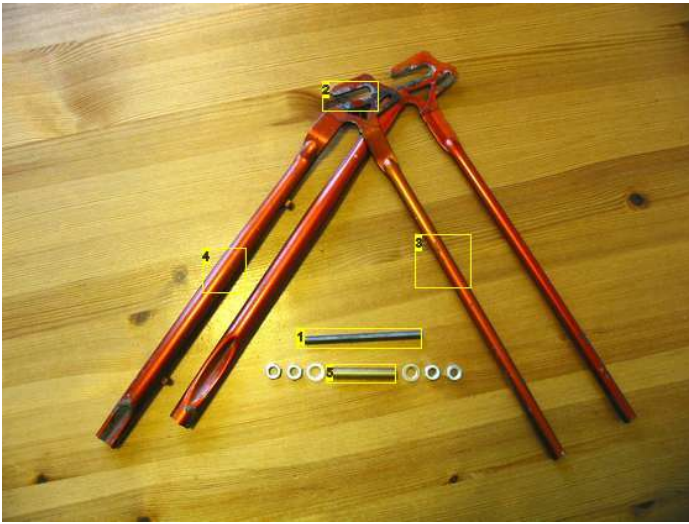


Image Notes

1. Threaded rod.
2. Drop out.
3. Seat stay.
4. Chain stay.
5. Brass tube.

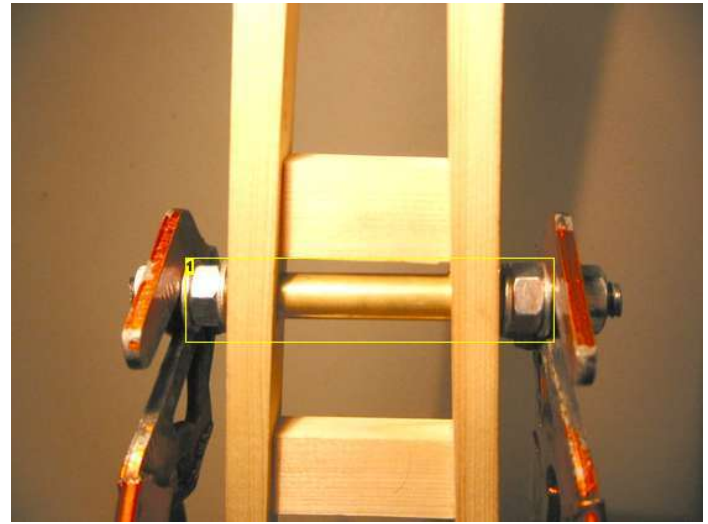


Image Notes

1. The brass pipe is a spacer that keeps the frame from crushing the throwing arm. All nuts in the axle must be very tight. The axle and the spacer are load bearing components and can not be left loose.

step 2: Throwing arm

Next I created the throwing arm. I took two 50cm wood strips (1 cm thick, 2cm wide) and planed a taper to the ends so that I could form an A-shaped form.

First I drilled the axle holes. This is an important step since it finalizes the length of the throwing arm and dictates the optimum size for the ammo. My throwing arm is 50 cm long. The axle hole is 36cm from the arm tip and the weight fasteners are placed 13cm from the axle. $36/13$ gives a 2.7 ratio for the arm, which is probably a bit too small. When measuring the hole, keep in mind that the weight must be able to swing below the axle without hitting the base. Again, remember that it is easier to make something shorter than longer.

After drilling the axle hole I inserted the spacer into the holes (the spacer sit quite tightly in the holes) and glued the tapered ends. The spacer kept the holes aligned properly. After the glue had dried (or cured, since I used epoxy) I glued in the horizontal struts. After the gluing was finished I drilled a hole for the sling release pin axle to the arm end. Then I took a narrow saw and cut a slot along the glue joint for the sling release pin itself.

In the picture can see th finished trebuchet, but don't jump ahead yet. I will next instruct you to trim the chain and seat stays and build the wooden base.

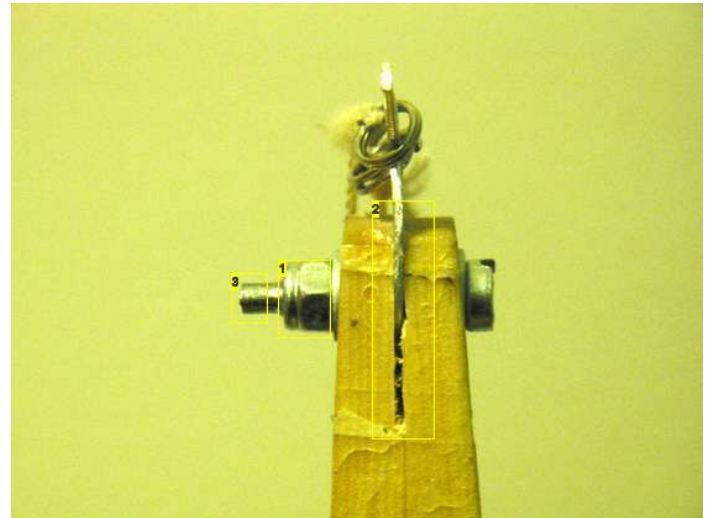


Image Notes

1. I suggest that you use a wing nut here. I didn't have any so I used a nylon lock nut.
2. Cut here.
3. Screw end filed clean for smooth trigger release.

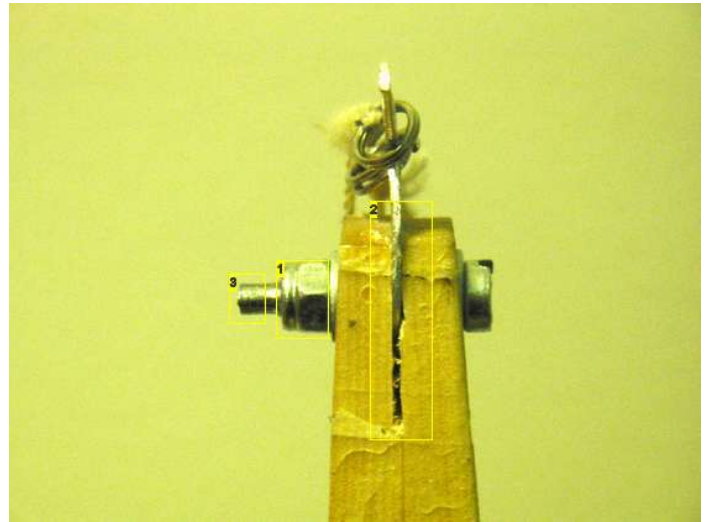
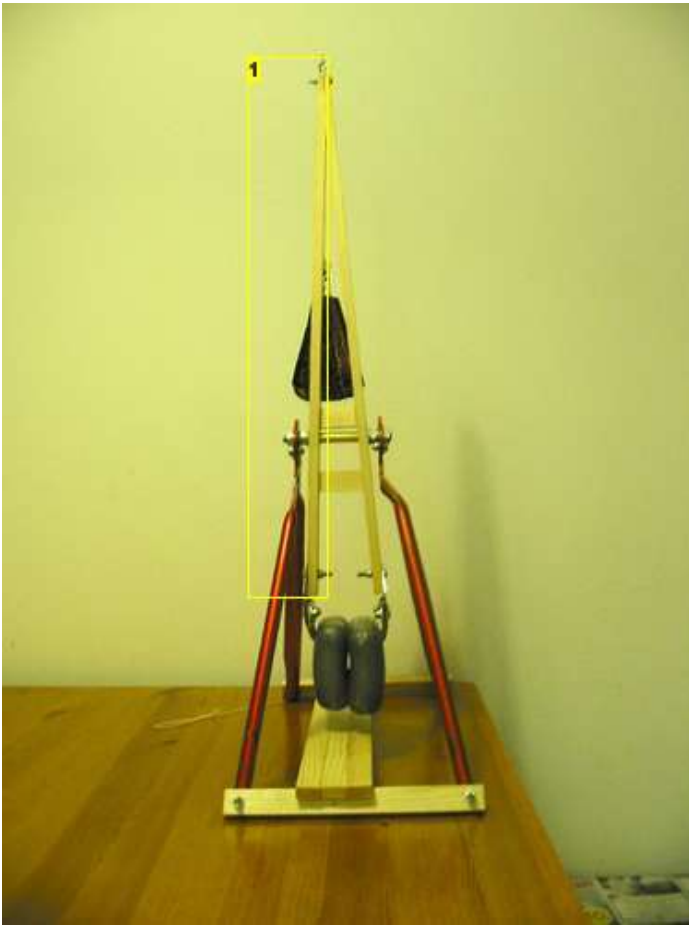


Image Notes

1. A-shaped throwing arm.

step 3: Trim frame and build base

After the throwing arm I built the base for the trebuchet. The base keeps the chain and seat stays from moving, provides a launching strip for the sling and fastenings for the trigger. Before I could build the base I had to trim the chain and seat stays to correct length.

Since the trebuchet I was going to compete against had 30cm axle height, I was going for 30cm too. I don't think I mentioned that this trebuchet is intended for inter-office warfare, did I? This trebuchet will increase my range of fire and give me an upper hand against my boss' trebuchet.

I set up my frame like in the picture, using the axle without the throwing arm. This is not optimal, since it is very difficult to get the drop outs aligned parallel to each other. I measured 35cm from the center of the axle along the outer side of each stay and cut the stays diagonally. It was not very accurate, since the other drop out is bent, but it worked Ok.

After trimming I drilled holes for the base, fastened the crosswise struts and glued the launch strip for the sling. You could use for example a metal sheet bent to low U-shape for the launch strip, but I think this approach is a bit more rigid.

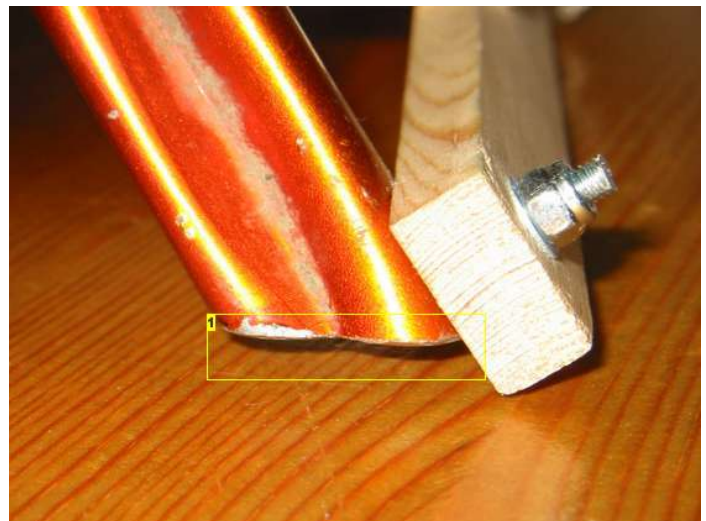


Image Notes

1. The base lifts the frame few millimeters off the table. The whole trebuchet moves a lot when it is fired and the metal frame ends would scratch the desk badly.

step 4: Weight

The last big step was building the weight. I purchased two lead diving weights and hung it to the throwing arm with a piece of leather belt and metal plates cut from the same bicycle chainguard as the sling release pin.

I cut the belt and attached the metal plates to it, estimated the height of the weight from the bottom to the upper fastening holes and subtracted that amount from the distance between the axle and the base. Then I subtracted a few centimeters (just to be safe) to get the distance between the weight fastening holes and the axle.

You absolutely DO NOT want to MELT LEAD! http://en.wikipedia.org/wiki/Lead#Health_effects

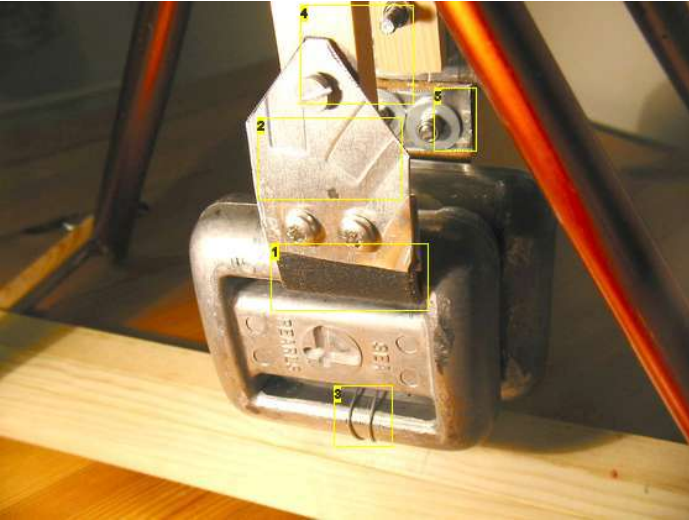


Image Notes

1. Old leather belt.
2. Metal plates cut from a discarded bicycle chainguard.
3. Metal wire keeps the weights in a tight package.
4. This would be more rigid if it was a single long 5mm screw.
5. Belt is held tight between two metal plates.

step 5: Sling release pin and trigger

By now all "heavy" work is done and the rest is just tinkering. The first small part is the sling release pin.

I made the sling release pin from a discarded bicycle chainguard. All it needs is a smooth pin and holes for the trigger pin and sling fastener. The ring used to fasten the sling to the pin is normally used for attaching fishing hooks to lures. Fishing equipment is really good for all kinds of things.

After the sling release pin I built the trigger. The trigger design is simple, a metal ring, attached to a wire, is placed over the screw that holds the sling release pin in place. To fire the trebuchet, pull the ring off the screw and the throwing arm is released. Fishing equipment is again used extensively here.

The sling release pin can be adjusted by loosening the nut a bit and tilting the pin. The more the pin points forward, the later the sling is released and the lower the trajectory will be. You need to adjust the pin angle every time you change the ammo weight, sling length or weights.

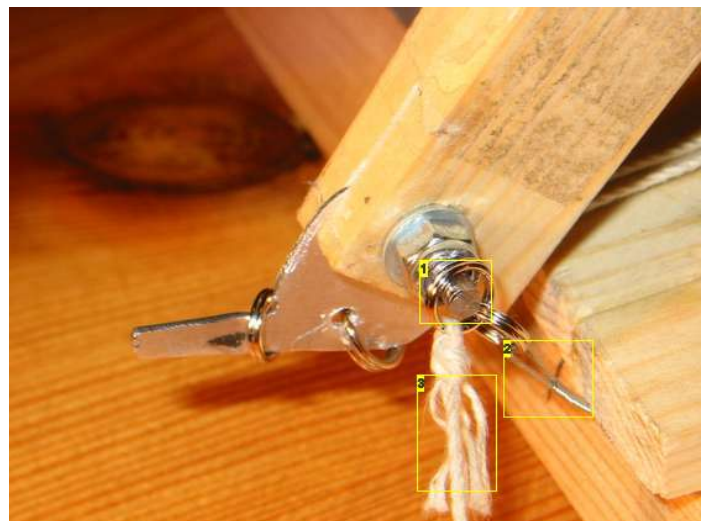


Image Notes

1. Sling fastener hole.
2. Trigger pin hole.

Image Notes

1. Screw filed smooth so the trigger ring slides off smoothly.
2. Fishing equipment here again.
3. String pulls the ring and releases the throwing arm.

step 6: Sling

I made the sling pouch by cutting a key strap into four pieces of equal length and sewing them together. My method was quite tedious to do without a sewing machine. The sling pouch is pretty thick in the ends, so don't break your sewing machine or fingers. You should improvise here again.

I sew the strap pieces so that in the middle they are side by side overlapping only slightly and in the ends the pieces are completely overlapped. This creates a nice bag in which the ammo sits snugly when firing.

The pouch is attached to the throwing arm with two strings. The other string is fastened to the smaller trigger pin hole. The other pin has a metal ring that is placed on the sling release pin. The strings should be measured so that the sling is as long as the throwing arm. Making it longer will usually be inefficient. If you fire heavier ammo, you will have to make the sling shorter.



Image Notes

1. Sling should be about as long as your throwing arm.

step 7: Improving the design

I have now described how I built a trebuchet. I wish that you do not follow my instructions blindly but think for yourself, IMPROVE them and write an instructable from your work. I found Instructables after I had finished the trebuchet so therefore this instructable is not as good as it could be. I apologise for the bad pictures. It is 21:30 now, the sun sets before I get home from work and I do not have proper lighting for taking pictures.

I have few ideas for improving the trebuchet. I will do them if my boss manages to build a better trebuchet (medieval arms race at work, brilliant). I'll disclose them and challenge you to implement them.

1. The axle could and should be made of a front wheel hub of a bicycle. I would use metal pipe for the arm and support it with bicycle spokes. It would look great and work like charm.
2. Adding wheels to the trebuchet improves its efficiency. The whole frame moves forward when it is fired. This means that the axle and the throwing arm moves too giving the ammo more velocity. I already have small wooden wheels waiting.
3. The sidewise wood strips on the base could be replaced with pieces from the main tubes from the bicycle frame. Drill holes to the tube through which the seat and chain stays can go through.
4. The launching strip could be made of a slightly flattened main tube that is cut open lengthwise. A mountain bike frame with an oversize diagonal tube would oh, suit you, sir! All in all, the amount of bicycle frame reuse could be improved

<http://www.instructables.com/id/Desktop-trebuchet-from-bicycle-frame/>

5. The throwing arm contains a lot of excess wood. The wood strips could be tapered to make it lighter. After all, every gram that is removed from the throwing arm goes right into the ammo. This could be "micro management," though.

6. Make the sling using old derailleur or brake cable and old bicycle tire.

This is no rocket science. They built trebuchets in the 12th century. How hard can it be?

Related Instructables



Catapults
(guide) by
mg0930mg



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Tripod** by
woofboy111



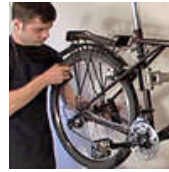
Fork truck bike
(video) by
mrmusty



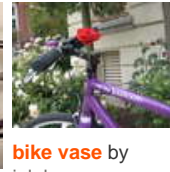
by savagemania



**Front-Wheel-
Drive Center-
Steer Semi-
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sennomo



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(video) by
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bike vase by
j_l_larson



**Replacing
Pedals** (video)
by BicycleTutor

Comments

24 comments

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T3hpw9ag3 says:

yeah, everyone has room on their DESK for a DESKTOP trebuchet of this size

Dec 22, 2008. 4:39 PM [REPLY](#)



Visitor says:

You obviously need a better job. :)

Dec 28, 2008. 9:58 PM [REPLY](#)



T3hpw9ag3 says:

nah, im 14. besides, this thing is a freakin behemoth. nobody has room on their desk for this, let alone office codes of conduct would prohibit such devices.

Jan 1, 2009. 3:48 PM [REPLY](#)



Visitor says:

Our office code mandates that fire shall be fought with fire.

Jan 1, 2009. 10:40 PM [REPLY](#)



T3hpw9ag3 says:

so by what you just said, in event of a fire, use a flamethrower? lol xD

Jan 5, 2009. 3:58 PM [REPLY](#)



T3hpw9ag3 says:

by the way, it seems neat, just a bit misnamed. oh , and lets see how long we can make this reply tree!

Jan 5, 2009. 3:59 PM [REPLY](#)



Kevin12345 says:

It shall go on forever

Oct 23, 2009. 4:34 PM [REPLY](#)



criggie says:

I'm 75% finished a similar trebuchet - but mine's made with the front forks rather than the back.

Aug 2, 2009. 12:50 AM [REPLY](#)

Forks were removed from the headtube and wedged into a slab of wood as a base (can fit wheels later if the damn thing actually works)

I also cleaned and used the hub from the front wheel - cut off all the spokes from the rim and unthreaded from the hub. (saved for some future use)

Biggest problem I have currently is attaching the boom to the hub.... currently its off-centered which will probably throw the whole action out of whack. Also, the end of my boom is off-set so the purse comes alongside the shaft, rather than through the forks.

Also need to source some kind of weight which will fit through the forks properly - there's not a lot of room for error.



John Smith says:

Feb 4, 2007. 1:56 PM [REPLY](#)

You could always make a heavy lead weight by using the technique in my instructable



Visitor says:

Feb 5, 2007. 5:18 AM [REPLY](#)

That is going to need a lot of solder. One can use other metals too. I have a smaller trebuchet where I used two large sacrificial zing pieces (those used to protect steel boats from corrosion).



mathman47 says:

Jul 31, 2009. 12:44 AM [REPLY](#)

Uranium is probably the heaviest metal out there. I hear there a storage problem, so you might get some dirt cheap!



Vertigo666 says:

Jan 25, 2007. 5:15 PM [REPLY](#)

where d'you find the weights?
of course, i could use something lying around that happens to be heavy enough.... a large electric motor?



17hmr243 says:

Jul 22, 2009. 11:45 PM [REPLY](#)

just go to our local tire place ask for 2kg of old tier lead alloy u then melt down in a old kitchen pot and cast into foil try like u get fore one serve of lasagna



Visitor says:

Jan 26, 2007. 7:13 AM [REPLY](#)

I bought the weights from a diving shop.



chromedonut says:

Jun 3, 2009. 7:55 AM [REPLY](#)

This is great. I've always liked hurling machines AND repurposing junk around the garage. This does both with one SWOOP!



longliversplayerestaban111 says:

Apr 22, 2009. 6:38 AM [REPLY](#)

I'm going to make one tonight because I've got nothing else to do.



StepsoftheSun says:

Jan 25, 2007. 3:08 PM [REPLY](#)

Well done! Perhaps I missed it in the Instructable but what kind of range are you getting? The pictures are very good, I think, but a video for a project like this is a must!

I've built several small trebs as well as one large one but never considered the use of a bicycle frame; I think it's quite creative.



Visitor says:

Jan 26, 2007. 7:18 AM [REPLY](#)

I have not fired it outside yet, so I do not know the maximum range. It shoots a golf ball sized (soft) ball across our office 8 meters with a very flat trajectory. Should do 15 meters outside.



stick1985 says:

Mar 26, 2008. 11:54 PM [REPLY](#)

add weels and you git better range



noahw says:

Jan 31, 2007. 4:06 PM [REPLY](#)

Medieval office warfare - sounds like the right kind of work environment. Nice job!



trebuchet03 says:

Jan 25, 2007. 5:46 PM [REPLY](#)

Wow! What an amazingly awesome idea!

I'll have to think a little bit and see if I can convert this idea into a FAT type.



StepsoftheSun says:

Jan 25, 2007. 8:21 PM [REPLY](#)

How would you create the tracks for a floating arm treb if you're sticking with parts from a bike?



trebuchet03 says:

Jan 26, 2007. 12:46 AM [REPLY](#)

That's what's going tot take some thinking ;) I have an idea for tracks, I'm just trying to come up with a way to make the weights slide properly :)



Jeza Bear says:

Jan 25, 2007. 5:42 PM **REPLY**

Very nice. I was thinking whilst I read this was that if I had a broken bicycle, I will possibly have a unused spindle from the wheel, If I was lucky the quick release type. That would make a great axle.

Good job
