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## Floating arm trebuchet design

### Trebuchet arm length ratio. How to make your arm float. What are arm floaties called.

This list of materials is copied directly from my science fair project. It includes what I used at the time. The lumber list is really long, but I think I bought somewhere around 20 8' long 2 X 4s, I'm not sure... This still does not include the 2 X 6 pieces or any other pieces of plywood. I would still recommend that you read through the list, and buy the lumber as you need it to avoid wasting wood. Buy 15 2 X 4s to start off with, then buy more later. Also, if I mention anything else in the instructable that I didn't mention here, let me know. Materials Lumber 2 segments of 6 ft. (1.8288 m) long 2 X 4 These are the horizontal beams that are used as the track. 2 segments of 6 ft. (1.8288 m) long 1 X 6 Long sides of the base 2 segments of 2 ft. (0.6096 m) 1 X 6 Short sides of the base \*It would be better if the two previous 1 X 6 pieces were 2 X 6, I'll explain later. 2 segments of 6 ft., 2 in. (1.8796 m) long 2 X 4 2 segments of 5 ft., 10 in (1.7272 m) long 2 X 4 The two previous segments are diagonal supports. Cut at least 3 inches longer unless you are very good at cutting angles accurately (A miter saw would help) 2 segments of 8 ft (2.4384 m) long 2 X 4 These will be the drop channels \*look at the last step: improvements. improvements 2 rectangles of 3/4" in. (2.54 cm.) thick plywood, 2 ft., 5 in. X 3.5 in. (0.7112 X 0.0889 m) Plywood also included in the arm 1 segment of 7 ft. long 2 X 4 the arm itself 2 rectangles of 3/4 inch (1.905 cm) thick wood, 1.5 in. by 2 in (0.381 X 0.0508 m) The two bits at the open top of the cut channel..keeps the drop channel from "opening" \*look at the last step, improvements. 8 segments of 3 ft., 6 in (1.0668 m) long 2 X 4 Main track supports look in improvements, may need to be changed 4 segments of 4 ft., 5 in.



(1.3462 m) long 2 X 4 These are the pieces of wood directly on either side of the drop channels. 2 segments of 2 ft., 11 in. (0.889 m) long 2 X 6 3 segments of 3 ft. (0.9144 m) long 2 X 6 More diagonal supports. These Are not included in the instructable because I did not think they were necessary. I might include them later. If you really want to include them, they should also be cut about 3 inches longer, until you know what to cut. 2 segments of 1 ft., 0.5 in. (0.3175 m) long 2 X 4 lateral supports 2 segments of 2 ft. (0.6096 m) long 2 X 4 extra lateral support 4 segments of 1 ft., 5 in. (0.4318 m) long 2 X 4 4 segments of 1 ft., 5 in. (0.4318 m) long 2 X 6 diagonal supports, lateral and track-supporting 2 segments of 3 ft. (0.9144 m) long 2 X 4 6 segments of 2 ft., 5 in. (0.7112 m) long 2 X 4 These make up the short arm May need to be shortened, look at improvements 2 rectangles of 3/4" in. (2.54 cm.) thick plywood, 2 ft., 5 in. X 3.5 in. (0.7112 X 0.0889 m) Plywood also included in the arm 1 segment of 7 ft. long 2 X 4 the arm itself 2 rectangles of 3/4 inch (1.905 cm) thick wood, 1.5 in. by 2 in (0.381 X 0.0508 m) The two bits at the open top of the cut channel..keeps the drop channel from "opening" \*look at the last step, improvements.



This may need to be changed 4 rectangles of 3/4 inch (1.905 cm) thick wood 9.5 X 5.5 in (0.2413 X 0.1397 m) 4 rectangles of 3/4 inch (1.905 cm) thick wood 9 X 4 in. (0.2286 X 0.1016 m) 4 rectangles of 3/4 inch (1.905 cm) thick wood 9.5 X 9 in. (0.2413 X 0.2286m) Three previous sections are for the counterweight boxes. This might change depending on your weights setup. This is what fit for me. Also, 1 inch thick wood would be stronger. Hardware about 250 2.5 in. (6.35 cm.) wood screws, phillips head drive, #8 I would get more in case some of their heads strip... if you buy pt lumber make sure they are approved for use in it., 8 5 in. (1.27 cm) wood screws, phillips head drive, # 8 16 1.5 in (3.81 cm.) wood screws, phillips head drive, #8 3 ft. (0.9144 m.) long 5/8 in. (1.5875 cm.) diameter threaded rod, coarse thread NEEDS TO BE MADE THICKER. LOOK AT IMPROVEMENTS 2 segments of 2 ft. (0.6096 m) long 5/8 in. (1.5875 cm.) diameter threaded rod, coarse thread May need to be made thicker 20 5/8 in. (1.5875 cm.) nuts, coarse thread for the threaded rod 24 5/8 in. (1.5875 cm.) washers again for the threaded rod 10 1/4 in. (0.635 cm) diameter, 5.5 in. (15.24 cm.) long carriage bolts For the arm assembly 6 1/4 in. (0.635 cm) bolts, matching thread for the carriage bolts 6 1/4 in. (0.635 cm) washers, matching carriage bolts for the carriage bolts 3/8" X 4" eye bolt (Including bolts) 8 matching cut washers these will be used in the trigger 2 1/2" X 10" eye bolts these are the trigger pinsWheels, weights 3 3 in. X 1.5 in. (7.62 X 3.81 cm) diameter wheels, 5/8 id bearing load rating of 200 lbs (90.71 kilos) or more May need to be hanged if the diameter of the threaded rod is changed excellent site for cheap, strong wheels 2 hand weights, 10 lbs (4.54 kilos)\* 2 hand weights, 8 lbs (3.63 kilos)\* \*must be able to fit inside counterweight boxesSling Approx. 50 ft. (15.34 m) of 3/16" (0.47625 cm) braided polyester cord The sling lines, I bough 50 ft because i needed to cut the right lengths for each ratio, you probably wont really need more than 15 ft. Approx 25 ft.



(7.62 m)1/2" braided nylon rope (This is actually for the trigger) 15 in. X 6.5 in (38.1 X 16.51 cm.) denim fabric for the sling Just find a pair of old jeans Approx. 10 ft. (3.048 m) of gorilla tape for the sling 1 keychain ring A solid metal ring of any kind would work better. One thick nail. This is the pin. I don't know what gauge mine was. I found it in the trash Buy one that is at least 4 inches. The thicker the better to prevent it from bending. You should also cut off the head if you keep getting downward throws no matter how you adjust it. If you want a better pin system, look at the turnbuckle pin system here. (third picture on the right) RLT industries trebuchet.com Tools erm... common tools hacksaw if you don't have a METAL CUTTING BLADE FOR YOUR JIGSAW, jigsaw the one I used here circular saw (The one I used here) OR miter saw AND table saw you need to miter, rip, and crosscut. drill (The one I used here came in a kit here) with a varied drill bit set, for pilot holes, etc. One drill bit MUST be the size of your threaded rod (Mine was 5/8", it should be thicker) Ideally, the drill bit would be a foot long, or 6 inches, so that the holes in the arm don't become misaligned. I'll explain later... also screwdriver bit driving in your screws. coping saw and orbital sander (The one I used here) Socket wrench for your threaded rod speed square ...I'm kinda adding these as I think of them.. Tape measure, ruler rubber mallet claw hammer um... I think that's it OK onto step 1 the base... the beginning... Variation of a medieval siege weapon The floating arm trebuchet is a counterweight siege weapon which is a modern variation[1] of the medieval trebuchet. Their defining feature is free movement of an axle on the throwing arm,[2] and a linear drop channel for the counterweight. The design and construction of such machines is a popular project assignment in post-secondary engineering classes.[3][4] Basic design A traditional trebuchet, which is simple to engineer, consists of an arm resting off-center on an axle with a hinged counterweight at the short end of the arm.[2] The difference in the lengths of the two ends of the arm provides mechanical advantage. In contrast, a floating arm trebuchet features an axle on the arm freely moving along a horizontal glide track.[2] This allows for a higher drop height for the counterweight,[2] which is allowed to fall down a sturdy linear vertical "drop channel". The arm is on a moving axle and the torque acts on the entire structure, preventing stalling.[5] The forward motion of the axle as the arm rotates adds speed to the projectile end of the arm. This linear drop of the counterweight is more efficient in transferring potential energy to kinetic energy than the pendulum counterweight motion of a traditional trebuchet.[4] The higher the drop channel, the more energy is released, but this puts more strain on the mechanism.[6] The dropping of the counterweight forces the arm to swing to one side of the glide track and quickly jerk in the opposite direction to launch a projectile.[2] This pulls the counterweight upwards slightly after a launch.[2] The projectile can be launched at a high velocity.[7] Operation The floating arm trebuchet uses a counterweight held on top of a tall drop channel to transfer potential energy into kinetic energy.[5] A projectile is loaded into a sling at the end of the throwing arm. Upon releasing the trigger, the counterweight is allowed to drop through the channel.[2] This causes the wheel on the axle of the arm to impact the glide track.[2][8] which is usually held steady with strong support beams. While this is happening, the wheel is moved backwards by the torque acting on the arm from the counterweight.[2] The arm then jerks forward and releases the projectile from the sling. To reset the device, the counterweight must be raised back to the original height and locked in with the trigger mechanism. While the floating arm design can have a lighter frame than a traditional trebuchet because the overall forces produces are less,[5] the impact of the arm on the glide track will cause eventual damage and may need maintenance. Reducing the drop distance of the wheel axle to the glide track would reduce damage, but also reduce the range of the trebuchet. Trigger mechanism The most common of several trigger mechanisms is two eye bolts and a peg through both bolts.[2] The eye bolts are usually placed at the bottom of the frame, locking above the arm to prevent accidental release. In larger designs, the trigger system is applied at the top of the drop channel. Large scale designs require special trigger mechanisms that can hold the weight of the throwing arm. The sling / pouch The sling or pouch, which contributes to acceleration of the projectile and then releases it at the desired launch angle, is often made using polyester rope or other durable thin material. The release mechanism is a hook with a specific bend in its tip to determine when centripetal force will release one end of the sling, freeing the projectile to continue on its path.[6] Friction reduction A floating arm trebuchet has three points of contact where friction can interfere with efficiency. Friction when the counterweight is dropping down to the glide strike can be reduced by using silicone grease or a thin film of plastic on the drop channel.[6] Friction of the wheel on the arm axle against the glide track should be managed in a similar way. To reduce friction of the sling on the launch track, the track should have a smooth surface.[6] Potential uses The floating arm trebuchet loses the range advantage over regular trebuchet at very large scales, because the difficulty in construction of the drop channel and axle increases with size. A regular trebuchet is a better realistic war machine. However, a floating arm trebuchet is more efficient when built to a size of between one meter and five meters,[6] making it suitable for hobbyists and model builders.[9] These machines and their designers are frequently to be found competing in various recreational events, for example, pumpkin chucking contests.[10][11][12] References ^ Mark Denny (4 May 2007). 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