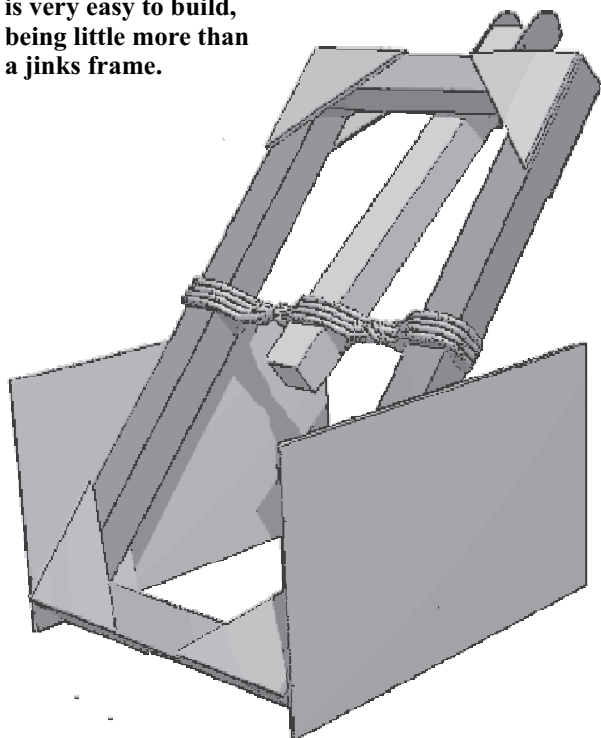
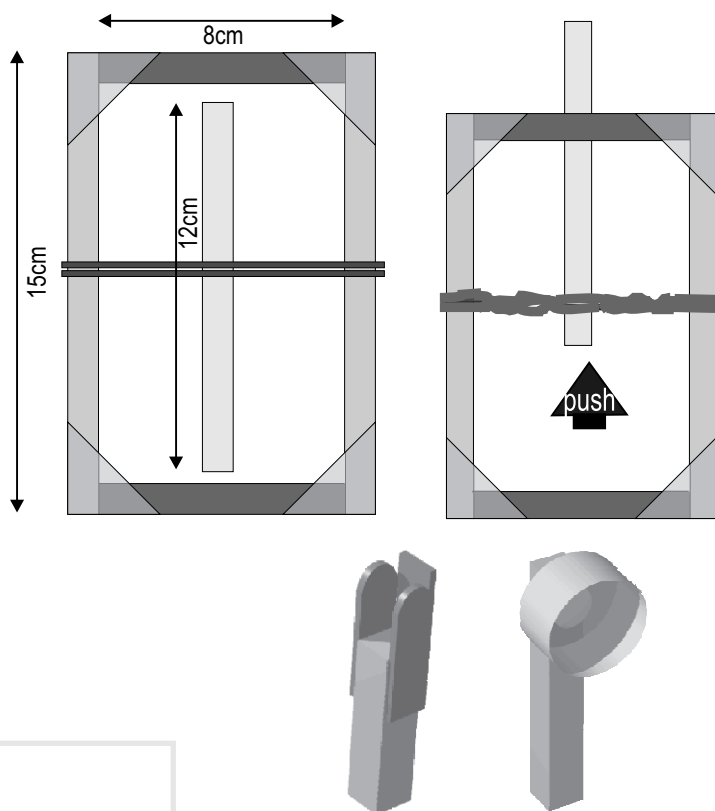


The onager is a very effective thrower that is very easy to build, being little more than a jinks frame.



An 'onager' is a species of wild donkey. It was the Romans who gave this name to the siege engine, which is also known, from the old French, as a Mangonel. It uses a 'spring' rather than the trebuchet's counterweight.



- Cut 2 pieces wood 15cm long [frame].
- Cut 2 pieces wood 8cm long [frame].
- Cut 1 piece wood 12 cm long [throwing arm].
- This should leave you no more than 1cm left over from one 59cm length of wood which will make an ideal 'projectile'.
- Make up a 'jinks' frame using card triangles to reinforce corner joints. These are shown transparent on the drawing, so that you can see how the wood of the frame is arranged. This arrangement is important, as the string puts a considerable strain on the corners.
- The throwing arm must be short enough to allow it to rotate inside the frame. Wind a length of string twice around the centre of the frame. Tie the ends together. The loops should not be too loose, but don't attempt to pull the string tight.
- Place the throwing arm inside the loop and inside the frame and 'wind up' the string. You'll only manage a couple of turns before it becomes too difficult to continue. At this stage push the arm through the twisted loop until one end is past the top of the frame and the other end is close to the string. *See diagram.*
- The arm is now locked and cannot unwind.
- You will need to devise some way of holding the projectile. If you're using a 1cm cube of wood then the illustrated solution is very straightforward. It is a lolly stick cut into three, then glued to the top of the arm. You could achieve the same result by using a piece of card, folded twice to make a channel. Glued to the BACK of the arm, it could replace the lolly stick parts.
- The second drawing shows a card 'cup' pinned to the arm. Something like this is ideal if you wish to throw a ping pong ball. The force can loosen the drawing pin however, so be warned.

Once the 'holder' has been attached to the arm you won't be able to dismantle the machine - the arm will be too long - any ideas?

This version is shown with two stiff cards for supports. Maybe a wooden construction would be better. What do you think?

There is no way to tell how far the onager will throw the projectile - it's not much use if the rocks are thrown right over the top of the castle! Can you design a calibrated scale, so that you can match the amount you pull back the arm to the distance the projectile will be thrown?

Every time the onager is used, the throwing arm hits the top crosspiece of the frame. All that is keeping this in place is the thin card of the triangles. Are they strong enough? Could you use a lolly stick, glued to the frame, to take the strain off this card?

Have you noticed what happens when you pull back the throwing arm?

Where is the energy stored when you pull back the throwing arm?

These are important questions, and it's all too easy to say that the twisted string stores the energy which is released when you let go the arm.

In fact it is the frame that stores the energy - not the string. When you twist the string it shortens and pulls the sides of the frame inwards. If you look closely you will see the sides of the frame bend. When the arm is released the wood straightens, untwists the string, which, in turn, rotates the throwing arm and flips the projectile. It's very much like an archer's bow.