



Build a scale to weigh bee hives
by [trearick](#) on November 14, 2010
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Intro: Build a scale to weigh bee hives

Portable Hive Scale

The goal is to build an accurate, electronic bee hive scale for under \$50 that allows anyone to weight 4 hives per minute – up to 250 lbs each – without materially disturbing the colony.

Problem

In my first year as a beekeeper, I had 2 out of 3 hives swarm. I think. I experienced a Tulip Poplar nectar flow. I think. I saw bees gather nectar – some days more than other days. I think. I say, I think, because I am led to believe that these things happened and I saw evidence that they did occur but I cannot be sure. And if they did occur, I cannot tell you if it was more or less than previous occurrences. But if I could have weighed the hive once or twice a day, I would have known for sure:

- * I would know the population of the runaway swarm ...estimated at 3500 bees per pound.
- * I would know the mass of nectar (and pollen) gathered during the day and of water evaporated at night. One pound equals roughly 1.04 US pints.
- * I would know the number of bees foraging by monitoring the loss of weight in bees leaving in the morning.
- * I would know the rate of growth of daily nectar collection as a nectar flow began.
- * I could compare my hives with the hives of others and with my own hives in previous years.

Lord Kelvin said, "To measure is to know." If I could weigh a hive, I would know a lot more than I do now...

How Does It Work?

The scale has 3 fingers or tongue that lift one side of the hive. The two outside fingers push down while the center finger lifts the hive. A \$16 electronic luggage scale measures the force required to separate the center tongue from the outside tongues. The force to lift up the back of the hive is roughly half the total weight of the hive.



step 1: Buy a luggage scale

This is the luggage scale that I bought off the Internet for \$16. You attach your luggage to these hand-held devices and lift them with the luggage attached. The scale beeps or stops changing value and then you read off the weight. Their maximum range is about 125 lbs – less than a lot of bee hives. However, if you measure the hive by only lifting one side - and assume that weight in the hive is more or less centrally distributed - then you are only measuring half the hive's weight. You have a loss in accuracy but your maximum range is now extended to 250 lbs.

You do not need to use exactly the same scale shown here. However, you may need to get creative in attaching the luggage scale to the scale handle.



step 2: Gather All Hardware Parts

Assemble all the parts in the photograph. You can find a complete parts list at http://www.beehacker.com/wp/?page_id=55. These are all available from Lowes or Home Depot.

Not listed are bolts, washers, and screws. I used mostly 1/4" x 1" rounded headed screws. You need washers to prevent the bolts from sinking into the wood and getting loose. Some of the parts are shown at right. Moving clockwise, the parts shown are

- * Electronic luggage scale
- * 1-1/2" corner brace (one of two needed)
- * tee hinge (one of two needed)
- * pulley as purchased. You need to break off the black hanger and drill out the axle.
- * steel mending plate shown in the middle of the picture
- * pulley assembly at top consisting of:
 - o two (2) 2-1/2" corner braces shown prior to bending of bottom flanges
 - o 1/4" clevis pin axle
 - o one 1" nylon spacer with .257" ID, cut in half to get 2 1/2" pieces
 - o one nylon pulley

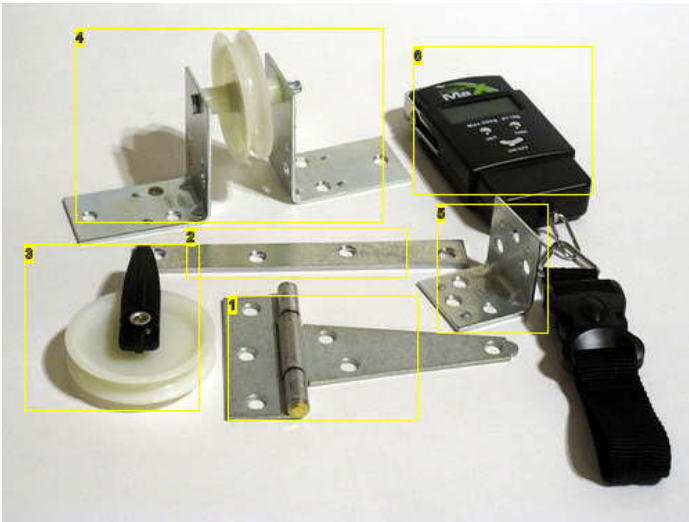


Image Notes

1. T-hinge, requires two
2. steel mending plate, requires 3
3. the pulley as purchased
4. The pulley as assembled with corner braces and clevis pin axle.
5. corner brace, two required, used to hold luggage scale to handle.
6. luggage scale

step 3: Drill and cut the wooden paddle and lever

Saw out the outline of the paddle in 3/4" plywood, oak, maple, hickory, or other tough wood. Make a lever that the user will use to pull the luggage scale with. Then drill the holes. Cut out the center tongue as shown at right. I used a band saw for the two long cuts down the tongue then used a jigsaw to join the two cuts. Sand and finish with a tough marine varnish.

A note on drilling the holes: the mending plates on the bottom share some of the same holes as the corner braces on the top. I could see no way around it. You just need to be precise in your drilling.

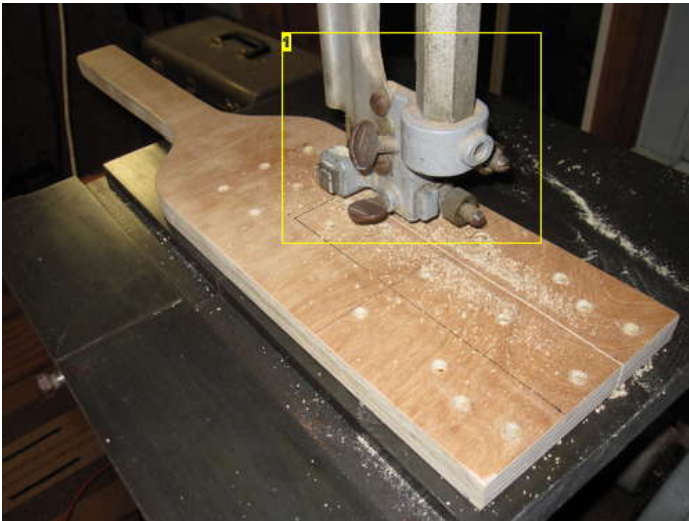


Image Notes

1. You don't need a band saw, though it making cutting fast and easy. Use a power saber saw or a hand coping saw.

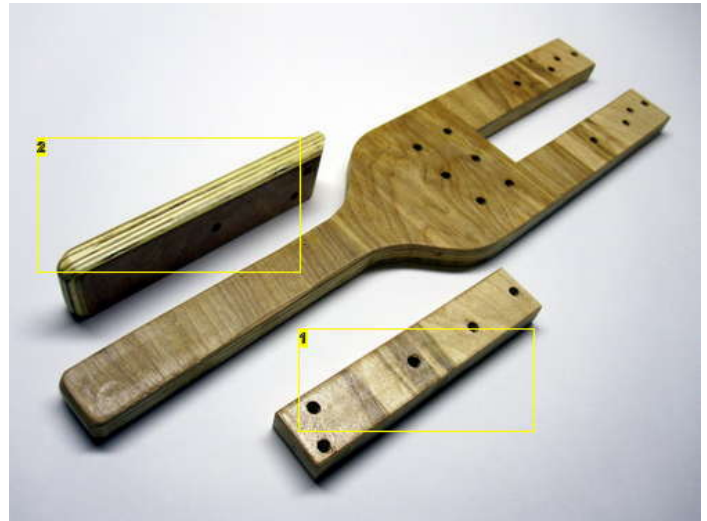


Image Notes

1. This is the center lifting tongue.
2. This is the lever of my first prototype. You should make your lever longer for more leverage.

step 4: Assemble the parts and attach the lifting cable

The parts screw together quickly. Note that the two smaller corner braces hold the luggage scale to the lever. In order to allow the luggage scale to move freely, I had to saw some plastic off of the side of the scale near the attaching screws. You may need a few slightly longer screws to hold the pulley assembly to the paddle and mending plates on the bottom.

The cable is 1/16" wire rope attaches the lifting tongue to the luggage scale with ferrules on both ends. The ferrule is used as a stop on the lifting tongue.

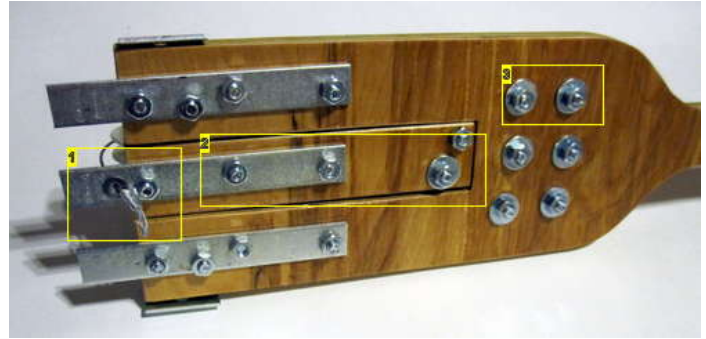
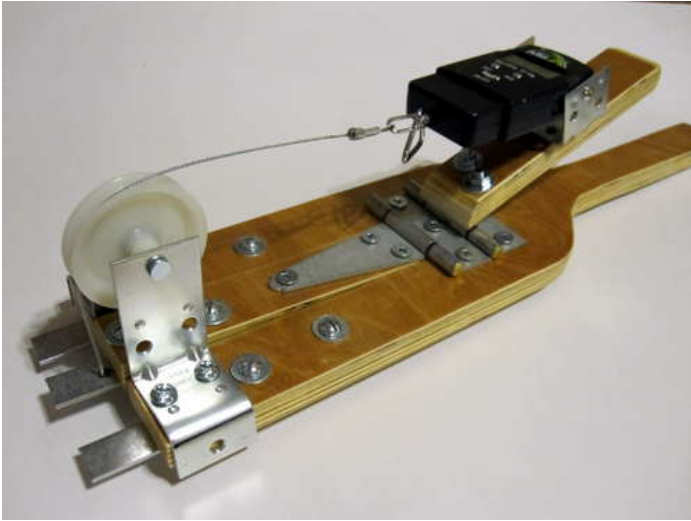


Image Notes

1. This shows the wire cable dropping through the center tongue and held by a small washer and a crimped ferrule.
2. This is the bottom view of the center tongue which lifts up the hive.
3. Make sure that nuts are on washers. Otherwise, they will sink into the wood and loosen.

step 5: Increase the Accuracy of your Pry Scale

The photo shows that I added two things:

1. A red plastic level insures that the scale is held consistently each time I weigh the hive.
2. A threaded insert, bolt, and 1/4" screw are shown under the lever. This insures that the tongue is lifted a consistent amount each time.

Both of these improvements will improve the accuracy of your hive scale.

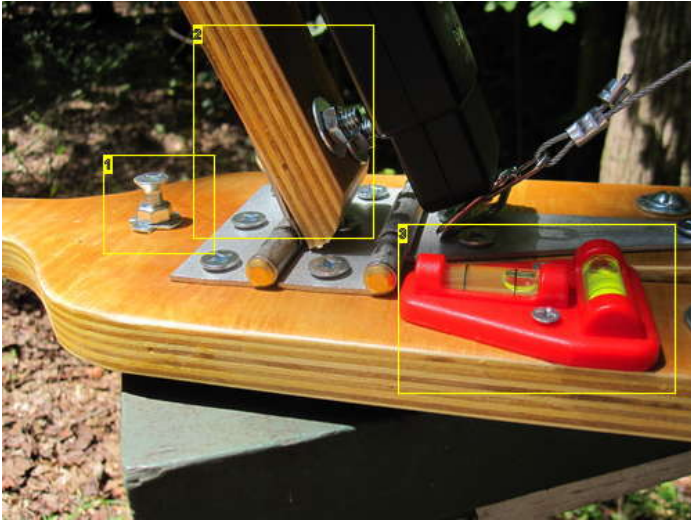


Image Notes

1. screw, bolt, and threaded insert.
2. Lever
3. a plastic bubble level

step 6: Create a slot stick

In order to pry up one end of your hive, you need a slot that you can insert your pry scale into. You can either route out a slot on your bottom board or deep body or simply build a stick like the one shown that you will simply leave under the backside of your hive.



step 7: Contribute to a NASA-sponsored research project

There is currently a NASA-sponsored nation-wide research project (<http://honeybeenet.gsfc.nasa.gov>) that asks volunteer beekeepers to take daily weight measurements of their bee hives. The data is used to estimate when nectar flows begin in order to answer how changing climate effects honey bees.

For more information on this project and many other projects for beekeepers, hackers, and beehackers, visit <http://www.beehacker.com>.



Image Notes

1. Embedded temperature and humidity sensors. Smart bee hive!

Related Instructables



The Beehive Swap by Mother Natures Son



Computer case beehive by alois



Honey Harvest and Extraction by neighborhoodfruit



Harvest and Extract Honey by fritz.bogott



Vegan Lip Balm by scoochmaroo



Building a Honey Extractor (using an 'antique' washing machine) by doozer_not_fraggle

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Comments

9 comments [Add Comment](#)



riff raff says:

Very cool. Kind of a mechanical/electronic solution.

I just put each hive on its own Nintendo Wii-Fit Board. :-)

Nov 18, 2010. 2:04 PM [REPLY](#)



twighahn says:

what is the purpose of this thing?im new to bee keeping.i always thought one build the hives buy the bees and that's it

Nov 18, 2010. 7:39 AM [REPLY](#)



trearick says:

I can understand your confusion. Very few beekeepers are able to weight their hives. The only other alternative to this pry scale is to buy an antique iron platform scale from eBay. Of course, that only takes care of one hive. At \$200 a pop (don't even think about shipping), you won't see too many beekeepers using platform scales.

According to a recent survey of beekeepers last year, the largest cause of colony death over winter was not CCD but starvation. The bees collect honey to generate heat to survive winter. What, you thought they did it all for you? Without enough stores, they die. Grizzled old beekeepers will tell you that you can lift your hive and tell if they need feeding. Ooookkaaay. But why leave it to guesswork?

For more information on this invention (and other inventions), visit www.beehacker.com.

Nov 18, 2010. 10:25 AM [REPLY](#)



Mother Natures Son says:

Well...often you can. However, in order to keep your hive healthy, monitor conditions and (of course) collect honey, it's important to work with your bees once in a while.

You wouldn't scatter some seeds and expect a beautiful, lush garden a couple of months later. Beekeeping's just like any other form of agriculture; without putting work into it, you can't expect great results.

One of the biggest problems you encounter is swarming. Swarming is how colonies propagate, and it involves the queen, along with a large portion of the workers, leaving the hive to start a new one elsewhere. Your workforce is hugely diminished, and raising up replacement workers and a new queen uses a lot of honey, meaning you won't get as much honey when you harvest. You can forestall this by a number of methods, but in order to do so, you have to realize that it's going to happen. A scale can help you figure that out.

Nov 18, 2010. 9:43 AM [REPLY](#)



twighahn says:

what would one do to prevent this?

Nov 18, 2010. 11:08 AM [REPLY](#)



trearick says:

Feed the bees with 2 parts sugar and 1 part water in a frame feeder. Of course, if it is too cold for the bees to get to the food source, they will starve - even if there is honey in the comb.

Nov 18, 2010. 12:24 PM [REPLY](#)



WilderLust says:

wow... i am learning a lot. i have never kept bees but am planning on doing so once the conversion of my property is further along. i plan on getting rid of all the grass and planting a lot of bee loving wild flowers and many more fruit trees. i want my 1 acre to be all food generating.

i live in N. Idaho which is not the warmest place on earth. are you saying that in cool climates like here, i have to worry about the bees getting food even if the hive has honey because the honey is too cold for them to get? is there a way to warm the hive? i am building green houses... would it be useful to have hive against the green house to warm in a bit in winter? i was not thinking about these things at all... thanks for bringing it to my attention :-)

Nov 18, 2010. 12:45 PM [REPLY](#)



carlislejt says:

Outstanding! Awesome job.

Nov 18, 2010. 6:19 AM [REPLY](#)



Warholm says:

Really neat.
Very well thought out and made.

Nov 16, 2010. 1:37 PM [REPLY](#)