Cheap Honey Extractor

by **dusanmal** on September 30, 2015

Intro: Cheap Honey Extractor

Honey extractor part list:

1. One 3/8" stainless steel threaded rod 36" length, 9$ at HomeDepot
2. One Honey Gate, 7$ at Amazon
3. Two 6"x6" Lazy Susan cabinet bearings, 4.50$ each at HomeDepot
4. One Food grade plastic 15 gallon barrel, 30-35$ on eBay depending on location
5. One 48"x1-3/8"x1/16" steel flat punched bar 6$ at HomeDepot
6. One 36"x1-3/8"x1/16" steel flat punched bar 4$ at HomeDepot
7. One 24"x48" 1/2" steel netting 10$ at HomeDepot
8. Ten 3/8" nuts, washers, lock washers 7$ at HomeDepot
9. Eight 1-1/2" 3/8" bolts 2$ at HomeDepot
10. Two 6"x6"x3/4" untreated wood with 3/8" hole in the middle, scrap wood
11. One 9"x6"x3/4" untreated wood with 2" hole in the middle, scrap wood
12. One 16"x6"x3/4" untreated wood with 2" hole in the middle, scrap wood
13. Four 3/4"x1-1/4"x18-1/2" untreated wood, scrap wood
14. Four 4"x2-3/8"x1-1/2" untreated wood, scrap wood
15. One 17"x17" x0.418" construction sheeting, scrap wood
16. Two 6"x25-1/4""x0.418" construction sheeting, scrap wood
17. Three 6"x2-3/8"x1-1/2" untreated wood, scrap wood
18. One 1/2" x 18" PEX water pipe, scrap piece and optional/non-functional
19. Number of scrap screws fit for the purpose (mostly for the base construction)
20. Consumable: shellac, some paint

Goal was to use parts typically available at home/shop/garage, however the total cost if one must purchase most of the parts is still relatively low 75-80 depending on your location and variable eBay pricing for the most expensive part - the barrel.

Tools:

Saw, screwdriver, socket wrench, drill and appropriate size bits, 2" or 2-1/8" hole cutter saw (typically part of door handle installation kit), hacksaw, pliers, tape measure. Paint brush or paint spray.

Inspiration for the project:

As a hobby-beekeeper I have typical bee-hobbyist need for a tool which is, because of its commercial use, typically expensive, keeps high price on used market and rarely appears on the used market: honey extractor. In the recent years there are some relatively cheap models, however of a very suspect quality for still significant 150$ price range, typically capable of tangential extraction of two frames at the time (not very efficient even at the relatively low cost). Rental/co-op use is a hassle for this purpose as well.

Not only because of the lack of honey-extractor but because of my choice to keep bees on a foundation-less frames, which by definition have a weaker comb (just beeswax laid by the bees), easily damaged by extracting forces, in the first couple of years I extracted honey using gravity extractor - essentially upside-down hive body with some spacers over a filter and collecting bucket below. That method is cheap and it works but is very, very slow (4-5 days per 8-9 frames) and it has its own inconvenient demands (keeping highly controlled cleanliness, temperature and humidity over days/weeks).

Hence, I started thinking about building an extractor myself, on the cheap, based a lot on the parts I have laying about. Aimed at extraction of a relatively small number of frames with good control of extracting conditions for foundation-less frames. I use only medium suppers/frames in my hives, so aim was to size the extractor for them. As most of us have a good rotational, adjustable speed tool: electric drill, aim was to have it power the system and avoid complications of hand-cranking (drill can simply attach to the axle). Amount of honey extracted at the time, so that extractor does not need to be emptied frequently, I chose to be on the order of my typical hive-body production - about 10000 cubic centimeters or about 20-something one pound honey jars.

I searched the Internet for existing projects of such type and found few. The greatest inspiration have been found here, on the Instructibles, a project by "turbobug" . There are significant differences between my project and his, but combine them and apply to your own "parts bin" and the result will have good chances to be useful to you.

Finally, looking both at the "turbobug" project on Instructibles and various other projects for self-built honey-extractors on the web, I find it important to underline the last project requirement, frequently not in part or whole followed by existing designs on the web: food safety. Though to us most plastics appear very similar, there is a reason why only some plastics are labeled "food safe". Other types may interact and leech poisoness substances into the food as well as trap organic material and breed bacteria in it. Hence, any plastics used must be food safe. For other materials that may come into the contact with the honey I required that they by themselves are not impregnated with poisoness substances (ex. only untreated wood) and that they are non-rusting (ex. stainless steel). Also, I decided to follow my cultural background practices when it comes to honey production apparatus and cover all metallic and wooden materials which may come in the contact with honey with shellac, as it is tradition in the country of my origin.

Step 1: Building It

Bucket:

Having all the goals in mind I arranged my project around 15 gallon food safe bucket I had. At 14" diameter base and 26" height it defined size and the scope of the project. Further decisions were based on that fundamental limitation. I happened to have one with the closed top (just the spout for putting things in-and-out on the top), which required me to cut it off. If you are purchasing one for this purpose, availability and prices are similar for similar buckets with so called open-top (those have separate removable lid on the top), use those and avoid one building step. If you are cutting the top of, be aware that most likely the bucket at the top will somewhat distort into an ellipse. Be sure that you orient the barrel in its stand later in the project so that the left and right supports face the widest elliptical sides of the barrel and hence, push them back into the circle. Some distortion will remain, that's why we are using rotor diameter with plenty of tolerance.

Rotor:

Size of the bucket and need to extract medium size frames defined that I can't extract radially (with frames perpendicular to the walls of the bucket) because extraction force drops with radius and a good portion of a frame would have experienced very weak extracting pull due to the rotation. Medium frames are just under 6.5" high and free radial space is less than 7" for 14" diameter bucket - almost no extracting power at the base. For tangential extraction (frames parallel to the tangent on the bucket wall) it turns out that I have just enough space to comfortably extract 4 medium frames at the time (on one side, tangential extraction requires flipping frames to extract the other side separately). Extractor will do fine for 4 small frames too but it can't extract deep frames as is. You could build another rotor if you need to extract deep frames, size of the bucket will support extraction from two deep frames at the time. Ability to hold 4 medium frames tangentially is defined by the height of medium frame, just under 6.5". Assuming that the rotor is 12" diameter, 6" radius, which leaves 1" gap between the rotor and the 14" diameter, 7" radius bucket side (for tolerance, wobbles and honey to drip down) - maximum theoretical frame size would be about 8.5" (solving a right angle triangle with two sides of 6" and third width available toward the bucket wall). In practice, some of 8.5" will be used by vertical supports of the rotor and remaining amount is gap for easy frame inserting/removal. Four frames capacity also implies a good starting point for a rotor design: it will be supported at each end (bottom and top) by a cross structure of 12" size, hung in the middle on a 3/8" axle. Top and bottom crosses ends supported and connected to each other at the vertical dimension defined by the frame length plus some gap: 18-1/2". I decided to support the frame in the "basket" made by stretching a 1/2" eye-size steel netting in the narrow U shape of the width slightly larger than the frame width in between each of four gaps between cross support ends. Netting will not only hold the frames but prevent potential flying-off of some chunks of my foundation-less comb on the frames. Materials choice for parts of the rotor was driven by the desire to make it structurally the best and simple in construction. You may freely change the materials to what you have at hand and adapt design to those materials. For crosses at the top and bottom of the rotor I used flat punched steel bars, four 12" pieces cut from 48" long bar. For vertical supports connecting ends of these two cross pieces I chose 3/4"x1-1/4"x18-1/2" wood. 1/2" netting "basket" that supports the frames will be hung onto those supporting pieces by the use of staples. Side note on the 1/2" netting as used in my exact example and in general: As you can see from the pictures, I did not have the whole roll of 24"x48" 1/2" steel netting. I have had remnants from the another project. If you need to purchase this netting, cut it in 3 pieces of 8"x32" to use as 3 U shaped 15.5" tall holders on three out of four frame positions. Remaining position can be covered by one 8"x24" plus one 8"x8" piece from the whole 24"x48" roll. In my particular case I used my own remnants so that each position have U shaped, be it shallower holder at the bottom and than on top front and back narrower holding strip. Hole/space in between these two strips is just fine as long as frame is supported and prevented from slipping at the bottom and top.

Bearings:

Though one could potentially avoid usage of bearings for the rotors for a small, non-demanding operation, bearings are always a better choice. I chose to mount top and bottom of the rotor on an inexpensive, easy to mount Lazy Susan cabinet bearings. They are typically 6" square with large circular gap in the middle, support 400-500lbs (way more than needed) and work well at extractor-desired speeds of no more than 200 rpm, most likely in the 100 rpm range. To attach these bearings to the rotor I

decided to use 3/4" 6"x6" planks of wood to which it is easy to attach to the bearing and the top and bottom crosses of the rotor using wood screws. In addition, the main axle (36" 3/8" threaded rod) will pass through 3/8" hole in the middle of these mounting wood planks, to be centered and attached by tightening nuts, washers and lock washers on each side of each plank.

Supporting and Centering the Rotor:

Rotor needs to be supported about 4" off the bottom of the barrel for my desired 20-something pounds of honey capacity so that honey does not touch the rotor. That defined how to mount the rotor in the barrel and support the whole system from the outside: On the bottom, the bottom of the bottom bearing is attached to a 6"x9" 3/4" wood plank, standing on four 4" high wooden legs in order to stay 4" above the bottom of the barrel. Free sliding of this platform is prevented by spacing pairs of the legs at the width of steel flat punched bar. Such bar will be attached to the walls of the barrel, centered, at just under 4" from the bottom and in addition to preventing sliding of the rotor, it plays a part in the structural integrity of the extractor as it will be seen further. 6"x9" wood plank also has one 1-1/2" long 3/8" bolt protruding below it, corresponding to the hole on the metal bar and center the bottom of the rotor. On the top, the top of the top bearing is connected to a 6"x16" wood plank. This is the top support of the rotor. On each outside end of it, it uses upward protruding 1-1/2" 3/8" bolts that attach to the outside support, create structural integrity and center the top end of the rotor. Both the bottom 6"x9" support plank and the top 6"x16" one have 2" hole in the middle, to allow access to the nut securing the bearing to the threaded rod/axle.

Platform:

Extractor bucket with the rotor inside sits on the structural platform. I had handy construction sheeting for this but any similar material would do. 17"x17" inch base has two 6"x25-1/4" (this height is defined by my choice of where to cut the top of the barrel and how tall to make the rotor) planks attached at the middle, tightly hugging the barrel. The very bottom is attached to the base with wood screws, 4" from bottom each is attached to the barrel and the structural steal rod near its bottom through the holes drilled in the bucket, through which 3/8" bolts pass tightly. At the top these side planks attach to the 6"x16" top plank via 3/8" bolts. Five 6"x2-3/8"x1-1/2" pieces of wood structurally assist connections on the structural platform. This is best seen in the images. Honey gate spigot should be installed by drilling a hole for it near the bottom of the barrel, perpendicular to the bottom structural steel rod, at the front of the barrel. Notice that by design (mounting side of the Honey Gate inside of the bucket) it must stay a little bit above the very bottom (measure your honey gate carefully for this purpose before drilling the hole!). Once honey is drained to that level, little left behind can be removed by tilting the bucket and using some kind of spatula to scrape the bottom of the barrel. By the very sticky nature of the honey, even if the gate was flush with the bottom you'd need to tilt and scrape to get it all...

Minor Adjustments and Details:

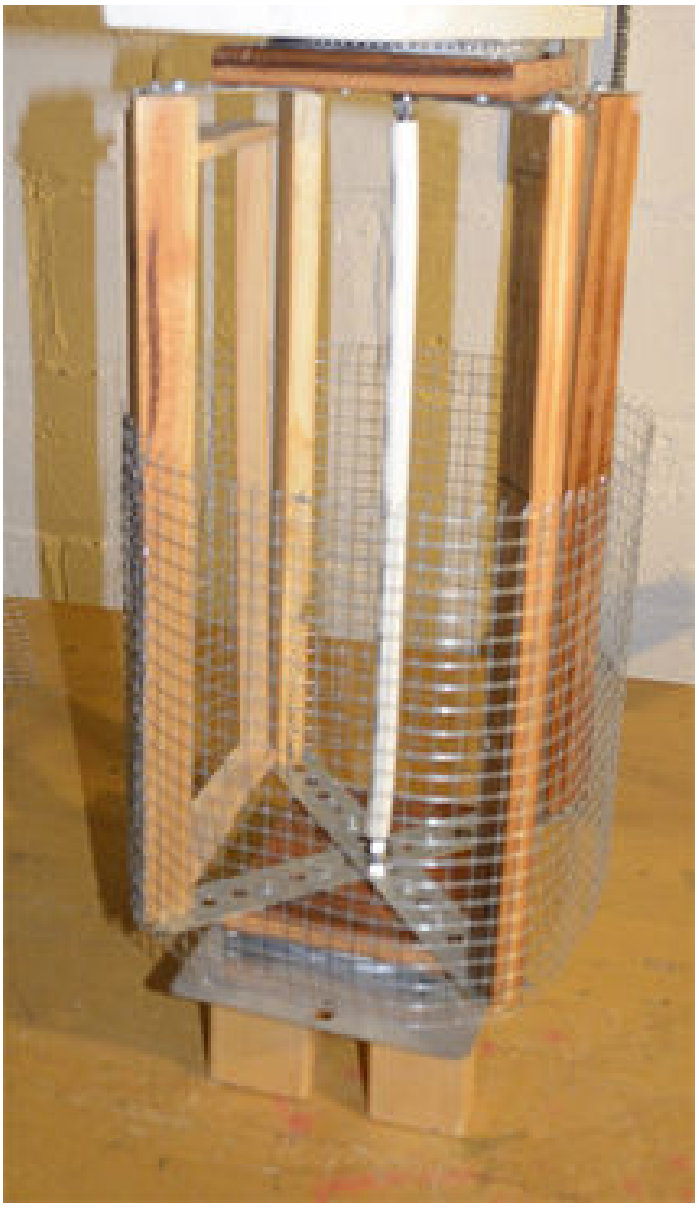
Top of the barrel, either cut-off as in my case or removable one can be used to protect honey in the bucket from debris and if splattering occurs during extraction, to prevent it. My cut-off top I notched to fit over structural top plank and drilled centered 2" hole to allow for the axle/threaded rod in the center. Not exact or tight fit but it works for some basic protection.

All non-plastic parts used in the construction: wood planks, metal rods, steel netting, bearings, nuts, bolts and washers; were coated with 2-3 light spray coats of shellac well (days) before assembly. I painted all outside structural elements with the paint I have had at hand. Looks better but this is not functional need.

I slid (before final attachments) a 1/2" PEX water pipe of just under 18-1/2" in length over the center threaded rod of the rotor. This serves no functional purpose and can be omitted. I already had the pipe and I see some cosmetic and hygienic benefit of protecting the threaded rod threads. However, it is really optional.

On the very top of the rotor axle I tightened 3 3/8" nuts against each other in order to provide a secure and simple connection to the drill. Hence, to operate the extractor one would insert in the drill appropriately sized socket and place it over the top nut, slowly increasing speed to about 100rpm, observing and adjusting to the effects.

Finally, as in any project some plans needed to be adjusted in production. In particular, I wanted to save additional 1/2" in height of the rotor so I replaced the very bottom wood board that attaches to the bottom bearing with a similarly sized metal plate I have had. Also, due to the limited amount of 1/2" netting I had, instead of a U shaped basket I just wrapped 12" wide netting all around the rotor, holding the frames from going outward. To prevent frames from falling through on the bottom I added an additional "cross" on the bottom composed of 5" long, 1/2" wide strips of wood shifted in the relation to the structural metal cross for 45 degrees, holding the middle bottom of each frame.




L
R