SDII T9 - Ripple Effect

Instruction Manual

Introduction

What is It?

The mesquite bean harvester is a mechanical device designed to provide an efficient harvesting technique that will expedite the mesquite bean harvesting process. The mechanical harvester will significantly reduce the time and manual labor necessary to harvest mesquite bean pods every harvest season.

What's the Problem?

Current mesquite bean harvesting methods are performed primarily by hand. This technique is labor-intensive, dangerous (large, sharp thorns on mesquite trees may cause injury), and inefficient. Hand-picking mesquite beans requires a lot of effort and time from the part of the farmers. Manually harvesting mesquite beans is not necessarily something that can help a farmer increase its mesquite bean yield and thus their supply of mesquite bean products.

Solution?

Our task is to develop a device capable of harvesting mesquite beans in a much more efficient manner. This will not only save time for mesquite farmers, but also provide a safer alternative to hand-picking.

Assembly

List of Components for Assembly:

- Lower Pillow Block
- Upper Pillow Block
- Lower Pillow Block Mount
- Upper Pillow Block Mount
- Lower Motor Mounts
- Upper Motor Mounts

- Main Hook frame
- Small Mass
- Medium Mass
- Large Mass
- Steel Shaft
- Shaft Collars
- Speed Controller + Case
- 12V Batteries + Case
- DC Motor
- L Brackets
- Polycarbonate Sheets
- 3/8” - 16 Bolts (6 ½” length)
- 3/8” - 16 Bolts (1” length)
- 1/2" - 13 Bolts (1 ¼" length)
- 1/4" - 20 Bolts (1 5/8” length)
- 1/4" - 20 Bolts (¾" length)
- 1/4" - 20 Bolts (2” length)
- Flagpole Sections
- Hook Connector
- Hook Filling

Tools:

- Allen Key Set
- Two Adjustable Wrenches
- Ratchet Wrench

Steps

1. The first step involves mounting the two lower motor mounts onto the hook frame. In this case, two 3/8” bolts that are 6 ½” in length are used to connect the mounts to the hook frame. The appropriate nylon nuts are then screwed onto the bolts to fix the lower motor mounts in place. For this step, two adjustable wrenches are used. One holds the bolt in place while the other is used to screw on the nuts. These two mounts serve as a platform for the motor to be secured onto the hook frame.

2. Next, the lower pillow block mount is bolted onto the hook frame. A 6 1/2” long 3/8” bolt is again used to connect the mount to the hook frame. A nylon nut is then screwed on using

an adjustable wrench. The lower pillow block mount is used to fix the pillow block closest to the motor in place. It also helps align the bearing with the shaft of the motor.

3. The motor can now be placed within the two lower motor mounts. Once the motor is in place, the two upper motor mounts are bolted down to the lower motor mounts using four 3/8” bolts that are 1 inch in length. Each bolt is hand tightened at the same time to avoid any misalignment of the bolts. An adjustable wrench is then used to screw the bolts in the rest of the way. The upper motor mounts are used to fix the motor in place and prevent it from sliding out. This is very important since the hook will be experiencing heavy vibrations.

4. The first pillow block is then mounted onto the lower pillow block mount using two ½” bolts. Again, the two bolts are hand tightened at the same time to help align the pillow block. An adjustable wrench is used to make sure the bolts are tightened all the way. The bolts may need to be loosened again to help align the shaft with the two pillow blocks. Once the shaft fits through, the bolts can be tightened again. The pillow block helps protect the motor from the vibrations and maintains the correct position for the rotating shaft.

5. Now, the shaft with the offset mass is fitted through the lower pillow block. The upper pillow block is then fitted onto the other side of the shaft. Note that shaft collars are added to each side of the offset mass to prevent it from sliding. In addition, two shaft collars are added to each side of the upper pillow block. In this case, these shaft collars prevent the shaft from slipping out. One end of the shaft is connected to the motor via the spider coupling. Make sure each shaft collar set screw is tightened. Once the shaft is fitted through, tighten the 1/2" bolts used to secure the pillow blocks in place.

6. The polycarbonate case is then bolted onto both pillow block mounts. The case surrounds the offset mass and is meant to protect the user as well as prevent any protruding branches from interfering. Eight 1/4" bolts are used to fix the case in place.

7. The battery case is then bolted onto the hook frame behind the motor. Two 3” long 3/8” bolts are used to secure the battery case. The battery case will house the two batteries used to power the motor and speed controller.

<u>Electronics</u>:

- To start up the electronics, look at the bottom of the speed controller. The clamps for the positive and negative ends of both the power supply and motor are labeled.
- Use a screwdriver to clamp conducting wire into these clamps.
- Place the speed controller and its contents into the speed controller case.
- You can use glue to keep the dial in place.
- Then, place the lid on and screw it in place.
- Once the lid is on, place the dial knob.
- Next, place the two 9-volt batteries into the case.
- Cover the exposed wires with electrical tape to prevent them from touching.
- Then, slide the wires through the circular holes and push the batteries inside.
- Remove the electrical tape and tie the two red wires together.
- Then, attach another wire extending from the tied ends of the exposed wire to the speed controller. Do the same for the black wires.
- When connecting the battery wires to the speed controller, make sure the dial is turned all the way to the left. This will ensure that the device does not power on while setting up the device.
- After installed, pressing the green button on the speed controller should power on the device, and turning the knob will adjust the speed of rotation.

Refer to our assembly guide video to aid with the assembly process:
https://youtu.be/CuuRvcgUr2A

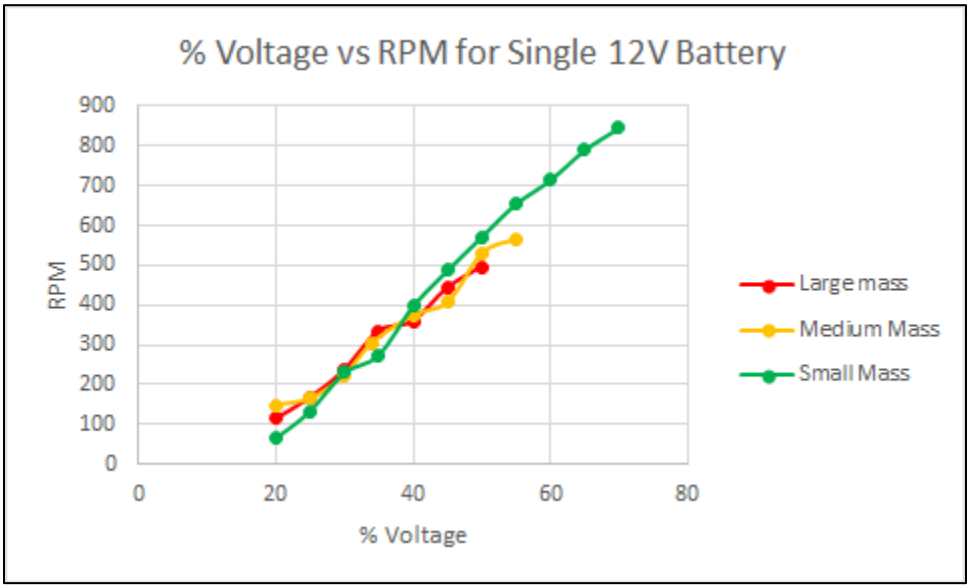
Speed Controller

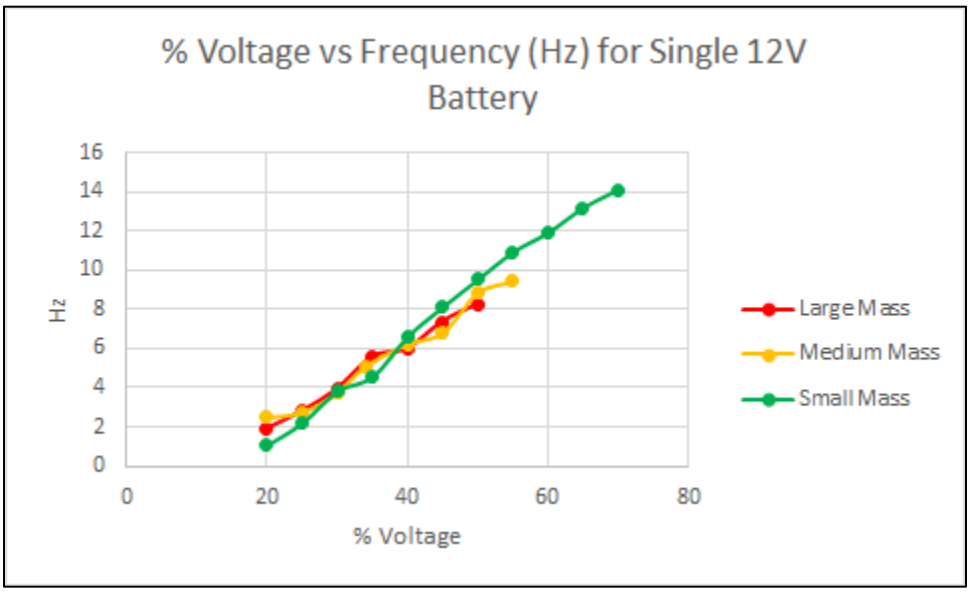
Tachometer data:

L mass, single 12 V battery		
% voltage	RPM	HZ
20	115	1.916667
25	168.4	2.806667
30	237	3.95
35	334.6	5.576667
40	359.7	5.995
45	442.2	7.37
50	495.2	8.253333

M mass, single 12 V battery		
% voltage	RPM	HZ
20	148.2	2.47
25	164.8	2.746667
30	223.2	3.72
34	305.2	5.086667
40	374	6.233333
45	408.2	6.803333
50	531.5	8.858333
55	566.5	9.441667

S mass, single 12 V battery		
% voltage	RPM	HZ
20	64.1	1.068333
25	132.7	2.211667
30	229.7	3.828333
35	274.3	4.571667
40	396.7	6.611667
45	487.5	8.125
50	572	9.533333
55	655.5	10.925
60	715.5	11.925
65	791.2	13.18667
70	846.8	14.11333





NOTE: The above charts and graphs also apply for two 12V batteries wired in parallel as in the instructional video.

Operating the Device

The green button on the speed controller toggles power to the device, while the dial controls the speed of rotation. Based on experimental data, it was found that lower frequencies tend to cause the most vibration of the mesquite tree branches (speed controller settings of about 30 – 35%). This is about 5 Hz.

Charging

How to charge the batteries:

To charge the batteries on the device, pull out the wires from the umbilical cord. Disconnect the battery wires from the speed controller. Untie the two 12V batteries from each other. Be careful not to accidentally short the batteries (don't let the red and black wires of the same battery connect). Take one of the 12V batteries and connect it to the included battery charger. Plug the battery charger into a wall outlet and place the red wire of the battery into the red slot, and the black wire of the battery into the black slot. Once the first battery is charged, remove it and charge the second battery in the same manner. Once both are fully charged, they can be re-installed on the device.