**MDF Rose Engine Lathe 2.0**

**with Stepper Motor Drive**

**A picture containing indoor, table, desk, sitting

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**Instructions for Building**

**Jigs, Fixtures, & Add-Ons**

**Version 1.4**

**05 August 2022**

This document is intended to help one familiar with the MDF rose engine to easily build the identified jigs, fixtures, and add-ons. You can purchase these from us at [www.ColvinTools.com](http://www.ColvinTools.com), or build them yourself.

As you get started with building these jigs, fixtures, or add-ons to the MDF rose engine lathe, please consider making the machine exactly according to the outlined instructions. There are lots of ways you can modify this, and, quite frankly, the MDF rose engine encourages experimentation. But it is best to attempt those modifications after understanding how it works. Some ideas which sound grand may not appear so after understanding how the machine works (we speak from experience).

If you have any questions on the terminology in this document, check out the “Ornamental Turning Book of Knowledge” ([www.OTBoK.info](https://www.otbok.info/)).

Throughout this document, I’ve tried to show the MDF in its native color of tan/brown. There are differences in the images I captured from the CAD drawing made, but those are not representative of the machine’s differences.

The added pieces are typically shown in different colors to ensure they stand out from the MDF rose engine lathe.

Unless otherwise noted, the MDF is ¾” thick.

If you have any questions, please contact us at [ColvinTools@Gmail.com](mailto:ColvinTools@Gmail.com).

Good luck and we hope you enjoy this machine as much as we.

Rich Colvin & Jack Zimmel

Permission is not granted to manufacture these for sale.

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# Amplitude Adjuster

The amplitude adjuster for the MDF Rose Engine Lathe 2.0 is shown installed to the right.

Also shown are some extra rubbers. Note that the RS1 has been flipped 180° to open up more space.

Details for building this follow the bill of materials.



Graphical user interface

Description automatically generatedThis diagram shows the AA removed from the MDF Rose Engine Lathe 2.0.

## Bill of Materials

Parts required for building this are below.

| Item # | Item | Qty | Source | Source  Part Number | Comments |
| --- | --- | --- | --- | --- | --- |
|  | **MDF Parts** |  |  |  |  |
| AA1 | MDF Spacer Block | 1 |  |  |  |
| AA2 | MDF AA Alignment Block | 1 |  |  |  |
|  | **Machined Parts** |  |  |  |  |
| AA3 | Aluminum bar, ¼” x 1” | 1 |  |  | A piece 7 ¾” to 8” long is needed.  Used for the horizontal bar. |
| AA4 | Aluminum bar, ¼” x ¾” | 2 |  |  | Two pieces, 12 ½” to 13” long (each) are needed.  Used for the vertical bars. |
| R1 | Rubber, Pointed | 2 |  |  | Shape  Description automatically generated |
| R2 | Rubber, 2” Radius | 2 |  |  | A picture containing shape  Description automatically generated |
| R3 | Rubber, Flat | 2 |  |  | Square  Description automatically generated with low confidence |
|  | **Other Parts** |  |  |  |  |
| 101 | Carriage Bolts, ¼”-20, 4” long | 2 | McMaster-Carr | 93548A560 |  |
| 102 | Washer, ¼” | 8 | McMaster-Carr | 90107A029 |  |
| 103 | Lock Washer, ¼” | 1 | McMaster-Carr | 92146A029 |  |
| 104 | Nut, ¼”-20 | 5 | McMaster-Carr | 95505A601 |  |
| 105 | Bolt, ¼”-20 | 1 | McMaster-Carr | 90272A196 | Used as the axle for the vertical bars (AA4). Cut down per drawing on pg. 11). Need 1 ½” of unthreaded area. |
| 106 | Spacer, ¼” ID, ½” Long | 1 | McMaster-Carr | 92510A765 |  |
| 107 | Collar, ¼” ID | 1 | McMaster-Carr | 6432K12 |  |
| 108 | T-Track Bolt, ¼”-20, 2 ½” to 3” Long | 2 | McMaster-Carr |  |  |
| 109 | T-Track Nut, ¼”-20 | 2 | McMaster-Carr |  |  |
| 110 | Bolt, #8-32, 5/8” Long | 2 | McMaster-Carr | 90272A196 |  |
| 111 | Knurled Nut, #8-32 | 2 | McMaster-Carr | 92741A120 |  |

## AA1 – MDF Spacer Block

This spacer block is used to attach the AA to the headstock at the correct distance. You will need to drill two holes in H4L on the headstock to match the thru holes.



5 ¼”

2 7/8 ”

**Top View**



1 ½”

1 ½”

Holes drilled for ¼” bolts.

“G” bit recommended.

**Side View**

## AA2 – MDF AA Alignment Block

This is used to help keep the vertical bars aligned to the rosettes.



2 ”

3/8 ”

3/8 ”

3/8 ”

1/2 ”

3/4 ”

3/4 ”

5 3/4 ”

2 1/4 ”

1 3/8 ”

**Top View**



Holes drilled for ¼” bolts.

“G” bit recommended.

Center in slot for T-Track.

**Side View**

**Text

Description automatically generatedNOTE:** There is also a 3D printable version in the 3D Printed Parts manual in the MDF Rose Engine Lathe 2.0 Library (<https://mdfre2.ColvinTools.com>).

## AA3 – Horizontal Bar

The horizontal bar is made from 1” x ¼” aluminum bar.



Hole drilled for ¼” bolt.

“G” bit recommended.

½”

½”

4”

7 ¾”

## AA4 – Vertical Bar

The vertical bars are made from ¾” x ¼” aluminum bar. There are two of these.



½”

8”

Hole drilled for ¼” bolt.

“G” bit recommended.

Hole drilled for #8-32 bolt.

#18 bit recommended.

12 ½” to 13”

## 105 – AA Lever Arm Axle

This is made from a partially threaded bolt. It can be cut with a hack saw, but be sure to smooth off the end, and chamfer it.

The one specified has sufficient unthreaded space.



~1 ½”

End is smoothed and chamfered after cutting.

## Square Description automatically generated with medium confidenceR1 – AA Rubber

Two are needed at any one time. More can be made. The basic shape to start with is like shown to the right, with measurements below.



½”

¼”

¾”



2 3/8”

2 3/8”

Through hole drilled for #8-32 bolt. #18 bit recommended.

1 3/16”

3/8”

Partial hole drilled for head of #8-32 bolt. Needs to be > 0.350”. 3/8” Forstner bit recommended. Drill this first. The point marks where to drill the through hole. Depth of the partial hole is 0.100” to 1/8”.

**Flat Rubber**

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**Pointed Rubber**

### Various Rubber Shapes

Some examples of rubber shapes are below. Others can be made to accomplish the desired results.

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|  |  |  |
| --- | --- | --- |
| **Pointed** | **Flat** | **Rounded**  **(2” Radius)** |

## Assembly

1. Drill the two holes needed in the headstock.
2. Attach the MDF Spacer Block (AA1) to the headstock using two carriage bolts with nuts and flat washers (#101, #102, & #104). The spacer block should be flush with the top of H4L.

**Looking from the back**

(H2 removed)



Nut

Flat Washer

MDF Spacer Block

Carriage Bolt

H4L

1. Attach the Axle (#105, cut as shown on pg. 11) to the Horizontal Bar (AA3) using two nuts (#104) and a lock washer (#103).
2. Add a flat washer (#102), one vertical arm (AA4), the spacer (#106), the 2nd vertical arm (AA4), and the collar (#107).



Lock Washer

Washer

Horizontal Bar

Vertical Bars

Nuts

Spacer

Collar

**Looking from the front**

## A picture containing text Description automatically generatedUsing the AA

1. Attach a rubber to each Vertical bar using an #8-32 bolt (#110) and a knurled nut (#111).
2. Attach the Horizontal bar to the MDF Spacer Block using two nuts and flat washers (#102 & #104). Ensure the vertical bars so that they are aligned with the front column (B3) on the MDF Rose Engine Lathe 2.0.
3. Add the MDF AA Alignment block (AA2) and hold it in place using two T-Track bolts (#108) and nuts (#109).



MDF AA Alignment Block

Front B3 Column

Vertical Bars

AA Rubbers

**Looking from the top**

MDF Alignment Block installed at the top of the front B3 column.

* If reducing amplification, install it at the top of B3.
* If increasing amplification, install it below the RS1 rubber support, but as high as possible so as not to interfere with the AA rubbers.

# Amplitude Adjuster Components for Independent Amplitude Adjustment

****A picture containing indoor, toilet

Description automatically generatedThese components can be used with the amplitude adjuster specified above. They are shown below and are installed on the MDF Rose Engine Lathe 2.0 in the picture to the left.

## Backstop

This is made from 3 pieces of ¾” MDF.



Holes drilled for ¼” bolt.

“G” bit recommended.

15”

12”

3”

1 ½”

5”

## Clamp

The clamp consists of two pieces of aluminum and two screws. Two clamps are needed.



> 1 ¼”

¾”

0.240”

0.240”



3/8”

1/8”

1/8”

Two Separate Pieces

The two screws are #8-32.

The thru holes on the L-shaped piece (the top one in the picture at the top right) are drilled #16 (0.177”). The screws simply feed thru these.

The thru holes on the flat piece (the bottom one in the picture at the top right) are drilled #28 or #29. These are tapped for a #8-32 screw.

# Pumping Mechanism

The pumping mechanism for the MDF Rose Engine Lathe 2.0 is shown …

Details for building this follow the bill of materials.

## Bill of Materials

Parts required for building this are below.

| Item # | Item | Qty | Source | Source  Part Number | Comments |
| --- | --- | --- | --- | --- | --- |
|  | **Spindle Parts** |  |  |  |  |
| 101 | Collar | 1 | McMaster-Carr | 6436K18 |  |
| 102 | Spring, Compression | 1 | McMaster-Carr | 9657K444 |  |
| 103 | Bearing, Needle Roller | 1 | McMaster-Carr | 5909K36 |  |
| 104 | Washer for Needle Bearing | 1 | McMaster-Carr | 5909K49 |  |
| 105 | Thrust Bearing | 2 | McMaster-Carr | 5906K523 | Bronze, oil-embedded. For 1" Shaft dia, 1/8" Thick |
|  |  |  |  |  |  |
|  | **Frame Parts** |  |  |  |  |
| 201 | Bolt, ¼”-20, 1 ½” Long | 4 |  |  | For attaching the frame to the headstock via T-Tracks |
| 202 | Bolt, ¼”-20, 2” Long | 2 |  |  | For attaching the horizontal bars to the vertical plate. |
| 203 | Washer, ¼” | 8 |  |  | 4 are for attaching the frame to the headstock via T-Tracks; 4 are for attaching the horizontal bars to the vertical plate. |
| 204 | Lock Washer, ¼” | 2 |  |  | For attaching the horizontal bars to the vertical plate. |
| 205 | Knob, 3-arm, threaded thru-hole | 4 | McMaster-Carr | 57715K23 | For attaching the frame to the headstock via T-Tracks |
| 206 | Nut, ¼”-20 | 2 |  |  | For attaching the horizontal bars to the vertical plate. |
| 207 | Bolt, ¼”-20, 1 ½” Long | 4 |  |  | For attaching the frame to the headstock via T-Tracks |
| 208 | Hex Drive Flat Head Screw, ¼”-20, ¾” long | 2 | McMaster-Carr | 91253A540 | Used to attach the vertical plate to the base. |
| 209 | Clevis Pin, ¼” x 2” long  with Hairpin Cotter Pin | 1 | McMaster-Carr | 98306A746 | 1-13/16" usable length |
| 210 | Aluminum plate,  ¼” x 9 ½” x 5 ¼” | 1 |  |  | Base |
| 211 | Aluminum plate,  ½” x 9 ½” x ??? | 1 |  |  | Vertical Plate |
| 212 | Aluminum bar  ½” x 1” x ??? | 2 |  |  | Horizontal Bars |
|  | **Lever Arm Parts** |  |  |  |  |
| 301 | Aluminum plate,  ½” x ??? x ??? |  |  |  | Used to make the lever arm |
| 302 | HDPE rod,  1 ½” OD x ?? long | 1 |  |  | Used to make the collar which is used to ensure the lever arm stays aligned with the spindle shaft. Mates the spindle to the bearing attached to the lever arm. |
| 303 | Bearing |  | McMaster-Carr |  |  |
| 304 | Screw |  | McMaster-Carr |  | Used to attach the bearing to the lever arm |

## Spindle Parts

### Assembly of the Spindle Parts



Needle

Bearing

#103

Washer

#104

Thrust

Bearing

#105

Compression Spring, #102

Shaft Collar

#101

Spindle

**View from the Near Side of the Headstock**

(H1 & H2 removed)

Thrust

Bearing

#105

H3

H3

## Frame Parts

### Base

### Vertical Plate

### Horizontal Arms

## Lever Arm Parts

### Lever Arm

### HDPE Collar

## Assembly

# Overhead Drive Power Switch

This device is used to shutoff the overhead drive motor when the end of a cutting has been reached (for example, if using the Sync function, when the distance to be traversed is reached). The idea is that such a cut will take a while and shutting off the overhead drive will alert the artist that the pass is completed.

## Safety Note

You are responsible to ensure your own safety when using unprotected, spinning cutters. This is meant as a convenience for the artist, and should not be relied upon to ensure your safety.

## Parts Required

| Item # | Item | Qty | Source | Source  Part Number | Comments |
| --- | --- | --- | --- | --- | --- |
| L1 | LED Panel Light | 1 | McMaster-Carr | 2779K91 | 120V AC. I selected green, but other colours are available. |
| R1 | Sequenced Latching Relay | 1 | McMaster-Carr | 6784T115 | SPST-NO, 24V DC Input |
| R2 | Relay | 1 | McMaster-Carr | 7098K67 | SPDT, 6V DC Input |
|  | Relay Socket | 1 | McMaster-Carr | 7088K21 | Used to secure R2 to a DIN rail. |
| S1 | Panel-mount, Push-button Switch | 1 | McMaster-Carr | 2779K91 | SPST, Normally off / momentary-on, 120V AC |
|  | Arduino Uno R3 | 1 | Amazon and others |  | Other Arduinos could be used.  Note: I have had bad luck using knock-offs. |
|  | ZMPT101B AC Voltage Sensor | 1 | Amazon and others |  |  |

## A black background with white text Description automatically generated with low confidenceHow it Works

In version 3.0 of the Teensy-based control system for multiple stepper motors, a signal has been defined that works as shown in the logic diagram to the right. Once the signal goes from LOW back to HIGH, a circuit with a latching relay can be used to power off the overhead drive.

In use,

1. The motor controller for the overhead drive is plugged into the 120V AC outlet shown in the drawing below.
2. The sequenced latching relay (**R1** in the diagram to the right) will stay set at whatever the last state was: either on or off.

Overhead drive plugged in here



1. A lamp (**L1** in the diagram to the right) is in place to let you know if the power is on for the 120V AC outlet.
2. A switch (**S1** in the diagram to the right) is in place to over-ride the setting of that relay. This is a normally-off / momentary-on switch.
   * Push it once, and the state of R1 changes.
   * Push it again, and R1 changes back.

The automation of this process is programmed into the Arduino Uno. The idea is:

* When the Teensy raises the output value from LOW back to HIGH,
* And the 120V AC outlet is powered on,
* Then the sequence of relays is triggered to turn it off.
* However, if that 120V AC outlet is already off, then nothing happens (rather than turning it back on).

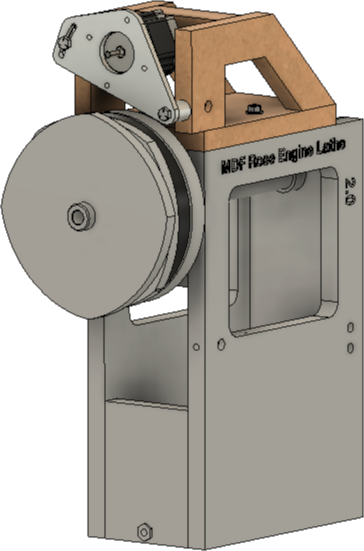
Either way, the lamp (L1) will be off, showing that the 120V AC outlet is powered off.

The code for the Arduino to produce this output is on the next pages. You can copy the text and paste it into the Arduino IDE (you can download the software from <https://www.arduino.cc/en/software>).

## Arduino Uno Code

|  |
| --- |
| /\* =============================================  \* MDF Rose Engine Lathe 2.0  \* Overhead Drive Power Switch  \* Version 1.0 - 19 Apr 22  \* R Colvin - ColvinTools@gMail.com  \* ============================================= \*/  /\* =============================================  \* This code is used to turn off the overhead  \* drive when the movement has completed a pass  \* (e.g., when using the Sync function).  \* ============================================= \*/  /\* =============================================  \* GLOBAL VARIABLES  \* ============================================= \*/  /\* Analog pins \*/  int aPinZMPT101B = A0; // AC Voltage Sensor Module  /\* Digital pins \*/  int dPinRelayR2 = 3; // Power to Relay Switch (R2)  int dPinTeensy = 5; // Input from Teensy  /\* Variables for I/O \*/  bool bRunning = false; // Status of movement (1 = yes)  int iTeensy = 0; // Teensy input  int iZMPT101B = 0; // Voltage on 120 VAC plug (R1 output)  /\* =============================================  \* SETUP  \* ============================================= \*/  void setup() {  /\* Setup analog pins \*/  pinMode(aPinZMPT101B, INPUT);  /\* Setup digital pins \*/  pinMode(dPinRelayR2, OUTPUT);  pinMode(dPinTeensy, INPUT);  /\*  Check to see if the latching relay (R1) is set so that  the output voltage is on. If not, turn it on.  \*/  iZMPT101B = analogRead(aPinZMPT101B); // read the output voltage  if (iZMPT101B < 50) {  digitalWrite(dPinRelayR2, HIGH);  delay(2500);  digitalWrite(dPinRelayR2, LOW);  }  }  /\* =============================================  \* LOOP  \* ============================================= \*/  void loop() {  /\* Teensy output is HIGH when not running \*/  iTeensy = digitalRead(dPinTeensy); // read the input from Teensy  if (iTeensy == LOW) {  bRunning = true;  }  iZMPT101B = analogRead(aPinZMPT101B); // read the R1 output voltage  /\*  When Teensy output goes from LOW back to HIGH,  iTeensy == HIGH && bRunning  and the overhead drive power is on  iZMPT101B > 100  then turn off output voltage (via the switching relay)  \*/  if (iTeensy == HIGH && bRunning && iZMPT101B > 100) {  digitalWrite(dPinRelayR2, HIGH);  delay(1000); //wait one second  digitalWrite(dPinRelayR2, LOW);  bRunning = false; // reset this variable  }  } |

# Rosette Phaser / Multiplier

This device is used to allow a second stepper motor to drive the rosette, separately from the stepper motor driving the spindle. It uses a second copy of the same components as the spindle stepper motor drive:

* Motor bracket
* Motor bracket pacers (2)
* Motor bracket screws, washers, and nuts (2 sets)
* Drive gear
* Drive belt

When using it with the amplitude adjuster outlined on

## Bottom Piece



1 1/8”

1 1/8”

5 1/4”

7 7/8”

2 1/2”

2”

This is made from ¾” MDF. One is needed.

The 4 holes are ¼” in diameter.

## Top Piece

This is made from ¾” MDF. One is needed.

3 3/4”

1 1/2”



## Side Pieces



Drill ¼” diameter,

2” deep

8 3/4”

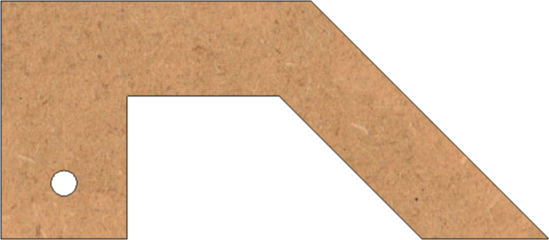
2”

2”

7/8”

4 5/8”

1 1/2”



1”

Drill 13/32” diameter,

Through

This is made from ¾” MDF.

Two are needed.

On the front piece, drill holes as shown.

Do not drill into the back one yet piece yet; drill those after aligning the stepper motor bracket.