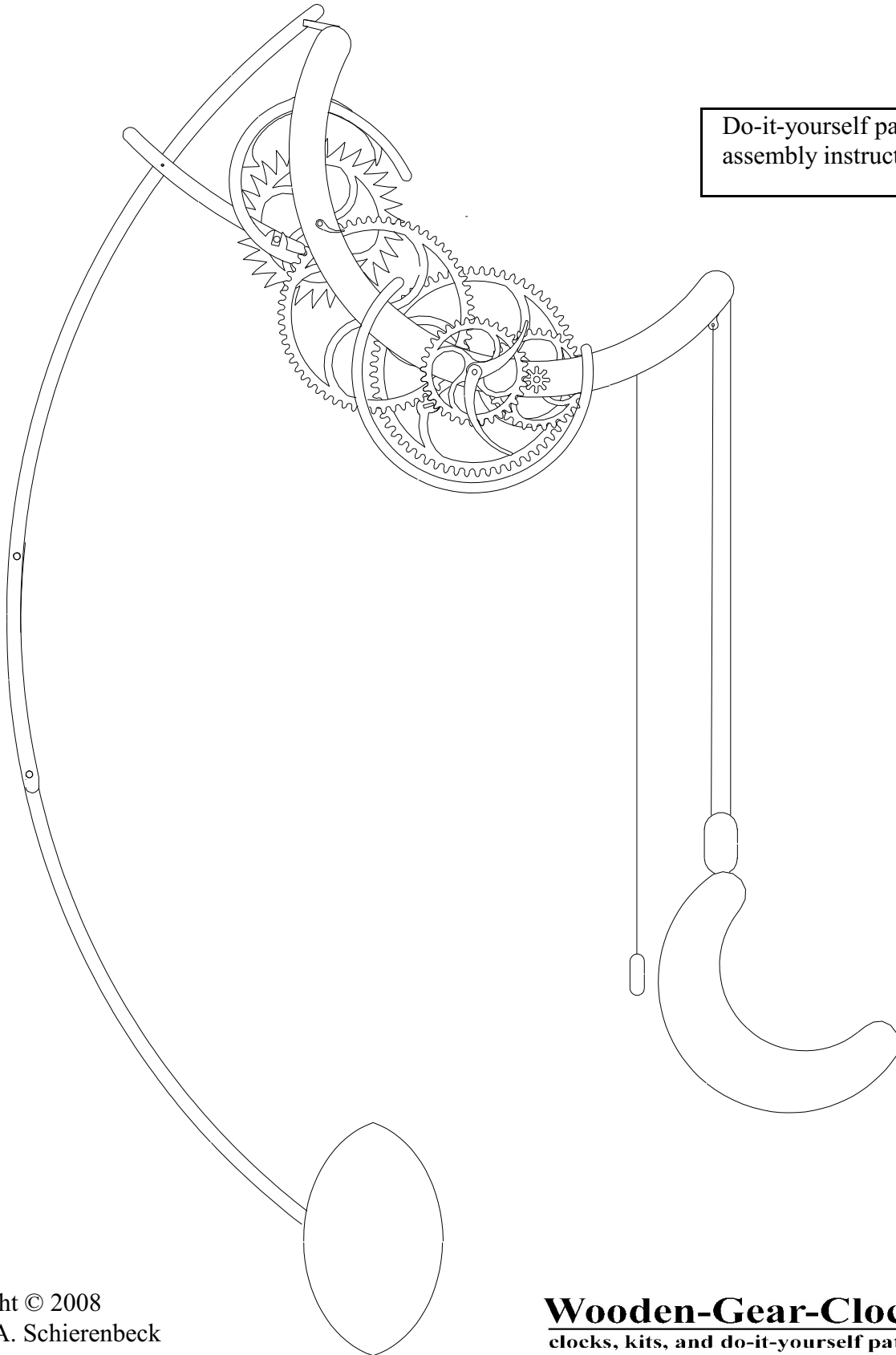


The Crescent Clock

Do-it-yourself pattern and
assembly instructions



Copyright © 2008
Jeffrey A. Schierenbeck

Wooden-Gear-Clocks.com
clocks, kits, and do-it-yourself patterns



Introduction

For hundreds of years, mechanical clocks have served as functional timekeepers. During that time, clocks have also been treasured for their artistic and aesthetic value. For most clocks, the artistry involves the shape and ornamentation of the clock's exterior case. However, these cases hide the inner beauty of the clock—its mechanical clockworks.

The Crescent clock is a wooden gear clock that is a functional timekeeper with an open frame which exposes its mechanical elements. All the moving parts are clearly visible. It is intriguing to watch the seconds and minutes tick away.

It is enjoyable to see and hear this clock running. However, the most enjoyable part of this clock is the satisfaction gained by assembling the clock yourself, perhaps adding your own creative touches. And, through the process of building the clock, you will gain an understanding of the principles that govern how a clock works.

We truly hope you enjoy building your clock. Please contact us if there is any way that we can help you with your clockmaking project.

Copyright

Thank you for respecting the following:

The Crescent clock patterns and plans are Copyright 2008 by Jeffrey A. Schierenbeck. Permission is hereby granted to the purchaser of these plans to make copies of the nine 11"x17" pattern sheets provided with these instructions for his or her personal use in cutting the clock. **(Please note: copies produced by copy machines may produce slightly distorted copies. Verify that any copies made are true to the original).** No pages of this instruction manual may be duplicated without express permission from Jeffrey A. Schierenbeck.

The Crescent clock patterns and plans are intended for use by the purchaser of these plans for scroll saw cutting of the clock. Any other use of these plans, such as automated mass production, including CNC, of the Crescent clock parts, is prohibited.

Tools and Materials

The following tools will be necessary to cut the components and assemble your Crescent clock::

- scroll saw
- drill (drill press recommended); various bits (1/16", 3/32", 1/8", 15/64", 1/4", 17/64", 3/8"
- Phillips screwdriver
- small slot screwdriver
- knife
- hammer
- clamps (small spring clamps work well)
- 7/16" wrench
- pencil

The following materials will be needed:

- 1/4" plywood (Baltic Birch recommended): 10 square feet
- 1/8" plywood (Baltic Birch recommended): 1 square foot
- 1/4" hardwood dowel: 48"
- wood glue
- sandpaper (150 grit, 220 grit, 400 grit suggested)
- about 5 lbs of metal shot (available from sporting goods or firearms stores)

Cutting and Assembly Tips

1) Cut out all parts with the scroll saw. Use temporary-bond spray adhesive to affix the pattern to the wood. The frame and pendulum shaft pieces are too large to fit on the pattern sheet; these patterns printed in two parts which have to be splice together where indicated. When cutting the pieces, try to split the line with the saw blade.

2) All components are cut from 1/4" plywood unless noted otherwise (e.g., 1/8" material) on the pattern. Orient the grain with the longer dimension of the pieces..

3) Several pieces are sized to fit together with other pieces. Plywood thickness vary slightly. You may want to test fit as pieces are cut out. Reviewing the assembly instructions prior to cutting will help you get an idea of how the parts will fit together.

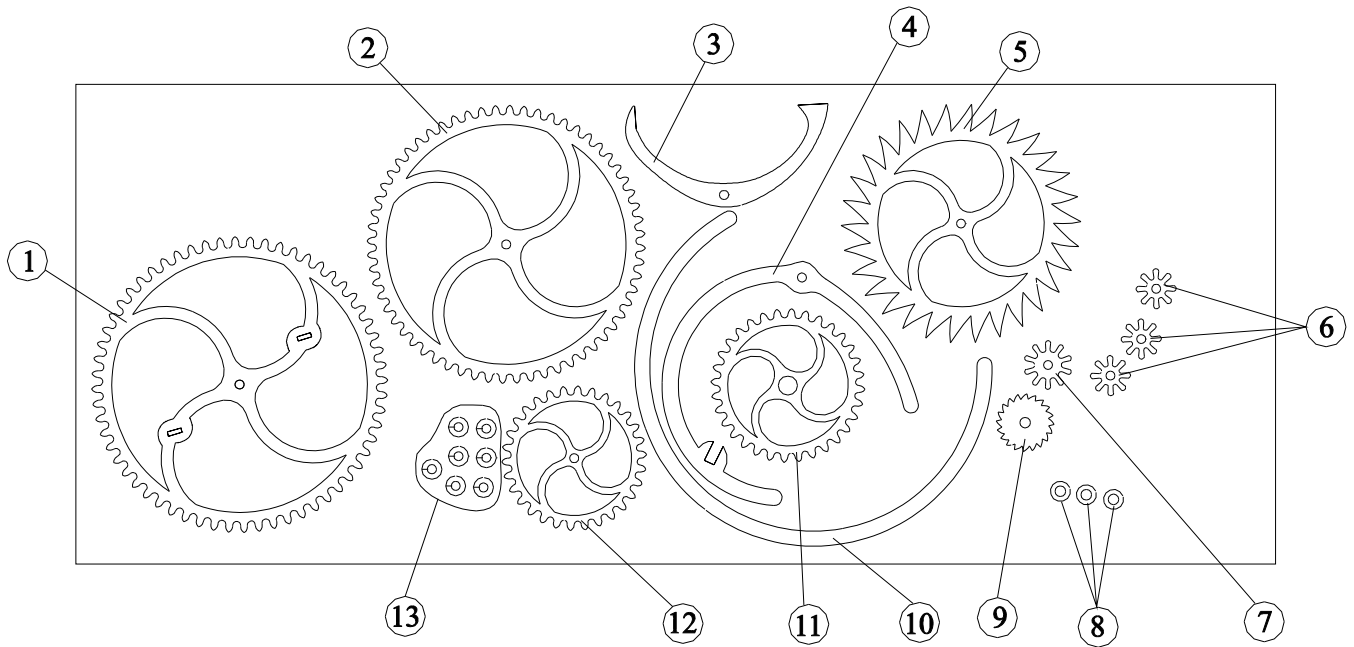
4) You are encouraged to stack cut identical pieces simultaneously (parts suggested for stack cutting are indicated on the pattern sheets..

5) Several holes are labeled as "1/4" diameter to fit on tightly on dowel". Since dowel diameters vary slightly, you should drill a test hole to determine the proper hole size. For example, you may find that 15/64" holes will provide a better fit on your dowels than 1/4".

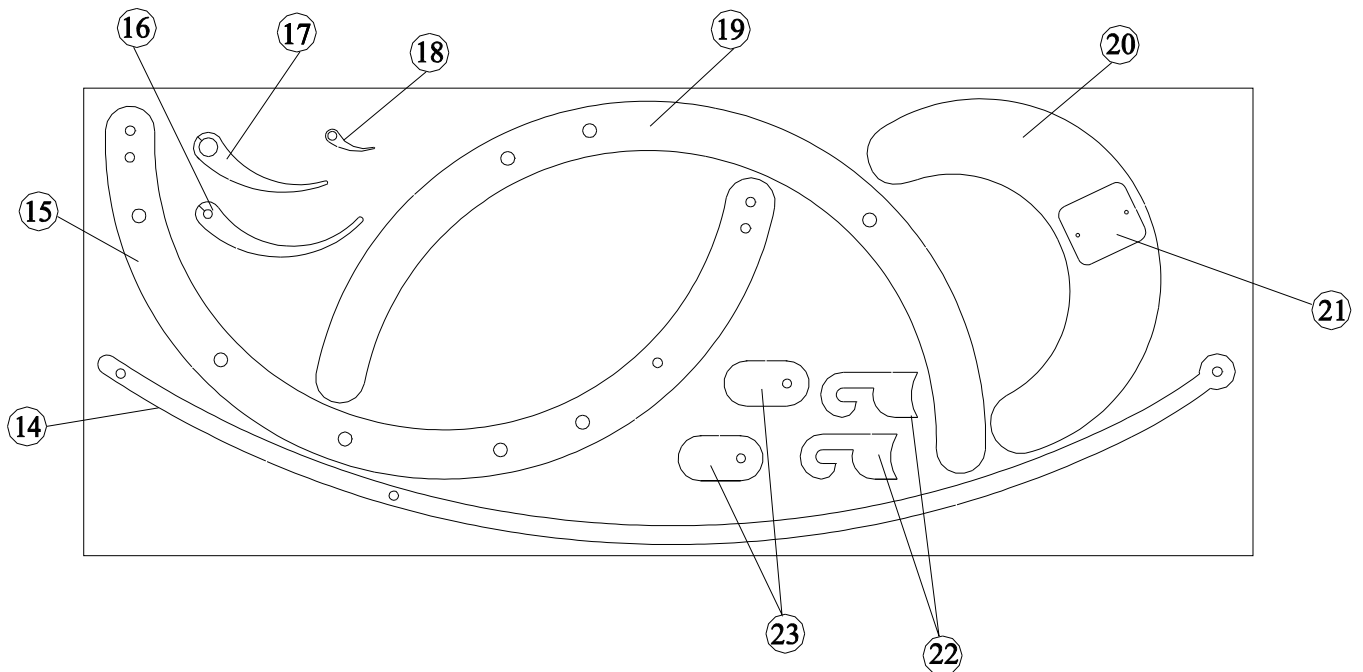
6) Several holes are labeled as "1/4" diameter, friction fit on dowel". These holes should be sized to provide a fit that is tight enough to hold the pieces in place, but loose enough that the fit can be made to slip. Several holes are labeled as ""1/4" diameter, slip fit on dowel". These holes should be sized to allow a dowel to slip into the hole and be glued in place.

- 7) Holes must be drilled perpendicular to the workpiece. If possible, use a drill press.
- 8) Before drilling the arbor holes in the frame pieces, we suggest that you lay out and drill the holes in a scrap piece. This allows you to test the distance between the holes by inserting adjacent gear assemblies and rotating to be sure the gear teeth mesh properly. Once the precise position is established, the scrap piece can be used as a template to locate the holes in the frame pieces.
- 9) Dimensions labeled “typical” indicate that the same dimension applies to all similar dimensions of similar components.
- 10) You may stain your clock if desired. See the Stain Chart on the next page for a suggested color scheme. Although it is possible to do all the staining after the clock is assembled (the clock is easily disassembled), you may find it easier to stain the gears prior to assembly. Since a finish can hinder glue bond, wait to apply finish to the remaining pieces until the components have been glued together (suggested sequence for sanding and finishing is included in the step by step instructions). **If you choose to apply a varnish, avoid getting varnish on the contact faces of the gear teeth and escape lever.**
- 11) Refer to the Part List for names and part numbers of the components referenced in the instructions.
- 12) A few components require gluing. Glued parts should be clamped while the glue cures.
- 13) Follow the instructions in order. Carefully complete one step before moving on to the next.
- 14) It will be beneficial to lubricate a few points with graphite (pencil lead). These points include the portions of the arbors that spin in the bearings and the contact faces of the escape lever.
- 15) Once the clock is assembled and mounted, there will likely be some adjustments required to get the clock running properly. Follow the suggestions in the ‘Adjusting and Regulating’ and the ‘Troubleshooting’ sections of the instructions.
- 16) Take your time and enjoy the process!

Part List (1 of 3)

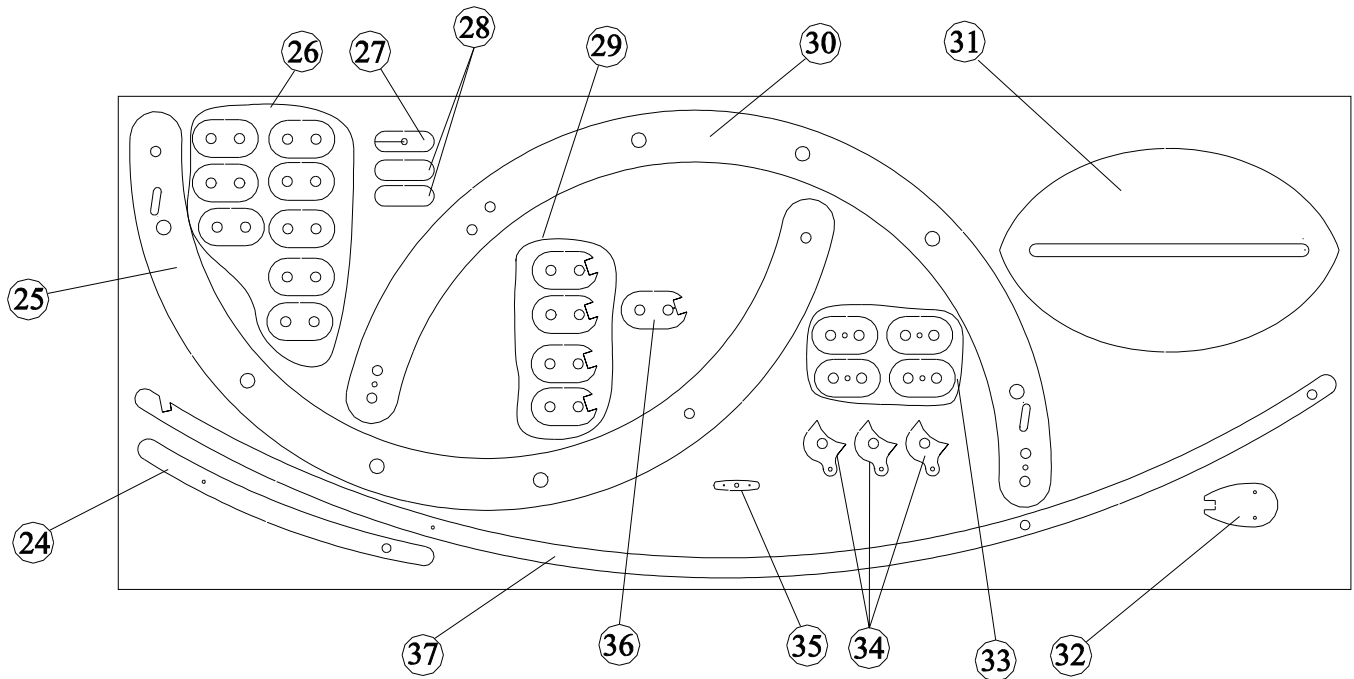


- | | | |
|-------------------------|--------------------------|--------------------------|
| 1. 64-tooth great wheel | 6. 8-tooth gear [3] | 11. 32-tooth hour gear |
| 2. 60-tooth middle gear | 7. 10-tooth gear | 12. 30-tooth minute gear |
| 3. Escape lever | 8. Minute pipe piece [3] | 13. Set washer [7] |
| 4. Crutch | 9. Ratchet | |
| 5. Escape wheel | 10. Dial | |

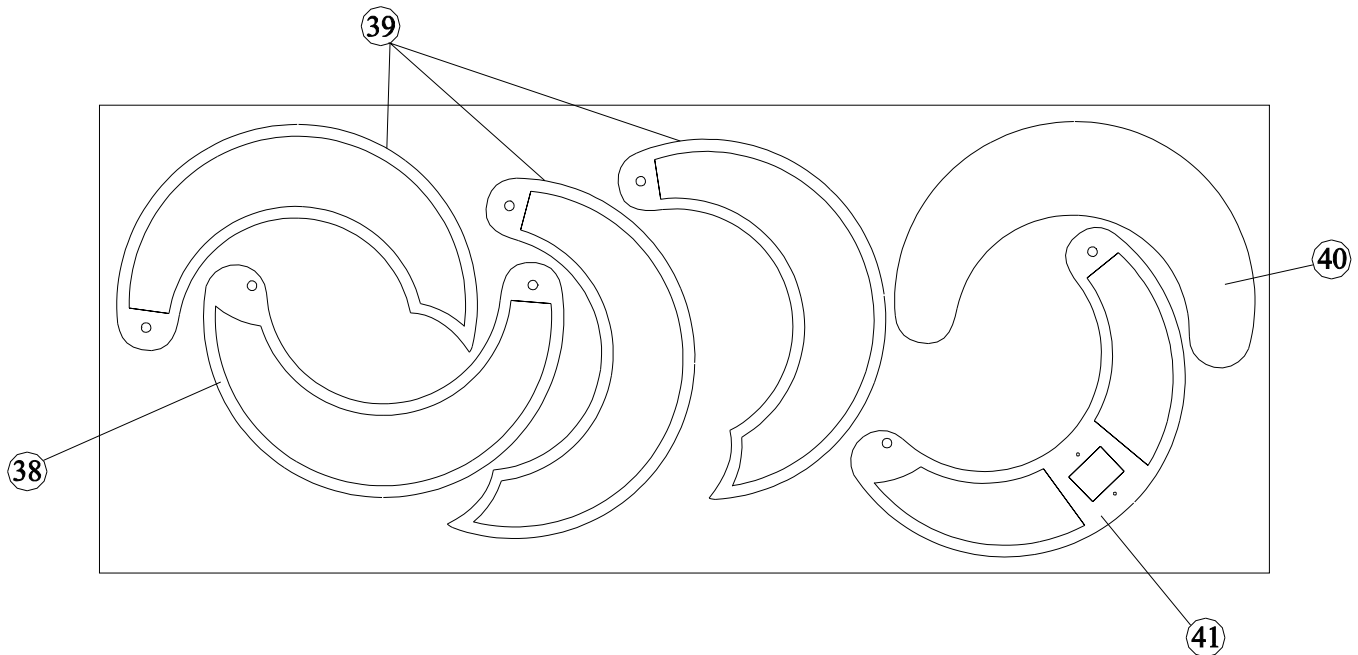


- | | | |
|-----------------------------|------------------------------|-------------------------------------|
| 14. Lower pendulum shaft | 18. Second hand | 22. Weight pulley hook piece [2] |
| 15. Front frame inner piece | 19. Front frame outer piece | 23. Weight pulley interior side [2] |
| 16. Minute hand | 20. Weight shell rear face | |
| 17. Hour hand | 21. Weight shell cover plate | |

Part List (2 of 3)



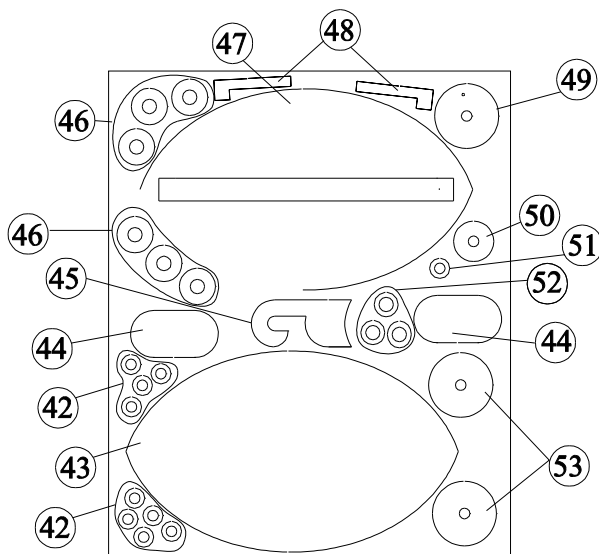
- | | | |
|---------------------------------|------------------------------------|---------------------------------------|
| 24. Crutch arm | 29. Upper pillar middle pieces [4] | 34. Lower pillar middle pieces [3] |
| 25. Rear frame outer piece | 30. Rear frame inner piece | 35. Pendulum support plate |
| 26. Pillar base pieces [8] | 31. Pendulum bob rear piece | 36. Upper pillar slotted middle piece |
| 27. Rewind pull middle piece | 32. Pendulum bracket | 37. Upper pendulum shaft |
| 28. Rewind pull outer piece [2] | 33. Pillar rear pieces [4] | |



- | |
|--------------------------------------|
| 38. Weight shell front piece |
| 39. Weight shell interior pieces [3] |
| 40. Weight shell front face |
| 41. Weight shell rear piece |

Part List (3 of 3)

- 42. Spacer washer [9]
- 43. Pendulum bob front piece
- 44. Weight pulley outer piece [2].
- 45. Weight hook interior piece
- 46. Pulley wheel side [6]
- 47. Pendulum bob interior piece
- 48. Ratchet Pawl [2]
- 49. Weight spool interior divider
- 50. Weight spool hub
- 51. Winding spool hub
- 52. Pulley hub [3]
- 53. Outer spool sides [2]

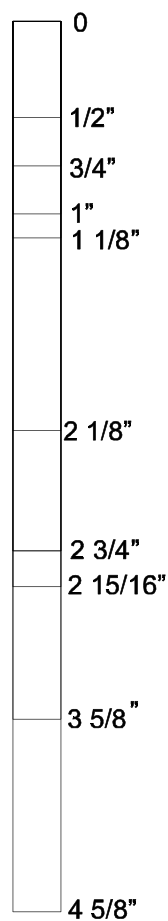


1/4" Diameter Dowels

- 1/2" Pendulum splice pins [2]
- 3/4" Crutch pin
- 1" Weight pulley axle
- 1 1/8" Weight shell rods [2]
- 2 3/4" Pillar rods [4]
- 2 15/16" Winding guide axle
- 2 1/8" Minute arbor
- 3 5/8" Escape wheel arbor
- 2 3/4" Escape lever arbor
- 2 3/4" Middle wheel arbor
- 4 5/8" Great wheel arbor

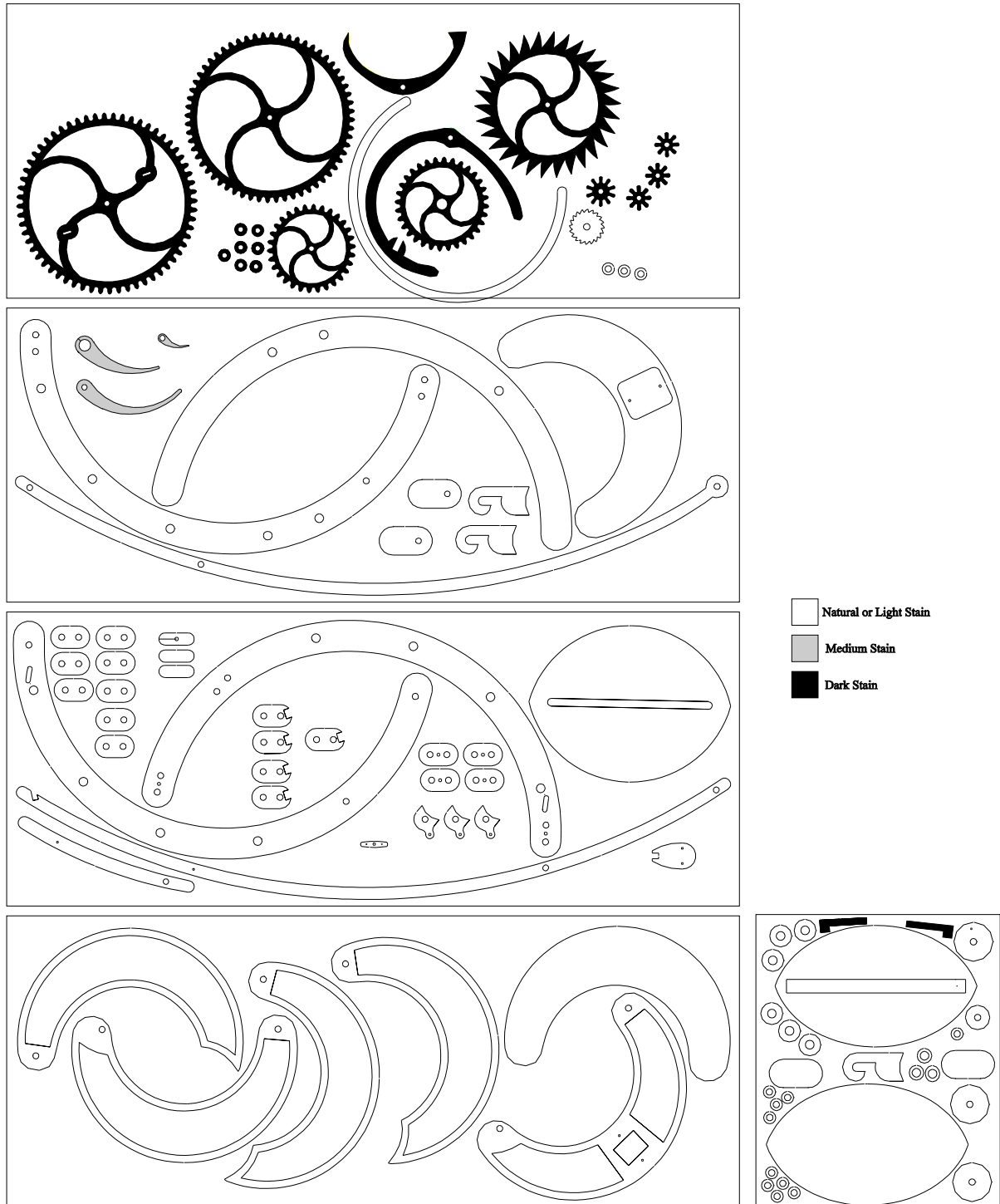
Hardware

- #4 x 1/2" screws [6]
- #6 x 1" screws [2]
- Nylon shoulder washers [16]
- 19' braided cord
- 1/4" - 20 x 2 1/2" hanger bolt
- 1/4" - 20 acorn nut
- 1/4" washer
- 1/4" x 20 x 1/4" T-nut
- drywall anchor
- #6 x 1 1/4" screw
- #8 washer
- 1/4" - 20 x 1/2" thumbscrew



Stain Chart

The diagram below indicates which pieces to stain dark if you choose to use a color scheme with darker gears and lighter frame. Of course, you can use another color scheme, such as light gears and darker frame. However, you may still find the stain chart helpful for grouping parts together that should be the same color. It is easiest to stain the gears before they are attached to the arbors. The other pieces (frame, weight shell, pendulum, etc) can be stained after the necessary components are glued together. The assembly instructions indicate at which time in the process that finish should be applied to the components.



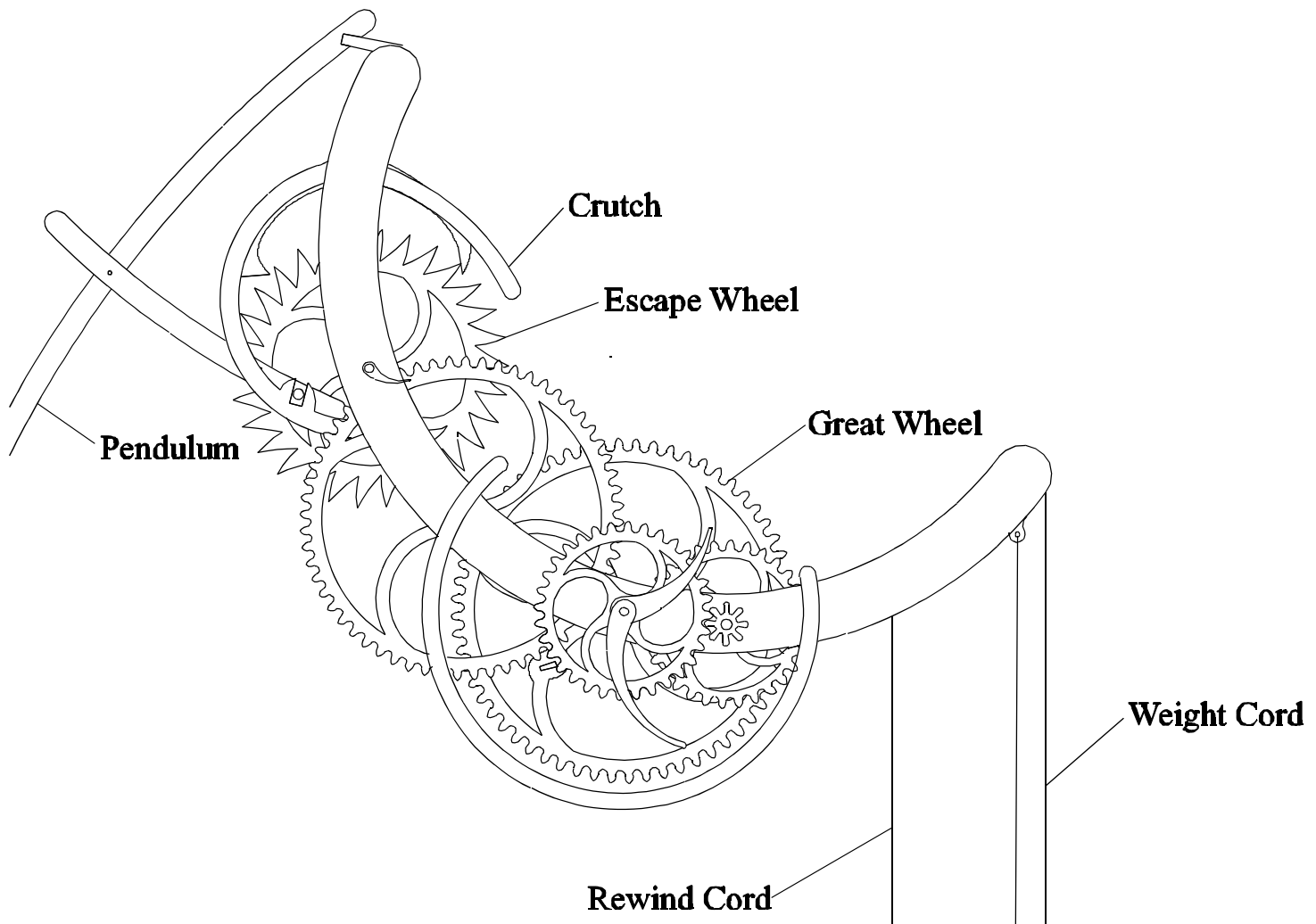
How the Crescent Clock Works

It is helpful to have an understanding of how the Crescent clock works. This insight will be especially beneficial if troubleshooting is necessary.

The Crescent clock is driven by weight. The weight is hung from a cord that is wound around the great wheel arbor (shaft). The weight unwinds the cord from the arbor, causing the arbor to rotate. The gears that are attached to this arbor mesh with a train of other gears, causing them to rotate as well. When the cord has unwound to a point where the weight has nearly reached the floor, the clock is “wound” by winding the cord back around the arbor.

The speed at which the weight is allowed to rotate the gear train is regulated by the pendulum. As the pendulum swings back and forth, it causes the escape lever to rock back and forth along with the pendulum. The escape lever alternately stops and then releases one of the wheels in the train (called the escape wheel). These contacts with the escape lever and the escape wheel teeth generate the “tick-tock” sound of the clock.

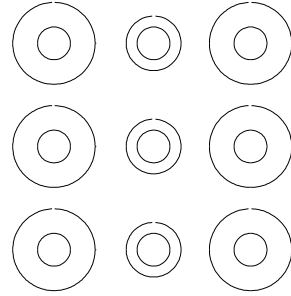
The faster the pendulum moves back and forth, the faster the escape wheel (and the entire gear train) will be allowed to advance. The pendulum swing period is determined by its length (or, more precisely, the length from its pivot point to its center of gravity). Increasing the pendulum length increases the time it takes the pendulum to complete its swing. This makes the clock run slower. Decreasing the pendulum length decreases the time it takes the pendulum to complete its swing, making the clock run faster. Therefore, adjusting the position of the pendulum bob along the pendulum shaft controls whether the clock runs fast or slow and provides a means by which the clock can be made to run “on time.”



Pulley Wheel Assembly

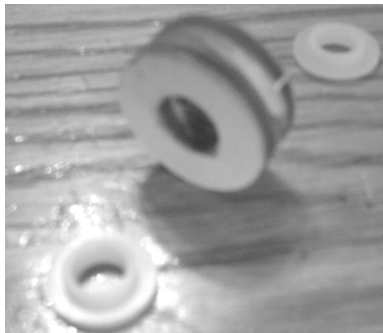
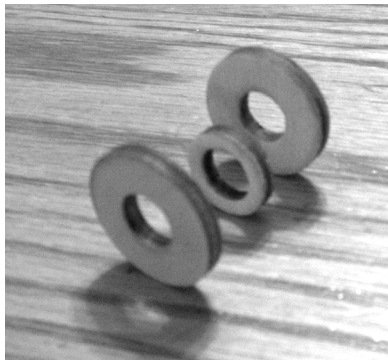
Parts (for three identical pulley wheels)

- 3 - Pulley hubs (#52)
- 6 - Pulley wheel sides (#46)
- 6 - Nylon shoulder washers



Assembly Procedure

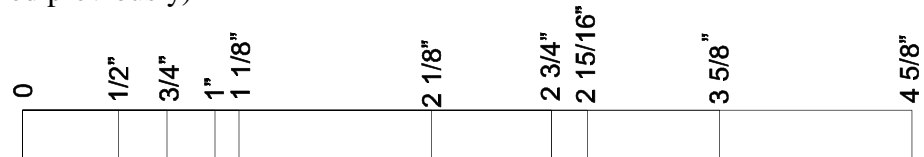
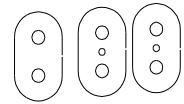
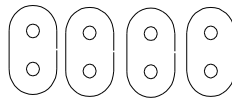
1) Glue together the three pulley pieces with the smaller diameter hub sandwiched between the two larger side pieces with all three holes aligned. After the glue has dried, the pulley edges can be sanded and finish applied. Next, apply a small amount of glue around the rim of the hole in both pulley faces and insert a nylon shoulder washer. It might be necessary to either press the washer firmly into place or to tap it into place with a hammer. Be sure the washer seats completely into the hole. Repeat this process twice to make a total of three identical pulley wheels.



Lower Pillar Assembly

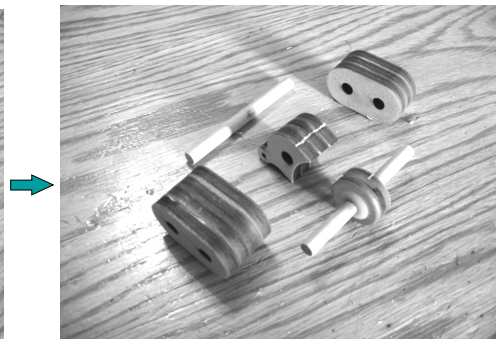
Parts

- 5 - Pillar base pieces (#26)
- 3 - Lower pillar middle pieces (#34)
- 2 - Pillar rear pieces (#33)
- 2 - 2 3/4" dowels
- Pulley wheel (assembled previously)



Assembly Procedure

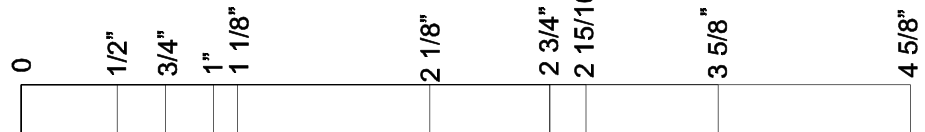
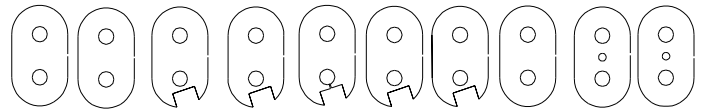
1) Glue together four of the pillar base pieces (#26). Then glue together the three pillar middle pieces (#34). Next, glue together the three pillar rear pieces (#26, #33, #33). After the glue is dry, sand the three pillar subassemblies. Next, glue the three subassemblies together with the two 2 3/4" dowels inserted through the pillar, making certain that the pieces are oriented as shown below. The dowels should protrude equally (approximately 1/4") from both faces. Verify that the pulley spins freely.



Upper Pillar Assembly

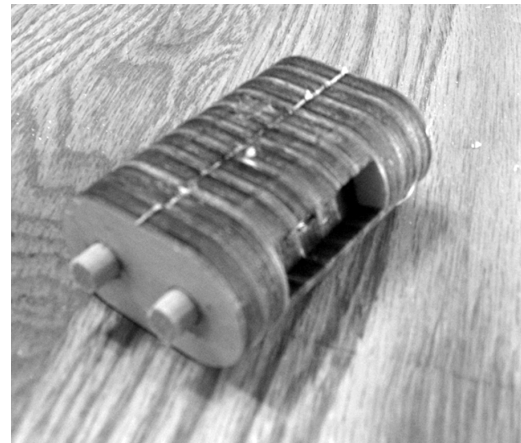
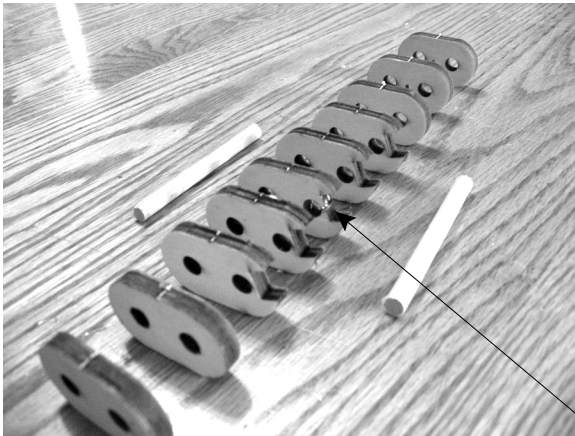
Parts

- 3 - Pillar base pieces (#26)
- 4 - Upper pillar middle pieces (#29)
- 1 - Upper pillar slotted middle piece (#36)
- 2- Pillar rear pieces (#33)
- 1 - Pendulum support plate (#35)
- 2 - 2 3/4" dowels
- 1 - #4 x 1/2" screw



Assembly Procedure

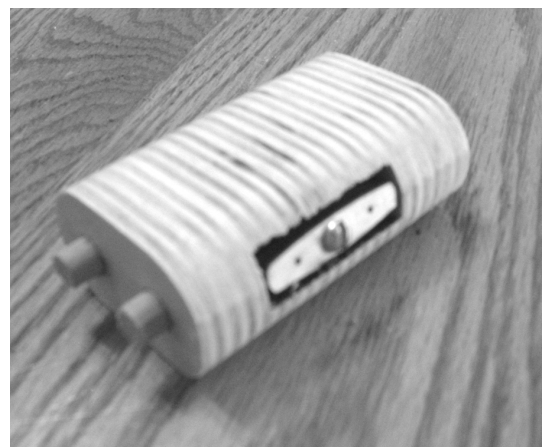
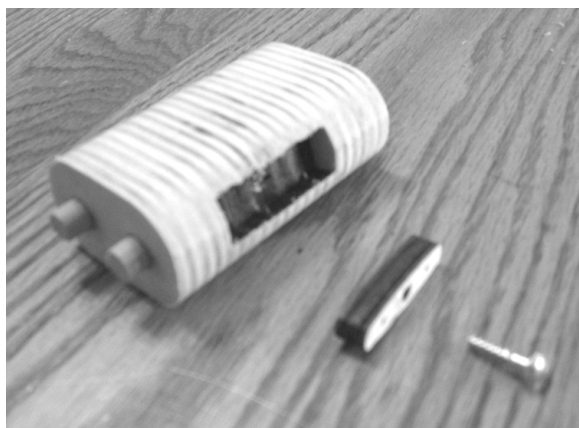
1) Glue together the ten pillar pieces, in the order shown below (from front to rear, #26,#26,#29,#29,#36,#29,#29,#26,#33,#33) with the two 2 3/4" dowels inserted through the pillar. Dowels should protrude equally (approximately 1/4") from both faces.



Slot

2) After the glue has dried, sand this completed upper pillar.

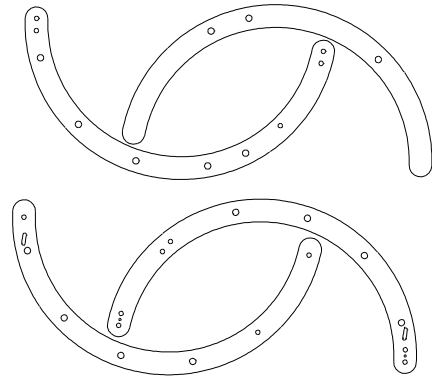
3) Attach the pendulum support plate (#35) to the upper pillar with a #4 x 1/2" screw, centering it in the recess. The slot in the center pillar piece serves as a pilot hole for the screw.



Frame Assembly

Parts

- 1 - Rear frame outer piece (#25)
- 1 - Rear frame inner piece (#30)
- 1 - Front frame inner piece (#15)
- 1 - Front frame outer piece (#19)
- 10 - Nylon shoulder washers
- Upper pillar (assembled previously)
- Lower pillar (assembled previously)



Assembly Procedure

1) Glue together front frame pieces (#15, #19). Glue together the rear frame pieces (#25, #30). Make certain that the pieces are oriented as shown below and that the holes are aligned. Clamp to a flat surface while glue dries to ensure that the pieces remain flat.

Front Frame Pieces

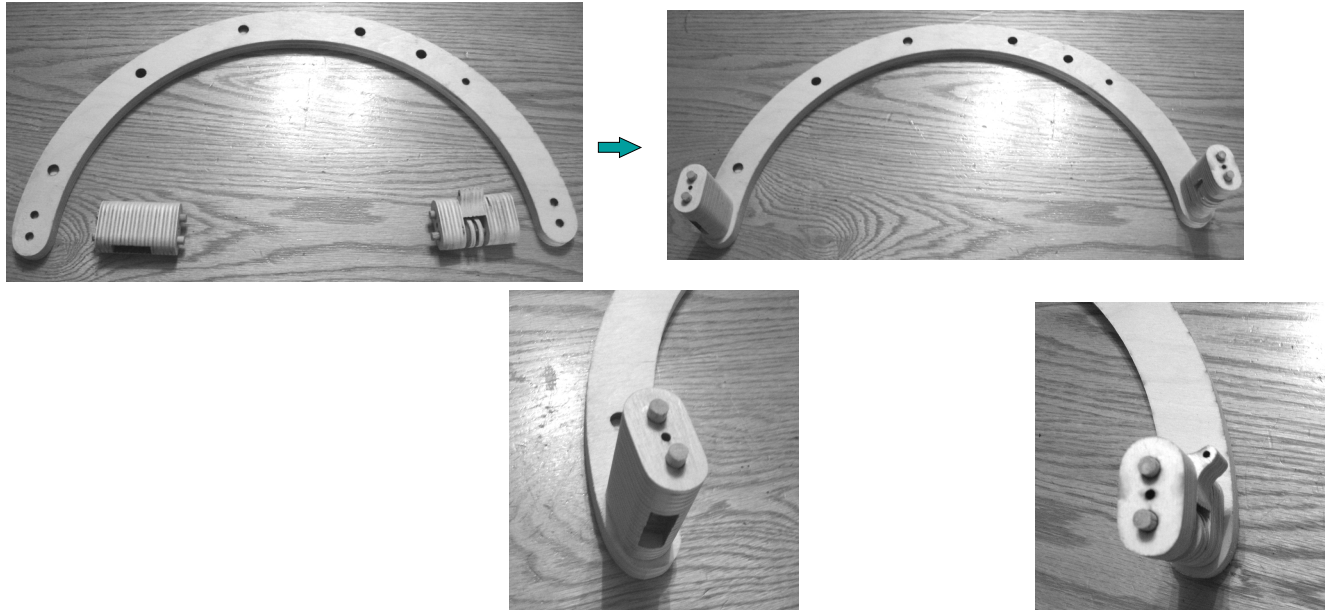


Rear Frame Pieces



2) Sand the frame units.

3) Glue the upper and lower pillars (assembled previously) to the interior side of the front frame. The protruding dowels engage with the two holes in the frame. Make sure the pillars are oriented as shown in the photos below.



4) Apply finish to the frame units.

5) With the frame pieces interior face up (as shown below), apply a small amount of glue around the rim of each of the 3/8" holes in the frames and insert a nylon shoulder washer. It might be necessary to firmly press into place or to tap in with a hammer. Be sure the washers get seated completely into the holes.

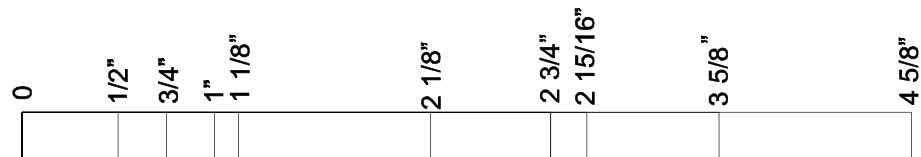
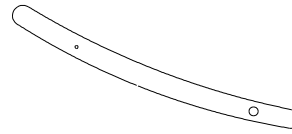
Flip the front frame over and likewise insert one shoulder washer into the endmost hole indicated in the photograph below. Do not insert washers into the remaining holes in the front face of the frame.



Crutch Arm Assembly

Parts

- 1 - Crutch arm (#24)
- 1 - 3/4" dowel



Assembly Procedure

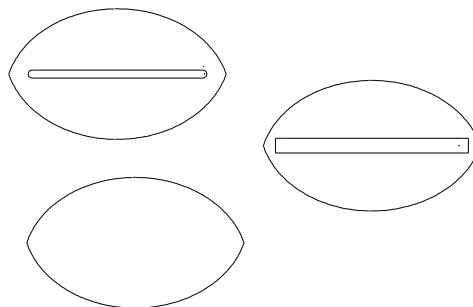
Glue the 3/4" dowel into the crutch arm (#24). Be sure the crutch arm is oriented as shown below.



Pendulum Bob Assembly

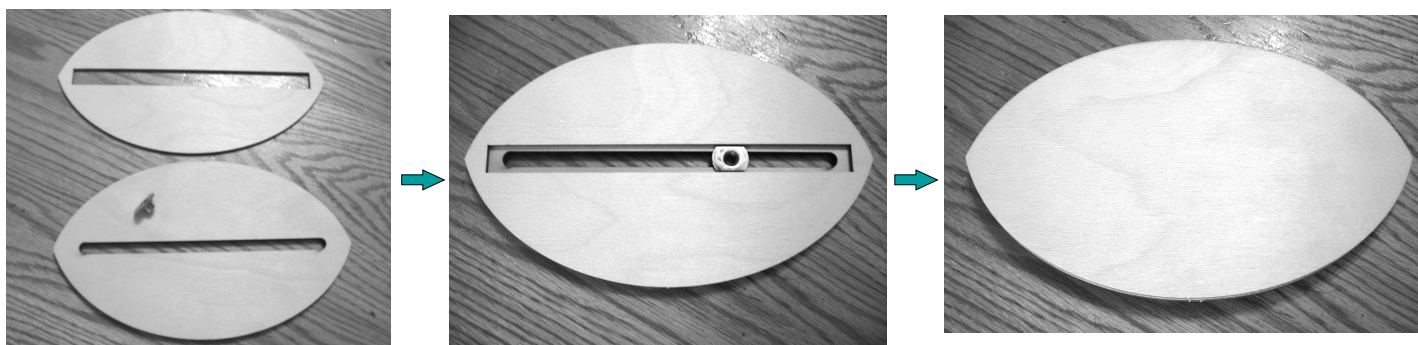
Parts

- 1 - Pendulum bob rear piece (#31)
- 1 - Pendulum bob front piece (#43)
- 1 - Pendulum bob interior piece (#47)
- 1 - T-nut



Assembly Procedure

1) Glue the pendulum interior piece (#47) to the pendulum rear piece (#31), making sure the outer edges are lined up. Clear any excess glue from the slotted portion. Set the tee-nut in the slot in the pendulum back with the barrel in the slot and the flat part facing up. Orient the nut so that it falls past the interior piece and drops all the way down in the slot. Glue the pendulum bob front piece (#43) onto the interior piece, keeping glue away from the slotted portion. Verify that the T-nut slides freely along the length of the slot prior to the glue curing.

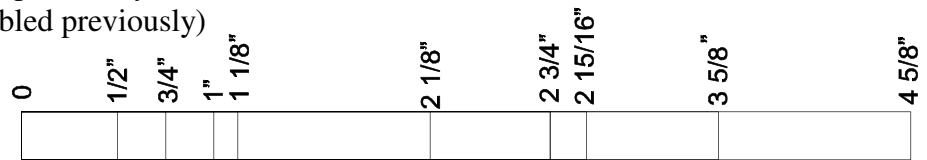
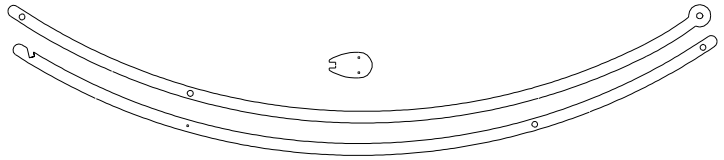


2) Sand the pendulum bob edges and front face.

Pendulum Assembly

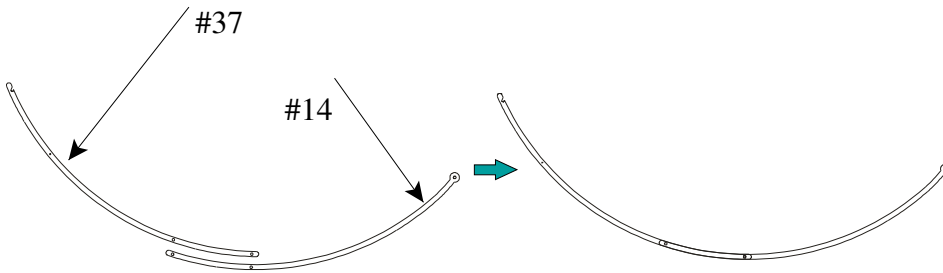
Parts

- 1 - Upper pendulum shaft (#37)
- 1 - Lower pendulum shaft (#14)
- 1 - Pendulum bracket (#32)
- 2 - 1/2" dowels
- 1 - 1/2"x 1/4-20 thumbscrew
- 2 - #4 x 1/2" screws
- crutch arm (assembled previously)
- pendulum bob (assembled previously)



Assembly Procedure

1) Sand edges of the two shaft pieces. Glue together the upper and lower pendulum shafts, with the 1/2" dowels glued into the holes, pinning the pieces together. **Make sure the upper shaft piece (#37) is on top of the lower shaft piece (#14).**

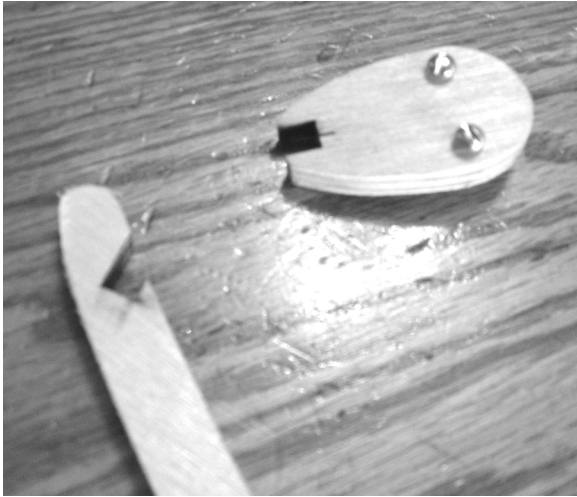


2) Touch up sand the pendulum edges where they overlap..

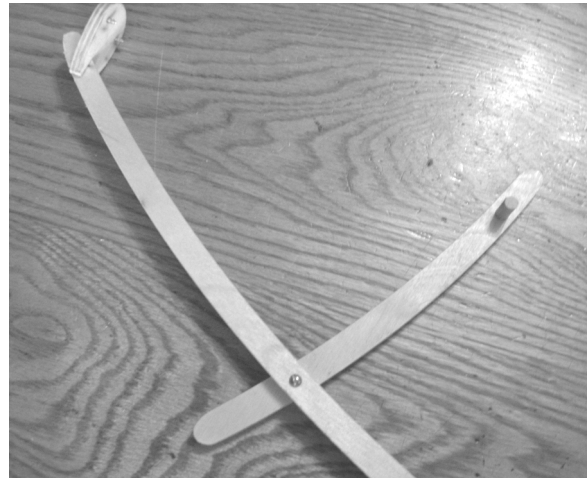
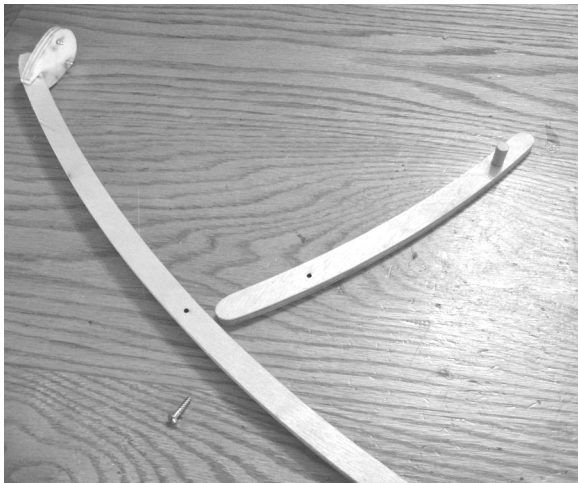
3) Drive the two #4 x 1/2" screws into the predrilled holes in the pendulum bracket (#32).



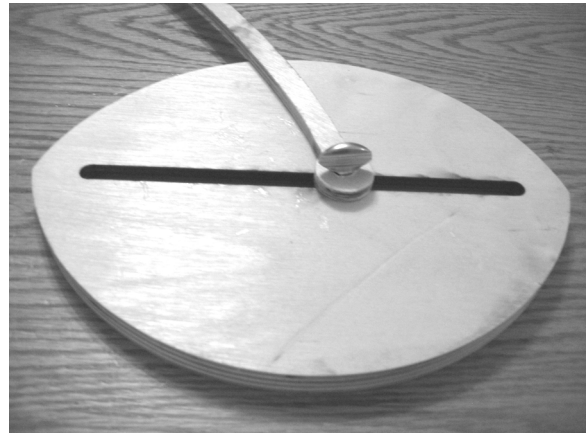
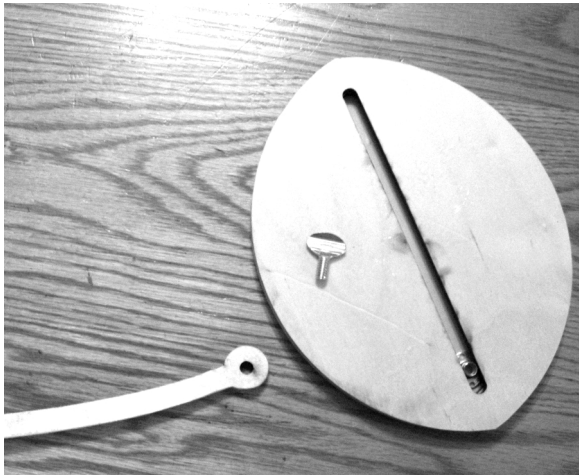
4) Sand the pendulum bracket (#32) and glue it into the upper pendulum shaft, with the screw tips pointing toward the lower portion of the pendulum.



5) Lay the pendulum shaft on top of the crutch arm (assembled previously), aligning the two predrilled pilot holes. Attach the crutch arm to the pendulum shaft with a #4 x 1/2" screw. The screw should be tight enough to hold the crutch arm in place (the exact position will be adjusted later).



5) Flip the pendulum shaft over and rest it on the back side of the pendulum bob (assembled previously). Attach the shaft with the thumbscrew engaged with the t-nut in the bob. Tighten snugly enough to keep the bob in place (the exact position will be adjusted later).

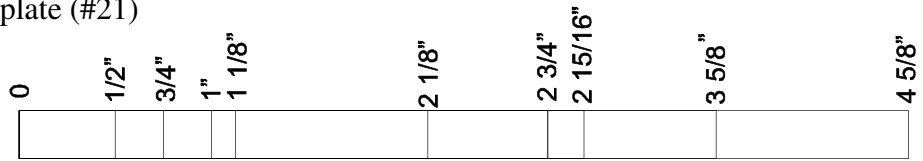
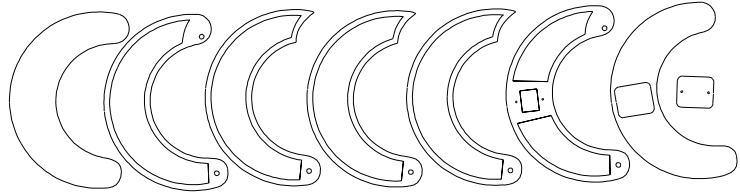


6) Apply finish to the pendulum unit.

Weight Shell Assembly

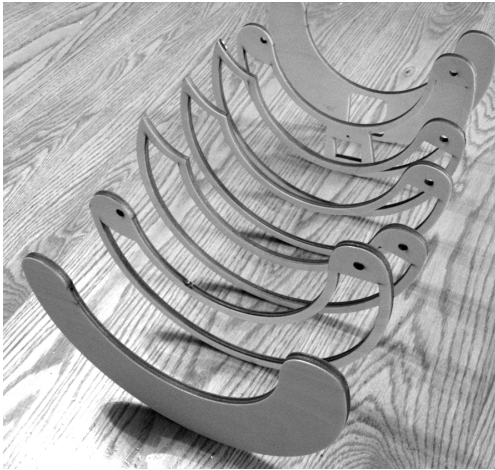
Parts

- 1 - Weight shell front face (#40)
- 1 - Weight shell front piece (#38)
- 3 - Weight shell interior pieces (#39)
- 1 - Weight shell rear piece (#41)
- 1 - Weight shell rear face (#20)
- 1 - Weight shell cover plate (#21)
- 2 - 1 1/8" dowels
- 2 - #4 x 1/2" screws



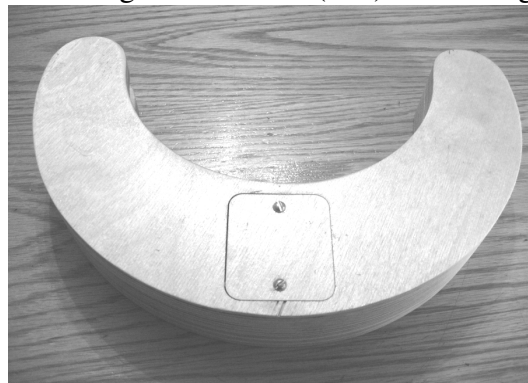
Assembly Procedure

1) Glue the weight shell pieces together. The pieces are ordered from front to back and oriented as shown below (40,38,39,39,39,41,20), with the two dowels inserted in the holes on either end of the shell. Note that the cutouts of the interior pieces have a curved end and a straight end; make sure the ends are oriented as shown below.



2) After the glue is dry, sand and finish the weight shell and cover (#21).

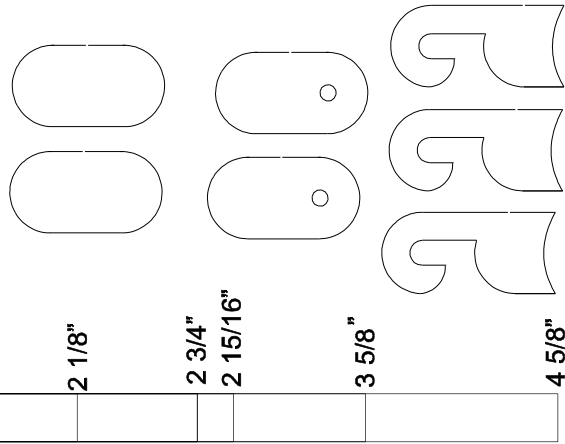
3) Carefully fill the shell with metal shot. As the shot nears the rim, jostle the shell back and forth to settle the metal shot. Use two #4 x 1/2" screws to secure the weight shell cover (#21) to the weight shell.



Weight Pulley Assembly

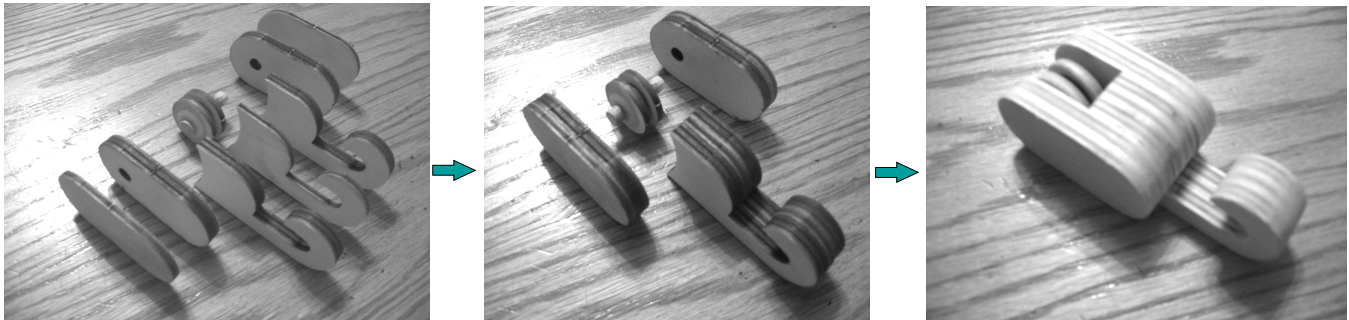
Parts

- 2 - Weight pulley outer piece (#44)
- 2 - Weight pulley hook piece (#22)
- 2 - Weight pulley interior side piece (#23)
- 1 - Weight hook interior piece (#45)
- 1 - 1" dowel
- pulley wheel (assembled previously)



Assembly Procedure

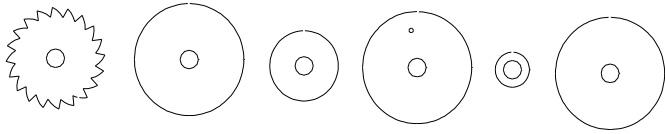
Glue together the two outer piece pairs. Glue together the three hook pieces. After the glue has dried, sand these three subassemblies. Next, sand smooth the center portion of the 1" dowel. Insert the dowel into the pulley wheel; sand more as needed to ensure that the wheel spins freely. Coat the middle portion of the dowel with graphite (pencil lead). Finally, glue together the three subassemblies with the pulley dowel engaged into the two holes on the inside faces of the hook unit sides. Verify that the pulley spins freely. Apply finish to the weight hook. Verify again that the wheel spins freely.



Weight Spool Assembly

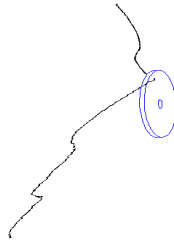
Parts

- 1 - Ratchet (#9)
- 2 - Outer spool sides (#53)
- 1 - Weight spool interior divider (#49)
- 1 - Weight spool hub (#50)
- 1 - Winding spool hub (#51)
- cord

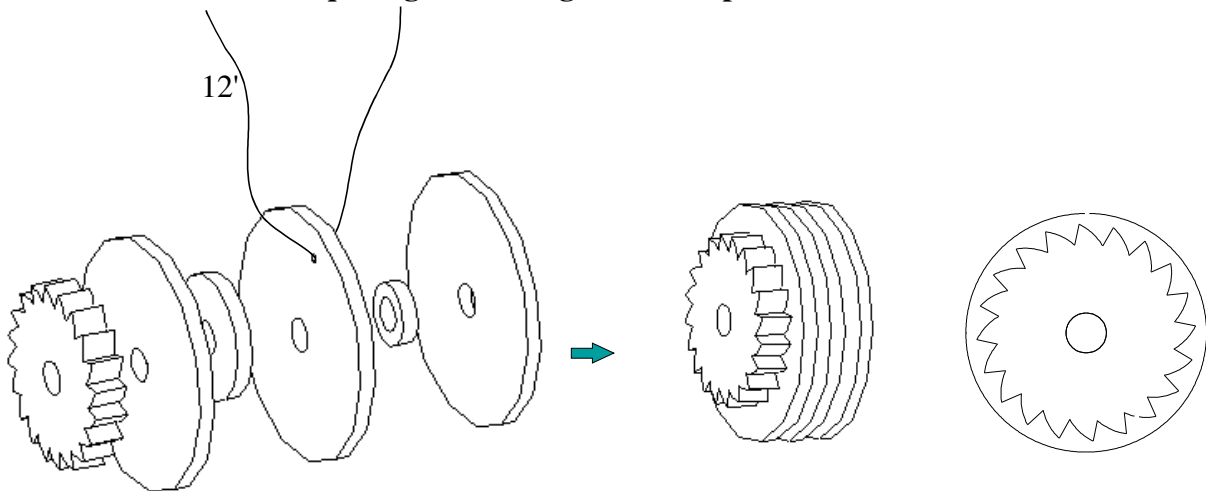


Assembly Procedure

1) Thread the winding cord through the small hole in spool divider (#49). Pull a few feet of cord through the hole so that it does not slip back through during spool assembly.



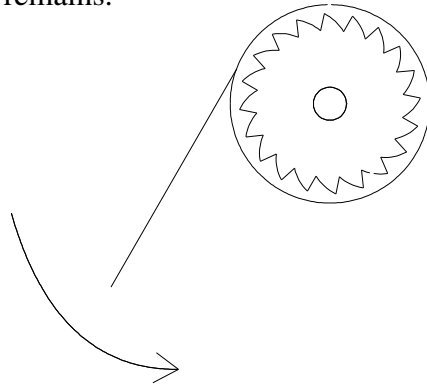
2) Glue the ratchet (#9), outer spool sides (#53), spool interior divider (#49), weight hub (#50), and winding hub (#51) together in the order shown. **Be careful to orient the ratchet teeth as shown.** Use a piece of 1/4" dowel or a drill bit to help align the pieces and to clear the center hole of excess glue (remove dowel before glue sets). **It is critical that the glue bond between all of the spool pieces are solid—ensure adequate glue coverage and clamp time.**



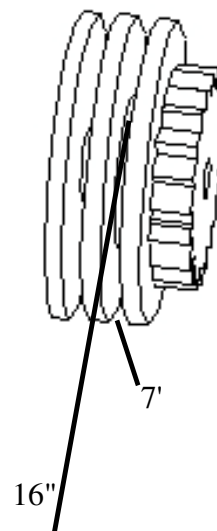
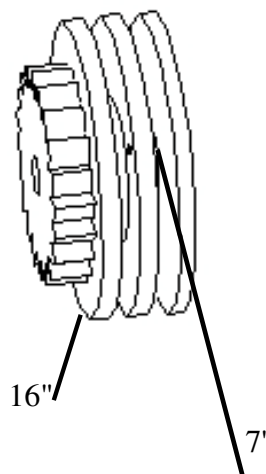
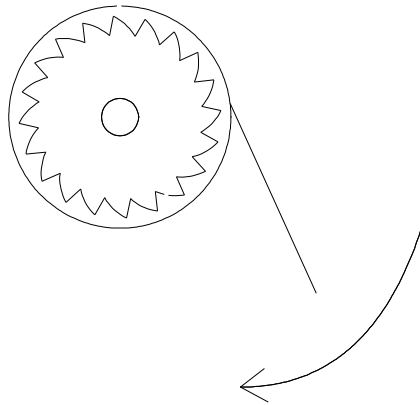
3) Pull the cord through the spool divider (#49) until there is approximately 12 feet of cord on the ratchet side of the spool divider.

4) If desired, apply finish to the weight spool (if desired, cord can be removed to stain and then reinserted with tweezers or similar tool).

5) Hold the spool so the ratchet is facing you (as pictured below). Wrap the cord protruding from the ratchet side of the spool around the larger hub in a counter-clockwise direction. Continue winding until about 16" of cord remains.



6) With the ratchet in the same position, wind the other length of cord 3 times around the smaller hub in a clockwise direction (about 7 feet of cord will remain).

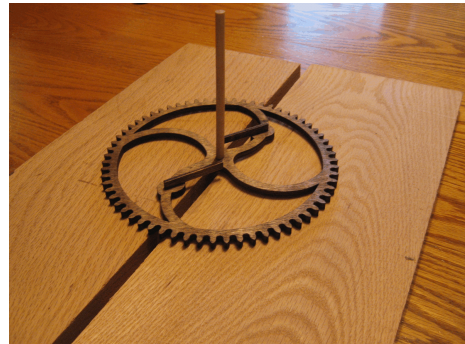


7) Secure the two strings with a piece of tape so they do not come unwound during the upcoming assembly sequence.

Installing Gears on Arbors

At this point, stain can be applied to all gears, set washers, and clock hands. Do not attempt to sand the laser browning off the edges of the gear teeth (this could distort the shape of the gear teeth).

In the following instructions, the assembly procedure is given for each arbor. Begin by using the gear location diagram to mark the locations for the gears, set washers, etc. This is most easily done by laying the arbor directly on the gear location diagram and using a pencil to mark the gear locations. To install gears on the arbors, place the gear on a flat, solid surface. Use a hammer to gently drive the arbor into the gear. Be sure to drive the arbor in perpendicular to the gear. Once the arbor is fully engaged in the gear, place the gear on two boards or blocks with a gap slightly wider than the dowel. Continue to drive the arbor through the gear until it arrives at the marked location on the arbor. Do not glue the gears in place yet; their positions may need to be adjusted after the clock is assembled.



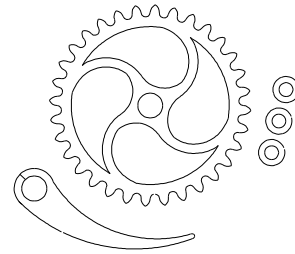
Important: After gears have been properly positioned on arbors, use fine sandpaper (220 grit or higher) to smooth the portions of the arbor that will rest in the frame*. This sanding is most easily done by wrapping a small strip of sandpaper around the arbor and twisting the arbor. Follow up with 400 grit sandpaper. The arbor should be slick and should spin freely in the nylon shoulder washers. Apply graphite to these contact areas of the arbors by coloring that section of the arbor with a pencil.

***the portion of the arbor that needs to be polished and lubricated with graphite is indicated on the gear location diagrams with gray shading**

Minute Pipe

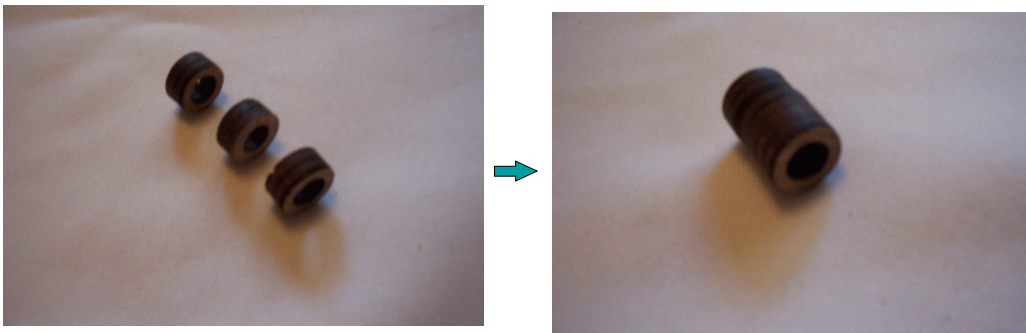
Parts

- 3 - Minute pipe sections (#8)
- 1 - 32-tooth gear (#11)
- 1 - Hour hand (#17)



Assembly Procedure

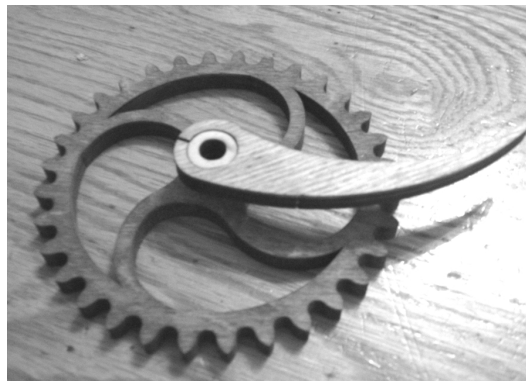
1) Glue three minute pipe sections (#8) together. Use a piece of 1/4" dowel to clear any excess glue from the inside of the minute pipe:



2) After minute pipe glue is completely cured, use a hammer to gently tap the minute pipe into the 32-tooth gear:



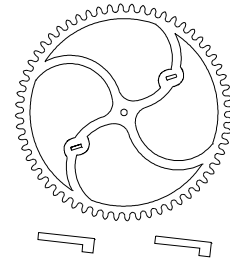
3) Press the hour hand (#17) onto the minute pipe. Do not glue in place. The friction fit should be tight enough to keep the hand in place yet still allow the hand to be rotated on the minute pipe.



Great Wheel Pawls

Part

- 2 - Ratchet pawls (#48)
- 1 - 64-tooth great wheel (#1)



Assembly Procedure

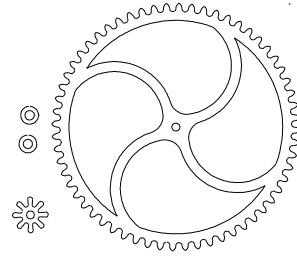
Glue the ratchet pawls into the slots in the great wheel gear spoke. Make sure the pawls are oriented in the great wheel as shown below.



Middle Wheel Arbor

Parts

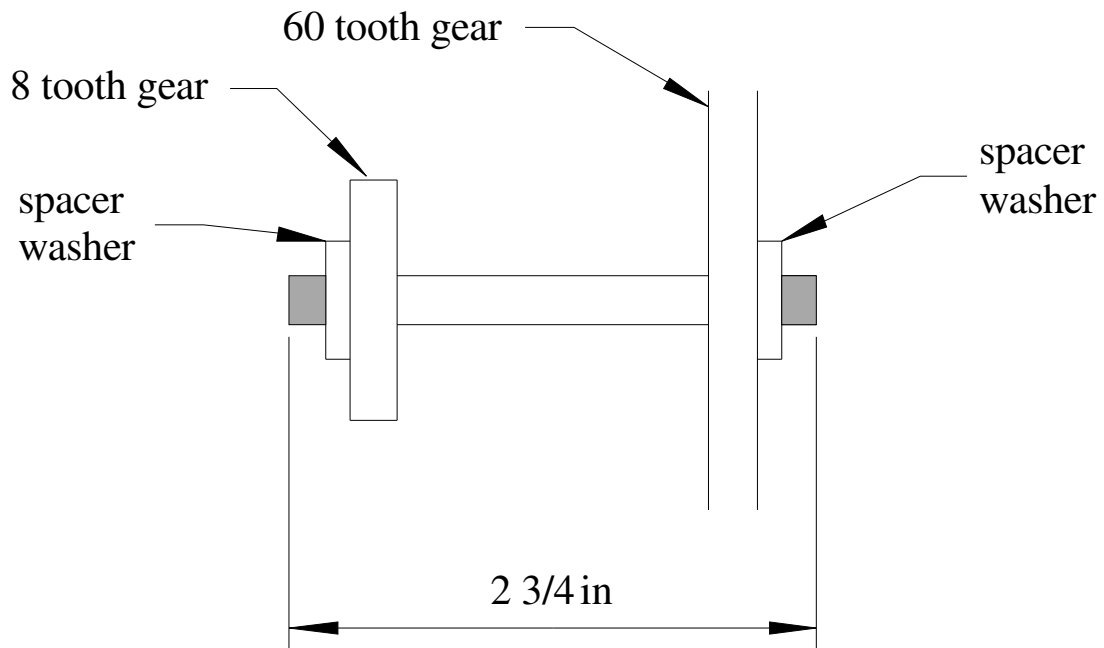
- 1 - 60-tooth Gear (#2)
- 1 - 8-tooth gear (#6)
- 2 - spacer washers (#42)
- 1 - 2 3/4" dowel



Assembly Procedure

Mount the 60-tooth gear and 8-tooth gear on the arbor in the positions indicated in the Gear Location Diagram. Place a spacer washer on both ends of the arbor.

Gear Locations



Escape Wheel Arbor

Parts

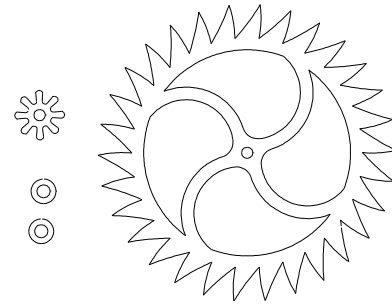
1 - Escape wheel (#5)

1 - 8 tooth gear (#6)

1 - 3 5/8" arbor

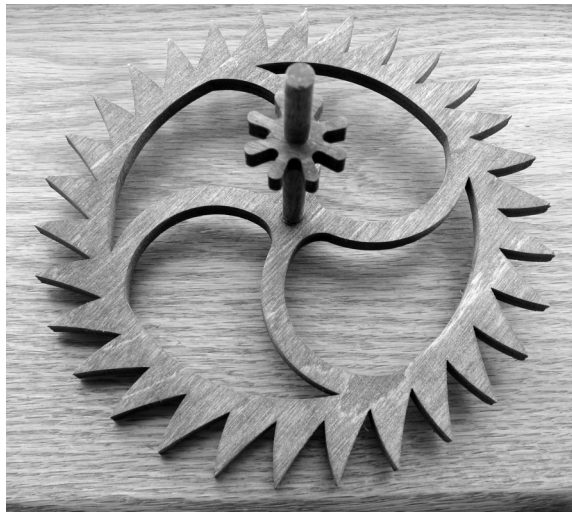
2 - Spacer washers (#42)

note: second hand will be installed
on this arbor after clock is assembled.

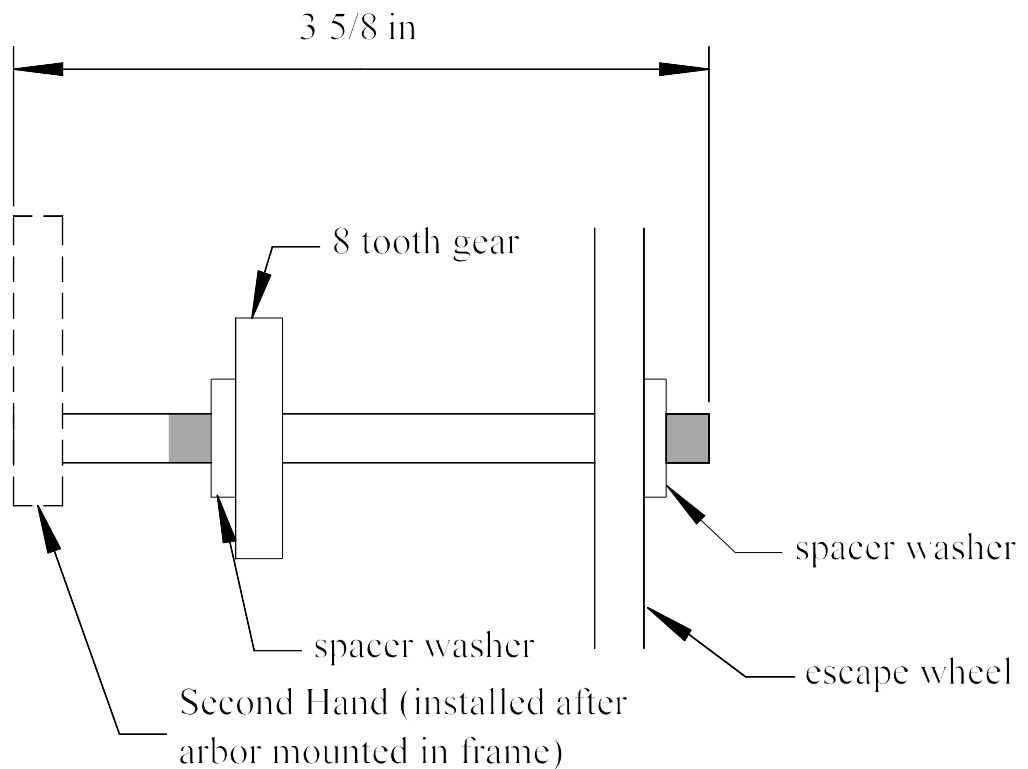


Assembly Procedure

Mount the 8-tooth gear and the escape wheel on the arbor in the positions indicated in the Gear Locations Diagram below. *Be sure the teeth of the escape wheel are oriented as shown below.* Place a spacer washer on both ends of the arbor.



Gear Locations



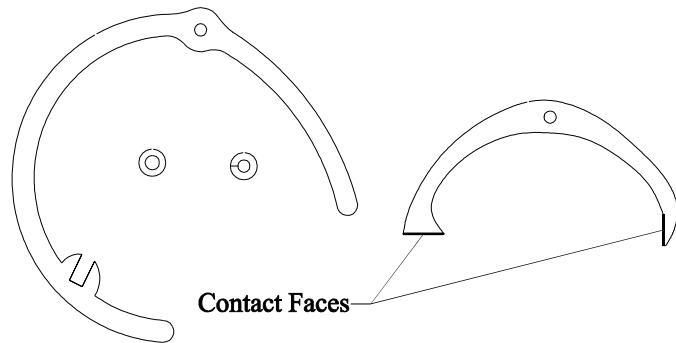
Escape Lever Arbor

Parts

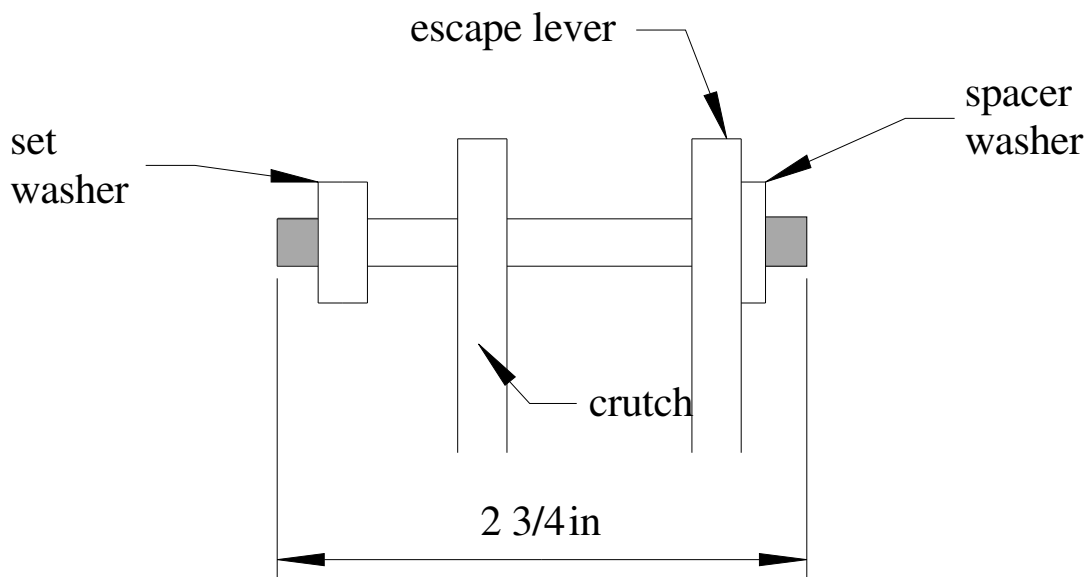
- 1 - Escape lever (#3)
- 1 - Crutch (#4)
- 1 - 2 3/4" arbor
- 1 - Set washer (#13)
- 1 - Spacer washer (#42)

Assembly Procedure

The contact faces of the escape lever must be smooth. Lay a piece of 220 grit sandpaper on a smooth, hard surface and lightly sand these two contact faces, making sure not to alter the angle or flatness of the faces. Repeat with 400 grit sandpaper. Then, apply pencil lead to the contact faces. Mount escape lever and the crutch on the arbor in the positions indicated in the Gear Locations diagram. *The escape lever must be oriented as shown below.* Mount the set washer and place a spacer washer on the escape lever end of the arbor.



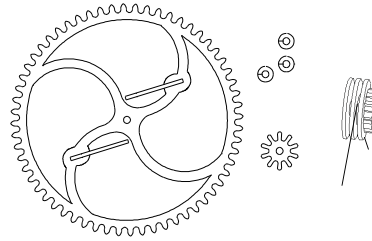
Gear Locations



Great Wheel Arbor

Parts

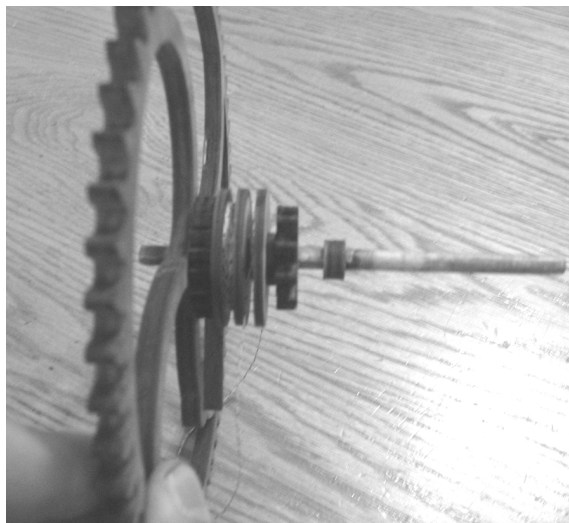
- 1 - 64-tooth great wheel (#1)
- 1 - set washer (#13)
- 1 - 10 tooth gear (#7)
- 1 - 4 5/8" arbor
- 2 - spacer washers (#42)
- Weight spool (assembled previously)



note: one set washer, hour gear, spacer washers, hour hand, and minute hand will be installed on this arbor after clock is assembled.

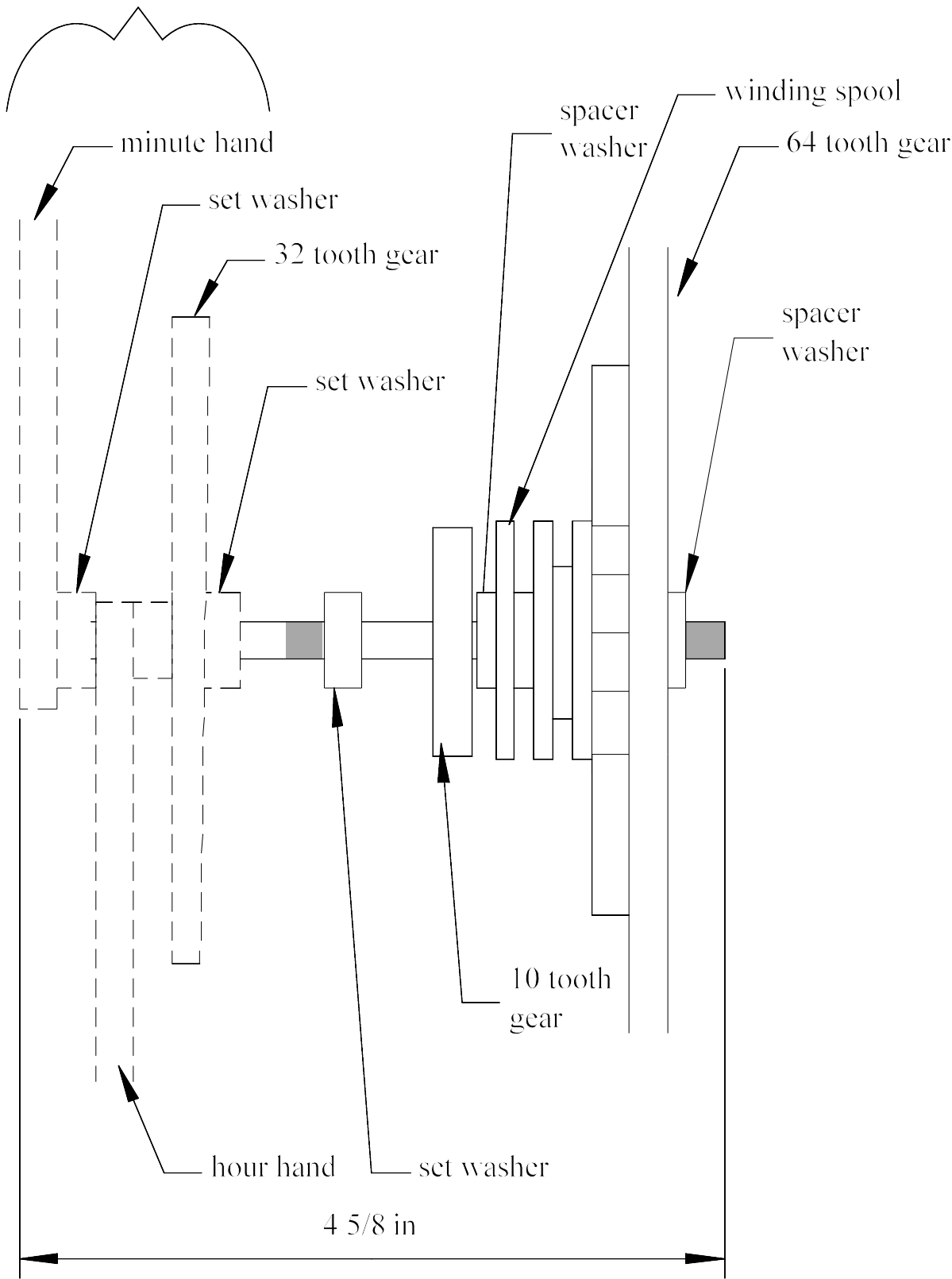
Assembly Procedure

Mount 64 tooth great wheel on arbor in position indicated in the Gear Locations diagram (see next page). *The side of the gear containing the ratchet pawl must be toward the long end of the arbor.* Slide weight spool, ratchet side first, onto the arbor. Twist the spool so the ratchet teeth mesh with the pawl. Slide a spacer washer onto the arbor, tight to the spool. Mount the 10 tooth gear on the arbor, bringing it nearly in contact with the spacer washer (leave about 1/16" gap so that the spool is free to rotate on the shaft without binding). Mount the set washer on the arbor in the position indicated in the Gear Locations diagram. Place a spacer washer on the great wheel end of the arbor. Additional components will be installed on this arbor after the arbor has been assembled in the frame.



Gear Locations

INSTALL THESE AFTER FRAME
HAS BEEN ASSEMBLED

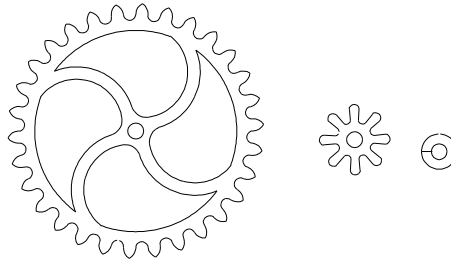


Minute Arbor

Parts

- 1 - 2 1/8" arbor
- 1 - set washer (#13)
- 1 - 30-tooth gear (#12)

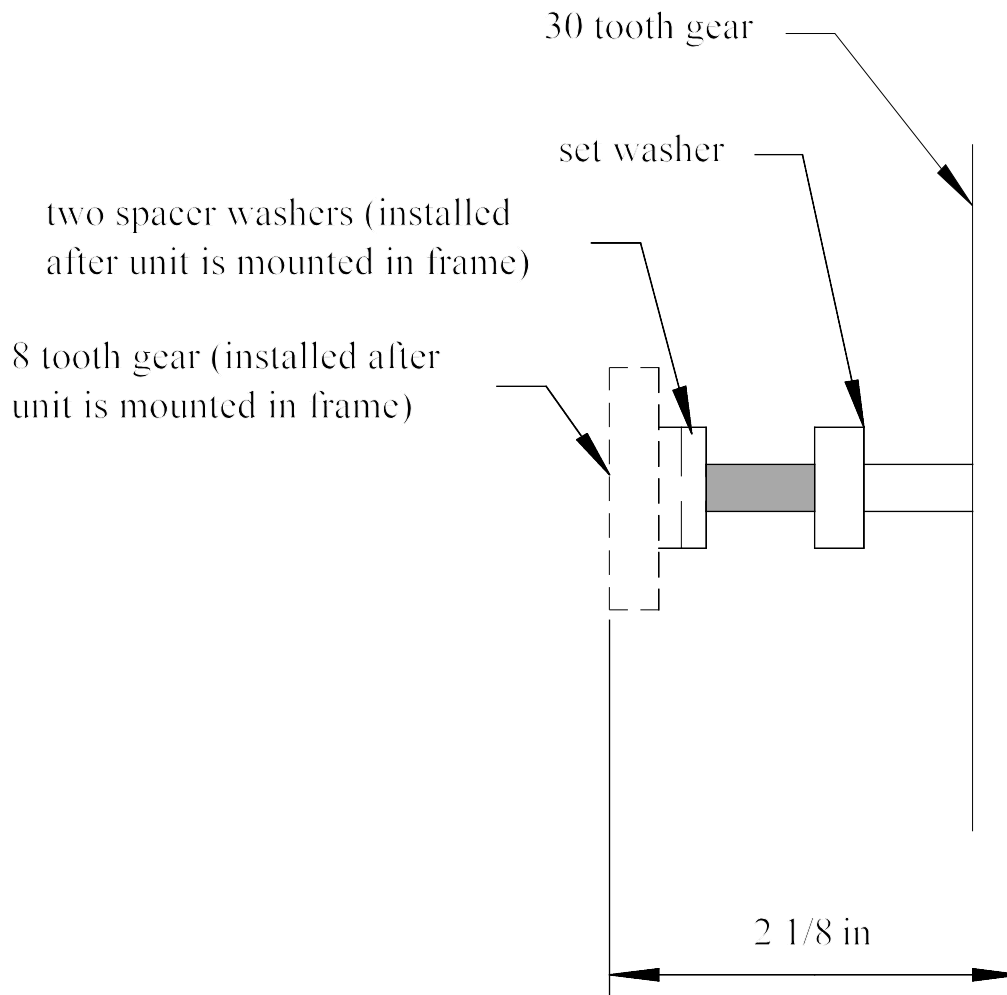
note: an 8-tooth gear and 2 spacer washers will be installed on the arbor after it is inserted in the frame.



Assembly Procedure

Mount the set washer and 30-tooth gear on the arbor in locations indicated in Gear Locations diagram (8 tooth gear and spacer washers will be mounted after arbor is mounted in frame).

Gear Locations



Winding Guide

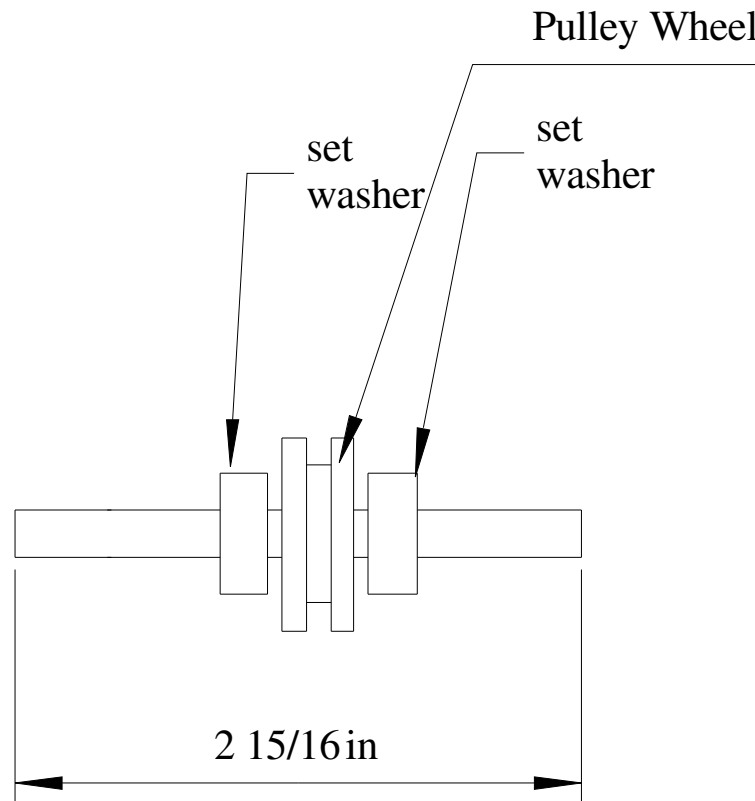
Parts

- 2 Set Washer (#13)
- 1 - 2 15/16" dowel
- Pulley Wheel (assembled previously)

Assembly

Mount the set washers and pulley wheel on the arbor in the locations shown in the Gear Locations diagram. Leave enough clearance between the washers and pulley wheel so the wheel can spin freely.

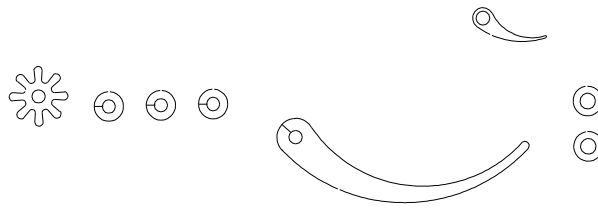
Gear Locations



Assembly

Parts

3 - set washer (#13)
Minute hand (#16)
Second hand (#18)
8-tooth gear (#6)
2 - spacer washer (#42)
2 - #6 x 1" screws



All of the following units have been assembled previously:

- Rear frame unit
- Front frame unit
- Escape lever arbor
- Escape wheel arbor
- Mid wheel arbor
- Great wheel arbor
- Minute wheel arbor
- Weight pulley
- Winding guide arbor
- 32-tooth gear with minute pipe and hour hand

Assembly Procedure

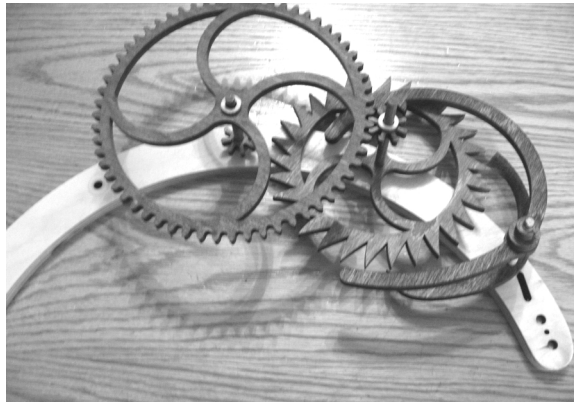
1) Set the rear frame unit on a flat surface with the interior face (the side containing the shoulder washers) up. Insert the escape lever into the topmost bushing with the escape lever down and the crutch up. Be sure that a spacer washer is located on the escape lever end of the arbor.



2) Insert the escape wheel arbor into the next highest bushing with the escape wheel down. Be sure that a spacer washer is located at both ends of the arbor.



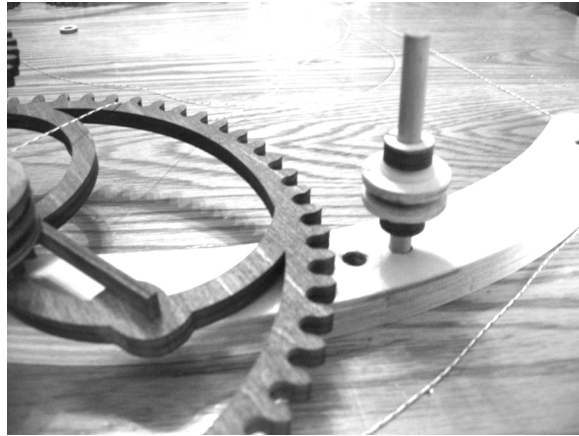
3) Insert the mid wheel arbor into the next bushing, with the 8-tooth gear down. Be sure there is a spacer washer at both ends of the arbor. The 60-tooth gear should mate with the 8-tooth gear on the escape wheel arbor.



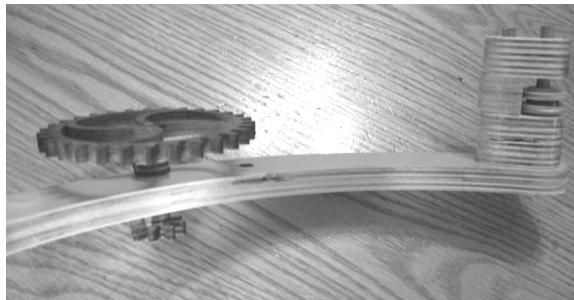
4) Insert the great wheel arbor into the next available bushing, with the 64-tooth gear down. Be sure there is a spacer washer adjacent to the 64-tooth gear. The 64-tooth gear should mate with the 8-tooth gear on the mid arbor. (Note: the 10-tooth gear on the great wheel arbor does NOT mesh with the nearby 60-tooth gear.)



5) Insert the winding guide arbor, short portion of the arbor down, into the endmost 1/4" hole in the rear frame.



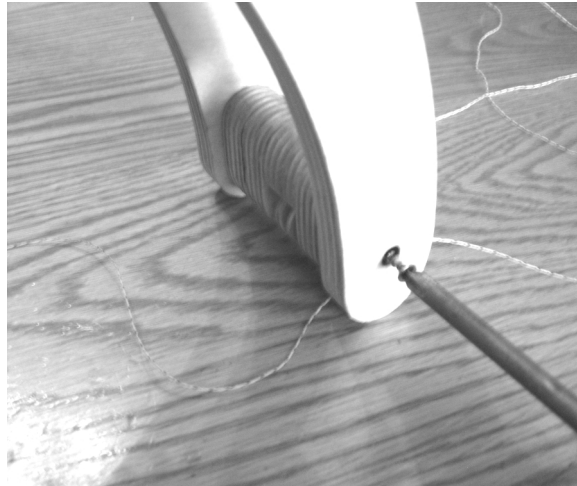
6) Insert the minute arbor unit through the lowest hole in the front frame unit (this hole contains a nylon shoulder washer on both sides, installed previously). The 30 tooth gear should be on the interior side of the frame (the same side as the pillar). Slide two spacer washers onto the arbor protruding through the front of the frame and complete by installing the remaining 8-tooth gear on the arbor. Adjust the position of the spacer washer and/or 8-tooth gear so the arbor can spin freely in the bushings.



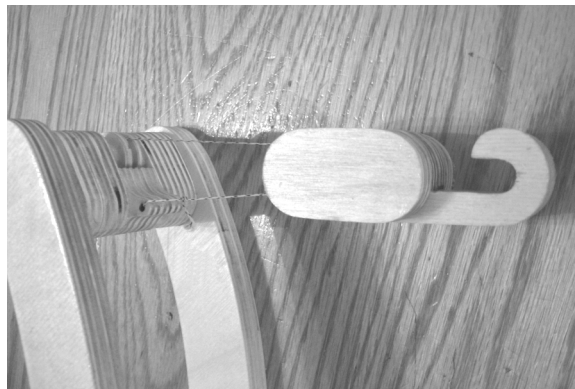
7) This might take a little patience. Carefully attach the front frame unit. Note that the escape wheel arbor and great wheel arbors extend through the front frame. Line the arbors up with the bushings as the frame front is applied. The dowels protruding from the pillars engage with the corresponding holes in the rear frame.



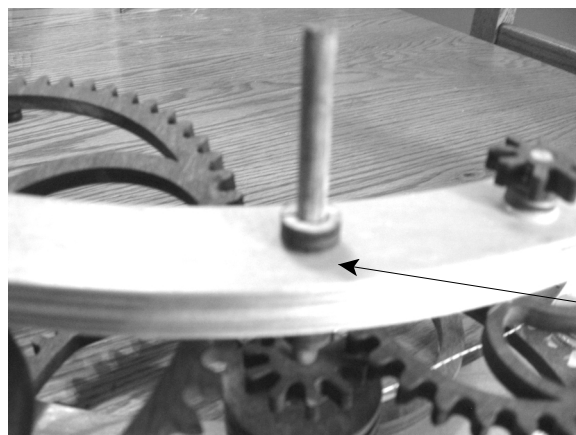
8) Secure the rear frame to the pillars with one #6 x 1" screw through the hole in each end of the frame.



9) Lay the clock down, front side up. Route the short cord from the larger diameter weight spool hub over the pulley in the lower pillar. Then route this cord through the weight pulley and back up to the pillar, tying off the cord in the hole in the bottom of the lower pillar. Make sure the weight pulley hook is oriented as shown below. Be sure the knot is secure since it will be supporting the weight shell.



10) Place a set washer on the great wheel arbor that extends through the front frame. Locate the set washer so that there is about 1/8" of clearance between the frame and the set washer.



1/8" gap between set washer and frame

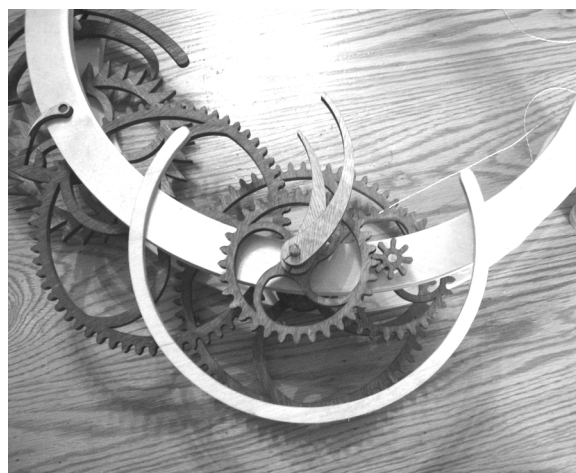
11) Slide the minute pipe (installed in 32-tooth gear) onto the great wheel arbor (it should fit loosely on the arbor). The 32-tooth gear mates with the 8-tooth gear. Push a set washer onto the arbor. Maintain a small amount of clearance between the set washer and the minute pipe so that the 32-tooth gear can rotate freely on the arbor. Finally push the minute hand onto the arbor. It should be tight enough to hold its position, yet be able to rotate to a new position (the hands cannot be glued to the arbor). *If either of the hands is too loose (causing the hands to slip), apply a small amount of glue to the shaft to build it up slightly. Allow to dry completely before attaching hand. If the hands are too tight, sand the shaft or interior hole of the hand.*



12) Attach the second hand to the escape wheel arbor protruding through top of front frame. It should be 'friction fit' like the other hands—not glued.

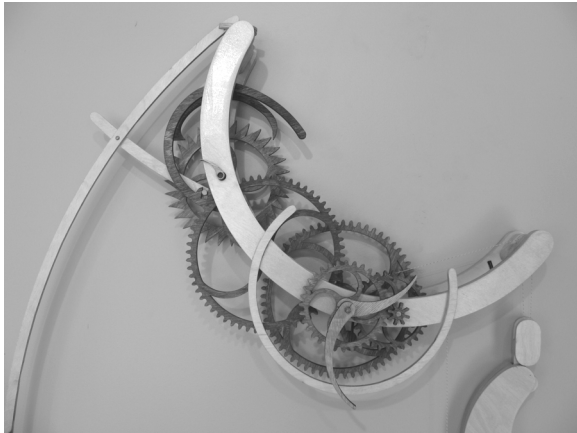


13) Place the dial on the front frame, centered on the great wheel arbor (look at the great wheel to help find the center position). Mark the dial's location on the frame. Glue the dial in place.

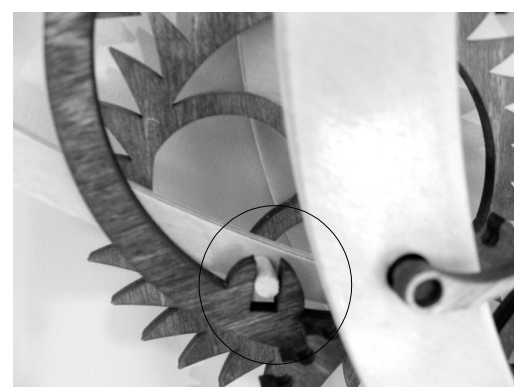
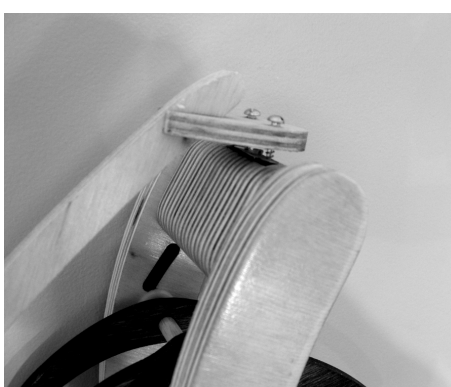


Mounting Instructions

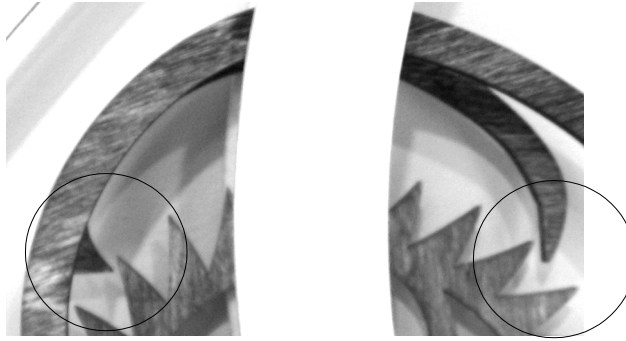
- 1) Determine the location to hang your clock. Be sure to consider the following:
 - a) The clock must be mounted securely to the wall. Locate a stud within the wall for the most solid mounting possible. The stud needs to be behind the 1/4" hole in the rear frame (near the winding guide).
 - b) Choose a location which is free from obstructions to the swinging pendulum or the descending weight.
 - c) Do not locate the clock near a child's crib or bed or in a child's play area.
 - d) For best operation, select a location that will be free from vibration and drafts (adjacent to a door may be problematic due to vibrations or air currents from slamming doors).
- 2) Thread the acorn nut onto the hanger bolt and drive the hanger bolt through the wall into a stud at a height of approximately 70" above the floor (it will be easier to drive the hanger bolt if you predrill a 1/8" pilot hole in the wall). Sink the hanger bolt until there is a gap of approximately 3/8" between the acorn nut and the wall.
- 3) Remove the acorn nut from the hanger bolt, leaving the hanger bolt in the wall.
- 4) Hang the clock on the hanger bolt through the hole in the rear frame. Place a washer on the hanger bolt, followed by the acorn nut. Orient the clock frame approximately as shown below (pendulum and weight are shown in photo but are not installed at this point). Tighten the nut until the clock is snug to the wall and holds its position on the wall unless forcibly rotated.



- 5) Hang the pendulum by setting the screw tips of the pendulum hanger bracket into the small holes in the pendulum support plate in the upper pillar. NOTE: The screw tips simply rest in the support plate holes; these screws do not get driven into the support plate. As the pendulum gets set into place, the dowel protruding from the crutch arm slips into the slot in the crutch. Rotate the crutch arm to bring the crutch pin into the approximate center of the crutch slot.



6) The clock must be positioned so the escapement is in balance. If necessary, rotate the clock on the wall until the escape lever appears to be evenly balanced over the escape wheel (note the spacing between the escape lever faces and the escape wheel teeth in the photo below).



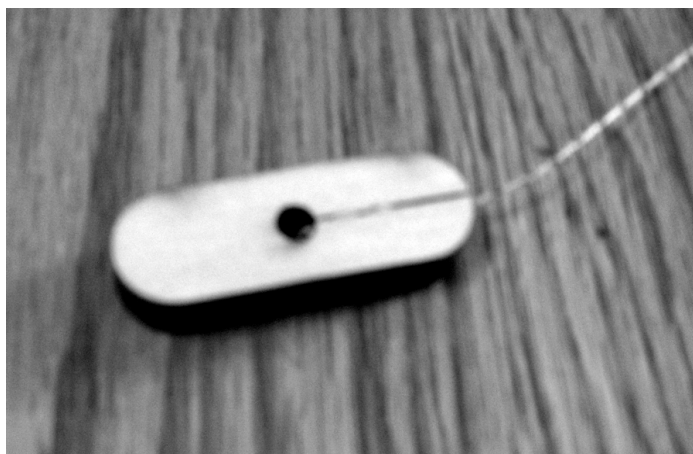
7) Refer to the circled portion of the last picture on the previous page. It is important that the proper amount of clearance be present between the crutch slot and the crutch arm dowel. The dowel should not fit tightly in the crutch slot, but there must be a small amount of clearance between the slot sides and the dowel. If necessary, sand the dowel to achieve proper clearance.

8) View the clock from the right side. Check that the pendulum shaft is approximately parallel with the crutch. If needed, the pendulum can be rotated to adjust its alignment with the clock. This adjustment is made by rotating the pendulum support plate in the top pillar. Once the proper position of the pendulum is established, the screw holding the support plate into the pillar can be fully tightened. Also, check that both of the screws are resting on the support plate. If necessary, raise or lower one of the screws so that they both bear on the support plate and allow the pendulum to be in a vertical plane.

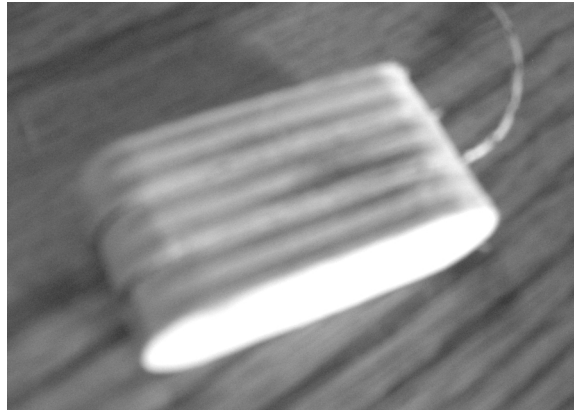
9) Sand the edges of the three rewind pull parts (#27, #28).

10) Route the long cord coming off the smaller hub of the weight spool over the pulley wheel on the winding guide. If necessary, adjust the position of the set washers on the winding guide axle so pulley wheel is in alignment with the smaller hub and the pulley wheel can spin freely. The rest of the cord should hang down to the floor.

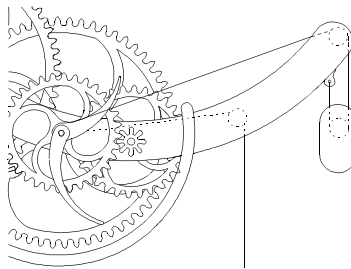
11) Cut off the long cord at the floor. Tie a large knot near the end of this rewind cord. Insert the cord into the slot in the rewind pull center piece (#27), with the knot located in the hole. Make sure the knot cannot pull through the slot.



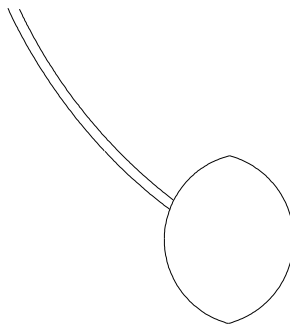
12) Glue the outer rewind pull pieces (#28) to either side of the rewind pull center piece (#27). Apply finish to the rewind pull.



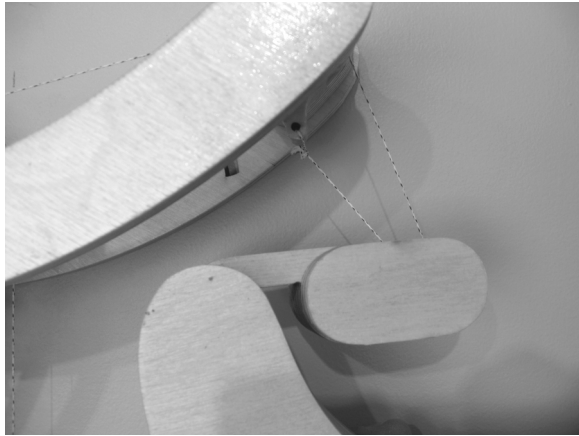
13) Make sure the weight cord (which comes off the larger hub of the weight spool) follows over the pulley wheel in the lower pillar, then down and back up around the pulley wheel in the weight hook. Make sure the rewind cord (which comes off the smaller hub of the weight spool) follows over the pulley wheel on the winding guide.



14) Adjust the pendulum bob's orientation until its midline is in a vertical position. The thumbscrew on the back of the bob can be loosened or tightened to aid adjustment.



13) Hang the weight shell from the weight hook by tipping the hook to the side threading the hook onto the dowel in the top of the weight shell.



14) At this point, some adjustments will likely be needed to get the clock running. For now, give the pendulum a slight push to the side and release to see if the clock will start running. Then, continue on to the next section of the instructions.

Adjusting and Regulating

After the clock is mounted on the wall, it will likely need some adjustment in order to get it running properly. Follow the steps below for initial adjustment of the clock. If you still experience difficulty in getting the clock to operate, see the Troubleshooting section of these instructions.

1) Verify proper play in arbors.

Each arbor should have a small amount of play (about 1/16") so that the arbors can be jiggled back and forth between the frame pieces. If necessary, move gears or set washers until proper play is established.

2) Check gear mating.

Verify that each gear is mating properly with its neighbor and that no gear is binding.

3) Bring clock into beat.

A slight push of the pendulum shaft to one side should start the clock in motion. The clock will most likely stop after a few seconds or minutes as the escape lever hangs up on an escape wheel tooth. If the escape wheel stops the motion after only a few swings, adjust the position of the clock on the wall as follows: if the escape lever hangs up its right side, rotate the clock slightly clockwise. This will raise the right side of the escape lever. If the lever hangs up on the left side, the clock must be rotated slightly counterclockwise in order to raise the left tip of the lever. Adjust until the pendulum will make several oscillations before stopping. Small adjustments of the clock's vertical position should bring the clock into beat. The vertical orientation of any pendulum clock is critical.

Once the clock's correct position is established tighten the acorn nut to firmly secure the clock to the wall. If needed, an additional anchor can be added. Mark on the wall the location of the slot in the upper portion of the rear frame. Remove the weight and pendulum, and carefully rotate the clock out of the way so that a wall anchor can be driven in at this point. Drive the wall anchor into the wall, reposition the clock, place a washer on the anchor screw and drive it through the slot into the anchor. Tighten both this anchor and the acorn nut. Replace the pendulum then the weight and doublecheck the clock beat as described in the previous step. Once the proper position is established, further tighten both wall anchors so the clock cannot move on the wall.

4) Setting the time

The hour and minute hands need to be set independently. Both hands should be friction fit on their shafts so that they can be rotated. You should grasp the great wheel when setting the hands to prevent the entire motion train from moving. After positioning the hands, verify that neither hand was inadvertently angled inward or outward so that it rubs on or interferes with the other hand or with the gear on the front of the clock.

5) Regulating the clock

The pendulum keeps the clock running at a constant pace. The position of the bob on the shaft determines how fast the clock runs. If the clock runs slow, move the pendulum bob higher. If the clock runs fast, move the pendulum bob lower. As you adjust the bob, make sure you keep the bob oriented vertically so the clock's beat is not affected. Patiently adjusting the bob over the course of several days should result in the clock keeping reasonably accurate time. Expect your clock to gain and lose time with changes in temperature and humidity. Also, expect your clock to require a "break-in" period of a week or two during which it may not be as consistent as it will in the future.

6) Winding the clock

Wind the clock by pulling downward on the rewind pull or rewind cord with your left hand while simultaneously lifting the weight with your right hand. It will take some practice to get the feel for this. Verify that neither cord has jumped off of its pulley. If necessary, restart the pendulum after winding. The clock should run for over 30 hours on one winding.

7) Final gluing

The friction fit of the set washers is purposely looser than the gears to permit easy adjustment. Once the proper position of set washers has been established, they can be glued onto the arbors if desired. The gears ought to be tight enough on their arbors to not require glue. However, if needed, they can be glued at any time in the future. Do not glue the following pieces: the two set washers on the front side of the great wheel arbor, second hand, hour hand, and minute hand.

Troubleshooting

If, after following the Regulating and Adjusting instructions, the clock fails to operate properly, refer to the suggestions below.

Gear Train Will Not Advance

If the gear train will not advance when weight is applied to weight cord, check the following possible problem sources. If you are having difficulty with the gear train, it might be easier to troubleshoot if the escape lever arbor is temporarily removed to allow free movement of the gears.

Friction between arbors and bearings

The arbors must spin freely in the nylon bearings. Check to see that the arbors have been sanded smooth where they contact the bearings. Additional sanding may be necessary if the arbors are too tight in the bearings.

Play in gear arbors

There must be a small amount of play in each of the arbors. There should be about 1/16" of free play so that the arbor can be jiggled back and forth between the frame pieces. If the spacers are pushed too tightly against the nylon bearings so that no back and forth movement is allowed, move one of the gears inward on the arbor to allow a small space between the spacers and the nylon bearings.

Gear alignment

Check to see that each gear is aligned with its mating gear. Reposition gears on the shaft as necessary so that mating gears fall in line with each other.

Gear positions

Each gear should mesh smoothly and easily with its mate, with a small amount of play between the mating teeth. Double check the assembly instructions to be sure the correct gear is in each position.

Hands rubbing

Check that neither the hour nor minute hand is toed inward or outward, causing them to rub on each other or on the gears on the front of the clock. Adjust hand positions as necessary so that hands are able to rotate completely without interference.

Pendulum pivot seating

Check to make sure that both of the pendulum pivot screws are resting in the holes in the pendulum support plate.

Gear tooth obstruction

Inspect the gear teeth to be sure that each tooth is clean and free of burrs, shards, or stain/varnish build up.

Clock Runs For A While Before Stopping

If the clock runs for awhile but then stops, there are a number of factors that could be involved. Check each of the following:

Gear train

The problem may be with the gear train itself. Remove the escape lever arbor and troubleshoot the gear train (see above section for possible causes of gear train problems).

Escapement out of beat

If the escape lever has stopped the clock by not releasing a tooth of the escape wheel, try to restart the clock by restarting the pendulum in motion. If it continues to run for a while and eventually stops on the same side of the escape lever as before, then the clock is likely out of beat. The clock is brought in beat as described in the Regulating and Adjusting section of these instructions.

Weight

As the escape lever releases a tooth of the escape wheel, the escape wheel should advance immediately and freely until its motion is stopped by the escape lever. If the wheel seems to lag, follow the suggestions in the above section on troubleshooting the gear train to minimize sources of friction. If this does not help, it might be necessary to add more weight to overcome the friction that is present. Try increasing the weight to see if this solves the problem. (You should not use more weight than is necessary to drive the clock. Excess weight will place undue strain on the parts and may increase wear and tear on the components.) You might find that more weight is required during the “break-in” period, and that the amount of weight can be reduced after the clock runs for a week or two.

Escape lever, crutch, or gear slippage

Make sure that none of the motion train components slip on their arbors. In particular, check that the escape lever and crutch are not loose enough to slip. Glue any components as necessary.

Crutch slot clearance

It is important to have the proper fit between the pendulum shaft and the crutch slot. Friction between the crutch forks and the pendulum shaft can rob energy from the clock and return the pendulum to a stop. The space between the crutch forks should be equal to the width of the pendulum shaft plus the thickness of a piece of paper. If it is too tight, sand the section of the pendulum shaft that passes between the forks. This section of the pendulum must be smooth, as must the interior portions of the crutch forks. On the other hand, the gap between the shaft and the forks cannot be much larger than the thickness of a piece of paper or the clock will not run well either.

Escape lever face smoothness

As the escape wheel teeth kick off the escape lever faces, the teeth must slip freely across the faces. Make sure the two faces (the parts of the escape lever that make contact with the escape wheel teeth) are very smooth and that the tips are free from burrs. When sanding the pallet faces, use 400 grit paper, sand very lightly, and be very careful not to change the angle or shape of the pallet faces. It will also help to lubricate the contact faces with some pencil lead.

Hanger tightness

If the hanger bolt(s) are not tight enough, the clock’s vertical orientation can change. This is especially likely to happen when winding the clock. Make sure that the anchors are tight enough to prevent the clock from shifting left or right without a deliberate effort to do so.

Pendulum plumb

The pendulum bob must not rub against the wall or on the weight casing. If the pendulum shaft does not hang straight down, adjust the pendulum support bracket screws in or out to alter the alignment of the pendulum shaft.

Miscellaneous

Humidity can influence the performance of your clock. When the humidity is very high, you might find it more difficult to keep the clock running on time.

Technical Support

We are available by telephone or email to assist you with any problems or to answer any questions you have while you are building your clock. Do not hesitate to contact us for assistance:

E-mail: jeff@wooden-gear-clocks.com

Telephone: 715-955-4104

Comments?

We'd love to hear from you about your experience with the Crescent clock. Please drop us a note if you want to share any thoughts about the Crescent clock or if you have any suggestions for improvements that can be made!