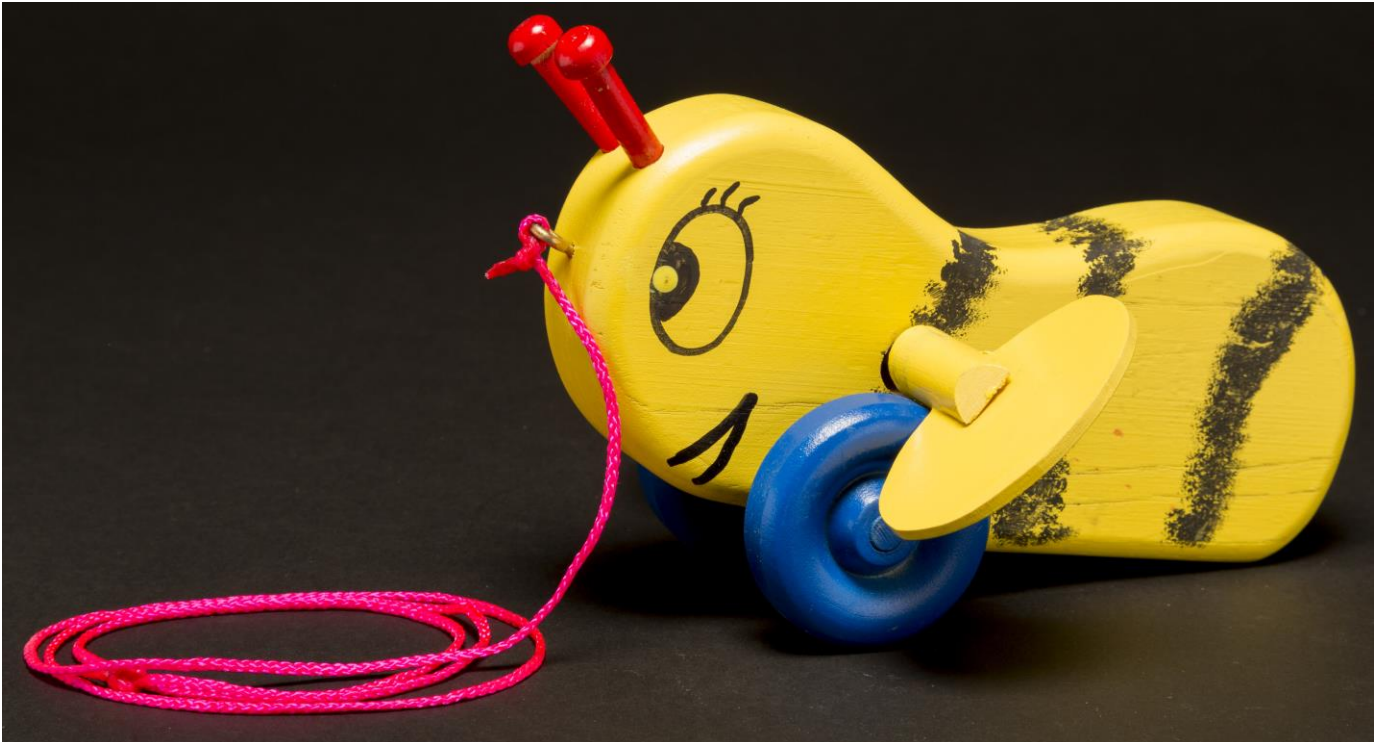


## 8. Honey Bee

Even though this honey bee is not designed to fly, it entertains young children by “flapping” its wings as it is pushed or pulled across the floor.



**Figure 8-1.** Honey Bee

### **Materials, Tools and Plans**

Tables giving the materials required to construct the honey bee are given on the next page, followed by a parts explosion (Figure 8-2) and the special tools required. Drawings of all the parts can be seen in Figure 8-3.

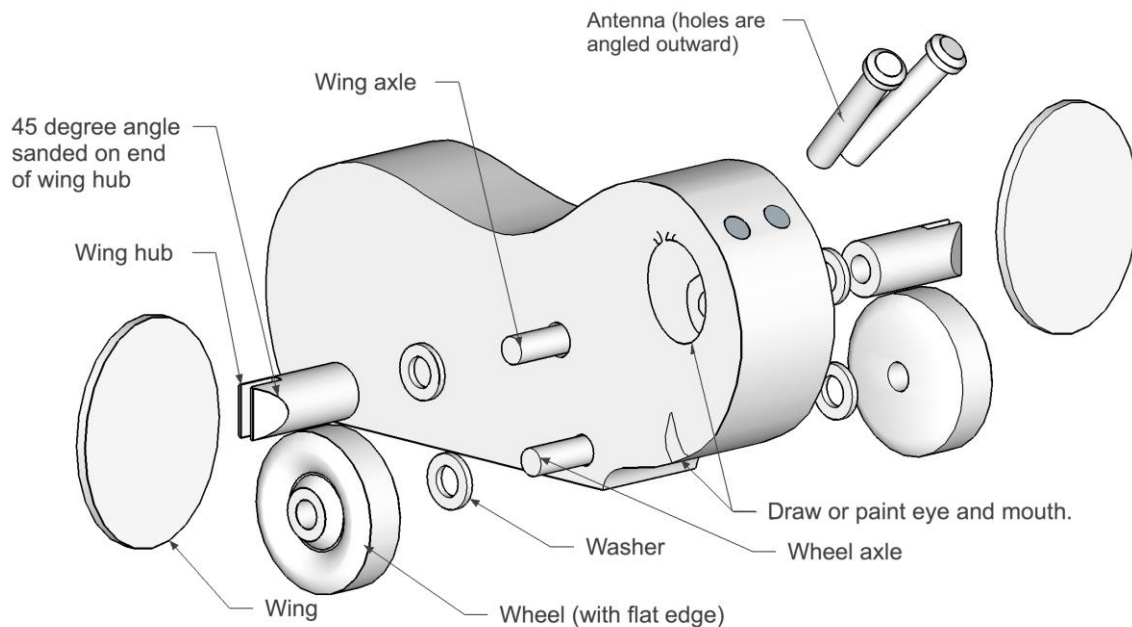
## 8. Honey Bee

### Wood Cut List

Part	Material	Size (thickness, width, length)	Qty
Body	Any wood	1 1/8" – 1 1/2" x 3 1/4" x 6 1/2"	1
Wings	Plywood	1/8" x 2" x 2 1/4"	2
Wheel axle	Dowel	1/4" diameter x 3" (cut-to-fit)	1
Wing hub	Dowel	1/2" diameter x 12" (cut-to-fit)	1
Wing axle	Dowel	1/4" diameter x 4" (cut-to-fit)	1

### Other Parts

Part	Material	Size	Qty
Wheel <sup>18</sup>	Any wood	1 1/2" with 1/4" center hole	2
Antenna	Axle peg	7/32"	2
Decoration	Paint, Sharpie pen	Yellow, blue, black, red	
Washers	Metal or plastic	1/4"	4
Screw eye <sup>19</sup>	Steel	Small	1
Pull string <sup>19</sup>	Nylon	30"	1



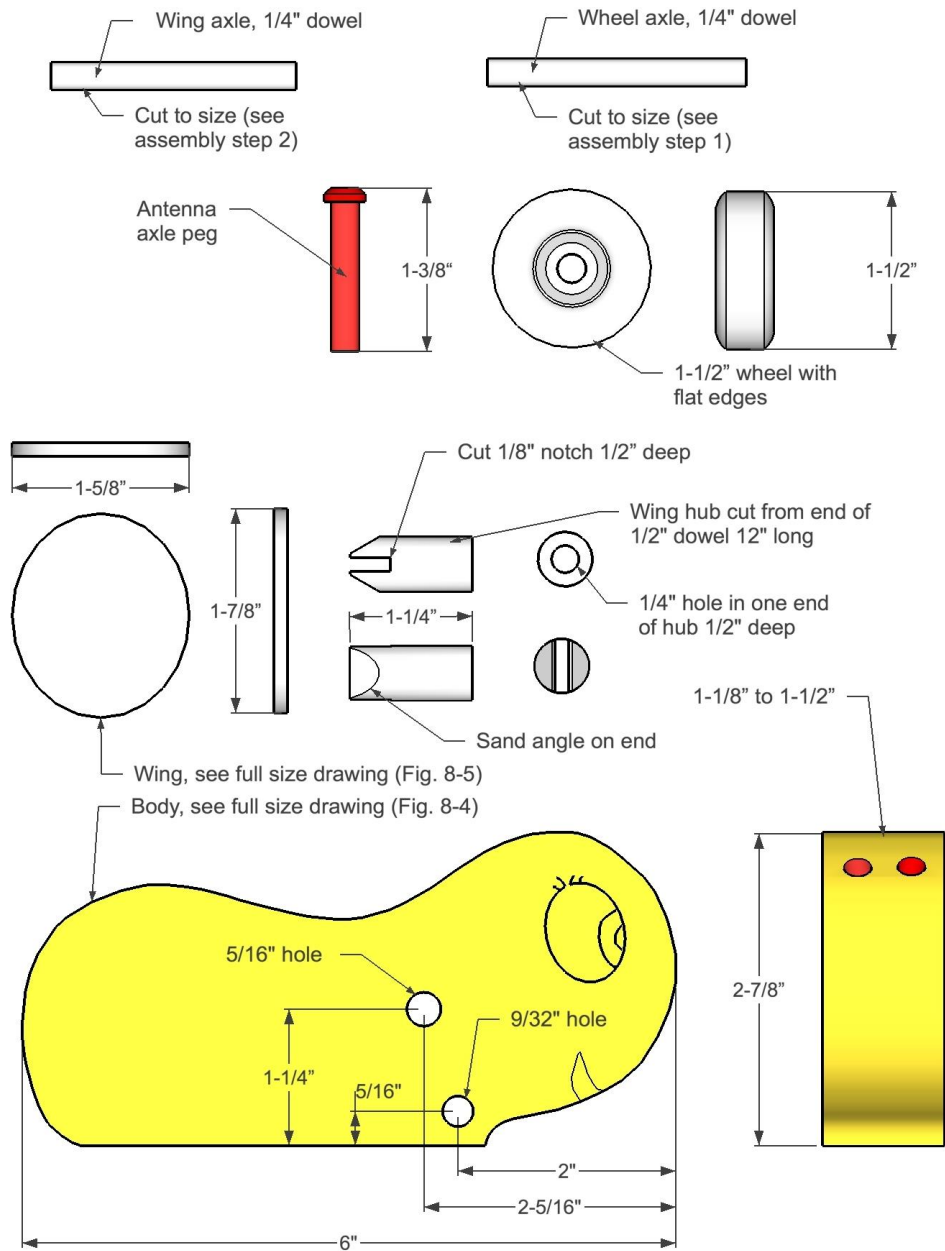
**Figure 8-2.** Parts Explosion

<sup>18</sup> A slab wheel, available from most wooden toy parts suppliers, could be used.

<sup>19</sup> These are optional. They are used to make the bee a pull toy.

**Tools Required**

- Woodworking tools and supplies (see Chapter 2, pp. 14-15)
- Special tools for this toy:
  - Drill bits:  $\frac{9}{32}$ " ,  $\frac{5}{16}$ " ,  $\frac{15}{64}$ " ,  $\frac{1}{4}$ " or  $\frac{17}{64}$ " ,  $\frac{1}{2}$ " (optional for jig, p. 65)



**Figure 8-3.** Honey Bee Parts

## Steps

The step-by-step instructions for making the parts and assembling the honey bee follow. Actual size templates for the body and wings are given in Figures 8-4 and 8-5, and a front view of the finished toy is shown in Figure 8-6.

### Body

**1 – Transfer pattern.** Use a block of wood at least 1 1/8" thick by 3 1/8" wide and 6 1/2" long. The block can be thicker - up to 1 1/2" thick. Transfer (trace) the pattern for the body (Figure 8-4) onto the block.

**2 – Mark holes.** Using a scratch awl or nail, mark the hole locations on one side. There will be one location for the wheel axle and one for the wing axle.

**3 – Drill holes.** Use a drill press if possible. If not keep hand drill bit square to the wood. The wheel axle hole is 9/32". The wing axle hole is 5/16".

**4 – Shape.** Cut out the shape of the body 1/32" to 1/16" outside the outline.

**5 – Sand.** Either by hand or with power equipment, sand all the edges to the outline.

**6 – Round over edges.** If a router is not available, round over the edges with a rasp, file, and sandpaper. If available, use a router with a 3/16" or 1/4" round over bit, to round over all the edges.

**7 – Finish sanding.** Hand sand all surfaces, finishing with 150-grit sandpaper.

**8 – Drill two holes for antennas.** On either side of the head of the bee, drill holes 1/2" deep for the axle peg antennas. From the side view (see Figure 8-4), these holes should be at an angle of approximately 45 degrees to the bottom of the body. From the front, they should point at a slight angle (10 to 15 degrees) outward (see Figure 8-6).

### Jig for Drilling Antenna Holes

See Chapter 19, p. 173

To drill these holes, use a 15/64" bit. The axle peg tenons will probably need to be sanded to create a proper glue joint. This operation can be done using a hand drill. The exact angle is not critical. Experiment in a piece of scrap wood and hold the body securely with a clamp or in a vice.

Set the body aside for now.

### Router Safety

**DO NOT USE** a router to round over edges of toy parts **UNLESS** the router is stationary, that is attached to a router table. See Ch. 18, p. 158.



## Wings and Wheels

**1 – Shape wings.** Cut two ovals out of a piece of  $\frac{1}{8}$ " plywood using the pattern provided (Figure 8-5). Sand the edges to smooth out the wings.

**2 – Prepare hubs.** Using a piece of  $\frac{1}{2}$ " dowel at least 12" long (for safety) cut a notch on each end of the dowel to accept the wings. Center the  $\frac{1}{8}$ " wide cuts on each end of the dowel. One way to do this is to make a  $\frac{1}{2}$ " deep cut on a band saw, then nibble away to widen the space. Check the fit frequently.

### Jig for Cutting Notches in Hubs

See Ch. 18 (p. 164) for a special purpose jig used to cut notches in hubs.

Next sand, file, or cut a  $45^\circ$  angle on each side where the wings attach. Each end of the 12" dowel should look as follows:



### Jig to Create 45 Degree Angle on Hubs

See Chapter 20, p. 182.

**3 – Holes for wing axle.** After both notches fit the wing, cut a  $1\frac{1}{4}$ " piece from each end of the 12" dowel. These  $1\frac{1}{4}$ " pieces will become the hubs that connect the wings to the wing axle. Make the cuts as square as possible.

Next, drill a hole in the center of the hub end that is not notched. Use either a  $\frac{1}{4}$ " or  $\frac{17}{64}$ " drill bit, depending on the actual size of  $\frac{1}{4}$ " dowel purchased for this project. Test in a piece of scrap wood to determine which drill bit provides the best fit for gluing the dowel into the hub.

Mark the center of the hubs as accurately as

possible for drilling. Use a scratch awl or small nail, but do not hit it hard or the hub may split.

This next operation should be done on a drill press if available. Drill the  $\frac{1}{4}$ " or  $\frac{17}{64}$ " holes in the end of the hubs  $\frac{1}{2}$ " deep. Be sure to keep the drill bit square to the end of the hub or the wings will not work properly. Securely clamp the hubs on the drill press bed or in a vice before drilling. The result will be two hubs that look as follows:



### Jig to Drill Holes in Hubs

See a simple jig at the end of this chapter (p. 65) for safely drilling holes in the end the hubs.

**4 – Attach wings to hubs.** Glue the wings into the hubs as shown in the diagram below, ending with what look like two small ping-pong paddles. Hereafter called a "hub-wing."



**5 – Flatten wheel treads.** To make the wings turn as the bee is moved across the floor, the edges of the wheels must be flat. If the  $1\frac{1}{2}$ " wheels purchased for this toy have a rounded tread, it will be necessary to flatten the tread. (It is, however, possible to purchase slab wheels that have a flat tread.) Rounded wheels can be flattened on a stationary belt or disk sanding machine, or by hand. Be careful. The wheels still need to be round but just have flat edges.

### Jig for Flattening Wheel Treads

See the wheel sanding jig, Chapter 20, pp. 178-9.

## Finish

**1 – Sand.** Use 150 grit sandpaper to sand all parts for finishing.

**2 – Prime.** Before painting, prime the body, hub-wings, wheels and antenna. Use an acrylic primer or shellac. If shellac is used, lightly sand the finish to remove the raised grain. Allow to dry completely.

**3 – Paint.** Use yellow for the body and hub-wings, blue and red (or colors of your choice) for the wheels and antennas, respectively. Cover the

last 1/2" of the antenna tenons with tape so no paint gets on the ends.

Avoid getting paint in the axle holes of the wheels and wing hubs. This will allow better glue adhesion. Don't paint the axles. To paint the black stripes on the body, use a brush, rag, or sponge. Draw the eyes and a mouth on the bee using a Sharpie pen.

Once the paint is dry, one or two coats of water-based polyurethane will help to preserve the finish and make it easier to clean the toy.

## Assemble

**1 – Wheel axle.** Cut the 1/4" dowel for the wheel axle about 1/4" longer than the sum of the thickness of both wheels plus the thickness of the body and two washers. This will allow a loose fit for the wheels.

**2 – Wing-hub axle.** Cut the 1/4" dowel for this axle 1/8" longer than the depth of both holes in the hubs plus the thickness of the body and two washers.

**3 – Dry assemble.** Assemble without glue to check that the wings turn while the bee is rolled along the work bench. The hubs should rest lightly on the wheels. If the wings do not turn, enlarge the hole for the wing-hub axle slightly and test again.

**4 – Glue wheels and wing-hubs.** After checking that the wings turn with the wheels, glue parts together. When gluing axles or axle pegs in holes, put glue into the hole using a toothpick or nail. Do not put glue on the axle or shaft of the axle peg.

Glue one wheel onto the wheel axle up to the outside edge of the wheel. Allow glue to set,

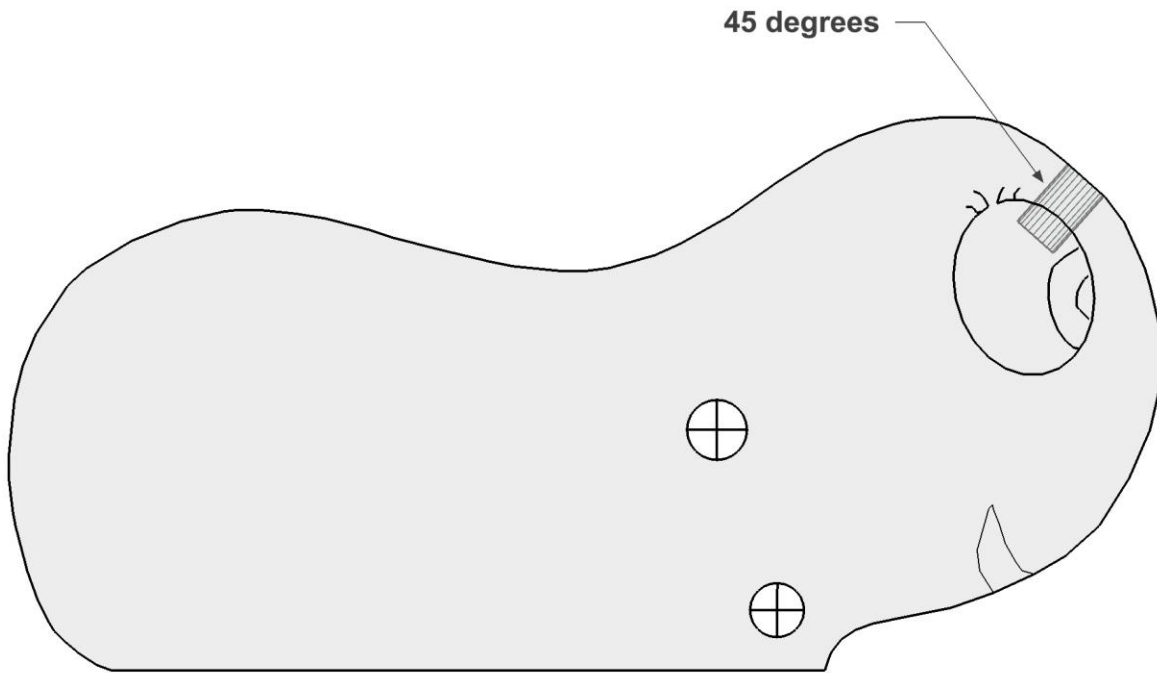
then place a 1/4" washer on the axle, slide the axle through the body, and place a second washer on the other side. Now glue the second wheel in place.

Glue one wing-hub onto the wing-hub axle. After glue sets, place a 1/4" washer on the axle, put the axle through the body, place a second washer on the other side, and glue second wing-hub onto the axle.

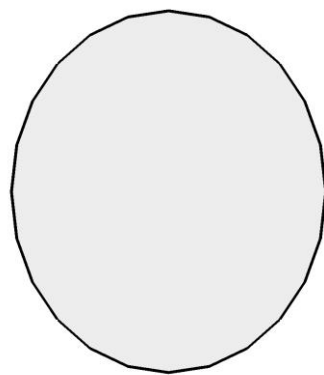
**5 – Glue antennas.** Glue the antennas in place. Since the antenna holes tend to become enlarged when drilling them at an angle, it is suggested that thicker wood molding glue be used.

**6 – Finishing touch (optional).** Once the glue has thoroughly dried, paint the ends of the wheel axles the same color as the wheels.

**7 – Pull string (optional).** If honey bee is intended to be a pull toy, attach a screw eye and pull string. (See Figure 8-1 and "Making a Pull String, p. 21.)

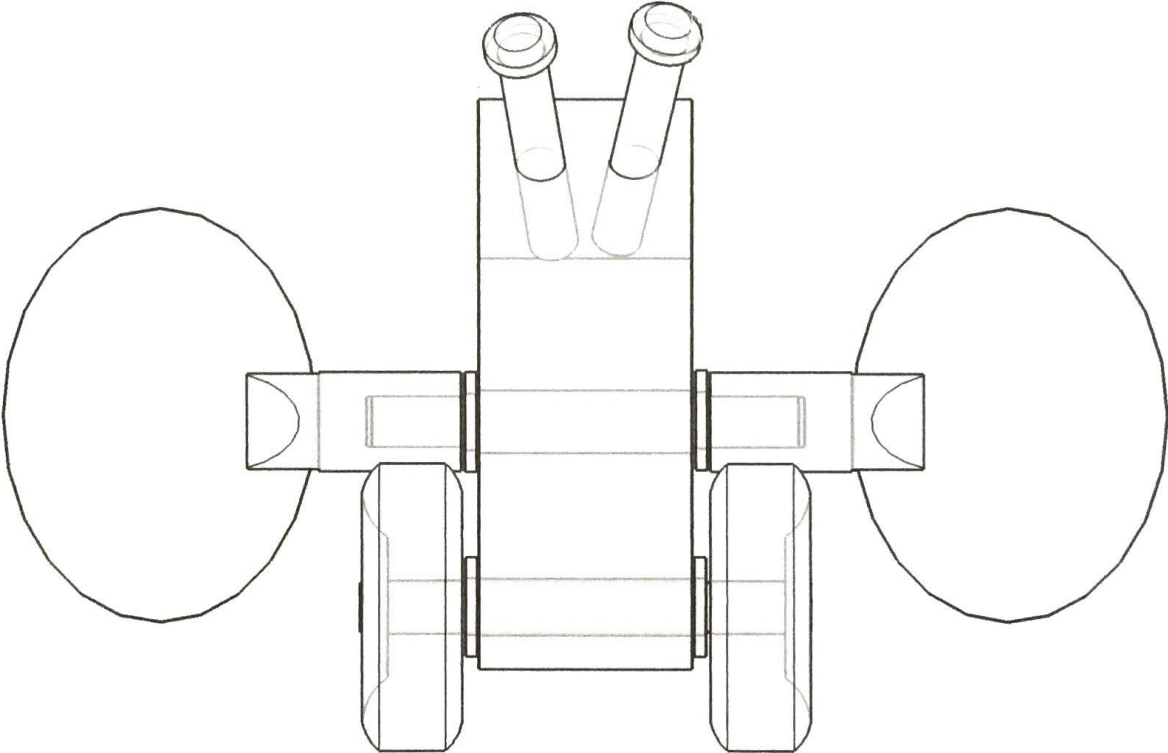


**Figure 8-4.** Body Template



**Figure 8-5.** Wing Template

8. Honey Bee



**Figure 8-6.** Front View



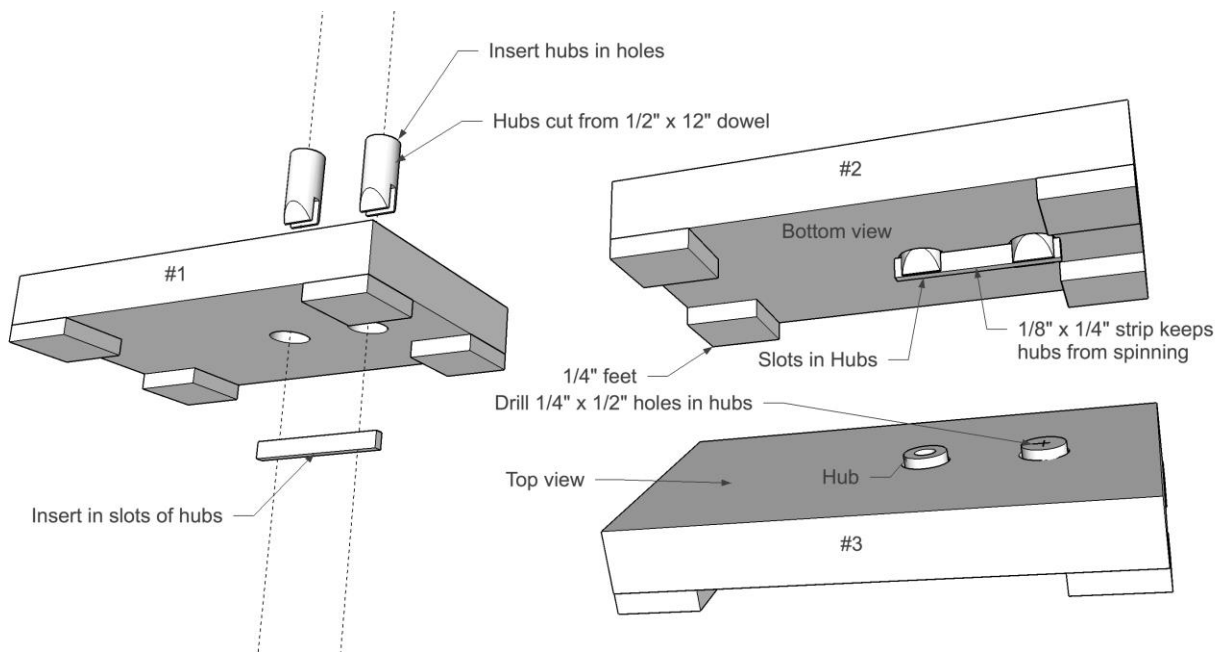
### Jig for Drilling Hole in End of Hub

One way to drill the hole in the end of the 1 1/4" hub is to first drill two 1/2" holes through a piece of scrap, then place the hubs in the holes as shown in view #1, Figure 8-7.

To keep the hubs from spinning put a narrow piece of 1/8" plywood through both notches previously cut on the wings (see view #2). It will be necessary to place feet under the piece of scrap to keep it from wobbling.

Finally, clamp the jig in place after lining the center of one of the hubs under a 1/4" drill bit in a drill press (see view #3). Drill the 1/2" deep hole. Repeat with the other hub.

This jig can also be used with a hand drill, but care must be taken to keep the drill bit perpendicular to the hub.



**Figure 8-7.** Wing Hub Drilling Jig

Another way to drill the holes in the wing hubs is to place the hubs into the piece of scrap wood as shown Figure 8-7, then wrap the exposed hubs with a rubber band and hold with a pair of pliers. The rubber band will prevent marring of the hubs as the holes are drilled.