

Chopper Bicycle - Instructor's Notes

Jigs and Fixtures

Purpose....

Jigs and fixtures for your projects will greatly increase the likelihood of student success. I recommend two jigs: A frame jig, and a fork jig to build a Chopper Bicycle.

Since every student will be utilizing different parts from different bicycles, and since every student will be a different size, and since every design will be unique to the builder, it is important that the jigs and fixtures be adjustable to accommodate the multitude of design variations.

To ensure driveability, the fork will require a jig that can accommodate the same variability as the frame, yet maintain proper steering geometry such that the bike can be ridden safely (or, as safe as a chopper can be ridden).

Preparation....

The frame jig will be made from the following material:

- 22' - 2" 0.120 wall square tube
- 14" - 1.5" 0.120 wall square tube
- 2' - 2" 0.120 wall angle iron
- 2 - 5/8" x 10" UNC RediRod®
- 4 - 1/2" x 3-1/2" UNC bolts
- 3 - 1/2" x 1" UNC cap screw
- 1 - 3/8" x 10" UNC RediRod®
- 4" - 2" solid round
- 8" - 2" x 1/2" flat bar
- 3 - 5/8" UNC nuts
- 6 - 3/8" UNC nuts
- 8 - 1/4" x 1" UNC set screws
- 8 - 1/4" UNC nuts
- 12" - 1" 0.120 square tube

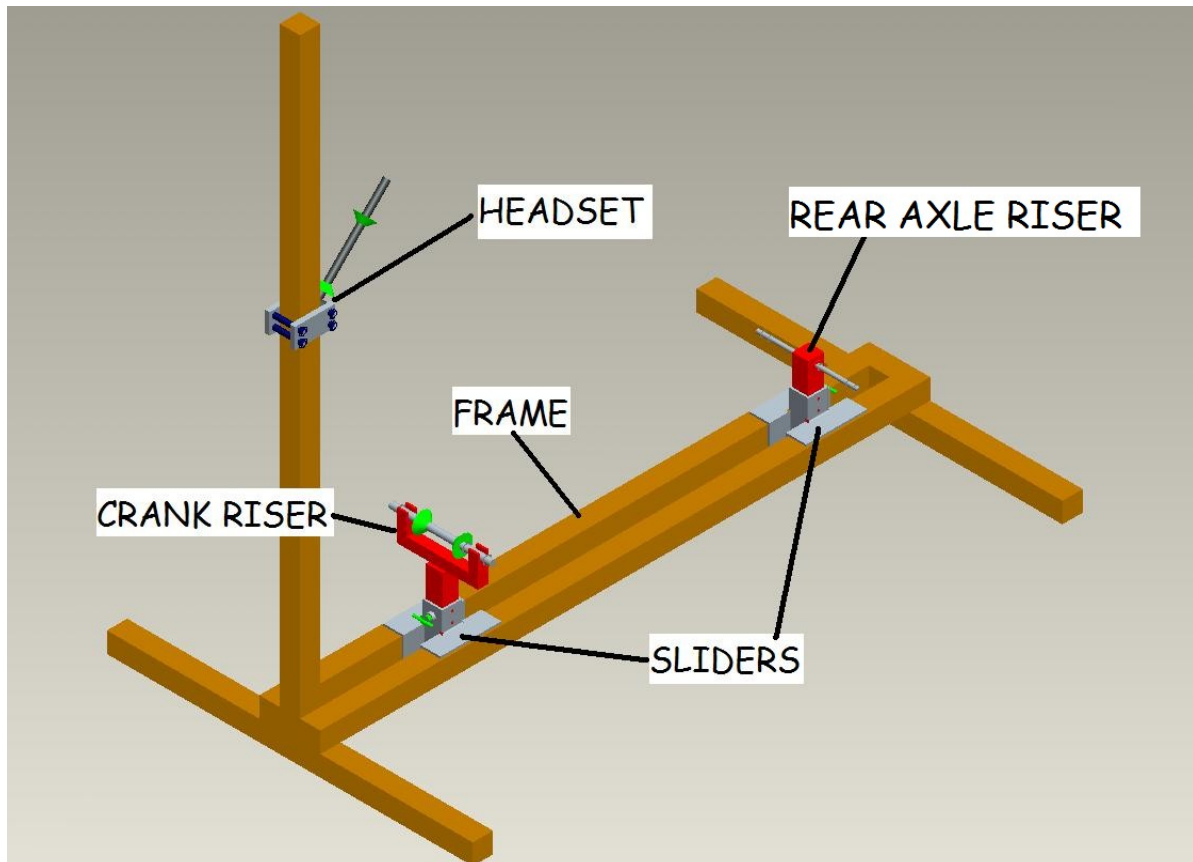
The fork jig will be made from the following material:

- 5' - 1.5" SCH40 pipe
- 5' - 1" x 0.120 angle
- 1' - 1.5" x 0.188 flat bar
- 1' - 2" 0.120 wall square tube
- 7" - 1.5" 0.120 wall square tube
- 4" - 2" SCH40 pipe
- 2" - 1" round solid
- 1 - 5/8" x 3-1/2" UNC Bolt
- 2 - 1/2" x 1" UNC bolt
- 2" - 2" solid round
- 1 - 5/8" nut
- 1 - 3/8" x 10" UNC RediRod®
- 6 - 3/8" UNC nuts

The Frame Jig

Perfect Alignment

The frame jig must ensure that the rear axle, crank and headset be perfectly aligned. All three of these parts must be allowed to be moved and repositioned such that a variety of frame sizes and shapes can be made.



Frame

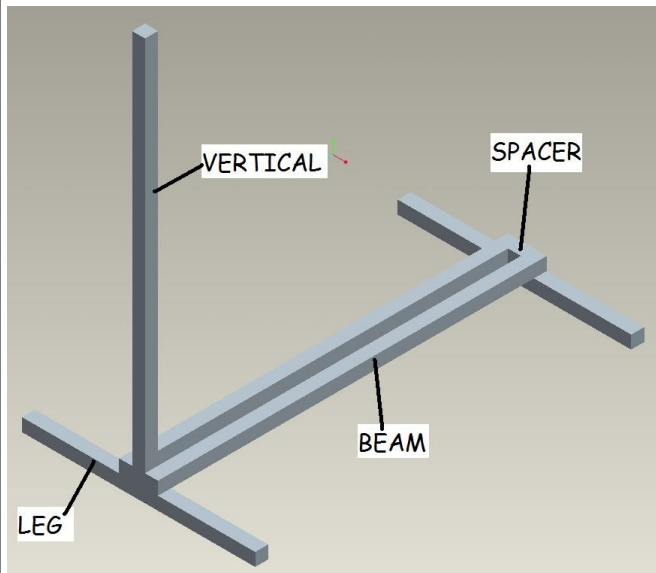
Cut three 5' pieces and two 3' pieces of 2" square tubing.

Cut 2" off the vertical tube to act as a spacer at the end of the beams

Weld together as shown on the right.

Take care when welding – the sides will likely bow in. You can avoid this by staggering your welds and stitching it together.

You can correct it by running weld beads on the outsides to pull the beams straight again when they cool.



Sliders (You need two of these)

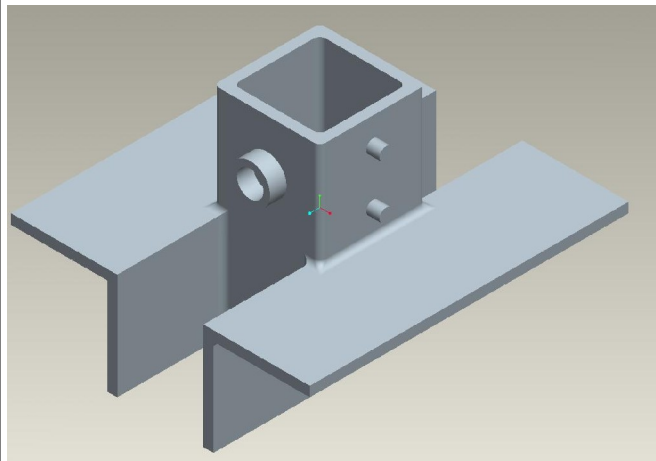
Cut two 6" pieces of 2" angle iron

Cut one 4" piece of 2" square tube

Trim one end of the square tube such that the tube will fit inside the two pieces of angle, nestled between the beams of the frame jig.

Weld a 1/2" UNC nut on the leading side. Drill through 27/64" and tap right through the Slider. A 1/2" cap screw with a small handle welded to it will be the lock bolt.

Drill and tap both sides for 1/4" x 20 set screws. These are used to align the Riser and compensate for wear. 1/4" locknuts secure the setting.



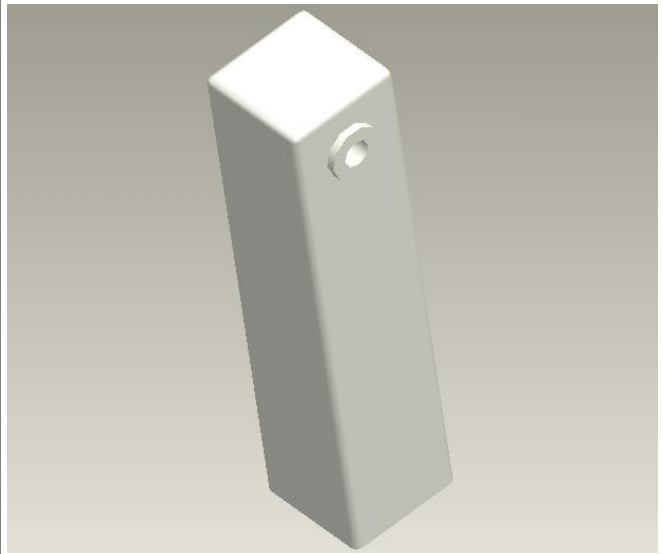
Riser (You need one for the frame jig, one for the fork jig)

Cut one 7" piece of 1.5" square tubing.
Drill a 1" hole 1" from one end through both sides

Cut one 1-3/4" piece of 1" solid round for a crush sleeve.
Use a lathe to drill a 3/8" hole all the way through.

Press the 1" round crush sleeve into the Riser, center, and weld together

You may cap the square tube ends with metal if you wish



Test fit the Riser into a Slider.

Adjust the set screws to maintain the Riser in vertical alignment, yet free enough to allow height adjustment.

Lock the two together with a 1/2" UNC capscrew. It is a good idea to weld a small handle to the capscrew head so adjustments can be made quickly and easily.

Add 3/8" UNC x 10" RediRod® and 6 nuts through the crush sleeve.



Crank Riser

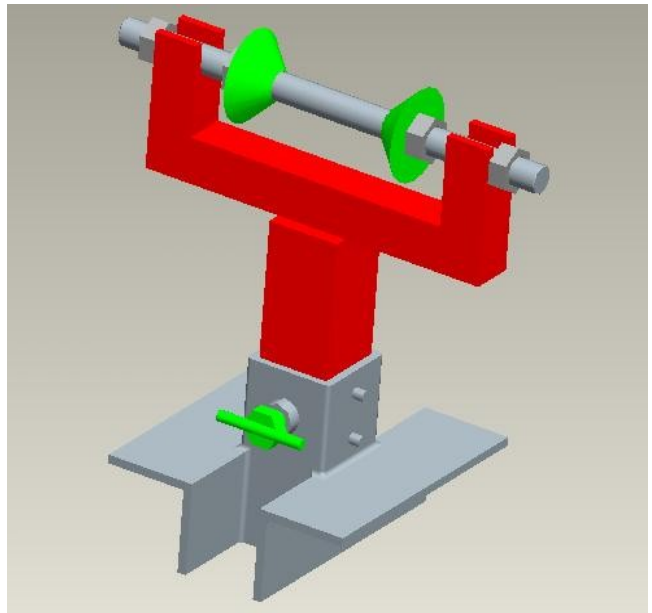
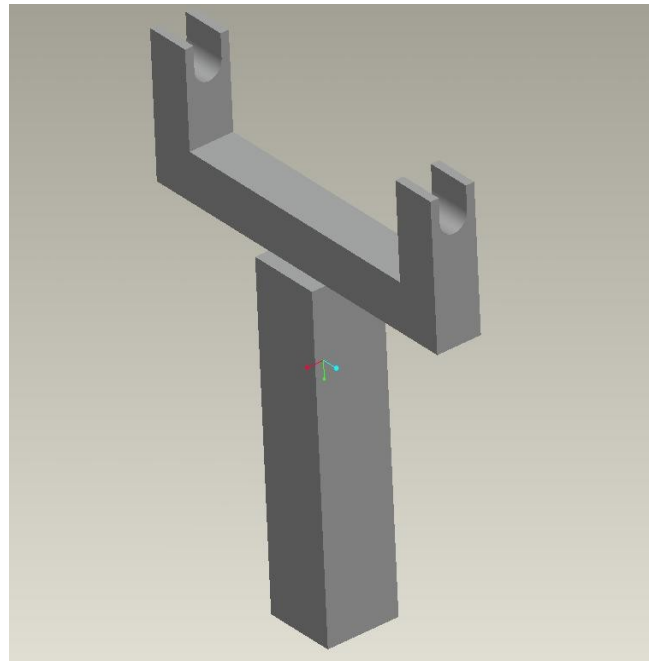
Cut one 7" piece of 1.5" square tubing.

Cut one 7" piece and two 2.5" pieces of 1" square tubing (these parts could be made of solid stock).

Drill a 5/8" hole 1" from the end of each of the 2.5" pieces. Slot the holes on a mill or with a hack saw as shown. Weld to the riser perfectly centered and square.

Machine two 45° cones from 2" solid round, bored 5/8" through the center.

Set a 10" length of RediRod® between the saddles with the two cones and four 5/8" nuts installed as shown. It would be a good idea to weld some handles onto the nuts for ease of use.



Head Set

Cut two 4" pieces of 2" x 1/2" flat bar.

Drill four 1/2" holes, 1/2" in from each corner.

Cut one 2" piece of 1" solid round.

Use a lathe to drill a 1/2" hole all the way through.

Use a V-block and a drill press to cross drill 17/32" and tap 5/8" UNC in the same fixture.

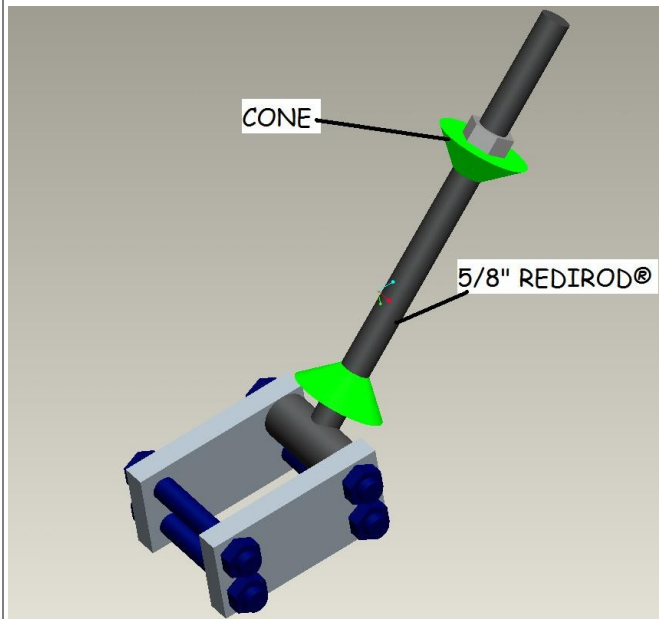
Cut one 10" piece of 5/8" UNC RediRod®.

Thread the 5/8" RediRod® into the 1" round almost to the 1/2" hole in the center, and weld securely.

The alignment of this piece is CRITICAL!!!

Machine two 45° cones from 2" solid round, bored 5/8" through the center.

Assemble to Frame Vertical with four 1/2" x 3-1/2" UNC bolts, and one 5/8" nut as shown. It would be a good idea to weld some handles onto the nuts for ease of use.



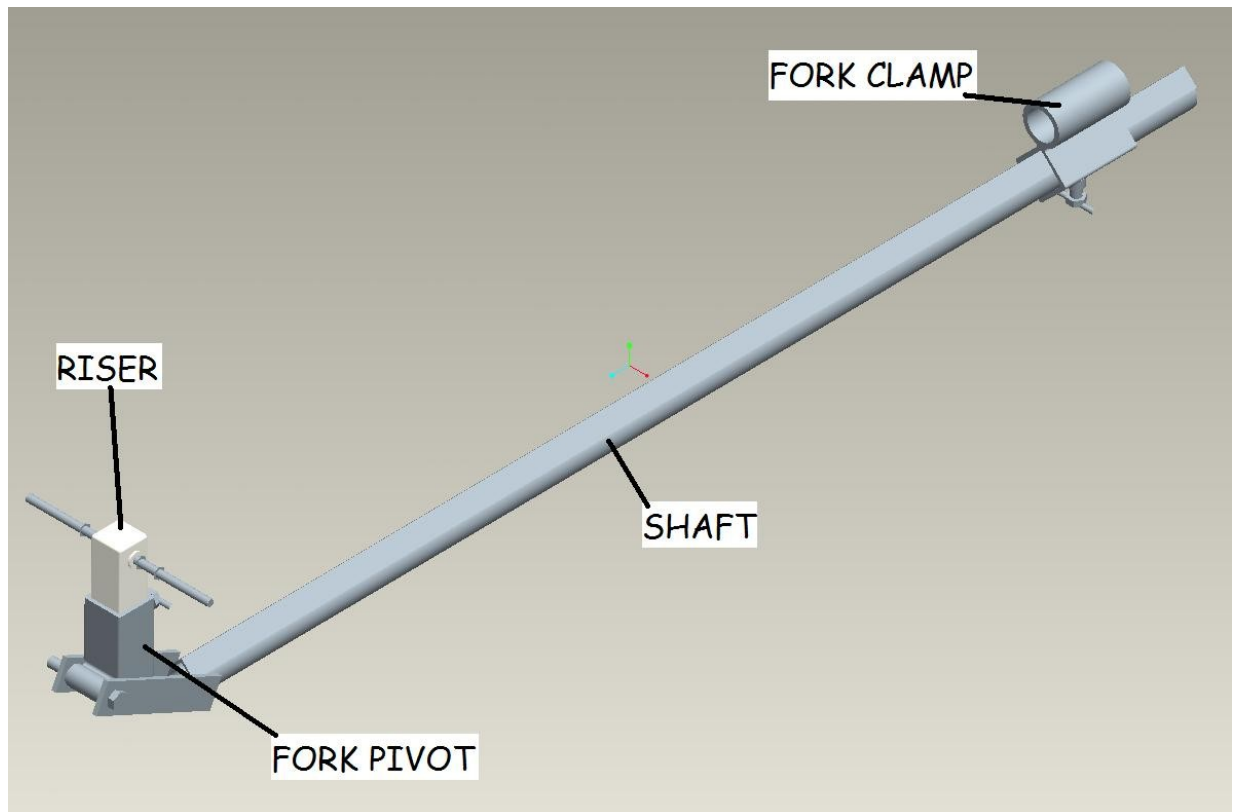
The Fork Jig

Perfect Alignment

This fork jig is designed to maintain proper “trail” regardless of what rake the student chooses, what length the forks are, or what diameter the wheel is.

Trail is how far the vertical centerline of the wheel “trails” the steering axis centerline where they each meet the ground.

This jig will ensure that the chopper built will have an acceptable amount of trail, only through testing will the “right” amount be found for “that” bike design.



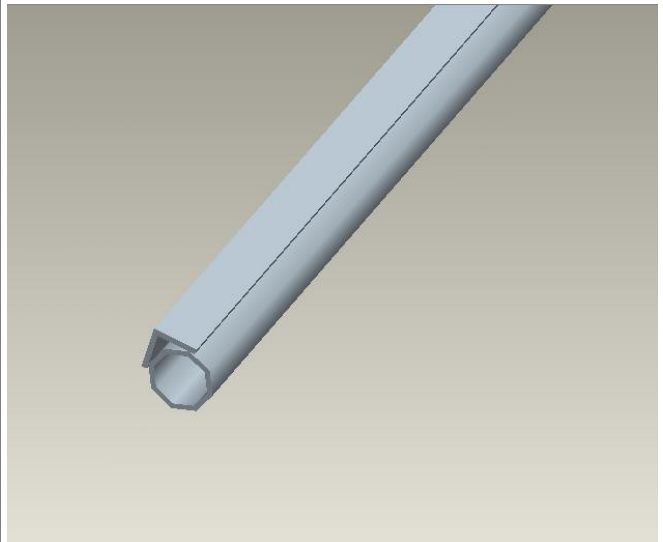
Shaft

Cut a 5' piece of 1.5" SCH40 pipe.

Cut a 5' piece of 1" angle iron.

Place the inside of the angle against the pipe and weld together.

This provides a constrained surface on which to slide the Fork Clamp for various sizes of forks



Fork Clamp

Cut a 4" piece of 2" square tubing.

Cut a 4" piece of 2" SCH40 pipe.

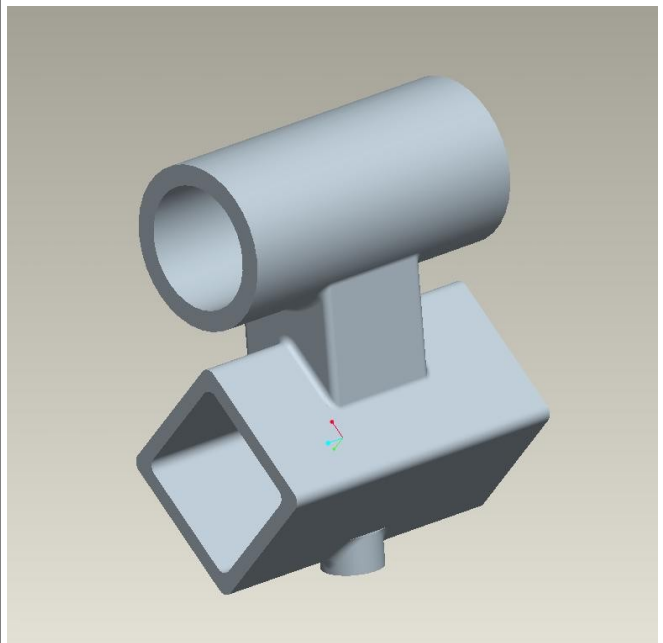
Cut a 2" piece of 1.5" square tubing.
Notch one end to fit around one corner of the 2" square tubing.

Fishmouth the other end to fit around one side of the 2" pipe.

Weld together, ensuring the pipe and the square tube are completely parallel.

Weld a 1/2" UNC nut to the bottom corner of the square tube. Drill through 27/64" and tap right through the Slider. A 1/2" cap screw with a small handle welded to it will be the lock bolt.

Attach to the shaft using the lock bolt.



The alignment of this piece is CRITICAL!!!.

Fork Pivot

Cut one 4" piece of 2" - 0.120" square tubing.

Cut one 2" piece of 1" solid round.

Use a lathe to drill 5/8" all the way through.

Weld a 1/2" UNC nut on the leading side. Drill through 27/64" and tap right through the Slider. A 1/2" cap screw with a small handle welded to it will be the lock bolt.

Setscrews cannot be used for alignment in this jig (clearance issues with the supports). Thin sheet metal for shim stock may be used, depending on the fit between this tube and the Riser to be used.

Weld the 1" solid round across the bottom of the tube.

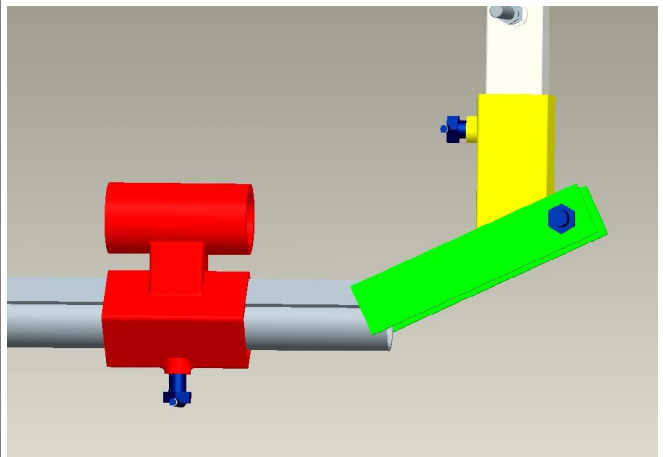
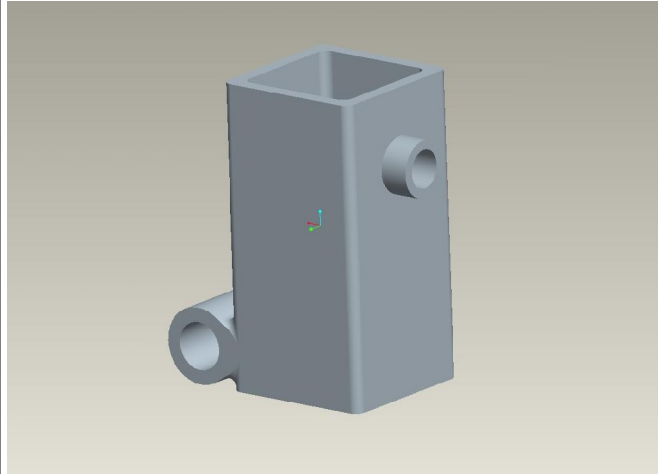
Cut two 6" pieces of 1.5" x 0.188 flat bar.

Drill a 5/8" hole 1" in from on end of each bar.

Assemble the two flat pieces to the Fork Pivot using a 5/8" x 3.5" UNC bolt.

The two free ends of the flat bar will be welded to one end of the Shaft such that the 5/8" bolt centerline is directly inline with the Fork Clamp centerline. Running a smaller length of pipe through the Fork Clamp can help visually align this.

The alignment of this piece is CRITICAL!!!



Insert a Riser (as outlined in the Frame Jig section) into the Fork Pivot, along with 3/8" RediRod® and 6 3/8" nuts.

Build Tips & Jig Images

- Neck Rake for most bikes is typically around $28-33^{\circ}$
- Neck Rake for most Choppers is typically around $36-45^{\circ}$
 - Do not exceed 45° rake – or the bike just won't turn
- Trail is typically 2-6" This jig should provide about 2" trail
 - Insufficient trail will result in a twitchy bike at best, and unrideable at worst.
 - Negative trail (where the wheel leads the steering axis) is death, Mr. Shopping cart!
- Flexible forks will reduce trail – forks must be very rigid to prevent this!
- Fork geometry is dependent on the frame geometry as well as wheel sizes. Any change will alter the geometry. The bike must be thoroughly thought out and parts acquired before construction begins.
- Number increments to accurately place wheel diameters on the Risers, as well as angle indicators for the Fork Pivot are a good idea

