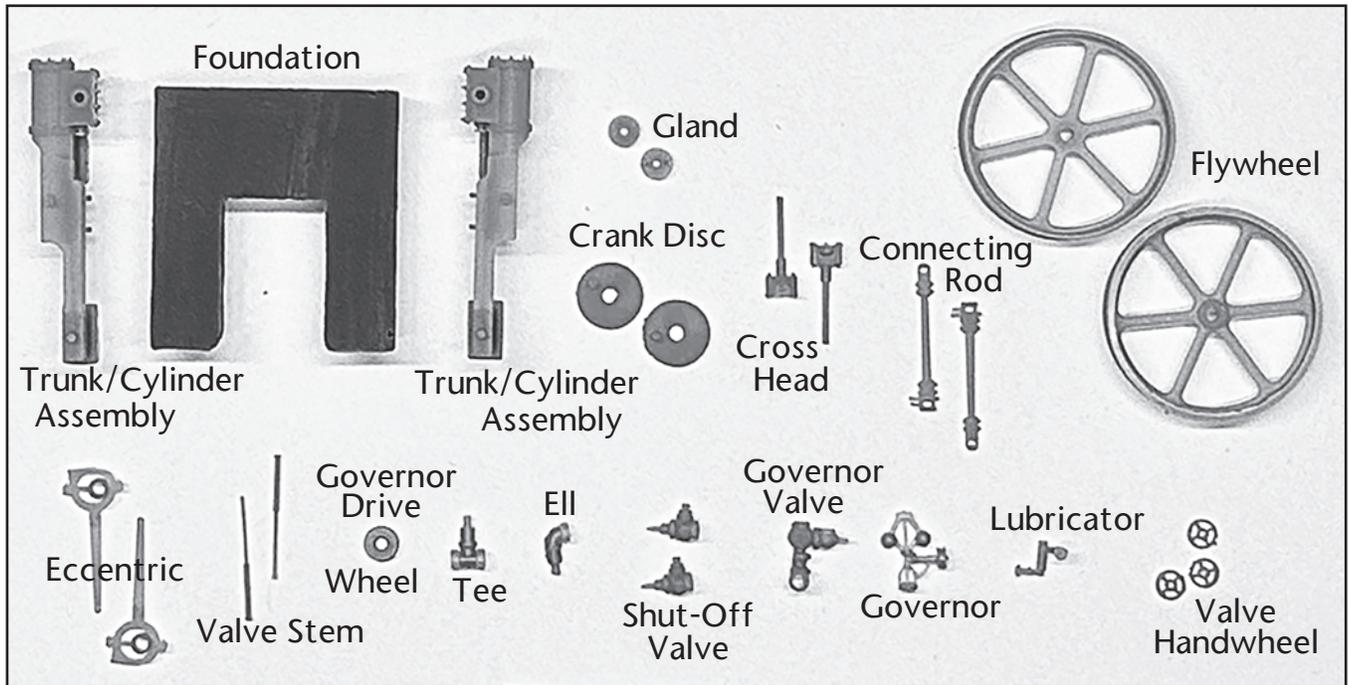


# Constructing the HO Scale Double Cylinder Mill Engine

by Brett Gallant



*Start by Downloading:* **“Working with SierraWest 3D Printed Castings”**. These instructions cover all of the basics and provide essential information you will require before preceding. There are two ways to approach the construction of kits with super detailed small parts. Paint and weather all the parts prior to assembly, or create logical assemblies, then paint and weather these as a group. I prefer to paint and weather all the parts before I begin using the techniques explained in the “Working with SierraWest 3D Printed Castings” download. In some cases you will find the glue does not adhere well to the weathered parts You will need to scrape it away where the glue is applied. For larger parts, I use a five minute epoxy. Super Glue (Cyanoacrylate or CA) works great for small part adhesion.

### *The Cast Resin Foundation*

Lightly spray paint the foundation with flat black paint. Allow to dry then apply a light, random concrete/gray water based paint layer allowing the black base to peek through. This

creates a nice texture on top of the texture already cast in place. Once dry, chalk weather with brown and gray chalk as desired.

### *Prepare the Parts*

Follow the detailed instructions in the “Working with SierraWest 3D Printed Castings” download to very carefully ream the bore holes so the appropriate brass/styrene rods easily slides through. Once assembly begins you will not want to apply force to make the brass/styrene fit. Use care, these are finely detailed parts and are fragile. Check the fit of the Shut-Off Valves in the top of the Trunk/Cylinder assemblies. Check the fit of the EII and Tee in the bottom of the Trunk/Cylinder assemblies. Do not force the boss in the bore hole or it will break off. Use care and a drill to slightly enlarge the hole on the cylinders, if necessary. Use a bit *just slightly larger*. If you use a bit too large it will chip the cylinder. Do not be intimidated by these steps. The tooling resin I use is actually quite resilient but the parts are so finely detailed they must be handled with thought and care.

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## *Paint and Weather the Parts*

Follow the detailed instructions in the “Working with SierraWest 3D Printed Castings” download to paint and weather the parts. Pay special attention to the sections that discuss “Creating a Simple Metallic Finish”, “Create a Metallic Finish on Top of a Color”, and “Alternative Base Layer Color Choices”.

## *Assembly*

Check the fit of the Valve Stems on the inside of the Trunk/Cylinders. Note how it slides through the square bores that protrude from the body of the trunk. The round stem seats inside the valve boss at the rear of the cylinder. Once satisfied with the fit CA them in position.

Check the fit of the Cross Heads in the Glands bore hole. They should slide freely. Next check the fit of the Glands inside the open portion of the trunk. Notice in the *Left Side View* drawing the position of the Glands then epoxy these in place. Allow to set.

Now Epoxy the Trunk/Cylinder Assemblies to the Foundation paying special attention to the correct orientation. There is a Left and Right Trunk/Cylinder Assembly. As mentioned, you will need to scrape a bit of the weathering off the top of the foundation to get good adhesion. Allow this to fully set. If the epoxy has not set, you will knock the assemblies off.

Check the fit of the Connecting Rods, Crank Disks, and Cross Heads. Carefully ream the holes as needed. This is a very fragile part so take your time and do not force anything.

Refer to the *Top View* drawing. Without using any glue, thread the Crank Shaft along with the Crank Disks, Governor Drive Wheel, Eccentrics, and Flywheels in the correct position through the Trunks bore holes.

Once satisfied with the fit of all parts, remove and cut the Crank Shaft to length. File the ends flat for a neat appearance then blacken with a brass blacking agent. Information on all materials and supplies may be found by clicking the “University” link on my website.

Re-assemble the parts, without glue, on the Crank Shaft being sure they are correctly ordered. Pay special attention that the Governor Drive Wheel is located on the right side of the Flywheel pair.

Epoxy the Crank Disks to the Crank Shaft. Note they are quartered, that is rotated 45 degrees in respect to one another. Locate one boss at the top and one at the back. This can be seen in the photographs. Allow the epoxy to fully set. Now, working with either side, epoxy the Cross Head and Connecting Rod in place. Study the *Left Side View* drawing and photographs to insure the pieces are correctly orientated. Repeat for the other side. Allow the epoxy to fully set.

Use a drop of CA, placed on the Crank Shaft, and secure both Eccentrics in place then use a drop to secure the front end to the rear boss that holds the Valve Stems. Do not glue the Governor Drive Wheel to the Crank Shaft at this time.

CA either Shut-Off Valve to a cylinder. Only CA one in place! Temporarily place the second Shut-Off Valve on the other cylinder then use the .047 brass rod to measure and cut the Steam Supply Pipe. Once satisfied the pipe fits correctly, file the ends then blacken. Thread the Governor Valve on the Steam Supply Pipe then epoxy the pipe and second Shut-Off Valve in place in one step. Allow to fully set then CA the Governor Valve in place. Be sure it is orientated properly.

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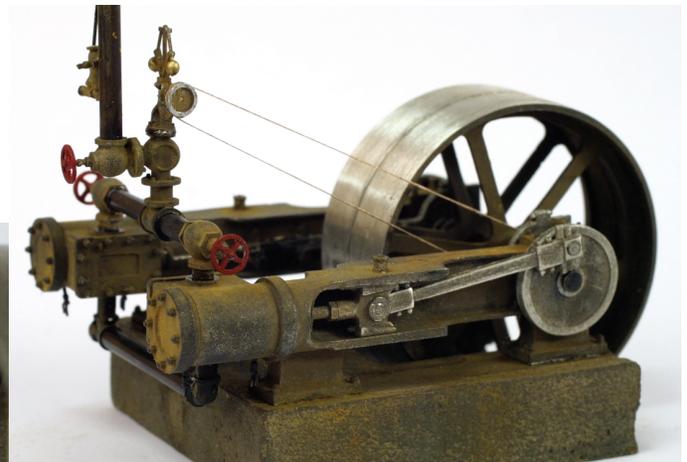
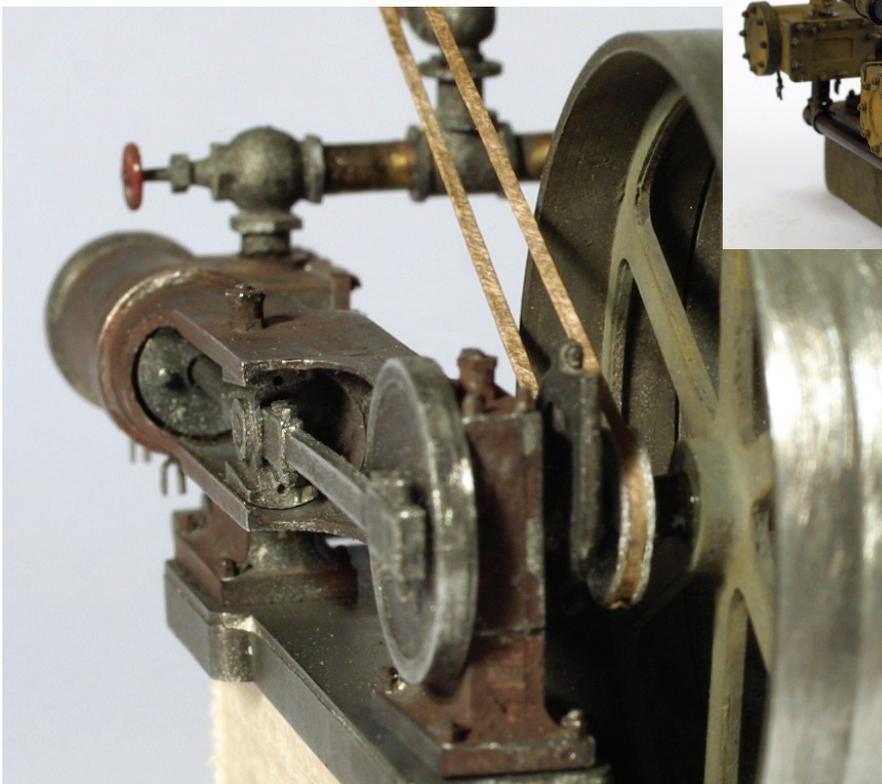
CA the Governor to the top of the Governor valve. Note the balls are brass.

Cut to fit, a very thin Governor Drive Belt from the supplied white thin plastic sheet. Make sure it is cut thin enough to fit between the raised flanges of the Governor Drive Wheel. Paint the belt brown then chalk weather and allow to fully dry. Slide the Governor Drive Wheel side to side so it is aligned with the wheel on the Governor Valve. Next, wrap the approximate middle of the belt around the wheel on the Governor Valve without using any glue. CA one end to the top of the Governor Drive Wheel and allow to set. Now wrap the belt under the wheel and CA it to the top of the wheel where you just glued the first end. Be sure the belt is taught but not tight! Allow to set then use a pair of hobby scissors to snip the excess off. Rotate the wheel so the cut ends are on hidden on the bottom then use a drop of CA to secure the wheel to the shaft. No need to glue the belt to the wheels. This material will not stretch or sag over time.

Please note, this is as far as construction should go until you are ready to connect the Mill Engine and Boiler, and install permanently on your diorama. At that time continue with the instructions here. Information and photographs on how they connect are included with the boiler instruction set.

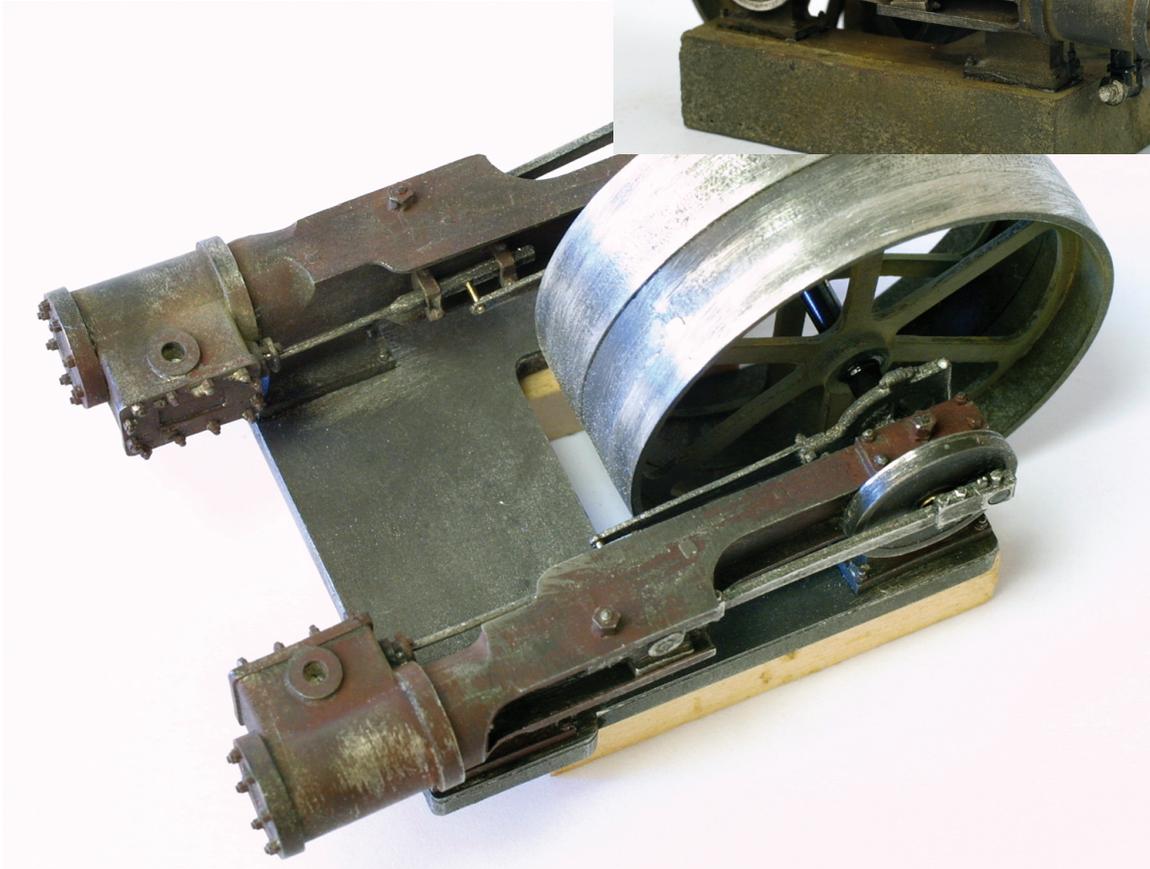
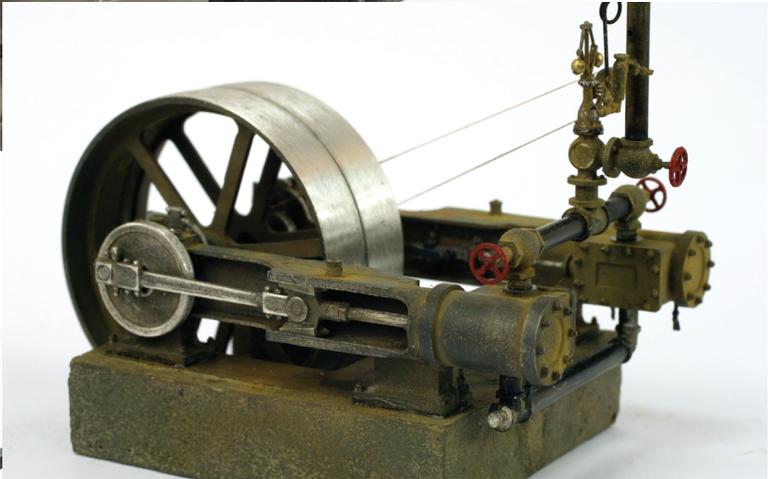
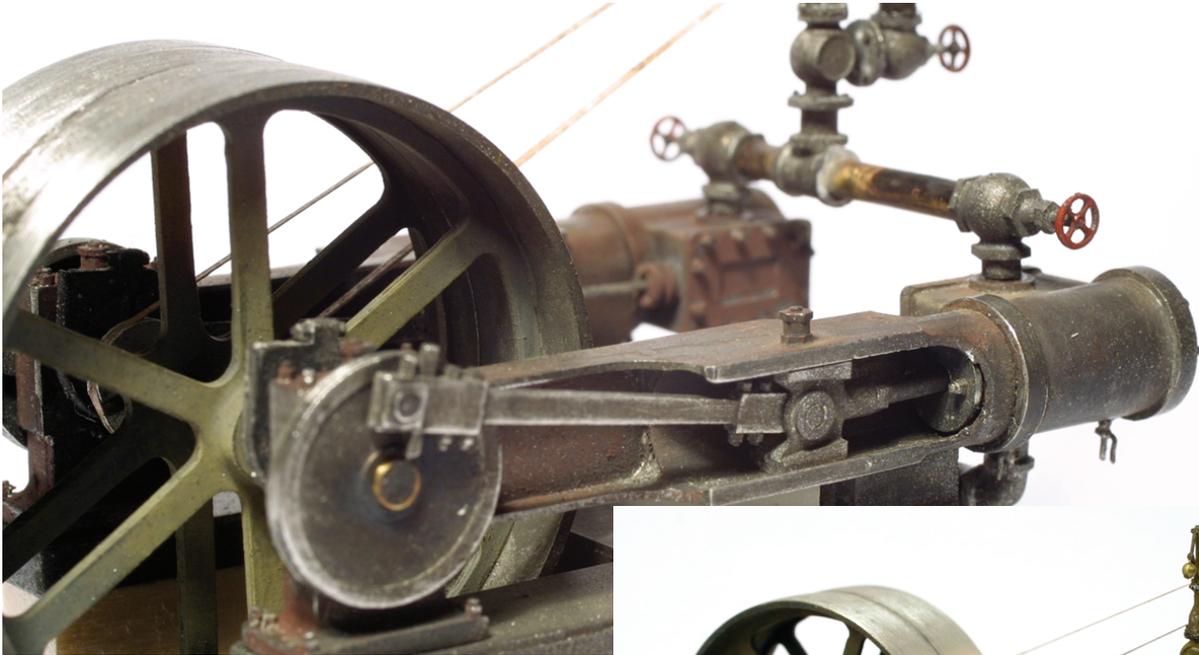
Install the Ell, Exhaust Pipe, and Tee in the same manner as the Shut-Off Valves and Steam Supply Pipe. The Exhaust Pipe is cut from the 3/64 styrene rod then painted black.

Cut the Steam Pipe as dictated by your installation requirements. Drill two small holes as shown for the Lubricator and Syphon Tube. Install the Lubricator then bend the Syphon Tube, blacken, and install.



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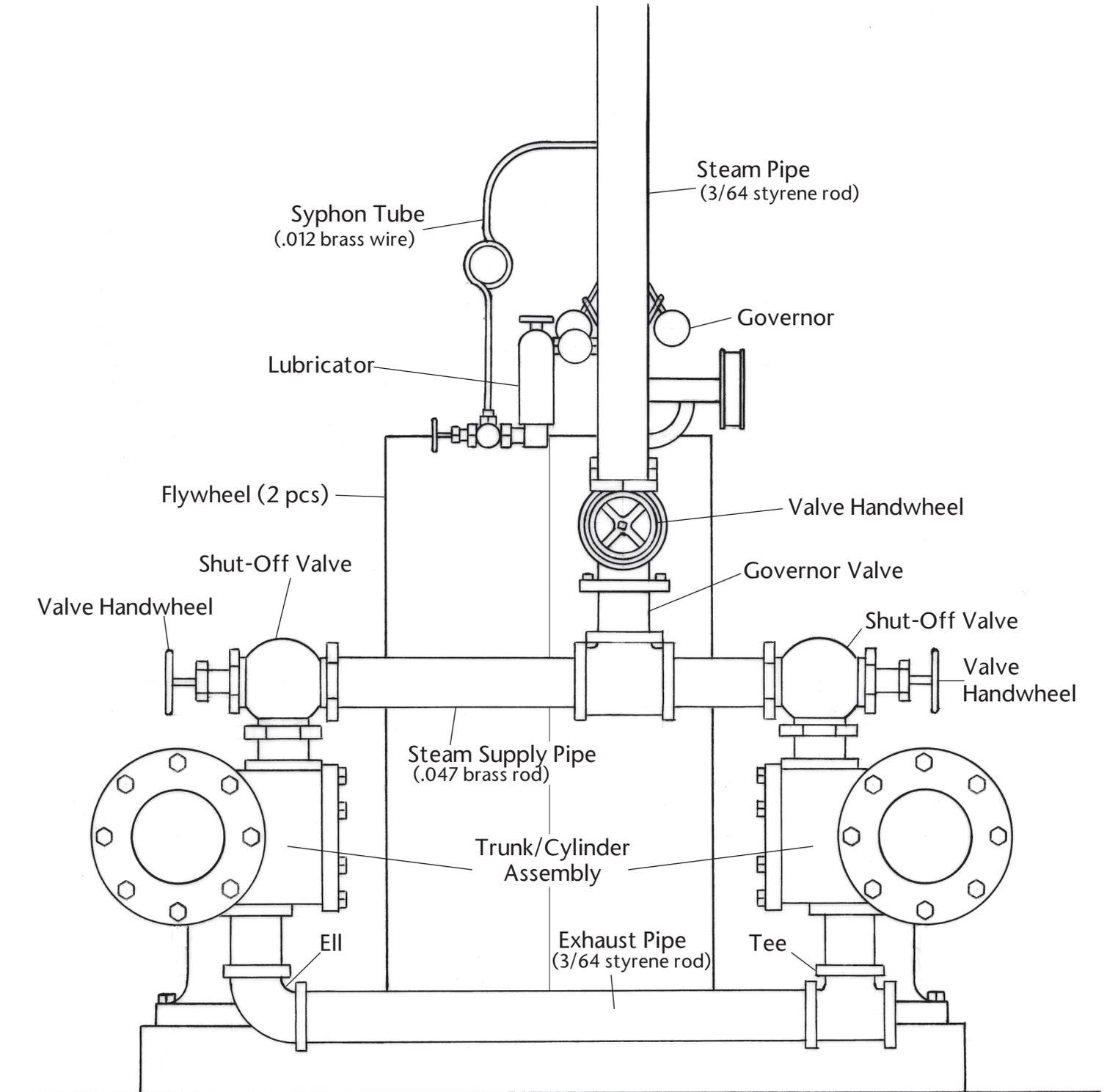
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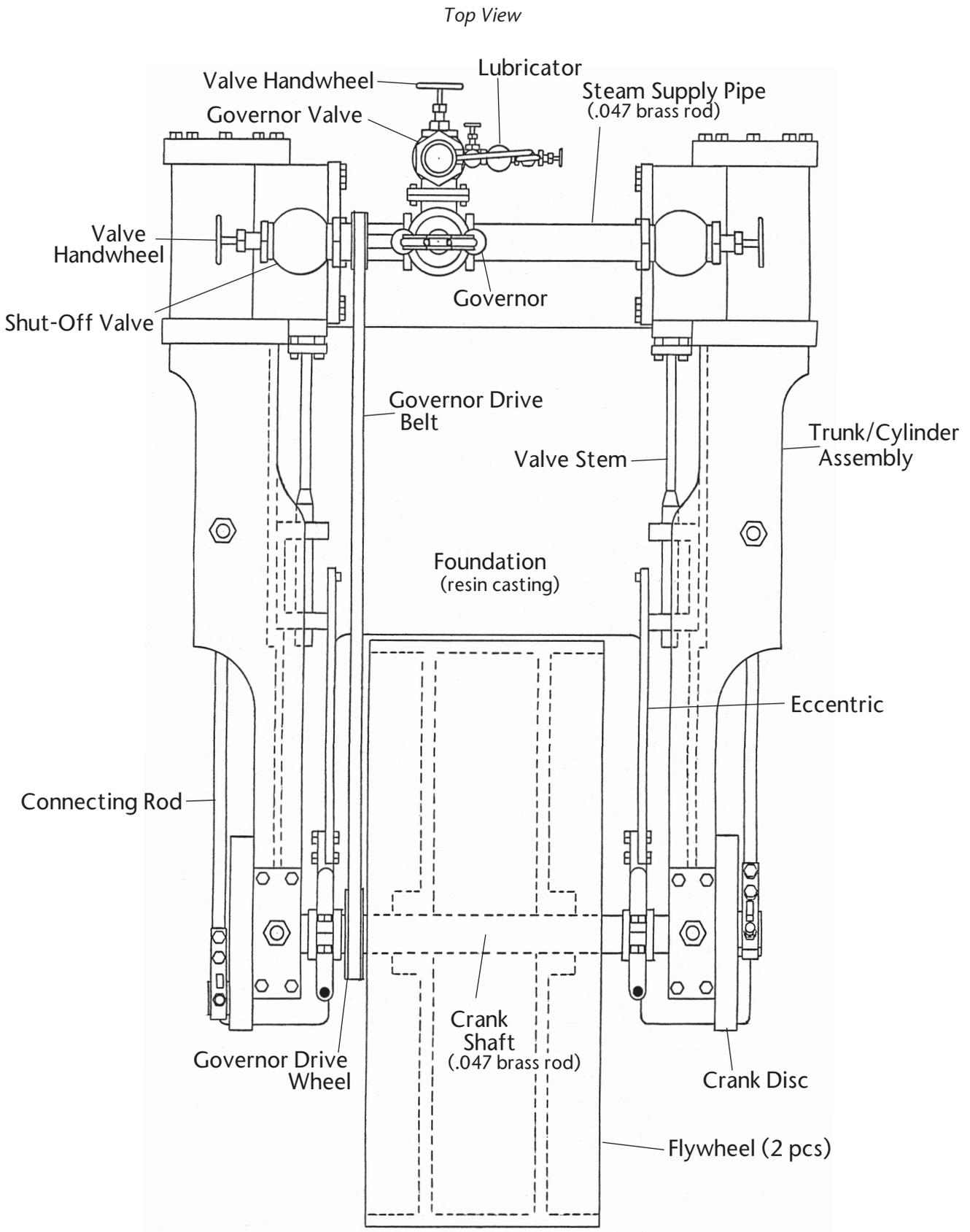
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Front View



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