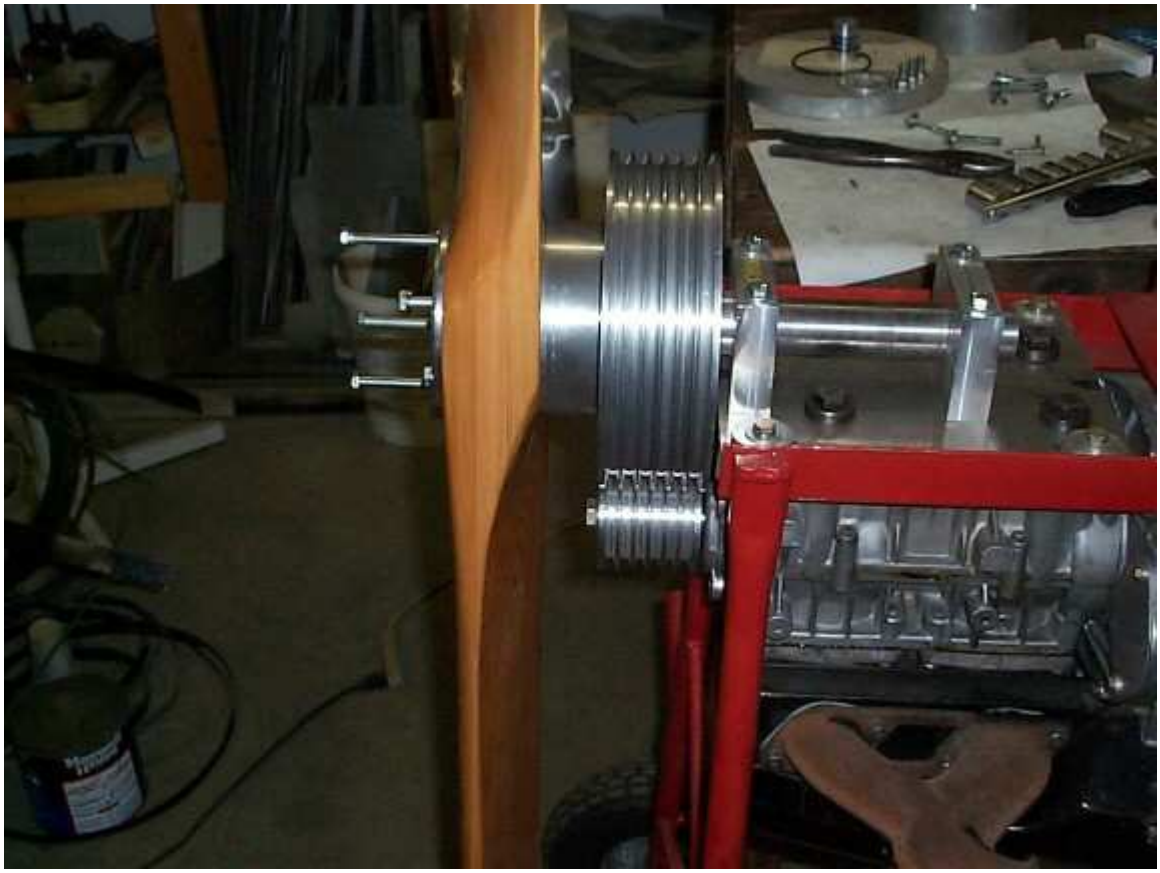
Reduction Gear for Ray's Prop Drive

Ray's engine is spec'd for 50hp at 6800rpm. The planned prop can run at up to about one third of that so a reduction is needed. Ray chose to use a multiple V-belt system with six 3VX series belts. The minimum practical size for the engine pulley is about 3" diameter so the prop pulley needs to be close to 9" in diameter. This poses a machining problem that will be discussed later.

The engine is mounted upside down on a 3/8" thick aluminum plate. The prop drive is mounted on the top side of this plate.

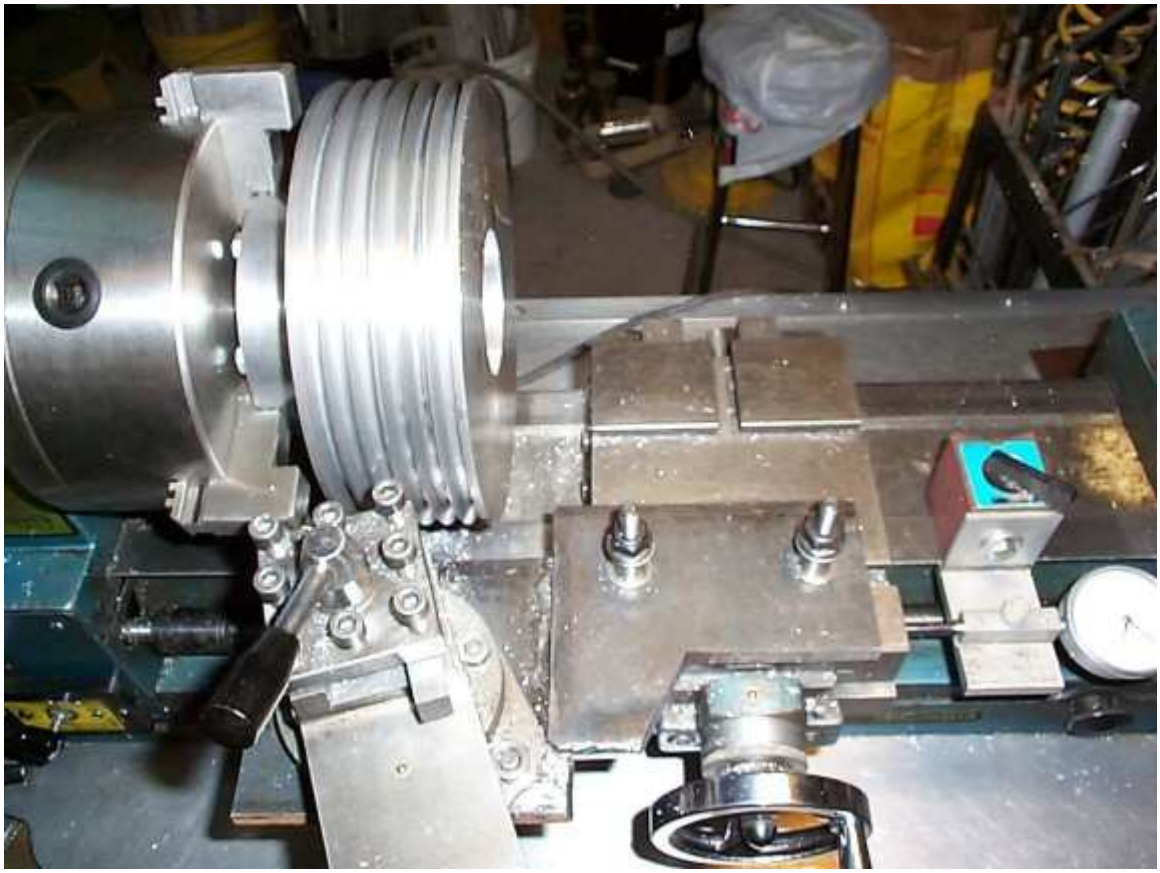


The complete reduction drive with test prop

The required pieces are:

Engine pulley with bolt and bolt locking assembly.

Axle assembly. Note circlip behind left block



Machining the belt grooves in the prop pulley.

This was the toughest part of the job. At first we thought that we would be forced to find someone with a larger machine to cut these grooves as this pulley is to large for the carriage to fit under it. We came up with the idea of making the extension to the table shown above. The steel is 1/2" plate. The extension where the compound is mounted is level with the top of the table so the compound is at its normal height. A form tool was rejected as being impractical on such a light machine. Instead, half of each groove was cut from edge to center with the correct angle set on the compound. A mirror image tool was used and the compond swung to the appropriate angle to cut the other half of the grooves. It took us most of two days to make the table extension and cut the grooves but it was good fun to *really* push the envelope of my 3-in-1.

Prop mounting hub with index nub for prop and o-ring groove.

The original plan was to oil fill the hub so an o-ring groove was provided for sealing. This idea was eventually discarded in favour of using factory sealed bearings. Nevertheless, the o-ring was retained to keep water and dust out the works.

The prop shown is intended for test stand use only. Ray made it by laminating the boards with epoxy and then shaping the blades. The final prop will be purchased from an outfit in Vernon, BC. Like the test prop, the factory version has a 1" diameter hole in the center for indexing on the nose of the hub.

An aluminum cover plate distributes the load from the six safety wired retaining bolts. There is almost 1/2" thread engagement of the bolts in the pulley so there is more than adequate strength in the threaded aluminum.

Machining Setups

The engine is a snowmobile engine with its pulley mounted on a taper. We had the matching part from the snowmobile so we set this up in the lathe and used a DTI reading tenths to set the compound to the matching angle. We then made an aluminum gage plug which we checked against the original. This test plug was used to check the taper in the pulley blank. The piece shown below in the lathe is a mandrel to hold the pulley for cutting the belt grooves.

Since the pulley is secured to the crankshaft taper with a bolt, a tab washer wouldn't work so we decided to use a locking plate to safety the bolt retaining the pulley on the crankshaft. The grooves were milled on the rotary table with a piece of MDF under the work to protect the RT. We made a piloted broach to form the hex hole in the locking plate. The three bolts that secure the locking plate can then be safety wired. The broach was driven with my hydraulic press.

The holes in the mounting blocks were bored and then the slits for the clamping cut on the bandsaw.

Checking the taper

That's the pulley blank sitting on the cross slide.

Piloted broach

Boring the shaft mounting blocks
The dial gage is a "poor man's DRO".

Alligning the RT axis

Centering the work piece

Drilling and reaming bolt holes

I forgot to take a couple of the pictures above before doing the work so I had to set them up after the holes were done. There are two 3/16" diameter locating pins to provide alignment between the large pulley and the hub. There are three recessed 10-32 screws to hold the hub to pulley while the prop is installed or removed. These are not structurally significant but make the job possible with only two hands. The six 1/4-20 bolts secure the prop and hub to the large pulley.

That's Ray acting as power cross feed. An electric one is on the todo list

I am trepanning an inspection hole cover for Ray's plane