Q: So it does not have a pressurized crankcase.

Symanski: Right, in fact it has no crankcase at all. The power piston is powered right off the top between the two displacers.

Q: How does your speed regulation mechanism work?

Symanski: I have a valve between the two displacers. The valve is operated by a twin ball governor mechanism like you have probably seen on the old steam engines. All the valve does is relieve air pressure from one side of the piston to the other.

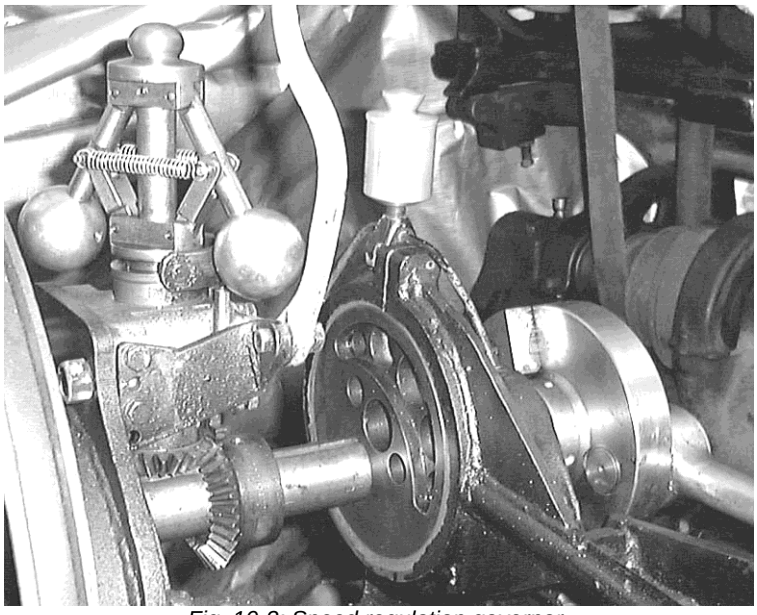

Fig. 10-3: Speed regulation governor.

Q: It allows the gas to bypass the power mechanism so you can achieve the speed that you want.

Symanski: Exactly! Since the engine is wood fired, it's almost impossible to regulate the fire quickly enough for any speed regulation. The hot caps are mounted vertically in the top of the firebox.

At first I wasn't getting enough draft so added on a forced air system for the firebox, so now I get a hotter fire.

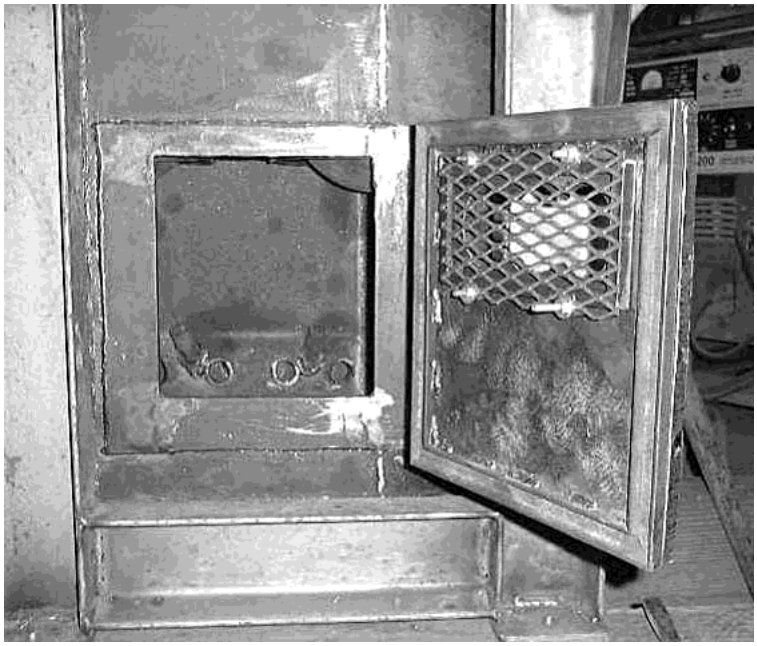

Fig. 10-4: Firebox for 2.5 hp engine.

Q: Is the forced air system powered by the engine?

Symanski: Yes.

Q: Sealing Stirling engines has sometimes been a difficulty. How do you seal the engine?

Symanski: I use ordinary buna rubber O-rings, just the regular multipurpose ones that everybody uses. The displacers use Quad O-rings. Some people call them the "square O-ring." It's almost like two O-rings. Those things work great! I've never touched them. I've had helium in that engine for months. I've not had any leaks from those O-rings.

There was one leak where the power piston was with the single O-ring. Now I've talked to people, and they say that buna does not seal helium very well. Well, I've had it in there under 200 pounds of pressure, and it very slowly does leak down. But it holds quite well!

Q: What is the air pressure that you are using when the engine is putting out 2 $^{1}/_{2}$ horsepower on air?

Symanski: The peak pressure is about 250 pounds.

Q: How do you pressurize the engine?

Symanski: I have an air compressor on the engine. The engine will start with atmospheric pressure, but it has to have about 50 pounds in it to get enough power to run the air compressor to pump the engine up to operating pressure. When the pressure starts getting up to about 100 pounds, then the engine really starts generating

power. The air compressor pumps up to about 130 pounds. You actually get more than that in there, especially when the engine is cold pumping itself up. What happens is that the engine still can accept air at the low-pressure point of its cycle.

Q: How do you get the full 250 psi inside the engine?

Symanski: The 250 pressure is the peak pressure inside the engine. I pressurize it to 130 psi with the compressor, and the temperature changes inside the engine produce a peak pressure of 250 psi.

Q: How is the engine cooled?

Symanski: It's water cooled. I have a radiator like they used to use on one of those old-time engines. It drips the cooling water over the top of a screen. As the water flows down the screen the air cools it. You get some evaporative cooling too. It's very effective.

Q: How do you use the engine in your workshop?

Symanski: I'm using it to run my shop right now because I don't have any electricity at my current location. I've got a 40-foot line shaft running the length of my shop. I have a clutch in the line shaft so I can engage it and disengage it. I connect up whatever machine I want with a flat belt.

Q: Isn't that how things were done in factories before they switched to having an electric motor on every machine?

Symanski: Exactly! This is a lot more efficient way of powering a shop if you only have a small amount of power. Because you're using mechanical power you don't have the conversion losses between generators and motors, and the machines run well.

Q: So is $2^{1}/_{2}$ horsepower enough to run your lathe and your milling machine?

Symanski: Right, it runs them with no problems.

Q: There are several different ways to measure power output of an engine. How did you do it?

Symanski: I used a simple strap brake on the flywheel. I used a strap like you would use to tie a load on a truck down, and then screwed a bunch of wooden blocks to it so the wood blocks became the contact surface with the fly wheel. I attached a spring scale to the floor, ran the strap with the wood blocks over the flywheel and on the other side I kept adding weights to slow your engine down. At the same time I was accurately measuring the engines rpm's with a tachometer.

I just kept loading weight on until I brought it down to where I got the maximum pulling power out of it. Then I measured the difference between the weight the engine was lifting on one side and the spring scale to figure out the torque. Once you have the engine's torque and