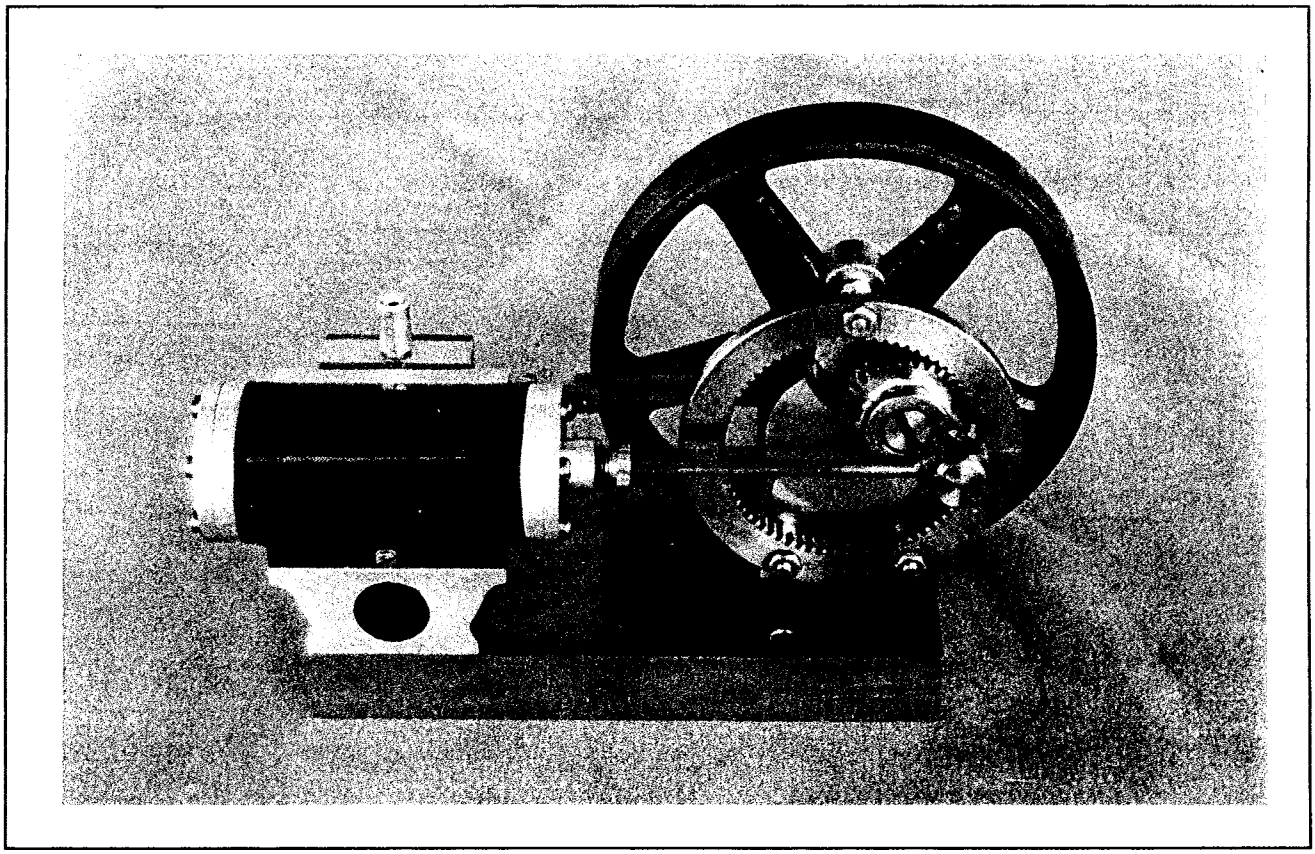
CHAPTER

5 Geared Steam Engine



This is an engine with an internal gear producing straight line motion to the piston rod. It required careful machining to prevent binding and is a bit more challenging than a simple crank engine.

First, the gears shown were purchased from Boston Gear and cost $38.00, which may discourage some builders. It is a fascinating engine to watch when running at slow speed and will not be found in many exhibits.

If you strike out on your own there are a few rules that must be followed:

1. The two gears must have the same pitch and pressure angle. Twenty degree pressure angle teeth will not mesh with 14-1/2 degree PA teeth.
2. On this engine the pitch diameter of the internal gear must be two times the PD of the orbiting gear and will have two times as many teeth. The PD of the internal gear is the piston stroke of the engine. Pitch diameters are the imaginary circles, or outside diameters of two wheels, one driving the other by friction. To make the drive positive, "teeth" are laced across these pitch circles.
3. The mounting of the internal gear must be with centerlines passing THROUGH THE TEETH CENTERS, and the piston rod screw CENTERED BETWEEN TWO TEETH as shown or you will get binding and not straight line motion.

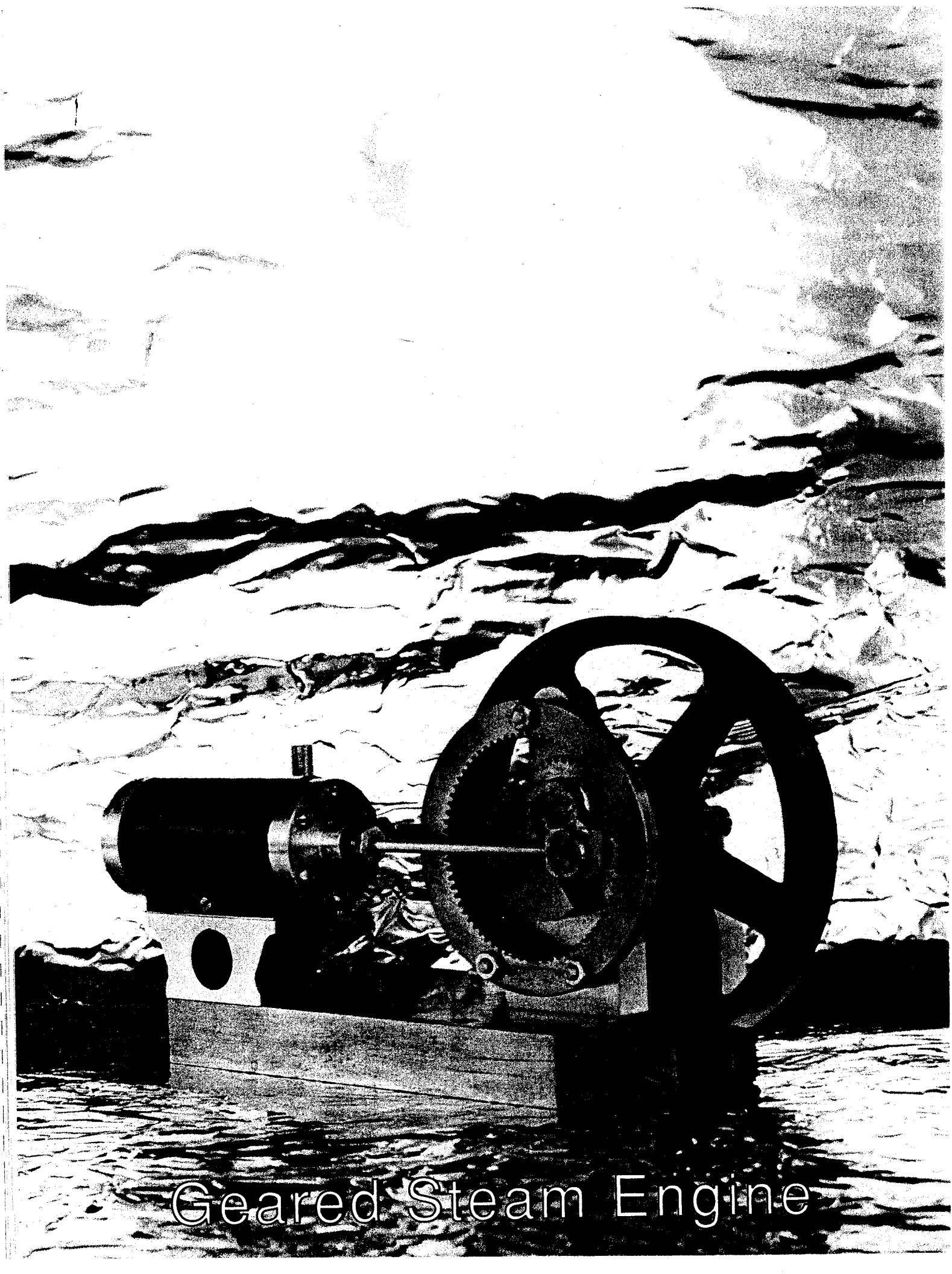
The critical dimension is the .375" dimension on the crank. Also try to hold the .375" dimension on the gear arm. A few thousandths full on the crank will cause binding. It is better to aim for a couple thousandths under on these two dimensions. Remember the tooth working depth for 48 pitch teeth is only .041" and you do not have much leeway.

The **BASE** calls for aluminum though the model shown has a steel base. The weight makes it more stable if not anchored down.

The **BEARINGS** are simple machinging except the tall Bearing should be laid out completely, the three gear mounting holes drilled and the #5-40 holes tapped. Locate these three holes very carefully for sake of gear alignment. Mount the two Bearings on the Base and hold this assembly squarely in the cross-slided milling attachment. Pick up the bearing center with a wiggler and drill in easy stages and line-ream to size for the crank shaft. Bushings are optional.

On the **PISTON ROD**, solder the 3/16" thick block in place and then mill to 9/64".

The **VALVE ROD** is 3/16" stock turned with tailstock support. Mount in the cross-slide milling attachment and mill the flats. It is well that the #2-56 thread fit the nut closely to



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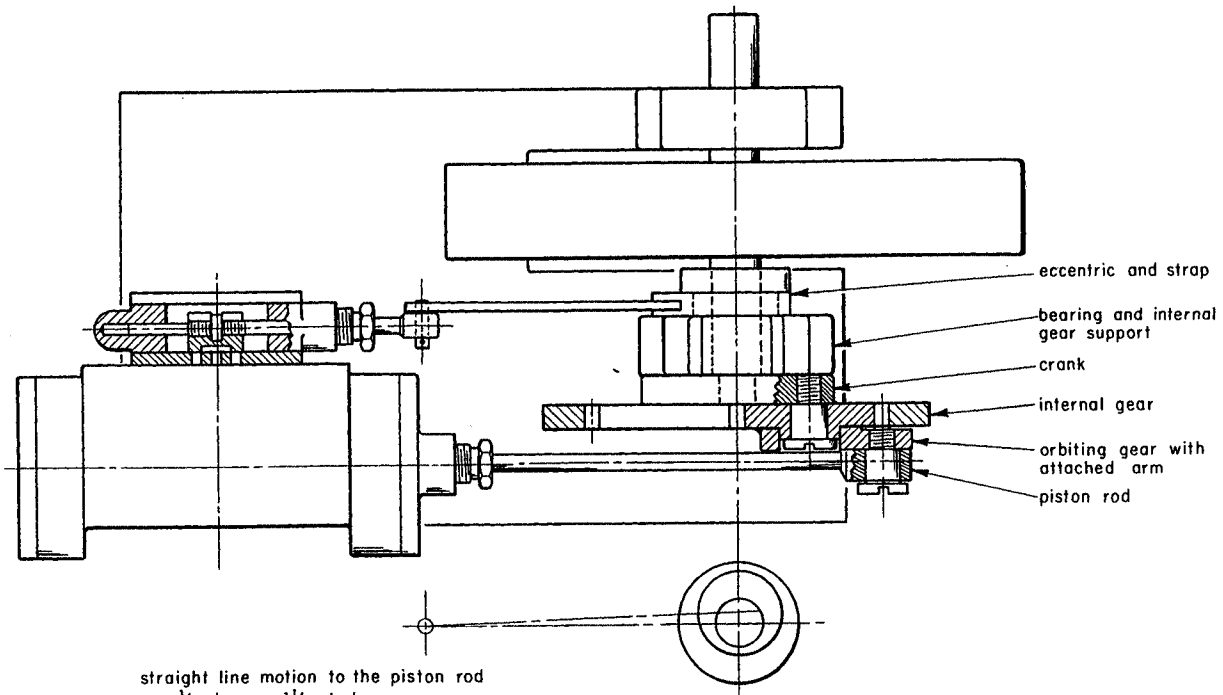
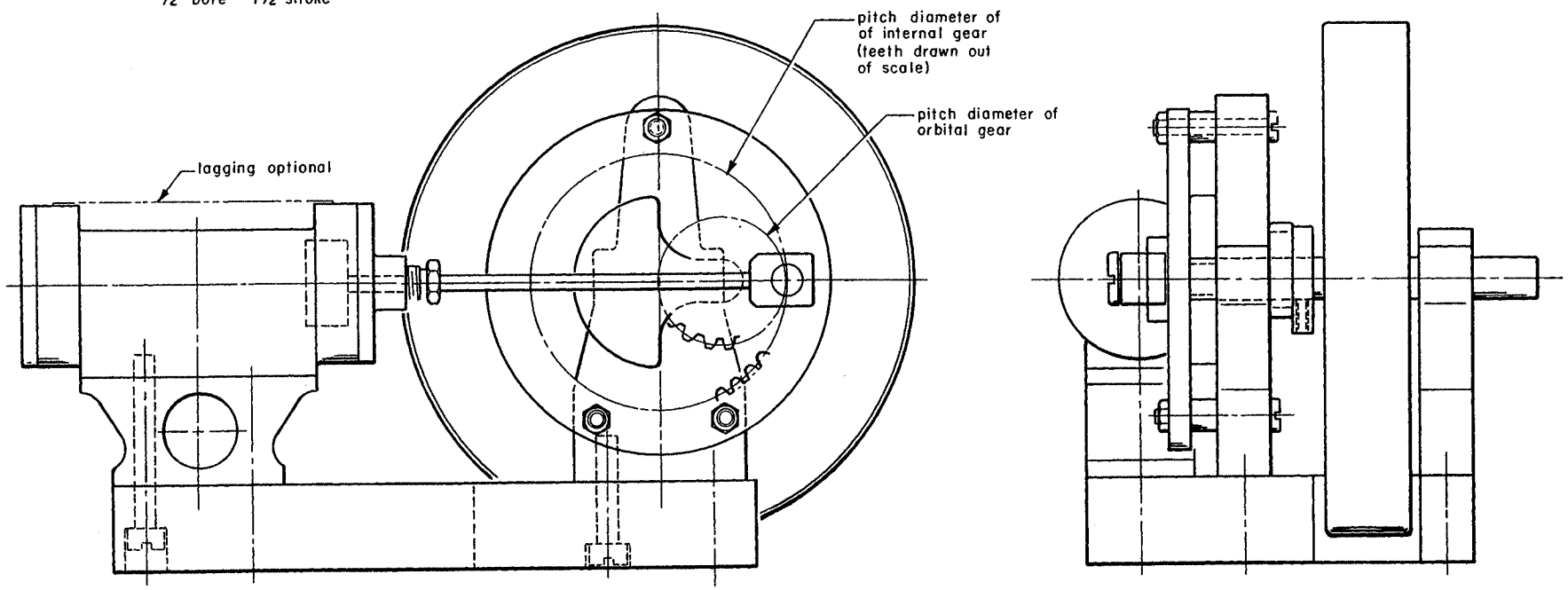


straight line motion to the piston rod
½ bore 1½ stroke

BOSTON GEAR		
TYPE	SPUR GEAR	INTERNAL GEAR
catalog number	Y4836	Y14872
pressure angle	20°	20°
pitch	48	48
number of teeth	36	72
pitch diameter	.750	1.500
outside diameter	—	2
face	1/8	1/8
hole	3/16	—
hub diameter	1/2	—
hub projection	1/4	



ENGINE WITH GEAR MECHANISM