

## Section 12

# SYNCHRO-BALANCE

Briggs & Stratton uses two methods of Synchro-Balancing engines.

One system uses counterweights that are geared to rotate in a direction opposite from the crankshaft counterweights. The other system uses a counterweight that oscillates opposite to the direction of the piston. Each system performs the same function of substantially reducing engine vibration, thereby giving exceptionally smooth engine performance.

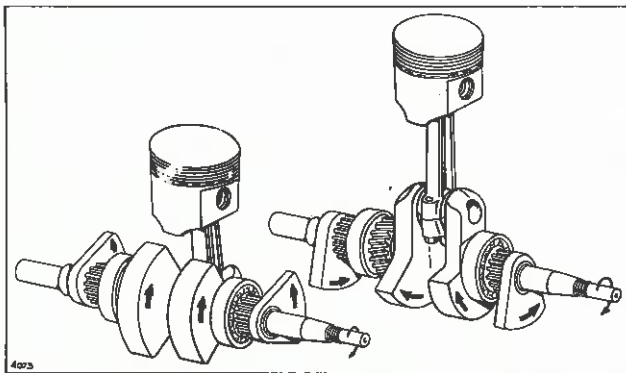


Fig. 1 — Cast Iron Engines,  
Rotating Counterbalance

### ASSEMBLING AND TIMING ROTATING SYNCHRO-BALANCERS, CAST IRON ENGINES

Remove all traces of oil or dirt from tapered surfaces of drive gears and cam shaft before assembling gears to camshaft. Turn crankshaft until piston is at top dead center.

Remove long 5-1/2" (139.7 mm) cam gear shaft bolt, place magneto drive gear on cam gear taper. Install bolt with Belleville washer, finger tight. See Fig. 2.

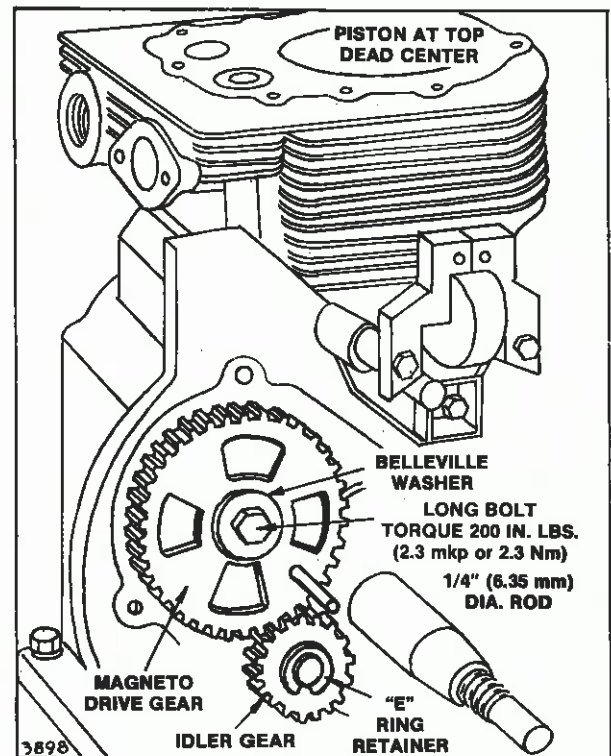


Fig. 2 — Installing and Timing  
Magneto Drive Gear

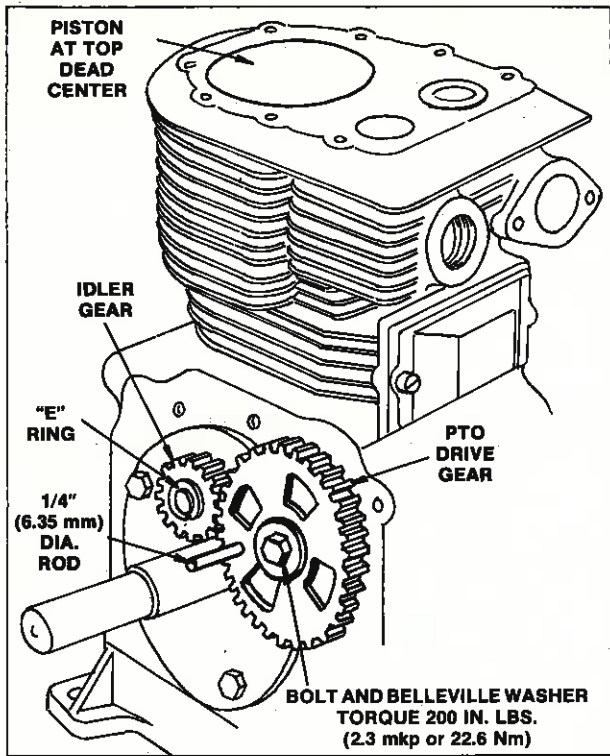
On MODEL SERIES 300400 and 320400 only, place PTO drive gear on the other end of camshaft. Install short cam gear bolt with Belleville washer, finger tight. See Fig. 3.

To time drive gears, insert short pieces of 1/4" (6.35 mm) rod through 1/4" (6.35 mm) holes in drive gears, and into locating holes in crankshaft bearing support plates. Fig. 2. For MODEL SERIES 300400 and 320400 also see Fig. 3. With piston at exactly TOP DEAD CENTER, torque cam gear bolt(s) [with 1/4" (6.35 mm) rods in place] to 200 inch pounds (2.3 mkp or 22.6 Nm). Be certain piston does not move. Remove the 1/4" (6.35 mm) rods.

Install idler gear(s). Install snap-in "E" rings to retain gears. No timing is necessary. Figs. 2 and 3.

# SYNCHRO-BALANCE

## Rotating & Oscillating Counterbalance

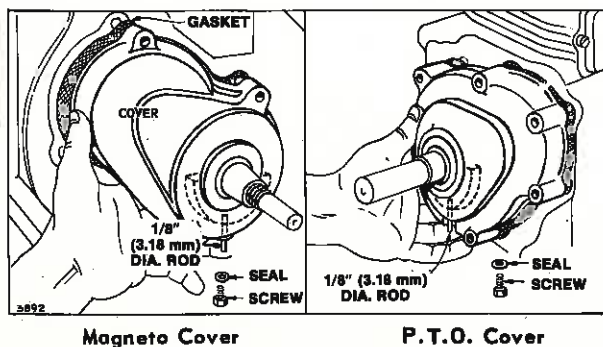


**Fig. 3 — Installing and Timing PTO Drive Gear**

The counterweights and ball bearings are an integral part of the covers, and cannot be removed. Lubricate the ball bearings and gears with a few drops of engine oil.

**PISTON MUST BE AT TOP DEAD CENTER.**

Remove the timing hole screw from cover assembly. Fig. 4. Insert a short piece of 1/8" (3.18 mm) rod through timing hole in cover and into matching hole in counterweight. Fig. 4. The rod holds the counterweight in the proper position while cover is installed on engine.



**Fig. 4 — Removing Timing Hole Screw**

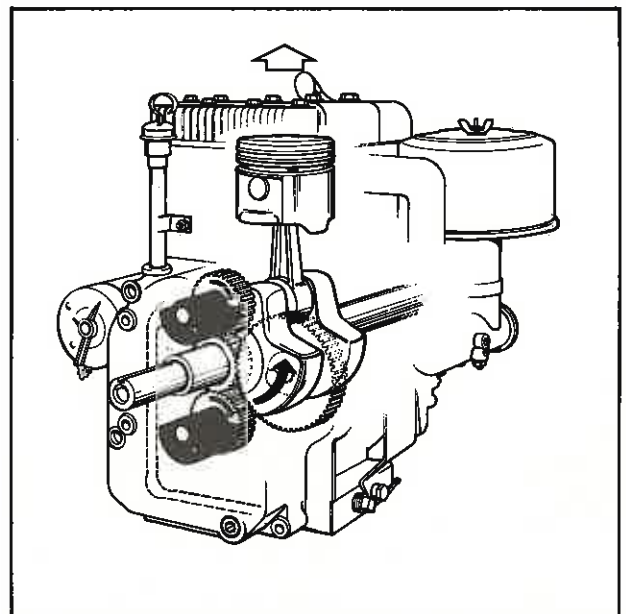
Install cover assembly and gasket, using care to avoid damage to oil seal and making sure that bolt holes line up with tapped holes in cylinder. To minimize gear backlash, push magneto side cover toward idler gear and torque bolts to 120 inch pounds (1.4 mkp or 13.5 Nm). For MODEL SERIES 300400 and 320400 repeat above for PTO cover, torquing bolts to 200 inch pounds (2.3 mkp or 22.6 Nm).

Remove timing rods. Coat threads of timing hole screw with a non-hardening sealant, then install screw and fibre sealing washer.

### MODEL SERIES 251400, 252400 & 253400

These Model Series utilize two gear driven counterweights in constant mesh with the crankshaft gear.

The cut-away view illustrates these gears, mounted in the crankcase cover, and how the Synchro-Balance counterweights rotate in opposite direction to crankshaft rotation, Fig. 5.



**Fig. 5 — Aluminum Engines  
Rotating Counterbalance System**

### SERVICE PROCEDURES FOR MODEL SERIES 251400, 252400 & 253400

The gear driven counterweights must be properly aligned when cover is installed.

# SYNCHRO-BALANCE Oscillating Counterbalance

## SERVICE PROCEDURES FOR MODEL SERIES 171700, 191700, 251700 & 252700 OSCILLATING COUNTERBALANCE SYSTEM

To do so remove two small screws from cover and insert 1/8" (3.18 mm) diameter locating pins through screw hole and into timing hole provided in counterweights, Fig. 6.

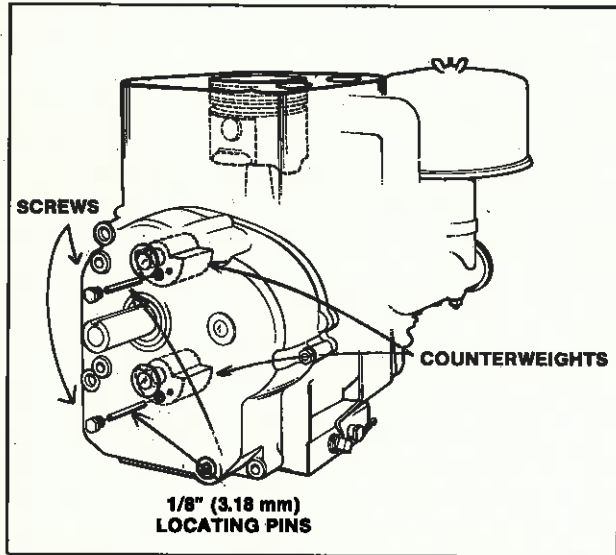


Fig. 6 — Timing Counterbalance Gears

With the piston at TOP DEAD CENTER, install the crankcase cover assembly and cover gasket. Remove the locating pins. Coat threads of timing hole screws with a non-hardening sealant, then install screws and fibre sealing washers.

If counterweights are removed from crankcase cover, exercise care in handling or cleaning to prevent losing needle bearings.

### ASSEMBLY OF COUNTERWEIGHTS

Install counterweights on shafts in crankcase cover. Install counterweight retainers and torque screws to 50 inch pounds (.57 mkp or 5.6 Nm).

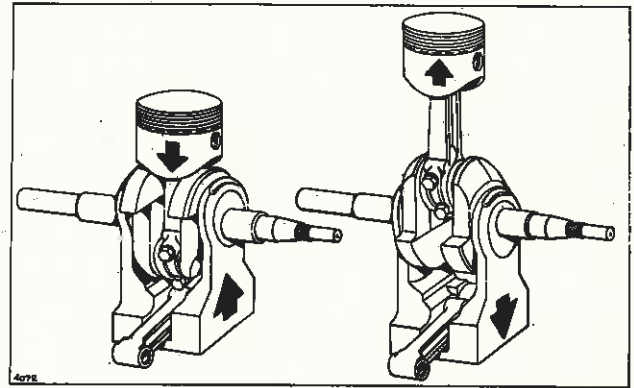


Fig. 7 — Oscillating Counterbalance

### Disassembling Oscillating Counterbalance

Use a screwdriver and hammer to open the connecting rod cap screw locks — remove connecting rod screws — remove connecting rod and piston assembly. Remove crankshaft and counterweight assembly. Remove crankshaft gear — in the event it should fit tight, it can be pried off with two screwdrivers, being careful not to damage the gear. Fig. 8. Save the key on MODEL SERIES 171700 only. Key is staked in on MODEL SERIES 191700, 251700 and 252700.

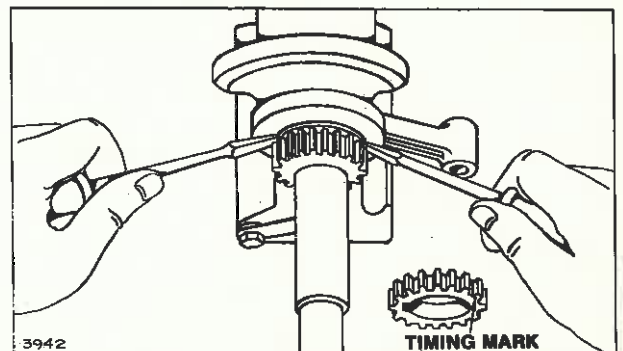


Fig. 8 — Removing Crankshaft Gear

Disassemble the counterweight. Open the locks and remove one or two screws holding the halves of the counterweight together. Separate and remove the dowel pin, link and spacer. Fig. 9.

# SYNCHRO-BALANCE

## Oscillating Counterbalance

Remove counterweight from the shaft.

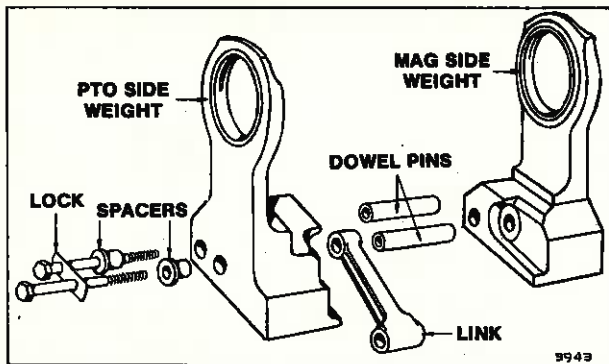


Fig. 9 — Disassembling Counterweight

### ASSEMBLY

Assemble magneto side of counterweight to the magneto side of the crankshaft. Hold the crankshaft and counterweight in an upright position in a vise. Install both dowel pins. Slip link over dowel pin with rounded edge of free end up. Fig. 10.

NOTE: New style counterweight assemblies use only one (1) dowel pin, one (1) spacer, and one (1) bolt. No lock is required. Torque to 115 in/lbs. (1.32 mkp or 13.0 Nm).

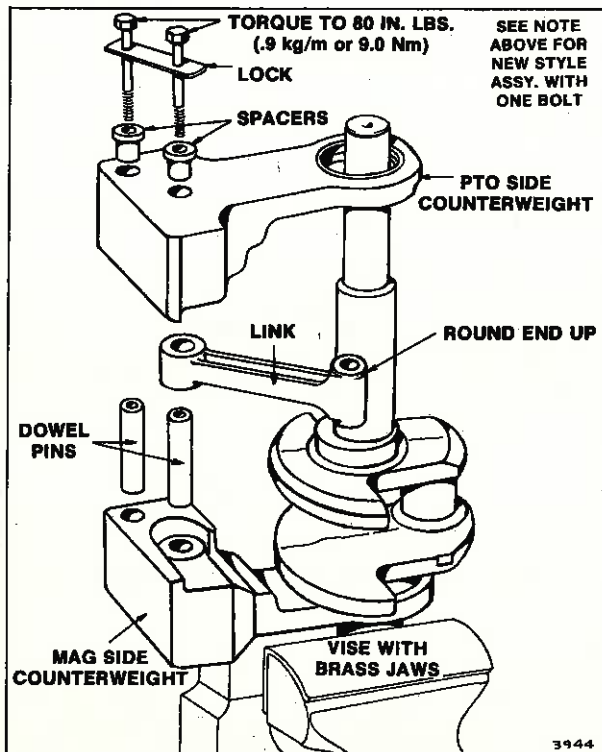


Fig. 10 — Assembling Counterweight to Crankshaft

Slip PTO counterweight in place, aligning counterweight bearing to the eccentric of crankshaft and against magneto half of counterweight. Install spacers and torque bolts to 80 inch-pounds (.9 mkp or 9.0 Nm). Bend up bolt locks and install crankshaft gear (and key on MODEL SERIES 171700). Gear is a slip fit — if tight, it may be heated to expand by laying it on a light bulb. NOTE: Chamfer on inside diameter of gear must face shoulder of crankshaft.

Lay cylinder on its side with cylinder head to the left. Start magneto journal of crankshaft into the magneto bearing in the cylinder. Align the link with the crankcase link pin and push crankshaft and counterweight assembly into place. Fig. 11.

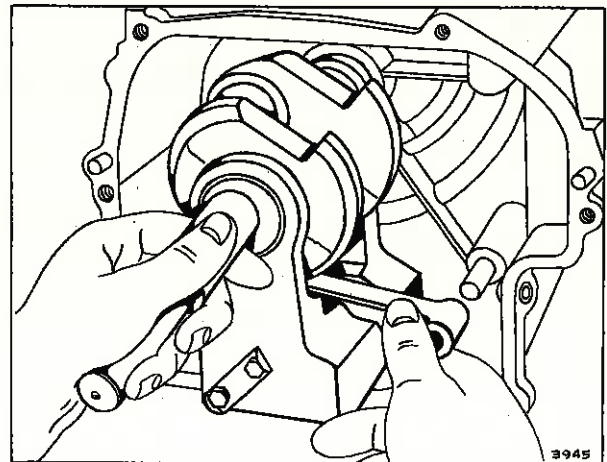


Fig. 11 — Installing Crankshaft and Counterweight Assembly

Install connecting rod and piston with lubrication hole in rod toward magneto side. This will expose rod assembly marks to view.

Assemble the cap screws and screw locks with dipper toward cam gear side. Torque screws and bend up locks. Proceed to install tappets, cam gear, etc., in usual manner.

Table No. 1

Crankshaft Eccentric Reject Sizes		
Basic Model Series	Eccentric	
	Inch	Millimeter
171700 & 191700	1.870	47.50
251700 & 252700	2.120	53.85

Counterweight Bearing Reject Sizes		
Basic Model Series	Counterweight Bearing	
	Inch	Millimeter
171700 & 191700	1.881	47.78
251700 & 252700	2.131	54.13