McCULLOCH

CHAMPIONSHIP KART ENGINES

LEADERSHIP THROUGH CREATIVE ENGINEERING

INSTALLATION

Your McCulloch Kart Engine (or engines) is designed to operate efficiently, mounted in any position. Figure 1 shows an accepted mounting position. If single engine operation is to be used, the engine may be mounted on either the right or left hand side of the frame.

Make certain that the engine mounting plate is flat, and that the engine fits flat and flush. If the engine mount plate is warped, or is too weak, crankcase cracking will result when the engine is pulled down tight.

Also, tighten down the engine retaining bolts evenly. If one bolt is pulled down tight and the others are then tightened, crankcase cracking can result. Before mounting the engine, be sure that the crankcase bottom and the mount face are both clean and free of foreign matter.

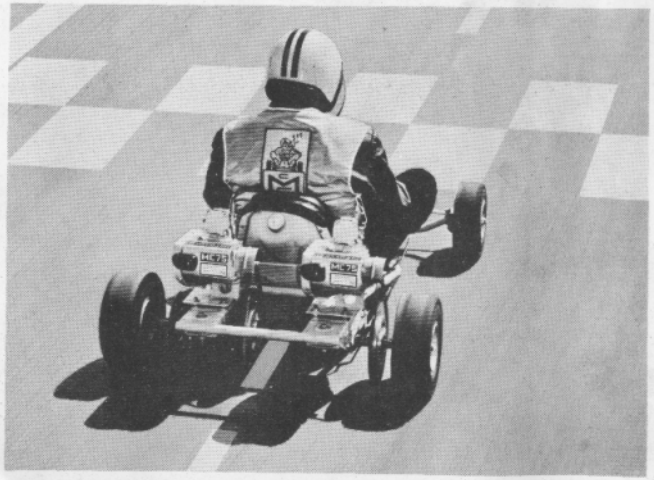

FIGURE 1

Use care to make sure that the drive and driven sprockets are perfectly aligned. Slight misalignment of sprockets may cause vibration and flexing of the crankshaft which can result in crankshaft failure.

Do not use a flywheel adapter as a power take-off for driving your kart. Use of a flywheel adapter will very likely cause crankshaft flexing which in turn, will result in a broken crankshaft. If you must drive from the flywheel side of the engine, use a good, well aligned outboard bearing mount. Although the outboard bearing approach is not infallible, its use will reduce the possibility of crankshaft bending or breaking.

NOTE

If the outboard bearing is not aligned, it can also contribute to crankshaft failure.

FUEL MIXTURE

The proper fuel for your McCulloch Kart Engine, as with most two-stroke-cycle gasoline engines, is a mixture of gasoline and oil.

The best kind of gasoline to use in the fuel mixtu e is white marine-type gas of 100 octane rating. However, any good regular grade gasoline may be used. Gasolines which have high octane ratings because of excessive leading are not good fuels for two-stroke-cycle engines. Any highly leaded gas used in the fuel mix will cause formation of lead balls on the spark plug electrodes, as illustrated in Figure 2. These lead balls will eventually short out the plug.

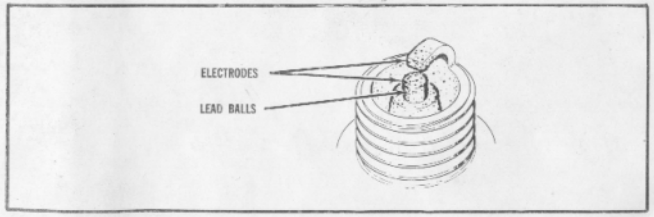

FIGURE 2

Gasolina recomendada → 100 octanas
óleo " → SAE 40
Mistura = 20 partes gasolina + 1 de óleo
(1 l " + 0,05 l ")

Some exotic fuels, such as nitro methane, are quite corrosive when in contact with magnesium and aluminum. These fuels are not recommended for McCulloch Kart Engines.

Avoid the use of unknown zip-type additives and fuel blends. Many karters pour their own problems into the fuel tank and find the experience expensive. If you are in doubt, stick to regular pump gasoline and approved oil for your fuel mix.

If exotic fuels are used, it is best to purge the engine at the end of the day by running regular gasoline-oil mix through the system. This will minimize the corrosive effects of the fuel on components of the engine.

The oil in the fuel mixture provides the only lubrication of the engine's moving parts and, for this reason, the amount of oil in the mixture -- as well as the kind of oil -- is extremely important. High-speed racing engines require the very best lubrication possible if long, trouble-free service is expected.

When preparing the gasoline-oil mixture for your kart engine, use a good grade of Two-Cycle Engine Oil with a viscosity rating of SAE #40. Mix the fuel blend in a ratio of 20 parts of gasoline to 1 part of oil.

If a synthetic lubricant is used, the gasoline-to-lubricant ratio should be as recommended by the lubricant manufacturer.

When castor oil is used for engine lubricant, one of the "de-gummed" types is recommended. By using a "de-gummed" type, the possibility of ring sticking and gum formation (normally associated with castor oil) will be greatly reduced.

OPERATING YOUR NEW ENGINE

Never attempt to start your new engine without first making certain that it is adequately lubricated. A "dry" engine can be quickly ruined by pushing the kart a very short distance.

Pre-lubricate your engine before starting it for the first time to give all of the moving parts sufficient oil for starting and running until the fuel-oil mixture is supplying the necessary lubrication.

Lubricate the engine by pouring about 1/4-cup of a rich, 75% fuel, 25% oil, mixture into the carburetor throat. Remove the spark plug and pour a tablespoon of the same mixture into the spark plug hole. Rotate the flywheel--or crankshaft--at least a dozen times to give the cylinder wall and bearings a coating of the lubricating mixture.

Holding the engine with the exhaust port down, continue turning the crankshaft until the excess fuel is pumped out of the engine. Install the spark plug and the engine is ready to go.

Break-in your new engine by at least 1/2 to 1 hour of mild running with a rich carburetor setting, before you try any all-out racing. You may foul the spark plug, but the price is cheap compared to replacing your engine.

Prolonged operation of your kart engine at part throttle, followed immediately by a burst of speed of full throttle, may result in engine damage. The lubrication of a two-cycle engine is dependent upon the amount of fuel/oil vapor that has been drawn into the crankcase through the carburetor venturi and the droplets of oil suspended in the vapor furnish the engine lubrication.

When the throttle has been held at a more or less constant opening, only the amount of fuel mixture needed for that particular speed will have been drawn into the crankcase. A sudden advance of the throttle upsets this mixture balance and before the increased engine speed can draw enough additional mixture vapor through the carburetor venturi to supply the additional lubrication for this increased speed, the engine damage has occured.

To overcome this tendency of lubrication starvation occuring after an extended period of running at partially opened throttle, ease up on the throttle for several seconds before going to full open position. This permits a build-up of an extra supply of fuel/oil mixture in the crankcase which will furnish lubrication for the higher speed until the increased mixture from the carburetor is supplying the additional lubrication needed at the higher speed.

SPARK PLUG

McCulloch Kart Engines are factory equipped with 14-mm, 3/8-inch reach spark plugs as shown in the chart. The spark plugs listed for the various models have the correct heat range for average running conditions. For normal operation of the engine, use of the listed spark plugs or their equivalents will provide the best all-around performance. Certain factors, such as unusual climatic conditions, length of races, or constant use of the engine may require the use of a hotter or a colder heat range spark plug.

Spark plugs are considered hot or cold according to the length of the inner insulator from nose to plug shell. The longer the insulator, the longer it will take for the heat to travel to the shell and the hotter the plug will run. With a short heat path, the heat dissipates rapidly and the spark plug runs cooler. Figure 3 illustrates both spark plug types.

Examination of the electrodes and the insulator will tell you whether the spark plug in your engine is hot or cold enough for your running conditions. A spark plug of the correct heat range will show brown to grayish-tan deposits around the insulator. Wet, black and sludgy carbon deposits indicate the need for a hotter spark plug (Figure 4). Whitish deposits, a blistered insulator nose and badly burnt electrodes call for the use of a cooler spark plug (Figure 4).

CAUTION

If your McCulloch engine is operated with a too-lean fuel mixture, the spark plug--regardless of heat range--will show all the indications of being too hot. And the too-lean mixture will seriously

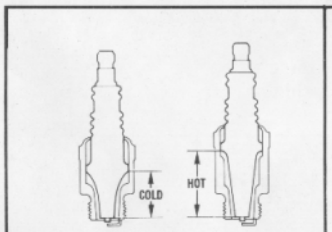

FIGURE 3

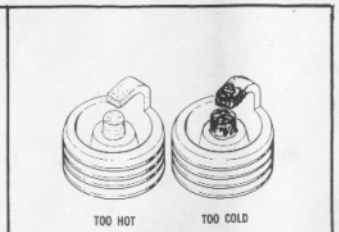

FIGURE 4

damage the engine through overheating and lack of lubrication. Before installing a colder spark plug, check to make sure the carburetor is correctly adjusted. (Refer to section on "Carburetor" page 8).

The following chart also shows the spark plugs which fulfill the normal requirements of a kart owner. If your engine is subject to extremely hard use, you may want to try a colder plug.

SPARK PLUG	HEAT RANGE	RUNNING CONDITIONS
J6J	Hotter	Average driving
J4J or M42K		Light racing
J2J	Colder	Lengthy racing

Only in case of emergency should you use an automotive-type spark plug in your kart engine. When an automotive-type plug is used, oil is likely to collect between the electrodes and cause the spark plug to foul and short out.

All spark plugs listed have been designed for two-stroke-cycle engines. Figure 5 shows the difference between this type of spark plug and the type used in automotive and other four-stroke-cycle engines.

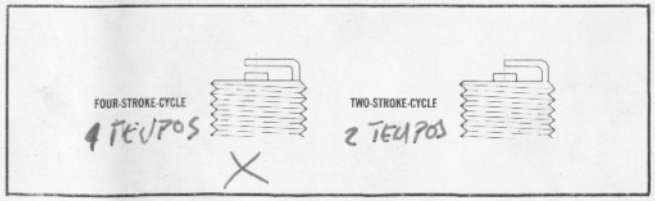

FIGURE 5

FUEL HOSE

A poor fuel hose connection on the kart engine can result in fuel starvation, especially when the engine is operating at the high end.

When installing the fuel hose, don't depend on the tightness of the connection to hold the fuel hose in place. When the hose is not clamped or otherwise secured on both the pump and the tank fittings, vibration can cause an intermittent air leak. When an air leak occurs at either of the fittings, it is easier for the fuel pump to suck air into the fuel line than it is for it to pump fuel. The air entering the fuel line causes a condition similar to a vapor lock and will prevent fuel being pumped to the carburetor.

To eliminate air leaks at these connections, use 0.020 to 0.025-inch (0.508 to 0.635 mm) safety wire to fasten the fuel hose securely on the fuel pump and fuel tank fittings. Make two complete turns around the hose as shown in Figure 6, pull the wire tight with pliers, and twist the ends together at least three times.

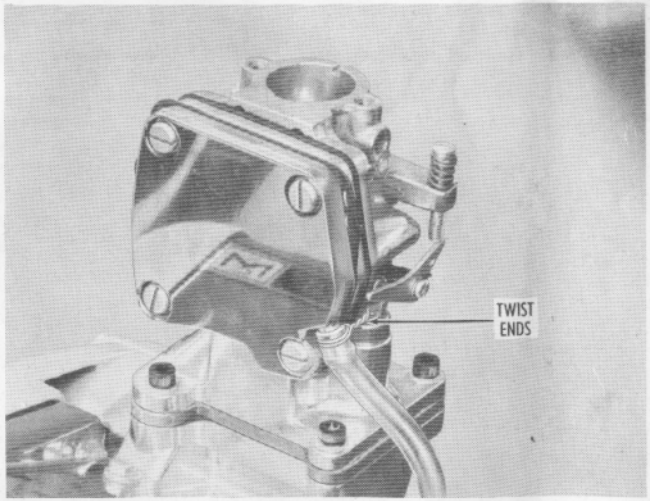

FIGURE 6

EXHAUST STACK

It's always advisable to use an exhaust stack when operating your McCulloch kart engine. Without an exhaust stack to provide back pressure at the exhaust ports, your engine will probably run uncontrollably lean. Such conditions can cause rapid engine failure.

Exhaust stacks, mufflers and other kart accessories may be obtained from your McCulloch dealer.

ADJUSTMENTS

SPARK PLUG

The spark plug should first be cleaned and then re-gapped, using a wire type feeler gauge to check the gap. The gap is set by bending the side electrode only. Any attempt to bend the center electrode will crack the insulator and ruin the plug. Set the gap at 0.025-inch (0.64 mm). folga do electrodo das velas

CARBURETOR

Preliminary Adjustment

1. Close the main and idle fuel adjustment needles (turn clockwise) until they just seat (Figure 7).

CAUTION

Do not jam the needles into their seats beyond the point of resistance. This will damage the needles and the carburetor body beyond repair.

2. Open the main fuel adjustment needle (turn counterclockwise) 1-1/2 to 2 turns. Open the idle fuel adjustment needle 1 to 1-1/4 turns (Figure 7).

3. Start the engine and warm it up to operating temperature.

4. Adjust the idle speed adjusting screw until the engine runs smoothly at lowest speed with the throttle off.

Final Adjustment

1. Put the kart on the track and warm it up thoroughly.

2. Adjust the idle fuel needle to obtain a smooth, even idle. Test acceleration on coming out of tight turns on the track. If the engine runs rough and smokes heavily on acceleration, close the main fuel needle (turn clockwise) until it smooths out. If the engine falters and mis-fires on acceleration, open the main fuel needle (turn counterclockwise) until the engine accelerates smoothly and without hesitation. Make adjustments or changes in the needle setting in steps of about 1/16 turn at a time.

3. Test the engine performance at high speed or full throttle. Adjust the main fuel needle by opening the needle (turning counterclockwise) until the engine begins to four-cycle (fire every other stroke) at a maximum RPM. Close the needle (turn clockwise) to lean the mixture just enough to return to two-cycling at full throttle.

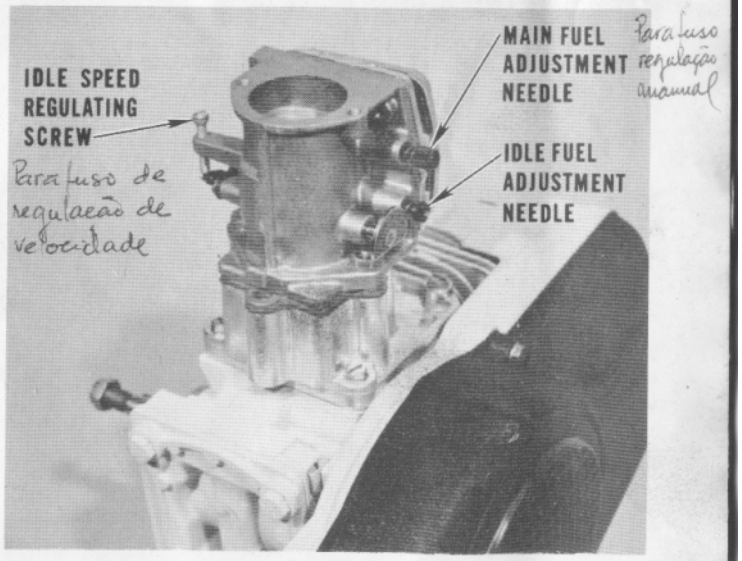

FIGURE 7

stroke) at a maximum RPM. Close the needle (turn clockwise) to lean the mixture just enough to return to two-cycling at full throttle.

CAUTION

Always adjust the main fuel needles under load conditions to avoid carburetor settings that will run the engine too lean. If the setting is too lean, overheating and lack of lubrication will seriously damage the engine in a very short time.

LAMINATION-TO-FLYWHEEL GAP

For best magneto output, there should be a 0.010 to 0.012-inch (0.254 to 0.305 mm) clearance between the lamination and the flywheel rim. Use a feeler gauge and have the flywheel magnet positioned directly under the lamination when measuring the gap under each of the two outer legs. If the clearance isn't between 0.010 and 0.012-inch (0.254 to 0.305 mm), adjustment is necessary.

1. Rotate the flywheel so that the magnet is not under the lamination.
2. Loosen the coil and lamination mounting screws, raise the assembly, and then re-tighten screws.
3. Rotate the flywheel until the poles of the magnet are directly under the lamination.
4. Insert a 0.010-inch (0.254 mm) feeler gauge under each of the laminations (Figure 8).
5. Loosen mounting screws and let the coil and lamination assembly drop onto feeler gauges and flywheel.
6. Tighten the mounting screws securely. (Refer to the "Table of Torque Values" if you're using a torque wrench).
7. Remove the feeler gauges and rotate the flywheel through several revolutions to make sure that the lamination legs do not rub on the flywheel.

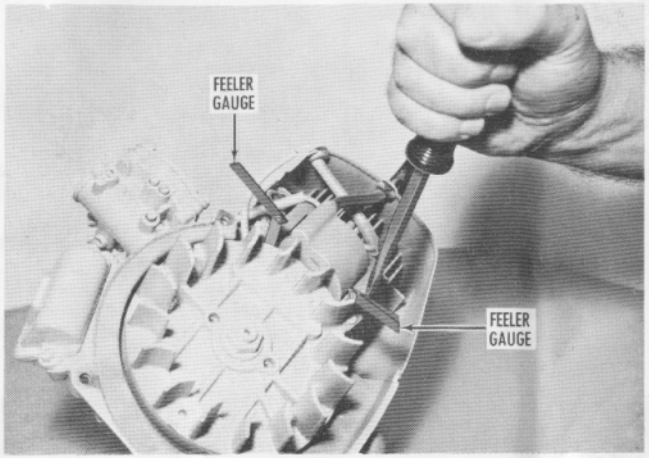

FIGURE 8

BREAKER POINTS

The breaker points will be found under the flywheel. The under-flywheel breaker points are actuated directly from a cam on the crankshaft. Check the rubbing block before setting the breaker point gap. If the block has been worn by the cam and looks like the one shown in Figure 9, replace the entire breaker point assembly. It is also advisable to replace the condenser every time the breaker point assembly is replaced.

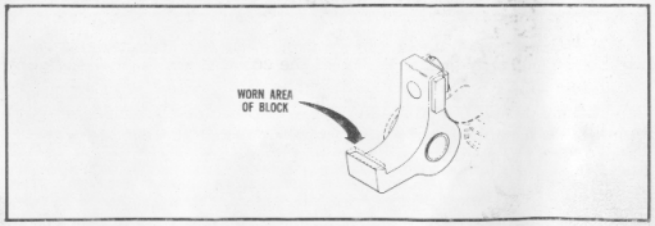

FIGURE 9

NOTE

When a new breaker point assembly has been installed, a cause of early breaker point failure can be eliminated by cleaning the surface of the new points before the engine is run. This is advisable because all new breaker points have a wax-type preservation on their faces, and drawing an emery stick or small card between the points will not remove this wax. This method will clean the high spots, but the wax will be compressed into the low spots on the point surface. Later, when this collected wax burns, it will have the same appearance and surface of burned points. To remove all the wax, saturate a small card with carbon tetrachloride and draw it between the points. The carbon tetrachloride will dissolve all the wax and leave a clean breaker surface.

WARNING

Carbon tetrachloride is toxic! Keep in small quantities when using and make sure room is well ventilated. Avoid inhaling fumes.

Timing Your Engine

The best way to time your engine requires the use of a degree wheel and a simple timing light, such as a flashlight with two leads. If you do not have a degree wheel, one can be made at a nominal cost. The following directions cover the making of a degree wheel, and the timing of an engine:

1. Obtain the following parts from your McCulloch dealer:

   1 -- Special extension nut (P/N 19521)
   1 -- Special 5/16-18 x 2 inch (7.937 x 50.8 mm) long bolt (P/N 101361)
   1 -- Round head 10-24 x 5/8 inch (15.875 mm) long screw (P/N 100716)

In addition, you will need a 180 degree protractor (5-inch diameter) which is obtainable from a stationery or 5 and 10 cent store.

NOTE

Make sure the protractor you use contains center lines similar to those shown in Figure 10.

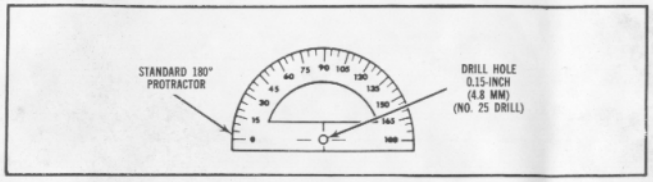

FIGURE 10

2. Drill a 0.15-inch (4.8 mm) hole through the center lines on the protractor, using a No. 25 drill. If desired, a thin piece of aluminum can be added to the back of the protractor to reduce its flexibility. Cut the aluminum in the same shape as the protractor and, using Pli-O-Bond or a similar sealant, mount the aluminum plate to the back of the protractor.

3. Install the round head screw in the special extension nut and jam the screw tight (Figure 11). Assemble the protractor on the nut and screw and secure with the 10-24 wing nut.

4. Remove the porcelain and ground electrode from a spark plug and drill and tap a 5/16-inch (7.94 mm) thread through the spark plug shell (Figure 12). Thread the special bolt into the shell. This assembly is your piston stop.

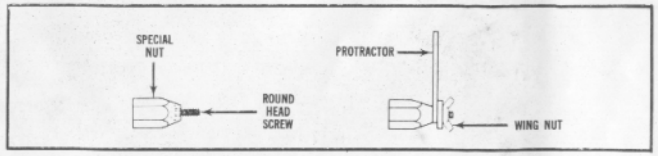

FIGURE 11

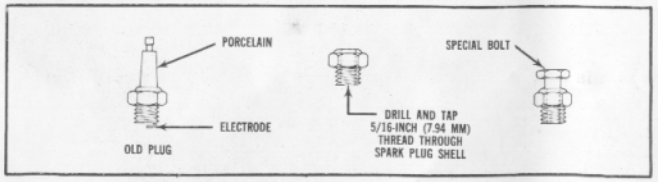

FIGURE 12

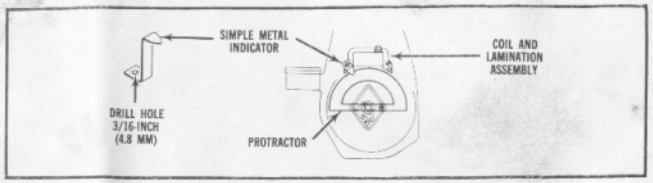

FIGURE 13

5. Remove the flywheel and breaker box cover from the engine. Install the degree wheel (protractor assembly) on the flywheel end of the crankshaft and tighten the special nut finger-tight.

6. Make a simple indicator for the degree wheel from the lid of a tin or coffee can (Figure 13). Mount the indicator on one coil lamination leg (either side is all right) in the same way as shown in Figure 13.

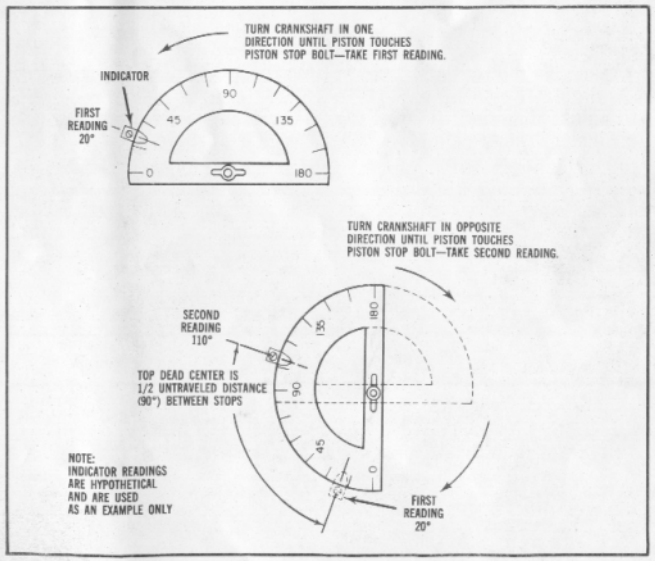

FIGURE 14

7. Remove the spark plug from the engine and install the special spark plug shell in the spark plug hole. Tighten the spark plug shell finger-tight.

CAUTION

Before installing the piston stop bolt into the cylinder bore, use a grinder or file to round off the bolt end to be sure there are no sharp edges or burrs which could damage the piston. As a compression relief, it is recommended that a 1/8-inch (3.175 mm) hole be drilled through the bolt.

8. Thread the piston stop bolt all the way through the spark plug shell and into the cylinder bore. Turn the crankshaft (either way) until the piston touches the piston stop bolt. At this point, take the degree wheel reading. Turn the crankshaft in the opposite direction until the piston again stops at the piston stop bolt. Take a second reading (Figure 14).

9. The untraveled degree distance between the two stops (Figure 14) can now be used to locate top dead center. One-half of this distance represents top dead center. If, for example, the degree distance not traveled by the crankshaft rotation is 90 degrees, top dead center is 45 degrees.

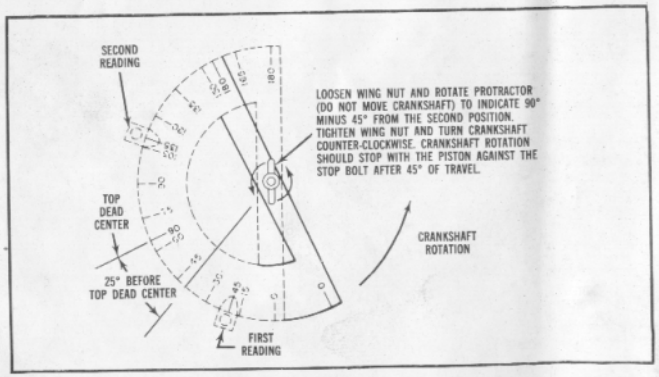

FIGURE 15

RPM - RATIO - MPH CHART

REAR TIRE DIAMETER	ENGINE RPM - MILES PER HOUR																																									
	4000			5000			6000			7000			8000			9000			10000			11000			12000			13000			14000			15000		
RATIO	10.5	11	12	10.5	11	12	10.5	11	12	10.5	11	12	10.5	11	12	10.5	11	12	10.5	11	12	10.5	11	12	10.5	11	12	10.5	11	12	10.5	11	12	10.5	11	12
5.0:1	25	26.2	28.5	31.2	32.7	35.6	37.5	39.3	42.7	43.7	45.8	49.9	49.9	52.4	57.0	56.1	58.9	64.2	62.3	65.5	71.3	68.5	72.0	78.4	74.7	78.6	85.6	80.9	85.1	92.7	87.1	91.0	99.9	93.3	98.0	107
5.45:1	22.9	24.0	26.2	28.6	30.0	32.7	34.3	36.0	39.3	40.1	42.0	45.8	45.8	48.0	52.4	51.5	54.0	58.9	57.3	60.0	65.5	63.0	66.0	72.0	68.7	72.0	78.6	74.4	78.0	85.1	80.2	84.0	91.7	85.9	90.0	98.2
6.0:1	20.8	21.8	23.8	26.0	27.2	29.7	31.2	32.7	35.7	36.4	38.1	41.6	41.6	43.5	47.5	46.8	48.9	53.5	52.0	54.4	59.4	57.2	59.9	65.3	62.4	65.4	71.3	67.6	70.8	77.2	72.8	76.3	83.2	78.0	81.7	89.1
6.54:1	19.1	20.0	21.8	23.9	25.0	27.2	28.6	30.0	32.7	33.4	35.0	38.1	38.2	40.0	43.5	43.0	45.0	49.0	47.8	50.0	54.4	52.5	55.0	59.9	57.3	60.0	65.3	62.1	65.0	70.8	66.8	70.0	76.2	71.6	75.0	81.7
6.66:1 X	18.7	19.6	21.4	23.4	24.5	26.3	28.0	29.4	32.0	32.7	34.3	37.4	37.4	39.2	42.8	42.1	44.1	48.2	46.8	49.1	53.5	51.4	54.0	58.8	56.1	58.9	64.2	60.8	63.8	69.5	65.5	68.7	74.9	70.2	73.6	80.2
7.0:1	17.8	18.6	20.4	22.3	23.3	25.5	26.7	28.0	30.6	31.2	32.6	35.7	35.6	37.3	40.6	40.1	42.0	45.9	44.5	46.7	51.0	48.9	51.3	56.0	53.4	56.0	61.0	57.8	60.7	66.3	62.3	65.3	71.4	66.8	70.0	76.5
7.2:1	17.3	18.1	19.8	21.6	22.7	24.7	25.9	27.2	29.7	30.3	31.7	34.6	34.6	36.3	39.6	38.9	40.8	44.5	43.3	45.4	49.5	47.6	49.9	54.4	51.9	54.4	59.4	56.2	59.0	64.3	60.6	63.5	69.3	64.9	68.1	74.2
7.5:1	16.6	17.4	19.0	20.8	21.8	23.8	24.9	26.1	28.5	29.1	30.5	33.3	33.2	34.8	38.0	37.4	39.2	42.8	41.6	43.6	47.6	45.7	47.9	52.3	49.9	52.3	57.1	54.0	56.6	61.8	58.2	61.0	66.6	62.4	65.4	71.4
7.63:1	16.3	17.1	18.7	20.4	21.4	23.4	24.5	25.7	28.0	28.6	30.0	32.7	32.7	34.3	37.4	36.8	38.6	42.1	40.9	42.9	46.8	44.9	47.1	51.4	49.0	51.4	56.1	53.1	56.7	60.8	57.2	61.0	65.5	61.3	65.3	70.2
8.0:1	15.6	16.3	17.8	19.5	20.4	22.3	23.4	24.5	26.7	27.3	28.6	31.2	31.2	32.7	35.6	35.1	36.8	40.1	39.0	40.8	44.6	42.9	44.9	49.0	46.8	49.0	53.5	50.7	53.1	57.9	54.6	57.2	62.4	58.5	61.3	66.9
8.4:1	14.8	15.5	17.0	18.5	19.4	21.2	22.2	23.3	25.5	25.9	27.2	29.7	29.6	31.1	34.0	33.3	35.0	38.2	37.1	38.9	42.5	40.8	42.7	46.7	44.5	46.6	51.0	48.2	50.5	55.2	51.9	54.4	59.5	55.6	58.3	63.7
9.0:1	13.8	14.5	15.8	17.3	18.1	19.8	20.8	21.7	23.7	24.2	25.4	27.7	27.7	29.0	31.6	31.[illegible]	32.6	35.[illegible]	34.7	36.3	39.6	38.1	39.9	43.5	41.6	43.5	47.5	45.1	47.1	51.4	48.5	50.8	55.4	52.0	54.4	59.4
9.33:1	13.3	14.0	15.2	16.7	17.5	19.1	20.0	21.0	22.9	23.3	24.5	26.7	26.7	28.0	30.5	30.0	31.5	34.3	33.4	35.0	38.2	36.7	38.5	42.0	40.0	42.0	45.8	43.4	45.5	49.6	46.7	49.0	53.4	50.1	52.5	57.3
10.5:1	11.8	12.4	13.6	14.8	15.5	17.0	17.8	18.6	20.4	20.7	21.7	23.8	23.7	24.8	27.2	26.7	[illegible]	30.6	29.7	31.1	34.0	32.6	34.2	37.4	35.6	37.3	40.8	38.6	40.4	44.2	41.5	43.5	47.6	44.5	46.6	51.0

MPH= Engine RPM x C x 0.01136 ÷ R

R= Sprocket Ratio
C= Tire Circumference { 12 in. dia. = 3.1416 ft. / 11in. dia. = 2.8798 ft. / 10.5 in. dia. = 2.7489 ft.

DRIVE	8T.	9T.	10T.	11T.	12T.
DRIVEN	SPROCKET RATIO				
60T.	7.5:1	6.66:1	6.0:1	5.45:1	5.0:1
72T.	9.0:1	8.0 :1	7.2:1	6.54:1	6.0:1
84T.	10.5:1	9.33:1	8.4:1	7.63:1	7.0:1

10. To make the 90 degree point on the protractor wheel top dead center, loosen the wing nut (piston is still against the stop) and move the protractor from the second degree reading to the 45 degree point on the protractor. Re-tighten the wing nut. Re-check for 90 degree top dead center by rotating the crankshaft counterclockwise to the stop. This reading should also be 45 degrees (Figure 15).

11. Remove the piston stop from the spark plug hole.

12. Slowly rotate the crankshaft counterclockwise until the degree wheel reading is 25 degrees to the left of 90 degrees (TDC). This is the before top dead center setting (BTDC) (Figure 16).

13. Disconnect the breaker point lead from the top of the coil. Don't disconnect any other leads.

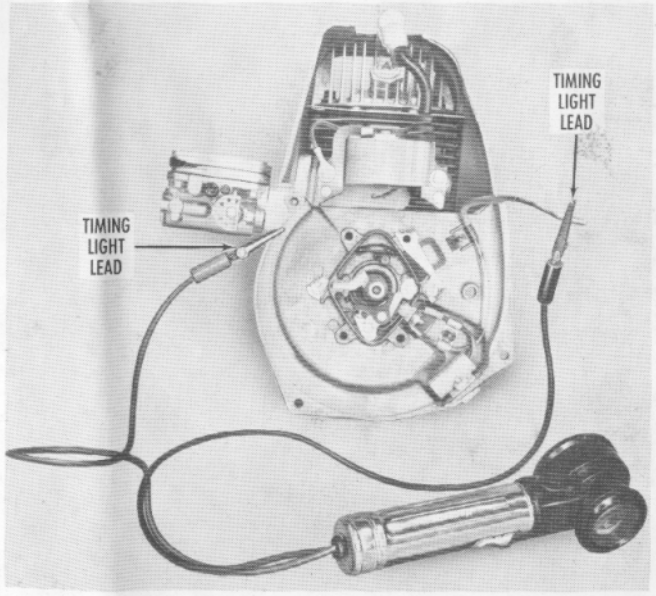

FIGURE 16

14. Connect one timing light lead to the breaker point lead and the other lead to the engine (Figure 16).

15. Gently rock the crankshaft to see if the timing light goes on and off. If the timing light goes on and off at the 25 degree BTDC position, the breaker point setting is correct. If the light does not flash on and off, loosen the breaker point screw and adjust the gap setting until the light does flash on and off as the crankshaft is gently rocked. Lock the breaker point assembly in this position without disturbing the setting.

16. Remove the degree wheel assembly and disconnect the timing light leads. Connect the breaker lead to the coil and reinstall the breaker box cover and flywheel.

Alternate Method of Setting Breaker Point Gap

An alternate method of setting the breaker point gap on these engines requires the use of an 0.018-inch (0.457 mm) feeler gauge:

1. Turn the crankshaft until the breaker points are at their greatest separation.

2. Loosen the screw which holds the slotted arm to the crankcase cover (Figure 17).

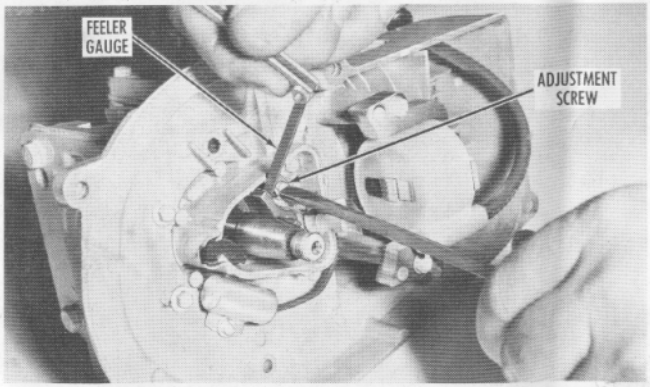

FIGURE 17

3. Using the feeler gauge, set the points to a gap of 0.018-inch and then tighten the screw securely.

CAUTION

Make sure the feeler gauge is free of oil and dirt to avoid contamination of the breaker points.

OVERHAUL

Any engine used for racing is subject to a high rate of wear. It is only natural that engine efficiency is eventually lost and that peak performance falls off. To maintain top performance, your McCulloch Kart Engine should be overhauled as frequently as called for by your racing requirements.

Your engine's greatest enemy--and the one which most often makes frequent and large-scale overhauls necessary--is just plain dirt. Dirt in the fuel mixture and the air induction system will cause wear of piston rings, piston cylinder, and crankshaft bearings. Always be sure to use only clean gasoline and oil. The use of an air filter in the carburetor air intake system is also recommended, particularly on dirt tracks, and in dusty running conditions.

A second cause of major wear in the engine is breakdown of the oil in the fuel mixture due to the internal heat of the engine. If the oil breaks down, moving parts of the engine won't be lubricated properly and overheating will result. Be sure that the oil you mix with the gasoline is of the highest grade. (Refer to the section on "Fuel Mixture" for the types of oil to use and the ratio of oil to gasoline when mixing fuel, page 2).

CYLINDER

Cylinder wall wear is largely the result of dirt, although improper lubrication and running with a lean fuel mixture will also cause rapid wear and cylinder scoring.

When the combined wear of the cylinder wall and the piston results in a clearance of more than 0.007-inch (0.178 mm), and the new

piston rings cannot be fitted with the correct end gap, or when the cylinder wall is badly scored or tapered, rebore and hone the cylinder to the next oversize--0.010, 0.020, or 0.030-inch (0.254, 0.508, or 0.762 mm) over standard. If wear is excessive and cannot be corrected by boring and honing to maximum oversize--0.030-inch (0.762 mm), install a new cylinder.

In either case, be sure to install a new piston and piston rings when installing a new cylinder or a new matching oversize piston and rings when the cylinder has been rebored. If the cylinder wall is glazed but appears to be in good condition otherwise, remove the glaze by dressing with a very fine grit finishing cloth or paper, and make sure that all dust from the finishing cloth is cleaned from the cylinder before reassembly.

PISTON

The piston in McCulloch kart engines uses two thin (0.025 inch) (0.63 mm) chrome plated piston rings. Needle roller bearings are used for the piston pin. Replacement of the piston is necessary if the piston has worn out of round or is badly scored. Piston ring grooves worn so much that the rings do not fit properly, leading to poor compression as shown in Figure 18, or worn bores in the piston pin bosses, means that a new piston should be installed.

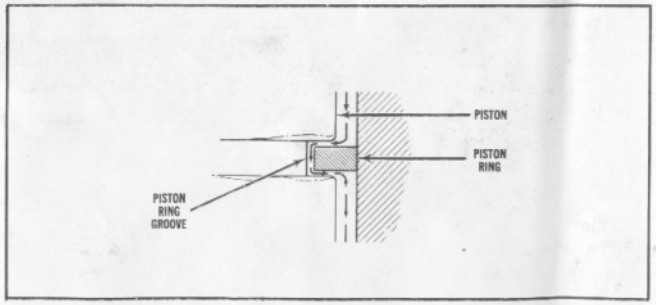

FIGURE 18

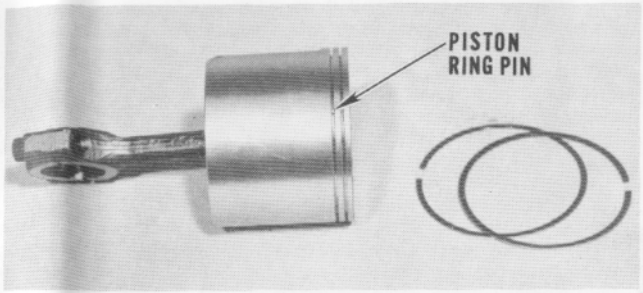

FIGURE 19

The engines have "pinned" piston rings. Care must be taken, when installing the piston, that the ring gaps fall on the retaining pins (in the ring grooves as shown in Figure 19) as the piston is inserted into the cylinder.

The piston pin is pressed into the eye of the connecting rod with an interference fit. Be careful, therefore, when removing the pin, that the piston or the connecting rod is not damaged.

PISTON RINGS

When the piston rings have been removed from the piston, quite often they will appear to be in good condition and suitable for re-installing. But, because piston rings are subjected to heat, pressure and constant tension, it is very likely that they will be below the standard required in a racing engine. It is best, therefore, to replace the piston rings whenever the engine is overhauled.

Thin, chrome plated rings, standard through oversize, are available for service replacement. Carefully clean away any carbon deposits from the ring grooves after the old rings have been removed. Use a wooden scraper or an old piston ring which has had one end ground to a sharp edge.

Before installing new rings on the piston, make sure that the ring end gap in relation to the cylinder bore, is correct. Slip a ring into the bore and, using a feeler gauge, measure the end gap with the ring positioned just above the transfer ports (Figure 20).

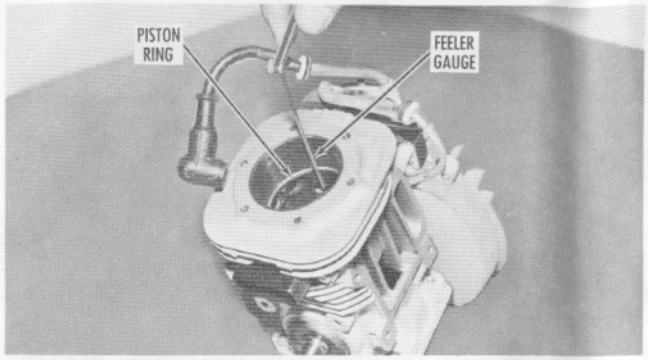

FIGURE 20

The ring gap should be between 0.051 and 0.091-inch (1.295 and 2.311 mm).

CAUTION

Never install a ring with less than the minimum clearance allowed. Expansion of the ring when heated will cause the ends to butt together. This will result in cylinder wall scuffing and possibly engine seizure.

When fitting rings to the piston, slip each ring into the groove and measure the clearance in several places around the ring. Side clearance, measured with a feeler gauge as shown in Figure 21, should not be more than 0.004-inch (0.102 mm).

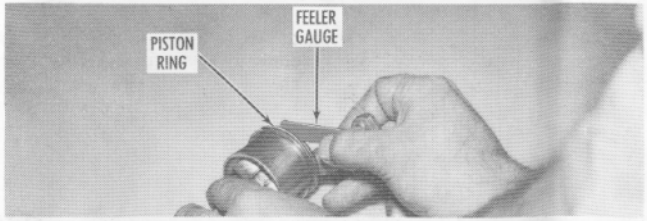

FIGURE 21

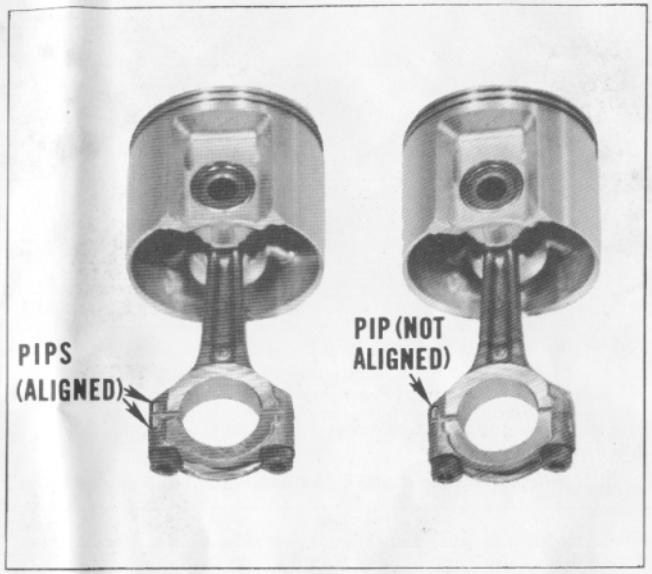

FIGURE 22

NOTE

The piston pin is supported by two needle roller bearings mounted in a "free skirt" blind piston. The piston is open on one side only as illustrated in Figure 22.

CONNECTING ROD

When the engine has been operated with a lean mixture or under very dirty conditions, the lower end of the connecting rod may become blackened and burnt. If this condition is noted, a new connecting rod should be installed.

In the same way, the 24 needle rollers between the connecting rod and the crank journal may become blackened, burnt, extruded, or

worn. If any of the rollers show any of these conditions, a complete new set of 24 rollers should be installed.

After installation of the crankshaft (see next section of this manual), the connecting rod rollers and the cap may be installed. Proceed as follows:

1. Coat the bearing surfaces of both rod and cap with a lightweight grease.
2. Install 12 rollers in the connecting rod and 12 rollers in the cap.
3. Fit the end of the connecting rod around the crank journal.
4. Fit the cap to the rod so that the identifying pips match.

CAUTION

If the cap is reversed in position on the rod and the pips do not match, the cap is not fitted properly (Figure 22). If not properly fitted, this misalignment will cause an immediate engine failure.

5. After making certain that the rollers are all in place and the cap in the correct position, tighten the screws until the cap is snug but not tight.
6. Rotate the crankshaft several times to see that movement is free and that the cap fracture line cannot be detected.
7. When sure of proper alignment, tighten the cap screws to the torque value shown in the "Table of Torque Values" page 32).

CRANKSHAFT AND MAIN BEARINGS

The crankshaft should be replaced if the journal or main bearing surfaces are galled, heat-discolored, or out-of-round. Crankshaft keyways which are pounded out or worn so that the key fits loosely in the slot are additional reasons for installing a new crankshaft.

To prevent early oil seal failures, scratches in the area covered by the oil seals should be removed by dressing with a very fine

emery finishing cloth. The main bearings should turn freely and smoothly. Any binding of the bearings, due to wear or dirt, will seriously affect engine efficiency. If the bearings are worn to this extent, they must be replaced.

1. Install the main bearings by pressing them onto the crankshaft until they seat against the shoulder on the side of the counterweight.

MC-90 - One main ball bearing on the flywheel end of the crankshaft.

MC-100 - Two main ball bearings on the crankshaft.

2. Before installing the assembled crankshaft and bearings in the crankcase end cover, heat the end cover under a heat lamp or in an oven to approximately 180 degrees F (82 degrees C).

CAUTION

Don't try to install the crankshaft without pre-heating the end cover, and don't use an open flame to heat the cover. Either procedure will seriously damage the end cover.

3. Before installing the crankshaft and bearings in the end cover, place a seal protector on the end of the crankshaft to prevent damage to the end cover oil seal by the crankshaft threads and keyway.

4. As soon as the end cover has been heated to the correct temperature, press the crankshaft into place. This will provide a shrink-fit retention of the bearings.

5. Before installing the assembled end cover, crankshaft and bearings into the crankcase, pre-heat the crankcase to 180-200 degrees F (82-93 degrees C).

6. Place a lightly oiled seal protector on the sprocket end of the crankshaft and press the crankshaft and bearings into the crankcase (Figure 23).

7. Remove the seal protector.

8. Install the piston and connecting rod as previously discussed.

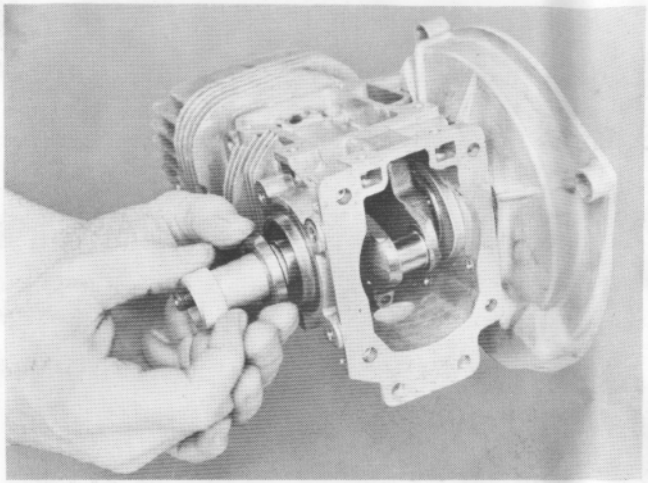

FIGURE 23

9. Install the needle roller bearings in the connecting rod and cap, install the cap and tighten the screws as previously described.

CAUTION

Be very careful to get the cap properly aligned and to tighten the cap screws to the torque value shown in "Table of Torque Values" (Page 32).

CRANKCASE OIL SEALS

If the crankcase seals are obviously damaged--split, cracked or cut--they should be replaced. And, replacement of the seals is advisable as often as necessary to maintain good crankcase pressure.

The seal in the crankcase itself can be replaced without disassembling the engine.

1. Use a seal removal tool to pull the old seal out of the crankcase.

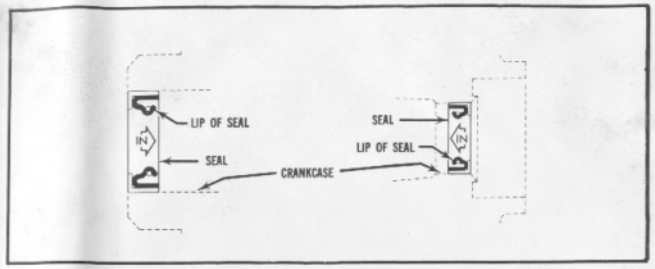

FIGURE 24

2. Remove all dirt from the crankcase and the crankshaft in the areas around the seal.

3. Slip a seal protector over the end of the crankshaft and lightly oil both the crankshaft and the seal protector.

4. Use a seal driver of the correct diameter--one which contacts only the outer diameter of the seal--together with an arbor press, to press the new seal into the crankcase. Make sure that the lip of the seal faces inward, as shown in Figure 24.

To replace the seal in the crankcase end cover, you must first disassemble the end cover.

1. Press out the seal from the cover.

2. Lightly oil the bore, after making sure that any dirt has been cleaned away.

3. Use a seal driver of the correct diameter--one which contacts only the outer dimension of the seal--together with an arbor press, to press the new seal into the end cover. Make sure that the lip of the seal faces inward, as shown in Figure 24.

4. Install the crankshaft and main bearing assembly into the preheated end cover according to the instructions in the section on "Crankshaft and Main Bearings" (Page 25).

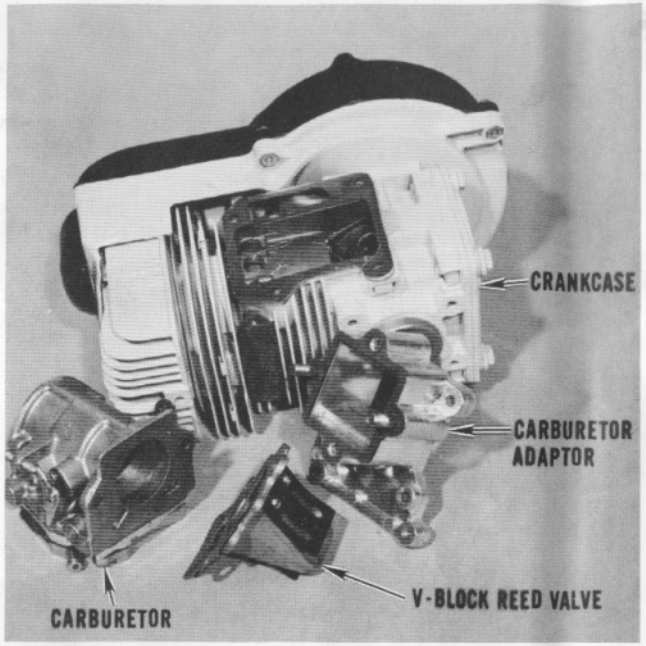

FIGURE 25

REED VALVE

The reed valve consists of a "V"-shaped reed block and four large phenolic reeds.

Correct seating of the reed valve is essential if crankcase pressure and engine efficiency are to be maintained. If the reeds do not seat properly because of dirt or other foreign material, careful probing with a small pick will usually dislodge the dirt. Broken or chipped reeds must be replaced. If the reed plate or valve block is badly worn in the reed seat area (on contact surfaces), it should be replaced.

When reassembling components of the reed valve assembly, be very careful of the proper placement and seating of the gaskets. Note that the gasket between the valve block assembly and the carburetor adapter has two holes for the pulsation passages to the carburetor. Be sure that the gasket is installed with these holes over the passages, or the fuel pump(s) will not function.

GASKETS

In a four-stroke-cycle engine, a leaky gasket often does no more harm than causing a little water or oil to be lost. But, a leaky gasket in a two-stroke-cycle engine can cause poor compression and, even worse, engine failure or damage from the leaning of the fuel mixture by the excess air which is allowed to enter the crankcase (Figure 26). Therefore, the correct installation of gaskets is extremely important in two-stroke-cycle engine assembly--particularly for your racing engine.

There are a few general things to keep in mind when installing gaskets. First, it's a good idea to use Pli-O-Bond, or equivalent contact cement to seal gaskets as they are installed. This provides extra protection against leaking. Use just enough gasket cement to coat the surface of the gasket, but not so much that the cement gets onto other parts of the engine. When applying the gasket cement to the carburetor or manifold gaskets, be particularly careful not to use too much around the small pulse passage holes in the reed plate, the manifold and the carburetor. If the pulse passage is even partially blocked, the carburetor fuel pump output will not match engine demand.

Each time you remove a gasket, replace it with a new one -- It's a small price to pay for better engine performance. Even if you don't remove a gasket completely but just enough to cause it to lose its bond, install a new gasket.

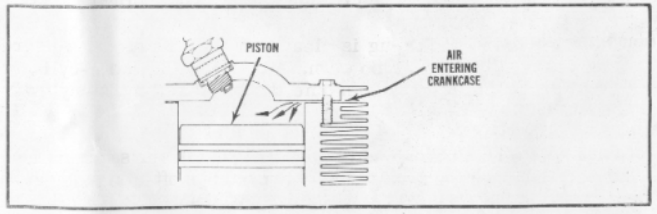

FIGURE 26

Correctly installed gaskets will not prevent compression loss or leaning of the fuel mixture if attaching screws are not tightened to their correct torque value. Be sure to follow the figures listed in the "Table of Torque Values" page 32.

CAUTION

Check travel of piston above the top of the cylinder. DO NOT use a head gasket that is too thin, as piston and engine damage is certain to result.

MAINTENANCE TIPS

Always use a clean can when mixing the gasoline and oil for your fuel mixture. Pour in only as much gas as you expect to use in the next couple of days or for a weekend of racing, add the right amount of oil (refer to the section on "Fuel Mixture"), and shake the can well until the gas and oil are thoroughly mixed. Since gasoline evaporates easily while oil doesn't, your mixture may have the wrong ratio if it's not used within a few days (see page 3).

It's a good idea to go over the engine after each day of running and make sure that all bolts and screws are tight. The engine mounting bolts are particularly liable to be loosened by vibration, so these should be checked often if you're racing on an unpaved track. Should the engine work loose, the castings are sure to be damaged.

You may find that by not using an air filter in the carburetor intake system, you gain some extra power output. But, the small amount of power gained is an expensive price to pay for the resulting higher rate of engine wear and the possibility of your spark plug shorting out (from dirt on the electrodes) at a critical moment.

Make sure your spark plug is clean and that the electrodes are gapped properly and aren't too worn. A faulty plug in a one-cylinder engine is much more troublesome than one in a multi-cylinder engine.

Always keep your chain adjusted to the manufacturer's recommendations. Check both engine and wheel sprockets often to make sure that the teeth aren't wearing because of a loose chain. A worn or loose chain can de-tooth sprockets in a short time.

TORQUE VALUES

Improperly tightened screws seriously affect the performance and life of a racing engine. If attaching screws are torqued either too tightly or too loosely, compression may be lost, the fuel mixture may be too lean, cylinder head gaskets may blow, or filters may be damaged. For these reasons, it's very important to use the torque values which are tabulated below:

PARTS	INCH-POUNDS	MK/G
Breaker Point Screw	30 to 35	0.35 to 0.41
Carburetor to Adapter Nuts	90 to 100	1.04 to 1.12
Carburetor Adapter to Manifold	60 to 65	0.69 to 0.75
Carburetor Manifold to Cylinder	60 to 65	0.69 to 0.75
Coil and Lamination Screws	55 to 60	0.64 to 0.69
Condenser Screws	30 to 35	0.35 to 0.41
Connecting Rod Cap Screws - MC-91	65 to 70	0.75 to 0.81
Connecting Rod Cap Screws - MC-101	90 to 95	1.04 to 1.1
Crankcase End Cover Screws	60 to 65	0.69 to 0.75
Crankcase Bottom Screws	95 to 100	1.1 to 1.12
Cylinder Head Screws	55 to 60	0.64 to 0.69
Exhaust Stack Screws	55 to 60	0.64 to 0.69
Fan Housing Screws	55 to 60	0.64 to 0.69
Flywheel Nut	300 to 360	3.46 to 4.15
Reed Valve Clamp Screws	30 to 35	0.35 to 0.41
Spark Plug	216 to 264	2.48 to 3.04
Clutch or Sprocket Nut	260 to 300	2.99 to 3.46

PRESSÃO PNEUS / DENTRO E FORA
FRENTE 15 — ATRÁS 18 A 23

SPECIFICATIONS

GASOLINA + ÓLEO 5L GASOLINA + 0,25 ÓLEO
SUPER MISTURA 20/1 AFITAR REM

	MC-91	MC-101
Weight - lbs. (peso)	11	11
Weight - kg.	4.97	4.97
Bore - in. (diâmetro cilindro)	2.165	2.280
Bore - mm.	55.00	58
Stroke - in.	1.635	1.835
Stroke - mm. (curso)	41.53	46.60
Displacement - cu. in.	6.05	7.49
Displacement - cc. (cilindrada)	99.30	122.76
Compression Ratio (taxa compressão)	10.1	10:1
Breaker Point Gap - in.	0.017-0.019	0.017-0.019
Breaker Point Gap - mm. (folga platinados)	0.43-0.48	0.43-0.48
Spark Plug Gap - in.	0.025	0.025
Spark Plug Gap - mm. (folga das velas)	0.64	0.64
Piston Pin Bearings	Needle	Needle
Connecting Rod Bearings	Needle	Needle
Main Bearings	1 Needle; 1 Ball	2 Ball
Piston Rings	2 (Pinned)	2 (Pinned)

— CREMALHEIRAS —

PISTA RAPIDA 66 DENTES
" MEDIA 72 "
" LENTA 78 "