Tractor Maintenance

An understanding of how the parts of an engine react to heat, carbon, lubrication, etc. gives mechanic more confidence in diagnosing trouble and making repairs

(First of two articles)

In its manual, "Tractor Maintenance and Tune Up", International Harvester Co. observes that it takes only a fairly competent mechanic to make repairs or adjustments on almost any piece of machinery when the need or the trouble spot is pointed out to him. But a man who can detect what and where the trouble is, and then correct it, is doubly valuable. The manual has been prepared with the purpose of helping the course mechanic or serviceman to make any diagnosis with confidence and then proceed to handle the necessary adjustments or overhaul. It also emphasizes that if proper adjustments are made periodically, the tractor always will be available for eight hours of work, and the life of the machine will be prolonged.

The first part of this series covers tractor engines. The second part, which will

appear in October Golfdom, will cover the hydraulic system. Editor.

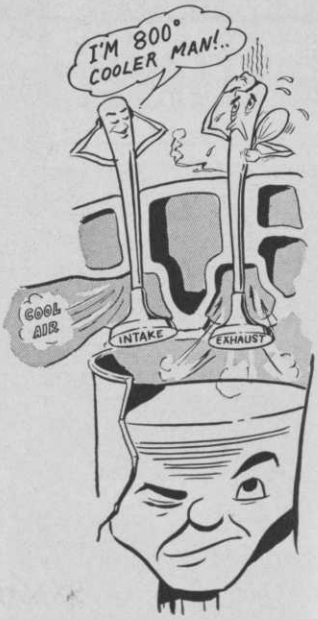
As a matter of general information, it should be kept in mind that when an engine is started, especially in cold weather, some fuel enters the combustion chamber in liquid form. During the first few minutes of operation, the liquid fuel mixes with the oil on the cylinder walls and is forced past the piston rings into the crankcase, thus diluting the crankcase oil.

Combustion is liable to be erratic during this initial period. Cold cylinder walls condense some of the fuel out of the fuel-air mixture, thus adding more liquid fuel to the crankcase.

For every gallon of fuel burned in an engine, about one gallon of water is produced. Contamination from water and other combustion products is exaggerated during low temperature operations because of the cold cylinder walls and incomplete combustion. These contaminating products remain in the crankcase until the oil temperature becomes high enough to evaporate them. (Oil temperature must reach approximately 140 deg. F. to keep water vapor from condensing.)

Can Block Screen, Passages

Sludge formed by the mixture of water, oil and contaminants tends to settle to the bottom of the oil pan and if it collects in sufficient quantity, it can block the oil pump screen or plug the oil passages. Crankcase and valve compartments are ventilated to aid in removing the water vapor. The crankcase breather must be clean to allow the vapor and other blowby products to escape and to reduce the sludge accumulation.

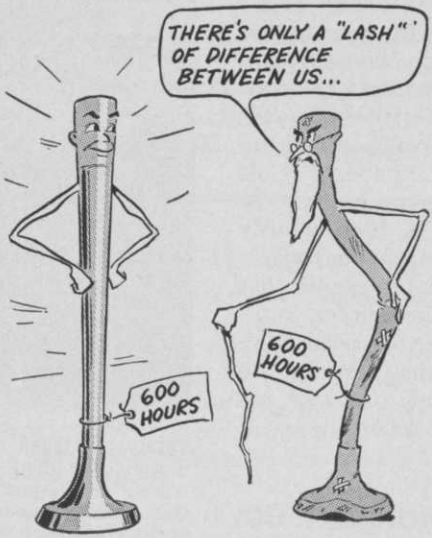


Engine Corrosion — The rusting of metal parts may result from the presence of water in the crankcase. Water alone causes rusting and in combination with blowby products may form acids which attack other metals such as copper or cadmium alloy. Water forms as the result of condensation of water vapor in the blowby products and in the air entering the crankcase, from low crankcase temperatures caused by worn-out thermostats, and from long periods of engine idling.

Engine Varnish — Unburned fuel that enters the crankcase in blowby gases contributes to the formation of varnish on engine parts. Deposits may then form on pistons and cause rings to stick. Similar deposits on valve stems result in sluggish valve action and "sticking" valves.

High speeds and temperatures and increased compression ratios with more power put new demands on engine valves. Im-

(*Continued on page* 62)



Tractor Maintenance

(*Continued from page* 36)

proved design has raised the engine's power output without increasing the engine's weight and bulk. A few years ago, the average tractor engine compression ratio was 4 to 1; now it often exceeds 7.7 to 1. Diesel tractors go as high as 23 to 1.

A complete cycle — intake, compression, firing and exhaust — takes place in less than 1/5 second at only moderate engine speed. A few thousandths variation from the specified "valve lash" can change valve timing, result in valve failure and loss of power.

High Combustion Heat

Exhaust valves and seats are exposed to combustion temperatures of as high as 4,000 degs. F and normally operate at *Cherry Red heat*. The exhaust valve temperature at high engine load ranges from 1,200 to 1,400 degs. F. A valve weighs about 5 ounces and must keep its true form in order to make a complete seal.

Considering the magnitude of these temperatures and the fact that exhaust gases are highly corrosive, it is apparent that the exhaust valve operates under extremely severe conditions.

Intake valve operation is similar to that of the exhaust valve. But because of the low temperature of the incoming charge, the intake valve temperature is much lower than that of the exhaust valve. It follows that the cooling system plays an important part in valve life. It should be kept in mind that "shutting off" a tractor without a short idling period can lead to short valve life.

Failure by burning nearly always is the result of incomplete valve sealing. This permits high temperature gas leakage between the valve and seat, and both face and seat are subjected to extreme temperature in the area surrounding the leak. Improper valve lash frequently is the cause of valves burning.

Carbon Causes Trouble

Carbon prevents heat dissipation. Clean metal is a good heat conductor but carbon insulates and retains heat, increasing combustion chamber temperatures and causing

valve warping and burning. Unburned carbon residue forms a gum on the valve stems and causes them to stick in their guides. Hard carbon deposits can become white hot and cause pre-ignition and detonation. Carbon formation can be minimized by proper fuel, correct mixture, proper engine temperatures and periodic valve adjustment. Additives in lubricating oils help keep carbon soft and harmless.

Correct tappet clearance gives quiet engine operation and long valve life. Insufficient clearance causes the valve to stay open too long, resulting in lost power and valve failure. Too much clearance upsets timing and reduces valve lift, preventing maximum intake and exhaust.

Test for Valve or Ring Trouble

Low compression readings, of course, indicate valve or ring trouble. There's an easy way to determine whether the reading stems from valves or rings. If the compression tester shows a low reading, squirt a teaspoonful of heavy oil (SAE-40 to SAE-50) into the combustion chambers of the affected cylinders. Crank the engine several times to distribute the oil and repeat the compression test.

If the trouble is in the rings, there will be a definite increase in compression. The oil temporarily seals any leakage past the rings. If about the same readings are obtained, the rings are sealing and the valves are leaking.

Before testing compression, the engine should be brought to normal operating temperature. During the check, both throttle plate and choke valve must be wide open and all spark plugs should be removed. If, during the test, pressure remains the same for several strokes and then increases on succeeding strokes, a sticking valve may be the culprit.

The practice of checking an engine using air pressure is not recommended since it can be misleading and even dangerous. Stick to the compression tester and you won't get in trouble.

Like A Lawn Sprinkler

The engine's lubrication system is similar to that of a lawn sprinkling system. Oil is pumped through oil passages to the various points such as crankshaft, camshaft, main and connecting rod bearings, where it escapes to be sprayed around in the engine to cool and lubricate. About

the same thing happens in a lawn sprinkling system. If no leaks develop, everything works satisfactorily in both systems.

The flow of oil through the main, connecting rod and camshaft journals is restricted by the running clearance between bearings and their respective journals. The smaller the clearance the smaller the volume of oil pumped through the bearing. The oil that escapes through the clearance sprays the inside of the crankcase and lubricates other moving parts such as camshaft lobes, cam followers and cylinder walls. The oil then returns by gravity to the crankcase where it is re-circulated.

Normal wear can knock the lubrication system out of adjustment. When this occurs, some parts of the engine may be overlubricated, causing increased oil consumption, or in case of lack of lubrication, excessive wear. Excessive running clearance of connecting rod bearings can cause too much oil to be thrown into the cylinder and the oil control ring is flooded and can't control the oil. Thus, too much oil is consumed, plugs are fouled, valves

stick and perhaps power is lost.

The oil filter should be changed regularly. The screen and oil pump should be checked for plugging and cleaned at the first indication of low oil pressure.

Operation Has Influence

Engine operation has an influence on the scuffing and scoring of pistons, rings and cylinders. "Lugging" an engine for sustained periods reduces its life and aggravates the scuffing problem. (Lugging is operating with wide-open throttle at low rpm). Lugging results in:

1. The drawing of a maximum fuel charge into each cylinder, resulting in more heat being generated in the combustion chamber;
2. The flow of coolant through the engine is at a minimum because the water pump is operating at reduced speeds;
3. The flow of air through the radiator is at a minimum for the amount on horsepower developed by the engine. The speed of the engine is low and the fan is not turning at sufficient speed to pull enough air

Dr. Jan Steele-Perkins (l) accepts trophy from Frank Strafaci, following Bahamas' 13 to 11 victory over a Florida Metropolitan Amateur GA team in recent matches played in Nassau. This is the first time the competition was held.

through the radiator;

4. Due to the above condition there is a great tendency for detonation to occur. Detonation results in an added increase in temperature and pressure of combustion chamber gases, causing much higher piston, ring and cylinder wall temperatures;
5. The oil throw-off from connecting rod bearings and the flow of oil through the engine are reduced to a slower rpm. Since oil acts as a coolant as well as a lubricant, its reduction cuts down on the protection of these parts.

Kerosene is not detrimental to the lubricating quality of an engine oil. What is more, it is a big help in getting an engine started when the thermometer drops.

Illinois Short Course

A short course in turf management will be offered for the first time by the University of Illinois, Urbana, this winter. It will run from Feb. 1 through Mar. 12, 1965. The student will have the choice of ten subjects and certificates will be awarded to those who complete the course. The estimated cost of the six weeks is from $215 to $270, including tuition, fees, housing and meals. Inquiries should be sent to Short Course Supervisor, 104 Mumford Hall ,College of Agriculture, U. of Illinois, Urbana.