behind can pull the clover off and out of the way of the mower. It can be left in a windrow to facilitate gathering when dry. The first two or three rounds may be tiresome to the man pulling the clover off the table, but it does not take long to get onto the knack of doing it.

The clover must be left a few days to dry, and then a solid-bottomed rack is preferable to a salt bottomed for drawing, as there will be less loss of heads. Every care should be taken to prevent loss, owing to the scarcity of seed and the price.

Threshing is best done in frosty weather. The seed can be separated from the head much easier than if the weather is damp and mild. The work is done with a clover huller, a machine designed to remove all the seed and to leave it clean. If you have a reasonable stand for seed save it.

AUTOMOBILES, FARM MACHINERY AND FARM MOTORS.

Water Jacket and Cooling Defects.

The function of the cooling system is to keep the cylinder cool enough to prevent excessive burning and destruction of the cylinder oil, and is not to keep the cylinder absolutely cold. The water leaving the jacket of a fully loaded engine should approximate 160 degrees F. in temperature with gasoline engines, and approximately 200 degrees F. with kerosene engines, although these temperatures are often exceeded with hopper cooling.

While an engine is more efficient at higher temperatures than those given, the lubrication places a practical limit beyond which it is not safe to go. Running with a cold cylinder not only reduces the efficiency by throwing away useful heat but also causes the condensation of tarry products of combustion, which sooner or later will interfere with the ignition or gum up the piston rings resulting in a power loss through the loss of compression.

Destruction of the oil through overheating means rapid wear of the piston rings and cylinder, and this is a fault that must be remedied as soon as it becomes evident.

An overload on an engine is one cause of heating, especially if of the air-cooled type, and if the load is not removed in time will result in a scored cylinder or a stuck piston.

When a cylinder becomes hot enough to cause smoke to issue from the open end, or to cause oil on the jacket to evaporate, or to burn the paint, the engine should be stopped immediately and the cause determined before it is started again. The smell of hot paint is usually a sufficient signal that something is wrong, even if the scraping and scratching of the dry piston does not attract attention at an earlier stage.

The immediate remedy is to increase the cooling water supply, or to increase the supply of lubricating oil; on an air-cooled engine, the load should be removed and the engine allowed to cool. Do not under any consideration pour a large volume of cold water into the jacket of an overheated engine, nor pour cold water on the ribs of an air cooler.

An overheated cylinder generally causes Preignition, through the carbon deposit on the combustion chamber, or piston head, becoming incandescent, and igniting the charge before the proper time. Preignition becomes evident from pounding and thumping noises in the cylinder, and is certain if the engine continues to run and pound after the ignition current is broken or turned off. Preignition nearly always accompanies an overheated, air-cooled cylinder.

Preignition sometimes occurs only when the engine is pulling a heavy load, and entirely ceases when the load is thrown off. This trouble is due to the fact, that the cylinder is so cool at light loads as to condense the deposits in the combustion chamber, and is so overheated at full loads that the deposit is kept continually incandescent. Removal of the deposit is the only certain remedy in any case of preignition, although the trouble may be checked, and sometimes entirely stopped by injecting a little kerosene oil into the cylinder from time to time, and reducing the temperature.

A tight piston may be caused by an overheated cylinder or may cause overheating by its excessive friction in the cylinder bore. In either case it makes itself known by a deep, heavy pound, that is often mistaken for preignition. If the ignition circuit is opened, the engine will stop immediately, if the pounding is due to a tight piston.

The following list will give the principal causes and remedies for overheated cylinders in the order in which they are most likely to occur, and all investigations as to the cause will be made easier and quicker if followed in the order given.

(a) Closed Supply Valve in the water line will prevent water from reaching cylinder. This is due to carelessness, but is a very common cause of trouble.

(b) Retarded Ignition.—Always advance the spark as soon as the engine is up to speed; never under any condition run with retarded spark on full load.

(c) Overload on Engine.—Either reduce the load, or increase the amount of water supplied to the jacket and increase the oil feed. Air-cooled engines should have the load removed, or stopped, and allowed to cool off. An overloaded engine is indicated by a full open governor, by a hit-and-miss engine taking all explosions without intermission, or by the engine stopping altogether after straining and pulling. These symptoms are usually accompanied by hot bearings and a slipping belt.

An overloaded engine is far from being economical with fuel and wears the bearings rapidly under the increased strain. Oval cylinder bores are rapidly developed in overloaded engines.

(d) Poorly Adjusted Carbureter.—A mixture either too rich or too poor is slow burning, and hence is a cause of overheating as it remains in contact with the cylinder walls for too long a period. Should this be the cause of the trouble, adjust the carbureter or mixing valve. An over rich mixture causes black smoke at the end of the exhaust pipe, too much gasoline will cause a two-stroke cycle engine to "four cycle," or to fire only every other revolution.

(e) Lubrication.—Lack of oil, or a poor grade of oil will cause overheating because of the increased friction of the piston. The only remedy is to increase the quantity of oil fed to the cylinder, taking care not to go to the other extreme and flood the engine. A dry piston produces a wheezing scraping sound which develops into a hammering or knocking. Excessive oil produces a dense cloud of yellowish white smoke at the end of the exhaust pipe. If the smoke comes in distinct puffs from a multiple cylinder engine it indicates that only one cylinder is being overfed; if in a continuous stream you may be certain that all of the cylinders have an oversupply of oil. Poor oil or oil of low fire test evaporates rapidly in the high temperature of the cylinder, and consequently has but little lubricating value. Feed good oil and plenty of it. See that none of the oil pipes or ducts are clogged with dirt or gum, and that the oil pump is in working order. Oil cups often get out of adjustment, become clogged or chilled by draughts of cold air. Use only gas engine cylinder oil, of which there are several good makes. Never use vegetable or oil of animal origin, such as palm oil, tallow, or sperm oil.

(f) No Water.—See that the reservoir, tank, or well is full of water, and if the thermo-syphon or natural circulation system, without a pump, is used; see that the water in the tank or radiator covers the discharge pipe coming from the cylinder. If this pipe projects above the water level, or is not covered by water, no circulation can take place and consequently the cylinder will overheat. If forced circulation is used with a pump, be sure that the suction pipe from the pump is under water.

(g) Scale, or Lime Deposits in Jacket.—Overheating caused by deposits of scale or lime in the jacket is one of the most common causes of an excessively hot cylinder. When hard water containing much lime is heated, the lime is deposited as a solid on the walls of the vessel forming a hard, dense, non-conducting sheet. When scale is deposited on the outside of the cylinder walls it prevents the transfer of the heat from the cylinder to the cooling water, and consequently is the cause of the cylinder overheating. Besides acting as an insulator or heat, the deposit also causes trouble by obstructing the pipes and water passages, diminishing the water supply and aggravating the trouble.

Scale interferes with the action of the thermo-syphon system more than with a pump, as the pressure tending to circulate the water is much lower. Whatever system is used, the scale should be removed as often as possible, the number of removals depending, of course, on the "hardness" of the water.

Large horizontal engines are usually provided with hand holes in the jacket, through which access may be had to the interior surfaces on which the scale collects. Under these conditions the scale may be removed by means of a hammer and chisel.

The scale may be softened by emptying half the water from the jacket and pouring in a quantity of kerosene oil, the inlet and outlet pipes being stopped to prevent the escape of the oil. The engine should now be started and run for a few minutes with the mixture of kerosene and water in the jacket; no fresh water being admitted during this time. After the mixture has become boiling hot, stop the engine and allow it to cool; it will be found that the scale has softened to the consistency of mud, and may easily be washed out of the jacket.

The work of removing the scale can be reduced to a minimum by filling the jacket with a solution of 1 part of Sulphuric Acid and 10 parts of water, allowing it to stand over night. The scale will be precipitated to the bottom of the jacket in the form of a fine powder and may be easily washed out in the morning.

If the jacket water is kept at a temperature above 185 degrees F. the amount of scale deposited will be nearly doubled over that deposited at 160 degrees F.

Wash out sand and dirt occasionally, a strainer located in the pump line will help to keep the jacket clear and free from foreign matter.

If a solution of carbonate of soda, or lye, and water are allowed to stand in the cylinder, over night, the deposit will be softened and the work with the chisel will be made much easier.

If a radiator is used (automobile or aero engine) the deposit can be removed with soda, never use acid, lye or kerosene in a radiator or with an engine with a sheet-metal water jacket.

(h) Obstructions in Water Pipes.—Poor water circulation may be caused by sand, particles of scale, etc., clogging the water pipes, or by the deterioration of the inner walls of the rubber hose connections. Sometimes a layer of the rubber, or fabric of the hose may loosen from the rest and the ragged end may obstruct the passage.

A sharp bend in a rubber hose may result in a "kink" and entirely close the opening.

The packing in a joint may swell, or a washer may not have the opening cut large enough, either case will result in a poor circulation.

Sediment is particularly liable to collect or form in a pocket, pipe elbow, or in the jacket opposite the pipe opening. Oil should be kept off of rubber hose connections as it will cause them to deteriorate rapidly, this may finally result in water circulation troubles. Rubber pipe joints between the engine and the radiator or tanks are advisable as they do not transmit the vibration of the engine, and hence reduce the strain on the piping. A strainer should be provided in order to reduce the amount of foreign material in the water.

(i) Radiators.—A clogged radiator will give the same results as a clogged jacket, with the exception that the steam will issue from the radiator if the circulation is not perfect.

If the radiator becomes warm over its entire surface it is evident that the water is circulating, the temperature being a rough index of the freedom of the water, of the interior condition of the surfaces. A leaking radiator may be temporarily repaired with a piece of chewing gum.

Should the radiator be hot and steaming at the top and remain cold at the bottom for a time, it shows that the water is not circulating and that the jackets on the cylinders are full of steam. Such a condition usually is indicative of clogging between the bottom of the radiator and pump, between the pump and bottom of cylinders, or of a defective pump.

Thermo-syphon radiators are more susceptible to the effects of sediment and clogging than those circulated by pumps.

A radiator may fail to cool an engine because of a slipping or broken belt driving the fan, or on account of a loose pulley or defective belt tension adjuster. Keep the belt tight. The fan may stick on account of defective bearings.

Radiator may be air bound, due to pockets or bends in the piping holding the air.

See that the drain cock is closed so that no water can escape from the circulating system.

(j) Evaporator Tanks.—Always clean evaporator tanks thoroughly before filling with water for the first time, as solder pellets, oil, metallic scale and dirt are liable to lie at the bottom of the tank.

Galvanized iron tanks have caused trouble by clogging the circulating pipes with a white gelatinous jelly-like substance (an oxide of zinc) that is so nearly transparent as to be passed over, by the casual observer. Should any of this deposit be found, it would be well to wash the interior of the tanks with vinegar or dilute hydrochloric acid, thoroughly rinsing out the tank after the application of the acid.

Evaporator tanks are usually operated on the thermo-syphon system without pumps, on small engines. A pump should always be used with engines larger than 25 horse-power.

To obtain the best circulation the bottom of the tanks should be set above the bottom of the engine cylinder.

Carefully wash out piping with gasoline when erecting engine in order to remove all grease and dirt.

The water in evaporator tanks will boil under full load, and the tank should not be filled more than three-fourths full of water to avoid slopping.—From Gas Engine Troubles and Installation.

Engine Fuels.

Question 1. As a prospective purchaser of a farm tractor I would like some information about fuel.

2. My understanding is that to insure complete combustion it is necessary to admit a certain amount of water with the mixture when kerosene is used, also that without water the engine will soon "pound" and carbon up very quickly.

3. Salesmen of a certain tractor which is supposed to use kerosene equally as well as gasoline, state that they get complete combustion by means of a superheated manifold between the carburetor and the cylinder. They say nothing about the water but insist that nothing is gained by using kerosene, as it takes double the quantity of gasoline and quickly fouls the engine.

4. Another point is the matter of speed with the two fuels. Does not kerosene work better in a slow speed engine (below 1000 R. P. M.) than at greater speeds?

5. Is it possible to have one carburetor so adjusted to handle both fuels?

S. B. H.

Ans.—1. The two common fuels for gas engines to-day are gasoline and kerosene. The former was used almost exclusively until a few years ago when it was found that kerosene would under certain conditions of engine design and care in operation, work very well. Since then great progress has been made in adopting the design of gas engines to the use of this fuel, so much so, that at present we find it in very general use, and many operators of tractors and other forms of engines, are getting good results with it and saving some money, as it is cheaper than gasoline.

Gasoline and kerosene, both are petroleum products, but the former is a lighter liquid being distilled from the crude oil at a temperature of from 70-140 F., whereas kerosene is heavier, being distilled at about 300 F. Hence kerosene is not volatile at ordinary temperatures and it is this difference chiefly that renders it so much more difficult to burn successfully in gas engines than it is to burn gasoline. Other differences are, that it is slower to warm up, has more carbon, contains more heat units, and weighs more per gallon than gasoline. When used efficiently in an engine it will give more power per gallon and greater efficiency than gasoline.

2. The injection of a little water into the cylinders