Tractor engines, roughly explained.

An engine is a machine that converts one type of energy or potential energy into a useful force.

Stationary engines can be powered by the energy in moving water or air.

Moving engines need to use a portable fuel. For almost all engines, that means a combustible material like coal or petroleum.

All modern farm tractors use petroleum powered, internal combustion engines.

Before 1900, virtually all farm tractors were steam engines. Steam engines are external combustion engines. They use bulky, high volume fuels like coal or wood. Steam tractors also need a large, heavy, but portable furnace to heat water into steam. And a relatively large and inefficient engine to convert that steam into useful energy.

Steam engines of the time were terribly big, clumsy and costly.

Internal combustion engines are much smaller than steam engines. They also consume a much lower volume of fuel.

Internal combustion engines were rapidly developed during the second half of the 19th century and the first decades of the 20th century.

Practical tractors using good internal combustion engines started to appear around 1915.

Those early engines were designed to run on a variety of petroleum products including gasoline, benzene, ethanol, kerosene, distillate and more.

This variety of fuel existed for several reasons.

No one knew what the best fuel choice would be.

Engine designs were improving rapidly and the choice of fuel could make a big difference.

Fuel availability varied from region to region.

From 1915 until almost 1940, all farm tractors were spark-initiated, air-breathing, internal combustion engines.

Diesel engines are also air breathing internal combustion engines but they are compression initiated.

Diesel engines have some advantages, and disadvantages compared to gasoline engines. The greatest advantage for many years was the lower cost of diesel fuel. When I started farming here in 1970, the oil company delivered diesel fuel to my bulk tank for 9 cents per gallon. There are no road taxes on diesel fuel for off road use. The same was true for gasoline but it was 25 cents per gallon.

Spark initiated engines were produced to operate on a variety of fuels to meet local supply situations and economy.

Gasoline is the most volatile of the fuels. That makes it the easiest to ignite and hence the easiest to start a cold engine on. Early IH tractors started on gasoline and then were switched over to a less volatile fuel such as kerosene or distillate.

Kerosene, diesel and distillate are closely related products, all recognized as "oils". Kerosene was commonly available from 1900 on as home heating fuel. Farmers had access to it.

Starting on one fuel and running on another required two fuel tanks. A small gasoline tank and a large kerosene or distillate tank.

Eventually gasoline, which was the clear choice for cars became the common fuel for farm tractors.

Over the years, virtually all early tractors have been setup to run exclusively on gasoline. The small tank is unused and the larger tank was switched to gasoline.

IH introduced the first successful diesel tractor in the mid-1930s. The McCormick Deering WD-40.

That engine started on gasoline and was switched over to diesel. The switch was done when the engine was hot enough to combust the diesel fuel. Of course, that required operating fuel valves, changing engine compression and disabling the spark mechanisms.

That system of starting on gasoline and switching to diesel was used on subsequent models right up to the International 650 in 1957.

Diesel engines operate at a much higher compression than gas engines. That means it is virtually impossible to directly crank start a sizable diesel. That also means that starters and

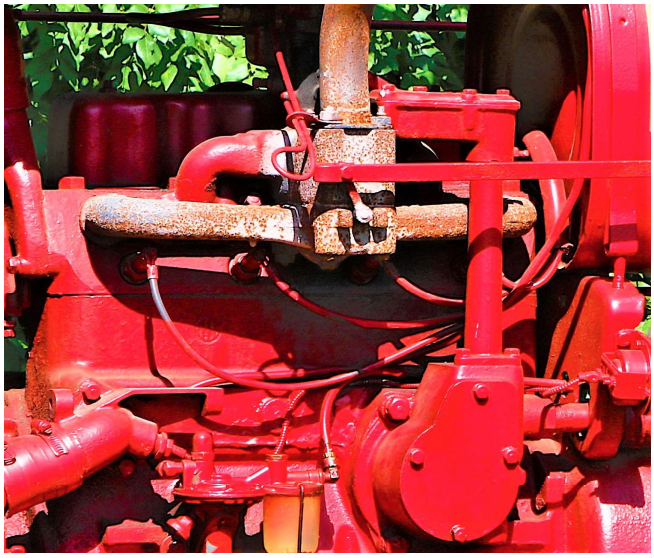
batteries for diesel engines need to be much more capable.

By the late 1950s, engines were available that could start directly on diesel. The first such diesels used electrically powered cylinder heaters called glow plugs.

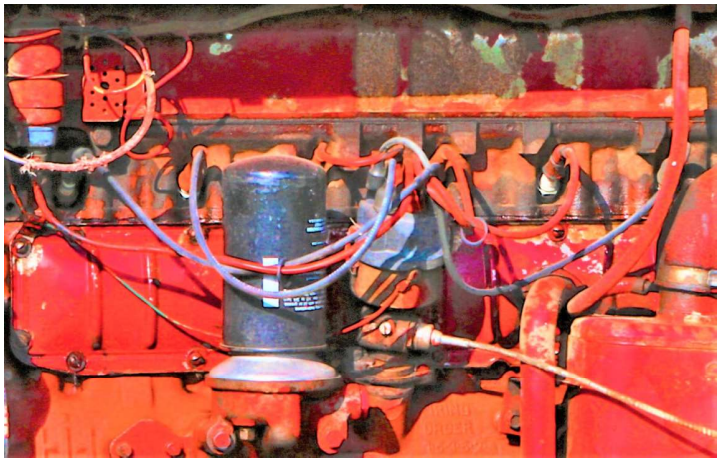
Diesel tractors of the 1960s used two large batteries. Even now, diesels use cylinder preheaters to help start ignition. My 2011 Farmall diesel tractor starts well using a coolant water heater.

From 1915 until 1960, tractor companies made almost yearly improvements in engine design.

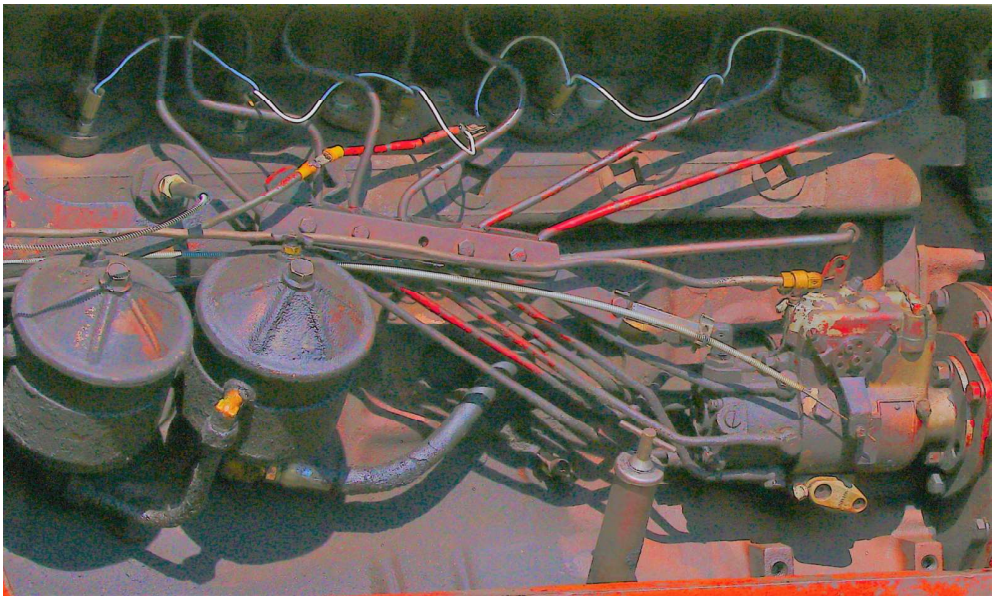
That resulted in continual reduction of size and mass to produce horsepower. The practical result was not smaller engines but more and more powerful engines in realistic sizes.



ABOVE. This tractor from the 1930s was designed to start on gasoline and then run on kerosene. The lever in the upper center was used to obstruct the exhaust manifold in order to heat the tractor faster. The carburetor needed to be hot in order to run well on kerosene.



LEFT. This photo shows a six cylinder, gas only engine of the 1950s. Starting on gasoline is easy.



LEFT. This direct start diesel engine was introduced in the later 1950s. It has a battery heated Glo-plug in cylinder. Before starting, the Glo-plugs are powered for about one minute. In most situations, that heated the cylinder sufficiently to enable direct ignition of the diesel fuel upon starting. The Glo-plug technique works well. This preheating technique, developed in the 1950s is still in common use today.