SAN RAMON HISTORIC FOUNDATION
Dedicated to the preservation of San Ramon's early farms and homesteads

Antique Farm Engines at Forest Home Farms

Introduction:

A Mobile Farm Engine

Before gasoline-powered tractors arrived on American farms in significant numbers, hundreds of thousands of gasoline engines were already at work there, significantly impacting the amount of work previously done by human labor or beasts of burden. There were hundreds of companies making them. These engines first appeared around 1872 and were used throughout the 1930's, mainly for pumping the lifeblood of any farm... water. But they were also used in a myriad other ways including the grinding of grain, elevating grain to the top of silos, separating cream from milk, churning butter, sawing wood, splitting logs, powering shop equipment, making ice cream, washing clothes, or wherever pulley-powered equipment was found on the farm. Some of the larger engines could also power tractors, harvesters or combines.

These farm engines could be permanently affixed to a given location, such as the water pump of a wellhead, or placed on mobile carts for transport to those areas on the farm where it was needed for pulley-powered equipment. Many engine companies designed and built mobile carts for their engines. Refer to the illustration above for an example. The carts for some of the larger, heavier engines even sported a tractor seat in front to allow the farmer to sit while he controlled a horse or mule in towing the assembly to the needed location.

Forest Home Farms has a small collection of hit-and-miss and throttle-governed farm engines, most located in the tractor museum. These engines range from 5/8 to 6 horsepower. These antique, hit-and-miss and throttle-governed engines are typically made of cast iron, generally have one cylinder, two large flywheels, and look very much like the steam engines they replaced. Power is taken from the engine via a pulley and a flat, wide, canvas or leather belt; the other end of the belt is attached to a pulley of the equipment being driven. The power to weight ratio of these engines is extremely low... an engine weighing a couple hundred pounds may only put out a couple of horsepower, but they do have a great deal of torque.

Hit-and-Miss Governed Engines:

A hit-and-miss engine is a type of four-stroke internal combustion engine that was conceived in the late 1800s and was produced by various companies from the 1870s through approximately the 1930s. The name comes from the method of speed control that is implemented on these engines (as opposed to the throttle governed method of speed control). These (hit-and-miss) engines do not have a throttle, and as

such operate “wide open”. If there was no mechanism for controlling the speed, the engine would continue to gather momentum and eventually fly apart. Controlling the speed is generally accomplished via two spring-loaded weights attached to the flywheel that fling out, due to centrifugal force, when the engine comes up to speed, causing a mechanism to engage that keeps the exhaust valve open. With the exhaust valve open, fuel and air cannot be sucked into the cylinder's free-floating intake valve, causing the engine to coast until the speed lowers enough for those two spring-loaded weights to be pulled back in, allowing the exhaust valve to once again close. With the exhaust valve now closed, fuel and air can once again be drawn into the cylinder when the piston retracts.

The sound made when the engine is running is a distinctive, "pop whoosh whoosh whoosh whoosh pop" as the engine fires and then coasts, by means of the massive flywheels, until the speed decreases and needs to fire again to maintain its average speed.

The fuel system of a hit-and-miss engine consists of a fuel tank, fuel line, check valve and fuel mixer. Mixer operation is simple, containing only one moving part, the needle valve.

Some of these engines do not have spark plugs, so sparks to ignite the fuel mixture are created by a device called a magneto/ignitor. The magneto provides the electrical impulse; the ignitor contains a set of electrical contacts located inside the combustion chamber. When the contacts of the ignitor are closed, electricity flows through the circuit. When the contacts are opened by the timing mechanism, a spark is generated across the open contacts igniting the gas-air mixture.


Grease Cup

Main crankshaft bearings and the connecting rod bearing on the crankshaft have a grease cup, (a small container filled with grease), and a cover which screws down on the cup, dispensing the grease. The piston is lubricated by a brass/glass drip oiler that continuously feeds drops of oil onto the piston at a slow rate, generally about one drop every 8 - 10 seconds. The rest of the moving engine components are lubricated by oil that the engine operator has to apply from time to time. Cooling is generally accomplished by a water-filled hopper that surrounds the cylinder or an external water tank.


Drip Oiler

Throttle-governed Engines:

Unlike its earlier cousin, the hit-and-miss engine, throttle-governed engines rely on a “butterfly” valve in the mixer's air intake throat to govern it's speed by controlling the fuel/air mixture entering the engine. As with the hit-and-miss engine, a mechanical feedback mechanism of weights and levers is used, but in this case to control the position of the throttle's butterfly valve. As the engine comes up to speed, the spring-loaded weights begin to fling out, due to centrifugal force, and the feedback mechanism starts to close the butterfly valve, thus slowing the engine down.

As with the hit-and-miss governed engines, throttle-governed engines generally also have a free-floating intake valve, but in this case it has no bearing on speed control.

The following are the antique farm engines found in our inventory, ranging from the smallest to the largest (in horsepower):

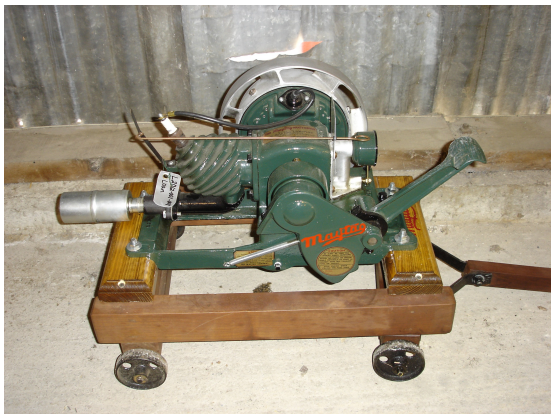
1.) 1939, Maytag Co., 2-Cycle, Throttle-governed Engine, Model 72 – Multi-motor – 5/8 H.P.

Maytag 5/8 H.P. Model 72 Engine

For the most part, electricity did not come to the American farm, and other rural areas, until the late 1930s. Clothes had to be washed by hand. This did not deter Fred L. Maytag who had introduced washing machines in 1909. This venture proved to be the foundation for a multi-million dollar business that endures to this day. These early farm washers were powered by small, gasoline-powered engines. Most common of the Maytag engines was the 2-cycle, air-cooled, hit-and-miss-governed Model 92, preceded by the Model 82. The last of this series of "multi-motors", the throttle-governed Model 72, shown here, was first introduced in 1937. These engines were not limited to washing machine service exclusively. Many were sold for various other applications, with Maytag actually adapting the Model 72 engine to a small 110 volt generator. Another accessory package included a small 6 volt generator to be used as a battery charger.

The Model 92 probably epitomized Maytag's claim as, "the lightest, most powerful and most convenient engine ever built." The twin-cylinder Model 72 was every bit as reliable as the Model 92.

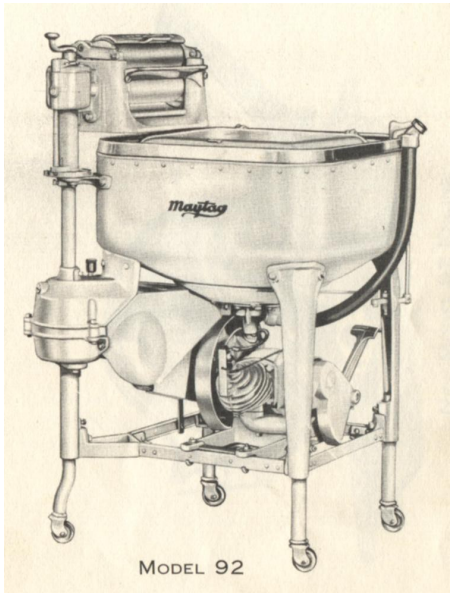
2.) 1936, Maytag Co., 2-Cycle, Hit-and-Miss-governed Engine, Model 92 – Multi-motor – ¾ H.P.


Maytag ¾ H.P. Model 92 Engine

Most common of the Maytag engines was the 2-stroke, air-cooled Model 92, first introduced in 1927 and manufactured thru 1942. The Model 92 probably epitomized Maytag's claim as, "the lightest, most powerful and most convenient engine ever built." While virtually all engines required some periodic repairs, the Model 92 usually ran for years at a time with practically no attention. Rated at just ¾ horsepower, the Model 92 soon became a common sight in rural areas. Despite their dependability, even the Model 92 engines would refuse to start on icy winter mornings. If the washing machine and engine were left out on the back porch and brought into the kitchen just prior to washing, the combination of cold and subsequent condensation made the engine balky. This prompted a nasty call to the appliance store, the farmer's wife complaining that the engine wouldn't start. In most instances, by the time a serviceman arrived, the engine had warmed up sufficiently to start, making the trip something less than worthwhile. The Model 92 engine was also used on other machinery, especially where light, portable power was needed.

Optional Attachments

Many of our visitors, the women in particular, find the two, Maytag



Maytag Model 92 Washer

washing machine advertisements, mounted on the wall behind the engine, to be of some humor. They indicate that two optional accessories were available to the farmer's wife for this washing machine: 1.) a butter churn, and 2.) a meat grinder!

Fred L. Maytag ventured briefly into the automobile industry, but that venture was short-lived. You can read about it here.

Maytag even ventured into the tractor business with the announcement of the Maytag tractor in 1916. This 5,000 pound model had a 12-25 horsepower rating and was powered by a four-cylinder Waukesha engine. Maytag only advertised this $900 outfit for a few months during 1916, and then withdrew from the tractor market permanently.

3.) Circa 1929/1930, Baker, Model VJ, "Little Monitor", 1 ½ H.P., Hit-and-Miss Engine

Baker 1 ½ H.P. Model VJ Engine

The Baker, Model VJ, "Little Monitor", pump jack engine, was manufactured by the Baker Manufacturing Co. of Evansville, Wisconsin. It is a 4-stroke gasoline engine with speed governing of the hit-and-miss type. As with other hit-and-miss engines of this time period, the design is very simple. There is no carburetor, just an air intake port and a needle valve for the gasoline. (This is called a mixer.) The 1 ¼ h.p. and 1 ½ h.p. units were very popular in the day. Production of these units started in 1905 and ended in 1930. Though engine/pump jack production ended long ago, the Baker Manufacturing Co. is still in business today, producing a variety of products.

These engines and pump jacks were widely used on American farms and other rural areas, particularly in the Midwest. The 1 ¼ H.P. outfit soon made its mark for reliability, with thousands being sold. Many wore out at about the time rural electrification came along. Farmers then discarded the cylinder of the engine, and other parts, bolting a plank over the crankcase and belting an electric motor to the flywheel, resulting in many more years of service for the pump.

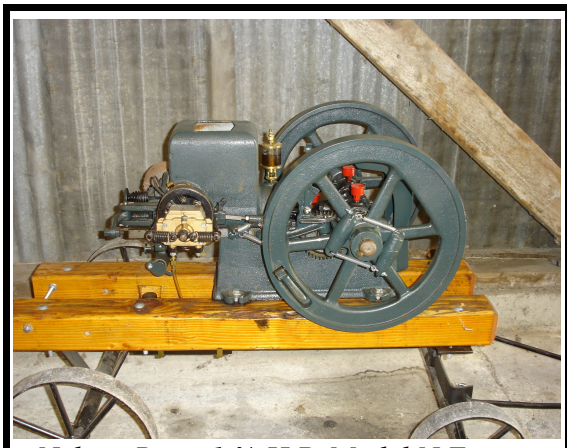
The pump was manufactured by the Aermotor Windmill Company which started making windmills in 1888 and continues to manufacture windmills and windmill-operated pumps to this day.

This unit was on display for several years at the Alameda County Fairgrounds and was generously

donated to Forest Home Farms by Russ Bearrows in January of 2015. When operating on special event days, it is fun to compare the output of this assembly with that of the Fairbanks Morse 2 H.P. Engine driving a gear pump. The difference between the two units in output flow and quantity is striking.

It is remarkable that this engine runs at all... the piston is cracked and brazed in three areas, and the cylinder is missing a large chunk in it's base. Though it runs, the downside is it smokes a lot.

4.) 1915, Nelson Brothers Co., Model N, 1 ¾ H.P., Hit-and-Miss Engine

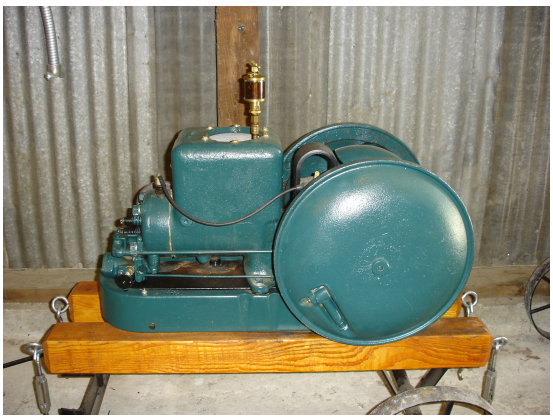


Nelson Bros. 1 ¾ H.P. Model N Engine

Of all the early American engine manufacturers, the career of Nelson Brothers Company is one of the most difficult to trace. Their engines were sold under more than 75 different brand or trade names.

Our Nelson Brothers engine was in a very sorry state when our volunteer took on the task of restoration. Indeed, many of the parts were missing, broken, or severely worn. Not knowing the history of this engine, it was physically evident that it had been run hard for many years until it could run no more. The other tractor volunteers called this engine a "lost cause" attaching a whistle to it so that it would make some noise when visiting school children turned it's crank. Through the aid of the Internet, rare parts were found and purchased, machine shops were employed to fabricate new parts, and foundries were called on to cast new iron parts. As with all our other farm engines, it is now fully functional. Note the cranking handle in the flywheel which is used to start the engine.

5.) 1917, Fairbanks Morse & Co., Model Z, 2 H.P., (Dishpan), Throttle-governed Engine



F/M 2 H.P. Model Z Engine

The 2 h.p., throttle-governed "Dishpan" engine, named for it's unique flywheel shape, has a reputation by some owners for "dancing" around, hence the eye bolts and turnbuckles on the cart ends, and ground anchor to keep it in place. The engine would normally be secured to an immovable, stable base. Again, note the cranking handle built into the "dishpan" flywheel.

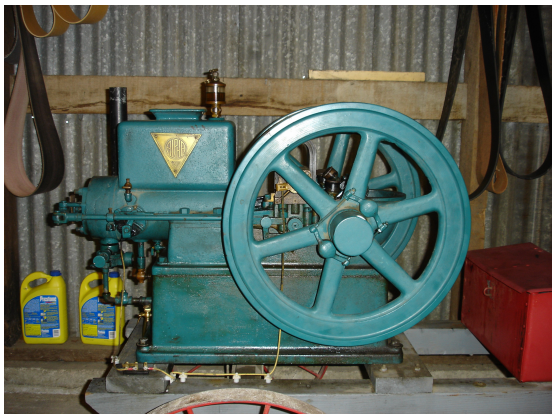
The centrifugally-operated, speed-control weights are hidden from view on this engine, whereas the weights on hit-and-miss engines are generally mounted on one of the large flywheels where they are easily visible. (As an example, when you visit the farm, see the Nelson Brothers hit-and-miss engine, where all of the parts are exposed and easily visible, revealing their function.) The control of speed on throttle-governed engines is more steady than with hit-and-miss engines, where an average speed is maintained between two extremes.

Gasoline in the early part of the 20th century was somewhat expensive, whereas kerosene was cheaper, being used in several appliances, especially lamps. Hence, some engines, like this one, used two

different fuels. This engine is started using a small amount of gasoline, then switched over to the cheaper kerosene when the engine comes up to a sufficient temperature.

This is the least favorite or appealing of all the engines restored by our engine volunteer. Much to his dismay, for some reason our visiting guests, especially the children, want to see this one in operation.

6.) 1919, De Laval Separator Co., Model Alpha, 2 ½ H.P., Hit-and-Miss Engine

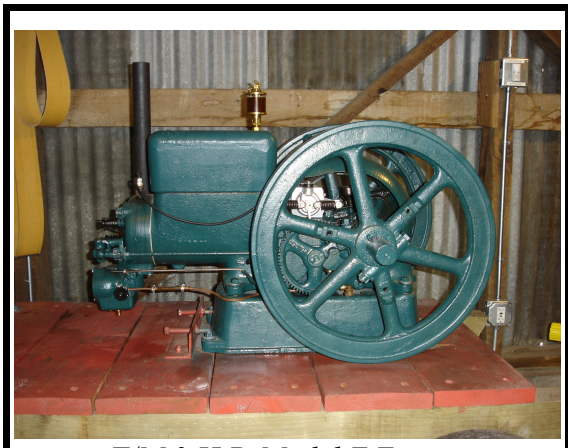


De Laval 2 ½ H.P. Model Alpha Engine

Shortly after World War I, the De Laval Separator Company offered the Alpha engine line along with their already established cream separator series, for which they had become famous in the dairy industry. (Early ads for their cream separators indicated that some of those engines came with a built-in electric generator, allowing the farmer to light up the inside of his barn with up to four, 15 watt light bulbs!)

Though rated to run at 450 r.p.m., this unit has been intentionally slowed to approximately 225 r.p.m. The engine is not owned by Forest Home Farms, but by one of our volunteers. It is a popular practice among antique engine owners to run their engines at the slowest possible speed. On many of these old engines, the speed can be controlled merely by adjusting the spring tension on the centrifugally-operated weights attached to the flywheel. This generally has to be done with the engine stopped. Some of the more clever designs allow the tension to be adjusted while the engine is running. On the downside of this practice (low running speed), it has been the observation of this engine restorer to note that without frequent firing, the inside temperature of the cylinder doesn't get high enough to burn away carbon buildup. The last time we looked, carbon buildup inside the cylinder was at least 1/8 of an inch thick! This engine is currently hooked up to a grain mill on it's moveable cart. Note that the muffler has been replaced with a straight pipe, resulting in fairly loud operation.

7.) 1917, Fairbanks Morse & Co., Model Z, 3 H.P., Throttle-governed Engine



F/M 3 H.P. Model Z Engine

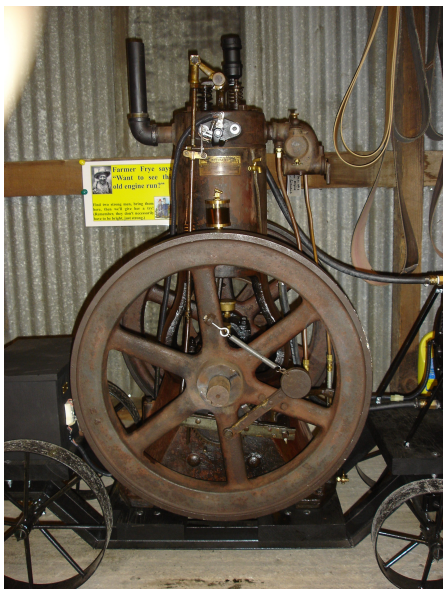
As is the case with our other Fairbanks Morse engine (the “dishpan”), this is also a duel-fuel engine, being started using a small amount of gasoline, then switched over to the cheaper kerosene when the engine comes up to a sufficient temperature.

It is our understanding that this particular engine was used in southern California to haul equipment up and down a mine shaft by means of a winch mechanism. Engines like this were also used to pump out water in mines, an ever-present hazard, but the engines were most likely much larger to handle the volume.

This engine is currently hooked up to a grain mill on it's moveable cart. Note that this engine has also had it's muffler removed and replaced with a straight pipe.

Before starting, the crowd is always warned that it is a “bit louder” than the De Laval engine. (For some reason, they usually draw closer.) Once started, they instinctively move back a step or two due to the shock of the cacophony. Even so, it's a real crowd pleaser.

8.) 1904-1913, Peerless Motor Co., 6 H.P., Hit-and-Miss Engine



Peerless Motor Co. 6 H.P. Engine

For the time being, this engine remains un-restored to it's former glory, but has been made fully operational, running slow and smooth. When visiting the farm, note the repaired broken parts on this engine, including a water jacket freeze-crack (repaired with J-B Weld) just to the right of the nameplate.

As is the case with our other engines, the fuel system consists of a fuel tank, fuel line, check valve and fuel mixer. As before, mixer operation is simple, containing only one moving part, the needle valve. However, with the mixer being so much higher than the base of the engine (which contains the fuel tank), the “overflow mixer” on this engine is fed by a simple piston fuel pump at the base, with any excess gasoline bypassing the mixer and flowing back into the fuel tank in the engine's base. A full tank would allow this engine to run for two days under load.

Sparks to ignite the fuel mixture in the cylinder on this engine are created a bit differently than on the other engines, inasmuch as there is no magneto. Therefore, a battery is used along with a coil, and an ignitor. When the ignitor's contacts are closed – the contacts reside inside the combustion chamber – electricity flows through the circuit. When the contacts are opened by the timing mechanism, a spark is generated across the open contacts, igniting the fuel-air mixture.

Cooling is accomplished with water in the surrounding water jacket by natural heat convection to an external tank, screened container, or in this case a radiator. The cooling system employed on this engine uses no water pump, but relies on the thermosyphon principle, the same as used on Henry Ford's early Model T automobiles.

An interesting side note on this engine is that except for the mixer, this engine is virtually identical to the Bates & Edmonds Motor Co. engine of the same horsepower. (The Bates & Edmonds engine has a small water hopper mounted on the top of the head.) Back in the day, it was a common practice for engine companies to buy each others parts and use them on their own machines. It is not known by this author/restorer which of the two companies had the original design and made the parts.

All the engines at Forest Home Farms can be started by hand, including this one, but is a bit more

difficult. For that reason, the above challenge appears in a sign on the wall behind the engine.

9.) 1918-1922, International Harvester Co., 6 H.P., Throttle-governed Engine

With the exception of the Fairbanks Morse, Z-series engine, the International Harvester, M-series was one of the most popular farm engines used in the United States; more than 429,376 Model M's were sold. The Model M engine came in 1½, 3, 6, and 10 horsepower sizes. 56,000 of the immensely popular six horsepower units were sold from 1918 thru 1937 at a cost of $165.00 in 1936. Ours is dated between 1918 – 1922. (The crankcase access cover design gives the clue to it's date of manufacture.)

IHC 6 H.P. Model M Engine

These engines were designed to be run long and hard. Overhauls were made easier by incorporating a removable cylinder sleeve in the engine's design. The Model M ran on gasoline and kerosene. It came with a variety of ignition systems including low or high-tension magnetos, ignitors, or spark plugs. A different head was generally used for spark plug operation. As is the case with our other dual-fuel engines, the mixer includes two needle valves: one for the gasoline and the other for kerosene. This engine/mixer is rather unique in that it has a third needle valve... for water! The operating instructions for this engine include...

> *"If engine is well loaded, open water needle valve and adjust it, giving engine just enough water to prevent pounding or knocking in cylinder. Do not turn on water until engine is hot. Too much water may stop engine. Engine does not require water when load is light."*

This particular engine was missing the entire factory-installed magneto/ignitor ignition system, but is an example of the skill and innovation some farmers employ to keep their equipment working. The previous owner, a farmer, modified the engine by installing a spark plug where the ignitor use to be, and used a Ford, Model T "buzz-coil" to fire it; the "buzz-coil" is mounted where the magneto use to sit. Timing is accomplished by the clever use of an adjustable-position hose clamp, insulating board and home-made grounding plate. If you get a chance, when you come to the farm, take a look at this engine and the clever work-around some farmer used to get his engine working again. Farmers weren't just "sod-busters"; they also had to be engineers, technicians, machinists, meteorologists, and skilled in a variety of other disciplines. The more this author/restorer learns about farmers and farming, the more respect he has gained for those hard working individuals who chose this noble profession.

End Notes and Invitation:

An excellent resource for learning more about the manufacturers of early American gasoline engines, and the engines themselves, can be found in the book, "American Gasoline Engines Since 1872", by C.H. Wendel, published in 1983 by Crestline Publishing Co., 1251 North Jefferson, Sarasota, Florida 33577.

Additionally, the paper, "Gas Engines on the Farm: The Forgotten Transition", by Carrie A. Meyer, Associate Professor, Dept. of Economics, George Mason University, e-mail: Cmeyer@gmu.edu, is another great source of information on this important part of American farm history.

Information, phrases and in a few cases entire sentences from both of the above publications, as well as facts garnered from numerous e-mails of other “antique engine owners” (in both senses of the phrase), have been freely used throughout this document.

Come visit us at Forest Home Farms on one of those special 2nd Saturdays when we're having an event and open to the public, giving tours and tractor rides, generally from 10:00AM – 2:00PM. Check the events page on our website for those upcoming events. We'll be happy to show you these engines in operation, up close and personal.

Sincerely,

The Author/Restorer -- Ronald W. Frye

Ronald W. Frye
Forest Home Farms Volunteer