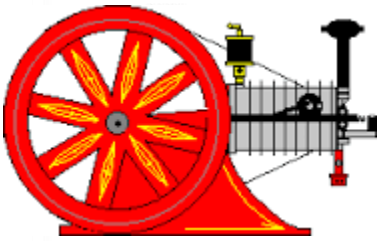
The Line Shaft

The Official Newsletter of the

NORTH JERSEY ANTIQUE ENGINE & MACHINE CLUB



March 2020

President: Chuck Klim
973/903-3583

Vice Pres: Paul Havens
973/222-7403
Treasurer: Dave Betts
908/303-1994
Secretary: Mary Muys
973/534-6781

Founded on October 15th, 1979 by: Arthur Goble, Fred W. Westbrook, John Snook, Roy Bischoff & Lewis Quince

Paul Havens called the meeting to order followed by the flag salute. Secretary Mary Muys read off the minutes from last months meeting. Dave Betts read off the Raffle Funds and the General Funds account balances. Dave also wanted the membership to know that he looked into seeing if there were any restrictions on how much funds we can have in our accounts as a non-profit organization...we can have up to $50K and not over a penny more. NOT MUCH CHANCE OF THAT HAPPENING!

Dave Betts also mentioned that Selective Insurance wanted us to change to a digital account as opposed to paper account and he said “no” because of us changing officers in the future and it would be cumbersome to do this rather than just handing over the papers to the new person. Dave said with Selective Insurance, we have 2 payments that are automatically withdrawn from our account during the year and we currently pay $1200. He said we should get quotes from other agencies to see if we can’t get a better rate elsewhere and to get our coverage in layman’s terms. Paul said we can table this for further discussion at the next meeting, when Chuck Klim is present.

Paul said the club received a letter from the Sussex County Fair Administrator Assistant asking if they could make a donation of $50 to the fair to help offset the maintenance fees at the Administration Building that we use during the winter months. Blace Flatts made the motion to pay the donation and Bill Castimore 2nd the motion.

Paul then brought up the St. Patrick’s day parade that is happening in Newton on March 21st. We will need one wagon for the queens to ride in. We should meet at 9:30 a.m. in the morning at G&H Service and the parade starts at 11:00 a.m. See Paul for any questions.

Blace Flatts mentioned that the quilt is already done for the 2020 State Fair raffle and its a “full size” quilt.

New businesss: Paul mention there will be a plow day at IDEAL FARMS at the end of March, weather pending, and if we need to reschedule it will be in April...Chuck will be the event coordinator.

Paul also mentioned about that he is now on as a Boy Scout board member, and they are having an American Heritage day on April 25th...an all day event...at the campgrounds in Vernon. If anyone is interested in participating, just follow up with Paul and discuss what you will be bringing.

Dave presented the clubs new banner that we will be using during parade events and, during the fair week, for selling peanuts. He and few other guys are in the process on completing the had-built cart, which will hold the banner.

Bill Castimore said he was looking for brake rotors to replace the stand/rims in the shed and Dave Betts is going to set him

Our next meeting is on March 26th at the Administration Building “and” the April meeting is on April 9th...this will only allow 13 days between the meetings. It may be difficult to finish the newsletter, get it printed, mailed and delivered to you in that time frame...so...<u>make a note of the date of the April meeting NOW</u>!
Also: 2020 dues are DUE!

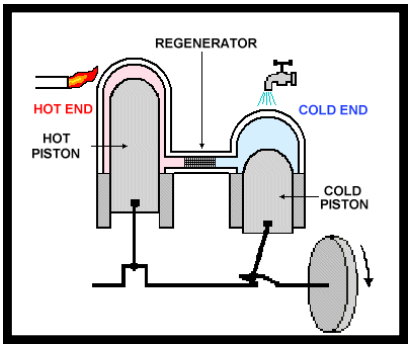
Our Web Address: njaemc.org

67 Branchville Lawson Rd., Newton NJ 07860

Hot Air Engine

Hot air engines use the heating and cooling and expansion and contraction of air to generate power!

The HOT AIR ENGINE can be found in various forms including both single and double cylinders, and is often called an AIR ENGINE, a CALORIC ENGINE, an ATMOSPHERIC ENGINE, or a STIRLING ENGINE. It is an external combustion engine and utilizes the expansion and contracting of AIR by thermal change (the addition of heat or lack of heat) to produce mechanical work. One of it's key features is that it is an extremely "quiet" engine!



The operational principle involves using a fixed volume of air in a closed system, with no additional air entering or leaving the engine. The engine is sealed and uses this same air continuously, moving it back and forth between the HOT and COLD cylinders...where it is cooled, compressed, heated and expanded in that order...called the "hot-air-cycle".

The COLD cylinder is in thermal contact with an external cooling source (air, water) and the HOT cylinder is in thermal contact with an external heat source (burning wood or coal, liquid or gas fueled fire etc. etc. etc...the key feature being; anything HOT).

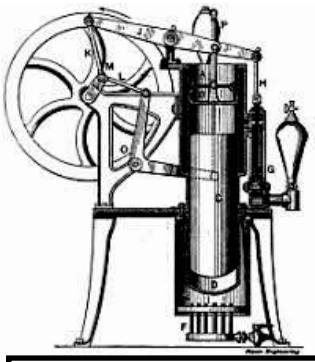
The air is first cooled and compressed in the (COLD) displacer cylinder...then...due to the action of the rising piston, moves to the (HOT) power cylinder. In the (HOT) power cylinder, the air is instantly heated and "rapidly expands"...driving the (HOT) piston downward and rotating the crankshaft. The two pistons are timed (phased) at 90 degrees and move the air between each other to "complete the cycle". If the engine is equipped with a REGENERATOR, it is mounted in the passageway between the two cylinders. This is a very simple engine with no valves and actually few moving parts, certainly when compared with a steam or internal combustion gas, kerosene or diesel engine.

Unlike the steam engine (it's early competitor): it requires "initial" rotation from an outside source, and the continued rotation and drive of a sizable flywheel carries the revolving crankshaft thru the many repetitions of the above hot-air-cycle.

The most popular Hot Air Engines include the **ALPHA-type engine,** which has (2) separate cylinders, the **BETA-type** engine which has its (2) pistons (called a power (COLD) piston and a displacer (HOT) piston) on a common shaft in a single cylinder and the **GAMMA-type** engine, which is a Beta with it's power piston in a separate cylinder, as in the illustration above. Note: there are more types and we could go on forever...some get more elaborate, some of them are undeniably "bizarre", but all develop the same basic cooling, compression, heating and expansion cycle required.

HISTORY:

Devices that work on the HOT AIR principle have been around since the late 1600s, but the first really efficient application was developed in Scotland by Robert Stirling. He patented the device in in 1816 and it was in production and marginally operational by 1818. This early engine included a regenerator (see illustration above), which he called an ECONOMISER in the original patent. The regenerator/economizer was a device that stored heat from the hot portion of the engine as the air passed to the cold side, and released the heat to the cooled air as it returned to the hot side. This improved the efficiency of the engine and should be present on any engine that is properly call a STIRLING ENGINE.



Beta -Type

single cylinder

Many types of HOT AIR engines were built during the early to mid-1800's, but none were highly successful and the period should be considered a time of trial and error for the engine. However, the technology was maturing. In this period and working in Europe, Swedish/American inventor and mechanical engineer John Ericsson, developed a HOT AIR engine of his own design, moving to and patenting it in America in 1851. Ericsson would go on to build a sea-going ship powered by a 4-cylinder HOT AIR engine (think 14' diameter pistons, and a 6' stroke), which was another failure. Of note, the only competition at this time was the low and high pressure steam engines, which were both difficult and dangerous to operate, but

were reasonably reliable and, "powerful". The Hot Air Engine was extremely fuel efficient and easy and safe to operate, but remained problematic in service (broke a lot) and made slow to little headway against steam in industrial applications.

Ericsson's failure with a large ship HOT AIR engine was a wake-up call to engine builders and he and others continued to improve on designs, recognizing it as a cheap, safe and efficient generator of power, within-certain-limits...think VERY SMALL!

John Ericsson is best known for his collaboration with Cornelius DeLamater and the American Civil War design and construction (in 100 days at Delamater's ship yard in New York) of the first ironclad warship in the US Navy...the MONITOR. The MONITOR was steam powered & included (2) twin reverse directional screw-propellers (an earlier development by Ericsson) and a rotating turret (also an earlier development by Ericsson). The Monitor famously engaged with the Confederacy's ironclad CSS Virginia (formerly USS Merrimack) and is credited with saving the wooden America Fleet at the Battle of Hampton Roads, Virginia in 1862.

LATER 19th CENTURY

Post civil war: Philander Shaw, Alexander Ryder, Sylvester Roper, and Ericsson would become important designers and major builders of NOW "reliable", but small, HOT AIR engines in America. That would be small in horsepower, not in weight….a 1-HP model of the period would weigh approximately 2,000 lbs., a 2-HP 3,000 lbs., a 3-HP 4,000 lbs. and a 4-HP 5,000 lbs. Their weight to-horsepower-ratio was extremely high, relegating them to stationary applications. **By the late 1860s, the HOT AIR engine began to find a small, but substantial, market niche:** as a reliable sources of low to medium power for pumping water, air compression, driving dental drills, sewing machines, and player pianos and running fans for ventilation systems. They were easy to operate, extremely quiet, could piggy-back off the waste heat from other sources (think furnace or stove exhaust) and became, pre-electricity, the "domestic" motor of choice. They were used in light industry, homes, hotels etc. New competitors during this period were the Otto Gasoline Engine, it's cousin...the spark-ignited kerosene engine, and late on, the Diesel Engine...all internal combustion engines.

20th CENTURY and beyond!

During the early 1900s the "role" of the domestic motor was gradually taken over by the electric motor and the internal combustion engines. The exception was in very rural, non-electric areas of the country, where the HOT AIR engine's ease of operation and low-to-no fuel consumption was a plus. By the end of the 1930s it was largely forgotten!

In the **21st century**, we saw a minor comeback as several countries developed small coastal submarines using STIRLING AIP (Air-Independent Propulsion) Hot Air engines in lieu of atomic power. They burn a combination of Liquid Oxygen & Diesel Fuel, exhaust into the seawater, have a maximum dive depth of 600', and can stay submerged for about 2-weeks. They are "cheap" to build, are not very powerful, but are VERY QUIET...and Sweden, China and Japan each have a handful of them. Also, we saw a proliferation of self powered Hot Air FANS for use with wood burning, gas and pellet stoves and fireplaces.

ADVANTAGES AND DISADVANTAGES...then and now:

Advantages:

- No boiler...a big plus in the 19th century, as the quality of steel was POOR and steam engines were plagued with often deadly boiler explosions!
- Easy to operate...with little to no training or operational monitoring.
- Can be run on any burnable fuel and can piggy-back off "other" heat sources.
- QUIET!

Disadvantages:

- Low power out-put and a high weight-to-horsepower ratio.
- Significant warm-up time required before operation.
- Not self-starting.
- Runs at a constant speed...later engines allowed speed changes, but brought complexity to the engine.
- The regenerators were complicated (for the time) and costly and were a mechanical failure point.

As most club members probably know, we own a 1906 RYDER-ERICSSON 6" bore BETA-Type Hot Air-water pumping engine. Donated by the late Ed Vander Berg and reconditioned and restored by Bill Castimore: the less-than-1 HP, 800 lb. engine-pump formerly provided water to the *Rock Lodge Club*, a local Hardyston Township nudist camp. Many of you may have seen the picture of Bill and the engine in the August 8th 2019 *New Jersey Herald* New Jersey State Fair/Sussex County Farm & Horse Show article.

For any of you with a few hours to spare and a myopic-attention-to-mechanical-detail problem, we have provided a colored insert showing the engines cycles/strokes. This will take time and effort and is not for the faint of heart. That this engine even runs, is just short of a mechanical miracle...and think "when' it was invented!

NJAE&MC—Upcoming Events

Sussex County St. Patty's Day Parade

Event coordinator: PauL Havens 973/222-7403

March 21st in Newton NJ...meet at 9:30 a.m. and park at G&H,...parade starts 11 a.m.

Plow Day - Ideal Farms

Event coordinator: Chuck Klim 973/903-3583

Date not yet determined!

Sussex District Boy Scouts - Spring Event

Event coordinator: PauL Havens 973/222-7403

April 25th in Vernon NJ...Woodlands Trails Camp Grounds

NOTE: THE WINTER 2020 MEETINGS ARE "NOT" ON THE 2ND THURSDAY OF THE MONTH...they will be on the 4th THURSDAY!

March 26th, 7 PM at the Administration Building

RETURN TO OUR NORMAL 2ND THURSDAY IN THE MONTH SCHEDULE

April 9th, 7 PM at the Shed

May 14th, 7PM at the Shed

June 11th, 7PM at the Shed

For Sale

1953 Ford 641 Workmaster

A show piece

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