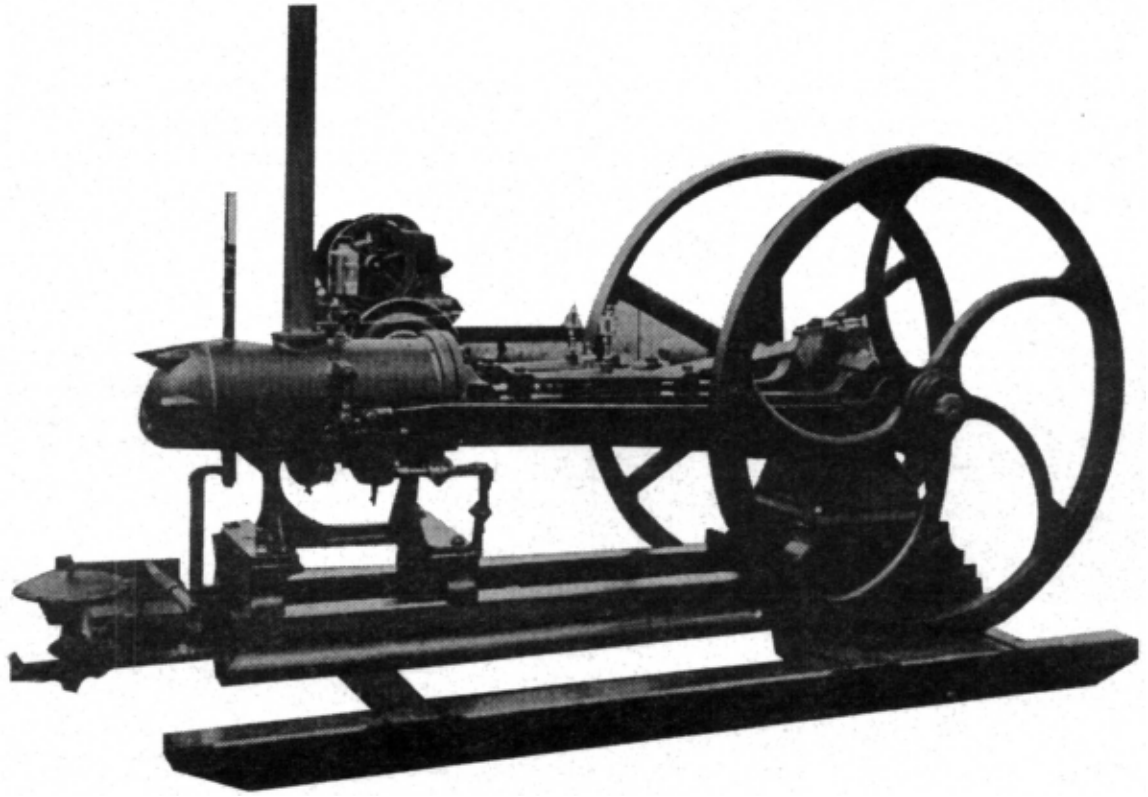
Bessemer Gas Engine Conversion



West Michigan Old Engine Club, Inc.
Scottsville, Michigan

August 1, 1997

American Society of Mechanical Engineers

Historical Significance Of Landmark

This Engine conversion is one of very few remaining examples of a population of 10,000 engines used in the extraction of petroleum by the South Penn Oil Company from wells in New York, Pennsylvania, and West Virginia. These engines made possible the early development of the petroleum products which fueled the industrial development beginning at the turn of the century until other petroleum deposits were discovered. Many of these engines gave faithful service until they were abandoned when the oil fields were depleted beyond profitability.

The history of this landmark is closely aligned with the history of the Bessemer Gas Engine Company, whose letterhead from the early 20th century enhances the cover of this brochure. The Bessemer Gas Engine Company merged with the Cooper Company in 1929 to become the Cooper-Bessemer Corporation. The following information was reprinted with editorial changes by permission from material updated from “THE FIRST HUNDRED YEARS”, a centennial booklet originally published in 1933 by the Cooper-Bessemer Corporation (Now known as Cooper Cameron). It included material from “THE BESSEMER GAS ENGINE COMPANY” issued in 1911.

The Bessemer Engine Company: "The Formative Years"

Dr. Edwin J. Fithian who with John Carruthers founded the Bessemer Company, was born on the first day of the Battle of Gettysburg, July 1 1863, in Portersville, Pennsylvania.

His father, I.N. Fithian was a cabinetmaker who, upon the advent of machine-made furniture, moved with his family to the Butler County oil fields, there to engage in both the retail furniture business and undertaking.

At twelve his son E.J. was painting furniture; at fourteen, driving the delivery wagon and making sleds for the boys of the town. At sixteen he attended his last year of public school. While acting as janitor in his spare time, at a church, the local bank and the school, he earned twenty dollars a month outside school hours. At seventeen he worked as a clerk at a William Riddles store in Prospect, PA.

From the age of eighteen until he was twenty-eight, E.J. Fithian worked at housebuilding trades in the summertime, and attended Grove City College in the winters. He received his B.A. from the college and entered the West Penn Medical College, graduating in 1892.

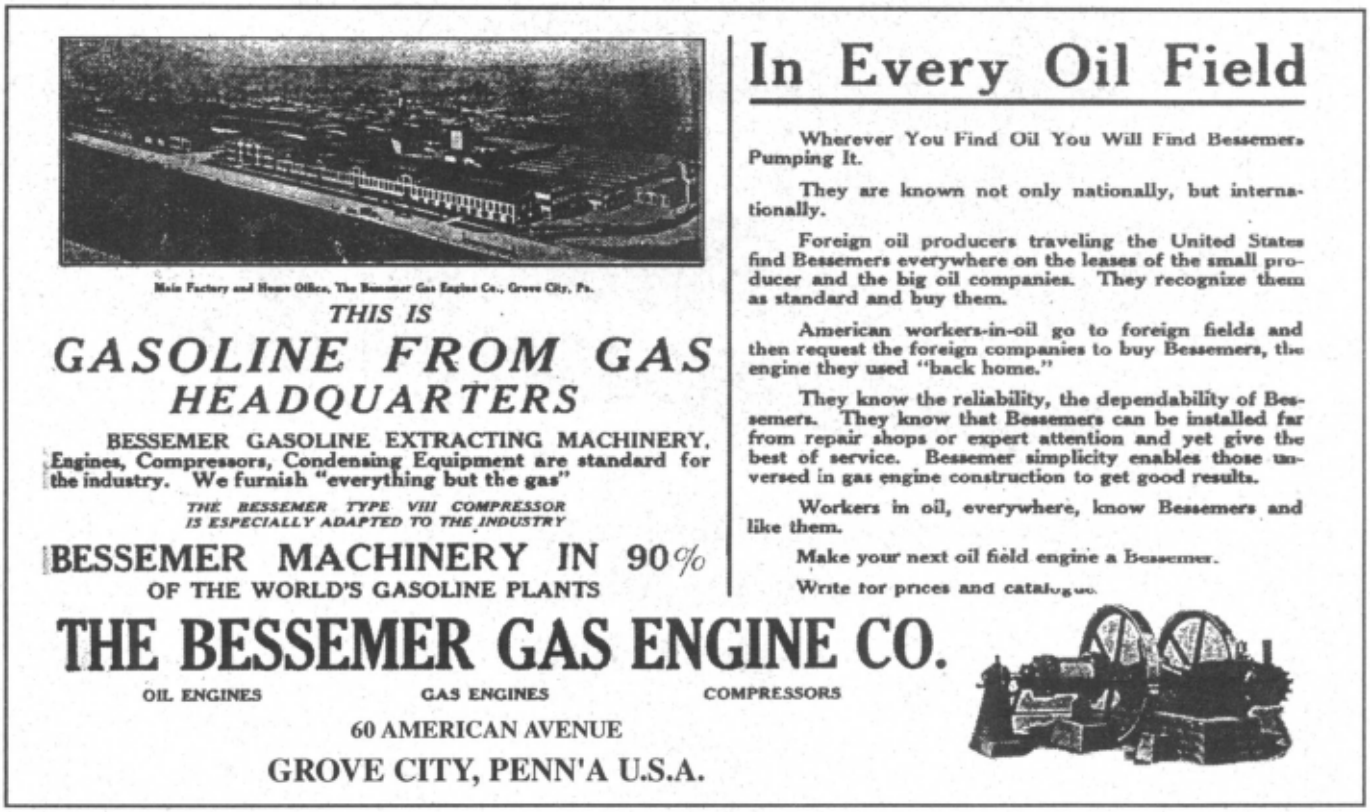


Figure 1: Advertisement featured in early trade journals.

In the Fall of 1892, he married Georgianna Shillito and practiced medicine for a period of six years at both Portersville, PA. and Harmony, in Butler County. The couple had two daughters, Leila and Mary.

Early in 1896 a friend of Dr. Fithian, one George H. Willetts who had a patent on an internal combustion engine, asked Dr. Fithian for some mechanical advice, after which they joined forces to build “gas engines”. In 1897, Mr. Willetts' brother Ruben, joined them as a machinist and helper and together they developed the engine. The engine was single cylindered rated at two horse power.

In the Spring of 1897 the Willetts brothers felt they had done enough development of the engine to manufacture it commercially. Dr. Fithian disagreed with them and offered to sell his interest in the project for $900.00, which was the amount he declared he had invested.

The Willetts could not raise the amount so they in turn offered to sell Dr. Fithian their share for $900.00 and to continue working for the project for wages.

Thus in 1890, Dr. Fithian purchased the interest in the engine from the Willetts brothers. About that time he associated himself with one John Carruthers, an experienced mechanic he knew, and discontinued the practice of medicine.

Together, Mr. Carruthers and Dr. Fithian formed the Bessemer Gas Engine Company. In 1899, the Bessemer Gas Engine Company was incorporated under the laws of Pennsylvania, and stock sold to the company employees as well as a few citizens of Grove City.

The founders decided upon the name Bessemer for their company because “Bessemer” denoted prestige in the Western Pennsylvania area, due to the advent of the Bessemer Steel process, and the Bessemer Railroad operating in the oil field areas.

During its first five years of existence, Dr. Fithian performed the office duties involved as well as those of designing draftsman. After five years, business had so increased that Mr. M.D. Murray, the shop foreman was put in charge of the drafting room and a Mr. John Wolfune Jr. an employee and stockholder, was promoted to the position of shop foreman.

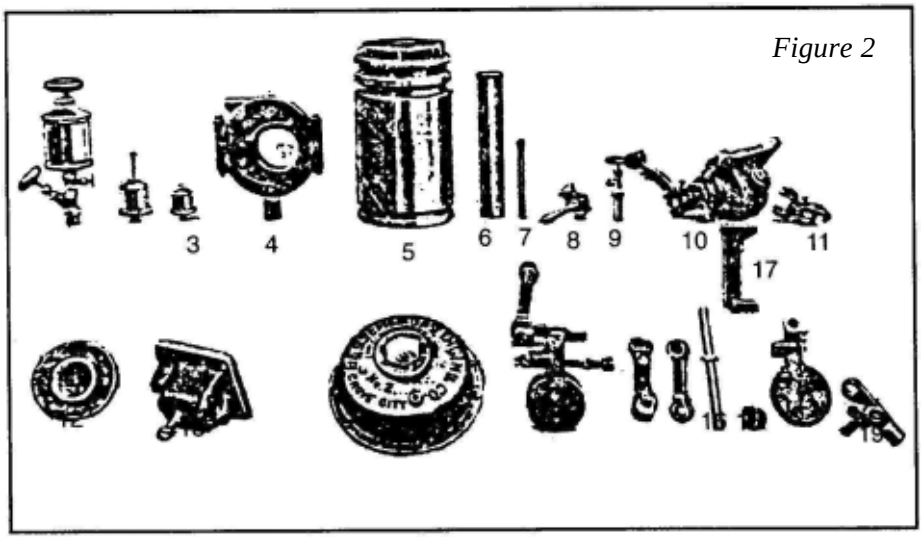
During the period between 1897 and 1898, the company built a 16 hp engine, tested it and offered to sell it to the Oil Well Supply Company. Since the Oil Well Supply Company had just hired a graduate engineer, they turned down the Bessemer offer and advised that they would develop their own engine. Dr. Fithian reports that they never did. At that time Bessemer was operating in a branch shop of the Oil Well Supply Company, at Harmony, PA.

Due to expansion it became obvious that a shop of their own would soon be needed. Mr. Bentley, a major investor, declined to invest further in such a venture, and offered his shares for sale. Mention of the matter was made to John Carruthers who decided to buy Bentley’s shares in 1898.

After looking around for a suitable shop location an offer from Butler, PA was rejected in favor of one from Grove City.

Mr. Carruthers came to Grove City, examined the site offered, and liked it. The property cost the citizens of Grove City $1500.00.

Figure 2



1. *Sight feed cylinder lubricator.*
2. *Crank pin grease cup.*
3. *Cross-head pin grease cup.*
4. *Eccentric complete.*
5. *Piston head.*
6. *Igniting flue.*
7. *Igniting tube.*
8. *Dialed and indexed gas stop cock for cylinder supply.*
9. *Bunsen burner for igniting tube supply.*
10. *Slide valve cap complete.*
11. *Internal rock arm.*
12. *Exhaust flange.*
13. *Air and gas valve complete.*
14. *Gas regulator. Gasometer action.*
15. *Governor swing complete.*
16. *Rock shaft.*
17. *Slide valve.*
18. *Rock shaft follower*
19. *Governor block.*

Bessemer engine conversion components are shown in figure 2 reproduced from a copy of the kit instructions provided by the

Mr. Carruthers moved to Grove City, and supervised the installation of the machinery in preparation for a full-fledged manufacturing plant operation.

The Engine Conversion

Bessemer management's first plans were to market a "gas operated cylinder outfit" (See Figure 2 on preceding page) to replace the steam cylinders on their own steam engine beds. The word "gas" in this instance refers to the plentiful natural gas available at every oil well.

To render the proposition more practical, it became necessary also to provide a "friction clutch" and pulley to go on the steam shaft. The purpose of the friction clutch was to provide a disconnection of the load from the engine in order that it could be started by hand. After examining the present clutches on the market, it was decided to develop a clutch of their own, which the engineers of the company proceeded to do.

The Bessemer clutch was automatic in adjusting itself to the drilling and pumping loads. With the new clutch ready, the company then designed and manufactured two sizes of cylinders, one at 10 hp and another at 15 hp. Dr. Fithian relates in his autobiography and company history that it took two men approximately one day of work to remove a steam cylinder and replace it with the Bessemer gas cylinder.

The outfits were offered to the oil producers at from $125.00 to $175.00 with the entire outfit, cylinder, gas regulator, and clutch installed. During the Summer 1898 the young company contracted with the South Penn Oil Company for several outfits.

However, Bessemer could not furnish them fast enough so the buyers agreed to pay a royalty fee of $20.00 for each outfit to Bessemer and co-produced them at their own plant at Alleghany, PA.

South Penn averaged two hundred units per month at their shop, and took all Bessemer could produce for the next three years.

South Penn made use of about 10,000 for the pumping of their own wells in Western Pennsylvania and West Virginia.

Later Development

Mr. Arthur Hull and Jack McCune had been associated with Mr. Carruthers before he joined Bessemer, and proceeded to move to Bessemer in the early 1900s.
From 1903 until 1907, Bessemer expanded their operation to produce engines from five to forty horse power. Later, in 1907 and 1908 they developed the direct engine driven gas compressor.

The Bessemer Roller Oil Well Pumping Powers

Figure 3

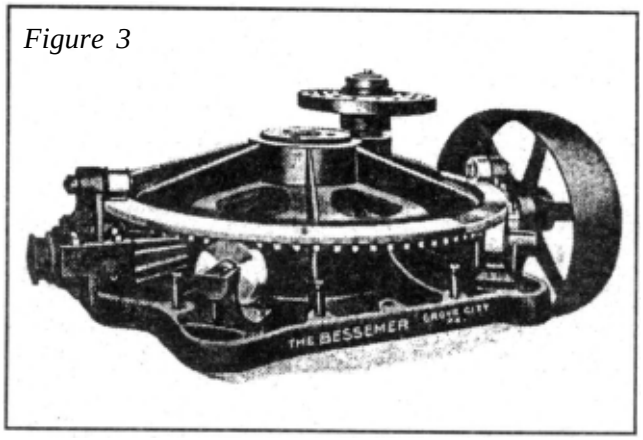


Figure 3 show a Bessemer Roller Oil Well Pumping powers. The gas engine conversions provided the energy to operate the "Pumping Powers".

Using the compressors and added machinery, Bessemer then began to offer a system of producing gasoline from "casing head natural gas". In the Bessemer laboratories an "absorption system" was used to determine the quantity of gasoline available from 1,000 cu. ft. produced by their compression machinery.

Dr. Fithian mentioned in passing, that upon entering the Washington patent office to patent the compression system they found a man named Gary, who had just secured a patent very much like that which they were about to register.

To simplify the obvious problem about to occur, Bessemer's representatives purchased Gary's patent and gave the resulting use of its principle to the oil producers without royalty charges.

John Carruthers, president of the Bessemer Gas Engine Company was born in Cleveland, Ohio in 1855.

Always interested in machinery and machine shops he was a member of the firm of Carruthers and Peters which for some time operated at Colloy, PA.

In 1898, Mr. Carruthers moved to Grove City, PA where he got interested in the young Bessemer Gas Engine Company.

He was a "joint-patentee" with Dr. Fithian of their automatic friction clutch.

Mr. Carruthers' wife, whom he married in 1880, was Laura J. Warthey.

Historical Development

The Bessemer Engine Conversion kits were developed to convert steam engines, economically, to operate using natural gas available at the well head. The engine which is the subject of the brochure, was built originally as a steam engine in the 1880's by the William J. Innis and Company in Oil City, Pennsylvania. The original engine was as shown in Figure 4 on the following page.

"Innis Steam Engines" written by David L. Weber includes the following information (Reprinted here with permission of the author) about Innis steam engines and the Innis companies.

Innis Steam Engines
David L. Weber, 1995

William Innis, a native of Worcester, Massachusetts, was an oil well driller in Venango County, PA, during the 1860s oil boom. He lost his business during the 1866 oil price collapse and was left with a lathe at Pioneer, PA, located halfway between Titusville and Oil City.

Innis used this lathe to produce the first practical iron sucker rod joint for the oil industry. The Pioneer shop was then expanded to manufacture the wooden rods, which were produced at the average of 50-70,000 feet per month.

The Innis sucker rod factory was moved to Seneca Street in Oil City, PA, 1870. A two story factory building was constructed, which was opened after Innis staged a ball on the second floor.

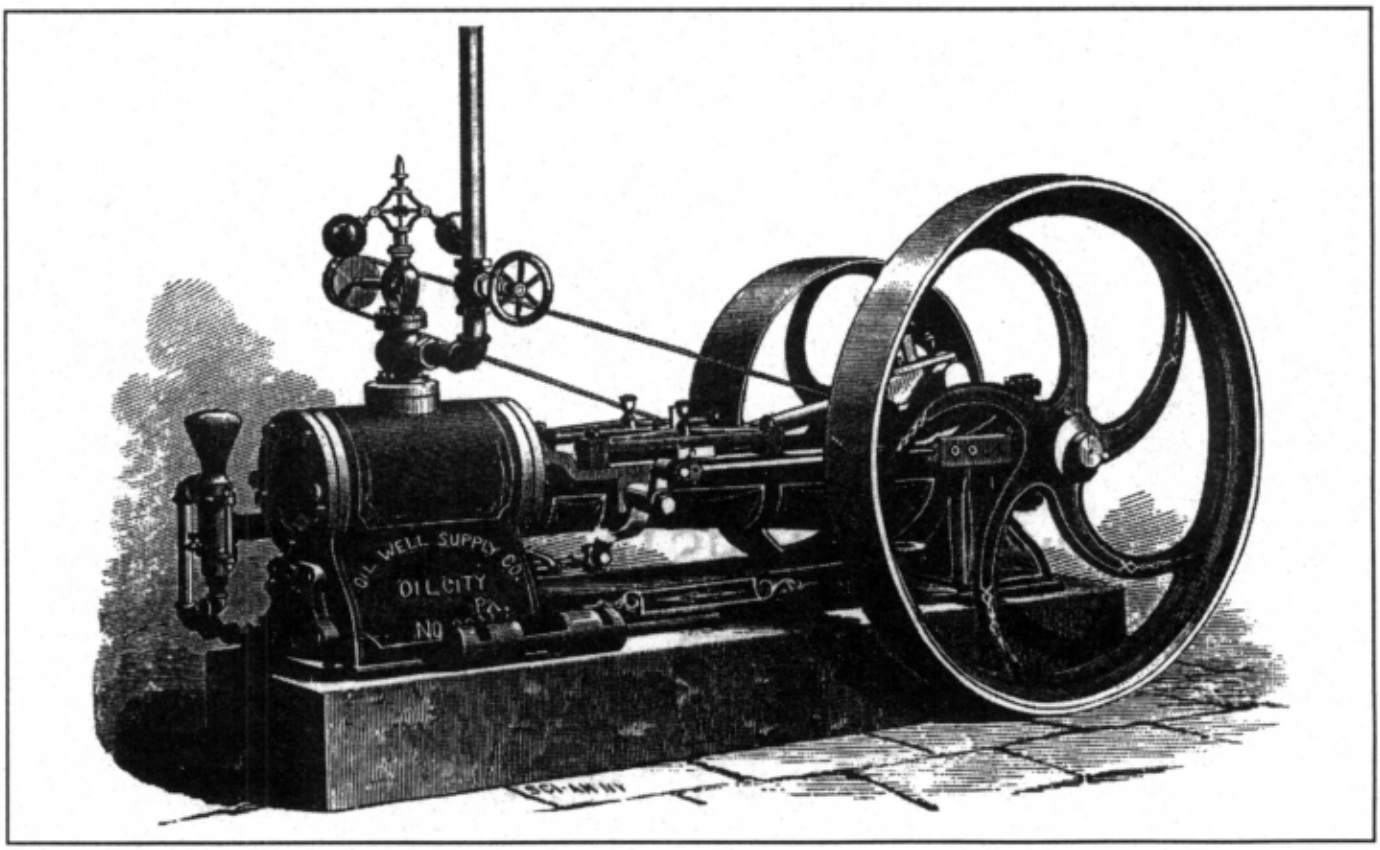
A steam engine was manufactured in the Innis shop, August, 1874. A blacksmith shop, pattern shop, and iron foundry were then added to the plant. William J. Innis and Company gradually converted their factory from the production of sucker rods to steam engines. Contemporary accounts state that the machine shop contained 6 large lathes and a heavy planer, in addition to numerous other machine tools used in engine building.

Innis steam engines were used in most existing oil fields during the 1880s. One 15 H.P. engine produced by this firm was used on an oil well near Baku, Azerbaijan. This well was located on an oil lease owned by the Nobel Brothers of Sweden. (Alfred Nobel, inventor of dynamite and originator of the Nobel Prizes, headed the firm.)

Innis steam engines were manufactured in 15 and 30 H.P. sizes. They were 98 and 78 inches long and weighed 2800 and 3500 pounds, respectively. The Innis shops employed 130 men for a short time during the 1880s.

William Innis sold his engine factory to the Oil Well Supply Co., an Oil City manufacturer of sucker rods and drilling tools, January, 1889. Innis was said to have given all his former employees money to buy new suits from a clothing store following the sale. Oil Well Supply continued to manufacture steam engines (and later Simplex gas engines) at the facility until 1902. The buildings were abandoned and razed when the Oil Well Supply completed a new factory for the production of oil field machinery in Oil City, which was the largest plant of its kind in the world for many years.

Figure 4: Innis Steam Engine (Circa 1880)



Bessemer Gas Engine Conversion

Mechanical Specifications:

Bore: 7 1/2" 4 - 7 1/2" x 1/2" x 1/2" solid rings, piston weight 68 Ibs. Stroke: 12" variable; adjustable piston rod into cross head

Rated hp @ 200 rpm: 12 1/2

Diameter of flywheels: 60 1/2"

Weight of flywheels: 540 Ibs. each

Operating rpm: 54 to 90, no load

Cross head lubrication: oil drip each side.

Connecting rod lubrication: grease cups both ends

Main bearing lubrication: wicked reservoir each side

Fuel: at present, propane @ 7" w.c. At well site, by condensate gas or natural gas at the well head.

The following information, used by permission, was originally published in "Bores and Strokes" by the Cool Spring Power Museum -Dr. Paul Harvey.

Hot-Tube Ignition

Method of Operation. Hot tube ignition was used with the Bessemer engine conversions. This method has fallen into disuse in this country with improvement in electric ignition. In England, however, this method is still used occasionally on engines using illuminating gas. The tube E, Fig. 5, is closed at the upper end, and communicates at its lower end through the port B with the cylinder A. It is heated by an external flame from the Bunsen burner C, and is maintained at a full red heat. The chimney around the tube is lined with asbestos, and keeps the flame in good contact with the tube. During the admission stroke, the tube is filled with products of combustion at atmospheric pressure remaining from the previous explosion. As compression goes on, the nonexplosive products of combustion are crowded into the upper part of the tube, while part of the explosive mixture in the cylinder is compressed into the lower part of the tube. The length of the tube and the position of the flame are adjusted by experiment, so that the explosive charge will just reach the hot portion of the tube and be ignited at the moment when ignition is desired. Shortening the tube makes the ignition come later. With this device the actual time of ignition is not very definite.

Engine Restoration

This engine would not have been available for recognition without the industry and initiative of its present owner, Dale Sonke. Dale has had an interest in early engines for many years. He has studied early and current publications to learn how to restore and operate engines. He currently has six engines in his collection, two of which have restoration pending. When he learned that the Bessemer engine conversion was available, he purchased it in northeastern Pennsylvania in 1988.

He began restoration in midsummer, 1989 with complete disassembly. As part of the process, he made drawings and measurements to facilitate re-assembly. He made bolts to match the original configuration (Head height 1 and 1/4 + X-the bolt diameter) for the exhaust flange, air mix base and governor pivot pin. He was able to preserve a portion of the original Innis Pin Striping on the engine base while removing the overcoatings of paint. *Figure 6 shows the paint removal operation.*

Main crank journals and crosshead slides were rebabbited. Jigs were built to align the crank shaft, connecting rod and piston rod with the engine base and the centerline of the cylinder bore. New babbitt was poured and scrapped to size. *Figure 7 & 8 show these parts.*

The cylinder was honed and new piston rings installed. Two of the tree porting gates on the top edge of the piston were rebuilt. *Figure 9 shows the piston.*

Restoration took four years with many late nights working in his spare time to complete the process. After restoration, the engine was installed on an ash base.

At such time he is unable to continue to show his engine, he has made arrangements to donate the engine to the Coolspring Power Museum for permanent exhibition. This Museum is located about 15 miles from Brookville, Pennsylvania, the site near where the engine resided for 75 years.

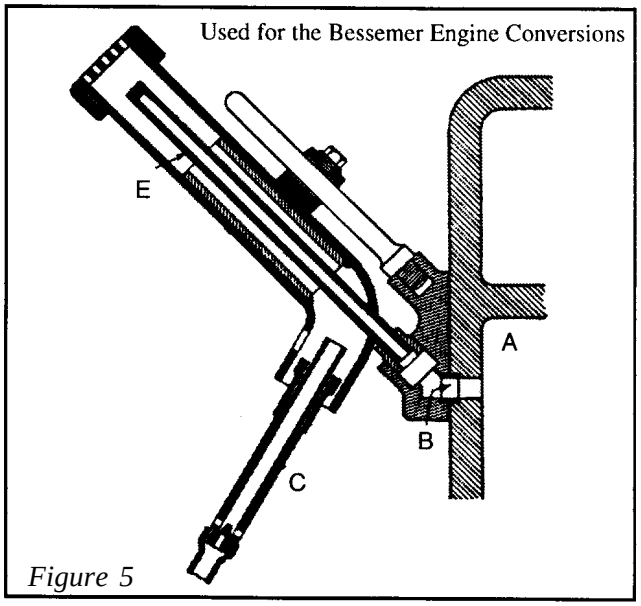


Figure 5

Restoration Photographs

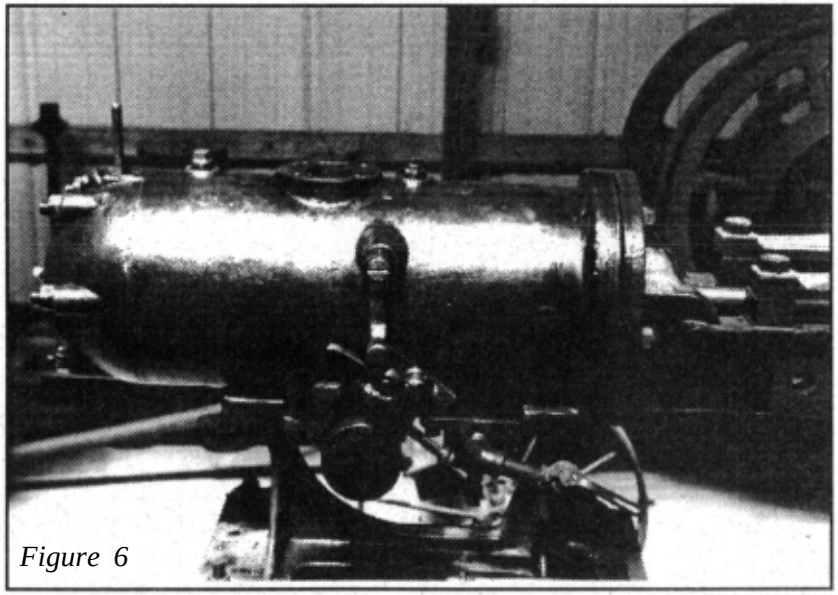


Figure 6

Removing Paint Applied By Dale Haugh (Previous Owner)
original conversion kits were not shipped painted

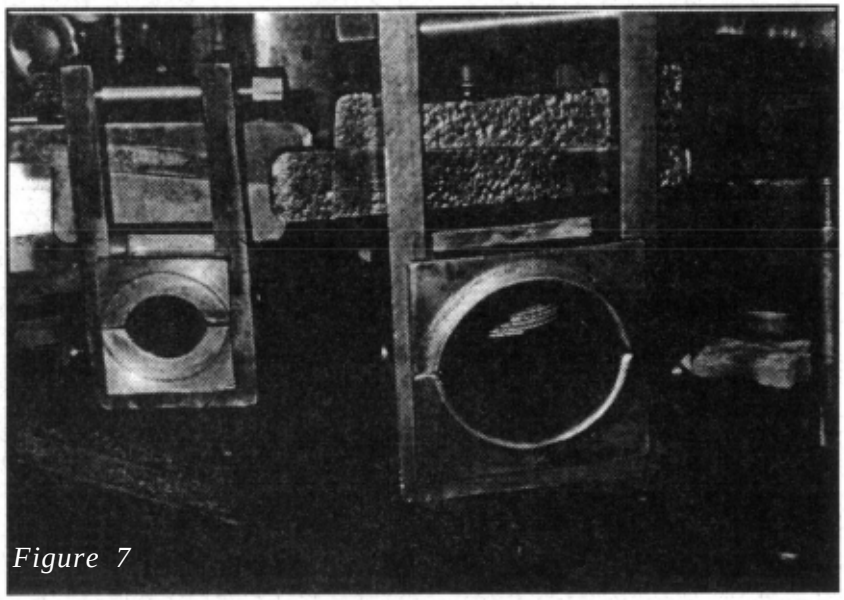


Figure 7

Connecting Rod Bearing (Brass) Boxes

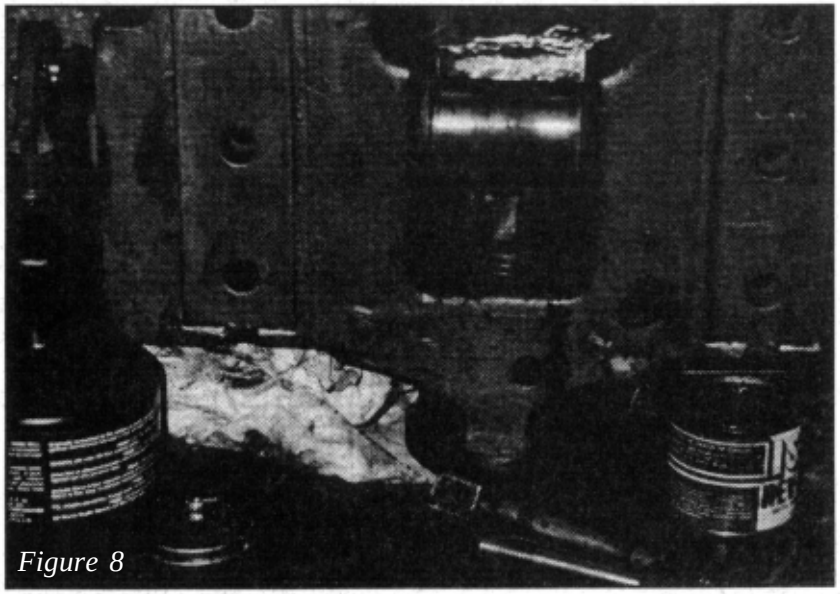


Figure 8

Descaling Crosshead before pouring Babbitt slide bearing
(Holed areas each side of Connecting Rod pin)

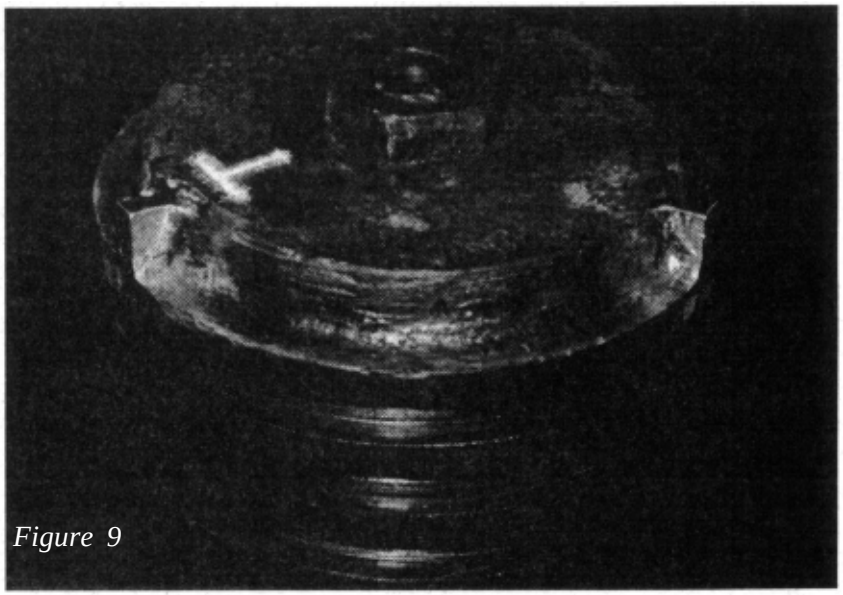


Figure 9

Rebuilt flow gates on top of piston
(2 cycles, assists in Ex.-intake flow)

Acknowledgements

The Central Michigan Section of The American Society of Mechanical Engineers gratefully acknowledges the cooperation of the West Michigan Old Engine Club, Inc. in permitting this ceremony to occur within their show so that Dale Sonke could receive this recognition while among his friends and peers.

Engine Owner

Dale Sonke

This Bessemer Converted Engine is exhibited and operated at various old engine shows in Western Michigan and Northern Indiana during the summer and at the Coolspring Power Museum in Coolspring, Pa. during June & October.

Cooper Cameron, Cooper Energy Services, Cooper-Bessemer Reciprocating Products

Terry Kearns, Manager of Application Engineering.

Text of the Bessemer Converted Engine Plaque

Historic Mechanical Engineering Landmark
Bessemer 12 Horsepower Conversion Engine c.1900

The 1859 discovery of oil underground at Titusville, PA required engines to drive drills and pump oil, but steam engines proved costly to operate. In 1898 Dr. Edwin J. Fithian and John Carruthers formed the Bessemer Gas Engine Company, and produced kits to convert steam engines into the new internal combustion engines, fueled with oil-field natural gas. This gas engine, in service for 75 years, is a kit conversion of an 1880s Innis steam engine. It illustrates the transition to internal combustion, and how machine life can be extended by clever adaptation of newer technology to save cost and resources.

American Society of Mechanical Engineers 1997

The ASME History and Heritage Program

The ASME History and Heritage Program began in September in 1971. To implement and achieve its goals. ASME formed the History and Heritage Committee, initially composed of mechanical engineers, historians of technology, and the curator (Emeritis) of mechanical and civil engineering at the Smithsonian Institution. The committee proved a public service by examining, noting, recording and acknowledging mechanical engineering achievements of particular significance. The History and Heritage Committee is part of the ASME Council on Public Affairs and Board on Public Information.

Since the ASME History and Heritage Recognition Program began, 181 Historic Mechanical Engineering Landmarks, 6 Mechanical Engineering sites, and 6 Mechanical Engineering Heritage Collections have been designated.

The ASME History and Heritage Program illuminates our technological heritage and encourages the preservation of the physical remains of historically important works. It provides an annotated roster for engineers, students, educators, historians, and travelers and helps establish persistent reminders of where we have been and where we are going along the divergent paths of discovery.

For further information, please write to:

Public Information, ASME International
345 East 47th Street
New York, NY 10017-2302

Phone: 212-705-7740
FAX: 212-705-8676

ASME International

ASME History & Heritage Committee