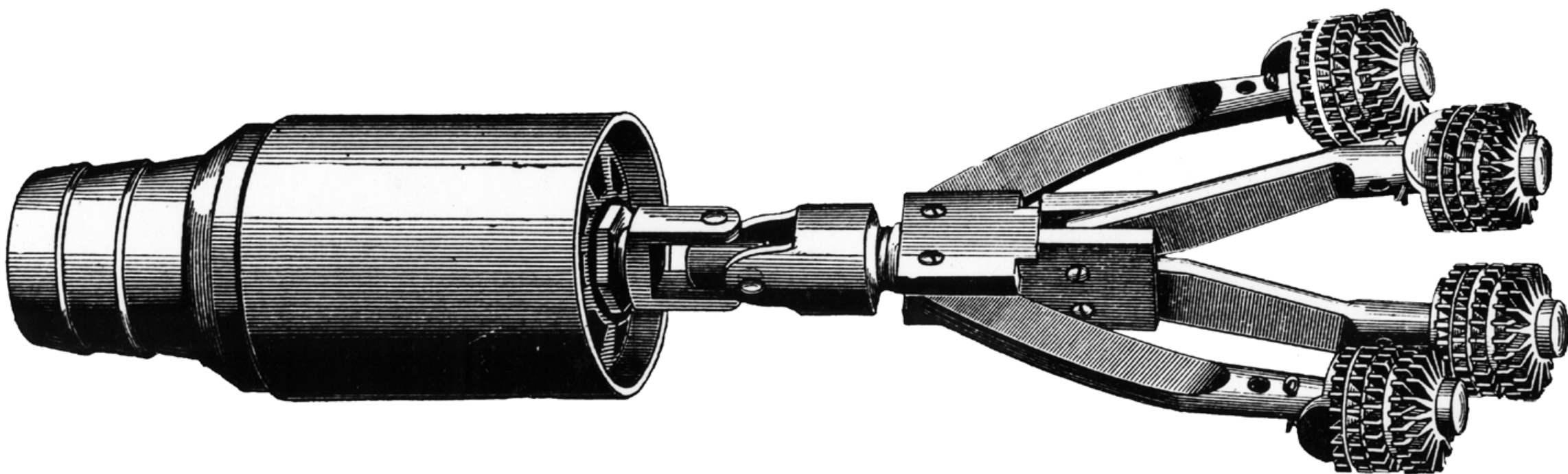


Part I:

The Early Days of Elliott Company



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Cleaning boiler tubes

Toward the end of the 1800s, there was tremendous demand for water-tube boilers to power industrial tools and machinery, to heat factories and offices, and increasingly to generate electricity. The steel industry alone accounted for thousands of boilers to power its huge mills. But with this explosive growth came new problems. A particular difficulty with water-tube boilers was fouling of the tubes by minerals or “scale” left behind after evaporation. The scale that built up on the walls of the tubes was nearly as hard as concrete and very difficult to remove. Over time these deposits clogged the tubes and reduced the boiler’s efficiency. The need for the easier removal of scale from boiler tubes led to the creation of the original Elliott Company.

As a boiler salesman in the 1890s, William Swan Elliott was very familiar with the problem of scale in boiler tubes, and he gave a great deal of thought to designing a more effective tube cleaner. Mr. Elliott was a dynamic individual – an innovative engineer, an outstanding salesman, and a shrewd businessman. He was also a hard man to miss, cutting an imposing figure at six-feet four-inches tall and 250 pounds (1.9 meters and 113.4 kilograms). He was born on a farm in Wellsville, Columbiana County, Ohio in 1864. After a collegiate preparatory course at the Pennsylvania State College, he earned a Mechanical Engineering degree at Cornell University in 1887. Mr. Elliott began his professional career with Edison General Electric Company in Chicago, and worked in several cities in the mid-west. He joined Stirling Boiler Company in Chicago as a salesman, and in 1896 he moved to Pittsburgh as sales manager for Stirling.

There were numerous mechanical products on the market designed to clean boiler tubes, such as flue punchers and button-and-chain devices that were pulled through the tubes, but the approach taken by Mr. Elliott was unique. He carefully studied the tube cleaners then available and patented a basic design that combined a motor, universal joint and drill or cutting head that he termed the “triple combination. The initial motor was a water turbine he designed. Connected to the water-motor with a flexible coupling were four metal arms, each capped with a cutter head or wheel with several disks of sharp metal teeth. The flexible coupling allowed the tube cleaner to move through curved or crooked pipes. High-pressure water caused the turbine and the connected arms to spin rapidly. Centrifugal force threw the spinning cutter heads out against the walls of the tube, where the metal teeth cut and pulverized the scale as they spun, and the water washed away the scale. This radical new idea, built on skillful engineering and intelligence coupled with marketplace awareness, ultimately led to the birth of Elliott Company.





Liberty Manufacturing Company

The Chicago Boiler Cleaner Company was formed in 1895 as a sales arm of Stirling Boiler Company. Stirling had the shop rights to Mr. Elliott's boiler tube cleaner and usually gave away a tube cleaner as a sales incentive with each new boiler. On January 9, 1900, Mr. Elliott received U.S. patent #641,092 for his invention. In 1901, he left his job with Stirling Boiler Company and with his own capital, created the Liberty Manufacturing Company in Pittsburgh to produce and sell his invention.

Mr. Elliott's decision to invest in Pittsburgh, "The Steel City," was logical. Pittsburgh and the surrounding communities were the fourth largest metropolitan area in the United States, after New York, Chicago and Philadelphia. As the cradle of burgeoning industries that manufactured everything from iron and steel to aluminum, chemicals, glass and locomotives, Pittsburgh was one of the most industrialized and energy-intensive cities in the world. In 1900, the Carnegie Steel Company based in Pittsburgh was producing more steel than all of Britain. Pittsburgh was also a primary center for natural gas, petroleum and refining. The first oil refinery in the United States opened in Pittsburgh in 1853. The first successful oil well was drilled in 1858 along Oil Creek, in Titusville, Pennsylvania, 100 miles north of Pittsburgh. The high concentration of industry in western Pennsylvania meant that there were many more boiler users to buy boiler tube cleaners.

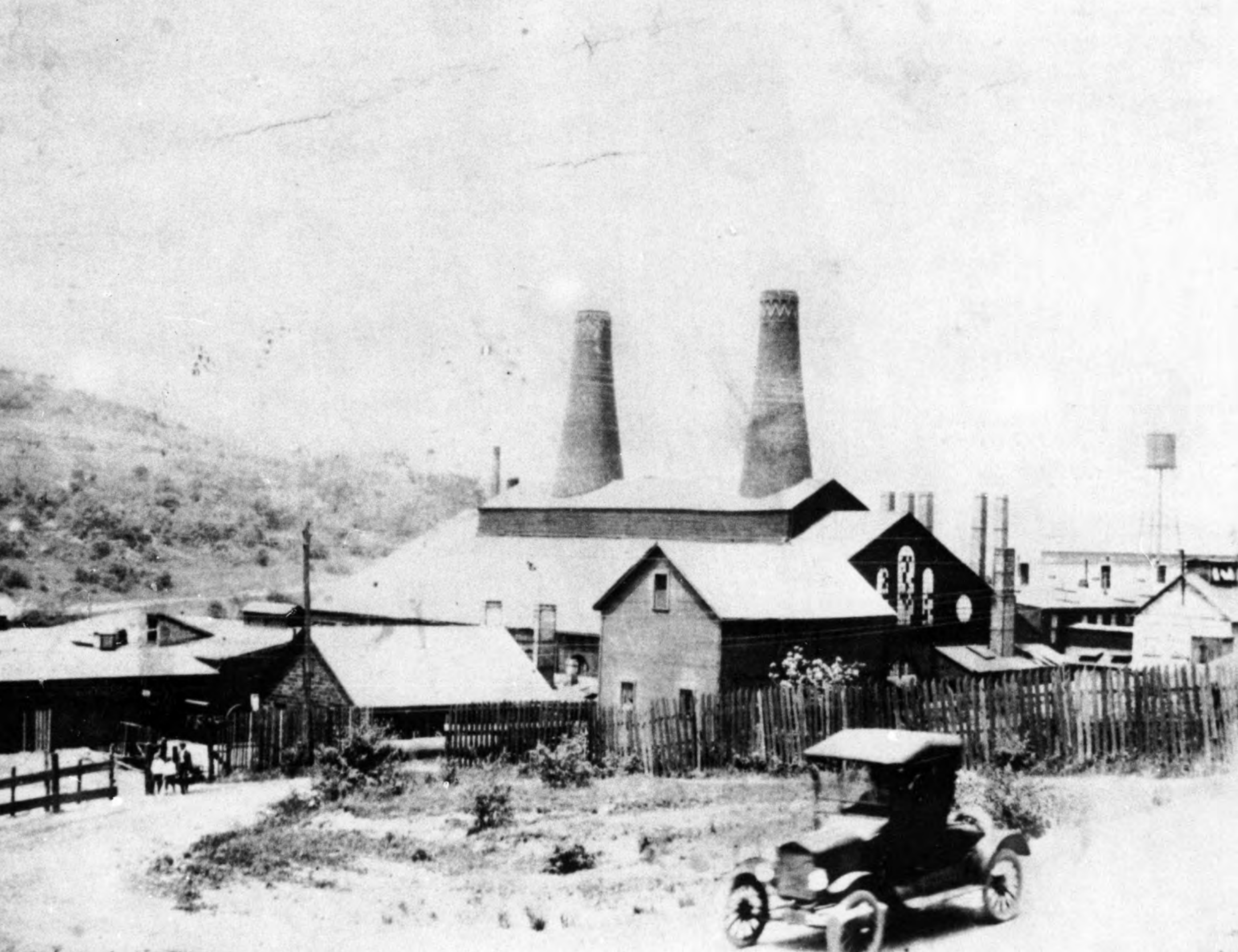
In the beginning, Liberty Manufacturing occupied one room in a building in the East Liberty section of Pittsburgh. The company purchased parts for its tube cleaners from third parties, who also handled assembly and shipping. Agents handled all sales. Growth came quickly. In 1902, Liberty moved to new offices, four times the size of the first, and in 1903, the company erected a small frame building on property it purchased in the Homewood section of Pittsburgh, where it began to manufacture some of its growing array of products. Around 1904, Liberty purchased the patent on an air-driven tube cleaner motor. This was a vast improvement over the water-driven machines that W.S. Elliott had designed ten years earlier, and it gave a boost to the already vigorous tube cleaner business.

In the early 1900s, the majority of industrial drivers or prime movers were still reciprocating steam engines, based on the same piston and cylinder technology that had launched the Industrial Revolution more than 100 years before. The cylinders in these engines required lubrication, which introduced some oil into the exhaust steam from the engine. The exhaust steam in turn was used for purposes such as heating boiler feedwater or to supply heat to factories and offices. Oil separators were customarily installed in the exhaust line to remove oil from the steam before it could clog valves, radiators, etc. A separator alone removed only part of the oil, so oil filters and grease extractors were often added to the system.

Mr. Elliott was a thoughtful and observant businessman, alert to opportunities to increase the products his company manufactured and to expand into new markets. By 1905, Liberty Manufacturing had added an oil filter to its product line. Continuing to branch out into areas related to steam technology, Liberty began to manufacture complete lubricating systems for reciprocating engines. Liberty next bought the patent rights to a twin strainer. When feedwater for boiler systems was drawn from sources such as rivers, ponds or reservoirs, it had to be filtered before it entered the boiler. Twins strainers incorporated two baskets through which the water was filtered, allowing for one basket to be cleaned while the other was in use. Liberty further expanded its product line with the purchase in 1908 of a line of oil and steam separators.

Sales growth and new products meant physical expansion. A brick building was put up next to the original building in Homewood, and this structure was enlarged several times between 1906 and 1909. Mr. Elliott hired William J. Burke as Liberty Manufacturing's first plant manager in 1906. Mr. Burke had been a machinist and foreman for Westinghouse Electric and Manufacturing Company since 1892, six years after that company was founded.





Elliott Co, A New Name

W.S. Elliott was understandably proud of the success of Liberty Manufacturing. In less than ten years he had created a new business in a new city and built it into a respected and growing supplier to industry throughout the eastern United States. He decided that his enterprise needed a better name. On May 19, 1910, a new entity, Elliott Company, was incorporated in Pittsburgh, Pennsylvania. The new company absorbed all but a few shares of Liberty Manufacturing which continued in existence to support tube cleaner sales. Shortly after it was established, Elliott Company purchased the Pittsburgh Feedwater Heater Company. Feedwater heaters pre-heat water before it enters a steam boiler. Feedwater heaters were part of Elliott's product line for the next 50 years.

Elliott Company was growing fast, and the Homewood facility in Pittsburgh was quickly becoming inadequate. In June 1913, Elliott purchased the Clifford-Capell Fan Company and its 33-acre site alongside Bull Run in Jeannette, Pennsylvania. Clifford-Capell Fans had been established by William Clifford in the 1890s to manufacture large fans for the mining industry. But demand for these fans was declining as the mining industry changed over to smaller, higher-speed fans. W.S. Elliott was unfamiliar with this market, so the dying fan line was quickly dropped.

Located 26 miles southeast of Pittsburgh, Jeannette at the beginning of the 20th century was one of the largest glass manufacturing centers in the world. A factory built there in the 1890s by James Chambers and H. Sellers McKee was more than five times larger than the next largest glass factory in the U.S. In 1903, Chambers installed the world's first mechanical glass blowing machines in his plant in Jeannette. Eventually the Jeannette operations lost ground to competitors such as Pittsburgh Plate Glass (PPG). The McKee Glass Company closed in 1990; in 1947 it had employed 1000 workers.

Elliott quickly improved the Clifford-Capell facilities in Jeannette. Part of the main shop today (Building 1) dates back as early as 1904. Construction began in 1914 on a modern brick office building (Building 14). By June 1914, all of the manufacturing machinery and 32 employees had moved from Pittsburgh to Jeannette. By 1917, Elliott employed over 200.





ELECTRIC MACHINE & POWER CO.

Battling over tube tools

Elliott's fiercest competitor in the tube tool market was Lagonda Manufacturing Company of Springfield, Ohio. Lagonda also sold a turbine-type tube cleaner. The company claimed experience dating back to the 1880s, although Lagonda Manufacturing was formed in 1896. After starting as a shoe-string operation, with the shipping department in the basement of a partner's home, Lagonda had grown quickly, in part by buying up smaller tube cleaner operations. Lagonda Manufacturing was incorporated in 1902, and in 1905 built a sizeable manufacturing plant in Springfield. The Lagonda plant was one of the first in Ohio to have individual electric motors to drive each machine.

One of the first employees of Liberty Manufacturing and later Elliott Company was H.A. "Harry" Pastre. According to Mr. Pastre, selling tube cleaners in the early days was a "smoke-stack-chasing proposition." Salesmen carried tube cleaners around with them and would stop at plants and give on the spot demonstrations if the boiler was open and the tubes were the right size. The competition between Liberty and Lagonda to sell boiler tube cleaners was so keen that many plants arranged to have their boilers cleaned free of charge by inviting each company to demonstrate their products and giving each half of the boiler to clean.

In 1904, Liberty filed a patent infringement suit against Lagonda. The two companies battled in the marketplace and in the courts until the matter was finally resolved in 1916, when Elliott acquired the Ohio company. Elliott took possession of the Lagonda works in Springfield, and eventually moved the manufacturing of all of its boiler tube cleaners there. The Lagonda name remained in use until 1960 to support the sale of boiler tube cleaners.

By the mid-1920s, another solution to the problem of scale in boiler tubes was becoming widely used. The chemical treatment of boiler feedwater, similar to water "softening," had proven to be an effective means of reducing the accumulation of deposits in boiler tubes. Boiler tube cleaning became less frequent, and Elliott's sales of these tools declined. But the tube cleaning business didn't die. Water treatment lessened scale formation, but did not completely eliminate it. Scale still formed, and boiler operators had no choice but to remove it.



It's mighty hard to raise boiler efficiency without regularly cleaning tubes

"Spare the Cleaner and spoil the Boiler"

LIBERTY PNEUMATIC SURFACE CLEANER

This cleaner has been developed in response to the demand for a tool for removing rust, paint, scale, etc. The motor has plenty of power and is smooth in operation. The valve handle and brush contain one of aluminum. The brush is very flexible and adaptable. The handle will not come out, and by the use of an aluminum plate the handle is advanced until the brush is entirely worn out. Full details on request.

Typical Liberty Cleaner for straight tubes

Buildup Water-Cleaner after Cleaning for straight tubes

Typical Liberty Cleaner for the use of normal tubes

LIBERTY CLEANERS

Liberty Manufacturing Company
FRICK BUILDING, PITTSBURGH, PA.

PROFITABLE operation of boilers depends upon utilizing the largest proportion of the heating units in the fuel. An accumulation of scale in the tubes interferes seriously with this ideal. The scale will do its worst to send the heat from the coal up the stack instead of into the evaporation of water. Scale puts up a barrier between coal and steam, and forms one of the most prolific sources of waste.

Thus, the boiler operator, who is striving for maximum efficiency, will find of all see that the boiler tubes are scaled at regular intervals. Frequent tube cleaning is true economy. It is the only way to get scale out and keep it out. Nothing is more systematic than the deposit of scale, bit by bit, day by day. Nothing but a systematic program of cleaning can meet the evil.

Put a Liberty Cleaner through your tubes regularly. Economy is impossible otherwise.

There is a Liberty Cleaner in the size and in the type best suited in operating conditions in your plant. Have your Liberty Catalog on file?

A complete tube cleaning service

Tubes through which a heat transfer is accomplished must be clean. Efficiency rapidly falls as scale accumulates.

Pipes clog up with scale, restricting the flow of liquid within. Either the pipes must be cleaned, or there is a loss of heat transfer.

Lagonda Tube Cleaners, originally constructed for boiler service, have been found useful in many other places. Builders build tubes. Lagonda Cleaners are in use in the following different services:

- Superheater Tubes**
- Circulating Tubes**
- Economizer Tubes**
- Condenser Tubes**
- Evaporator Tubes**
- Boiler Tubes**
- Water Screen Tubes**
- Waterheaters**
- Locomotive Arch Tubes**
- Locomotive Superheater Flues**
- Oil Mills**
- Boilers**
- Pipes**

Our experience is at your service. If you have a special cleaning problem, let us know.

Ask for Bulletin

The Lagonda Mfg. Co.
SPRINGFIELD, OHIO
FUEL SAVING SPECIALISTS

Typical Lagonda Cleaner for straight water tubes—oil, steam, water driven.

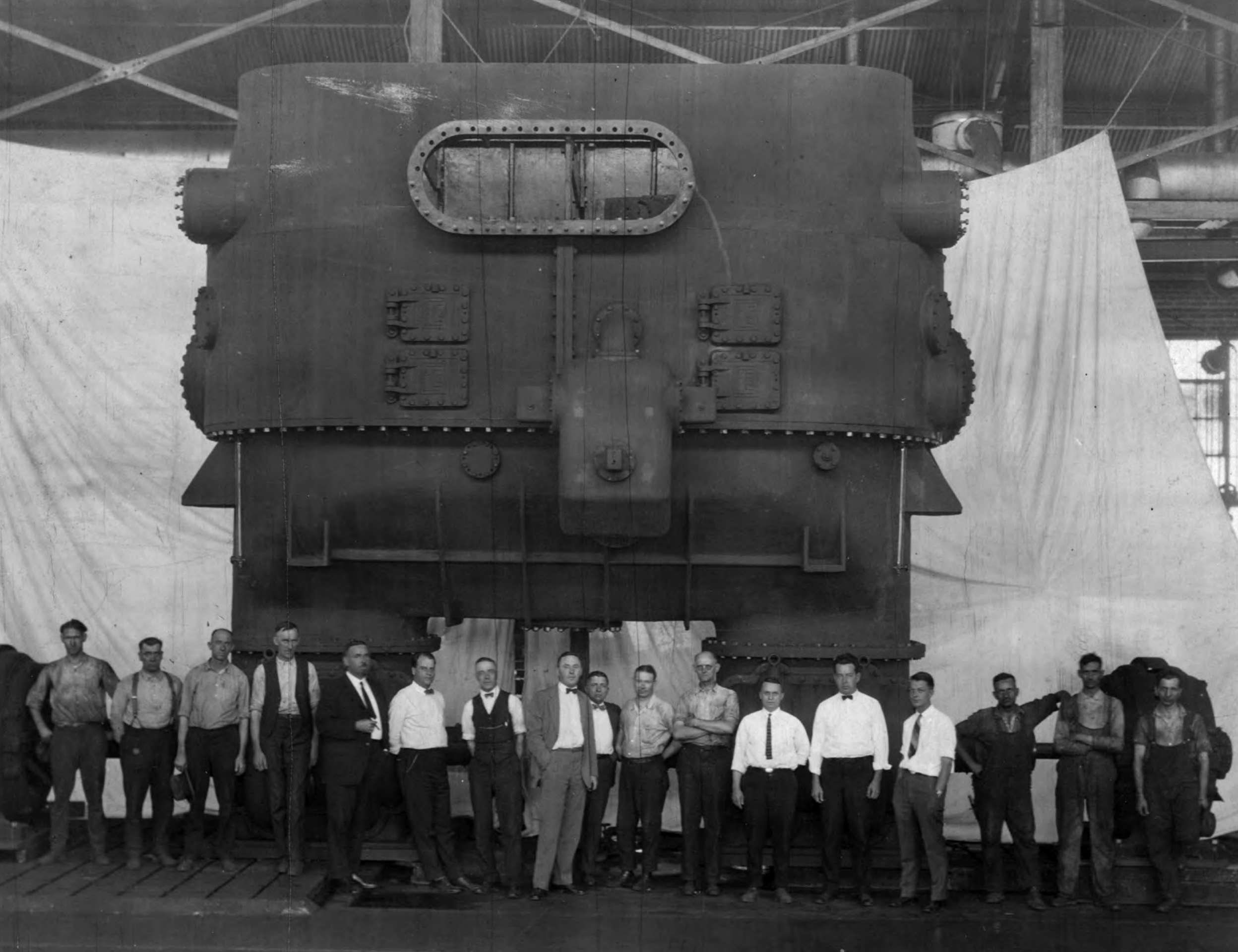
This type for curved water tubes—oil, steam, water driven.

Lagonda Water-Cleaner for removing scale from outside of the tubes—oil, steam driven.

This type of Cleaner is being used in locomotive tubes.

Small Tapering Type Cleaner for condenser and boiler tubes.

Large Tube Cleaner for oil, ammonia, etc., up to 18 in. in diameter.



Branching out

Elliott's acquisition of the Pittsburgh Feedwater Heater Company in 1910 was the company's first step in expanding its product line beyond tube cleaners and auxiliary equipment for boiler systems. The feedwater heater was an integral component of a steam system. It increased the efficiency of the boiler by heating the feedwater before it entered the boiler so that it would more quickly turn to steam.

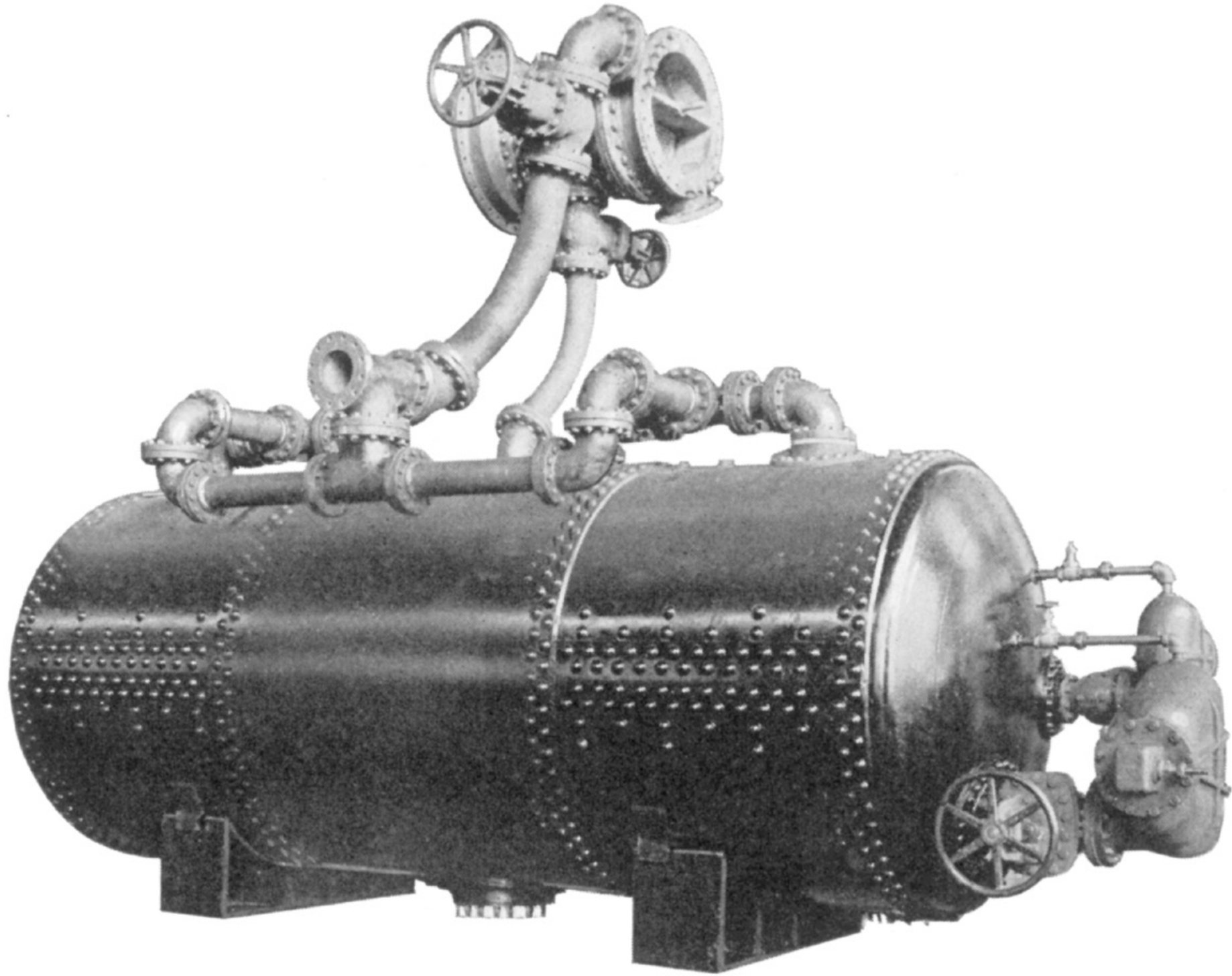
As World War I came to an end, Elliott began to manufacture additional components of a steam system. Surface condensers were the most significant addition to the product line. Condensers receive exhaust steam from pistons or turbines and use water or air to cool it and condense it back to water. The recovered water, or condensate, is then returned to the boiler as feedwater.

Along with surface condensers, Elliott also began to manufacture steam jet ejectors at this time. Among other purposes, ejectors are used to create and maintain a vacuum inside a surface condenser. The efficiency of a steam turbine is improved by the vacuum in a condenser. The ejector also removes the gases produced as the steam condenses. These gases can introduce impurities into the feedwater and contribute to corrosion and deposits in piping and tubes.

Elliott Company's production of condensers and ejectors required the addition of a staff of engineers into the company for the first time, starting a trend that continued as the evolving product line required more custom engineering. R. N. Ehrhardt, the first Chief Engineer, brought his ejector design expertise to Elliott from Westinghouse Electric Company. Another early Elliott Company engineer, Harold Graham, later created Graham Manufacturing Company, which today remains a global supplier of condensers, ejectors, and other equipment.

The continued expansion of Elliott Company's product lines required additional engineering talent. To this end, W.S. Elliott established the Elliott Fellowship, the first graduate level assistantship for engineering students at Pennsylvania State University. The company also created an apprentice program for "fledgling engineers" just out of college. Beginning in 1921, the "boys" were rotated through shop and sales departments for a year in order to become thoroughly familiar with the business. The program was later extended to eighteen months. By 1940, 60 of the 82 men who had gone through the program were still with the company. Lawrence Forncrook, a member of the 1923 apprentice class, served as Elliott's President in the 1940s and sat on Elliott's board of directors for many years.



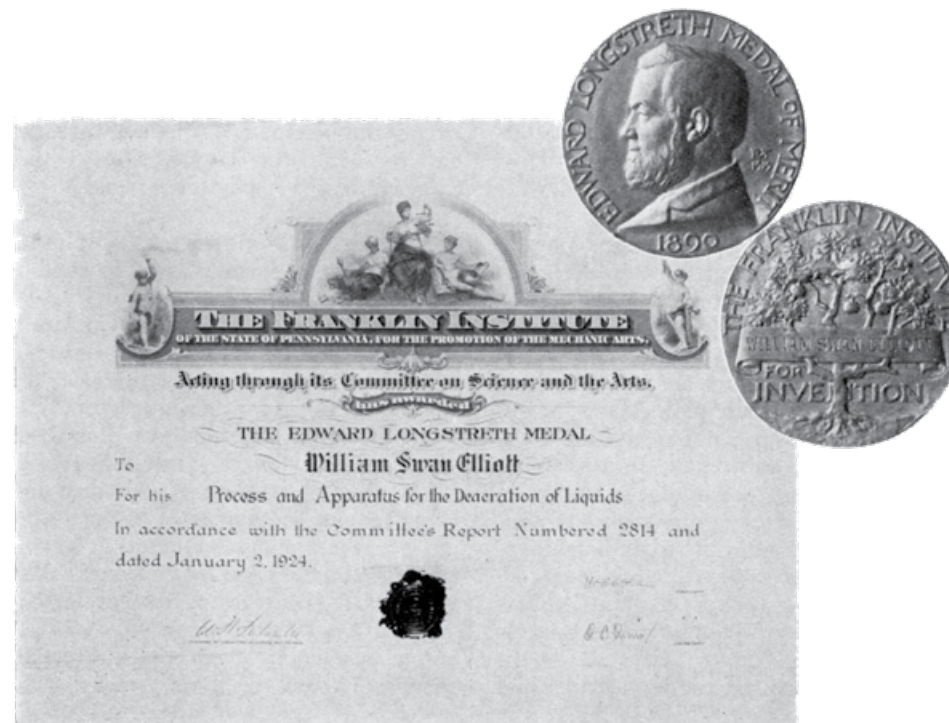
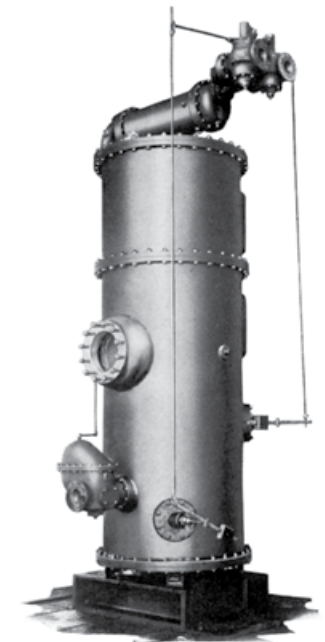
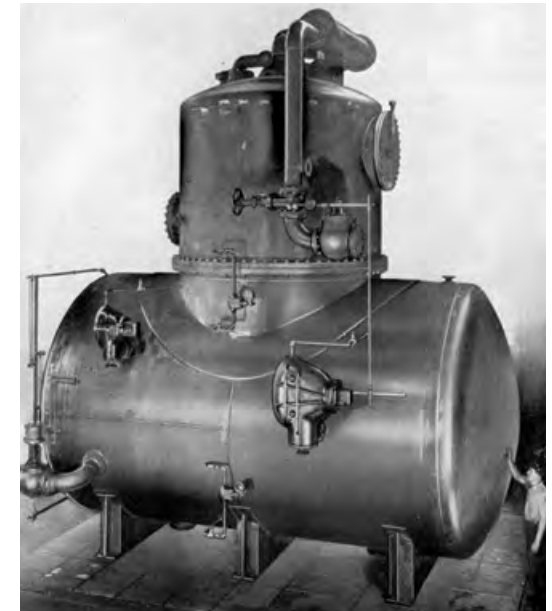


Deaeration: solving a knotty problem

Leave a glass of water to stand undisturbed and you will notice that bubbles often form on the inside of the glass. These are bubbles of air that is dissolved in the water and is released as the water warms. Dissolved air, particularly the oxygen in the air, is the primary cause of corrosion in boilers and hot water piping systems. W.S. Elliott noted in a 1915 patent application that “the air and other gases contained in steam and water cause boiler corrosion, and also corrosion of the valves, pipes, fittings, and other metal parts with which the water or steam come in contact.” Corrosion damage to boiler tubes, piping and shells was expensive and time consuming to repair. As boiler systems came to operate at higher temperatures and pressures, the corrosion hazard also increased, and the removal of dissolved oxygen, known as deaeration, became increasingly important.

W. S. Elliott was a leader in developing a solution to the problem of corrosion caused by dissolved oxygen. In 1914, he established a fellowship at Pittsburgh’s Mellon Institute of Industrial Research to investigate the problem. In 1915, he filed his first of several patent applications for a “water heater and degasifying apparatus.” One of the first recipients of Elliott’s research fellowship was John R. McDermet. Mr. McDermet had a very broad education, holding five degrees including Mechanical Engineering, Electrical Engineering and Civil Engineering. The result of J.R. McDermet’s and W.S. Elliott’s collaboration was an early “deaerator,” the forerunner of what evolved into a line of efficient and reliable Elliott deaerators and deaerating heaters. Deaeration became a standard practice that saved the industry millions of dollars by minimizing the corrosion of tubes, pipes and boilers. J.R. McDermet joined Elliott Company in 1918. He was soon named to head a new Heater Division at Elliott that included deaerators and deaerating heaters, as well as condensers and steam jet ejectors.

In recognition of W.S. Elliott’s leadership and the work done by Elliott Company in the field of deaeration, the Franklin Institute of Philadelphia honored Mr. Elliott in 1924 with the Edward Longstreth Medal for “The Invention and Development of Process and Apparatus for the Deaeration of Liquids.” Mr. Elliott was extremely proud of this award.



8 BILLION
GALLONS OF
WATER PER DAY
PASS THROUGH
ELLIOTT
TWIN STRAINERS

LIBERTY BOILER TUBE CLEANERS
OUR ORGANIZATION BUILDS 70% OF
THE WORLDS TUBE CLEANERS

WELT JET
ENSERS LIKE THIS
THICH WE ALSO
AND
TYPES

ELLIOTT COMPANY
POWER ACCESSORIES

SERVING THE
POWER PLANTS
OF THE NATION

THE ELLIOTT MARK
MEANS HIGH GRADE
DEPENDABLE PRODUCTS

ELLIOTT

CONDENSERS
AIR EJECTORS
DEAERATORS

TWIN STRAINERS
TWIN FILTERS
OIL FILTERS

COMPANY

OIL SEPARATORS
STEAM SEPARATORS
RECEIVER SEPARATORS

STEAM TRAPS
BLOW-OFF VALVES
FEED WATER HEATERS



Achievement and accolades

By 1920, W.S. Elliott had become a prominent and respected business leader in Pittsburgh and beyond. Western Pennsylvanians, a reference book published in 1923, noted that Mr. Elliott combined “a scientific calling with industrial interests and his efforts have been attended with unvarying success.”

Elliott Company employed 350 people in 1920, ten times more than when it had moved its manufacturing operations to Jeannette in 1914. Elliott advertised that it had sold 70% of the world’s tube cleaners. More than 8 billion gallons of water flowed each day through Elliott twin strainers. Deaerators were rapidly becoming standard components in electrical generating plants and other steam systems. Engineers from as far away as Japan studying heat balance and thermal efficiency of electrical power stations were “acquainted with Elliott Company as one of the best U.S. manufacturers of various heat exchangers and other equipment.”

Recognizing opportunities in the evolving technical needs of customers was a key factor in Elliott’s early success, as it is for Elliott Company today. Building upon the success of his boiler tube cleaner, W.S. Elliott and the engineers who worked with him developed or improved many products related to the evolving technologies of steam, and later, electrical power generation. During the course of his life, Mr. Elliott received more than 30 patents. His final patent for an “air conditioning apparatus” was granted following his death in 1935.

Known by his peers as “a man of vision, initiative and industry,” W.S. Elliott must have foreseen in 1920 the new challenges his company would soon pursue and the explosive growth that would ensue.



