A Jacksonville, Florida Historic Mechanical Engineering Landmark . . .

1917 Reynolds-Corliss Reciprocating Steam Engine and Water Pump

MAIN STREET PUMPING STATION - JACKSONVILLE WATER DEPARTMENT - 1917
OLD PLANT IN FOREGROUND - LANDMARK REYNOLDS-CORLISS ENGINE AND
ALLIS CHALMERS PUMP LOCATED IN THE BUILDING IN THE BACKGROUND.
VIEW LOOKING NORTH FROM HOGAN'S CREEK.

PRINTED IN HONOR OF THE OCCASION OF ITS

DESIGNATION AS A JACKSONVILLE, FLORIDA HISTORIC

MECHANICAL ENGINEERING LANDMARK BY THE

Northeast Florida Section

The American Society of Mechanical Engineers

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LOCAL HISTORIC MECHANICAL ENGINEERING LANDMARK
THE ALLIS CHALMERS WATER PUMP DRIVEN BY
A REYNOLDS-CORLISS RECIPROCATING STEAM ENGINE

During the period 1914 and 1917 Jacksonville undertook a water supply improvement program. Two Corliss steam engine driven water pumps were installed. The first five million gallons per day pump, manufactured by Epping-Carpenter Company, was installed in 1915 and was operated until its removal in 1956. The second pump, the ASME Historical Landmark, was developed by American engineering pioneer Edwin Reynolds at the Allis Chalmers plant in Milwaukee. The landmark was installed during the year 1917 in the Jacksonville Main Street water pumping plant located at Main Street and Hogan Creek in downtown Jacksonville, Florida. The cover photograph shows the plant with the Reynolds-Corliss steam driven pump located in the original building on the right. Steam engine operation was discontinued in 1956. This Allis-Chalmers Reynolds-Corliss engine driven pump remains today in this plant as a mechanical engineering landmark.

The Reynolds-Corliss engine is a unique landmark because the pioneer engineering work of Edwin Reynolds during the last quarter of the nineteenth century was undoubtedly the predominating influence in the development of the reciprocating steam engine in America. Corliss' basic patent was issued in 1849 and exclusive rights to manufacture engines embodying his patents expired in 1873. By 1878 the world famous Reynolds-Corliss engine went into manufacture. Reynolds designed a valve mechanism which had several distinct advantages over the releasing gears previously employed. The leverage of the releasing mechanism was constant so that the reaction on the governor was the same at all points of cutoff. The gear was more quiet and could run at much higher speeds. By 1885 more than 500 had been sold and this created a furor in American industry.

The ASME History and Heritage Program is dedicated to the preservation of noteworthy mechanical engineering landmarks such as the Reynolds-Corliss engine located in the Jacksonville Main Street pumping plant because it represents an era in our Country's history which should be retained for future generations to observe.

The photographs show the "landmark" arriving in Jacksonville and being transported by "horsepower" and "manpower" in the year 1917. Other pictures show the erection on its present foundation together with details of the engine itself.

No landmark machine is without human significance, and Edwin Reynolds was a giant in his time. By 1890 the Society of Mechanical Engineers was devoting entire sessions for study of the engines produced by Edwin Reynolds.

John M. Crump
Chairman
Northeast Florida Section, ASME

Tom Bostwick
Chairman
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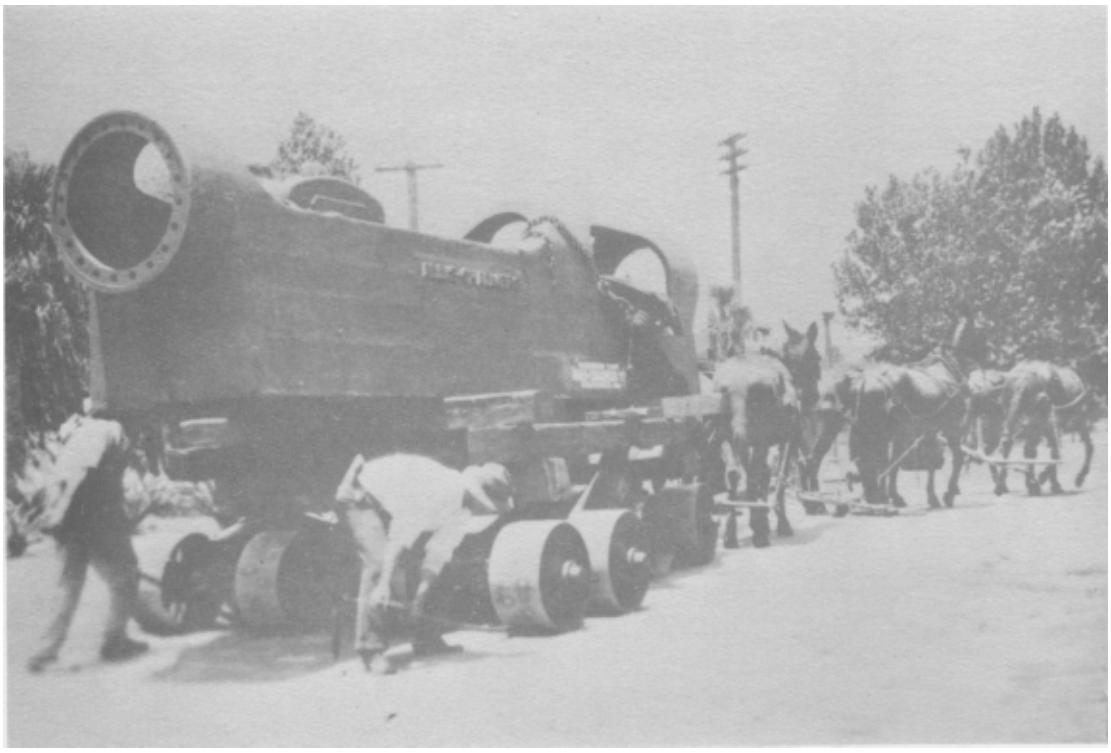
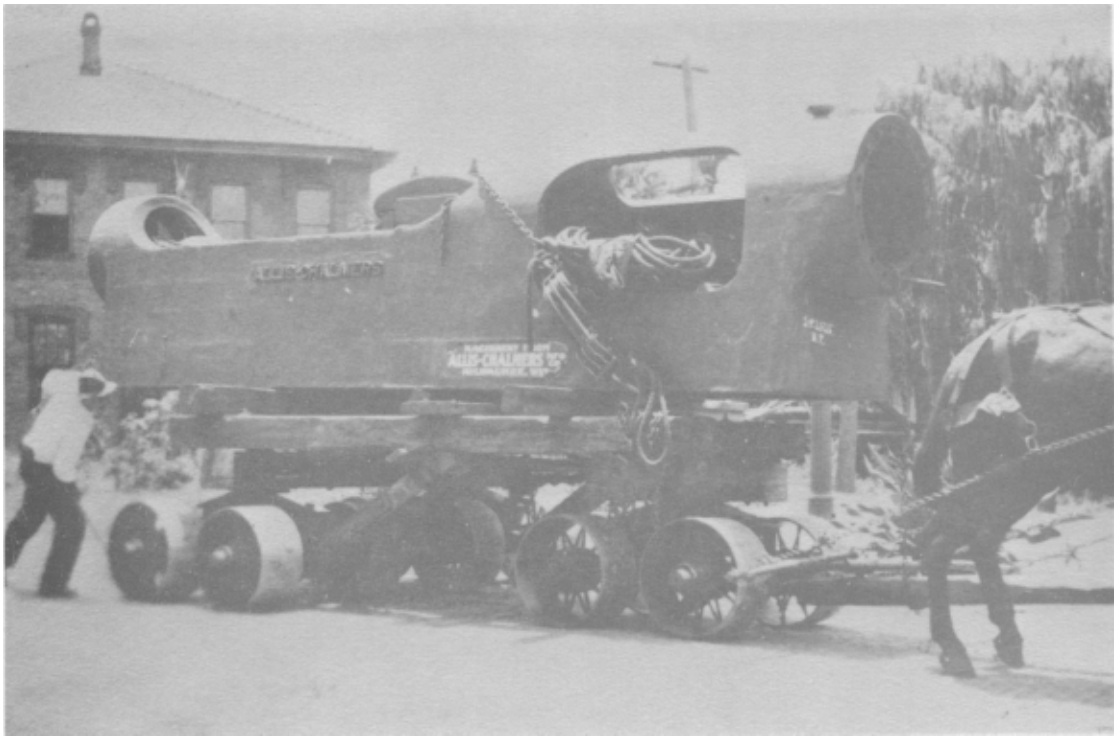
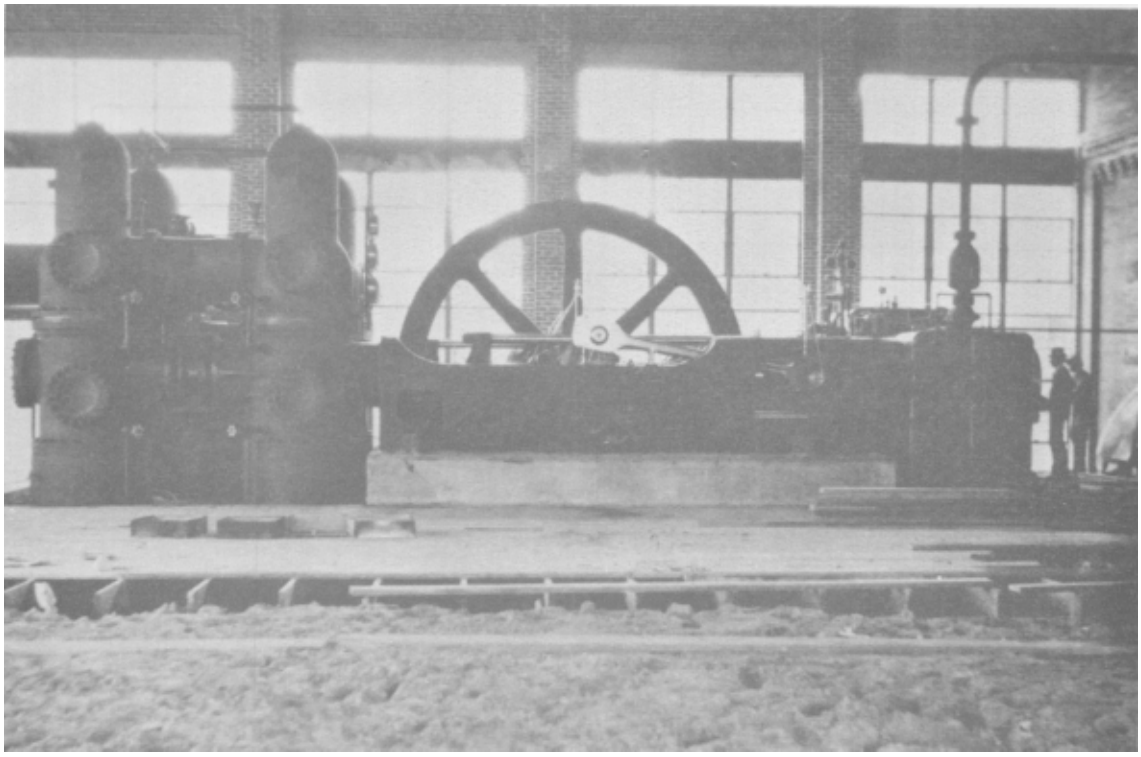


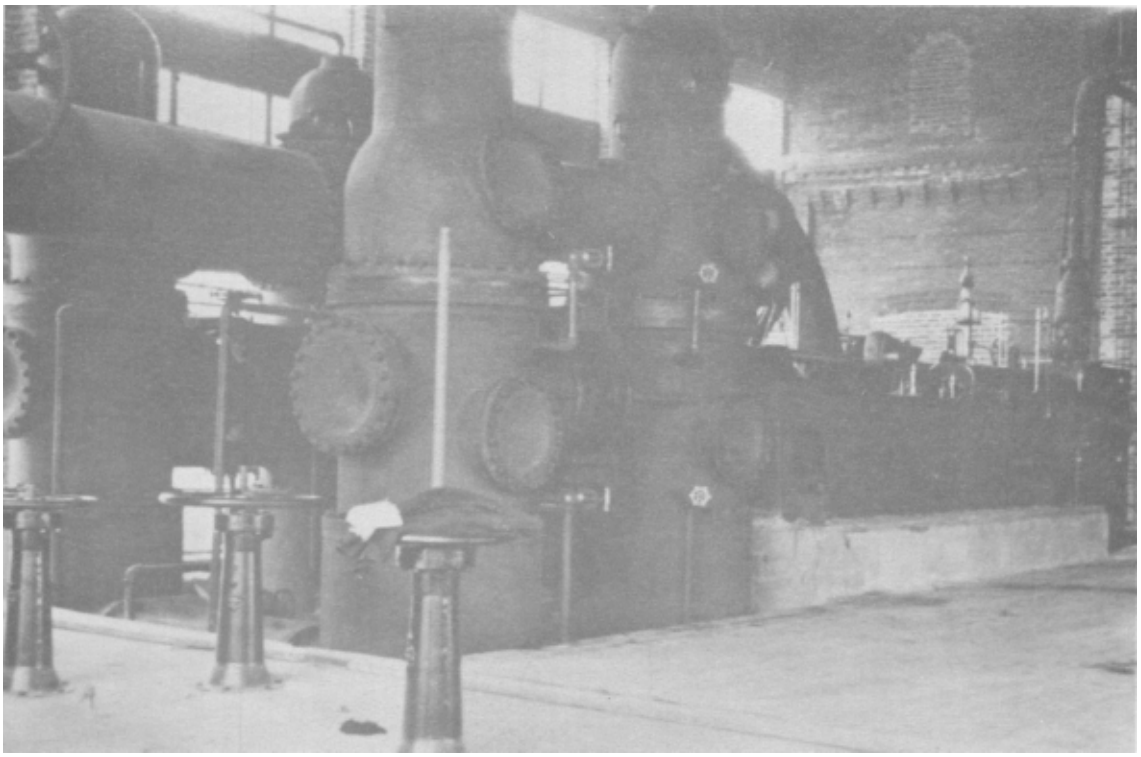
MANPOWER PLUS HORSEPOWER MOVED HEAVY PUMP FRAME IN 1917.
ALLIS CHALMERS 5 M.G. PUMP BEING BROUGHT TO SITE.



MAN BRAKES HEAVY PUMP FRAME WHILE MULES REST 1917.

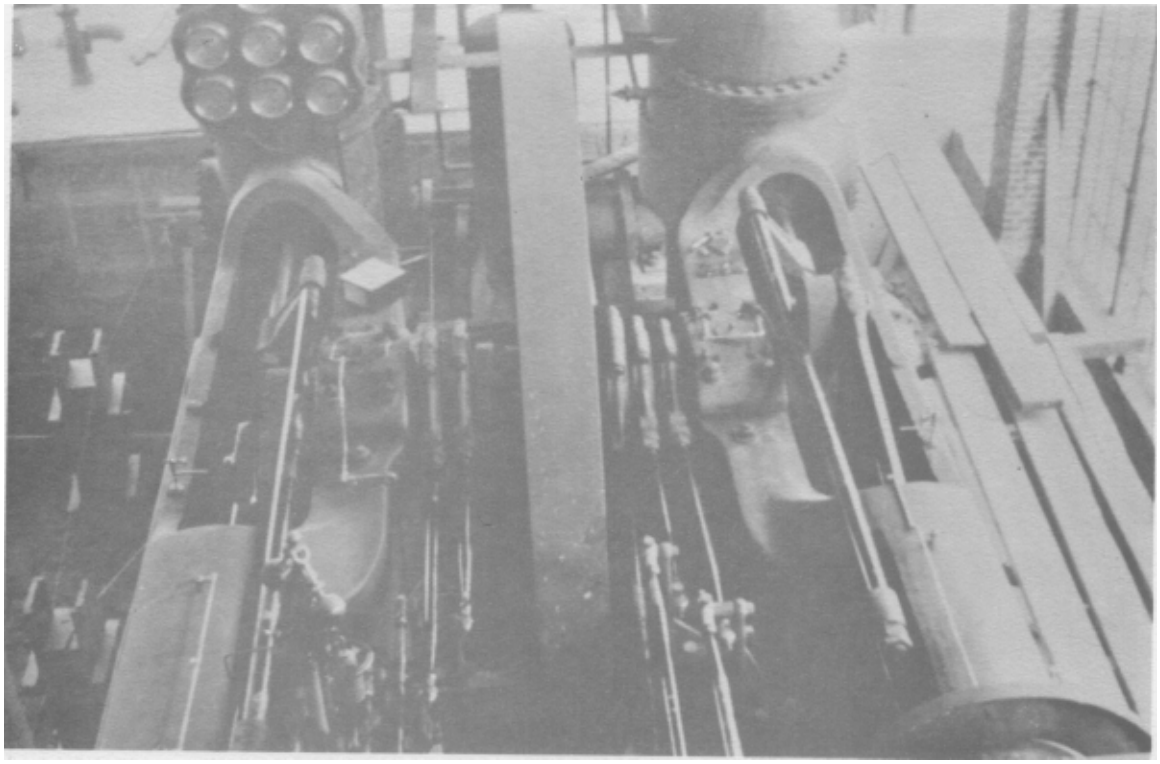


FOUNDATION BEING PLACED FOR ALLIS CHALMERS PUMP.
VIEW LOOKING SOUTH WITH EPPING-CARPENTER PUMP IN BACKGROUND. JUNE 1917.

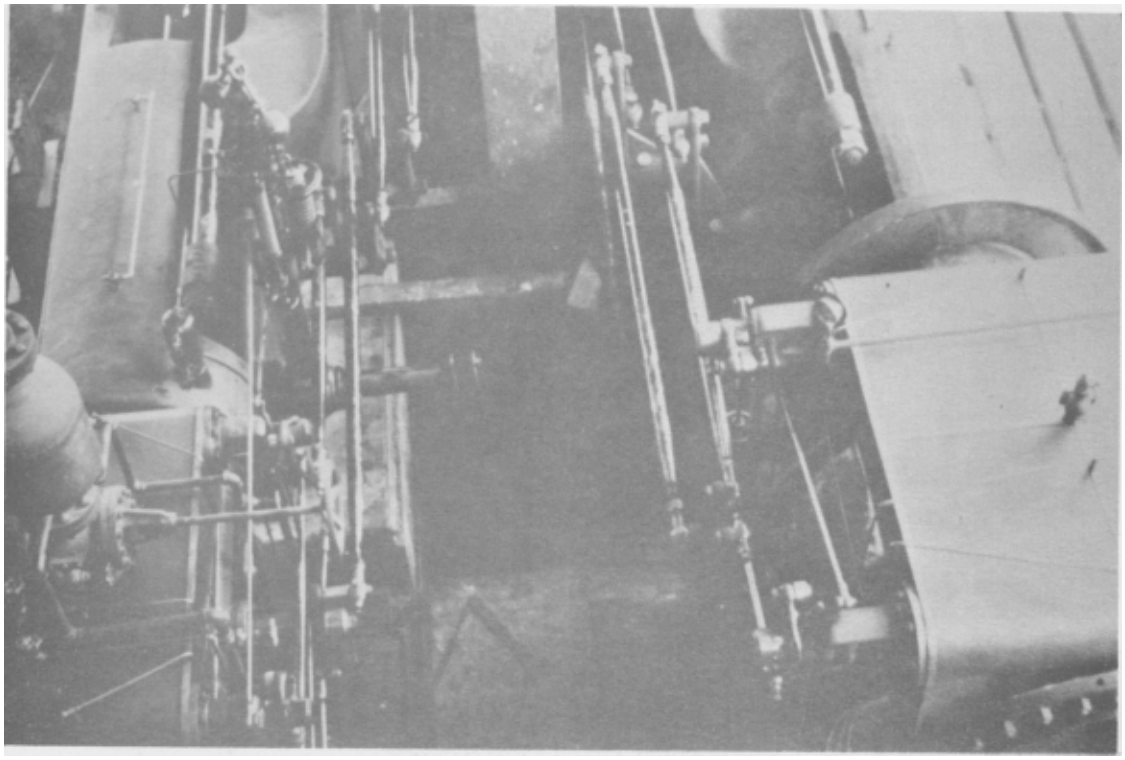


EPPING-CARPENTER PUMP INSTALLED.
INSTALLED AND OPERATING IN APRIL 1915. THIS PUMP HAD A CORLISS ENGINE.
BOTH PUMP AND ENGINE HAVE BEEN REMOVED FROM PLANT.

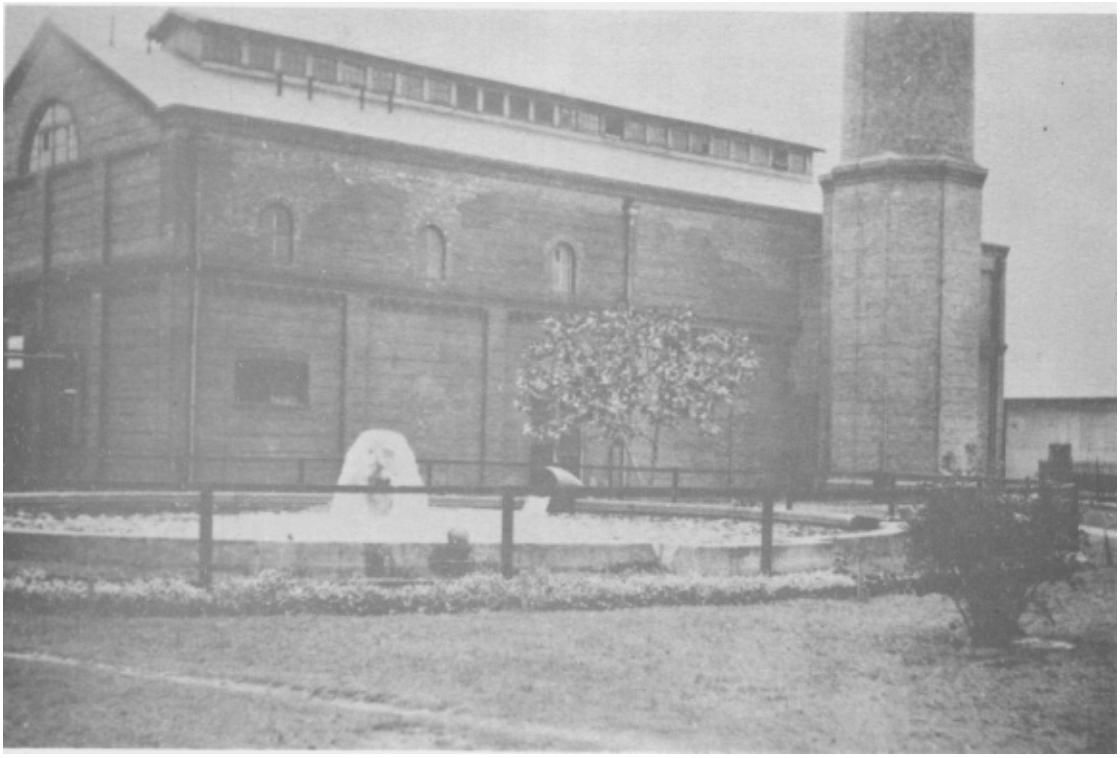
OUTSIDE VIEW OF BOILER ROOM.
NEW PUMPING STATION GROUND BEING PREPARED IN 1914.



VIEW LOOKING DOWN ON FLY WHEEL, VALVE GEARING
AND CONNECTING RODS TO CORLISS ENGINE.



VALVE GEARS ON ENGINE.



OLD NORTH AERATING BASIN – 23 JUNE 1914.
WITH FREE FLOWING ARTESIAN WELL IN CENTER.

Edwin Reynolds

He opened the door to new progress in iron and steel

Seated at his desk in the Reliance Works, Edwin Reynolds appears relaxed, although he was extremely dynamic.

When America's iron and steel industry was beginning its first big expansion to meet-the demands of an increasingly mechanized economy, Allis-Chalmers engineering had great influence on the course of iron and steel progress. One man — a giant in his time — set the pace.

Development of the Reynolds-Corliss reciprocating steam engine and the steam driven blowing engine with metal valves by Edwin Reynolds — for more than 30 years unquestioned dean of America's engineers — revolutionized the iron and steel industry. The engine's radical and sound design was speedily acclaimed and adopted, and before the turn of the century A-C reciprocating steam-driven blowing engines were almost universally used in the rolling mills and blast furnaces of the nation's steel mills. Later they were supplemented and superseded by the A-C gas-driven blowing engine, then steam turbine-driven axial and centrifugal blowers.

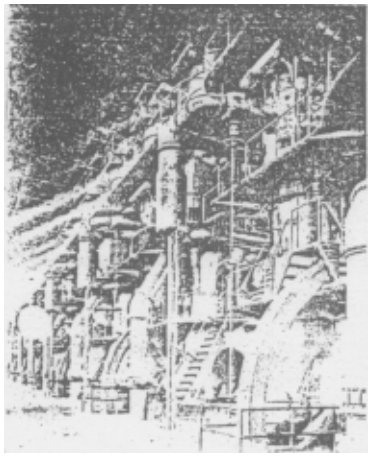
As the iron and steel industry today girds itself to reach the new production highs our economy demands, Allis-Chalmers is well prepared to help iron and steel meet its goals. That's the way Reynolds would want it to be.

Reynolds was hired in 1877 by Edward P. Allis to be superintendent of the E. P. Allis & Co.'s Reliance Works. He later became vice president, general superintendent and a director. When the Allis-Chalmers Co. was formed in 1901 he became chief engineer, a role in which he embodied many of his original functions. But whatever his title, his sheer genius as an engineer led him and the company down paths of development and service to industry which were virtually uncharted in those times.

American industry in the years of Reynolds' early professional career was only a few decades removed from a largely handwork economy — an economy in which Reynolds had his roots.

Born in 1831 in Mansfield, Conn., the world of young Reynolds was one in which there was little to stimulate a man to engineering. At 16 he became a machinist's apprentice and after three years he took a journeyman's tour of lower New England shops, only a year before George Corliss took out his two basic patents on the Corliss engine — opening up a world of promise for a machine economy.

Reynolds turned his hand to whatever was offered in his field. He helped build sawmills and drainage pumps from New England as far west as Mississippi. He served as superintendent for the Aurora (Ind.) firm of Stedman & Co., builders of engines, sawmill machinery and drainage pumps. He helped John Ericsson build the ironclad Monitor, which, with the Merrimac, ushered in the age of armored battleships.



Blowing engines like these set the pace in American industry. Shown are steeple-type units at the central furnace of the American Steel & Wire Co., Cleveland, Ohio.

Came to Providence

This kind of career, which lasted 16 years, eventually brought Reynolds at 36 to the Corliss Engine Works in Providence, R. I. and his lifework began. Here was engineering at its best for its times — shop engineering, practical engineering, trial and error engineering —but engineering nevertheless, and a sterling foundation for the man who was to stand head and shoulders above them all.

Reynolds' Innovations Were Many

In four short years Reynolds was named superintendent of the Corliss Works — and in those days "superintendent" meant almost everything or anything.

Six years later, when Reynolds answered an advertisement by Allis for a "superintendent" at the Reliance Works, the word implied responsibility for all engineering and manufacturing — and sales to a large extent.

The record shows that Reynolds left his post at Corliss to join Allis at a lower salary. But there is also ample evidence that Allis was a pioneer in management, a man with a dream, just as Reynolds was a pioneer in American engineering. In an atmosphere of freedom for growth and inquiry, gifted men worked with enormous creativity with E. P. Allis, the hardest working man of them all. Such an arrangement must have appealed to Reynolds.

Saw Market

He also realized, with an acute business perception, that the midwest was wide open for an economical steam engine. Up to the time Allis engaged Reynolds, most steam engines were of the slide valve type, using about 40 lbs of steam per horsepower per hour. The Corliss engine had a steam consumption of 26 lbs, or 35 percent better than the old slide valve units.

Corliss' exclusive right to manufacture engines embodying his patents expired in 1873, after about 24 years of manufacturing. By 1878 the world famous Reynolds-Corliss engine went into manufacture at Reliance Works, where Reynolds had expanded the plant's equipment so that it would be adequate for all the activity he envisioned.

Corliss' basic patent, issued in 1849, consisted of two claims. The first covered a toggle motion (later known as a wrist plate) for operating four slide valves. The second claim covered the method of regulating the motion of steam engines by means of the centrifugal regulator — by combining the regulator with catches that liberate the steam valves; and by means of movable cams or stops.

Corliss was the first to combine the two mechanisms. Reynolds took the development even further. He designed a valve mechanism which had several distinct advantages over the releasing gears previously employed. The leverage of the releasing mechanism, for example, was constant so that the reaction on the governor was the same at all points of cutoff. The gear was more quiet than previous developments and could be run at much higher speeds.

The Reynolds-Corliss engine created a furor in industry and by 1885 Allis had sold more than 500. So great were the fuel economies that early promotion declared the sale price to be the equal of the fuel saving over a period of 300 to 500 days. In some instances, old model engines were accepted as trade-ins.

As it worked out, the fuel saving was greater than the list price, so deals after the first few sales were made on a more standard basis.

During the busy, creative years, Reynolds took out some 48 patents, although the success of the Reynolds-Corliss engine would have insured him a niche in industry's hall of fame. His ideas for improving machines or devising entirely new types of equipment seemed inexhaustible. His associates said that he often declined to accept a solution arrived at earlier, but would start again with the basic facts and seek the answer through other channels — often coming up with amazing, audacious conclusions.

He turned his nimble mind to the problems brought to the company by steel mills, iron mines, pumping stations and municipal traction firms. The nation was hungry for power — big power — and blowing engines, rolling mill engines, air compressors, centrifugal and screw pumps, and horizontal-vertical engines were only a few of the power applications which were improved by his original touch. Time after time his unusual solutions were questioned, but each time the performance proved better than the promise. By the '90's the Society of Mechanical Engineers was devoting entire sessions to the engines produced by Reynolds and his staff.

Had Steel Valves

In 1880 came blowing engines for blast furnaces and Bessemer converters at the Joliet (Ill.) Steel Co. and Edgar Thompson Steel Works at Pittsburgh, now part of U. S. Steel. These engines were built with steel valves instead of the leather valves commonly used and they proved to be the most economical ever applied up to the time for this service. They revolutionized construction of blowing engines and air compressors.

The '80's also saw development of girder frames for Corliss engines and wrought iron frames for engines whose size was too great for girder frames.

In 1883 two pumping engines for the City of Allegheny (now part of Pittsburgh) presented another innovation. The engines were of the vertical, three-cylinder, compound type, with steam cylinders at floor level on the base plates, and the crank shaft and flywheels overhead. The pumps were single-acting, outside-packed plunger type, each plunger being directly connected to the piston rod of the steam cylinder above it. The engines marked the first departure from the conventional municipal type which used some form of working beam or bell crank. The principles applied here later were employed in other pumping engines.

Next year saw the construction of the largest centrifugal pump in America at the time. Built for the City of Milwaukee, it had a capacity of 70 million gallons a day against a 15-ft head. The 12-ft diameter pump impeller was driven by a tandem-compound Reynolds-Corliss engine directly connected to the vertical pump shaft.

In quick succession came a 40 by 60-in. piston valve rolling mill engine which operated at 110 rpm, driving at the Joliet Steel Co. the finishing rolls of the first continuous roll in America. The equip ment operated at the exceptionally high piston speed of 110 ft per minute. This development opened the door for a healthy rolling mill engine business.

Pump was Forerunner

Then came hoisting engines, steam stamps and screw pumps. The screw pump, used at low head to flush out the Milwaukee river, was the forerunner of the screw-type hydraulic turbine developed later. Other developments were electric cranes — the first in America — and mine pumps, heavy duty engine frames, and by 1892 engine-type generators.

Previous to 1892, driving of electric generators from engines of Corliss or other slow speed types was done by belts to line shafts. But so successful were two horizontal, cross-compound generators with the generator spiders mounted directly on the engine shafts that the Allis practice became general.

He Had Soft Spot, Too

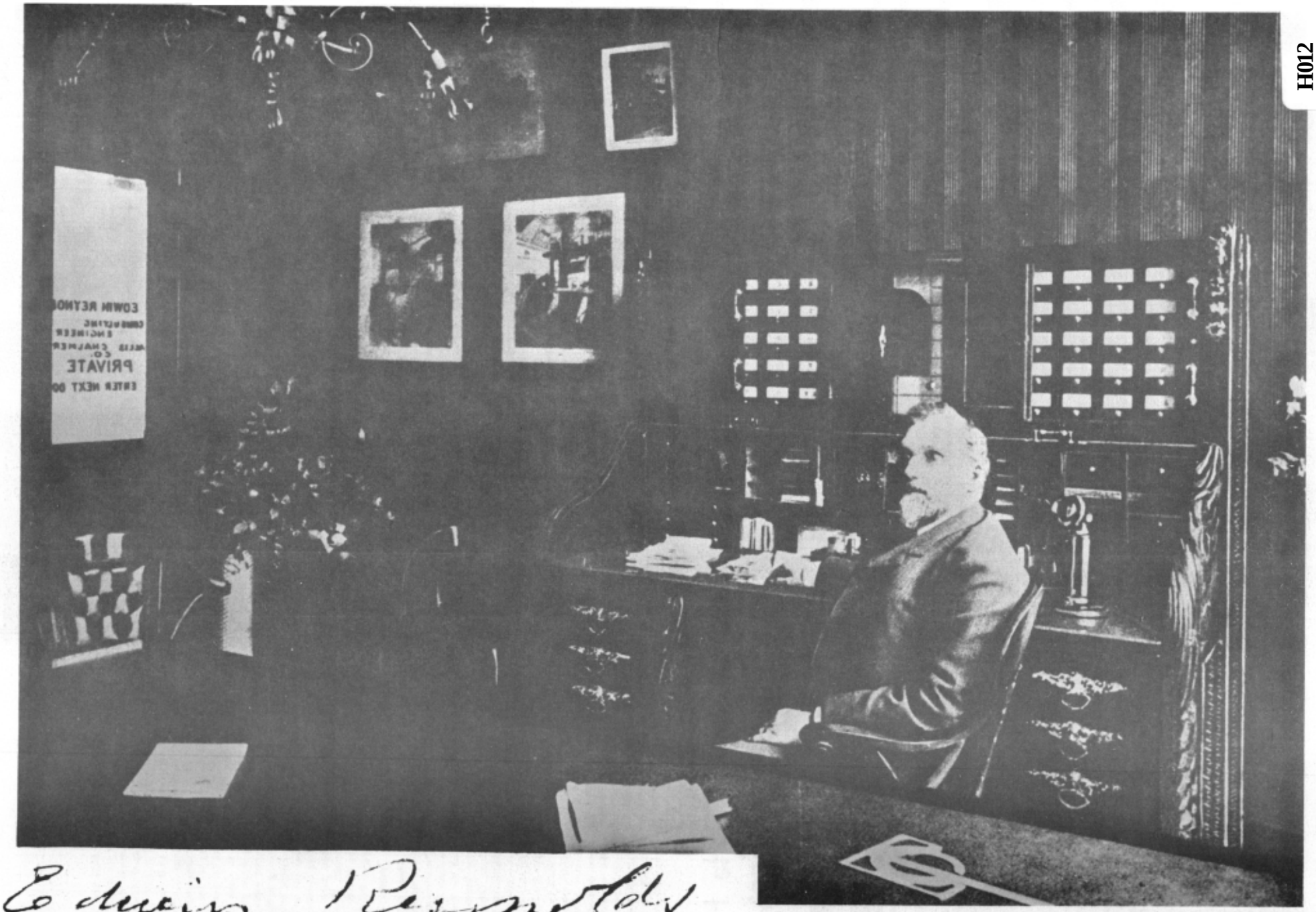
The equipment was built for the Narragansett Electric Co., of Providence, R. I.

Before leaving the story of Reynolds we cannot overlook his development of the angle compound steam engine. He built an engine for lighting the Columbian Exposition in Chicago in 1898 and also a 5000-hp unit, combined with a Bullock (later Norwood Works) generator for supplying all the decorative lighting at the St. Louis Exposition in 1905.

In order to provide power for transportation in New York City alone, 47 Allis engines were installed in three power plants. The aggregate horsepower was over 320,000, with the largest of the engines rated 12,000-hp each. Other engines were installed in power plants all over the world.

Reynolds in time became consulting engineer for Allis-Chalmers, but as his health failed he became less active, retiring in 1906, three years before his death. The big new West Allis Works was in operation before he laid down his responsibilities, but he never headquartered in West Allis.

Until the end of his career his desk remained at the original Reliance Works — a reminder that this devotee of the new had a soft spot in his heart for the old. The desk was a gift from the ASME and was made of carved Honduras mahogany.



Edwin Reynolds

Edwin Reynolds posed for this picture in his office in Old Reliance Works. The handsome carved desk of Honduras Mahogany was a birthday present to him from The American Society of Mechanical Engineers of which he was president at the time. The 1902 Reynolds-Corliss Engine Catalogue reproduced the picture.