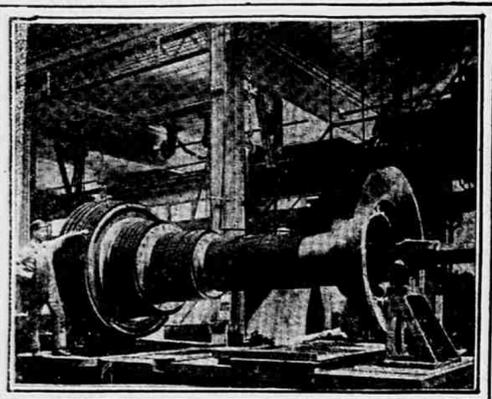
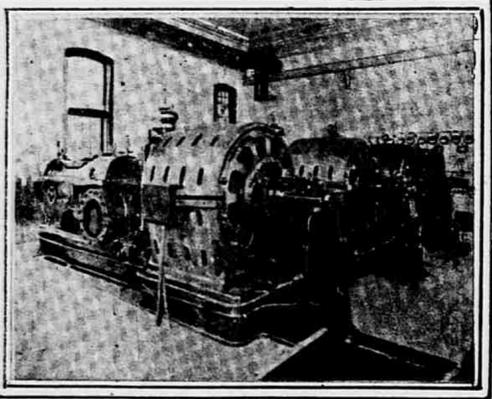


DELAY OF CENTURIES IN STEAM TURBINE DEVELOPMENT.

How the Present Furor It Has Created Was Brought About After a Romantic History.



ROTATING ELEMENT 2500 H.P. OF WESTINGHOUSE STEAM TURBINE.



TURBINES CONNECTED WITH ALTERNATING CURRENT GENERATORS

WRITTEN FOR THE SUNDAY REPUBLIC.

It is indeed remarkable that the development of the steam turbine engine should have been so recent when it is considered that it was the earliest type of steam engine recorded in history.

There are two types of steam engine employed at the present time—the rotary and the reciprocating engine.

The turbine is at present creating a mild furor, and much discussion among mechanical and electrical engineers, for it seems destined to replace the reciprocating engine, which has been our principal steam prime mover since the days of Watt.

The history of both these engines is interesting, but that of the turbine especially so—ever romantic.

The turbine dates back to the time of Hero, who is credited with having invented not only the first rotary engine, but the first engine of any type.

The date of Hero's invention of the utilization of steam as a motive power is given as 120 B. C., and the place of its birth was at Alexandria, ancient Egypt, which at that time was the mighty seat of learning and the very hub of civilization.

It is undoubtedly true that Hero's first engine was a mere toy, a plaything compared with the gigantic turbines of today.

Even at that remote period it found its application, for it was employed by the alchemists, who operated mechanical apparatus with it, doubtless to the wonderment and mystery of all who might perchance behold its operation.

Now, the rotary engine of Hero consisted merely of a copper sphere mounted on trunnions.

At its equator it had two pipes, bent in such a manner that when the sphere was revolved it was filled with steam, which the steam generated would be emitted from the bent pipes, and, impinging upon the air, reacted on the sphere, thus causing it to revolve at a high velocity.

For this reason Hero's engine and those constructed upon this principle are called reaction steam turbine engines.

But there is another type of steam turbine, and the modern turbine machine, for utilizing the tension of steam and making it do work, in a very different manner, is called an impulse turbine.

The development of this beautifully simple device seemed simultaneously with the advent of the reciprocating steam engine in 1765.

Since that time until a few years past—not more than twenty-five—nothing was accomplished toward making the turbine a commercial machine.

The reciprocating engine originated with Newcomen.

It consisted essentially of a boiler for the generation of steam and a cylinder for the application of the steam tension to a piston.

When the end of the stroke was reached the steam would be made to flow back again, and so turn a wheel attached to the piston. This was done by hand until Watt perfected the engine by making it automatic—that is, when the piston was forced down the steam was shifted without the aid of human hands.

The modern reciprocating steam engine is developed acting—that is, steam is admitted alternately above and below the piston and is accomplished by means of a sliding valve.

In modern turbines and in reciprocating engines when the steam is forced out of the exhaust after it has been used it has to overcome an atmospheric pressure of fifteen pounds to the square inch, and such engines are known as noncondensing engines, easily recognizable by the escape of steam in puffs.

These engines usually operate at high pressure, and locomotives are high-pressure, noncondensing engines.

In condensing engines the steam is condensed in the exhaust pipe to a chamber called the condenser, steam from the cylinder and a spray of cold water being admitted at the same time a vacuum is formed, and the loss of energy due to the atmospheric pressure is avoided.

Steamboat engines are generally condensing engines.

structure and the problem of converting all of the heat energy into mechanical energy, and the thermodynamic conversion of energy, as the engineer terms it, in the reciprocating engine is not much nearer solution to-day than when Watt perfected the engine; in other words, the reciprocating engine is very wasteful of energy.

PRESENT FORMS PERFECTED.

The conversion of heat energy into mechanical energy in the Watt engine is accomplished by permitting the steam to expand behind the piston, and, while not utilizing its kinetic energy—the energy of motion—subjects it to a resistance corresponding with pressure.

Builders of steam engines have long since recognized and understood the defects and the improbability of further improvement in the reciprocating steam engine, since improvements during the last two hundred years have been mechanical, and although these have, of course, added mightily to the effectiveness of the engine as a heat motor, it is far from ideal.

There are, however, difficulties and difficulties, inventors have wrestled with the problem of utilizing directly the heat energy which would approach more closely to the ideal, and in this they found a large field of promise in the fundamental principles of Hero and Branca relating to turbines.

Although work along this line has been in progress for some years past, the first turbine to be built and commercially operated as a competitor of the reciprocating engine was that of De Laval, who made and operated a small steam turbine in 1883 after the plans of Hero's reaction engine.

This he connected to the shaft of a cream separator, a mechanism requiring high speed.

Parsons of England, brought out in 1884 the first multiple expansion turbine and formed a combination of the reaction and the impulse type of turbines.

Parsons' turbine evolved 15,000 per minute and was directly connected to an electric light dynamo used for lighting the factory in which it was run.

While these turbines are characterized by simplicity of construction, directness of energy conversion and producing complete expansion, conditions which have never and can never be obtained in the reciprocating engine, the gigantic difficulty in the way of the commercial utilization of the turbine is principally due to its enormous high speed, since the periphery, or rim, of the wheel sometimes attains a velocity as high as 1,200 feet per second.

This turbine is of 2,000 horse power is built in 1884, the manufacture of the Parsons turbine has been on the up-grade and ever increasing in number.

An immense impetus was given to the industry, when, in 1884, the 2,000 horse power turbine built in its trial heats its marvelous power, and this was followed in 1887 by the phenomenal record run of the Viper, a British destroyer, equipped with turbine engines amounting to over 10,000 horse power, and which obtained the phenomenal speed of forty-three statute miles per hour.

The turbine drove eight propellers, and the whole equipment was contained in a vessel measuring only 210 feet long and 21 feet beam.

OTHER TURBINE FORMS.

The Coburn, another turbine destroyer built on the same general lines as the Viper, was successfully operated, but owing to the frailty of the craft they were unable to withstand the tremendous strain and were finally lost.

The Parsons marine turbine has proved one of the most practical forms of the steam turbine, combining as it does the reaction and the impulse types of rotating elements.

In this country the rights of the Parsons turbine have been acquired by the Westinghouse Company.

The Westinghouse Air Brake Company, at Wilmering, Pa., put into service the first turbine engine in America, and in connection with it does the reaction and the impulse system replaced entirely the original reciprocating engine plant of the works.

The Parsons turbine equipment has been installed at Hartford, Conn., and has caused much comment on account of its enormous size and the satisfactory results secured.

It has been shown that for a powerhouse where an equipment of 1,000 horse power is required, the cost of the engine-room, including real estate and buildings, is for a turbine outfit less than half as much as for a horizontal Corliss and two-thirds as much for a vertical engine.

The compactness of the steam turbine is

WORLD'S LARGEST STORE AS SEEN BY FRANK CARPENTER.

MOSCOW BAZAAR, WHICH COVERS TWENTY ACRES AND HAS A THOUSAND DEPARTMENTS, COST \$8,000,000.



MOSCOW'S \$8,000,000 BAZAAR. IT CONTAINS 1,000,000 SHOPS.



INSIDE THE LARGEST STORE OF THE WORLD



RAPID TRANSIT IN MOSCOW.



IN THE OPEN AIRMARKET.

Special Correspondence of The Sunday Republic.

Moscow, June 30.—The biggest store in the world under one roof is in Moscow.

It is situated close to the Kremlin, under the shadow of some of the oldest and holiest churches of this holy city.

It is a great stone building with roofs of iron and glass, covering at least twenty acres, and embracing 1,000 different business establishments.

I have called it a store.

It is rather a collection of stores, for each establishment has its individual owner, who rents of the syndicate which constructed the building.

It is a gigantic department store, or bazaar, under a thousand different heads, selling all kinds of goods and carrying on every kind of business.

I have seen the bazaars of Cairo, Calcutta and Constantinople.

The most of them are rude sheds, or caves in the walls of narrow streets, roofed with matting.

This bazaar is in one of the finest buildings of glass above the city.

It has been erected within the past few years, and with the ground upon which it stands has cost the enormous sum of \$8,000,000.

This is one-third more than our National Library building at Washington, and many times more than any business establishment of the United States.

I have spent days in wandering through this mighty bazaar.

The twenty acres represent only the ground floor. The building is of three stories.

It is divided up into streets, crossing one another at right angles, with mighty arches of glass above them.

Along the streets are booths with plate-glass windows, and over them two galleries, representing the second and third stories, each lined with stores.

The basement is a vast catacomb of stores and the whole might be compared to a beehive, each cell filled with the treasures of Europe, Russia and the Far East.

The stores are not the little cavetto holes in the wall which form the Oriental bazaars.

Many of them would be respectable in the great cities of the United States, and were they situated on Broadway or Twenty-third street, New York, they would catch the attention of the passerby for their costly goods and fine window dressing.

You would lose the idea that the Russians are a poor nation and see something of this enormous market for our American goods. The merchandise offered is worth many, many times the cost of the building.

It amounts to tens of millions of dollars, and a vast part of it is made up of goods from Europe.

The Germans, the French and the English have contributed to fill it, and it is only now and then that you see anything from America.

I should like to show you the prices. They are far above those of our country or the other countries of Christendom and the goods are of the costliest description.

Indeed, one of the best openings for American capital is in founding department stores in Europe.

I understand that John Wanamaker, Siegel & Cooper and others are thinking of establishing them in London, but they would pay almost equally well in all the European capitals.

Paris is the only one that has any art in it. It has the Bon Marche, the Louvre and Au Printemps, together with some smaller establishments, all of which are making money.

I have written of the two Berlin department stores, Wertheim's and Tietz's, both of which are doing an enormous business, but there is room for more.

Russia is peculiarly well fitted for such stores. Its people are rather Oriental than Occidental.

They are used to the great bazaars, and a department store is only a bazaar under another name.

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Moscow is the commercial capital of Russia. Its business is scattered, and I have walked myself tired in going from one commercial quarter to another.

Many new stores are going up, and in some American elevators and others of our inventions are being introduced.

There is one store here which sells nothing but American goods, and, strange to say, it belongs to an Englishman, who has made a fortune in dealing in our specialties.

His name is Hisek, and he has been doing business in Russia for the past twenty years.

He started as an agent of the Fairbanks, and pushed them so that the government adopted them and made them the standard scales of Russia.

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Such books are private, but they can be called for by order of the court.

According to law a Russian clerk cannot carry on any business of his own or that of any other person except his master's.

His employment is after special contracts, which must be written, and if he breaks them he is responsible to his master for any loss or injury through competition caused by him.

The clerk can be fined to the amount of \$50 and imprisoned for three months in such an event.

Every clerk must within a month after the end of each year give an account of his work to his employer and he is responsible for all damages premeditated or brought about by carelessness during his service.

This includes bookkeepers, correspondents, salesmen and workmen.

A vast deal of Russian business is done by peddlers, who carry the goods from village to village in wagons and trade them for grain, eggs, flax, hemp and wool.

There are many peddlers with packs on their backs both in the cities and in the country and there are open-air markets in the cities every Sunday, where these peddlers congregate, selling all sorts of things.

I have attended some in St. Petersburg and I find large ones here in Moscow.

The Sunday market in Moscow begins early and closes about 2 o'clock.

I visited the market the other day. There must have been something like a thousand merchants, each selling his own kind of wares.

There were hundreds of boot and shoe stores. The goods were homemade and most of them cheap. They were hung from racks or placed on low tables.

The shoe merchants were long-coated, high-boiled men with caps.

They tried the shoes on their customers out in the broiling sun and then dickered with them as the price.

They had brushes and kept brushing the caps to call the attention of the crowd.

The purchasers tried on the wares without the aid of a mirror, the only question being that of fit, for the same kind of cap is used all over Russia.

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There is little business done after dark, but the light lasts so long in the summer that it is full day until long after 9 p. m.

The Russians are babes as stock speculators. They have just begun to monkey with the buzz saw, and are afraid of its teeth.

They are conservative and prefer to put their money into the imperial savings banks or Government bonds.

They have at present about \$400,000,000 so invested, and without they can make 20, 30 or 40 per cent per annum outside they will not subscribe.

They are afraid of new institutions, and no American need expect to come here and start an enterprise based on Russian capital.

He must furnish enough to make the business pay, and he then may be able to sell his stock.

IN THE MOSCOW STOCK EXCHANGE. I visited the Moscow Stock Exchange the other day.

There were about 500 brokers present, but the crowd looked more like one of farmers than of bankers and brokers.

The most of the men wore caps and long overcoats.

Many of them were merchants, a few were Chinese, one was a Persian and several were Armenians.

The trading was slow, and there was more gossiping than selling.

The stock companies here are operated with foreign capital.

The French have invested most, next the Belgians, then the Germans and then the English.

The Americans are far in the rear. The French and Belgians are operating chiefly in Southern Russia, the Germans more in Poland and the territory opposite the German frontier, while the English have their money pretty well scattered.

The total number of stock companies is 1,784, and the share capital is a little more than \$1,000,000,000.

The companies cover all branches of industry.

Twenty-eight of them have from mines of about \$30,000,000, and among these is the first foreign joint stock company of the Empire.

This was organized by an Englishman named Youth with a capital of \$1,000,000 to operate coal and iron mines in the south. It has had an enormous success, and it now employs 10,000 workmen.

There are nine companies interested in gold mines, with a capital of \$25,000,000, forty-two in petroleum wells, with a capital of about \$60,000,000, and thirty in coal mines, with a capital of about \$30,000,000.

The largest industry is cotton, embracing clearing, spinning and weaving mills.

It is operated by 138 companies, with a capital of more than one hundred millions.

There are sixty-eight woolen companies, twenty-five linen companies, twenty-nine breeding companies and 128 sugar refineries.

The most of these companies are doing well, and many of them pay very large dividends.

FRANK G. CARPENTER. Copyright, 1903, by F. G. Carpenter.

WHAT WE EAT.

In German markets California prunes and apricots are rapidly supplanting the products of France and Italy.

California fruit is cheaper and its flesh brighter and more solid.

Americans consume twelve pounds of coffee per capita in a year.

Danes and Norwegians use more. England being a tea-drinking country, uses less than three-quarters of a pound.

The Agricultural Department has established a microscopic laboratory for the inspection of imported foods as provided in the pure-food laws in effect from July 1.

Cheap coffees are adulterated with blue clay.

Coffee berries made of chicory, starch, clay and other ingredients are shaped in molds, colored, and in some instances flavored, so as to resemble the genuine article.

This fraud is not profitable, however, unless the price of coffee is above the average.