

Detailed History of the Improvements Made in Mechanical Appliances by the Skilled Workmen in This Country.

At the Chautauqua college of the First Methodist Episcopal church, held last Monday night, J. H. McConnell, superintendent of motive power and machinery of the Union Pacific rallway system, delivered a lecture on "American Industries and Inventions of the Ninetcenth Century." In discussing the subject, Mr. McConnell said:

When we investigate the growth of American industries and inventions in the nineteenth century, from a mechanical standpoint, the first to attract our attention is Fulton's steamboat on the Hudson river. In the year 1897 the Clermont was completed and made the first trip on Friday, August 4, from New York to Albany in thirty-six hours. The return trip was made in thirty

While Robert Fulton was not the first man to construct a steamboat, he was the first man to make a success of the steamboat, as all other attempts previous to 1807 were failures. The Clermont, after the first trip, was established as a regular passenger boat between New York and Albany. During the winter of 1808 she was enlarged and in the following spring began running again as a regular boat. In 1812 Fulton built two steam ferry boats for crossing the Hudson river one for the East river. In 1814 Fulton proposed plans for a war vessel to be prosteam. Congress passed an act pelled by the same year authorizing the building one or more floating batteries for coast de-Fulton was appointed the engineer for the construction of the first vessel. In June, 1814, the keel was laid, and in Octobe the boat was launched. By May, 1815, her engine was put aboard. July 4, 1815, the first steam man-of-war ever built made the trial trip to the ocean and back, a distance of fifty-three miles, in eight hours and twenty minutes by the force of steam.

In September the complete armament was eed abcard and another trip was made to the ocean and back, the vessel going at the rate of five and one-half miles per hour. The vessel was named the Fulton, the First In 1811 Fulton built the steamboat Orleans. The first trip was made to New Orieans in time fourteen days. He also built at Pittsburg in 1814 a steamboat called the Vesuvius. While Fulton was building the Clermont John Stevens was building Phenix in New Jersey. It was completed after the Clermont commenced her shortly regular trips. Fulton having been granted a monopoly of steam navigation on the Hudn, the Phenix could not run on that river. Stevens, however, was bold enough to take his vessel out to sea in order that it might be put in service on the Delaware river, and John Stevens was the first man to navigate the ocean by steam. The first trip across the ocean by steam was made by the Savannal in 1819 from Savannah, Ga., to Russia by way of England. She returned direct from Petersburg, Russia, to New York in twonty-pix days.

A RACE ON THE HUDSON.

in 1809 a company was formed in Albany s an opposition steamboat line to Fulton's boat, and in September the first vessel was advertised to leave at the same time as Ful-ton's. Excitement ran high. Both vessels left Albany together, each capta'n deter-mined on reaching New York first. For a long distance the contest was even and it that Fulton's proved itself to be the fastest Kemp of Columbia college and as it left the other behind after a thirty-hour struggle, the professor held out a coll of rope to Captain Stout, offering to tow him into port.

Consider the feelings of the passengers, wrought up to the highest pitch by the intense excitement, and what a sigh of relief must have escaped them as they passed the slower boat and the race was won. Can you imagine those two boats tearing down Can you imagine those two boats tearing down high pressure cylinder it enters the low the Hudson river at the tremendous speed pressure cylinder and performs the same

Previous to 1815 it required four months to make the trip on a flat boat from New Orleans to St. Louis. The steamer Enter-prise, built in 1815, made the trip from New Orleans to Louisville in twenty-five two hours and forty minutes; in 1819 the steamer Paragon made the run in eighteen days and 10 hours; in 1834 the Tuscorrora, in seven days, sixteen hours; in 1840 the Ed Shippen in five days, fourteen hours, and in 1853 the Eclipse in four days, n'ne hours and twenty minutes. In 1844 the J. M. White made the run from New Orleans to St. Louis. listance of 1,218 miles, in three days, twenty three hours and nine minutes. This was not equalled until the famous race in 1870 between the R. E. Lee and the Natchez, when the former boat made the run in three

days, eighteen hours and fourteen minutes, heating the Natchez by six hours. For inland service American steamboats are superior to any in the world.

THE FIRST TELEGRAPH LINE.

In the year 1832, while returning from In the year 1852, while returning from a voyage to England, Prof. Morse conceived the idea of the electric telegraph. After a great many experiments and discourage-ments in New York in 1835 he put in opera-tion his first model. The matter was brought before the public in 1837, when he secured his patent. In 1838 a bill was in-tended in compress to appropriate \$30,000 troduced in congress to appropriate \$30,000 to construct a telegraph line between Baltimore and Washington. The proposition was looked upon as wild and visionary and ridiculed by the American people. After some delay the bill passed and the line was completed in May, 1844, when the first mesage was sent a few days later. May, 27. 1844, a message was sent from Baltimore Washington saying: "James K. Polk has been nominated for

president by the democratic convention

An evening paper published the dispatch and it was everywhere ridiculed. When the morning train from Baltimore brought the confirmation of the message Morse's triumph

and fortune were assured. The improvement in the stationary engine in the United States was not very marked until about 1850. Engines were not constructed with any particular view to fuel economy. Some were running, consuming twice the quantity of fuel necessary to do economy. the work. The Corlis engine, invented by George H. Corlis of Providence, R. I., created a revolution in stationary engine build-ing and it has been extensively copied all ing and it has been extensively copied all successful sewing machine. Elias Howe, over Europe. When the first Corlis engines were built Mr. Corlis offered the proprietors ceived the idea of making a sewing maof the James mills at Newburyport to replace their engines with Corlis engines and at it.

The new Corlis engines were run one year from December 3, 1855, and It was found that the average amount of fuel used par day was 5,690 pounds. The coal being reckoned at \$6 per ten. Mr. Corlis received for his engines \$19,734.22.

HIGH SPEED ENGINES.

In 1852 Mr. Corlis contracted with Crocker Bros. of Taunton, Mass., to furnish them with an engine to do the same work with two tons of coal per day that they were doing with five tons, and agreed to pay them \$1 per pound for every pound of coal his engine consumed over two tons per day. His con-tract was successfully carried out. The in-troduction of the electric light has produced a large number of what are termed high-speed engines, particularly adapted to fast running machinery. By their use a small engine running at a high rate of speed is mide to develop the same power as a much larger engine running at a slow speed.

revolutions per minte. The immense amount of power required in large munufacturing mail and express. This service re-establishments and the large ocean steamers has brought out the compound and triple standishments and the large ocean meaners has brought out the compound and triple expansion engine. The compound engine has one high and one low pressure cylinder to the store of the stor

ner in which its speed was regulated. In the old engines the ordinary flat slide valve was used. In the Corlis engines the valves were circular and made to oscillate in place of sliding. The construction of the governor on the Corlis engine absolutely controlled the amount of steam admitted to the cylin der. If the load was light a smaller quantit was admitted; if the work was suddenly in creased by the starting of additional ma hinery the governor immediately responded and admitted a larger quantity of steam to ake the increased load, giving the engine at | distances.

all times a steady and uniform motion PRINTING PRESS EVOLUTION. The printing press has shown remarkable

leve opment since 1860 .. In 1835 the New York Tribune had a printing press capable of printing 1,500 copies an hour and three nen working from midnight until 6 in the norning could turn out the whole edition After a long season of experimenting the storeotyping process was applied to news-paper work. In 1861 W. M. Bullock of Pittsburg built the first web press, but it was several years before he produced the improved press capable of turning out 10,000 seffect copies an hour. In 1871 Richard M. perfect copies an nour. In INIT Richard M. Hoe produced a press which turned out 18,000 papers per hour. He soon brought out another press called the double perfecting press, which turned out 30,000 papers per hour. His next improvement was a press turning out 48,000 eight-page papers per hour. This work is done night after night, always producing the same result. This maalways producing the same result. This ma chine folds the papers and automatically counts them out in bundles of fifty each. The latest machine from the Hoe com pany is a press that prints, pastes, folds and counts at the rate of 90,000 four-page papers

an hour, 48,000 six or eight-page papers and 24,000 ten to sixteen-page papers per hour. In the art of printing the new typemaking and setting machine is considered a marvel. By its use the melted metal is run into a type, set up and ready for the column before leaving the machine. The New York Tribune has a man at one of these machines who has made and set up 80,000 "ems" in one

day. An ordinary day's work on one of these machines is 48,000, made and set up ready for the press. The types are not used a second time and after being used once are not distributed in the ordinary way, but are To America belongs the credit of the first at it. In 1845 his first model was made and place their engines with Corlis engines and take for his pay \$10,000 in cash, or five times the price of the fuel his engines saved in one year over those in operation. They be-ing considered very economical on fuel, 10,483 pounds of coal per day was the average amount used for five years. It was decided to accept the proposition on the fuel saving basic. The wave Carlis engines ware run one the tried to introduce it, without success. On returning to Boston he found parties had constructed machines after his patent. After numerous law suits he secured his rights in the invention. At the expiration of his toright and the secure of the success. patent his invention had netted him \$2,000,-

ADVENT OF THE RAILROAD

date from 1826, when the mat failed, two miles long, was built at Quincy, Mass. It was operated by horses. Originally the rails were made of wood. Afterward they were covered with an iron plate. The introduction of locomotives met with a great deal of op-position and the suggestion that they would eventually pull a train of cars twelve miles an hour was considered the talk of a crazy man. From 1826 to 1840 only 2,197 miles of railroad had been built. In 1870 48,000 miles railroad had been built. In 1870 48,000 miles were in operation and in 1895 180,000 miles. The present milesge of the United States is nearly one-half of the total mileage of the world, being 45 per cent. The interstate com-merce report, 1854, says: "There are \$10,506.-235,410 invested in the railways of the United States." No other enterprise has grown so rapidly. The total earnings for the year ended June, 1893, were \$1,154,187,071, divided as follows: Passenger earnings, \$301,491,816. mide to develop the second state of the second 32 00

1859 the ordinary freight car weighed five tons and carried a load of five tons. The modern freight car weighs 35,000 ounds, and carries a load of 60,000 pounds. The former car and load weighed pounde, while the modern car and load

weighs 95,000 pounds. Since 1870 the transportation of fruit, vege tables, dressed beef, and other perishable goods has brought the refrigerator car into use. It has insured the successful trans Portation of fruit from California to New York. Meat can be carried with safety long

COST OF SOME CARS.

The furniture car is of recent date. Some of there care are fifty feet long and are used for the transportation of furniture, wagons, agricultural implements and articles of large bulk and light weight. The transportation of oil in bulk now requires a tank car holding 5,000 gallons. Special stock cars for cattle and horses are now in common use. All of these special features have in-creased the cost. A refrigerator car costs from \$925 to \$1,000, furniture cars about \$625, the modern box car about \$525. Th increase in size and capacity of the moder The coulpment has been occasioned by compet tion, decrease in rates and the transporta tion of perishable freight, which could no be transported long distances until these cars were provided. The refrigerator car has concentrated the packing houses in a few large cities. The passenger car equipment has increased in size, weight and magnifience in the last twenty-five years. Previous to 1860 there were not many sleeping cars in service. After their introduction the public demand required their adoption on all trunk lines. When first introduced they weighed 60,000 pounds. This weight has weighed 60,000 pounds. This weight has been increased to 100,000 pounds. Originally they cost \$12,000, and a number are in serv-ice today costing \$28,000. A modern pascen-ger car or sleeping car has gas light, steam heat, hot and cold water, and are a perfect palace compared with cars twenty-five years ago. With better equipment the speed has been increased. In 1870 twenty-two miles an hear was the average speed of a passenger hour was the average speed of a passenger train. It required six days and twelve hours to go from New York to San Francisco. The

trip is now made in about four days; three days from Chicago to San Francisco and day from New York to Chicago. one day from New Fork to Curaha to Ogden In 1870 the journey from Umaha to Ogden required fifty-two hours; it is now made in thirty hours. With increased speed and

thirty hours. With increased speed and comfort the public, gets cheaper fare and still they want it for less. The first American locomotive was built at the West Point foundry in 1830. After running a short time it blew up and an-other was built by the same company. In January, 1831, the Baltimore & Ohio railroad offered \$4,000 for the best anthracite coal burning locomotive, weighing three and a burning locomotive, weighing three and a half tons, capable of drawing fifteen tons constructed machines after his patent. After numerous law suits he secured his rights in the invention. At the expiration of his built the old Iranside. This engine built the old weighed five tons.

AMERICAN LOCOMOTIVES THE BEST. In 1833 Richard Norris of Philadelphia built

The railway industries of the United States date from 1826, when the first railroad, two miles long was built at Onited States a locomotive that hauled 19,200 pounds up a weighed seven tons.7 The performance of this weighed seven tong.) The performance of this engine attracted attention in England. Sev-eral of this class were ordered and cent over, where they performed very successfully. As the railroads increased the locomotive facto-ries increased. The Baldwin Locomotive works of Philadelphia is today the oldest and largest in the souther. They also oldest and largest in the country. They have a capacity for turning out 1,000 new locomotives per year. They have sent them to all parts of This year they are sending the world. Russia forty locomotives for the Russian gov-ernment. Last year the Brooks Locomotive works sent sixty locomotives to Brazil. The locomotive works of the United States have a locomotive works of the United States nove a capacity of 2,500 locomotives per year. The American locomotive is superior to any built in the world and is a distinct type. There is a similarity in all the European engines, nearly all are copied from English manufacturers. Previous to 1870 a large por-

tion of the locomotives in service in the United States were about thirty ton engines The increase in the size and weight of trains has resulted in engines for freight service weighing sixty, seventy and eighty tons, while the increased speed demanded for passenger trains requires fifty and sixty ton engines for that service. The limited trains between New York and

be purchased for \$7,000. The introduction of pany were A. L. Denison, E. Howard, D. steel rails in place of iron commenced about 1860. They cost \$120 per ton and were im-ported from England. When the manufacture P. Davis and Samuel Curtis. The location at of steel rills commenced under the protective tariff in the United States, the price declined. During the year 1895 steel rails were sold the United States for \$20 per ton.

MILES AND MILES OF CARS.

The weight of a rall is given as so much per yard. A seventy pound rail means sev-enty pounds per yard. Ralls are thirty feet In length. Some years ago twenty-six feet was the length, but now thirty feet is standard. The average life of a steel rail is about thirteen years. In the last twenty years the increase in the weight of engines and cars has made it necessary to entirely replace all the bridges and rails on all the trunk lines of the United States, in fact, there is practically nothing left of the railroad of twenty years BRO.

Enginee, cars, bridges, rails and ties have all been replaced with new. As the ties las about five years, they have been replaced four ti

The Westinghouse air brake is one of th important American inventions of the last thirty years. It is now in use on railroads in all parts of the world. Its application to passenger trains commenced in 1869. For five years it advanced slowly. Railroad companies were disposed to be conservative in adopting it. After 1875 it was rapidly applied to all passenger equipment. By the use of it on passenger cars the increased safety in handling trains led to its application to freight cars. Increased speed of all trains brought out

the brake applied to the driving wheels of the locomotive. In the railroad service of the United States there are 410,000 freight and passenger cars and 28,000 locomotives with air brakes. The cost of an air brake on a passenger car is \$100, on a freight car, \$40, and on a locomotive the equipment of air brake and driver brake cost about \$600.

It was not until 1850 that horse cars were used in the United States. After their suctwo minutes, while the others failed. cess was catablished here they were adopted n England. The first English street car line was built at Berkenhead, England, in 1860 by George Francis Train. In 1869 horse cars were introduced in Liverpool. In 1873 the first cable street railway in the world was put in operation on Clay street, San Francisco. It was built by A. S. Hallidie. His friends refused to assist him, as the enterprise was looked upon with derision and con sidered visionary.

DECLINE OF THE HORSE CAR.

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United States.

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The

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500 tacks per minute.

1838.

everybody has them.

of the present typewriter.

gimlet-pointed screw was invented by

mas Blanchard of Massachusetts in

After working six years h

Fhomas W. Harvey of Providence, R. L. in

vented the lathe for turning irregular shapes

such as gun stocks, wagon spokes, shoe lasts, hat blocks, ax handles and many other ir-

invented and patented a machine that made

Notwithstanding the opposition, the line as completed and put in operation in August to the surprise of everybody but Mr. Hallidie, It was a success. After three years service other lines were established in San Francisco. In 1879 Robert Gillham of Kansas City turned his attention to the practicability of a cable line for that city, but met with maried opposition from the people there. Receiving the money and influence of captern capitalists he built the first cable line and put it in operation in Kansas City in 1885. It was considered that while it might do for a country where there was no winter, it would be impossible to operate it in winter time, as frost and snow would pre vent its operation. Kanuas City and Chicago demonstrated to

the world that a cable line could be operated successfully in winter weather. The cable system was finally adopted in England in 1883. At the present time there are 857 street rallways in operation in the United States, with a trackage of 13,176 miles, representing a capital of \$520,745,823, with 45, 353 horses in service, 2,607 dummy cars, 12,-563 motor cars and 30,857 passenger cars The rapid increase of electricity applied to street car service has displaced 145,000 horses since 1891.

built at Cincinnati in 1852 and tested before a committee of the city council. At the test, steam was raised from cold water, the engine started, and water discharged from the nozzle to the distance of 159 feet through

Roxbury was unfortunate on account of the fine dust from the clay soil. The company afterward built an extensive plant at Waltham, Mass., called the American Watch company. It turned out annually 80,000 watches A machine for the manufacture of solid head pins was invented by L. W. Wright of Massachusetts. He carried it to England, and in 1833 the first solid head pins were sold. In 1840 John J. Howe patented another machine for making pins. In 1846 a number of pin machines were invented. Few succeeded in doing good work. There is a firm in Waterbury, Conn., having an improved machine for making pins, that turns out

8,000,000 pins each day. The wire is run into the machine from a reel, cut to the right length, headed, pointed and dropped into the hopper of the sticking machine. This machine arranges them and sticks them in papers, and they come out ready for the market, and we wonder what becomes of all

the pins. HERE THE REAPER CAME IN. In 1834 Cyrus H. McCormick obtained a patent for his reaper. No machines were made for sale before 1840, as he found it

company, which is expected to haul a greater load and make greater speed than any steam needed a number of improvements. For sli years he worked at the machine, improv The construction of the electric power plant ing it after each harvest, each one built by at Niagara Falls will eventually make Buffalo himself in his father's blacksmith shop a great manufacturing city. When we see what has been accomplished by electricity in Walnut Grove, Va .- when he was finally able to build one machine per week. In 1844 the first consignment was shipped to last fifteen years we look with interest and anxiety to the future to know what is Cincinnati, where a factory was started the in store for us. same year. In 1846 he moved to Chicago. In 1855, in a trial of American reapers against the world, near Faris, three ma-

weight.

RELIGIOUS,

chines were entered, one American, one Eng-lish and one Algiers, each machine to cut In all the world there is but one man and rake one acre of oats. The American machine did its work in twenty-two minutes, that can read the translation of the bible into the language of the aborigines, which the English in sixty-six minutes, and the was made by a Mr. Ellot in what is now Paxton, in 1649. That man is the well Algerian in seventy-two minutes. At a subsequent trial of three other machines of known antiquarian and scholar, Trumbull English, French and American manufacture of Hartford, Conn. the American machine cut its acre in twenty-

lighting, running pumping machinery and

drills. Small shops are operated by dyna-mos in place of steam engines. It is also

used to run sewing machines, passenger ele-vators, and it is successfully used for heat-

ing and cooking. The expense of the cook-

ing apparatus so far has prevented its general use. With the storage battery it is

used to propel small boats. In street car

service over 12,000 cars are operated by it in

this country alone. In the last five years a

number of electric locomotives have been built. The Brooklyn Elevated railway is

now switching trains with electric locomo-tives in place of stram. This system has also been adopted on one of the elevated

and the second second of the second s

tr'e locomotive in the Baltimore tunnel. It is successfully handling freight and passen-

ger trains and it is claimed does better

work than steam locomotives of the same

New Haven railway was operated by an electric locomotive. On one of the trials it was claimed a speed of eighty miles an hour was obtained. A new engine has just been completed by the Baldwin Westinghouse

Last summer the Nantasket branch of the

Bishop Churchill Julius (Anglican) of Christ church, New Zealand, has become contest was finally narrowed down to three machines, all of American manufacture. Each performed the work to the astonishnoted for his occentricities. A few years ago he insisted on personally laying the last stone on the restored apire of his cathedral, ment and satisfaction of the judges. In 1867 at the Paris exposition, in a field trial, the McCormick reaper defeated all competitors and now he is surprising good churchmen by riding a tricycle in public.

The London Telegraph says: "His ex-cellency, Hon. T. F. Bayard, the Amer-ican ambassador, has fixed Monday, June and demonstrated on two occasions the su periority of the American reaper against the

The Bell telephone was patented May 8. 29, for the laying of the foundation stone of the John Robinson Memorial church, 1876, and was first exhibited at the Centennial in Philadelphia by the inventor, Alexander Graham Bell. At first it was considered a toy and the American people Gainsborough, the original home of many of the Pilgrim Fathers. The deputation of American Congregationalists who are to did not take to it. In 1877 Bell took it to England and could not dispose of one-half visit England this summer will take part in the proceedings. the European right for \$10,000. Marc 1880 but 183 telephones were in use in March 1

Albert Seeman of Wilkesbarre, Pa., has a ring which he believes to be the wedding ring of Martin Luther. It purports to be one Three years later 890 were in use. They have become so common now of the two which the Kurfurst of Brandenburg had made symbolical of the life and the crucifixion of Christ, and which were L. Sholes of Wisconsin is the inventor presented to Martin Luiner and his wife on

B. B. Hotchkiss of Connecticut invented their wedding day. It came into possession of the Seemans in 1867, while they were at the breech-loading cannon. Meeting no success in the United States he took it to Stockholm, Sweden. Europe where it met with favor and he a

A Gardiner, Me., religious society, which was so unwise as to go into the postago stamp collecting business, has found out that it does not pay. The pastor of the church succeeded in accumulating 91,000 stamps, which he sold for \$10, but he is now kept so busy answering letters from persons who wish to know how he did it that he expects to be obliged to spend all of his hard-carned \$10 for new stamps.

A strong movement is being planned by the Congregational, Presbyterian, Haptist, Episcopal, Methodiat and some other min-THE AGE OF ELECTRICITY. In 1875 Charles F. Brush of Cleveland, O. isters in Brooklyn against the custom of conducting services at the grave after the patented a dynamo which has made the present system of arc lights successful. He regular funeral exercises in the house of also improved the arc lamp, making church. A statement was read from many pulpits on Sunday, and the reasons for the Brush are light the first successful one in

change in practice were given. It is asserted that the present custom is a needloss tax upon the strength and health of advantage During the early part of this century an invention was perfected which has made the inventor famous; the date is not clearly upon the strength and health of clergymen. It is a fact that services at the grave are the nozzle to the distance of 130 feet through 350 feet of hose in four minutes and ten seconds from the time smoke was seen to issue from the stack. The city council con-tracted for an engine of the same character. When delivered it was placed in charge of a company organized and paid by the city.

The first successful steam fire engine was