A group directed by Major Alexeyev of the Bakinskii Corps of Mining Engineers hand-drilled an **oil well** in the Baku region in **1848**.

Crawford Williamson Long used ether for the first time on March 30, 1842 to remove a tumor from the neck of a patient, James M. Venable, in Jefferson, Georgia. Long subsequently removed a second tumor from Venable and used ether as an **anesthetic** in amputations and childbirth. The results of these trials were published in **1849** in *The Southern Medical and Surgical Journal*.

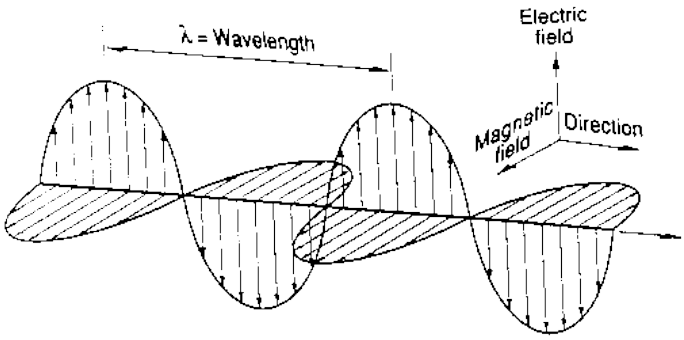
The world's first **large refinery** opened at Ploiești, Romania, in 1856-**1857**, with United States investment.

The **first commercial oil well** in Canada became operational in **1858** at Oil Springs, Ontario (then Canada West). Businessman James Miller Williams dug several wells between 1855 and 1858 before discovering a rich reserve of oil four metres below ground. Williams extracted crude oil, refining much of it into **kerosene** lamp oil.

Belgian Jean Joseph Etienne Lenoir (1822–1900) produced a **gas-fired internal combustion engine** similar in appearance to a horizontal double-acting steam engine, with cylinders, pistons, connecting rods, and flywheel in which the gas essentially took the place of the steam. This was the first internal combustion engine to be produced in numbers in **1860**.

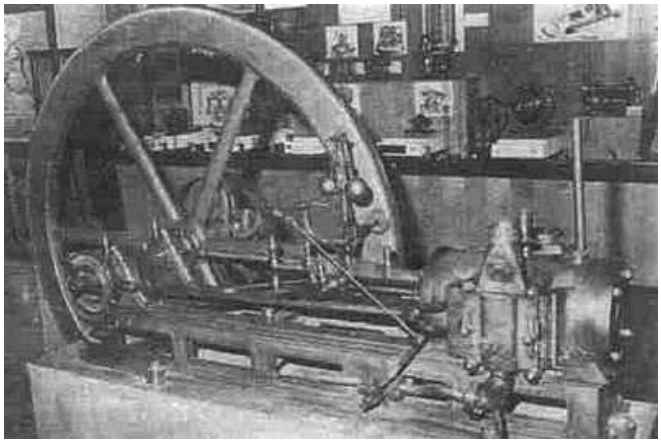
Louis Pasteur's research showed that the growth of **micro-organisms** was responsible for spoiling beverages. With this established, he invented a process by **1862** in which liquids such as milk were heated to kill most bacteria and moulds. This process was soon afterwards known as **pasteurization**.

In 1855 an Act of Parliament was passed approving the construction of an underground railway between Paddington Station and Farringdon Street via King's Cross. The Great Western Railway (GWR) gave financial backing to the project when it was agreed that a junction would be built linking the **underground railway** with its mainline terminus at Paddington. The Metropolitan Railway opened on 9 January **1863** and was carrying over 26,000 passengers a day within a few months of opening.



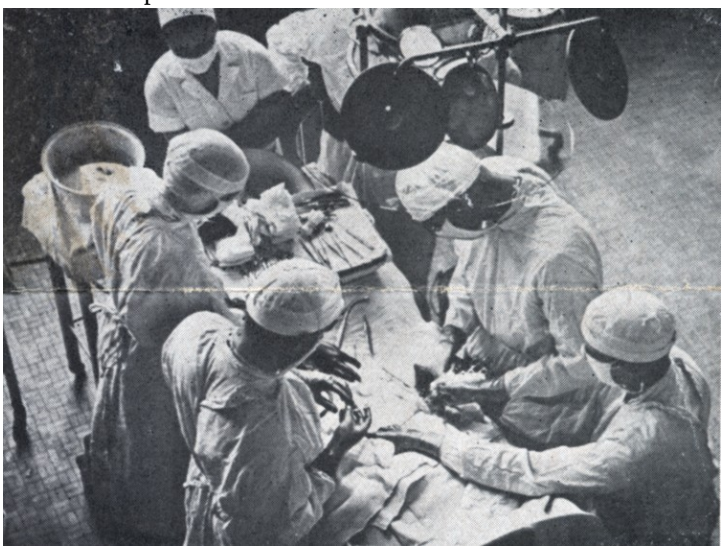
In **1864** James Clerk Maxwell of Edinburgh announced his **electromagnetic theory of light**, which was perhaps the greatest single step in the world's knowledge of electricity. Maxwell had studied and commented on the field of **electricity and magnetism** as early as 1855/6 when *On Faraday's lines of force* was read to the Cambridge Philosophical Society. The paper presented a simplified model of Faraday's work, and how the two phenomena were related. He **reduced all of the current knowledge into a linked set of differential equations with 20 equations in 20 variables**.

In **1865**, the French engineer Pierre-Émile Martin took out a license from Siemens and first applied his **regenerative furnace** for making **steel**. The most appealing characteristic of the Siemens regenerative furnace is the rapid production of large quantities of basic steel, used for example to construct **high-rise buildings**. The usual size of furnaces is 50 to 100 tons. The Siemens-Martin process complemented rather than



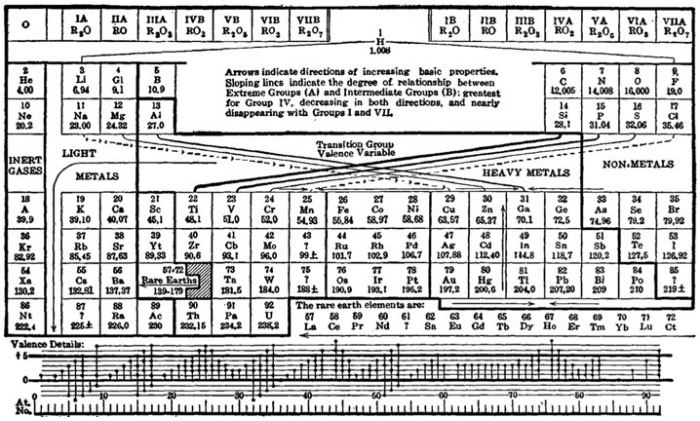
replaced the Bessemer process. It is slower and thus easier to control. It also permits the melting and refining of large amounts of scrap steel, further **lowering steel production costs** and recycling an otherwise troublesome waste material. Its worst drawback is the fact that melting and refining a charge takes several hours. This was an advantage in the early 20th C., as it gave plant chemists time to analyze the steel and decide how much longer to refine it.

In August 1865, Joseph Lister applied a piece of lint dipped in carbolic acid solution onto the wound of an eleven-year-old boy at Glasgow Infirmary, who had sustained a compound fracture. After four days, he renewed the pad and discovered that no infection had developed, and after a total of six weeks he was amazed to discover that the boy's bones had fused back together, without the danger of suppuration. He subsequently published his results in *The Lancet*. Later, on August 9, **1867**, he read a paper before the British Medical Association in Dublin, on the ***Antiseptic Principle of the Practice of Surgery***, which was reprinted in *The British Medical Journal*.



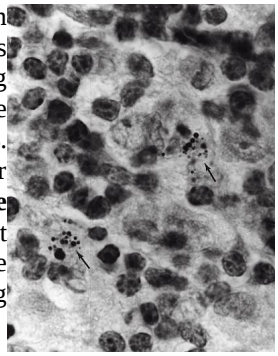
Alfred Bernhard Nobel found that when nitroglycerin was incorporated in an absorbent inert substance like Kieselguhr (diatomaceous earth) it became **safer and more convenient to handle**, and this mixture he patented in **1867** as '**dynamite**', referring to the Greek word for 'power'. Nobel demonstrated his explosive for the first time that year, at a quarry in Redhill, Surrey, England.

Russian chemistry professor Dmitri Mendeleev and German chemist Julius Lothar Meyer independently published their **periodic table**s in **1869** and 1870, respectively. Mendeleev's table was his first published version; that of Meyer was an expanded version of his (Meyer's) table of 1864. They both constructed their tables by **listing the elements in rows or columns in order of atomic weight and starting a new row or column when the characteristics of the elements began to repeat.**

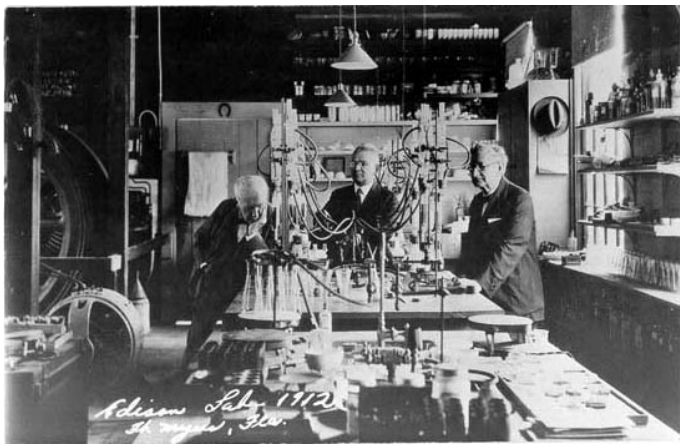


There are three types of **internal combustion** engines designed by German inventors Nikolaus Otto and his partner Eugen Langen. They are the 1862 compression engine, which failed, the 1864 atmospheric engine, and the engine known today as the "Gasoline Engine", the **Otto Cycle engine** created in **1876**. Otto engines were used primarily for stationary uses, as Otto had no interest in transportation.

In **1882** Major Eduard Rubin, director of the Swiss Army Laboratory at Thun, invented the **copper jacketed bullet** — an elongated bullet with a lead core in a copper jacket. It was also small bore (7.5mm and 8mm) and it is the precursor of the 8mm "Lebel bullet" which was adopted for the **smokeless powder** ammunition of the Mle 1886 Lebel rifle.

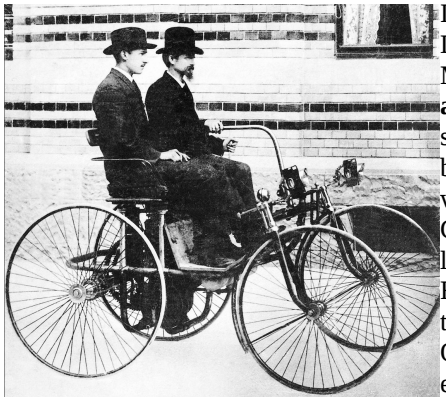


Danish scientist Hans Christian **Gram** (1853–1938) developed his **staining** technique while working with Carl Friedländer in the morgue of the city hospital in Berlin in **1884**. Gram devised his technique not for the purpose of **distinguishing one type of bacterium from another** but to enable bacteria to be seen more readily in stained sections of lung tissue.



Although thermionic emission was originally reported in 1873 by Frederick Guthrie, it was Thomas Edison's **1884** investigation that spurred future research, the phenomenon thus becoming known as the "**Edison effect**". Edison patented what he found, but he did not understand the underlying physics, nor did he have an inkling of the potential value of the discovery. It wasn't until the early 20th century that the rectifying property of the diode tube was utilized, most notably by John Ambrose Fleming, who used the diode tube to detect (demodulate) radio signals. Lee De Forest's 1906 "audion" was also developed as a radio detector, and soon led to the development of the triode tube.

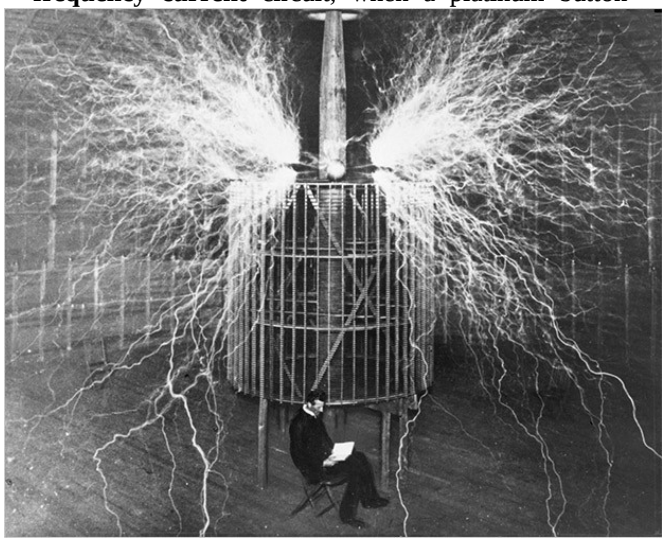
In **1887**, Prof. Heinrich Hertz in a series of experiments proved the actual existence of **electric waves**. The discovery of electric waves in space naturally led to the discovery and introduction in the closing years of the 19th century of **wireless telegraphy**, various systems of which are now in successful use on shipboard, lighthouses and shore and inland stations throughout the world, by means of which intelligence is transmitted across the widest oceans and large parts of continents.



In **1889**, Gottlieb Daimler and Wilhelm Maybach built their first **automobile** which was somewhat influenced by bicycle designs. There was no production in Germany, but it was licensed to be built in France and presented to the public in Paris in October 1889 by both engineers.

Herman Hollerith invented the **recording of data on a medium that could then be read by a machine**. Prior uses of machine readable media had been for control, not data. After some initial trials with paper tape, he settled on **punched cards**, developing punched card data processing technology for the **1890 US census**. He founded the *Tabulating Machine Company* (1896) which was one of four companies that merged to form Computing Tabulating Recording Company (CTR), later renamed IBM.

In **1891**, notable additions to our knowledge of the phenomena of electromagnetic frequency and high potential current were contributed by Nikola Tesla. Amongst the **novel experiments** performed by Tesla was to take in his hand a glass tube from which the air had been exhausted, then bringing his body into contact with a wire carrying currents of high potential, the tube was suffused with a pleasing bright glow. Another experiment was to grasp a bulb that was suspended from a single wire attached to a **high potential, high frequency current** circuit, when a platinum button



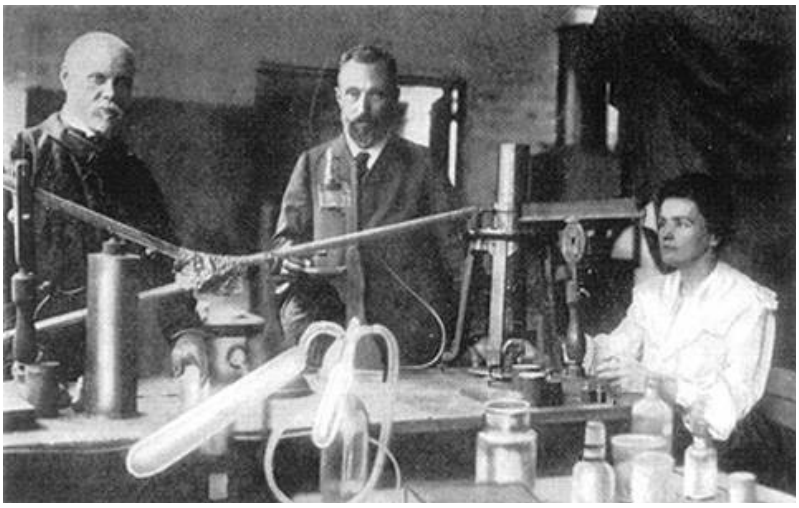
within the bulb was brought to vivid incandescence, the experimenter at this time standing on an insulating platform. The frequency and potential involved in the experiments made by Tesla at this time were of the order of one or more million cycles and volts. In 1893, Westinghouse won the bid to electrify the 1893 World's Columbian Exposition in Chicago with alternating current. This World's Fair devoted a building to electrical exhibits. It was a key event in the history of **AC power** as Westinghouse and Tesla demonstrated the safety and reliability of alternating current to the American public.

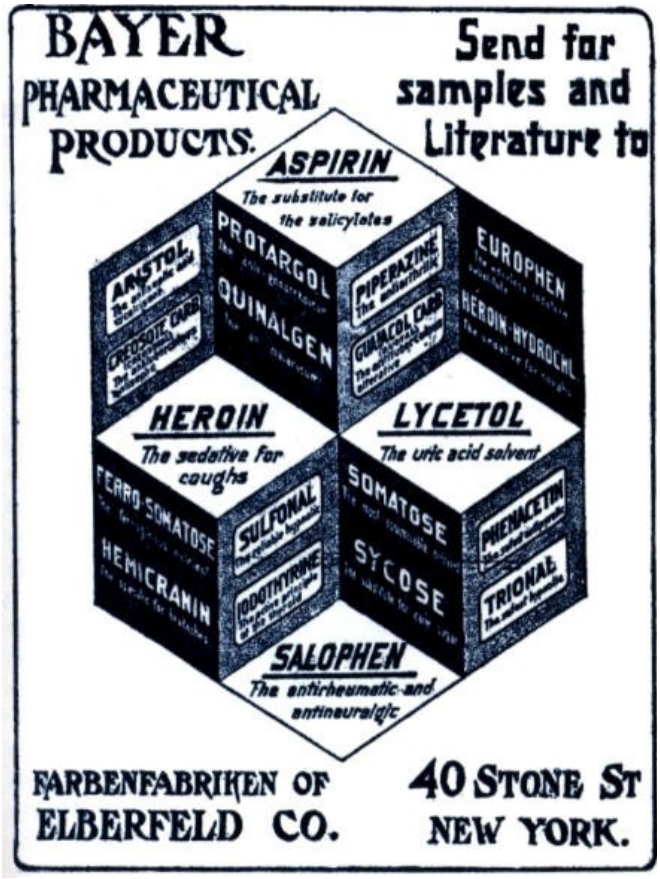
The **chloralkali process** is an industrial process for the electrolysis of sodium chloride solution (brine). Depending on the method, several products besides hydrogen can be produced. If the products are separated, chlorine and sodium hydroxide (caustic soda) are the products; by mixing, sodium hypochlorite or sodium chlorate are produced, depending on the temperature. Higher temperatures are needed for the production of sodium chlorate instead of sodium hypochlorite. **Industrial scale production** began in **1892**.

August Köhler designed a new method of illumination which uses a perfectly **defocused image of the light source** to illuminate the sample. This work was published in **1893** in the Zeitschrift für **wissenschaftliche Mikroskopie** and was soon followed by publication of an English translation in the Journal of the Royal Microscopical Society.

"Über eine neue Art von Strahlen", was published on 28 December 1895. On 5 January 1896, an Austrian newspaper reported Wilhelm Conrad Röntgen's discovery of a new type of radiation. Röntgen was awarded an honorary Doctor of Medicine degree from the University of Würzburg after his discovery. He published a total of three papers on X-rays between 1895 and 1897. **Röntgen** is considered the father of **diagnostic radiology**, the medical specialty which uses imaging to diagnose disease.

On 11 January **1896** John Francis Hall-Edwards made the first use of **X-rays** under clinical conditions when he radiographed a needle stuck in the hand of an associate. A month later on 14 February he took the first radiograph to direct a surgical operation. He also took the first X-ray of the human spine. Hall-Edwards' interest in X-rays cost him his left arm, which had to be amputated in 1908 as a consequence of X-ray dermatitis





In **1897**, chemists working at Bayer AG produced a synthetically altered version of salicin, derived from the species *Filipendula ulmaria* (meadowsweet), which caused less digestive upset than pure salicylic acid. The identity of the lead chemist on this project is a matter of controversy. Bayer states the work was done by Felix Hoffmann, but the Jewish chemist Arthur Eichengrün later claimed he was the lead investigator and records of his contribution were expunged under the Nazi regime. By 1899, Bayer was selling it around the world. The name **Aspirin** is derived from "acetyl" and *Spirsäure*, an old German name for salicylic acid. The popularity of aspirin grew over the first half of the 20th century, spurred by its supposed effectiveness in the wake of the Spanish flu pandemic of 1918.

In **1900**, Marie Curie became the **first woman faculty member** at the École Normale Supérieure, and Pierre joined the Sorbonne's faculty. In June 1903, supervised by Henri Becquerel, Marie was awarded her doctorate from the University of Paris. That month, she and Pierre were invited to the Royal Institution in London to give a speech on **radioactivity**; being female, she was **prevented from speaking**, and Pierre alone was allowed to. Meanwhile, a new industry began developing based on radium. The Curies did not patent their discovery and benefited little from this increasingly profitable business.

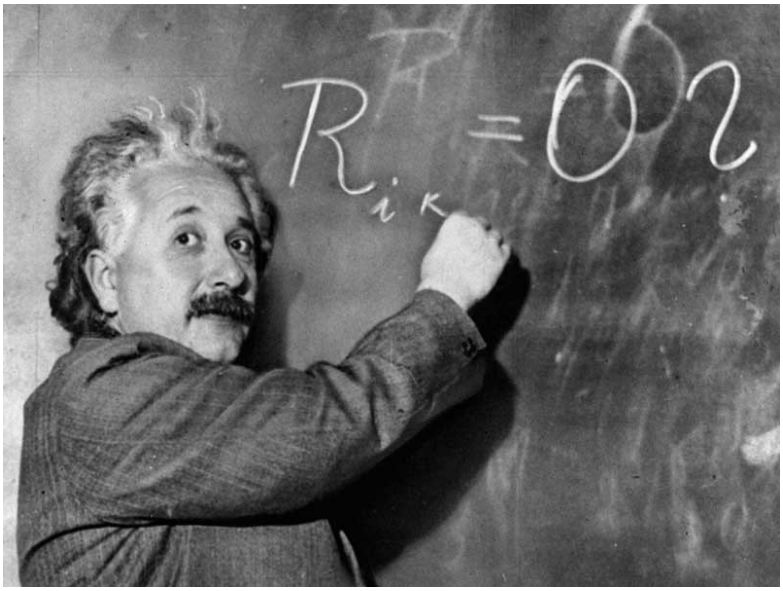
Rudolf Diesel demonstrated the **diesel engine** in the **1900** *Exposition Universelle* (World's Fair) in Paris using peanut oil fuel.

In **1901** Karl Landsteiner discovered **human blood groups**. Mixing blood from two incompatible individuals can lead to an immune response, and the destruction of red blood cells releases free hemoglobin into the bloodstream, which can have fatal consequences. Karl Landsteiner discovered that when incompatible types are mixed, the red blood cells clump, and that this immunological reaction occurs when the receiver of a blood transfusion has antibodies against the donor blood cells. His work made it possible to determine blood type and allowed a way for **blood transfusions** to be carried out much more safely. For this discovery he was awarded the Nobel Prize in Physiology and Medicine in 1930, and many other blood groups have been discovered since.

The Birkeland–Eyde process was one of the competing industrial processes in the beginning of **nitrogen based fertilizer** production. It was developed by Norwegian industrialist and scientist Kristian Birkeland along with his business partner Sam Eyde in **1903**, based on a method used by Henry Cavendish in 1784. This process was used to fix atmospheric nitrogen into nitric acid, one of several chemical processes generally referred to as nitrogen fixation. The resultant nitric acid was then used as a source of nitrate in the reaction.

In **1905**, while he was working in the patent office, Albert Einstein had four papers published in the *Annalen der Physik*, the leading German physics journal. These are the papers that history has come to call the *Annus Mirabilis Papers*:

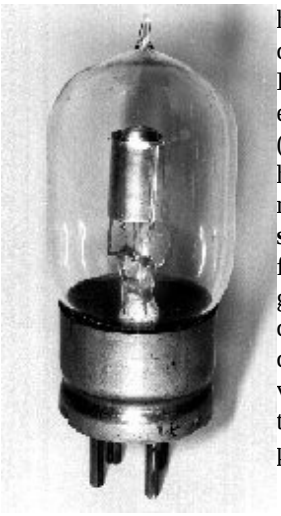
- His paper on the particulate nature of light put forward the idea that certain experimental results, notably the photoelectric effect, could be simply understood from the postulate that light interacts with matter as discrete "packets" (**quanta**) **of energy**, an idea that had been introduced by Max Planck in 1900 as a purely mathematical manipulation, and which seemed to contradict contemporary wave theories of light (Einstein 1905a). This was the only work of Einstein's that he himself called "revolutionary."
- His paper on Brownian motion explained the random movement of very small objects as direct evidence of molecular action, thus supporting the **atomic theory**. (Einstein 1905b)
- His paper on the electrodynamics of moving bodies introduced the radical theory of **special relativity**, which showed that the observed independence of the speed of light on the observer's state of motion required fundamental changes to the notion of simultaneity. Consequences of this include the **time-space frame** of a moving body slowing down and contracting (in the direction of motion) relative to the frame of the observer. This paper also argued that the idea of a luminiferous aether—one of the leading theoretical entities in physics at the time—was superfluous. (Einstein 1905c)
- In his paper on mass–energy equivalence (previously considered to be distinct concepts), Einstein deduced from his equations of special relativity what later became the well-known expression: $\mathbf{E=mc^2}$, suggesting that **tiny amounts of mass could be converted into huge amounts of energy**. (Einstein 1905d)



All four papers are today recognized as tremendous achievements—and hence 1905 is known as Einstein's "Wonderful Year". At the time, however, they were not noticed by most physicists as being important, and many of those who did notice them rejected them outright. Some of this work—such as the theory of light quanta—remained controversial for years.

In **1905** George Oenslager discovered that a derivative of aniline called thiocarbanilide accelerated the action of sulfur to rubber, leading to shorter cure times and reducing energy consumption. This breakthrough is almost as fundamental to the development of the **rubber industry** as Goodyear's sulfur cure. Accelerators made the cure process faster, improved the reliability of the process and enabled **vulcanization** to be applied to **synthetic polymers**. One year after his discovery, Oenslager had found hundreds of applications for his additive.

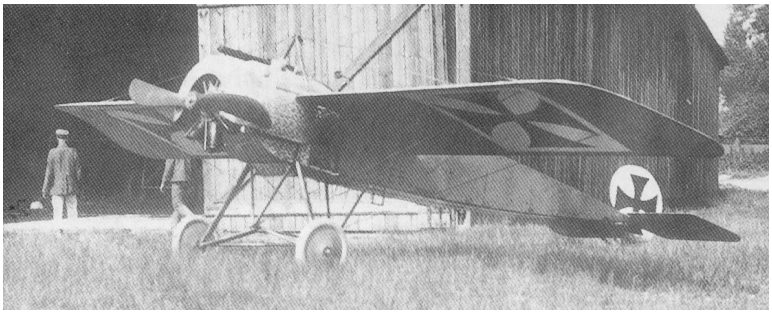
Lee De Forest is credited with inventing the **triode tube** in **1907** while continuing experiments to improve his original Audion tube, a crude forerunner of the triode. By placing an additional electrode between the filament (cathode) and plate (anode), he discovered the ability of the resulting device to **amplify signals of all frequencies**. A few volts' difference at the grid would make a large change in the plate current and could lead to a much larger voltage change at the plate; the result was voltage and power amplification.



BASF, Bayer and Hoechst produced several hundred different dyes, along with the five smaller firms Agfa, Cassella, Chemische Fabrik Kalle, Chemische Fabrik Griesheim-Elektron and Chemische Fabrik vorm. Weiler-ter Meer concentrated on high-quality specialty dyes. In **1913** these eight firms produced almost 90 percent of the world supply of dyestuffs and sold about 80 percent of their production abroad. The three major firms had also integrated upstream into the production of essential raw materials and they began to expand into other areas of **chemistry** such as **pharmaceuticals, photographic film, agricultural chemicals and electrochemicals**. Contrary to other industries the founders and their families had little influence on the top-level decision-making of the leading German chemical firms, which was in the hands of professional salaried managers. Because of this unique situation the economic historian Alfred Chandler called this "the world's first truly **managerial industrial enterprises**".

General relativity is a theory of gravitation that was developed by Albert Einstein between 1907 and **1915**. According to general relativity, the observed gravitational attraction between masses results from the warping of space and time by those masses. General relativity has developed into an essential tool in modern **astrophysics**.

In July **1915** the Fokker E.I became operational – this was the first type of aircraft to enter service with a "synchronisation gear" which enabled a machine gun to fire through the arc of the propeller without striking its blades. This constituted an important advantage over other contemporary fighter aircraft. This aircraft and its immediate successors – also commonly known as the *Eindecker* – for the first time supplied an effective equivalent to Allied fighters. Two German military aviators, Otto Parschau and Kurt Wintgens, worked for the Fokker firm during the spring of 1915, demonstrating the revolutionary feature of the forward-firing synchronized machine gun that the Eindecker was armed with, to the embryonic force of *Fliegertruppe* pilots of the German Empire.



The discovery of **RDX** dates from 1898 when Georg Friedrich Henning obtained a German patent (patent No. 104280) for its manufacture, by nitrating hexamine nitrate (hexamethylenetetramine nitrate) with concentrated nitric acid. In this 1898 patent, its properties as a medical compound were mentioned; three further German patents obtained by Henning in 1916 proposed its use in **smokeless propellants**. The German military started investigating its use in 1920 and referred to it as hexogen. Research was not published further until Edmund von Herz obtained a British patent in **1921** and a United States patent in 1922.

Amylobarbitone is a drug that is a barbiturate derivative. It has **sedative**-hypnotic properties. It is a white crystalline powder with no odor and a slightly bitter taste. It was first synthesized in Germany in **1923**.

Alan Arnold Griffith publishes his groundbreaking paper ***Aerodynamic Theory of Turbine Design*** *in* ***1926***, changing the low confidence in jet engines. In it he demonstrates that existing compressors are "flying stalled", and that major improvements can be made by **redesigning the blades from a flat profile into an airfoil**, going on to mathematically demonstrate that a practical engine is definitely possible and showing how to build a **turboprop**.

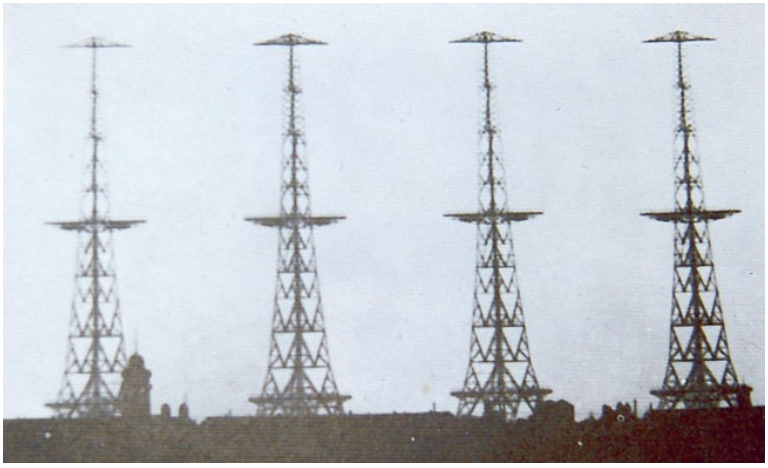
The first feature film released using the Fox Movietone system was *Sunrise* (**1927**) directed by F. W. Murnau. It was the first **professionally produced feature film with an actual sound track**.

Werner Heisenberg formulated his **uncertainty principle** in **1927**, and the Copenhagen interpretation started to take shape at about the same time. Starting around 1927, Paul Dirac **began the process of unifying quantum mechanics with special relativity** by proposing the Dirac equation for the electron. The Dirac equation achieves the relativistic description of the **wavefunction of an electron** that Schrödinger failed to obtain. It predicts **electron spin** and led Dirac to predict the existence of the **positron**. He also pioneered the use of operator theory, including the influential bra-ket notation, as described in his famous 1930 textbook. During the same period, Hungarian polymath John von Neumann formulated the rigorous mathematical basis for quantum mechanics as the theory of linear operators on Hilbert spaces.

Sir Alexander Fleming recounted the discovery of **penicillin** on the morning of Friday, September 28, **1928**. It was a fortuitous accident: in his laboratory in the basement of St. Mary's Hospital in London, Fleming noticed a Petri dish containing *Staphylococcus* plate culture he mistakenly left open, was contaminated by blue-green mould. There was a halo of inhibited bacterial growth around the mould. Fleming concluded the mould released a substance **repressing the growth and lysing the bacteria**. He grew a pure culture and discovered it was a *Penicillium* mould, now known to be *Penicillium notatum*. Charles Thom, an American specialist working at the U.S. Department of Agriculture, was the acknowledged expert, and Fleming referred the matter to him. Fleming coined the term "penicillin" to describe the filtrate of a broth culture of the *Penicillium* mould. Even in these early stages, penicillin was found to be most **effective against Gram-positive bacteria**, and ineffective against Gram-negative organisms and fungi.

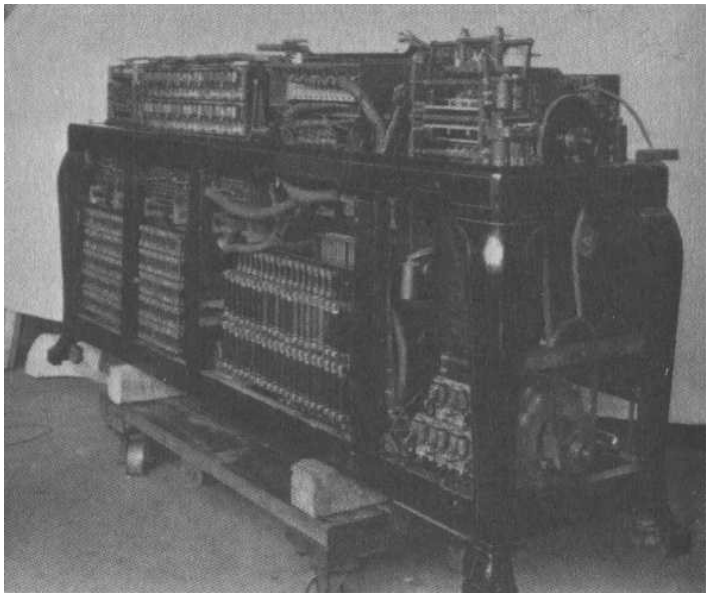
In the autumn of **1929**, Hermann Julius Oberth conducted a static firing of his first **liquid-fueled rocket motor**, which he named the *Kegeldüse*. The engine was built in a workshop space provided by the Reich Institution of Chemical Technology. He was helped in this experiment by an 18 year old student Wernher von Braun, who would later become a giant in both German and American rocket engineering from the 1940s onward.

In August **1929** *LZ 127 Graf* ***Zeppelin*** departed for a daring enterprise: a **circumnavigation of the globe**. The growing popularity of the "giant of the air" made it easy for Dr. Hugo Eckener to find sponsors. One of these was the American press tycoon William Randolph Hearst. *Graf Zeppelin* flew to Friedrichshafen, then Tokyo, Los Angeles, and back to Lakehurst, in 21 days 5 hours and 31 minutes.



In **1929** British **motor vehicle production** was dominated by Morris (founded by William Morris in 1910 in Oxford) and Austin (founded by Herbert Austin in Longbridge in 1905 after he left Wolseley) which between them produced around 60% of total UK output. Singer (Coventry motorcycle manufacturer started building cars in 1905) followed in third place that year with 15% of production.

In **1931** the term "Super Computing Machine" is used by the New York World newspaper to describe the *Columbia* ***Difference Tabulator***, a one-of-a-kind special purpose tabulator-based machine made for the Columbia Statistical Bureau, a machine so massive it was nicknamed "Packard".



Poly(methyl methacrylate) is a transparent thermoplastic, often used as a lightweight or shatter-resistant alternative to glass. Chemically, it is the synthetic polymer of methyl methacrylate. The material was developed in 1928 in various laboratories, and was first brought to market in **1933** by the Rohm and Haas Company, under the trademark **Plexiglas**.

The British were the first to fully exploit **radar** as a defence against aircraft attack. This was spurred on by fears that the Germans were developing death rays. The Air Ministry asked British scientists in **1934** to investigate the possibility of propagating electromagnetic energy and the likely effect. Following a study, they concluded that **a death ray was impractical but that detection of aircraft appeared feasible**. Robert Watson Watt's team demonstrated to his superiors the capabilities of a working prototype and then patented the device. It served as the basis for the Chain Home network of radars to defend Great Britain.

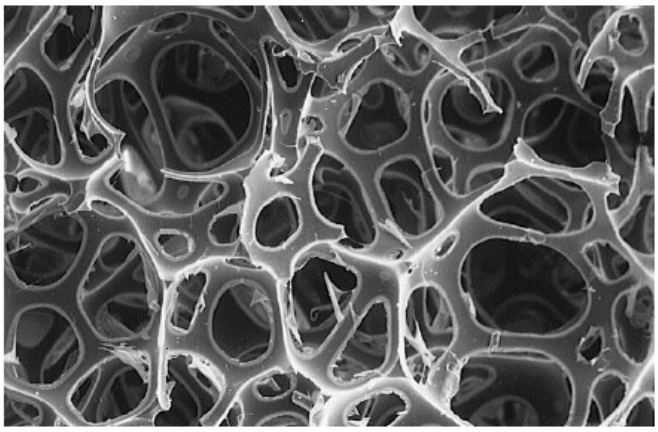
Amphetamine was first synthesized in 1887 by the Romanian chemist Lazăr Edeleanu in Berlin, Germany. He named the compound phenylisopropylamine. It was one of a series of compounds related to the plant derivative ephedrine, which had been isolated from the plant Ma-Huang (Ephedra) that same year by Nagayoshi Nagai. No pharmacological use was found for amphetamine until 1927, when pioneer psychopharmacologist Gordon Alles resynthesized and tested it on himself, in search of an artificial replacement for ephedrine. From **1934** Smith, Kline and French began selling the volatile base form of the drug as an inhaler under the trade name **Benzedrine**. One of the first scientific studies was done by M. H. Nathanson, a Los Angeles physician, in 1935. He studied the subjective effects of amphetamine in 55 hospital workers who were each given 20 mg of Benzedrine. The two most commonly reported drug effects were "a sense of well being and a feeling of exhilaration" and "lessened fatigue in reaction to work". In subsequent years amphetamine was extensively used to combat fatigue and increase alertness in soldiers.

The readily water-soluble sodium salt of sulfonamidochrysoidine, which gives a burgundy red solution and was trademarked **Prontosil** Solubile, was clinically investigated as an **antibiotic** between 1932 and 1934 at the Düsseldorf university hospital. The results were published in a series of articles in the February 15, **1935** issue of *Deutsche Medizinische Wochenschrift*, and were initially received with some skepticism by a medical community bent on vaccination and crude immunotherapy.

Nylon is a generic designation for a family of synthetic polymers known generically as **polyamides**, first produced on February 28, **1935**, by Wallace Carothers at DuPont's research facility at the DuPont Experimental Station. Nylon is one of the most commonly used polymers.

French engineer René Leduc, having independently re-discovered René Lorin's design, successfully demonstrates the world's first operating **ramjet** in **1936**.

Otto Bayer and his coworkers at I.G. Farben in Leverkusen, Germany, first made **polyurethanes** in **1937**. The new polymers had some advantages over existing plastics. Early work focused on the production of fibres and flexible foams and PUs were applied on a limited scale as aircraft coating during World War II.



The first successful run of Sir Frank Whittle's **gas turbine for jet propulsion** is demonstrated in **1937**.

The first practical **electron microscope** was constructed in **1938**, at the University of Toronto, by Eli Franklin Burton and students Cecil Hall, James Hillier, and Albert Prebus; Siemens produced the **first commercial transmission electron microscope** (TEM) in 1939.

The first industrially practical polyethylene synthesis was discovered in 1933 in Northwich, England. Upon applying extremely high pressure (several hundred atmospheres) to a mixture of ethylene and benzaldehyde a white, waxy, material was produced. Because the reaction had been initiated by trace oxygen contamination in the apparatus, the experiment was, at first, difficult to reproduce. It was not until 1935 that another ICI chemist, Michael Perrin, developed a reproducible high-pressure synthesis for **polyethylene** that became the basis for industrial LDPE production beginning in **1939**.

The Heinkel He 178 V1 pioneer **turbojet aircraft prototype** makes its first flight, powered by an He S 3 engine, on August 27th **1939**.

In August **1939**, prominent physicists Leó Szilárd and Eugene Wigner drafted the Einstein–Szilárd letter, which warned of the potential development of "extremely powerful bombs of a new type". It urged the United States to take steps to acquire stockpiles of **uranium** ore and accelerate the research of Enrico Fermi and others into **nuclear chain reactions**. They had it signed by Albert Einstein and delivered to President Franklin D. Roosevelt. Roosevelt called on Lyman Briggs of the National Bureau of Standards to head the Advisory Committee on Uranium to investigate the issues raised by the letter. Briggs held a meeting on 21 October 1939, which was attended by Szilárd, Wigner and Edward Teller. The committee reported back to Roosevelt in November that uranium "would provide a possible source of **bombs with a destructiveness vastly greater than anything now known.**"

First use of **electronics** in IBM unit record equipment - a **gas triode vacuum tube** replaces a relay on the card sorter – appears in **1940**.

In the 1920s, as hemlines of women's dresses rose, women began to wear **stockings** to cover the exposed legs. These stockings were sheer, first made of silk or rayon (then known as "artificial silk"), and after **1940 of nylon**.

1848 Oil Well
1849 Anesthetic
1857 Refinery (Kerosene)
1858 Commercial Oil Well

1860 Gas Fired Combustion Engine
1862 Micro Organisms, Pasteurization
1863 First Underground Railway
1864 Electricity and Magnetism,
20 Variables and Equations
1865 Regenerative Furnace, Cheap Steel
1867 Antiseptic Surgery
Dynamite
1869 Periodic Table of the Elements

1876 Otto Internal Combustion Engine

1882 Smokeless Copper Jacketed
Cartridged Bullet
1884 Gram Staining
Edison Effect
1887 Electric Waves, Wireless Telegraphy
1889 Daimler-Maybach Automobile

1890 Punched Cards Data Storage
1891 Tesla Experiments
> 1893 Chicago World Fair
1892 Industrial Chloralkali Process
1893 Defocused Microscope Illumination
1896 Röntgen Diagnostic Imaging
1897 Aspirin

1900 Marie Curie Faculty Member
Radioactivity
Diesel Engine
1901 Human Blood Groups, Transfusions
1903 Nitrogen Based Fertilizer
1905 Thiocarbanilide Polymer
Vulcanization
Einstein's Annus Mirabilis:
Quanta of Energy
Atomic Theory, Brownian Motion
Special Relativity
$E=mc^2$
1907 Triode Tube

1913 Proto-IG Farben:
Managerial Industrial Enterprise
1915 General Relativity
Fokker E.I

1921 RDX
1923 Amylobarbitone Anesthetic
1926 Aerodynamic Theory
of Turbine Design, Turboprop
1927 Studio Sound Film
Uncertainty Principle
Wavefunction of an Electron,
Spin, Positron
1928 Penicillin
1929 Kegeldüse
Zeppelin circumnavigation
of the globe
Morris, Austin, Singer

1931 Packard Difference Tabulator
1933 Plexiglass
1934 Benzedrine
Radar
1935 Prontosil Antibiotic
Nylon, Polyamides
1936 Ramjet
1937 Polyurethanes
Gas Turbine for Jet Propulsion
1938 Electron Microscope
1939 Polyethylene
Turbojet Aircraft
Einstein-Szilard Letter warns
of Atom Bomb

1940 Electronics and Data Processing
begin to merge
Nylon Stockings