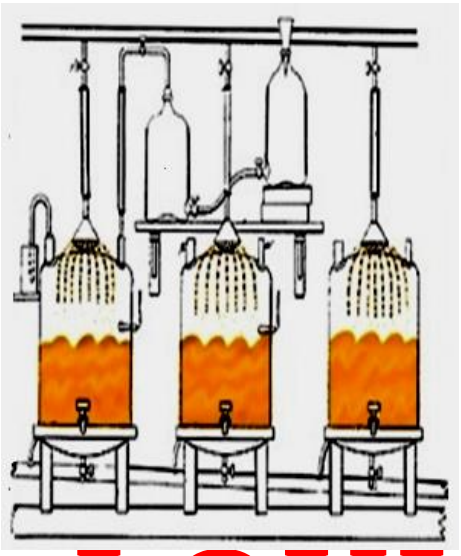
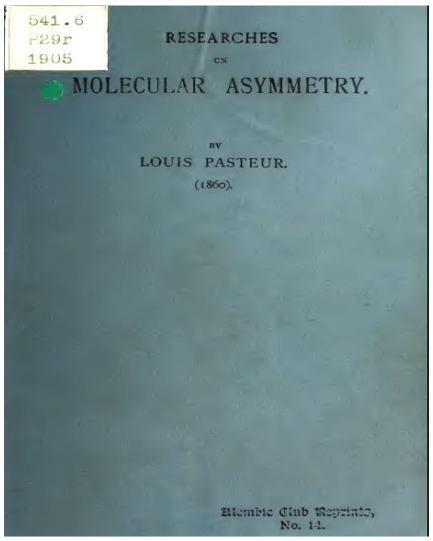
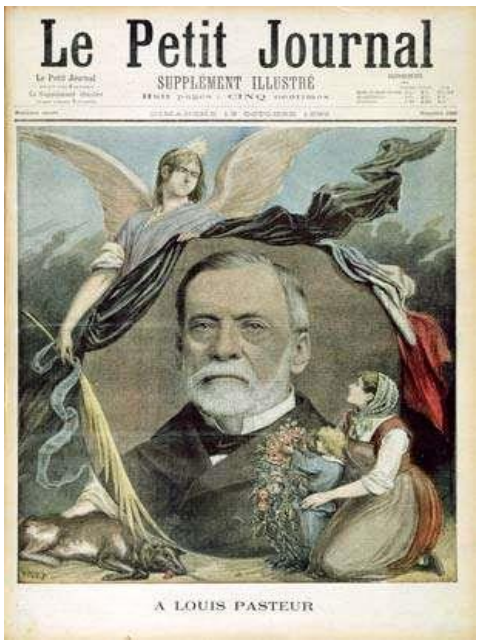
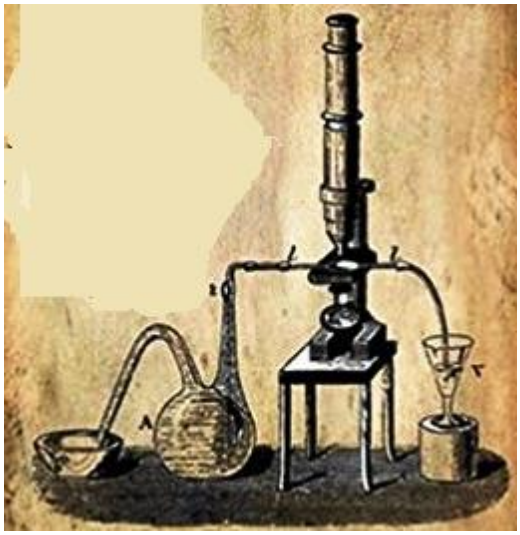




LOUIS PASTEUR

Dr. Abhay B. Solunke





LOUIS PASTEUR

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http://www.abhaysolunke.info

Contents

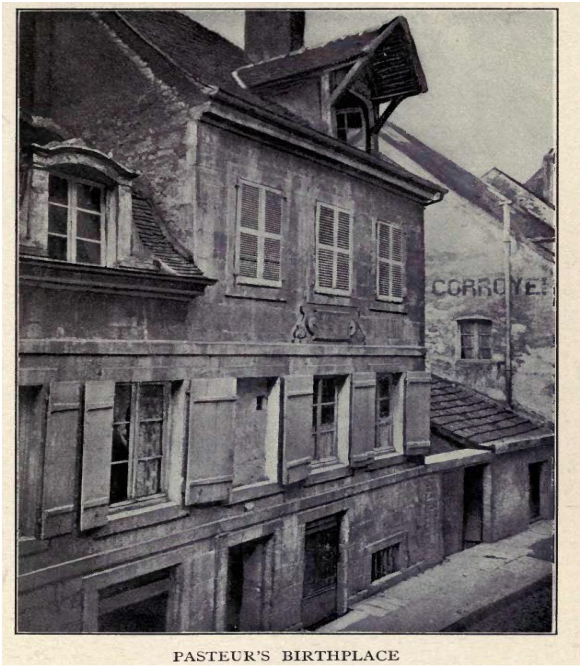
Abstract

Pasteur made brilliant studies not only of the diseases of beer and wine (1866 to1876) but also of silkworm diseases (1865 to 1869), anthrax (1877 to 1881), gangrene, septicemia, and child birth fever (1878), rabies (1880 to 1887), fowl cholera (1880), and swine erysipelas (1882). Pasteur may be best known for one of his inventions named after him as **Pasteurization**. In 1881 Pasteur develops anthrax vaccine and rabies vaccine in 1885.

LOUIS PASTEUR

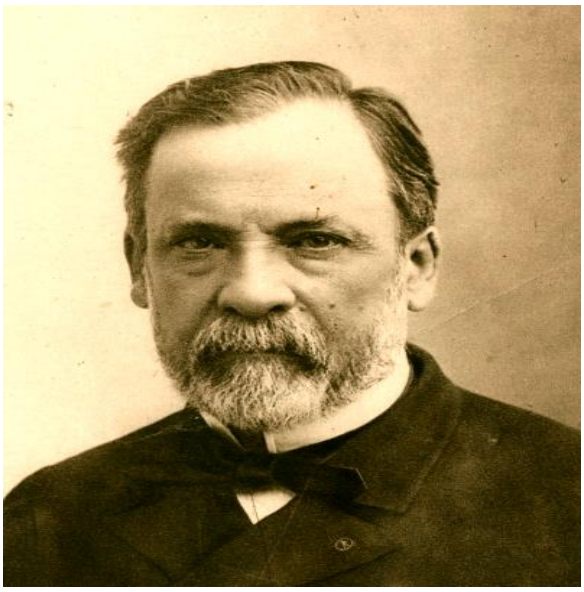
General Information

Louis Pasteur was born in Dole, Franche-Comtek France, on December 27th, 1822, at two o' clock in morning and he died on September 28th, 1895, at Villeneuve l'Etang, near Paris. He was buried in the cathedral of Notre-Dame de Paris, but his remains were transferred to a Neo-Byzantine crypt at the Pasteur Institute in 1896. Pasteur came from a family of **tanners**. Louis Pasteur's father, name was Jean Joseph and mothers name Jeanne Etiennette Roqui. Pasteur made the metamorphosis from chemist to microbiologist at the age of 35 because of a decision to focus on amyl alcohol, which he details in the introduction to his 1857 paper on lactic fermentation.



PASTEUR'S BIRTHPLACE

Fig. Pasteurs Birth place and Tomb

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Make Card

LE PASTEUR

Vol. 1. APRIL, 1889. No. 2.

Paris France March 1. 1886
This Filter was invented in my laboratory where its great usefulness is put to test every day. Knowing its full scientific and hygenic value, I wish it to bear my name. L. Pasteur.

THE OLD OAKEN BUCKET.

[Illustrated on page 8.]

With what anguish of mind I remember my childhood,
Recalled in the light of knowledge since gained;
The malarious farm, the wet, fungus-grown wild-wood,
The chills then contracted which since have remained;
The scum-covered duck-pond, the pigsty close by it,
The ditch where the sour-smelling house drainage fell.
The damp, shaded dwelling, the foul barnyard nigh it—
But worse than all else was that terrible well.
And the old oaken bucket, the mold-crusted bucket,
The moss-covered bucket that hung in the well.

Just think of it! Moss on the vessel that lifted
The water I drank in the days called to mind
Ere I knew what professors and scientists gifted
In the water of wells by analysis find.
The rotting wood fiber, the oxide of iron,
[illegible] dog of unknown size,
The water impure as the verses of Byron,
Are the things I remember with tears in my eyes.
To tell the sad truth, though I shudder to think it,
I considered that water uncommonly clear.
And often at noon when I went there to drink it,
I enjoyed it as much as I now enjoy beer.
How ardent I seized, with the hands that were grimy,
And quick to the mud-covered bottom it fell;
Then reeking with nitrates and nitrites, and slimy
With matter organic, it rose from the well.

Oh, had I but realized in time to avoid them,
The dangers that lurked in that pestilent draught,
I'd have tested for organic germs and destroyed them
With potassic permanganate ere I quaffed;
Or perchance I'd have boiled it and afterward strained it
Through filters of charcoal and gravel combined,
Or, after distilling, condensed and regained it
In portable form with the filth left behind.
How little I knew of the dread typhoid fever
Which lurked in the waters I ventured to drink;
But since I've become a devoted believer
In teachings of science, I shudder to think.
And now, far removed from the scenes I'm describing,
The story for warning to others I tell,
As memory reverts to my youthful imbibing,
And I gag at the thought of that horrible well,
And the old oaken bucket, the fungus-grown bucket—
In fact, the slop bucket that hung in the well.

—J. W. BAYLES.

If Mr. Bayles, half poet and half scientist, could have had the filter that was invented in the laboratory of M. Pasteur, that has no use for the abominations of "charcoal and gravel combined," he could now look back with more complacency to the "old oaken Bucket that hung in the Well."

Reason for Refusing Life Insurance.

A Mr. Bagley, of Virginia, recently applied for a life insurance and was refused by the company on the ground that he had been bitten by a spitz dog on December 15, last. Mr. Bagley wrote to Dr. Pasteur on the subject, and received a reply from the eminent scientist, in which he declares that the bite of a healthy dog is harmless, but that the animal should be kept under surveillance eight days after inflicting the wound, in order to be sure that it does not show signs of rabies.

A Streak of Bad Luck.

Philadelphia Doctor (despondently)—"Just my luck. I have only recently succeeded in becoming the regular family physician of the Westends, and now they have taken steps to render further employment of a doctor unnecessary, or nearly so."

Wife—"Why, my dear, what have they done?"

"They have bought a Pasteur Filter."—*Record.*

DECORATIONS, MEDALS AND DIPLOMAS

—OF—

LOUIS PASTEUR.

Member of the French Academy, of the Academy of Science, of the Academy of Medicine, Member of the Council of Hygene and Health of the Seine.

A few years ago when the medal of honor was offered to Pasteur on behalf of the Academy of Sciences, M. Dumas, in a complimentary speech, said: "Among these little things of life you have discovered a third realm, that to which belong those beings which, with all the prerogatives of animal life, have no need for air in order to live, and find the heat, which is necessary to their existence, in the chemical decompositions they provoke around them. The thorough study of ferments gave you the complete explanation of the alterations which take place in organic substances, in beer, in wine, in fruit, in animal matters of every kind. You explained the preservative role of applied heat to their conservation, and you discovered how to regulate afterward the effect of temperature so as to produce death to the ferments. Your life has known only successes. The Ecole Normale is proud to count you among its pupils; the Academy of Sciences rejoices in your works. France ranges you among her glories."

As eulogistic as this seems it does not do full justice to the achievements of Louis Pasteur. No other man, living or dead, not excepting even Bacon himself, has undertaken and accomplished so much for the material welfare of the world. It is no wonder that every civilized country on the globe has showered its honors upon his head.

DECORATIONS.

Grand Cross of the Legion of Honor.
Grand Cross of the Order of Saint Anne, of Russia, with badge of diamonds.
Grand Cross of the Order of Saints Maurice and Lazarus, of Italy.
Grand Cross of the Order of the Rose, of Brazil.
Grand Cross of the Order of Medijidieh, of Uraguay.
Grand Cross of the Order of St. James, of Portugal.
Grand Cross of the Order of the Polar Star, of Sweden.
Grand Cross of the Order of Isabelle, the Catholic.
Officer of the Order of Agricultural Merit (French.)
Commander of the Order of the Crown, of Italy.
Grand Cross of the Order of Servia.
Grand Cross of the Nicham.
Grand Cross of Roumania.
Grand Cross of the Iron Crown, of Austria-Hungary.
Grand Cross of the Order of the Savior of Grace.

DIPLOMAS.

Member of the Vandian Society of Natural Sciences.
Member of the Egyptian Institute, (by acclamation) of Cairo.
Member of the Literary and Philosophical Society of Manchester.
Member of the Veterinary Society of Tuscany, Florence.
Member of the Academy of Sciences of Toulouse.
Doctor of Obstetric Medicine of the University of Zurich.
Member of the Literary Academy of the South, Marseilles.
Member (elected by acclamation in general assembly without the presidency of the king) of the Academy of Sciences of Lisbon.
Member of the Royal and National Society of Veterinary Medicine of Turin.
Member of the Imperial Society of Medicine of Constantinople, (by acclamation).
Member of the Royal Society of Dublin.
Member of the Society of the Board of Health of London.
Honorary Doctor of the University of Louvain.
Member of the Society of Medicine and Surgery of Edinburg.
Medal of gold of the Society for the Improvement of the Breeds of Dogs, (May, 1884).
Civil Crown decreed by the Society for the Encouragement of Good, (May, 1884).
Member of the Central Society of Agriculture of Belgium, (by acclamation).
Member of the Society of the Sciences of St. Petersburg.
Medal *Bene Merenti* of the 1st class conferred by King Charles I, of Roumania.
Member of the Society of Agriculture of Aveyron, Bodez.
Member of the Society of Civil Engineers of Paris.
President of the Central Agricultural Committee of Cologne.
Member of the Philosophical Society of Glasgow
Member of the Society of Medical Sciences of the East Indies at Batavia.
Doctor of Law of the University of Edinburgh, on the centennial of the foundation, April, 1884.
Member of the Society of Medicine of Dublin.
Member of the Academy of Sciences of Cambridge.
Member of the Society of Biology.
Member of the Society of Agriculture of Nice.
Member of the Royal Society of the North of Sydney.
Member of the American Academy of Sciences and Arts, Boston.
Member of the Royal Academy of the Netherlands, Amsterdam.
Member of the Society of Horticulture and Sciences of the Aurillac.
Member of the American Philosophical Society of Philadelphia.
Member of the Society of Natural Sciences of Nimes.
Member of the Imperial Economical Society of Petersburg.
Albert Medal of the Society for the Encouragement of Arts and Manufactures of London, November, 1882.
Member of the Society of Sciences of Lille.
Member of the Royal Society of Sciences of Upsal.
Member of the Academy of Medicine and Statistics of Milan.
Vice President of the Britannic Secular Union of London.
Member of the Society of Arts of Geneva.
Member of the Academy of Sciences of Vienna.
Member of Victoria Institute of London.
Honorary Doctor of Law of the University of Cambridge, June, 1882.
Member of the Society of Agriculture of Versailles.
Member of the Society of the Emulation of the Doubs, Besancon.
Member of the Society of Veterinary Surgeons, Chartres.
Member of the Marne Agricultural Society, Chalons.
Member of the Medical Society of the Yorne, Auxerre.
Member of the Society of Medicine of Stockholm.
Member of the Society of the Agriculturists of the North, Lille.
Member of the Royal College of Veterinary Surgeons of London.

(*Continued on second page.*)

SCIENTIFIC DIRECTOR

In 1857 he was scientific director of the Normal School at Paris.

MEDAL

In the year 1856, he received from the Royal Society of London the Rumford Medal for his researches on light.

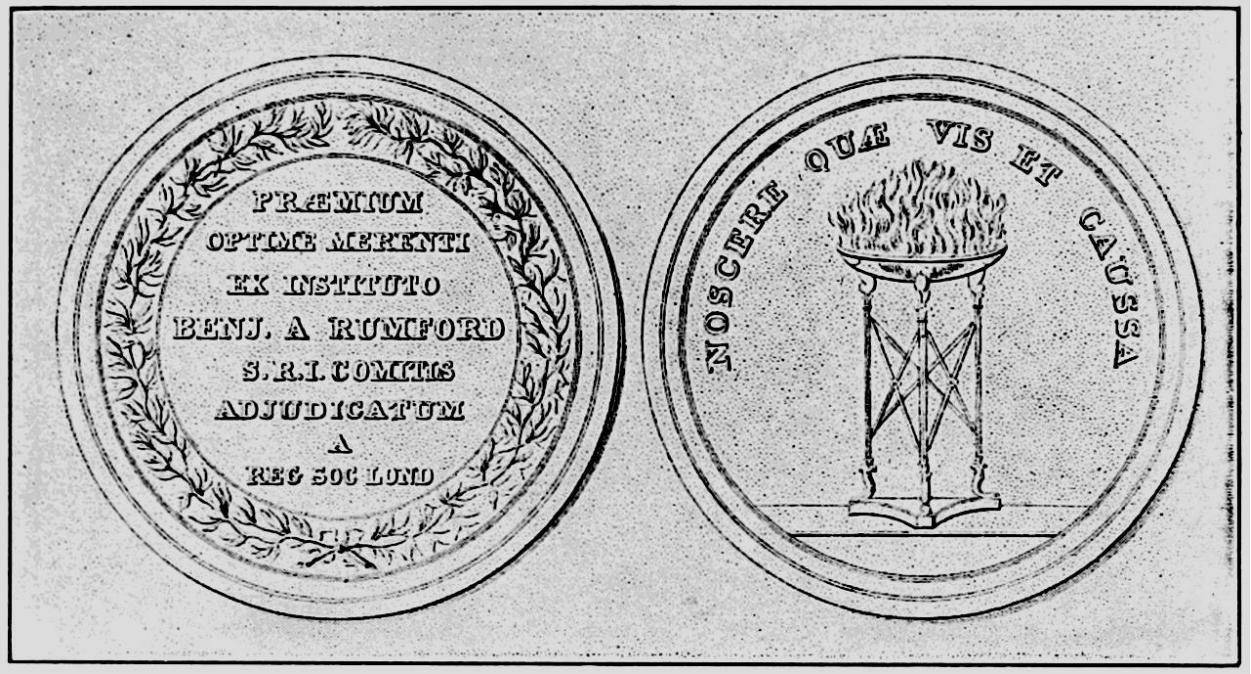


Fig. Rumford Medal awarded to Louis Pasteur

He was also awarded Copley Medal in 1874.

PASTEURS BOOK

In 1860 Pasteur wrote a book entitled "**Researches on Molecular Asymmetries**" published by THE ALEMBIC CLUB

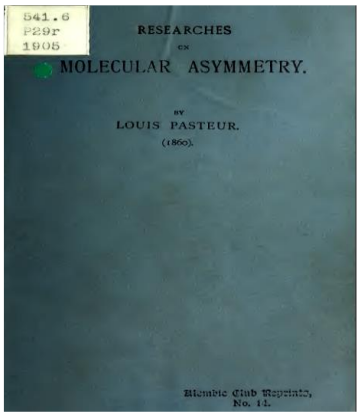


Fig.: Book,

TORTUOUS PATH

Self-sealed hypodermic syringe uses Louis Pasteur's principle of the "**tortuous path**" to maintain a sterile condition within a medicament chamber contained within the syringe barrel without using airtight seals.

Louis Pasteur in his experiments relative to the behavior of bacteria fashioned glass flasks with various neck shapes. Each flask contained an enclosed sterile media. The necks on some flasks allowed airborne dust particles to fall on the contained media, which soon became contaminated as evidenced by the appearance of bacterial growth. The media in those flasks with **S-curved necks**, or which presented a "**tortuous path**" for airborne dust and bacteria, remained sterile. The dust and bacteria were stopped at the openings to thecurved necks, as well as at the curves in the necks. Hypodermic injection devices using Pasteur's "tortuous path" principle have long been known, as may be seen by the "***Monoject***" brochure, copyright 1973, by Sherwood Medical Industries, Inc.

LOUIS PASTEUR AS FATHER & FOUNDER

Louis Pasteur is regarded as father of **Immunology** or anything else. But I call him as the Father of **Patent Microbiology**. As he is the first to patent microorganisms. He is one of the ***founders of bacteriology***.

FATHER OF GERM THEORY OF DISEASE

Louis Pasteur conducted numerous experiments in his career to demonstrate the relationship between germ and disease. He established without doubt that certain diseases are caused by microorganisms. Hence, though he was not the first to propose it, Pasteur is regarded *as one of the* ***fathers of the germ theory of disease***. Louis Pasteur was the first to recognize that ***virulence***, or the ability of the microbe to cause damage to its host, was *not a constant attribute but a variable property*.

STEREOCHEMISTRY (OR SPATIAL CHEMISTRY)

Pasteur made an important contribution to chemistry laying the foundation of stereochemistry through his identification of ***isomerism*** in tartaric acid.

Louis Pasteur's determination of the problem concerning tartaric acid in *1848* established that just studying the composition of a compound was not enough to understand how a chemical behaves as its structure and shape was also important. This was the *first time anyone had demonstrated* ***molecular chirality*** and also the ***first explanation of optical isomerism.*** Louis Pasteur thus laid the foundation of *stereochemistry*, a sub-discipline of chemistry which involves the study of the spatial arrangement of atoms and molecules.

The development of chemical synthesis was originated after Pasteur described this fundamental rule:

"Only products originating under the influence of life are asymmetrical, because the cosmic forces that preside over their formation are themselves asymmetrical".

CRYSTALLOGRAPHY/MOLECULAR ASYMMETRY

Pasteur demonstrated that a crystal's shape, its molecular structure and its effect on polarized light are all interrelated.

Louis Pasteur studied tartaric acid and noticed that it consisted of two different types of tiny crystals which were *mirror images of each other*. When polarized light was passed through each, both solutions rotated it, but in opposite directions. When the two crystals were together in equal quantity in a solution, the effect of rotation was cancelled. Thus Louis Pasteur *discovered the existence of* ***molecular asymmetry***.

FRENCH SILK INDUSTRY

He also saved the French ***silk industry*** which had been plagued by an unknown disease.In the middle of the 19th century, the French silkworm industry was being destroyed by two infectious diseases which were killing a great number of silkworms. In 1865, Louis Pasteur accepted a request to investigate the problem though he knew nothing about silkworms. He identified that *parasitic microbes were the cause of the diseases* and, after several years of research, was able to save the silkworm industry through *a* ***method of prevention of contamination of healthy silkworm eggs***. The method was soon employed by silk producers all over the world and is still used in silk producing countries.

FERMENTATION

Pasteur showed that fermentation was caused due to living organisms

In the 1850s and 1860s, Louis Pasteur showed that fermentation was a process initiated by *living organisms* in a series of investigations. At the time it was thought to be caused by yeast dying and decomposing. In 1858, Pasteur demonstrated that fermentation was a process involving the *action of living yeast* and that fermentation could also produce *lactic acid*, *which makes* ***wines sour***. Through further research, Pasteur showed that *the growth of micro-organisms was responsible for spoiling beverages*, such as beer, wine and milk.

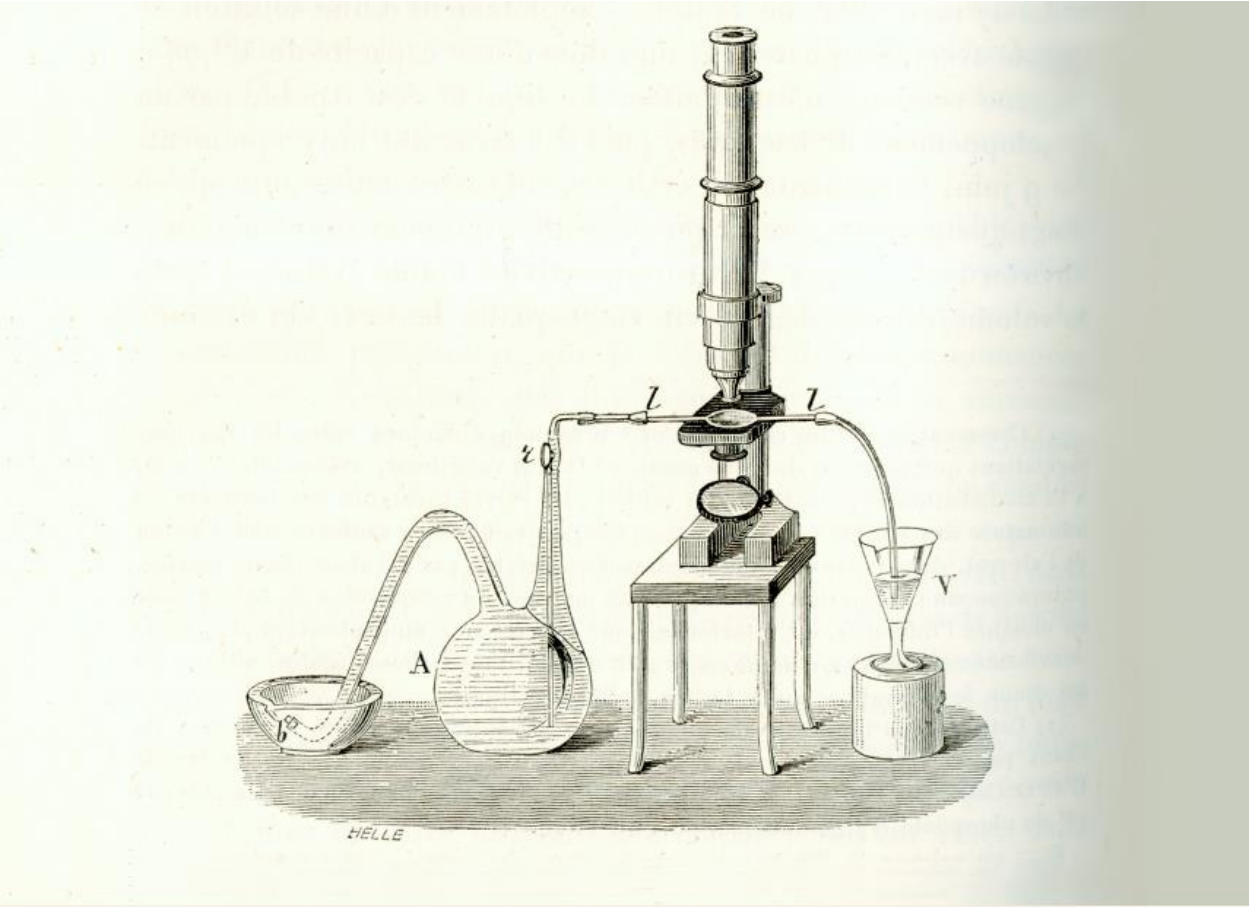


Fig. Equipment used by Pasteur for examination of contamination in Beer fermentation

SPONTANEOUS GENERATION & ALHUMBERT PRIZE

Louis Pasteur decisively disproved spontaneous generation. *Spontaneous generation* was a prevailing notion during Pasteur's time by which simple life-forms were ***spontaneously generated from non-living matter***.Louis Pasteur conducted an experiment in which he sterilized beef broths by boiling them in swan-neck flasks that contained a filter to prevent all particles from passing through. Nothing grew in the broths unless the flasks were broken open, showing that *living organisms came from outside and were not spontaneously generated*. Pasteur thus disproved the centuries old doctrine of spontaneous generation and was awarded the ***Alhumbert Prize*** in *1862* for his effort.

ANAEROBIOSIS & PASTEUR EFFECT

Pasteur rediscovered anaerobiosis. In 1857, during his study of butyric acid fermentation, Louis Pasteur discovered that the *fermentation process could be arrested by passing air through the fermenting fluid*. This led him to conclude the presence of a life form that could exist in the absence of oxygen. Pasteur thus *re-discovered* ***anaerobiosis*** around 200 years after Leeuwenhoek. His rediscovery led to the establishment of the **concept of *aerobic and anaerobic life.*** His process to inhibit the fermentation process through oxygen came to be known as ***Pasteur Effect.***

TARTARIC ACID

In 1858, Pasteur firstly demonstrated the microbial resolution of tartaric acid. He performed fermentation of the ammonium salt of racemic tartaric acid, mediated by the mold *Penicillium glaucum.* The fermentation yielded (–)-tartaric acid.

VINEGAR

In 1862, Pasteur investigated the conversion of alcohol into vinegar and concluded that pellicle, which he called "the flower of vinegar", "served as a method of transport forthe oxygen in air to a multitude of organic substances".

VACCINES

Louis Pasteur created vaccines for rabies and anthrax. Louis Pasteur's first important discovery in the study of vaccination came in *1879* and was regarding the disease known as ***chicken cholera*.** After accidentally exposing the chickens to an attenuated culture of the disease, he observed that they became *resistant to the* ***fully virulent strain***. He developed methods of protecting people against two deadly diseases by developing their vaccines**, *anthrax in 1881* and *rabies in 1885.***

On July 6, 1885, Pasteur vaccinated Joseph Meister, a nine-year-old boy who had been bitten by a rabid dog.The News appeared in the Local Newspapers of America after the discovery of the Rabies vaccine

Examination of Anti-Rabies vaccine by Bratain Committee

Pasteur's technique of anti-rabies inoculation was investigated in Britain by a Committee of Enquiry set up in April 1886 under the chairmanship of Sir James Paget, with Victor Horsley as secretary, and including Sir Thomas Lauder Brunton, Sir Henry Roscoe, John Burdon Sanderson**, Sir Joseph Lister** and Sir Richard Quain. Its conclusions were reported in Nature in July 1887: 'Fromthe evidence ofall these facts, wethink it certain that the inoculations practised by M. Pasteur on persons bitten by rabid animals have prevented the occurrence of hydrophobia in a large proportion of those who, if they had not been inoculated, would have died of the disease . . . M.Pasteur's may justly be deemed the first proved method of overtaking and suppressingby inoculation a process of specific infection.

GREAT TRIUMPHS OF MEDICAL HISTORY...

1885 — a *MAD DOG*... and a fighting Frenchman!

How France — and all the world — was freed from the threat of a frightful death

A blood-curdling shriek "Mad Dog—MAD DOG!" The sudden rush of frantic feet stampeding and stumbling in panic!

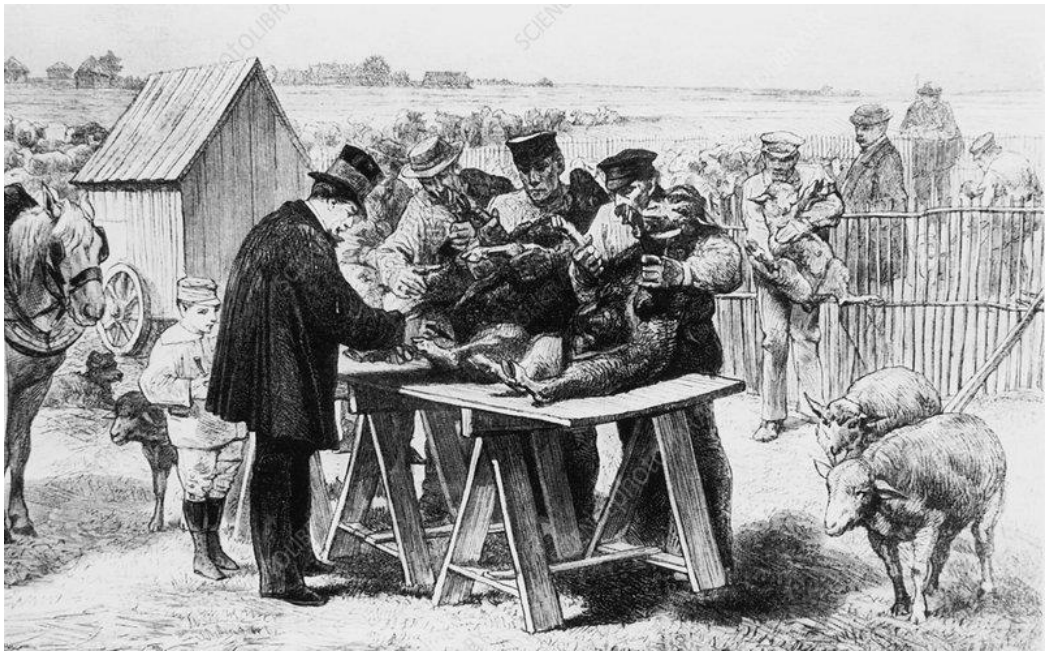
Grimly gazing from a laboratory window at the frenzied mob below, no wonder the eyes of a famous fighting Frenchman were filled with horror and pity. No wonder the heart of Louis Pasteur—whose life was a ceaseless battle against microbes, disease and death—was filled with resolve to seal Hydrophobia's fate.

Not a living soul knew better than he how justified was man's mortal fear of this ghastly malady. For the only hope of a victim was that merciful Death would hurry . . . and he seldom waited in vain.

In the face of jeering skeptics, in the face of heart-breaking defeats, this dauntless hero of France fought an unflinching battle for four solid years against an army of murderous germs that outnumbered him billions to one. But written in the History of the World's Great Medical Triumphs—in ink that will never fade—is "*The 6th of July 1885*"—the day when a little Alsatian boy, cruelly torn by a rawing beast, received from Louis Pasteur the first anti-rabies vaccine.

What a day in the life of that little boy's mother, when he trotted home—healed and happy—whistling the "Marseillaise!" What a day of VICTORY for France—and medicine—and all the world. Today, over 99% of those given the "Pasteur Treatment" totally recover!

Louis Pasteur performed his anthrax vaccination experiment at Pouilly-le-Fort in 1881. On 28 April 1881, Pasteur injected 24 sheep, one goat and six cows with the attenuated cultures; he repeated this on 17 May. Two weeks later he injected this group and 29 unvaccinated animals with a virulent strain of anthrax. On 2 June he found that all the unvaccinated animals were dead or dying whilst the inoculated animals survived.



Picture of anthrax vaccination at Pouilly-le-Fort in 1881

VIRULENCE

Pasteur was the first to recognize variability in virulence

PASTEURISATION

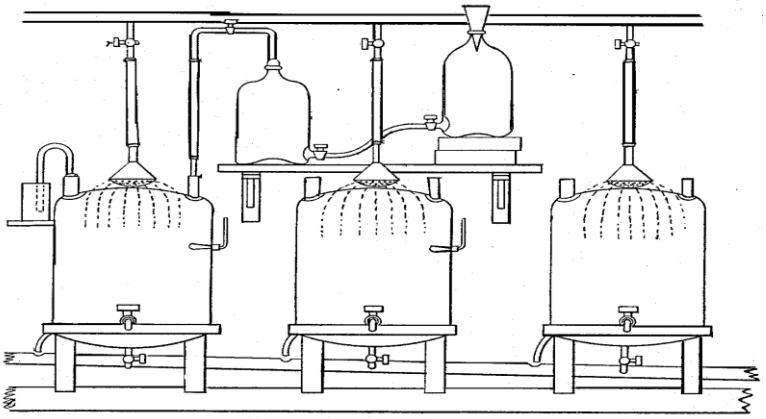
Pasteur showed that each disease is due to a specific ferment and with a special heating at 55°C, it is possible to prevent diseases from affecting wines. This method is known worldwide as "*Pasteurisation*".

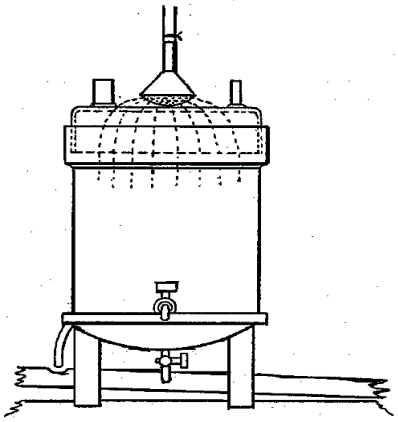
PASTEUR'S PATENTS

Country	Title of Patent and its number	Year
England	(a) 2225	Aug., 24, 1871
	(b)1106	Mar., 25, 1873
France	(a) 91941	June 28 1871
	(b) 92505	Aug., 21 1871
	(c) 98476	Mar. 13, 1873
Italy	(a) series II, Vol.3	April 8, 1872
	(b) series II, Vol. 4	July 10, 1873
United States	(a) No. 135245 with title Improvements in Brewing Beer and Ale	28th January 1873
	b) No. 141072 for Improvements in manufacture and Preservation of beer and in the treatment of yeast and wrot together with apparatus for the same.	July 22, 1873

1106. And Alexander Melville Clark, of 53, Chancery-lane, in the county of Middlesex, Patent Agent, has given the like notice in respect of the invention of "improvements in the manufacture and preservation of beer, and in the treatment of yeast and wort, together with apparatus for the same."—A communication to him from abroad by Louis Pasteur, of Paris, France, Chemist, Member of the Institute.

The figures of the processes and the apparatus as patented by the Pasteur.





Signature of Pasteur

Louis Pasteur

Signature is adapted from the Patent of Pasteur on Beer

ARTICLES, MONOGRAPHS, and PUBLICATIONS

Year	Title
	Notes on the Crystallization of Sulphur.
1848	Researches into the different Modes of grouping in Sulphate of Potash.
	Researches in Dimorphism.
	Memorandum on the Relation which may exist between crystalline Form and chemical Composition and on the Cause of rotary Polarization.
	Researches into the Relations which may exist between crystalline Form, chemical Composition and the Direction of the rotary Power.
	Researches into the Relations which may exist between crystalline Form, chemical Composition and the Direction of rotary Polarization (2d Memorandum).
1849	Researches into the specific Properties of the two Acids which compose racemic Acid.
1850	New Researches into the Relations which may exist between crystalline Form, chemical Composition and the Phenomenon of rotary Polarization.
	New Researches into the Relations which may exist between crystalline Form, chemical Composition and molecular rotary Power.
1851	Memorandum upon aspartic and malic Acid.
	Regarding a Memorandum relative to aspartic and malic Acid.
1852	Observations upon artificial Populin and Salicin.
	New Researches into the Relations which may exist between crystalline Form, chemical Composition and the molecular rotary Phenomenon.
1853	New Facts relating to the History of racemic Acid
	Notes on the Origin of racemic Acid.
	Notes on Quinidine.
	New Researches into the Relations which may exist between crystalline Form, chemical Composition and the molecular rotary Phenomenon.
	Note upon Quinidine.
	Transformation of tartaric Acid into racemic Acid.
	Researches into the Alcaloids of the Cinchonas.
	Transformation of the tartaric Acids into racemic Acid. Discovery of inactive tartaric Acid. New
	Method of separating racemic Acid into right and left tartaric Acid.
1854	Regarding Dimorphism.
1855	Memorandum upon amylic Alcohol.
1856	Note upon Sugar and Milk.
	Isomorphism between isomeric Bodies, some active and others inactive, in relation to polarized Light.
	Studies regarding the Methods of Growth of Crystals and the Causes of their Secondary Forms.
1857	Memorandum upon so-called lactic Fermentation.
	Memorandum upon alcoholic Fermentation.
1858	Upon alcoholic Fermentation.
	Memorandum upon the Fermentation of tartaric Acid.
	Constant Production of Glycerine in alcoholic Fermentation.
	New Researches into alcoholic Fermentation.
	New Facts concerning the History of alcoholic Fermentation.
1859	New Facts contributing to the History of lactic Yeast.
	New Facts concerning alcoholic Fermentation.
	New Facts relating to alcoholic Fermentation, Cellulose and the fatty Matters in Yeast formed at the expense of Sugar.
	Note upon the Remarks Presented by M. Berthelot at the last Session of the Academy.
	Memorandum upon alcoholic Fermentation.

PASTEUR'S VISITS TO GREAT BRITAIN

Pasteur visited Great Britain on four occasions: in 1862, 1871, 1881 and 18841• The first visit, in 1862, occurred when he was working on fermentation and he hoped to meet the German chemist A W von Hofmann, who was living in London but happened to be away at the time. The second visit took place in September 1871 when Pasteur was working on the production of beer. He visited Whitbread's brewery in Clerkenwell, London, and using his own microscope, he examined the yeast (*Saccharomyces cerevisiae*) used for the production of the porter and observed that it was contaminated by moulds. He therefore advised the brewers to change to another yeast'', The third visit was in August 1881 on the occasion of the 7th International Congress of Medicine held in London, when he led a delegation of 250 French medical scientists and delivered a lecture on the attenuation of microbes and on his method of vaccination against two animal diseases: fowl plague and anthrax.

Pasteur's fourth and last visit was in 1884 when he represented the Academic des Sciences, Paris, at a commemoration of the University of Edinburgh.

THE COMPLETE PATENTS OF LOUIS PASTEUR

L. PASTEUR.

UNITED STATES PATENT OFFICE.

No. 135,245. Patented Jan. 28, 1873.

Fig. 1.

LOUIS PASTEUR, OF PARIS, FRANCE.

IMPROVEMENT IN BREWING BEER AND ALE.

Specification forming part of Letters Patent No. **135,245**, dated January 28, 1873.

To all whom it may concern:

Be it known that I, LOUIS PASTEUR, of the city of Paris, France, have invented certain new and useful Improvements in the Process of Making Beer, for which Letters Patent were granted to me in France on the 28th day of June, 1871; and I do hereby declare the following to be a full, clear, and exact description thereof, reference being had to the accompanying drawing making part of this specification and the letters of reference marked thereon.

Previous to my invention in the process of making beer it has been customary to permit the exposure of the "wort"—that is, the boiled extract of malt or other material seasoned with hop or other qualifying ingredients—to the action of atmospheric air. I have discovered that by contact in the usual way with air during the process not only is the quality of the beer produced much impaired, but also that a less quantity is made from a given amount of wort than can be otherwise produced.

Based upon this discovery and the idea of performing the process of brewing without the presence in the wort of atmospheric air, my invention has for its object to produce a better quality and greater quantity of beer from the same quantity and quality of wort, and to afford a beer which shall also embody the quality of greater degree of unalterableness during time and changes of climate, &c., in transportation and use; and to these ends my invention consists in expelling the air from the boiled wort while confined in a closed vessel or closed vessels, and then cooling it by the application of sprays of water to the exterior of such vessel or vessels, as will be hereinfter more fully explained.

To enable those skilled in the art to fully understand and practice my improved process for the manufacture of beer, I will proceed to more fully describe it, referring at the same time by letters to the accompanying drawing, in which I have shown an apparatus adapted to carry on my said improved process.

At Figure 1, A A A represent three casks or tanks, which may be made of galvanized iron, wood, or other suitable material, and which are supported on suitable stands *b*, as represented. Above the series of cylinders or vessel A is arranged a water-supply pipe, E, from which depend branch pipes, (one over each of the vessels A,) provided with cocks *r*, and having attached to their lower ends flexible tubes or hose *s*, which in turn carry at their lower extremities spray-nozzles P. Upon a suitable stand or shelf, F, is located an apparatus, M M, for the generation of carbonic-acid gas, which is to be supplied therefrom to the vessels A for purposes to be presently explained, and by means of tubes connected at *w* to the said vessels. The escape of the gas is permitted through exit or escape tubes at *x*, which extend siphon-like into water cups or chambers *v* from whence the gas may be collected in a gasometer.

I have shown the connection of the gas-generator with only one of the vessels; but it will be understood that the others may be similarly connected.

The spray-nozzles P are located about centrally over each of the vessels A, which should be made slightly convex or dome-shaped on top, and so that the jets of water discharged therefrom will fall like rain on the tops of the said vessels and trickle down their sides, as illustrated by the dotted lines in Fig. 1. Around the base of each vessel A is arranged a circular trough, which catches the water and from which the water is led off by a tube, *i*, into a conductor or discharge-trough, *c*, which carries it to any desired destination. R′ are cocks through which the contents of the vessels may be discharged into other vessels for the permanent retention of it, and R are faucets, which are used to draw off the beer for use, when it shall have been left or allowed to remain in the vessels A, as will be presently explained.

At Fig. 2 is illustrated a modification of the vessel or cask, in which, in lieu of being closed permanently at the top, said vessel B is made with a removable top, and is provided with the usual and necessary water-gages, thermometers, man-holes, &c., common to such contrivances.

The following explanation in connection with the foregoing description of apparatus will suffice to convey a full exposition of my improved process: The wort prepared in the usual manner, and while yet boiling hot, is introduced into the vessel A, into which a current of carbonic-acid gas is then conveyed for the purpose of expelling all contained air, and the water-spray is then let on to the vessels

L. PASTEUR.

Brewing Beer and Ale.

No. 135,245. Patented Jan. 28, 1873.

Fig. 1.

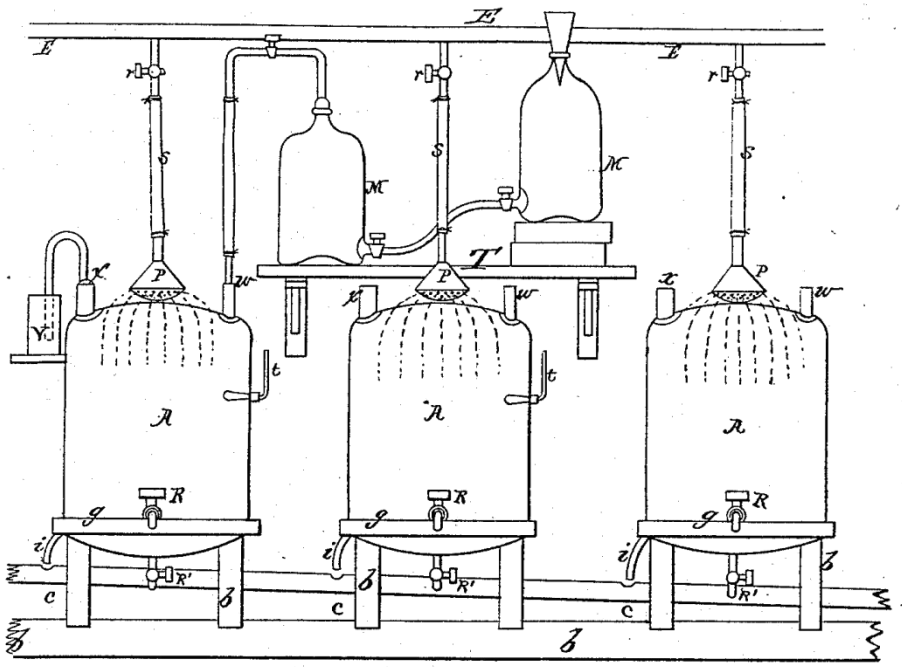
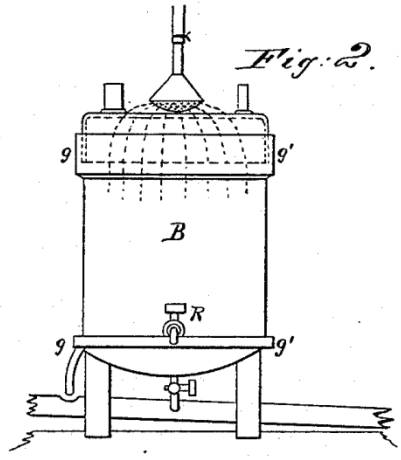


Fig. 2.



Witnesses,
E. Wolf
J. Felbel

Inventor
Louis Pasteur
By his attorney
C. M. Keller

to cool them and their contents. As soon as the temperature of the charge has been reduced to about from 16° to 18° Reaumur, the yeast or pure ferment is added to provoke or induce fermentation. After this fermentation, or the first fermentation, the contents of the vessels A may be drawn off through the cocks R′ into casks or barrels for future use, and in which the usual and further fermentation goes on, from which the beer becomes both clear and bright.

In lieu of drawing off the beer thus into barrels it may be allowed to remain, when the apparatus is not needed further, in the vessels A, and therein complete its fermentation, and be drawn for use through the faucets R; but in this case, or where it is desired to accelerate or make more complete the first fermentation, it may be found desirable to introduce a small quantity of air into the vessel, first, however, passing the air through a hot tube, or at least filtering it through cotton, for the purpose of either killing or extracting any germs which it may contain.

The apparatus which I have shown is adapted to the working of small quantities —say about one barrel; but it is obvious that the capacity of the apparatus may be varied at pleasure to manufacture more or less extensively.

In conducting my new mode of manufacture or process, the carbonic-acid gas generated from the fermentation of the wort may be collected properly in a gasometer, of course, and employed in lieu of or in connection with that derived from a generator, such as shown, and which is necessary for the first operation, it being important always to effect a thorough penetration of the mass by the carbonic-acid gas to expel all contained air.

It will be understood that by my improved process not only are the usual cooling-vessels dispensed with and all loss by evaporation prevented, but that the quality of the beer and its alcoholic gradation are improved and a larger quantity produced from a given supply of material.

I have found that by my new process the beer produced possesses in an eminent degree the capacity of unchangeableness, and can be transported without detriment or deterioration; and that in the use of my process, by which I am enabled to brew in all seasons and in most any climate successfully, the product is more aromatic and is perfectly limpid.

What I claim as new in the process of brewing or in the manufacture of beer is—

Subjecting the wort to a process for the expulsion of the air and cooling it off, substantially as and for the purposes set forth.

In testimony whereof I have hereunto set my hand this 8th day of December, 1871.

LOUIS PASTEUR.

Witnesses:
CAYON,
GRENET FYRE.

UNITED STATES PATENT OFFICE.

LOUIS PASTEUR, OF PARIS, FRANCE.

IMPROVEMENT IN THE MANUFACTURE OF BEER AND YEAST.

Specification forming part of Letters Patent No. **141,072**, dated July 22, 1873; application filed May 9, 1873.

To all whom it may concern:

Be it known that I, LOUIS PASTEUR, of Paris, France, have invented Improvements in the Manufacture and Preservation of Beer and in the Treatment of Yeast and Wort, together with Apparatus for the same; and I do hereby declare that the following is a full, clear, and exact description of the same, reference being had to the annexed sheet of drawings, making a part of the same.

The variations in the condition of brewers' yeast, worts, and beer, are caused by the presence of microscopic organisms, the development and multiplication of which are accompanied by the formation of substances which change the properties of the wort, beer, or yeast, and also prevent it keeping beyond a certain time. These organisms exist in varying proportions in cooled worts, as prepared by the ordinary processes, as well as in yeast and beer.

The object of this invention is to eliminate and prevent the multiplication of these organisms by the following means, viz: First, obtaining pure yeast by separating the organic germs foreign to brewers' yeast; second, treating the wort while cooling from the time it leaves the copper, in which all the germs of disease are destroyed, until it reaches the vats, tuns, or fermenting apparatus, and even after fermentation in such manner that it shall not again receive, either by unlimited contact with the open air or with the vessels employed, any pernicious germs capable of multiplying and of subsequently changing the condition of the product; third, cooling in closed vessels in the presence of a limited supply of filtered air or carbonic-acid gas.

Pure yeast, free from pernicious germs, may be obtained in various ways, among which I will indicate the following: I take impure yeast and cause it to act on a solution of sugar-candy in pure water. When the fermentation is terminated, I decant the fermented liquid and add a fresh quantity of sugared water on the top of the yeast deposit. This operation is repeated two or three times, more or less, according to circumstances. I then take a shallow porcelain dish, first dipping it in boiling water, and put in it a little beer wort which has been recently boiled or preserved by the Appert process. I then dilute a little of the yeast deposit of the above-described fermentation in the wort, and cover it with a glass plate. The yeast, which has become more or less exhausted by its action on the sugared water, will then rise and rapidly revive, purified of all germs of disease.

This treatment may be repeated by diluting a little of the yeast deposited at the bottom of the first dish in some fresh wort.

The degree of purity of the yeast may be ascertained with the aid of a microscope, which will indicate the presence of the germs, and show whether, by means of the yeast, a beer may be produced which shall not vary in condition at any temperature.

In the diagram, Figure 1 of the accompanying drawing, the left half of the figure shows a pure alcoholic yeast, and the other half an alcoholic yeast containing the diseased germs, which are filiform in appearance. For this purpose I take a balloon, of the form shown in Fig. 2, of any suitable dimensions, and about half fill it with beer wort, which is first rendered unalterable by being boiled in the balloon itself. The neck A B is closed by an India-rubber tube, *b' c'*, and a glass plug, C D. The plug is removed, and one or more drops of the yeast from the dish, diluted with a little of the supernatant liquid, is introduced by means of the tube M N, which ferments the wort and transforms it into beer.

If this beer, after remaining some weeks in a stove having a temperature of from 70° to 80° Fahrenheit be examined under the microscope and no germs of disease can be perceived, it will show that the small quantity of yeast introduced was perfectly free therefrom.

With yeast thus obtained large quantities may be prepared, it being generated during the manufacture of the beer itself. Yeast may also be preserved indefinitely in a pure state in contact with pure air—that is to say, air which has been purged of all diseased germs

L. PASTEUR.

Manufacture of Beer and Yeast.

No. 141,072. Patented July 22, 1873.

Fig. 1.

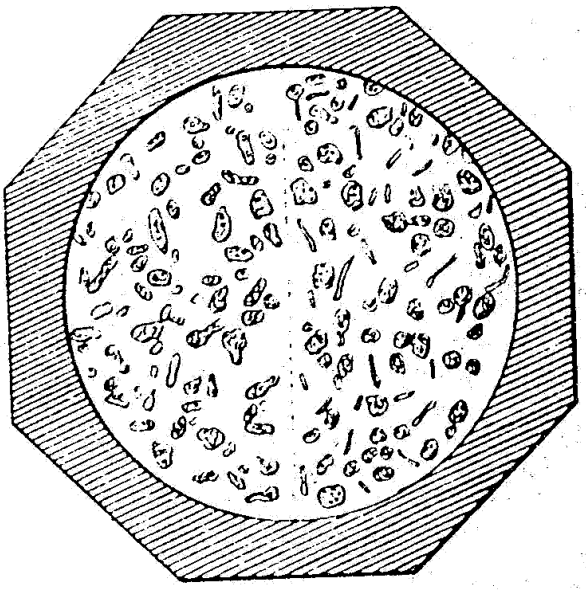


Fig. 2.

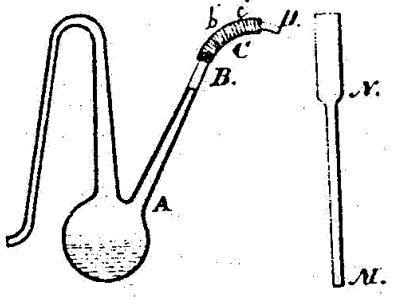
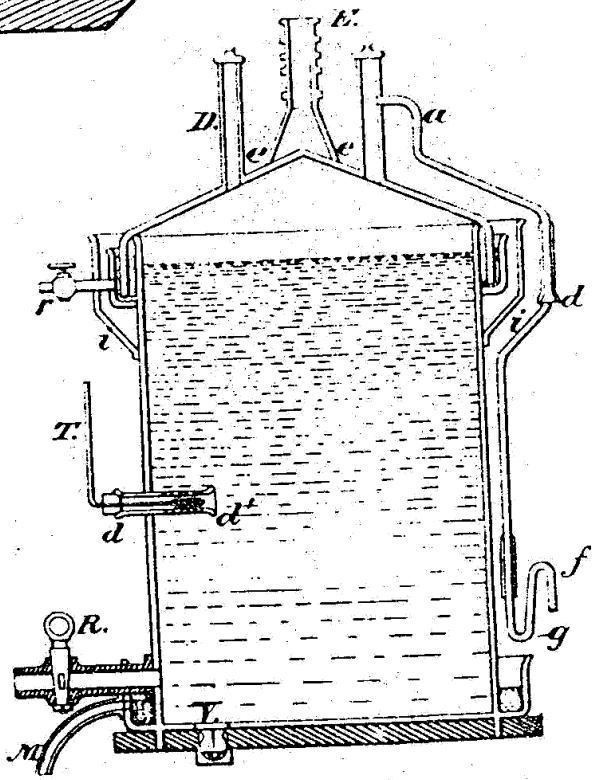


Fig. 3.



Witnesses.

Charles Dehos

Inventor.

Louis Pasteur

liable to affect the condition of the yeast, either in an apparatus such as that shown in Fig. 2, or other similar arrangement. It may also be carried long distances without affecting its condition, and so serve for preparing pure yeast at all seasons and in any quantity desired. By this means the brewer will be spared the necessity of obtaining a fresh supply of yeast from a brewery when his own has become deteriorated, inasmuch as he has always yeast at his disposal in an ever pure condition.

Alcoholic yeasts, which are properly distinct, may also be propagated and cultivated, without becoming altered, by the aid of the apparatus shown in Fig. 2.

I will next describe the improved process of manufacturing and preserving beer, and preparing yeast exempt from diseased germs on any desired scale.

I use the apparatus, Fig. 3, consisting of a cylindrical vessel, closed by a cover, the rim of which dips into a water-trough around the top of the vessel, provided with a cock, r. The beer-wort, properly so called, or other wort used in beer-making, is first boiled in the copper, and then poured into the cylinder, which is completely filled, and the cover put on. Then, by means of a rubber tube, *c d*, the metal pipe *a c*, opening into a stoppered pipe rising from the cover, is connected with the tube *d c f g*. Boiling water is then poured on the cover and on the pipes rising therefrom, which fills the trough, the overflow passing into a gutter, *i i*, from which the water escapes through a slit or a number of small holes in the bottom, and is collected in another gutter at the bottom of the cylinder, provided with a discharge-pipe, M.

T is a bent thermometer, for indicating the temperature of the wort, the bulb of which is protected by a perforated guard, *d' d'*. R V are cocks or apertures for discharging the liquid and sediment from the cylinder.

The cylinder thus filled is allowed to cool by contact of the external air, afterward assisted, if necessary, by cold water introduced at pipe E on the cover, which passes through apertures *e e*, and trickles down over the cylinder. Air enters the long tube *g c f d c a*. The yeast is then introduced through the pipe D, which is immediately closed, the carbonic acid produced during the fermentation passing off at tube *f g*.

A tube similar to *a c d c f g* may be adapted to pipe D, of a different length, if desired, for the escape of the carbonic-acid gas, while a limited quantity of air is admitted by the other tube.

The wort may be readily cooled in presence of carbonic-acid gas by introducing the latter beneath the cover during the cooling.

The tube *f g* may terminate by a loose plug of asbestus or cotton, or by a metal tube heated during the admission of the air. A drop of liquid in bend *g* will serve to indicate the movements of the gases.

The apparatus may be greatly varied in form, and any apparatus which will serve to eliminate the germs of disease, derived either from the air, the raw materials, the yeast, or the apparatus itself, will answer the purpose.

The employment of pure yeast in the above process is of prime necessity—that is to say, yeast deprived of the germs by which the beer is liable to be affected.

All kinds of beer manufactured by this process may be preserved without the aid of ice, and may be made in hot as well as cold climates, as summer as in winter.

As there is no liability of the worts undergoing any change a very small quantity of pure yeast will be sufficient to ferment it.

The following is a recapitulation of the essential features of this improved process: The wort is introduced in a boiling state into the apparatus, on which a cover is then placed, or the cylinder may be entirely closed and communicate with the atmosphere only by means of the pipes, cocks, and long tubes with which it is provided. Boiling water is then thrown on the apparatus, after which it is allowed to cool with or without the assistance of cold water, during which time air or carbonic-acid gas is admitted by the long tube *g d c f c a;* but previous to this one of the pipes on the cover is closed by a plug, through which passes a tube, terminating in an India-rubber tube and glass stopper. Pure wort is then fermented by pure yeast, and, when sufficiently advanced, the contents are poured through the tube in the stopper of the pipe on the cover of the fermenting apparatus.

If there is a supply of pure yeast from the preceding operation this may be used, as in the ordinary processes, the vessel being uncovered for the purpose, if necessary, after fermentation has commenced; but this might lead to great inconvenience at a subsequent period, although the use of pure yeast, manufactured according to this improved process, would of itself form a great improvement on the ordinary processes.

With the aid of the microscope and the method of control, before indicated, the change of condition, which might arise under the latter modes of treatment, may be readily ascertained; but one cooling apparatus may be used or a few, only the wort being passed into vats, (pitched or varnished on the exterior,) which are deprived of any germs of disease, either by the use of boiling water or by a recent coating of pitch on the interior.

It will be seen that the ordinary processes, and the improved method, may, if desired,

be carried on simultaneously, so that brewers will be enabled to gradually transform their plant.

After the beer is made any short exposure to the air, to which it may be subjected, will have little or no prejudicial effect on its keeping qualities, and it may also be fined in the usual way.

I claim—

1. The method of obtaining pure yeast by eliminating the organic germs of disease from brewers' yeast, in the manner described.

2. Yeast, free from organic germs of disease, as an article of manufacture.

3. The vessel, having neck A B, rubber tube *b' c'*, and glass plug C D, as and for the purpose described.

4. The apparatus, consisting essentially of a covered vessel having water-trough around the top, rubber tube *c d*, metal pipe *a*, tube *d f g*, top and bottom gutters, and pipes D E, together with suitable cocks, thermometer, outlets, and inlets, substantially as set forth.

LOUIS PASTEUR.

Witnesses:

CHARLES DELUOS,

ADOLPHE GUION.

Questions.

1. Define Pasteurization.
2. Define Spital Chemistry.
3. Define fermentation.
4. Name the vaccines developed by Pasteur.
5. Define Vinegar.
6. Define Beer.
7. Draw the Diagram of Louis Pasteur Beer Patent Instrument.
8. Comment on tortuous path.
9. What is Pasteur Effect?
10. Define anaerobiosis.

MCQ.

1. How many patents did Pasteur filed……..
a] 0 b]1 c]5 d]9
2. How many vaccines were developed by Pasteur……
a] 0 b] 1 c]2 d]3
3.Pasteurisation is carried out at …….. temperature.
a]55°C b]60°C c] 62°C d] 10°C
4. …….. served as a method of transport for the oxygen in air to a multitude of organic substances.
a] the flower of vinegar b] Cholera c] rabies d] None of these
5. Pasteur Wrote book entitled……..
a] Researches on Molecular Asymmetries b] Vaccines of Man and Animals c] Spital Chemistry d] None of these.
1. Pasture received …… award for disproving of spontaneous generation.
a] Alhumbert Prize b] Noble prize c] Peace prize d] None of these.
7.Pasteur firstly demonstrated the microbial resolution of ……
a]tartaricacid ; b] acetic acid c] citric acid d] none of these
8. Pasteurs Patent Agent was……..
a]Robert Hook b] Emil Fischer c] Alexander Melville Clark d] D. Clark
9] Louis Pasteur performed his anthrax vaccination experiment at……..
a] Pouily-le-Fort; b] Bombay; c] Paris; d] Washington
10] Worlds First Rabies vaccinated boy is ……..
a] Joseph Meister b] Joseph Lister c] Joseph Karl Landsteiner d] none of these

Answers to MCQ

1.d; 2.c; 3.a; 4.a; 5. a.;6.a; 7. a. 8.c. 9. a. 10.a

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