Mr. Richard Kersey, of Lexington, Ky., has patented a simple and compact middlings purifier that will thoroughly separate the flour and bran from the middlings without creating dust in the mill, and that will enable the operator to grade the middlings at will.

An improved heating apparatus for sanitary purposes has been patented by Mr. William R. Macdonald, of Allegheny City, Pa. The object of this invention is to supply at small cost an effective apparatus of simple construction for the sanitary uses of heating, ventilation, and disinfection of buildings—public and private—sewers, drains, and vaults, isolated, sick, or other apartments, water closets, and mines, to be used either solely as a heater or as a heater, disinfector, and ventilator, or for outdoor use as a disinfecting ventilator alone.

A machine which will receive labels or other sheets or prints as they are delivered from a varnishing or enameling machine, and keep them in slow motion through the air for a sufficient length of time to dry the varnished surfaces, without smearing them or making contact between the varnished sheets till they are dry, has been patented by Mr. Joseph E. Hinds, of Brooklyn, N. Y.

An improved machine for grinding glassware, such as tumblers, goblets, and similar articles, has been patented by Mr. Emmanuel Hutter, of Rive de Gier, France. It is simple in construction and operation. and can conveniently be adjusted and regulated to suit the various forms and sizes of the articles and the grinding stones.

### The Electricity of Atoms.

The most novel conclusion of Professor Helmholtz, in his recent Faraday lecture, is to the effect that the atom of every chemical element is always united with a definite unvarying quantity of electricity. This quantity stands in close connection with the combining power of the atom which modern chemistry has termed quantivalence. For if the amount of electricity belonging to the monad atom be taken as the unit, then that of the dyad is two, that of the triad three. and so on. "If," says Professor Helmholtz, "we conclude from the facts that every unit of affinity of every atom is charged always with one equivalent either of positive or of negative electricity, they can form compounds, being electrically neutral, only if every unit charged positively unite under the influence of a mighty electric attraction with another unit charged negatively. You will see that this ought to produce compounds in which every unit of affinity of every atom is connected with one—and only with one—other unit of another atom. This is, indeed, the modern chemical theory of quantivalence, comprising all the saturated compounds."

### A Rare Japanese Medal.

At the late meeting of the Philadelphia Numismatic and Antiquarian Society, a member exhibited a very rare and valuable Japanese gold medal, termed "Shinroku Oban," 400 years old, which excited interest not only from the credentials accompanying it, but also from the manner in which it comes to this country. A few years ago the Japanese Ambassador at Washington asked the advice of Col. Thomas A. Scott in relation to the selection of an American engineer to superintend the construction of certain important works contemplated by the Japanese Government. Col. Scott suggested Mr. Joseph W. Crawford, of Pennsylvania, then engaged upon the Texas Pacific Railroad. Mr. Crawford sailed for Japan, and commenced the construction of an artillery road around the island of Yesso, the northernmost of the Japanese possessions, bordering on Russia. This road, although primarily constructed for the transportation of troops and cannon, was graded so that rails may be laid at any time.

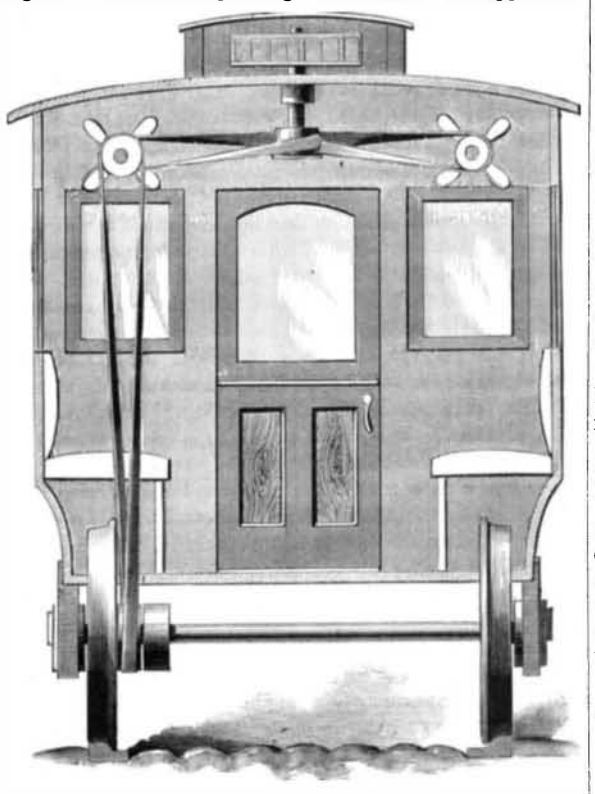
Owing to the precipitous rocky cliffs, the climate, and other causes, this undertaking was regarded as exceedingly difficult to accomplish. The manner, cost, and celerity with which this road was completed proved so acceptable to the Japanese Government that Mr. Crawford was sent to this country to purchase supplies, equipment, and assistants to construct the Polonai Railroad. The road was completed and opened with formal ceremonies last November, on which occasion Mr. Crawford was decorated with the Order of the Rising Sun, and as a particular mark of favor this "Shinroku Oban" was presented to him by the government, through Gen. Koroda, Colonial Secretary and member of the Privy Council of the Mikado. The medal is supposed to be one used at the time of Hiyashiyama (a Tycoon who reigned over the empire about 400 years ago), as a reward to any person of an extraordinary merit.

### Sleigh Bells—How Made.

It has, no doubt, been a mystery to many how the iron ball inside of sleigh bells got there, and it is said to have taken considerable thought on the part of the discoverer before the idea struck him. In making sleigh bells the iron ball is put inside a sand core, just the shape of the inside of the bell. Then a mould is made just the shape of the outside of the bell. This sand core, with the jinglet inside, is placed in the mould of the outside, and the melted metal is poured in, which fills up the space between the core and mould. The hot metal burns the core so that it can be all shaken out, leaving the ball within the shell. Ball valves, swivel joints, and many other articles are cast in the same manner.

### NOVEL CAR COOLER.

We give an engraving of a device lately patented by Mr. Isaac H. Fridenberg, of Philadelphia, Pa., for cooling passenger cars and for improving ventilation. The apparatus

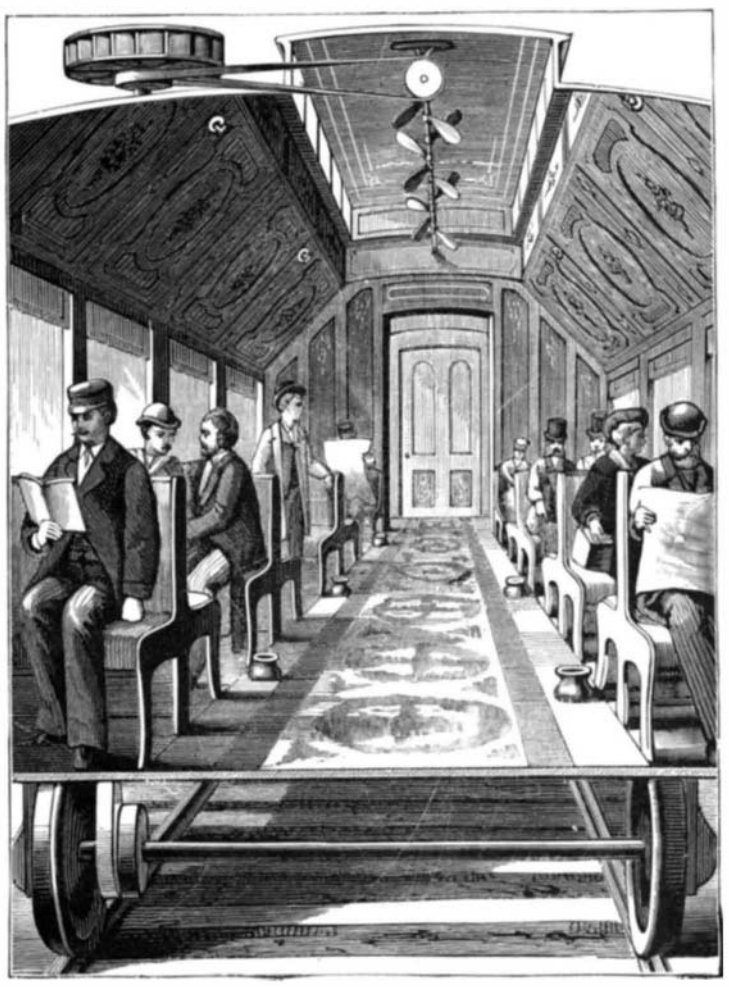


COOLER FOR HORSE CARS.

is very simple indeed, consisting of a shaft running lengthwise through the car, and carrying a number of wings like screw propeller blades, which, as they revolve, set the entire body of air in the upper part of the car in motion, and produce currents in the lower portion of the car which have a cooling effect similar to that produced by so many fans.

When the device is applied to steam cars motion is imparted to the propeller shaft by a wheel mounted on the roof of the car and driven by contact with the air as the car moves along. A belt or a shaft and miter gears may be employed to transmit the motion. When the device is applied to horse cars the power to drive the propeller shaft is taken by a belt from one of the axles.

The discomforts of summer travel will be greatly relieved wherever this invention is applied. It has a large field in



FRIDENBERG'S CAR COOLER.

sleeping cars, where a comfortable and wholesome atmosphere is usually wanting, and in ordinary passenger cars and street cars it will insure a degree of comfort which should warrant its general application.

Further information in regard to this useful invention may be obtained by addressing Mr. I. H. Fridenberg, S. W. corner 7th and Poplar streets, Philadelphia, Pa.

### Industrial Secrets.

A century ago what a man discovered in the arts he concealed. Workmen were put upon an oath never to reveal the process used by their employers. Doors were kept closed, artisans going out were searched, visitors were rigorously excluded from admission, and false operations blinded the workmen themselves. The mysteries of every craft were hedged in by thick-set fences of empirical pretensions and judicial affirmation. The royal manufactories of porcelain, for example, were carried on in Europe with a spirit of jealous exclusiveness. His Majesty of Saxony was especially circumspect. Not content with the oath of secrecy imposed upon his workpeople, he would not abate his kingly suspicion in favor of a brother monarch. Neither king nor king's delegate might enter the tabooed walls of Meissen. What is erroneously called the Dresden porcelain—that exquisite pottery of which the world has never seen its like—was produced for two hundred years by a process so secret that neither the bribery of princes nor the garrulity of the operatives revealed it. Other discoveries have been less successfully guarded, fortunately for the world. The manufacture of tinware in England originated in a stolen secret. Few readers need be informed that tinware is simply thin iron plated with tin by being dipped into the molten metal. In theory it is an easy matter to clean the surface of iron, dip it into a bath of boiling tin, remove it enveloped with a silvery metal to a place of cooling. In practice, however, the process is one of the most difficult in the arts. It was discovered in Holland, and guarded from publicity with the utmost vigilance for more than half a century. England tried in vain to discover the secret, until James Sherman, a Cornish miner, insinuated himself master of the secret, and brought it home. The secret of manufacturing cast steel was also stealthily obtained, and is now within the reach of all artisans.

### Facts about Sahara.

Recently Dr. Lenz, who has just returned from an expedition across the Sahara desert to Timbuctoo, gave a lecture before the Paris Geographical Society. Dr. Lenz decisively condemns as impracticable the project of flooding the Sahara. The fresh water fossils, which are met with in many parts, show that the Sahara is not the bottom of a dried-up sea. The temperature is not nearly so hot as might be expected; wild beasts are rare, and the most formidable enemies to be met with are the Touraeg tribes, who, according to report, have recently massacred the French Trans-Saharan Expedition. On the whole, the impression is conveyed that the Sahara is not half as black as it has been painted, and that it is entitled to an apology from the entire civilized world.

### Wild Rice.

At a recent meeting of the Academy of Sciences, San Francisco, Capt. R. W. Simpson made an interesting statement detailing his efforts to acclimatize the *Zizania aquatica*, or wild rice, which grows so plentiful in some ponds, lakes, and rivers of Canada, extending north to Mackenzie River, nearly to within the Arctic circle. It grows annually from seed, and induces the presence of enormous flocks of wild fowl in the autumn, who visit these rice lakes and extensive beds for food. At Lake Erie it grows in water six to eight feet deep, and millions of reed birds, as well as bucks and other water fowl, resort there, and afford very fine shooting. Sportsmen's clubs East are taking means to extend its growth, as it attracts game of all kinds. In Rice Lake, where it grows prolifically, it has been cut before seed time by manufacturers, who find its fiber, taken from the under surface of the water to a depth of six or seven feet, to be very valuable. It affords the strongest kind of fiber known for making bank note parchment paper. The Canadian Government are now trying to cultivate and stimulate its growth all over the inland waters of the Dominion. Two friends of Capt. Simpson have each sown thirty bushels of this rice seed, in Wales' Pond, Maine, and he desires to call attention to it, as an element likely to prove very useful in improving the shooting in our State, and as such capable of contributing largely to increase our food supply. Different varieties of it are known, but they all belong to one single species, varying according to climate and location. Capt Simpson had tried to make it grow in Oregon and California, but had failed. He now learned that the seed needed first to be soaked in lukewarm water.

### EARTH FUNGUS AS FOOD.

Dr. Harkness exhibited colored drawings of a new species of earth fungus, first discovered in Golden Gate Park by Mrs. Dr. Mary Curran, which, if to be had in quantity, would prove a valuable article of food. He called it the *Octaviana*. Its spores are distributed underground, in the same manner as those of the famous luxury called truffles. He said he had hunted annually for fifteen years under the small oak groves of California, hoping to discover truffles, which in Paris are eagerly sought after as a great delicacy, and sell readily there at $4 a pound. French scientists with whom he has conversed assure him that our State has conditions which convince them that they will undoubtedly be found here, when a large number of observers are trained to hunt for them systematically. In Europe they are often rooted up

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by hogs, who are very fond of them, and have a remarkable faculty of finding them. They grow just under the surface, within four or five feet of oak trees, in fields, and are highly esteemed by epicures the world over. Mr. Clayton, now in Sonoma, once found some red truffles, not the genuine variety, but a very good article of food, and a fair substitute, among the foothills around Santa Clara, and off a little from San José. He had himself dug up some interesting earth puff-balls at Roseburg, and found them edible and quite good for a fungus. Feeling confident that truffles exist on our coast, he recommended farmers engaged in grubbing around oaks to hunt for them especially, and try and recognize them, for thus they could add a new industry to our State, and increase the value of their farms. Capt. Simpson recommended hunting among the heavy oak forests of Oregon and Willamette valley.

## THE GAMGEE PERPETUAL MOTION.*

Chief Engineer Isherwood goes on to say in his report to the Secretary of the Navy, which is dated New York, March 19, 1881:

From observations made by Professor Gamgee in the experimental working of this machine, he deduced the possibility of what he terms a zeromotor, in which, by means of properly adapted apparatus invented by himself, the heat in water or other objects at ordinary atmospheric temperatures may be utilized to vaporize liquid ammonia under very considerable pressures, but within the control of known means of retention. The high pressure gas thus obtained being used with the greatest practicable measure of expansion on a working piston generates power, becoming by that very expansive use greatly refrigerated and diminished in bulk, and partially liquefied at the end of the stroke of the piston, when it is exhausted and then returned by a method invented by Professor Gamgee to the ammonia boiler whence it came. The cycle is thus a closed one; no material is lost, and no heat is rejected in matter leaving the engine. The work done by the engine is due to the difference in bulk of the material when it enters and when it leaves the boiler, that difference being caused by the heat derived from water or other natural objects in the ammonia boiler and from the refrigeration resulting from the transmutation of a portion of this heat by the engine into the mechanical work performed by the latter. That this difference of bulk exists is indisputable, and if the proper mechanism can be contrived to utilize it, the idea of the zeromotor becomes realized. It will be observed that this power has not been obtained from artificial heat produced by the combustion of fuels, but from the heat of natural objects at ordinary atmospheric temperatures, and therefore costing nothing in money. This is made possible by the fact that liquid ammonia gasifies under considerable pressure at ordinary atmospheric temperatures, the sole difficulty in constructing the zeromotor being to find the means of economically condensing the gas after it has been used on a piston. Were it not for the refrigeration due to the expansive working of the gas, the condensation would have to be obtained by the application, externally to the condenser, of artificially produced cold, and the zeromotor could not be made a commercial success. It is only by obtaining the lower limit of temperature from the action of the engine itself, while the higher limit is furnished without money cost by natural objects at atmospheric temperatures, that commercial success becomes possible.

### A MOTOR TO SUPERSEDE THE STEAM ENGINE.

The purpose of the Department in ordering an examination of Professor Gamgee's ice making machine was not to obtain an opinion on its ice making merits, but one as to whether his observations on the behavior of ammonia in the process were sufficiently accurate to warrant his inference of the practicability of constructing a successful zeromotor for industrial uses—a motor, in short, destined to supersede the steam engine. Accordingly the undersigned closely investigated the working of the apparatus. The facts of liquid ammonia gasifying at ordinary atmospheric temperature under very high pressures, and of that gas undergoing very great refrigeration when used expansively in doing work, are not called in question by any one. Both are well known phenomena. The special fact to be observed was whether any part of the ammonia which entered the cylinder as a gas left it as a liquid, and so far as the form of the apparatus allowed any observation to be made, such appeared to be the case. The possibility of the invention of a new motor of incalculable utility would seem to be established, and in view of the immense importance of the subject to the Navy and to mankind at large, I strongly recommend it to the serious attention of the Department, suggesting further that whatever facilities the Department can, in its opinion, consistently extend, be allowed to Professor Gamgee for the continuance of his important experimental inquiries in the Washington Navy Yard. He is most anxious to bring his invention, with the least possible delay, to a crucial test by the completion of the necessary mechanism, and its submission to any board of experts which may be ordered to experimentally ascertain its merits. For this purpose he proposes to use such parts of his present ice making machine as can be recombined in his zeromotor, adding the other necessary parts, and thus producing, with but little loss of time, an embodiment of his idea that will by simple trial show whether an unquestionably correct theory has been successfully reduced to practice.

Professor Gamgee has perfected the calculations and drawings for the mechanism required to give practical effect to his invention, and there remains only to execute the mechanical work. He proposes to use the steam cylinder of his ice-making machine as the ammonia cylinder of the new motor, the present ammonia condenser, and the present ammonia boiler as a low pressure boiler, adding another ammonia boiler as a high pressure boiler. These, together with the ejector between the condenser and the low pressure boiler, a small pump for pumping liquid ammonia from the low pressure to the high pressure boiler, etc., will constitute the zeromotor—a machine, as will be apparent from this brief description, of the simplest, cheapest, and most manageable kind.

In the high pressure boiler the liquid ammonia will be gasified by the heat in water of atmospheric temperature to the pressure normal to that temperature. In the low pressure boiler ammonia is kept at a considerably less tension than in the high pressure boiler, and with this lower pressure ammonia gas the engine is operated, the gas being used as expansively as practicable and made to do work during its expansion, thereby becoming refrigerated, greatly reduced in bulk, and partly liquefied. Immediately on being exhausted the cooled and shrunken gas, and whatever liquid of condensation may be mingled with it, are discharged by the ejector from the condenser into the low pressure boiler, the ejector being worked by the higher pressure in the high pressure boiler. As a result the low pressure boiler is continually receiving ammonia and heat from the high pressure boiler. This excess of ammonia in the liquid form is pumped by an ordinary pump from the low pressure back to the high pressure boiler, while the excess of heat is continuously being converted into the mechanical work done by the engine. There is also the extinction of such part of the heat in the high pressure ammonia gas working the ejector as is due to the work done by it in forcing the contents of the condenser into the low pressure boiler. Of course the cylinder, heat condenser, the low pressure boiler, and their connections are protected from receiving heat from the atmosphere and surrounding objects by a non-conducting substance.

### NO FURTHER USE FOR COAL.

The plan proposed is far from chimerical. It is based on well demonstrated thermodynamical principles. The whole is definite and precise, both in theory and mechanical detail, nor can it be shown, *a priori*, that there is not a fair prospect for success. There can be no doubt that the product of the pressure and volume of the contents of the condenser which are to be forced into the low pressure boiler, is less than the product of the pressure and volume of the ammonia gas which leaves that boiler to operate the engine, and that this difference which has not been produced by the external application of artificial cold, but by the working of the machine itself, is available for the production of power for industrial purposes. All that remains is to give the system a practical test in order to ascertain whether the mechanism proposed will act efficiently enough to realize the expected result. Should this prove to be the case, the steam engine will, within the near future, be certainly superseded by the zeromotor, for the great item of coal, whose cost is the principal expense of operating the former, will be wholly eliminated with the latter. If it can once be practically shown that a very much cheaper, lighter, and a far less bulky mechanism than the steamengine, including for the latter its boilers and, in case of steam vessels, the coal bunker and its contents, can be employed for the production of power to any amount without the use of fuel, nothing can prevent its introduction into general use for all industrial purposes, with the vast result of a great cheapening to mankind of every article of manufacture, from the daily bread of the poor to the luxurious textures which robe the rich. The whole world is concerned in the solution of this problem, and the poorer the person the greater is his interest in it. The source of heat for the steam engine is the continually diminishing supply of coal—a diminution that will be severely felt some centuries hence; but the source of heat for the zeromotor is as inexhaustible as the sun himself, and will last undiminished as long as he shines.

The success of the zeromotor is of more importance to the Navy of the United States than to the navies of the great maritime powers of Europe with which it may come in collision, because those powers have colonies and coaling stations on the farthest shores, while the United States possesses neither, and would consequently, in naval warfare, be at great disadvantage for want of coal—its navy, as a rule, having to render service within a reasonable distance of its own coasts the sole base of supplies. If coal, however, can be dispensed with, we are at once placed on an equality in this respect, and our cruisers enabled to penetrate the remotest seas as easily as those belonging to countries having possessions there.

### VALUE OF THE ZEROMOTOR TO OUR NAVY.

The enormous importance of a motor capable of superseding the steam engine and furnishing power without the combustion of coal can be estimated from the fact that it would produce an industrial and consequently social and political revolution equal to what was effected by the introduction of the steam engine. The whole of modern society is based on the steam engine which mainly has made the difference between the ancient and the present world, for our civilization would be impossible without it. It is the inanimate slave which performs the labor of mankind, freeing them from the greater part of their drudgery and giving them the time and means for culture.

I have ventured these few remarks to show the nature and scope of Prof. Gamgee's invention, which is not that of a machine for the application of power, but for the immensely more important purpose of generating power itself, so that, strictly speaking, it includes as a basis all other machines. I have wished to show this in order to make clear how different is his invention from those of others who may ask to have their apparatus tested in a Navy Yard, and to bespeak for it the most favorable consideration of the Department.

Professor Gamgee and able assistants—among whom is Mr. W. E. Sudlow, an accomplished mechanical engineer, thoroughly versed in the theory and practice of his profession—are well acquainted with the difficulties to be overcome. They are quite aware of all the objections that can be raised, and have well considered the means of obviating them. The subject has been carefully studied, and there are brought to bear upon it the requisite scientific and engineering information necessary to give it an exhaustive treatment. His engine, like the steam engine, is a heat engine, and produces power by the conversion of heat into mechanical work, the same quantity of work consuming in both cases the same quantity of heat, but with this immense practical difference, that the heat for his zeromotor is freely furnished to hand by nature, while for the steam engine it has to be excavated from the depth of earth and afterwards handled and transported by expensive manual labor.

What is now mainly desired is that Professor Gamgee may be permitted to prosecute his experiments at the Washington Navy Yard to a conclusion, and there bring his engine to a practical test with as little delay as possible. Should the Department be able to grant this, the favor will be well and properly bestowed in the interest of the Navy and of the world. Submitted with great respect by,

Sir, your obedient servant,

B. F. ISHERWOOD, Chief Engineer.

* From the Report of Chief Engineer Isherwood, U. S. A., on the Gamgee Zeromotor.

## Bitter Substances Developed during Fermentation.

We have on several occasions drawn attention to this subject, and have expressed an opinion that peculiar bitter substances are occasionally developed during the fermentation of saccharine fluids. As a rule the bitter flavor imparted by the hop is sufficiently strong to mark this extraneous bitter even if it be produced at all, but it must be within the experience of almost every brewer that beers do sometimes acquire an intense and peculiarly bitter flavor quite beyond anything that can reasonably be expected from the hops used. Some experiments by Mr. W. H. Langbeck recorded some time since, point to the occasional existence in fermented liquids of a bitter principle allied to colchicine. He prepared two samples of a fermented liquor from solution of glucose with small quantities of tartar, tartaric acid, kino, and a few drops of a mixture of formic and œnanthic ether. Fermentation was set up by means of sound pressed yeast, and was maintained at a temperature of 64° to 68° Fah. One sample, filtered through flannel after four days and allowed to stand for three weeks in a stoppered cask at 47° Fah., yielded a pleasantly vinous liquid. The second sample, not filtered till after five days, tasted intensely bitter, and grew worse on standing. The newly-formed yeast, at first of a whitish yellow, had taken a brownish color, died off, was precipitated by the more alcoholic character of the fluid, and formed with the alcohol in nascent state that substance which betrays itself by its bitterness in unhopped fermented liquors when the fermentation has been neglected. The compound in question is by no means innocuous. It was isolated by treating the liquor according to Dragendorff's methods I. and II. Langbeck succeeded in obtaining it in a crystalline form, and described its reactions. There is but little doubt that other products besides alcohol, carbonic acid, glycerine, and succinic acid are produced during the fermentation of worts, and some of these may materially modify and injure the flavor of the resulting beer; the use of chemically prepared sugars may tend to the production of these mysterious compounds, but at present our knowledge of the subject is very meager.—*Brewers' Guardian.*

## A French Safety Lamp.

At the usual annual meeting of the Académie des Sciences, just held, the yearly prizes bestowed by the society in recompense of services to science have been awarded. Among others, M. Birckel, a civil engineer employed at the Pechelbronn mines, has received the Montyon prize—which is restricted to improvements in dangerous industries—for a modification of the Davy safety lamp. M. Birckel's improvement is very simple, consisting in providing the wire gauze cylinder with a double iron casing. The top case is movable, and slides over the under one, which is fixed, when a concentric movement is given to it by turning the hanging handle. These casings have corresponding openings of equal section, so that it is possible to more or less restrict the supply of air, or to shut it off altogether, and so instantly extinguish the gas burning inside the lamp when there is much light carbureted hydrogen in the atmosphere. It is not generally necessary to go so far as to extinguish the lamp by hand, because if the air supply be carefully regulated, any addition of combustible gas to the atmosphere will of itself cause extinction through lack of oxygen. M.

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