ATMOSPHERIC DUST AND GERMS.

Atmospheric dust and germs have been the subject of a profound study for the last few years at the Observatory of Montsouris, and the results obtained have recently been communicated to the Faculty of Medicine, of Paris, by Mr. P. Miquel, chief of the micrographic service of the former institution.

Mr. Miquel did his collecting with an aeroscope (Fig. 1) invented by Mr. F. A. Pouchet. This apparatus consists of a cylinder of small diameter connected with an aspirator, and provided with a plate of glass covered with glycerine for receiving and retaining the minute bodies carried along by the current of air.

The number and variety of the spores that are disseminated by the air is found to be immense (Figs. 2, 3, and 4). The spores of *Penicillium* and the cells of *Protococcus* and *Chlorococcus* are almost always present in great abundance. Mr. Miquel applied himself at the outset to the counting of these organisms, and to estimating the numberthat existed in each cubic meter of air, and thus succeeded in determining what influence the seasons, temperature, dryness, and moisture had upon their development. The results are as follows: The number of spores belonging to moulds is

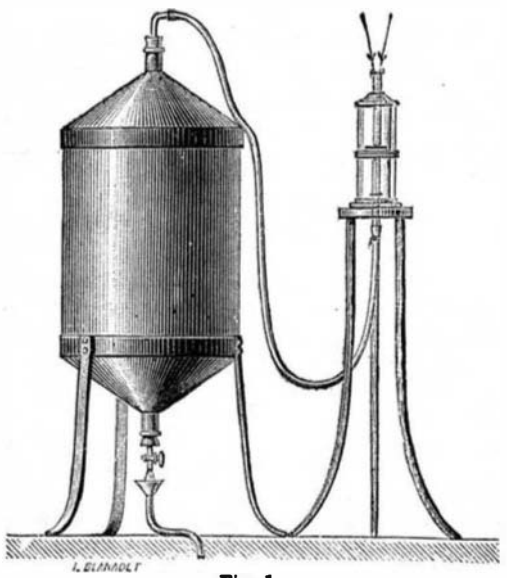


Fig. 1.

Fig. 2.

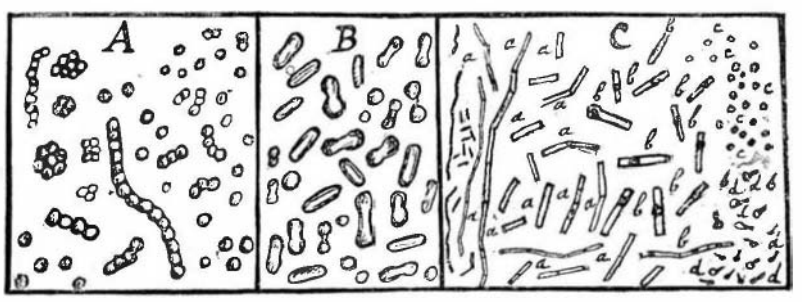


Fig. 3.

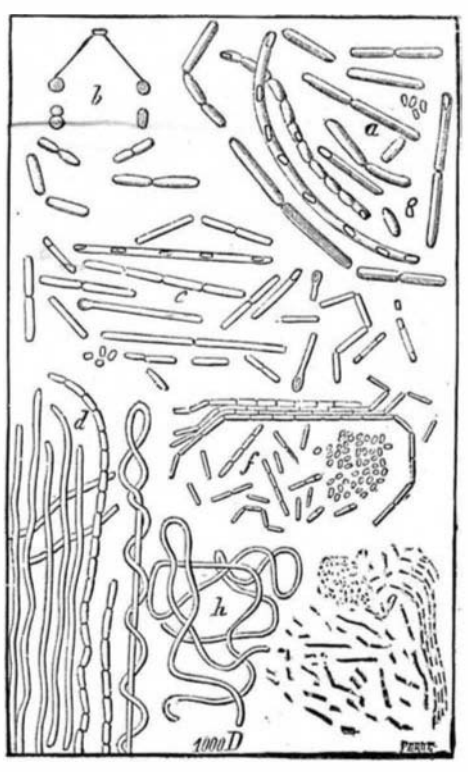


Fig. 4.

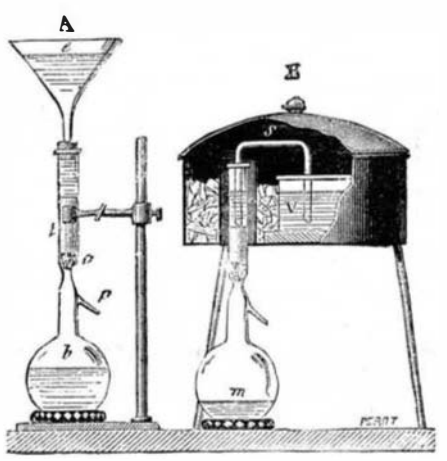


Fig. 5.

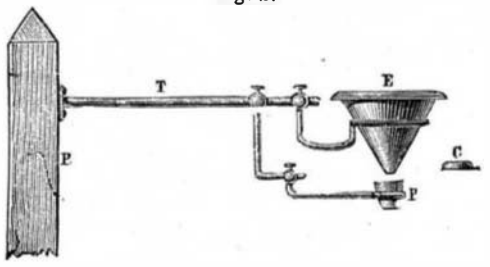


Fig. 8.

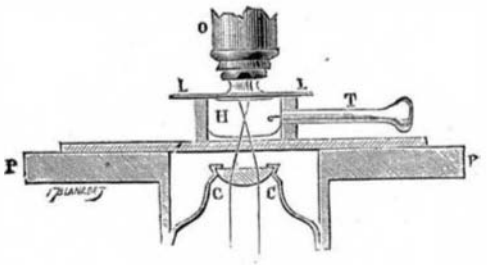
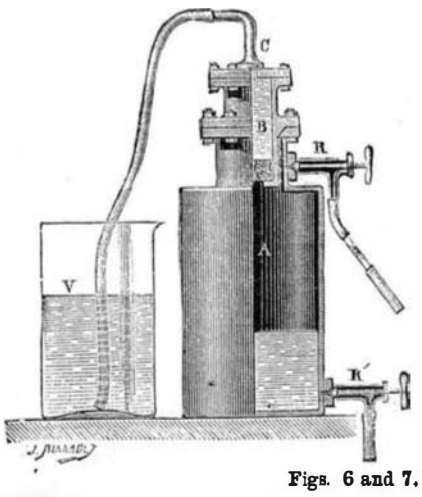
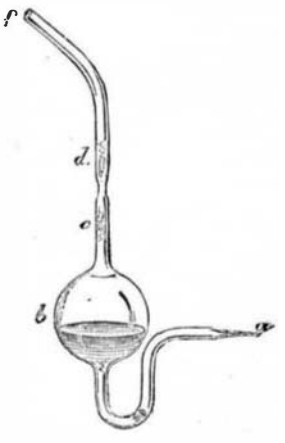


Fig. 9.





Figs. 6 and 7.

ATMOSPHERIC DUST AND GERMS.

small in January and February, very small in March, increases in April and May, reaches its maximum in June, and finds its minimum in December. The number of such spores per cubic meter of air was found to be, on an average:

January	7·000
February	7·000
May	12·000
June	35·000
August	23·000
October	14·000
November	8·000
December	7·000

Heat is not the most important factor in the development of these bodies, but the hygrometric state of the air is. This was to be foreseen as a deduction from the researches made on this subject by Mr. Pasteur. Storms are always followed by an increase in the number of cryptogamic germs; but mineral dust and a few species of microbes, on the contrary, remain fixed to the soil through dampness.

The exact determination of the peculiar vegetations for which the atmosphere serves as a vehicle is made through cultures—the air or water containing the organisms being made to pass into liquors favorable to their nutrition. The liquors used for this purpose are the mineral solutions of Pasteur and Cohn, infusion of hay and beet, neutral urine, beef or chicken broth, and Liebig's extract of beef. The difficulty consists in having these solutions absolutely free from all living organisms. Recourse has been had, without success, to ebullition at 100°—a temperature sufficient to coagulate protoplasm, the physical basis of life, according to Prof. Huxley. Certain spores, however, resist the action of boiling water for several hours.

Mr. Koch extols the method of discontinuous heating for sterilizing liquors. He raises the latter to a temperature lower than 70° in order to kill the adult bacteria, and then allows them to cool so as to give the spores time to germinate, and finally raises the temperature again in order to kill them. Mr. Miquel, however, formally attacks this method, as he considers it inefficacious owing to the uncertainty that exists in regard to the exact period of evolution of certain germs. He also recommends operators not to rely upon the limpidity of the liquors as a test of their sterilization; for there are liquors, Cohn's for example, which are not deprived of active germs after an ebullition of four hours at a temperature of 100°.

It results from experiments that have been made that beef broth, neutralized by potassa and kept for two hours at a temperature of 110° in closed vessels, remains indefinitely stirile. Sometimes, a temperature of 150° ought to be reached or even exceeded, for Mr. Miquel has characterized a bacterium which resisted a temperature of 145° for two hours.

Yet heat offers one drawback, and that is that it weakens the nutritive properties of the organic liquids. An effort has therefore been made to dispense with it and to substitute for it a filtration through porous substances. For this purpose Mr. Miquel has used at Montsouris the apparatus shown in Fig. 5. This consists of a glass bulb, *b*, with a long neck, *t*, having a lateral tubulure, *p*, and being surmounted with a funnel, *e*.

Plaster and asbestos having been placed in the funnel, the bulb is raised to a high temperature in a stove, and sterilized water is then introduced through the tubulure, *p*, and raised to the boiling point. Before the water has entirely disappeared the tubulure is closed by means of a blowpipe, and, when a cooling occurs, a vacuum is produced in the bulb. The broth, being poured in a cold state over the mixture of plaster and asbestos, filters slowly through it, deposits its germs therein, and enters the bulb absolutely devoid of organisms.

During summer, in order to prevent putrefaction, the funnel and vessel, V (Fig. 6), are surrounded with ice. This cold process succeeds better than any other tending to the same end.

The sowing of atmospheric germs in nutritive liquids is done by means of special matrasses resembling in form those used by Mr. Pasteur. The culture liquid is introduced into these through suction, then the slender extremity is closed by melting it in a lamp, and finally the liquid is sterilized by heat. In order to make sure that no atmospheric germ has got into the bulbs while being filled, the latter are tested by allowing them to remain for a month in a stove at a temperature of 30°–35°. If they do not become turbid, they are considered as adapted for the sowing. This latter is effected in different ways. If it concerns rain water, the latter is collected in the collector, P', of a rain gauge (Fig. 8). This collector is carried by a movable arm, so that the operator placed at a distance can take it and put it very gently under the funnel, E, of the apparatus.

Mr. Miquel has applied this arrangement to the estimation of the number of bacteria contained in rain-water, and has thus ascertained that at the beginning of storms such water contains fifty of these organisms to the cubic centimeter, and that this number soon begins to diminish, although it increases again at times at the end of a few days of damp and rainy weather. It seems, then, that bacteria are capable of multiplying in the clouds, or that the latter become charged with them mechanically during their travel through space. At Montsouris, out of 100 bacteria contained in a drop of rain-water, there were, on an average, 28 *Micrococci*, 63 *Bacilli*, and 9 *Bacteria*. In the air the proportion was 66 *Micrococci*, 13 *Bacilli*, and 21 *Bacteria*.

The development of these little organisms in sown liquors is followed under the microscope by means of the *moist chamber*, an invention of Messrs. Van Tieghem & Lemonnier. This apparatus (Fig. 9) consists of a hollow glass cylinder, H, at the bottom of which there is placed a little water, which is afterward covered with a thin piece of glass, LL, To the under surface of this latter is attached the culture liquid containing the spore that is to germinate therein, both being introduced by means of the rod, T. The moist chamber is placed on the stage, PP, of the microscope, under the objective, O. Mr. Miquel has in this way studied the evolutions of a bacillus, which afterward became transformed into a micrococcus (Fig. 10). He has also shown the phenomenon of the devulcanization of India-rubber, through a bacterium which is very frequent in sewage waters. This schizophyte furnishes nascent hydrogen, and, in the presence of sulphur, gives hydro-sulphuric acid. In-

troduced with the ferment of urea into a solution of urea, into which dip sulphureted papers, it gives hydro-sulphate of ammonia.

The methods that we have just described have given very interesting results, and have shown that there exist, on an average, 80 bacteria to the cubic meter of air. The maximum occurs in autumn, and the minimum in winter. The average numbers are as follows:

December and January	50 bacteria.
February	33 "
May	150 "
June	50 "
October	170 "

Contrary to what occurs in moulds, the number of schizophytes, which is small during rainy weather, rises when all the dampness has disappeared from the surface of the soil.

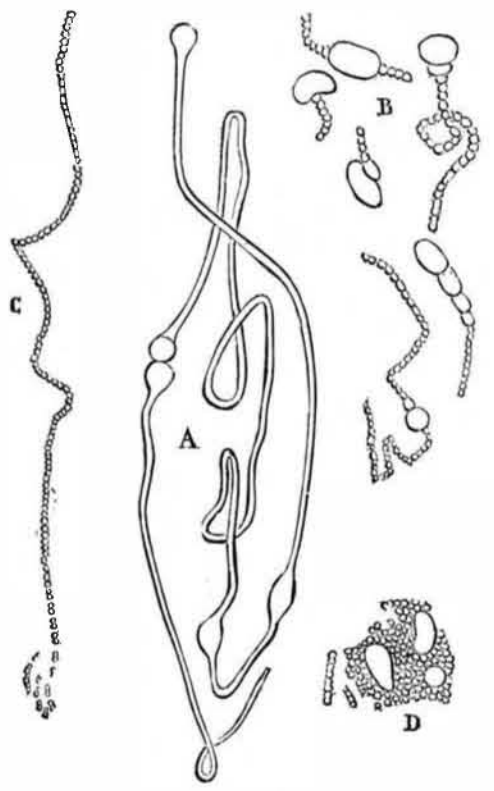


Fig. 10.

The action of dryness is greater than that of the temperature. It seems, in fact, as a result of numerous experiments, that the water evaporated from the surface of the soil never carries schizophytes with it. Dry dust, on the contrary, that from hospitals principally, is charged with microbes. As a result of comparative experiments made in Rue Rivoli, and at Montsouris, it appears that the air contains nine times as many bacteria in the interior of Paris as in the vicinity of the fortifications. The influence of the dominant winds is notable. That from the northwest reaches Montsouris laden with a considerable number of bacteria. This is the wind that blows from the hills of La Villette and Belleville. Then come the winds from the east, north, and northwest. The south wind is less charged with these organisms. The distribution of microbes in a vertical direction indicates that they are derived from the mud and dirt of the streets and dwellings. A cubic meter of air, which contains but 28 of them at the summit of the Pantheon, contains 45 at the Park Montsouris and 462 at the Mayoralty of the fourth ward.

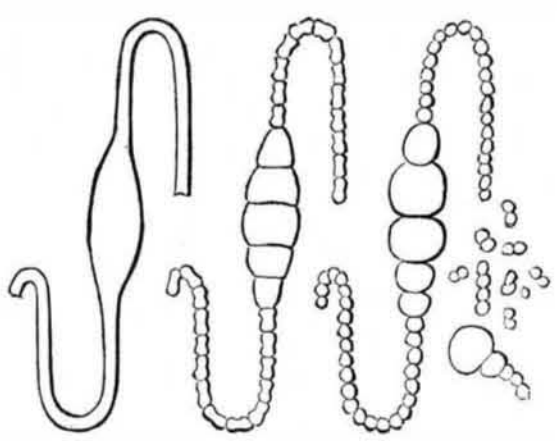


Fig. 11.

The determination, among these myriads of schizophytes of the air and water, as to which are the ones that intervene in contagious diseases is the final problem proposed to science, and the solution of which will be greatly aided by the work that is being done at the observatory under consideration.—*Le Genie Civil.*

A CORRESPONDENT of the *British Medical Journal* states that he has found the application of a strong solution of chromic acid three or four times, by means of a camel's hair pencil, to be the most efficient and easy method of removing warts. They become black and soon fall off.

FIRE AND BURGLAR PROOF SAFES.

The series of nine engravings on the first page are illustrations from sketches of the fire proof and burglar proof safe manufactory of Hollar's Safe and Lock Company, York, Pa. One of the views represents their factory, which was recently built and equipped with machinery and appliances specially designed for their business, and is not excelled by any other establishment for completeness of tools, fittings, and means of producing good work with facility and dispatch. The company have a frontage of 350 feet on the N. C. R. R., from which sidings run to the shops, enabling them to receive supplies direct and to ship finished work with the least possible delay.

The largest of the interior views represents the burglar proof department, so called, because that in it burglar proof safes and vaults are made. Many who are not fully informed on the subject believe that there is no possibility of constructing a burglar proof safe or vault, the belief being induced by published accounts of successful "crackings" of safes by professional burglars. It is probable, however, that investigation would show that the fault lies with those purchasers of safes who regard the price of the safe as of more consequence than its quality, and so encourage the manufacture of inferior and unreliable articles. These ideas would be modified and corrected by a visit to this factory and an inspection of the processes there employed to construct absolutely burglar proof safes and vaults.

These processes are the forming of solid welded angles and frames out of welded plates of chrome and carbon steel and iron; the thorough fitting of all joints by planing and grinding; the exactness of the preparation of the parts for the reception of the company's patented compound key wedges and conical and stub bolts for securing all the parts together as one body; the protection against the introduction of all explosives by the use of their patent ribbed tongues and grooves; the security of the door against the force of the most skillfully driven wedge; the means employed by the company for resisting screw power by their patented method of locking the bolt frames to the door, making it a part of the complete construction; the making, grinding, and building-in their patent lock arbor, that strengthens instead of weakens the door, which has heretofore been the weakest part of the construction. These methods, and intelligent effort in their application, have made it possible to construct a safe with no weak point, the door, always heretofore a point of weakness, being made equally invulnerable with all other portions of the safe or vault.

The facilities for heating, working, hardening, and tempering of steel are excellent. These processes may be seen in the view of the smiths' department, in which large furnaces, bending clamps, and cooling tanks are provided. The tanks are kept constantly supplied with cold, soft water procured from an artesian well, drilled for the purpose; and after all the various parts of the steel safe, vault, or section are completed, they are here treated to the tempering process that renders them proof against the drill or any known cutting device. Then follows the rebuilding of the safe, vault, or section, as the case may be, not again to be taken apart.

In another view is seen the department for the construction of the iron work essential in the production of the highest grade of fire-proof safes. In this department nothing is left undone that will aid to the desired end—that of absolute protection of records, books, papers, plate, jewelry, etc., from fire; for without a strong iron exterior and interior case to contain it and hold it securely, the best non-conducting material is useless. This has been demonstrated by many fires, in which strap or hoop front and back safes have been broken open by falling from a considerable height, or crushed by the weight of falling walls. In order to remedy this fatal weakness this company have introduced, in the construction of their fire-proof safes, solid welded angle fronts and backs, the doors being protected by a wrought iron tongue, which is made to fit neatly into a corresponding groove in the door jamb on all sides.

In the center view is seen the final process of grinding the surfaces of the safes, with traversing emery wheels, as they progress to the filling room, shown in the view to the right. In this room the important process of preparing and mixing the fire-resisting materials is performed. Filled with this substance the hottest fire can never force its heat through the walls of the safe to the injury of the contents. This material is mixed with fifty per cent of water, and thus mixed has the quality of rapidly attaining the solidity of stone with its burden of water sealed within it, ready, in case of fire, to be liberated in the form of vapor, which, pervading the whole interior, prevents the destruction of the contents of the safe.

During the process of fire-proofing an expert examines every part of the work and all the materials used, before the safe is approved and declared ready for the reception of the cabinet work, which is prepared in another department shown in a view on the right. The safe is then ready for the paint-room, seen in another view. Here it receives treatment at the hands of a competent artist, and when finished may be justly pronounced a thing of security and beauty.

The company have a capacity of twenty complete safes a day besides jail and other work. Only the best of materials and the best of workmanship are used and employed—the company make no claim to cheap, second-class work. The most skillful workmen are employed, having been gathered from those localities where the best grade of safe work has been hitherto produced.

Mr. William H. Hollar, the founder and able president and manager of the company, is a gentleman well qualified for the responsible position he occupies, having had years of experience in the business and fully understanding all its requirements. He has able assistants in every department, and a number of the directors and principal stockholders represent much of the wealth and enterprise of a progressive and important community.

RECENT DECISIONS RELATING TO PATENTS.

By the Supreme Court of the United States.

Reissue Letters Patent No. 6,673 granted to Mrs. P. Duff, E. A. Kitzmiller, and R. P. Duff, October 5, 1875, for an improvement in washboards, on the surrender of original letters patent No. 111,585, granted to Westly Todd, as inventor, February 7, 1871, are not infringed by a washboard constructed in accordance with the description contained in letters patent No. 171,568, granted to Aaron J. Hull, December 28, 1875.

In view of prior inventions, the claims of the Todd patent must be limited to the form shown—namely, projections bounded by crossing horizontal and vertical grooves—and do not cover diamond-shaped projections bounded by crossing diagonal grooves.

In the field of washboards made of sheet metal, with the surface broken into protuberances formed of the body of the metal, so as to make a rasping surface and to strengthen the metal by its shape, and to provide channels for the water to run off, Todd was not a pioneer, but merely devised a new form to accomplish those results; and his patent does not cover a form which is a substantial departure from his.

Letters patent granted to Edwin L. Brady, December 17, 1867, for an improved dredge boat for excavating rivers, declared to be invalid for want of novelty and invention.

The design of the patent laws is to reward those who make some substantial discovery or invention which adds to our knowledge and makes a step in advance in the useful arts. It was never their object to grant a monopoly for every trifling device, every shadow of a shade of an idea, which would naturally and spontaneously occur to any skilled mechanic or operator in the ordinary progress of manufactures.

Although a patent is not set up by way of defense in an answer, yet if the invention patented thereby is afterward put into actual use, the date of the patent will be evidence of the date of the invention on a question of priority between different parties.

One person receiving from another a full and accurate description of a useful improvement cannot appropriate it to himself, and a patent obtained by him therefore will be void.

By the Court of Claims of the United States.

The language of the Constitution confers upon Congress the power of "securing to inventors the exclusive right to their discoveries." It is not empowered to grant to inventors a favor, but to secure to them a right; and the term "to secure a right" by no possible implication carries with it the opposite power of destroying the right, in whole or in part, by appropriating it to the purposes of the Government, without complying with that other condition of the Constitution, the making of "just compensation."

Neither does the term "the exclusive right" admit of an implication that, with regard to such patentable articles as the Government may need, the right shall not be exclusive.

Such right, when properly secured in the manner provided by law, becomes property in the eye of the law, and the Government cannot make use of the improvement any more than a private individual without license of the inventor or making him compensation.

Where, as in this case, there is clearly an implied contract between the Government and the citizen, and the suit is brought entirely upon that agreement, and the claimant is without judicial redress elsewhere, the Court of Claims of the United States has exclusive jurisdiction.

The above decision has been confirmed by the Supreme Court of the United States.

By various Circuit Courts of the United States.

A licensee is at liberty to contest the question whether the articles made by him embody the invention or any material part thereof, and a stipulation to the contrary in the contract is of no effect.

In a suit by a patentee against a licensee for license fees for the use of a patented improvement, something corresponding to an eviction of the licensee must be pleaded and proved if he would defend against an action for royalties.

Where plaintiff's claim must be construed as a "shortened vamp"—that is, a vamp which ends substantially where the box toe begins—as a means of uniting the box-toe and tip to the upper, and defendant's vamp is carried for the full length over the toe and lasted with the sole, *Held* that there was no use of plaintiff's invention.

A mere license to make and use, without the right to grant to others to make and use, the thing patented, though exclusive, will not authorize the licensee to bring suit in his own name for infringement without joining the patentee. *Semble*, if the patentee refuses to join, a court of equity can give a remedy to the licensee.

Where a manufacturing company and a firm entered into a contract by which the former let out to the latter all the power, machinery, etc., of the company, to be used for the manufacture of tools, and for carrying on the business of