also of his brothers in trade by seeking labor elsewhere. But if A and his friends should post themselves in front of C's door, and tell B, D, and E, and every other employee of C's whom they met, that C would not accede to prices fixed by A and company, and that the shop was black-listed, and then should endeavor to make B and his comrades leave their work, not directly for B's benefit, but first to injure C, and thus coerce him into benefitihg A: such is clearly wrong, since it is an invasion of the rights of C.

A recent case decided in England exemplifies this point very clearly, and at the same time adds another to the precedents which stand to mark how far trade unions can lawfully interfere with trade. Messrs. Jackson & Graham, a large upholstering firm in London, altered their system of paying per hour to that of piece work throughout their entire establishment. The operatives at once, with a few exceptions, struck, whereupon the firm promptly supplied their places with non-society men, and continued business. The strikers then through their association, stationed pickets in the vicinity of the shops, waylaid the workmen going and coming, and for the space of three months persistently labored, though with little success, to induce the new hands to join them. No physical intimidation was employed, and nothing but verbal persuasion used to discourage the men from their labor. Finally the proprietors caused five of the ringleaders of the pickets to be arrested on the criminal charge of conspiracy. The trial involved the services of very eminent counsel, and lasted two days. Baron Cleasby, the presiding judge, in his charge laid down the law clearly and emphatically, that it was an offense to offer any molestation or obstruction to a working man, to coerce him to quit his employment, or to a master, to alter his mode of carrying on his own business. Picketing, he said, might not be unlawful under certain circumstances; but it is when carried on in such a manner, and to such a degree, that it might be expected to influence other persons to the extent of annoyance, apprehension, or loss. The case went to the jury on a mere question of fact; the defendants were found guilty, and sentenced to brief imprisonment.

THE IRON HORSE.

On page 340 of our current volume, we published a letter from Mr. Flower, President of the West End Railroad Company, of Philadelphia, Pa., in which he offers a premium of $5,000 to the inventor of a substitute for horses, to draw street cars, on condition that he gives the company the control of the invention. It appears to us that, considering the difficulties of the problem and the immense value of a successful solution thereof to those having the control of it, the compensation is rather trifling. This practical problem has been occupying many minds for several years, and many others are working at it now; but the difficulties are scarcely realized unless we consider the great advantages possessed by the living horse, in case only the power of one, two, or three horses is required. When we need the power of ten, twenty, or more horses, no doubt the locomotive is preferable; but we doubt if locomotives of one or two horse power will ever be found to give satisfaction even when well constructed, as they can never compete with a living horse, the trouble of raising which is less than the labor of building a locomotive in a shop. And the horse takes its own water and fuel when needed, and needs no stoker; it also continually repairs itself, until it is entirely worn out. Even then, at its dissolution, there is no danger of bursting a boiler. It is always ready, and needs no firing up; and finally, having a sense of self-preservation, it will not blindly go ahead, and run in the river off an open drawbridge, as locomotives have often done. If it is objected that occasionally the control of horses has been lost by the driver, and that they ran off, it must be remembered that runaway locomotives are by no means uncommon. Taking all things into consideration, we believe that the ordinary horse is a good institution, which it will be very hard to surpass by labor in a machine shop.

GRASSHOPPER INVENTIONS WANTED.

The grasshoppers have appeared in the Western States in such countless throngs that the terrible devastation worked by them among the crops of last year bids fair to be repeated. In the neighborhood of St. Joseph, Mo., it is said the gardens are literally black with the insects, and that the land extending from that city southwest, across the Territories to the Rocky Mountains, is covered for miles in breadth. The size of the locust is from that of a flea to that of a house fly; but, in spite of its lack of growth, its inroads on vegetation are none the less severe. The Colorado journals think that the crops, not merely of that State, but of five or six States to the eastward, will be entirely ruined. This is certainly a very gloomy prospect, and the wholesale destruction of the wheat will make itself felt over the entire country.

It is getting high time that the extermination of this nuisance should engage more widely the attention of inventors. A machine, for example, which can be dragged over the fields before the crops are put in, and which will destroy the eggs deposited in the ground, is needed; or a device might be produced for killing the grown insects without injury to the crops. The Greeley *Tribune*, located in the midst of the ravaged district, says: "We want the same acuteness, the same nice observation applied to the grasshopper question, that is applied to abbreviating labor by mechanical contrivances and in constructing works of beauty and skill. Enough ingenuity is displayed in the sewing machine to catch every grasshopper in our valley and skin him into the bargain." There have been already several attempts made to invent the grasshopper out of existence. The apparatus last brought out is a fire machine, which is simply a grate on runners. The inventor says that "pitch pine is used for fuel, and our Colorado zephyrs fan it into a miniature hell." The fire is made on the grate, and a sheet iron cover directs the blaze downward. This machine is dragged by a team around in circles of large diameter, burning the hoppers which get under it and driving others before it, "corraling" them, in fact, in the scorched circumference. It keeps on its circuitous route in gradually decreasing circles until every insect within an extended radius is burned.

Ditching entirely around the fields, and filling the cut with water, is said to keep the grasshoppers out. This is probably of little use, however, after the insects are able to fly. Another plan is to keep the entire land wet (a rather difficult operation, we should imagine), it being found that the hopper prefers dry localities to damp ones. A farmer who has adopted this mode of protecting his fields combines it with the ditch system, keeping the ditches filled with running water, which is made rough by passing over a number of small dams. He cuts the ditch first around the plot, and then wets the enclosed area. The grasshoppers try to crawl off, and then tumble into the ditches where they are quickly drowned and washed away. If he finds an army marching in from a new quarter, he directs a stream of water on the threatened point and thus heads off the column. Another individual has saved a ten acre patch by putting a little kerosene oil just above the head gate which admits water to the enclosing ditch. The oil floats on the surface and is held in place by a board, the edge of which touches the water. Under this board it gradually leaks out, forming a film over the entire ditch, rendering the latter a river of death to the insects. We notice also another fire invention somewhat similar to that already described. It has wings on which fires are kindled, and a fan which blows the insects into the flame.

It seems to us that a good road engine, rigged with an extra boiler to make steam which could be directed in jets downward—something after the fashion of the numerous snow-melting inventions—might be usefully employed. It could go over the ground quickly, and one machine would serve to protect a large area. Or there is that apparatus we described a short time ago, which makes a fearful heat underneath it by a current of superheated steam entering ignited naphtha gas. This melts thick ice by merely passing over it at the rate of some four miles per hour. Judging from this effect, the machine would readily destroy grasshoppers.

The Governor of Missouri has appointed a day of prayer for relief from the scourge. If these supplications are as earnestly supplemented by products of our inventors, we have not the slightest doubt but that they will be answered. Meanwhile, we commend to the people of Missouri the old maxim: "Help yourself and God will help you;" in other words, invent first and pray afterwards.

CLIMATE OF THE ICE AGE.

The science of meteorology has, of late years, been growing more and more in popular favor. The revelations of the United States Signal Service, and the valuable practical deductions that have been made from them, have created an interest in the subject which will not soon die. And while the climatology of our own day has commanded the careful study of our best scientists, that of earlier times in the earth's history has received equal, if not more profound, consideration. The study of the plants and animals which previously existed on the globe—including the vexed questions relating to the development of organic forms—has largely to do with the climate and state of the atmosphere that prevailed in those earlier periods.

It has long been supposed, and taught by text book and teacher, that during the carboniferous age, when the sun's heat was stored up for us in the form of coal, petroleum, etc., the atmosphere was supercharged with carbonic acid gas; but recent investigations have rendered this extremely improbable, and some late experiments have demonstrated that plants are killed by a greater amount of this poison gas than is ordinarily found in the air. But doubtless the greatest intellectual capital has been invested in a consideration of the meteorological conditions of the glacial period; and the conclusions which have been reached on the subject are as widely apart as the antipodes. While all agree that the northern part of our continent, down to 40° of north latitude, was almost completely covered with a sheet of ice from one to three miles thick, during this period, some make it a season of intense cold, and others claim that it must have been a time of moderately high temperature. Many theories have been advanced to account for the climatic changes which brought the alternations of heat and cold to our earth during the past ages. One of these is the supposition that the solar system, in its translation through space, may have passed alternately through regions of extreme cold and great heat. Another is that the earth may have changed the position of its axis of rotation, because of some great mountain upheaval between the equator and the poles. Still another is the wild supposition that the earth's crust has gradually slipped on its nucleus, so as to bring the equatorial belt nearer to the pole than usual, and then away from it again. Lyell has attributed these changes to a supposed change of place between the land and the sea. He argues that, if the land were accumulated most in the tropics, the vast amount of solar heat which it would "soak up" would be carried by currents to the polar regions, and afford nearly or quite a summer climate to any islands that might be situated there. And if the land were accumulated about the poles, it would result in a great diminution of terrestrial heat, because the water, which is exposed, in this case, to the direct rays of the sun, has far less heating power than the land. Professor Shaler has advanced the idea that these changes may be explained on the supposition that our sun, like many other suns in the universe, is a variable star, and makes our earth warm or cold according as its brightness varies. Whether any one of these is the real cause of past cosmical climatic changes, we cannot say; but we can reasonably conceive that the first and the last two may each be considered a true cause.

Among those who believe the ice age to be one of extreme cold, stands prominently Mr. James Croll. His theory for explaining the cause of this cold is based upon the eccentricity of the earth's orbit, the precession of the equinoxes, and the obliquity of the ecliptic. The orbit of the earth is an ellipse, varying in eccentricity as the planets are variously situated in their orbits, being most elliptical when the planets draw it farthest from the sun. Its rate of variation is very variable. If a plane pass through the sun's center, parallel to the plane of the earth's equator, it will cut the earth's orbit in two opposite points, namely, at the vernal and autumnal equinoxes. The line between these points does not divide the earth's orbit into equal parts, on account of its eccentricity. The earth passes through the perihelion part of its orbit in seven or eight days' less time than through its aphelion part. Hence, now our winter is shorter than our summer, and *vice versâ* in the southern hemisphere. The action of sun and moon on the protuberant equatorial mass of the earth is constantly changing the plane of the earth's orbit, and hence, also, the position of the line joining its equinoctial points. These make a complete revolution in about 21,000 years. Now, when the earth had its winter in the northern hemisphere, while it was in aphelion, its winter was longer than the summer, hence extremely cold. In this case, the ice and snow of winter will not be entirely melted during the summer, because much of the sun's heat is taken up in melting ice, and therefore does not ameliorate the temperature. The result is that, during this long period, ice and snow are accumulating in the northern regions. The vapor from melting ice would obscure the sun with cloudy atmosphere in the summer, and thus make the air raw and cold. It is said by antarctic explorers that the summer there is even colder than summer in northern regions of the same latitude, though the latter are millions of miles farther from the sun.

Another consideration, Mr. Croll thinks, would make great difference with the cold at the north pole, when its winter occurred in aphelion. All permanent oceanic currents originate in the Antarctic Ocean. The chief one divides into two parts: one goes north to the East Indies; the other goes west through the Indian ocean, is deflected round the Cape of Good Hope, follows up the west coast of Africa for some distance, then crosses the Atlantic and forms two currents: the Brazilian, going south, and the Gulf Stream, going north. Now the sun causes the air at or near the equator to give place to cold currents from the poles, which rush in to produce equilibrium. During the long cold of the northern hemisphere, the north currents would be stronger than those from the south, where the climate is, at the time, warmer. He thinks this stronger current from the north might be able, by its friction on the water, to entirely stop the Gulf Stream, and leave the northern hemisphere to unmitigated cold. Croll's theory supposes that the time of the ice sheet in the northern and southern hemispheres was not synchronous, but distant by at least 10,000 years. He supposes that glacial time began some 240,000 years ago, and terminated about 160,000 years ago, that the most intense cold was about thirty or forty thousand years after the period commenced, and that there were several great changes of climate during its continuance.

Mr. Murphy claims that, if the climate at any given elevation is cold enough to form glaciers, no decrease of winter temperature will increase their magnitude, while, on the other hand, a low summer temperature is shown, by the facts of physical geography, to be eminently favorable to glaciation. He therefore concludes that the glacial age occurred when the earth's greatest distance from the sun was in summer rather than in winter.

Another theory, still more at variance with Mr. Croll's, is that held by Mr. Thomas Belt and many others. Savants of this school believe glaciation was not due to extreme cold, but to excessive precipitation. They hold that the ice was thickest over the American continent, because the great evaporating area of the Pacific lay to the southwest of it, and counter trade winds swept across it, and precipitated the moisture with which it was laden. While Mr. Croll makes the ice six miles at least in thickness at Greenland, it was probably thicker south of the poles than near the poles, because the water from warmer regions would be precipitated before reaching the poles. The glacial age probably existed on both continents at the same time, as traces of glaciation north and south of the equator nearly inosculate, and the character and appearance of the morains is the same in both. This supposition only could make correct Mr. Darwin's explanation of the fact that forty flowering plants of North America and Europe are also found at Terra del Fuego. He says that plants were driven to the equator during the ice age, and then followed the retreating ice sheet, both ways from the equator.

Agassiz considered the glacial period a cold time followed by a much warmer one. He thinks it not long and slow, else boulders would have been carried as far south as the ice sheet extended, but sudden and short, as is proven by Siberian elephants caught in the snow and frozen so that their flesh is preserved for recent dogs and wolves to eat.

To harden a wooden pulley, boil it for about eight minutes in olive oil.

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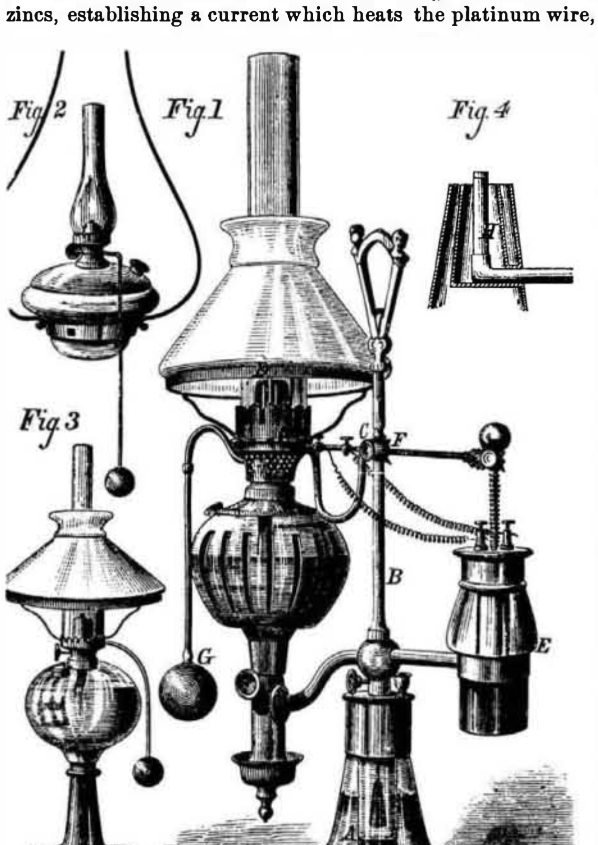
ZIMMERMAN'S HYDRO-ELECTRIC LAMP AND EXTINGUISHER.

We illustrate in the annexed engraving, Fig. 1, a curiously ingenious lamp, which has been recently invented by Professor Wm. H. Zimmerman, Vice President of Washington College, Chestertown, Md. The lamp is self-lighting, and this, although any form of burner, or wick, or any kind of illuminating fluid be used. To effect this, the inventor has arranged a combination of Professor Döbereiner's well known hydrogen lamp with a small galvanic battery, in a neat and even graceful design, so that the whole apparatus takes up no more room than the ordinary German student's lamp, which in fact, in exterior aspect, it somewhat resembles.

The Döbereiner lamp serves as the pedestal. A is the receptacle for the acid and water, and within is seen the inverted bell glass, in which the zinc is suspended. When the acidulated water attacks the zinc, hydrogen gas is evolved, which fills the interior bell glass, and forces out the water, until the latter, falling below the zinc, no longer acts upon it, and the evolution is arrested until, the gas being allowed to escape, the water again reaches its former level. This is the regular action of the hydrogen lamp, with which every student of chemistry is familiar, and regarding which nothing further need here be said. In the present instance the gas ascends the vertical tube, B, passes through the valve at C, when the same is opened, traverses a flexible tube, and finally escapes from a side orifice in the small vertical pipe, D, placed just beside the burner. Before leaving the hydrogen generator, it may be noted that the vertical tube is free to revolve in the metal cap which covers the glass pedestal, and may be secured, as desired, by the thumbscrew provided, also that said cap has a filling cup through which a fresh supply of acid and water may be poured into the pedestal. E is a small galvanic battery (bichromate of potash or otherwise), the zinc in which is attached to a vertical rod, a spiral spring on which keeps it raised, thus holding the metal out of the exciting fluid, and normally keeping the battery out of action. To the upper end of said rod is pivoted an arrow-shaped lever, F, which connects with the valve, C, in the hydrogen pipe, so that, when horizontal, or rather when its rod-supporting end is held up by the spiral spring above referred to, the valve, C, is shut. The conducting wires from the battery lead to binding screws on the chimney frame, and thence connect with two electrodes which stand vertically beside the hydrogen outlet, D. Between these electrodes is extended a fragment of fine platinum wire.

The automatic illumination of the lamp will now be readily understood. The operator simply pushes down the knob on the end of the battery rod. By so doing, he lowers the zincs, establishing a current which heats the platinum wire,



between the electrodes, red hot. As the rod descends the lever, F, tilts, and so opens the valve, C. A stream of hydrogen then escapes at D, strikes just above the incandescent wire, becomes inflamed, and so ignites the lamp wick toward which it is directed.

The inventor states that he has had the device in operation since last November, and that during this period he has renewed the solutions but once. The ignition, he states, is now instantaneous on touching the lever.

In connection with the apparatus described and applied to lamps of other patterns, in Figs. 2 and 3 we represent a novel device by the same inventor for extinguishing the light, the object being to avoid the danger resulting from the common habit of blowing down the chimney. A hollow rubber bulb, G, is connected by flexible piping to a metal tube, H, which passes up inside the burner, as shown in section in Fig. 4. Around the upper extremity of said tube are a number of small apertures, through which, when the bulb, G, is compressed, a number of radial jets of air are directed upon the burner, blowing the flame away from the wick and quickly causing its extinction. The lamps are provided with apertures for filling without necessitating the removal of the wick and chimney. As represented in Fig. 2, the device will prove particularly useful in lamps hung high and out of reach, as the flexible conducting tube may be of any length to render the bulb convenient to the hand.

These inventions were patented through the Scientific American Patent Agency, respectively March 9 and 16, 1875. For further particulars address the inventor as above.

THE DISEASES OF THE SILK WORM.

M. Pasteur, the distinguished French chemist, has recently published an exhaustive treatise on the above subject, the same being the results of his investigations conducted in the heart of the French silk-manufacturing district and under the auspices of the French Government. The enormous mortality which, during certain years, has happened among the silkworms, M. Pasteur ascribes to two diseases, each perfectly distinct. The first he terms *pébrine*, and it is characterized by the presence, in all the organs of the worm or butterfly, of small ovoid corpuscles, invisible except when magnified four or five hundred times, and then appearing under the microscope as represented in Fig. 1. The other disease, called *flachérie*, is an enfeeblement of the vital force of the worm, and is recognized by the presence of a particular ferment in the digestive tube or stomach. The malady first mentioned attacks the worm at all ages, and is eminently hereditary and contagious. Its progress is very slow. The worm, born healthy but subsequently contracting the germ, generally has time to make its cocoon before falling a victim. The disease is, however, transmitted to the offspring, which perish prematurely. The way to avoid the trouble is to raise only such worms as come from eggs deposited by healthy butterflies. The cultivator, although by no means sure that the worms will not become diseased during their lives, is, however, secure in ultimately having cocoons which will remunerate his labor.

Fig. 1.

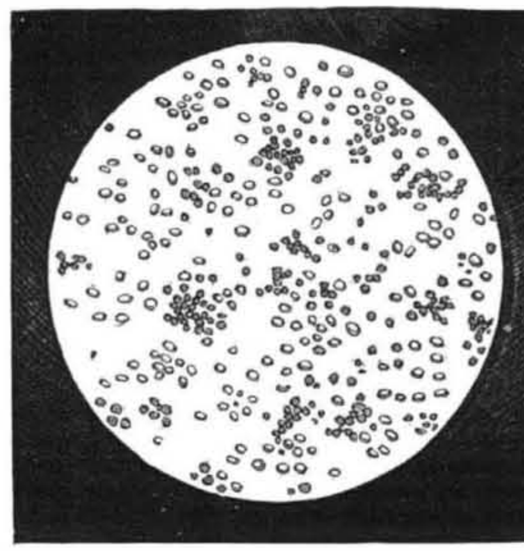


Fig. 2.

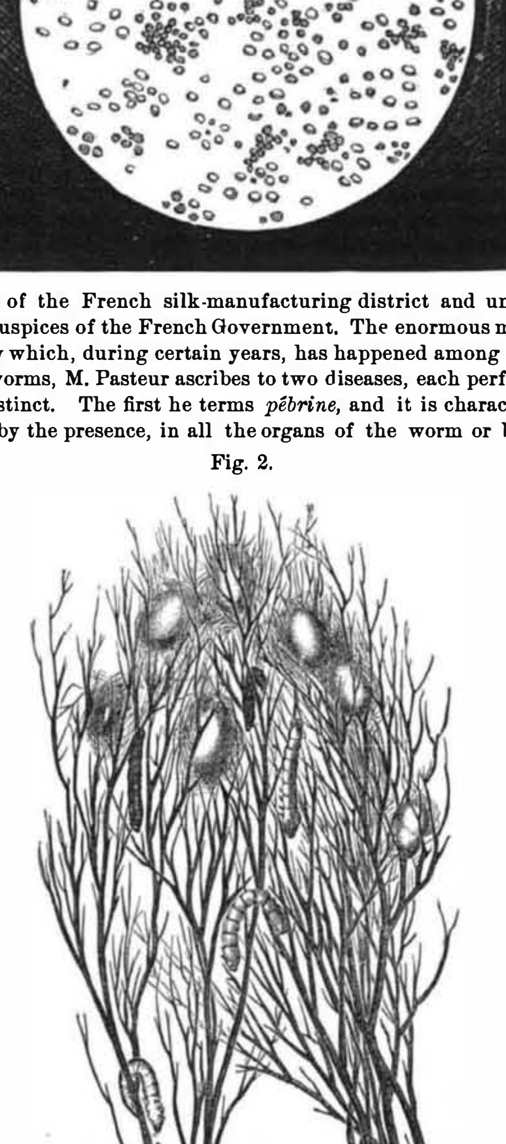
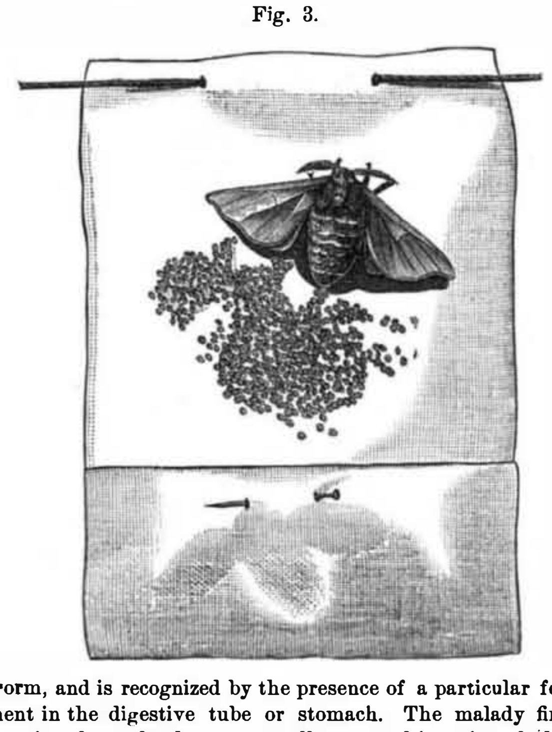


Fig. 3.

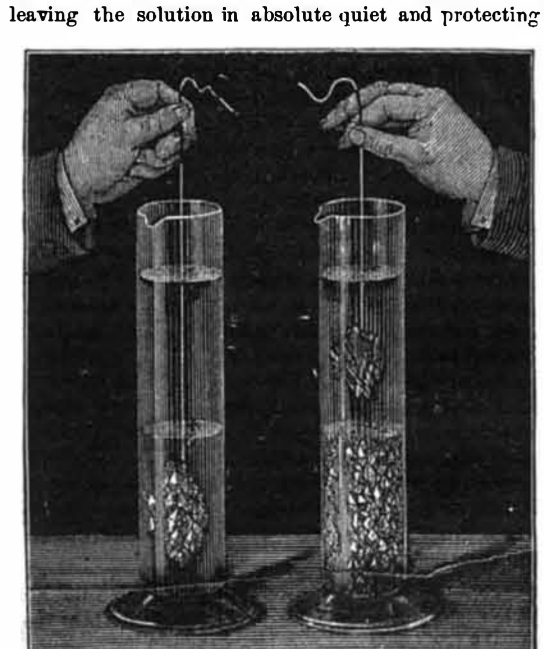


Flachérie is a disease more alarming than *pébrine*, because it attacks at the end of the fourth age, after the rearing is accomplished, and the cultivator expects soon to realize the fruits of his outlay of time and money. Within a few days every worm dies, leaving at the foot of the shrubs, which it had been hoped would be covered with cocoons, nothing but a mass of infected bodies. The effect of the disease is shown in Fig. 2. The malady is either accidental or hereditary, and may be caused by careless sanitary measures, in the conservation of the eggs, during the rearing, or more frequently by feeding on a leaf of bad quality. The hereditary transmission is only to be guarded against by careful selection of the butterflies which are to furnish the eggs for the crop of the following year; and those attainted, after a little experience can easily be recognized by their lack of vigor and the slowness of their movements.

M. Pasteur gives the following instruction for obtaining eggs which are almost sure to yield a remunerative harvest In selecting the cocoons, preference should be given to those from a healthy stock, which are appear to be the finest. After the butterflies emerge, those which seem at all diseased should be carefully eliminated, and the others coupled and deposited on little squares of linen or calico suspended so that the insects cannot crawl from one to the other. As soon as the fecundation is terminated, the male is imprisoned by closing with a pin either one corner of the cloth or a little tuck previously made at the lower edge. (See Fig. 3.) After the deposition of the eggs, the female should be shut up in like manner, and the whole should be kept in a dry, well ventilated place, submitted to all the variations of the exterior temperature. Nothing remains further than to examine the butterflies for corpuscles, a proceeding to which the entire winter may be devoted, as it can be done just as well when the butterflies are dried. The examination is accomplished by grinding one or both of the insects on a cloth, in a mortar, with the quantity of water necessary to obtain a thick paste. A minute drop of this is placed beneath the microscope and examined rigidly. If any corpuscles characteristic of *pébrine* are recognized, the whole batch of eggs on that cloth are at once destroyed, and so on through all, keeping only such eggs as are entirely free from infection.

CURIOUS EXPERIMENT IN INSTANTANEOUS CRYSTALLIZATION.

It is well known that various salts dissolve in water in different proportions, and that the solution usually takes place more readily when the water is warm. After cooling, crystallization of the fluid takes place, but this may be prevented by leaving the solution in absolute quiet and protecting it



from contact with the air. It is then said to be supersaturated, and the least shock, or the addition of a minute crystal of the salt, is sufficient to cause instantaneous crystallization of the whole. A curious experiment, based on the above, has recently been devised by M. Peligot: 150 parts, by weight, of hyposulphite of soda are dissolved in 15 parts of water, and the solution is turned into a large test tube, previously warmed, so as to half fill the same. Another solution of 100 parts, by weight, of acetate of soda in 15 parts of boiling water is made, and this is carefully poured in on top of the first solution, so as to float on and not mingle with the latter. To the above two solutions is then added a little boiling water, and the whole is left in quiet to cool.

After the cooling is accomplished, a little crystal of hypo sulphite of soda may be let down into the liquid. The fragment will traverse the acetate solution without effect there-on; but on its reaching the solution below, instant crystallization of the same will take place, as shown in the figure on the left of the illustration. As soon as the reaction in the hyposulphite is finished, a crystal of acetate of soda may be caused to produce a similar result in the acetate solution

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