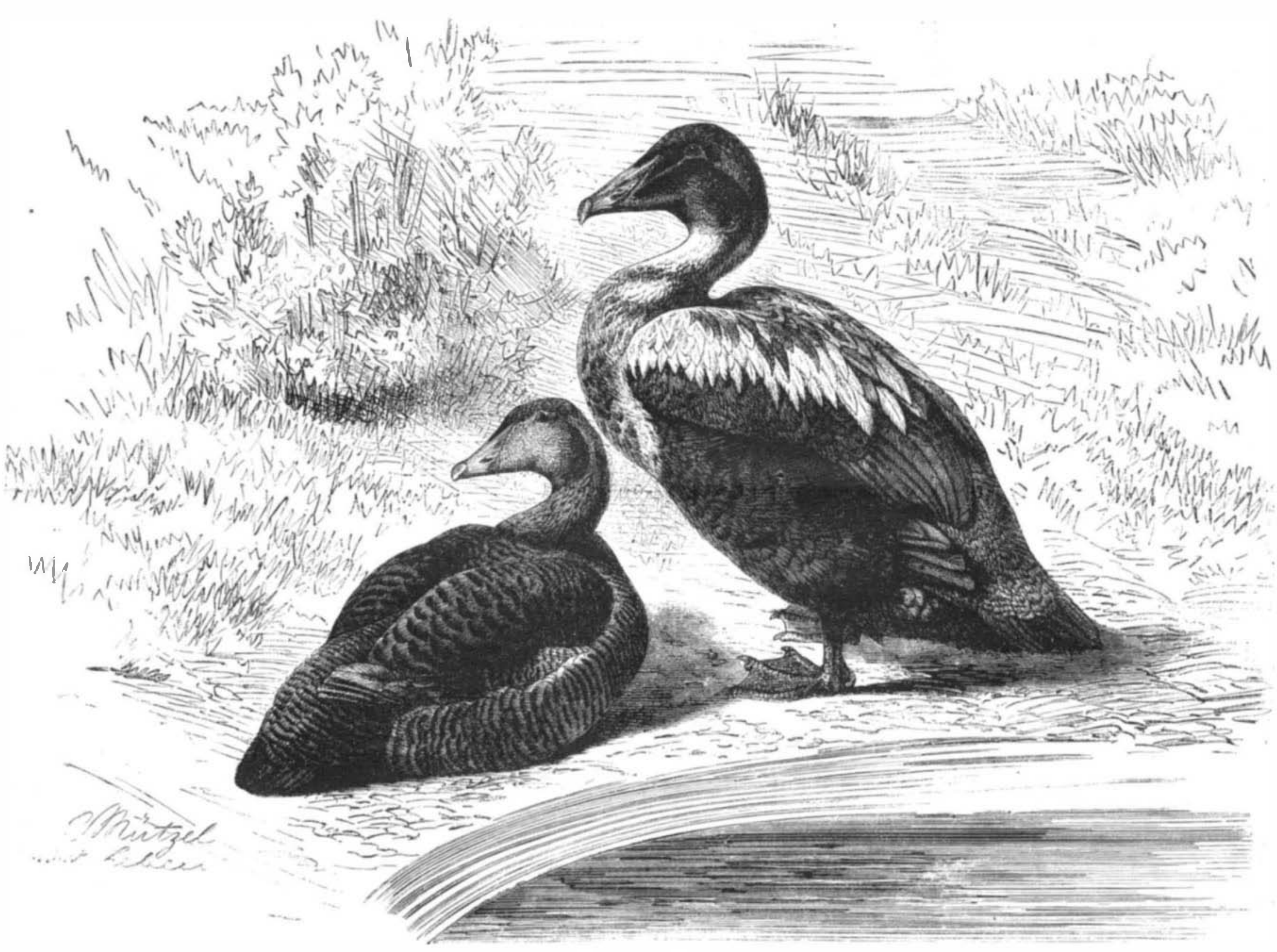
A glove buttoner, by which a glove may be buttoned without stretching or tearing the button hole or twisting off the button, has been patented by Mr. Nathaniel Pyles, of Westport, Mo. This glove buttoner is provided with a broad slotted hook having its inner portion grooved out to fit the periphery of a button, whereby the button may be rigidly held in a horizontal position while the button hole is being passed over the end of the buttoner.

An improved sound transmitter has been patented by Mr. Henry B. Porter of Chicago, Ill. This invention relates to that class of telephone transmitters in which the undulations of the electric current in the wire are controlled by the varying pressure of a conducting surface on a piece of carbon, which variations of pressure are controlled by the vibrations of a diaphragm, and which current is made through the contact faces.

THE EIDER DUCKS.

The eider duck (*Somateria mollissima*) is widely celebrated on account of the exquisitely soft and bright down which the parent plucks from its breast and lays over the eggs during the process of incubation. Taking these nests is a regular business on the northern coasts of Norway and Scotland, but is not devoid of risk on account of the precipitous localities in which the eider duck often breeds. The nest is made of fine seaweeds, and, after the mother bird has laid her complement of eggs, she covers them with the soft down, adding to the heap daily until she completely hides the eggs from view. The plan usually adopted is to remove both eggs and down, when the female lays another set of eggs and covers them with fresh down. These are again taken, and then the male is obliged to give his help by taking down from his own breast and supplying the place of that which was stolen. The down of the male bird is pale colored, and as soon as it is seen in the nests the eggs and down are left untouched in order to keep up the breed. The eider is a shy, retiring bird, placing its nest on islands and rocks projecting well into the sea. It is an admirable diver, its legs being set very far back, and obtains much of its food by gathering it under water. The bird lays from five to six eggs, of a pale green color. There are generally two broods in the year.



EIDER DUCKS.

Trichinæ in Man.

For some thirty years subsequent to the first description of the capsule by Hilton, and some twenty-five years after the identification of the parasite itself in man, the same were looked upon as mere harmless curiosities, and that, although Leidy discovered the parasite in the flesh of swine in 1847, still it was not until 1860 that the connection was established between them, appearing, as they had, in two totally different species (men and swine). The honor of this important discovery belongs to Dr. Zenker, of Dresden, Germany. The disease was discovered in a servant girl, admitted as a typhus patient to the City Hospital in Dresden. She died, and her flesh was found to be completely infested with trichinæ. Leuckart's and other experiments have shown that a temperature of 140 degrees Fahrenheit is necessary to securely render trichinæ inert. Direct heat applied to the slides holding specimens of trichinous pork, by means of the Schultz heating table, has demonstrated under the microscope that a temperature of 50 degrees centigrade (122 degrees Fahrenheit) is necessary to the certain death of the trichinæ. Leisering's experiments with trichinous pork, made up into sausage meat and cooked twenty minutes, gave positive results when fed to one rabbit and negative by another. He sums up his experiment as follows:

1. Trichinæ are killed by long continued salting of infected meat, and also by subjecting the same for twenty-four hours to the action of smoke in a heated chamber.

2. They are not killed by means of cold smoking for a period of three days, and it also appears that twenty minutes cooking freshly prepared sausage meat is sufficient to kill them in all cases.

The various kinds of cooking, however, are quite different in their effects on trichinous pork. Frying and broiling are most efficient, roasting coming next. Boiling coagulates the albumen on the outer surface, and allows the heat to penetrate less readily; it should be kept up, therefore, for at least two hours for large pieces of meat. Whether boiled, broiled, or fried, pork should always be thoroughly cooked. Practically speaking, the cooking, salting, and hot smoking which pork in its various forms receives in the United States must be, in the vast majority of cases, sufficient to kill the trichinæ and prevent infection of the person consuming the meat. Everything like those reported in Germany are unknown here, and trichiniasis in a fatal form is undoubtedly a rare disease. In the vicinity of the great pork packing establishments near Boston the "spare-ribs," containing the intercostal muscles, are very largely bought and eaten by the people near by, and trichiniasis among them has not in a single case been reported, so far as I have been able to learn. The cuts being thin and well cooked any trichinæ in them are quite certain to be killed. Even when trichinæ are introduced into the intestinal canals, too they are sometimes expelled by diarrhea, and the invasion of the system by a small number does no harm.—*American Microscopical Journal.*

M. H. TOUSSAINT (*Comptes Rendus*) finds that no contagious malady possesses a greater virulence than tuberculosis, the virus resisting and preserving its efficacy at temperatures which destroy the bacteria of splenic fever. The infection takes place as easily by ingestion as by inoculation.

Worms in Fishes.

Several communications have been received lately asking whether the small white worms infesting black bass are injurious to those who may eat the fish.

Such parasites are very common in fish, and the best authorities say that they are harmless to man; indeed Italian epicures regard certain species occurring in sea fish as a great delicacy. Of this class apparently are the white or transparent round worms which our correspondents find in the bass of the Susquehanna. They are known as *Hematodes*. Another group of fish parasites, *Cestodes*, resemble ordinary tape worms, but do not flourish in the human organism. The *Trematodes*, or flukes, and *Acanthocephalis*, two other groups of fish parasites, are too small to attract the attention of any but microscopists.

In an article on this subject in *Forest and Stream*, some months since, Mr. Frederic W. True, of the Smithsonian Institution, said that the salmon harbors at various times no less than sixteen different kinds of parasitic worms, or at least so many sorts have been discovered, and undoubtedly many others remain unknown. Four species are tape worms, and four round worms; the rest belong to the other groups above mentioned. The yellow perch has been a favorite hunting ground for the helminthologist, and he has already brought to light twenty-three species. The pike (*Esox lucius*) carries about with him at least twenty kinds. The parasites of our trout have escaped attention to a great degree, and it is credited with only one kind, but the European saibling plays host for five tape worms and three or four other worms. But one species is known to infest our shad, namely, the round worm, *Agamonema capsularia*, Diesing, although the German maifish (*Alosa vulgaris*), a close relative, carries at least seven. It must not be gathered from these facts that our fishes are more favored than those of other parts of the globe, but only that the parasites have been less carefully studied.

It was the shad worm (*Agamonema capsularia*) which caused some excitement among the fishermen in a certain part of New Jersey a few years ago, where it was found in great numbers. All anxiety was removed, however, by Dr. Leidy, of Philadelphia, the only American helminthologist whose observations have been at all extensive, who pointed out the harmless character of the animal.

The carp, lately introduced from Germany by Prof. Baird, undoubtedly brings with it some of the twelve parasitic worms which make its life unhappy in its native waters. Every new animal thus introduced in this way adds more than one name to the faunal list.

Mr. True has in his possession an undescribed tape-worm which infests the herring of the great lakes. It is not content to live in the intestines of the fish, but at a certain season in its development must needs bore into the flesh, producing ugly marks and quite injuring the fish for sale, much to the disgust of the fishermen. It would appear from this that these worms are interesting not only zoologically but economically. In this and some other cases it is a matter of dollars and cents.

Orange Culture in Syria.

Some very interesting notes on this subject are given in a recent consular report from Beyrout. From this we learn that the two districts in which oranges are the most plentiful are those of Jaffa and Sidon. The orange trade began to assume considerable proportions some forty years ago, when the new government of Egypt took shape, and it is now one of the most profitable industries in the two towns above mentioned. Unfortunately the inhabitants, allured by first gains, commenced planting gardens and expending money beyond their resources, the result of which has been that, in spite of all remunerations for small outlays, their improvidence has placed most of them in the power of money-lenders, who continue to advance at interest of 15 to 20 per cent. However, a company has lately been formed in Jaffa to negotiate loans with orange cultivators, and if its operations be carried on fairly we may expect an extension of horticulture, with benefit alike to the company and the borrowers. At the present moment Jaffa possesses some 340 gardens, averaging from 2,000 to 2,500 trees in each. The crop of fruit from these may be put down at about 34,000,000.

A garden costs from 40,000f. to 50,000f., and brings in 4,000f. to 5,000f. per annum. For several miles round Jaffa extends a fertile plain on which water is always to be found at a depth of 40 ft. or 50 ft. With capital and enterprise much of this might be planted, and the orange trade doubled in a short time. The present system of irrigation is that of small wells, from which the water is drawn by mules; but experiments have proved that very little engineering skill would be required in order to turn the streams of the river Andjah, some four miles from the town, over the plain. The land near Jaffa would then be cheapened in proportion as the value of that freshly watered rose. At present unplanted land close to Jaffa able to support 2,000 trees is worth 2,000f. to 3,000f.; but at two or three hours' distance it will fetch only 5f. to 6f. a deunum. The export is carried on chiefly by sailing boats for Egypt and Constantinople, and by steamers for Russia, Trieste, and Marseilles. Exportation in cases is a comparatively recent introduction, which has given considerable impulse to business with Europe. The orange gardens of Sidon are cultivated on the same principle as those of Jaffa. An acre of land at Sidon is generally valued at from 6,000f. to 7,000f., and is capable of bringing in an income of about 600f. The exportation begins in September, and is at first almost exclusively directed to Russia, till the winter closes the Black Sea ports, when it is continued to Trieste and Egypt. European cargoes are packed in paper and close cases, the rest are sent in open crates. Each case contains some 300 oranges or lemons, and last year's export is reckoned at 20,000 cases, all of which fetched very high prices, especially lemons, in Russia. The average prices are for 1,000 lemons 150 to 170 piasters; while for 1,250 oranges, reckoned as a trade 1,000, the cultivator receives 70 to 80 piasters.

Vegetation in Oil.

Some time ago Herr Von Tieghem noticed in a bottle of olive oil that was often uncorked in a room in which various kinds of mould were being cultivated several flocks of mycelia, or spawn of fungi, partly attached, partly not. He found there were two kinds, one of which could be grown on slices of potato in moist air. Returning to the subject lately, he put into olive oil fragments of stems, roots, or leaves, or whole plants, or seeds saturated with water, and submitted them to a temperature of about 25 deg. C. in an oven. In a few days the pieces were covered abundantly with mycelium vegetation, forming a continuous layer of considerable thickness. The spores which had become attached in air were thus vigorously developed in the oil. For this vegetation oil is necessary. The same species of plants inserted in water did not become covered with mycelium. In a vessel half filled with water and half with oil, and containing a piece of stem or root in both liquids, the portion in water remained sterile, while that in oil was covered largely with mycelium. On inverting the piece so that the part formerly in water was in oil, and conversely, the mycelium already developed died, and the previously sterile part grew mycelium. Mycelium flocks detached from the plants and sown in oil developed very slowly, probably because they had too little water at their disposal. No fructification was observed, and the nature of the mycelium could not be determined. These mycelia do not develop in linseed or rapeseed oil. When grown in olive oil and put in either of the others they soon die and disappear.

Some Effects of Heat and Light on Vegetation.

A curious modification of the normal structure of plant stems has been observed by M. Prillieux on making the temperature of the ground about the plant higher than that of the air above. Beans and pumpkins gave the best results. The seeds were placed in earth in a large dish, in which was inserted part of a brass rod bent at a right angle and having a gas flame applied to its horizontal end. The chamber was moist and cold. The seeds germinated well; but on coming above ground the plants acquired a peculiar shape; they grew but little in length and became unusually thick, the latter growth involving much tension in the surface layers, so that deep rifts before long appeared (mostly transverse) and made further growth impossible. M. Prillieux found the enlargement traceable mainly to an increase, not of the number, but of the volume of cells in the interior (cells of the cortical tissue and the pith). The excessive growth of these cells occurred not only in the cell wall, but in the nucleus, which was often multiplied. The excess of temperature of the ground over the air was about 10 deg. Again, the view adopted by the older botanists that light is either without effect on germination, or has an adverse effect, fails to harmonize with some results lately arrived at by Herr Stebler, in the case of many seeds of agricultural importance, such as varieties of meadow grass (*poa*), the germination of which he finds to be favored considerably more by light than by heat. Thus, with two groups of 400 seeds each of *Poa memoralis*, in one experiment, there germinated in light 62 per cent, and in darkness 3 per cent. Similarly with *Poa pratensis*—in light, 59 per cent; in darkness, 7 per cent, and so on. Sunlight being a very variable force difficult of determination, experiments were further made with gaslight, and with the same result—that light favors the germination of certain seeds, especially grasses, and that these germinate either not at all, or very scantily, in darkness. The fact was verified by Herr Stebler in quite a series of seeds, *Festuca*, *Cynosurus*, *Alopecurus*, etc. In the case of seeds that germinate quickly and easily, such as clover, beans, or peas, he thinks light is probably not advantageous.

On the Difference between Fusibility and Fusing Point.

Prof. A. Ledebur contributes to the *Metalarbeiter* an article of practical importance as well as general interest, from which we abstract the following:

The term "fusibility" is one much used in metallurgy, and generally means the temperature at which a body passes from the solid into the liquid state, and the lower this temperature the more fusible the substance is said to be. Thus ice, which melts at 0° C. (32° Fahr.) is more easily fusible than tin, which melts at 230° C. (446° Fahr.), and the latter is more fusible than lead, which melts at 325° C. (617° Fahr.). The term fusibility can also be employed in a different sense, and it seems to me that the other is more sensible and logical. Fusibility may refer to the *quantity* of heat instead of the *degree* of heat required to raise it from the ordinary temperature, or, say, from 0° C. to its melting point, and then fuse it. The smaller the quantity of heat required the more fusible the substance, because less fuel is needed to melt it. This very relation between fusibility, in the latter sense, and the consumption of fuel, which is an important factor in calculating the cost of fusion, is of such importance that I take the liberty of entering somewhat more into details.

The temperature of fusion bears no direct ratio to the consumption of fuel, for it is only necessary, when the melting point is very high, to have fuel of high pyrometric heating power (producing a higher temperature). Thus, coked or charred fuel generally gives a hotter fire than the raw fuel. Gases, which burn easily and require a smaller excess of atmospheric air than the material would that they are made of, give a still higher temperature.

The less the quantity of products of combustion, in proportion to the quantity of heat produced, the higher the temperature; hence the advantages of warming the air used (increasing the amount of heat without increasing the products of combustion), also of employing pure oxygen instead of atmospheric air (by which the products of combustion are greatly lessened by removal of the nitrogen of the air), whereby such intense temperatures are attained. The higher the temperature at which a body melts the more we are obliged to take advantage of these facts without necessarily increasing the consumption of fuel; but the more infusible it is, in the other sense of the word, the more fuel will be required to melt it.

The two different ideas of fusibility do not proceed with even step side by side, as many would at first thought suppose. To convert one kilo of ice at 0° C. into water at the same temperature, requires 79 units of heat, while only 15 units are necessary to heat a kilo of lead from 0° C. up to its melting point and fuse it. Lead, then, although it melts at 325° higher than ice is five times more fusible—that is to say, it only takes one-fifth as much fuel to melt a given quantity of lead as it does to melt an equal weight of ice.

From this it follows, that a knowledge of the quantity of heat necessary to melt the metals and their alloys—their fusibility in the narrower sense—is quite as important, both practically and theoretically, as a knowledge of the temperature at which they fuse. This quantity depends upon three factors: the specific heat, the temperature at which it melts, and the latent heat of fusion; it is $=(s \times t)+l$, in which s= specific heat, t=melting point, and l=latent heat. These values are not accurately known for all the metals; specific heats vary with the temperature, and have generally been determined accurately only for temperatures below the boiling point of water; and the latent heat of but few metals is known at all.

It is, however, comparatively easy to ascertain this, and thus obtain a measure of its fusibility, by simply melting the metal and pouring it into a known quantity of water, the temperature of which was accurately measured, both before and after, with a thermometer graduated to one-fifth or one-tenth of a degree, and afterwards drying and weighing the metal which was poured into the water.

For this experiment the vessel employed is made of thin sheet copper or brass, holding a few quarts and surrounded by a poor conductor of heat (flannel or a stagnant stratum of air obtained by putting this vessel within a larger one). Within this copper vessel is a smaller one, full of holes, to receive the melted metal, so that it can be easily taken out and weighed. There is also a spatula of copper or brass for stirring after the metal is poured in. The metallic vessels and spatula are weighed, and the weight multiplied by the specific heat of copper or brass (0·095), and the product added to the weight of the water used.

The amount of heat requisite to raise the metal from 0° C. to its melting point, and fuse it, may be represented by W, and we have the formula:

$$W = s \times t_2 + \frac{V(t_2 - t_1)}{G}$$

in which V is the weight of the water plus the product of the weight of metal multiplied by its specific heat.

G=weight of metal.

s=specific heat of the metal below 100° C.

t=temperature of the water before the metal was poured in.

t_2=temperature of the water after pouring it in.

The most difficult point is to tell when the metal is just melted and not over heated. Pure metals may be allowed to cool until a crust begins to form, and then poured in, but for alloys this is not applicable. For those which melt below 300° C., the temperature at the time of pouring can be taken with a thermometer.

The author determined the quantity of heat necessary to melt zinc, tin, bismuth, and lead by experiment. He also calculated it from their known specific heats and latent heats. The two are shown in the following table:

	Found.	Calculated.
Zinc	62 units.	71 units.
Tin	26 "	27 "
Bismuth	18 "	22 "
Lead	14 "	16

He also examined several alloys, and found that an alloy of 90 per cent lead and 10 per cent antimony melted at 240° C., and required but 13·6 units of heat to melt it, while an alloy of tin and antimony in the same proportions melted at 236° C., yet required 28 units of heat to melt it.

It will be noticed that the quantity of heat necessary for the fusion of an alloy cannot be calculated when we know this for each constituent, any more than one can tell at what temperature an alloy will melt from a knowledge of the melting points of its constituents.

Of the simple metals lead is the easiest fusible, requiring but half as much heat to melt it as tin does, although its melting point is nearly 100° higher.

Sulphur Fumes for Cholera.

In a former issue, says the *Indian Tea Gazette*, we referred to a system of disinfection advocated by Dr. Tuson, and stated how admirably suited it was to the requirements of tea factories. A report recently published by Surgeon-Major J. W. Johnston, on cholera in the 3d Ghurkas, at Candahar, in July and August, 1879, bears out Dr. Tuson's views. The following extract from the *Englishman* on this subject, and on the question of the infectiousness of cholera, may prove of interest to our readers:

"Cholera appeared in the detachment at Abdul Rahman, and Dr. Johnston immediately applied for a supply of disinfectants. Carbolic acid was furnished, but not sulphur. On the 19th July, however, a large supply of the latter article was allowed, and a thorough process of disinfection of both accouterments and buildings was carried out that night. Among the measures adopted was the burning of two or three seers of powdered sulphur in each of the huts, tents, etc., occupied by the troops, as well as the lighting of sulphur fires outside. The village was reoccupied the following night, and, although the regiment continued to suffer, no fresh case occurred in this detachment.

"On the 23d July the same system of disinfection was carried out in the case of a detachment located at Mir Dil Khan's garden, the result being that cholera ceased at once.

"Similar results followed the use of sulphur in the 25th N. I. Cholera broke out on the 8th July and continued till the 11th August, with increasing virulence and in spite of shifting of camps. Sulphur disinfection was then carried out, and after this only one sipahi and four camp followers were attacked. The history of these cases is interesting. The sipahi had been seen on the 10th carrying some of the clothes of a man who had died of cholera. He was attacked on the 13th. The four followers were dooly bearers who had been employed in carrying cholera patients a day or two after the disinfection. On the appearance of one cholera case in G-4 Field Artillery, the same system was adopted, at Dr. Johnston's suggestion, and no other case occurred.

"The bearing of these facts on the question of the infectiousness of cholera is so obvious, that possibly men committed to the opposite theory may be tempted to under-estimate their importance. In weighing evidence of the efficacy of a remedy or a preventive, however, all preconceptions as to the etiology of a disease must be laid aside. Let those who hold that cholera is not infectious console themselves, if they please, with some new theory of the mode of action of sulphur fumes. But common sense protests against their closing their eyes to palpable facts."

Railway Gardening.—The Boston and Maine Company now allows its station agents $10 a year each with which to buy seeds, plants, etc., and offers prizes of $50, $30, and $20 to the agent whose stations are best kept and present the neatest and most attractive appearance.

Expansion of Cement and Concrete.

Opinions of authorities differ much as to the behavior of cement in setting. An examination of extensive concrete walls, such as those of the New Victoria Docks, discloses a number of vertical cracks, which seem to indicate that a contraction of the mass has taken place. From the experiments made by Messrs. Dyckerhoff, it would appear that expansion and not contraction had taken place. In Mr. Henry Faija's little book, "Portland Cement for Users," which we lately noticed, two tables giving the results of experiments by Messrs. Dyckerhoff on a prism of cement of ten centimeters in length and five centimeters square, lying in water, are introduced. These tests show the amount of expansion in twelve varieties of cement from one week to twelve months old. Mixed with three parts of sand, the expansion is much diminished, and for architectural works, the results need not cause any serious apprehensions. Mr. Faija's remarks point to a possible contraction during the action of setting, which, however, is afterward replaced by a slight expansion.

This expansion or contraction is not so great that architects or engineers may feel any distrust of the value of cement concrete. It is, in fact, so slight that in practice, as Mr. Faija says, it may be disregarded, and we think it useful to quote the latter gentleman's observation on the experiments: "Ignoring, therefore, Messrs. Dyckerhoff's experiments (although they may have a theoretical value) in practice, when laying any large space, such as a courtyard or a length of footway with a concrete paving, it is advisable to lay it in sections, separating each by thin wooden battens. These battens may be removed in a few days, or when the concrete is thoroughly set and hard, and their space filled up with a similar concrete to that already laid; by this means there will be no danger of the appearance of the work being spoiled by the cracking of the concrete." For the walls of buildings this advice becomes of less importance, if the concrete is filled up in frames or panels, as we have more than once hinted; besides which, the occurrence at intervals of doors and windows, etc., would relieve any large surface.

Where finished surfaces have to be made, Mr. Faija deprecates the practice of putting a differently proportioned concrete as a finishing coat. It is nearly sure to crack or peel off. It is preferable to make the concrete of a finer kind, and work the face up with a trowel or float. Thus treated, the surface may be made to have the appearance of rough-cast, or a smoother finish if desired. The crushing strength of concrete seems to have been repeatedly made the subject of experiment; yet architects and engineers, in applying the ordinary weights given in tables, seem to think that the same results ought to be reached in building everywhere, whereas those tests have only reference to a small cube of an inch each way. A one-inch cube of cement will bear a great deal more than a small pillar of it twice or three times the height and of the same base.—*Building News.*

Influence of Barometric Pressure on the Discharge of Water from Springs.

BY BALDWIN LATHAM, M. INST. C.E., F.G.S., F.M.S., ETC.

The author of this paper, read before Section C (Geology), British Association meeting, York, mentioned that it was alleged, by some of the long-established millers on the chalk streams, that they were able to foretell the appearance of rainfall from a sensible increase in the volume of water flowing down the stream before the period of rainfall. He had, therefore, undertaken a series of observations to investigate the phenomena; and he found, in setting up gauges on the Bourne flow in the Caterham Valley, near Croydon, in the spring of this year (1881), and selecting periods when there was no rain to vitiate the results, that whenever there was a rapid fall in the barometer there was a corresponding increase in the volume of water flowing, and with a rise of the barometer there was a diminution in the flow. The fluctuations in the flow of the Croydon Bourne due to barometric pressure had at one period exceeded half a million gallons per day. The gaugings of deep wells also confirmed these observations; for where there was a large amount of water held by capillarity in the strata above the water line, at that period of the year when the wells became sensitive and the flow from the strata was sluggish, a fall in the barometer coincided with a rise in the water line, and under conditions of high barometric pressure the water line was lowered. Percolating gauges also gave similar evidence, for after percolation had ceased and the filter was apparently dry, a rapid fall of the barometer occurring, a small quantity of water passed from the percolating gauges. The conclusion arrived at was, that atmospheric pressure exercises a marked influence upon the escape of water from springs. The increase in the flow of the water was attributed to the expansion and escape of the gases held by the water under low barometric pressure, which cause the water to escape more freely, while with high barometric pressure there was a condensation of the gases, which led to a retardation in the flow.

Soap Bubble Balloons.

M. Delon, of Paris, produces miniature balloons by means of ordinary gas conducted through a caoutchouc tube and clay pipe to glycerine soap solution. A small disk of thin paper, with fine wire from its center to a little paper car with aeronaut figures, is connected to the bubble when it begins to swell, the disk being attached by capillarity to the part where the drop forms. The detached bubble rises with its car.

Electricity and Ballooning.

Soon after the announcement of Faure's new accumulator of electricity the idea was thrown out by Mr. Martin Tupper in this country that storage batteries could be employed with advantage in propelling balloons. Power and not levitation was, in Mr. Tupper's opinion, the true key to the attainment of aerial travel. French aeronauts have also given their attention to the subject, and at the recent meeting of the French Academy of Sciences M. Gaston Tissandier made a communication on it. The true solution of the problem, if it be feasible at all, appears to us to lie not in the exclusive use of levitation or electric power, but in a proper combination of both principles. This plan is that which M. Tissandier contemplates, and he points out that a propeller driven by electricity possesses advantages over other methods of movement. For example, it requires no fire, which is a dangerous element in a balloon inflated with hydrogen gas; it has a constant weight and gives off no products of combustion, and is readily manipulated.

M. Tissandier prepared a small balloon, pointed at the ends, 11 feet long by about 4½ feet in diameter. Its volume was 484 gallons, and when filled with pure hydrogen gas it had an ascending force of about 4½ pounds. A Trouvé motor of the Siemens type weighing nearly 8 ounces was fixed to the lower part of the balloon and connected to a double-bladed screw of 18 inches diameter. With the aid of a Planté secondary battery weighing nearly 3 pounds, the screw was driven at the rate of 6½ turns per second, and propelled the balloon through the air at a speed of over 3 feet per second during a space of 40 minutes. With two secondary elements weighing 1½ pounds, and a screw of 21 inches diameter, a speed of 6½ feet per second was maintained during 10 minutes. With three elements the speed was about 10 feet per second. M. Tissandier also measured the work done by the little dynamo-electric motor, and found it to be about 314 foot pounds with a single element and a speed of 5 turns per second; and with three elements it is about 7 foot pounds. He estimates that a dynamo-electric motor of 5 cwt. with 17 cwt. of secondary batteries will yield 6 horse power of work. This weight could be raised by a hydrogen charged balloon of 3,900 cubic yards volume, and similar to that employed in 1852 by M. Giffard, and in 1872 by M. Dupuy de Lôme. It would be 131 feet long by 43 feet in diameter at the middle, and its ascending force would be about 3½ tons. With all its appurtenances it would weigh from 19 cwt. to 22 cwt., and there would remain from 1 ton to 2 tons for ballast and voyagers. In calm weather it would have a speed of from 12 to 15 miles per hour, and it would be able to deviate from the line of a wind.

It is true that this result could only be obtained during a limited time, but the conditions would be greatly improved by lighter batteries and possibly by the use of M. Faure's accumulators. While upon this subject we may also mention that M. Trouvé has tried his electrically propelled boat on the upper lake of the Bois de Boulogne with a Trouvé motor and a four-bladed screw about a foot in diameter. Twelve Bunsen cells of Ruhmkorff's pattern propelled the boat, containing three persons, at a speed of 10 feet per second, but this rate fell off at the end of three hours to about 9 feet per second, and at the end of five hours to 8 feet per second.—*Engineering.*

Improvement in the Manufacture of Parabolic Mirrors.

A very ingenious method of manufacturing parabolic reflecting surfaces has been invented by M. Latchinoff, who has described the process fully, says *Engineering*, in our Russian contemporary, *L'Electricité*. It is based on the fact that all points of the free surface of a liquid turning round a vertical axis acquire a constant angular velocity and take a parabolic form. If, then, the liquid is put into a vessel which is rotated round a vertical axis it will form a hollow shell of parabolic section inside, and if the liquid is one which will solidify a rigid paraboloid will be obtained capable of being used as a reflector. M. Latchinoff, therefore, mounts a hemispherical vessel upon a vertical shaft carrying a pulley, and rotates it by an endless belt from a motor. Into this he pours a sufficient quantity of plaster of paris liquid or a solution of the mastic prepared by M. Mendelejeff. Fusible metals would serve the purpose, too, but they are apt to oxidize on the surface, and in cooling they tend to crystallize. The shape of the vessel need not necessarily be a hemisphere, but this form is convenient; and a glass cover should be added to it.

To regulate the thickness of the liquid shell a ring of wood is fixed within the bowl at a proper distance below the edge. This prevents the liquid rising above a certain height. Regularity of motion is most essential to the success of the operation, and hence a steam engine is not adapted to drive it; but a small Gramme or Siemens dynamo-electric machine actuated by a Thomson or a Tchikoleff battery will answer well. Three or four cells will suffice, and the speed can be regulated by resistance placed in circuit. With a Deprez or Helmholtz regulator any kind of battery may be used. An angular speed of a turn per second is quite sufficient for the purpose; and the axis ought to be verticalized by means of a spirit level, and fixed so as to be free from shake or jar. The liquid should be one which solidifies slowly, say in an hour, and without shrinking much in bulk. The shells thus prepared can be made reflective by electrotyping with nickel, silver, or iron, which, when prepared in this way, oxidizes with difficulty, and being almost white will serve for a reflector if kept under glass.

The Chanoine Dam at Pittsburg.

Work upon this great undertaking—which has been described fully in these columns—is progressing with unusual rapidity, owing to the remarkably low stage of water in the Ohio River. The most difficult and hazardous portion of the work is now being vigorously prosecuted, namely, the digging for the foundations of the sill of the dam. This requires an excavation 556 feet long and 15 feet below the bed of the stream, and, of course, directly across the channel. To render this work possible an enormous coffer dam, 614 feet by 230 feet, was successfully constructed.

To fill the double walls of this coffer with clay an ingenious arrangement was devised by Superintendent Meredith. A line of 4-inch pipe, 1,800 feet long, led from a powerful centrifugal pump to the coffer. The pump was supplied with water and clay in proper proportions and delivered a 4-inch stream of mud into the coffer walls. The water draining off left the clay a compact, watertight mass just where it was wanted. The necessity for haste in the present stage of this work can be understood when it is stated that the coffer dam virtually blockades the Ohio, and that nearly every town and city along the Ohio and the Mississippi from Pittsburg to New Orleans, and including St. Louis, depends wholly or in part upon the river shipments of coal from Pittsburg. Until the coffer dam is removed the only passage way for steamers is between the completed lock walls of the dam, a space only 110 feet wide.

There are at present 10,000,000 bushels of coal loaded in barges, etc., at Pittsburg, and awaiting a favorable stage of water to start down the Ohio. To move this requires a fleet of 70 steamers and nearly 200 barges, and it is an open question whether even a small proportion can get through the lock wall space before the erratic river recedes again. Lieutenant W. M. Black, the United States officer in charge, is, however, pushing things rapidly, and by the use of the electric light doubles the working hours of the force of laborers employed, promising to raise the blockade by November 15.

Influence of Lime on Soils.

Professor E. W. Hilgard, in discussing the "Objects and Interpretation of Soil Analyses," gives, among other things, the following advantages resulting from an adequate supply of lime in soils:

1. A more rapid transformation of vegetable matter into active humus, which manifests itself by a dark or deep black tint of the soil.

2. The retention of such humus, against the oxidizing influences of hot climates; witness the high humus percentages of such soils, as against all others, in the Southern States.

3. Whether through the medium of this humus, or in a more direct manner, it renders adequate for profitable culture percentages of phosphoric acid and potash so small that in the case of deficiency or absence of lime the soil is practically sterile.

4. It tends to secure the proper maintenance of the conditions of nitrification, whereby the inert nitrogen of the soil is rendered available.

5. It exerts a most important physical action on the flocculation, and therefore on the tillability of the soil, as heretofore shown by Schloesing and by myself.

Professor Hilgard adds that in the majority of soils (excepting those that are extremely sandy) the lime percentage is greater in the subsoil than in the surface soil. This is doubtless, he explains, the result of the easy solubility of calcic carbonate in the soil water, which carries it downward and thus tends to deplete the surface soil. This fact is strikingly shown in the results of Loughridge's investigation on the composition of the several sediments. The efficacy of lime in preventing "running to weed" in fresh soils, and in flavoring the production of fruit, is conspicuously shown in a number of cases.

Magnets.

M. Trouvé finds that if three steel bars of the same length and size are magnetized, then demagnetized, and afterwards remagnetized, the magnetic power due to the first magnetization being represented by 2, 3, 4, the power of the second will be 4, 9, 16. He found it necessary to demagnetize very regularly. To mangetize the bars he placed them in two solenoids in juxtaposition, closed the magnetic circuit by means of two soft iron plates, and caused a current to pass from a battery of six Wollaston cells. He thus obtained magnets of great constancy. He states that straight magnets support twelve or fourteen times their weight; if the magnet be of horseshoe form it will support forty-eight or fifty-six times its own weight.

Expectancy of Life.

Insurance companies are aware of the credulous weakness of those whose lives they assure, and have therefore compiled numerous tables of expectancy of life for their own guidance, which are carefully referred to before a policy is granted. These tables have been the result of careful calculation, and seldom prove misleading. Of course, sudden and premature deaths, as well as lives unusually extended, occasionally occur; but the average expectancy of life of an ordinary man or woman is as follows: A person 1 year old may expect to live 39 years longer; of 10 years, 51; of 20 years, 41; 30 years, 34; of 40 years, 28; of 50 years, 21; of 60 years, 14; of 70 years, 9; of 80 years, 4.