shops than those in more moderate circumstances, and, as a rule, desire that their sons shall have the manual training, even though they intend to enter professions.

What is claimed for the Washington experiment is, that it is an attempt to ingraft upon the common schools a system of manual training that shall give to all the boys a practical knowledge of the use of the most common tools used in working in wood and iron, and to all the girls a similar knowledge of plain cooking and sewing. This it is intended to do without interfering with the regular studies; each class, when the schools are completely organized, devoting two hours a week to the manual training.

The shops in Washington have not been established long enough to make it possible to determine whether the experiment will be successful or not. The only thing that can be said of it is that the results thus far seem to be encouraging. Of the single school of carpentry established in the High School last year, and attended by 225 pupils, Superintendent Powell says, "The work was successful. It was not difficult to manage it with the other regular courses of study of the school. The boys seemed to like the work, and showed no disposition to withdraw from the class. Although but one hour's instruction per week was given each pupil, a marked improvement in the use of tools was noticed; and it is known that many boys did corresponding work at home for practical and useful purposes, which was furthered at least, if not induced, by the training and suggestions received at the school shop." The late principal of the High School, in his annual report of the first year's instruction in carpentry, said, "It is certain that it did not hinder the general progress of any boy engaged in it, and it is equally certain that the influence of the work was beneficial in various ways in the school."

Superintendent Powell recommended an appropriation of ten thousand dollars for manual training in the Washington schools for the next year, and it is probable that eight thousand will be granted. This will make it possible to increase the number of schools of cookery and of the shops, and to provide additional instruction. Opportunities will thus be provided for all the pupils of the highest two grades of the grammar-schools and of the High School, and probably the number of hours of instruction can be increased from one to two hours a week for each class.

The Yellow-Fever Germ.

Something more than a year ago it was positively announced that a Mexican physician had discovered the yellow-fever germ; that it could be cultivated; and that, by inoculation with it, human beings could be rendered unsusceptible to the disease. Subsequently a similar report was received from Brazil, and together they caused wide-spread discussion both in this country and Europe, not only in the medical journals, but in the popular press. So important was this matter considered in Washington, that the President determined to have a special inquiry made in regard to it, and Dr. George M. Sternberg of Johns Hopkins University, a man of large practical experience with fevers, was appointed to make it. He visited Mexico and Brazil; and, although he has not yet submitted his official report, he obtained permission to prepare and read in advance of it a paper on the subject, setting forth in a general way the results of his inquiry. This paper was read before the College of Physicians, of Philadelphia.

The amount of time accorded Dr. Sternberg not only prevented the investigation from being as thorough as was desirable, but it made it necessary for him to visit Brazil in June, which is in the winter season south of the equator, and Mexico in September, when there were comparatively few cases of yellow-fever. His opportunities for observation, therefore, were not as good as could be wished. But his inquiries did go far enough to justify him in saying that he found really nothing to sustain the sanguine expectations of the Mexican and Brazilian scientists. Such examination as he had been able to make in Havana, Vera Cruz, Rio Janeiro and other Brazilian ports, which had yellow-fever, had not discovered any such micro-organisms as these gentlemen say they have found. These investigations were not confined to the blood alone, but to the alimentary canal and other parts of the digestive organs, and were extended also to the muscles and other tissues.

In order to show the exact degree of success in preventing yellow-fever by inoculation, Dr. Sternberg said that out of 44 inoculated in Rio Janeiro, 22, or 50 per cent, had been seized with the disease; and of these, 9, or 40 per cent, had died. "This is important," observed Dr. Sternberg, "when taken in connection with the usual rate of mortality, which is 30 per cent, as showing, that, so far from being a protection, inoculation increased the effects."

Dr. Sternberg said that in his official report to the government he had laid stress upon the fact that certain experiments which ought to have been carried out were rendered abortive by his having to return to Washington in accordance with his official orders. Under these circumstances, he had thought it best to advise that the investigation be continued by means of autopsies and with the blood taken from the living patient. In accordance with this recommendation, the President had directed him to continue his inquiry. So far as a practical analysis of the blood of the subjects referred to by the Mexican and Brazilian doctors was concerned, he had failed to find any such condition as they had described. At the same time further experiments ought to be made, although he had found no evidence to prove that the Mexican and Brazilian doctors had solved the problem of preventing yellow-fever by their inoculation and microbe theories.

Copper, Lead, and Zinc.

Prof. David T. Day, geologist in charge of the Division of Mining Statistics and Technology, of the United States Geological Survey, has issued a preliminary statement of the production and consumption of copper and of the production of lead and tin in the United States for the year 1887. The production was as follows: —

	1885. Pounds.	1886. Pounds.	1887. Pounds.
Domestic copper	165,875,766	156,735,381	177,420,524
From imported pyrites and ores	5,086,841	4,500,000	3,750,000
Total	170,962,607	161,235,381	181,170,524
	Short Tons.	Short Tons.	Short Tons.
Desilverized lead	107,437	114,829	135,552
Non-argentiferous lead	21,975	20,800	25,148
Total	129,412	135,629	160,700
Spelter	40,688	42,641	50,340

It is very difficult to secure trustworthy statements of stocks of copper in producers' and dealers' hands, and *in transitu*, and therefore Professor Day has adopted the plan of obtaining statements from the consumers of the country of the amount of copper used by each for a series of years. Answers were received from every brass and copper mill and from every brass foundery of any consequence in the country. The consumption of the copper and brass rolling-mills and wire-drawers was, in 1885, 51,110,522 pounds; in 1886, 63,921,217 pounds; and, in 1887, 72,521,287 pounds. The brass-founders used, in 1886, 8,146,866 pounds, which rose to 9,822,731 pounds in 1887, — an increase of 20.5 per cent in one year. Adding the two series of figures, a total consumption is reached of 82,344,018 pounds in 1887, as against 72,068,083 pounds used in 1886 by the same establishments, — an increase of 14 per cent. Professor Day reaches the conclusion, therefore, that the copper-consumption of the United States has been generally overestimated, and that in 1887 it was not much, if any, in excess of 100,000,000 pounds of new copper.

ELECTRICAL SCIENCE.

Intensity and Consumption of Different Sources of Light.

THE following are results of careful measurements, the unit being a standard English candle. The tables are summarized.

Petroleum Lamps.

A number of different lamps were used. The general result was

that all the forms had about the same efficiency. The consumption of oil is about 4.5 grams per candle-power per hour.

Gas-Burners.	Candle-Power, Mean.	Cubic Feet per Candle-Power per Hour, Mean.
Ordinary fishtail	17.	.523
Argand	20.5	.410
Auer's incandescent	12.5	.290
Siemens regenerative No. 3	66.	.260
" " No. 1.	172.	.350
Wenham No. 2	40.	.230
" No. 4	181.	.160

The argand burner is better than the fishtail: the latter uses nine cubic feet per hour instead of five or six, as is usually calculated, although this is largely a matter of local condition. The Auer incandescent lamp uses only half the gas that the fishtail consumes, but the deterioration of the incandescent material must be added. Of the high-candle-power lamps, the Wenham is most economical.

Arc Lamps (Electric).

	Mean Candles.	Mean Candles per Horse-Power.
Piefer	250	900
Piette-Krizik	820	1,090
Seimens	2,200	1,330

Incandescent Lamps.

	Mean Candles.	Mean Candles per Horse-Power.
Edison (old type)	16	122
" (new type)	16	147
Swan (old type)	16	133
" (new type)	16	157
Siemens	16	169
Bernstein	16	157

Magnesium Lamps.

These consist of a small clock-work which gradually unrolls the magnesium ribbon, and advances it through the centre of a reflector at a rate which can be regulated to equal that of consumption. From one to eight ribbons can be used. A ventilator is provided for the escape of the fumes produced by the combustion of the metal.

No. of Ribbons.	Candles.	Consumption per Hour per Ribbon for 100-Candle Power.
1	3,200	11.14 grams.
2	5,880	14.10 "
4	8,000	14.80 "
6	11,300	14.15 "
8	17,000	14.03 "

The price of the ribbon is nearly five dollars a pound, and this will make the price of one hundred candles per hour sixteen cents. This lamp can be improved, and the price of magnesium will probably fall.

A NEW ELECTRIC METER. — Prof. R. Boernstein of Berlin has invented a new form of current-meter for measuring the amount of current used at points of consumption. It consists of a compact electro-dynamometer whose indications are proportional to the intensity of the current, combined with a planimeter for integrating the deflections. The registering-apparatus is attached to a vertical wheel, which turns by the friction of a horizontal wheel driven uniformly by clock-work, which it touches. As the vertical wheel is nearer to or farther from the centre of the horizontal wheel, its velocity of rotation is less or greater, and its position is governed by the deflection of the dynamometer, being nearer the centre for a small, farther for a large, deflection. The apparatus is compact, and is said to measure to one-half of one per cent: it can be used for both direct and alternating currents. In case the necessity of winding the clock-work were an objection, it would be easy to accomplish this by a small motor that would be thrown in circuit when the spring was uncoiled to a certain amount.

THE RADIOGRAPH. — M. Louis Oliver proposes, by an application of Crooke's radiometers, to measure the total amount of light falling upon the vanes, the record having reference both to the time and intensity of the light. As the vanes of the radiometer revolve, they make contact with a wheel, closing an electric circuit. The wheel form of contact is adopted, as it offers very little resistance to the motion of the vanes. The current closes a relay, bringing into action a more powerful current, which moves the needle of a step-by-step apparatus across a scale. If the instrument is constant in its action, and fulfils the expectations of its inventor, it may be useful for photometric purposes, measuring the number of rotations in a given time.

STORAGE-BATTERIES ON THE BRUSSELS TRAMWAYS. — There have been lately reports of the failure of the storage-batteries on the tramway in Brussels that is experimenting with them. It is said that the deterioration of the batteries has been as much as seven cents per car-mile; and at that price they cost more than horses. The company supplying the batteries has come forward with the statement, that, since they delivered the cells, they have never been consulted in any way, and that their directions have not been complied with. It has been pointed out in this journal, that while in many cases storage-batteries will to-day be cheaper than horses, yet this will only be true when they are supplied at moderate cost, and when the facilities and cost of renewal are reduced to a minimum. At the same time, the cost of the batteries in Brussels is more encouraging than otherwise; for, at seven cents per car-mile for depreciation, the cost will be only slightly greater than that of horses, and the increased speed and comfort will more than compensate for this. The total cost for horses may be roughly estimated at ten cents per car-mile for an ordinary car in our Eastern cities. At seven cents for depreciation, the cost of batteries will be something under eleven cents per car-mile. With the advantages electricity offers, even this should throw the balance in its favor; and the calculation is on the most unfavorable data obtainable.

THE EICKEMEYER DYNAMO. — This dynamo differs from the ordinary type in that the field-magnet coils are wound close around the armature, with a heavy shell of iron outside. The object is to concentrate the lines of force where they are most needed, — through the armature, — and to prevent magnetic leakage. It makes a compact machine, which should give considerable output for its weight. The principle of the 'ironclad dynamo,' such as is embodied in Mr. Eickemeyer's invention, has been claimed by a number of inventors. Whether Mr. Eickemeyer was the first to construct such a machine or not, he seems the first one who has made it a practical success.

AN IMPROVED PRONY BRAKE. — In an ordinary Prony brake, in which the work of a machine is absorbed by the friction of its pulley between two clamps fitting over it, and where the power is calculated from the moment of the force tending to turn the clamps, and the revolutions of the pulley, there are many difficulties. The friction between the clamps and the surface of the pulley varies from different causes, — changes in lubrication, change of pressure due to heating, etc., — and the readings are most irregular. M. E. Meylan has described a new form of brake, simple of use and construction, that will measure with considerable accuracy powers

from five-horse power upward. The improvement consists in an automatic arrangement by which the pressure between the clamps is adjusted to compensate for irregularities in lubrication, etc. The two clamps are connected by a system of levers, so arranged, that, if there is a tendency for the whole system to revolve in the direction of revolution of the pulley, the pressure between the clamps is decreased; if it begins to move in the other direction, the pressure increases. This seems a great improvement over the ordinary Prony brake, and will be useful in measuring the efficiency of steam-engines, large electric motors, gas-engines, etc. It cannot, however, replace transmission dynamometers for many purposes, and it is probably not so efficient as the best of the latter class; the Tatham dynamometer, for example. It is an instrument that can be cheaply made, and no doubt will be extensively used.

HEALTH MATTERS.

Cholera-Infantum and the Weather.

AT a meeting of the New York Academy of Medicine, held in February, Dr. A. Seibert read a paper on cholera-infantum and the weather. The frequency and fatality of this disease in this latitude during the summer months make this subject one of great interest. Dr. Seibert includes under the name 'cholera-infantum' all cases of acute gastro-intestinal catarrh in children under five years of age. The basis for this paper was an experience of ten years (1878 to 1888) in the children's department of the German dispensary of New York City, during which time 8,036 cases of gastro-intestinal catarrh had been treated. The disease exists all the year round, even in the coldest weather; and the proportionate mortality, one in four, is just the same in cold as in hot weather. This he claims is shown not only by his own statistics, but also by those of the board of health. The largest number of cases, however, occurred during the summer months. Thus, in the ten Julys there were 2,443 cases, and in the ten Augusts 1,524 cases, while in the ten Februarys there were only 117 cases. The number of deaths was always much greater in July than in August. Thus, during the ten years, the number of deaths reported in the city of New York in the month of July was 12,428, and in August only 6,205. In July, 1881, when the mean temperature was 80°, the number of cases treated in the dispensary was 290; in August of the same year, when the mean temperature was 82°, the number of cases was 223; and in September, when the mean temperature was 87°, the number of cases was 137. During the summer months it was found that the number of cases and of deaths bore no relation whatever to the rise and fall of temperature, and the same was true as regards the range of humidity; so that warm, moist weather did not predispose more to the disease than warm, dry weather. No relation could be demonstrated between the prevalence of the disease and the rainfall, and the same was true in regard to the velocity of the air-current. According to prevalent opinion, the months containing the greatest number of hot days ought to have had the greatest number of cases and of deaths; but there was no evidence supporting this. It is evident, Dr. Seibert thinks, from the facts, that *hot* weather is not necessary for the production of the disease, but that *warm* weather is. Statistics show that in the early part of the summer season, as soon as the minimum daily temperature remains above 60° for a number of days (a week or more), the disease becomes epidemic; and this, no matter how high above 60° the temperature may go, whether it is 75°, 80°, or 85°. His conclusions are as follows: First, Hot weather, either dry or moist, is not necessary for the epidemic appearance of acute gastro-intestinal catarrh; Second, Warm weather, either dry or moist, showing a minimum daily temperature of not less than 60°, brings on the epidemic every year, irrespective of the height of the maximum daily temperature; Third, The disease loses its epidemic character as soon as the minimum daily temperature falls below 60°, as in October; Fourth, Therefore this disease cannot be brought about by the direct effect of high temperature upon the child's body.

Dr. Seibert then went on to say that the lowest temperature of each day was reached during the night; and it was at this time that the milk which furnished the principal food of so many young children was brought into the city. It was often carried long distances, being much jolted about, and absorbing impurities from the time it left the cow: it was therefore only a question how far the decomposition of the milk had advanced by the time it reached the child. It was well known that a low temperature retarded decomposition; and Dr. Cyrus Edson, of the New York Health Department, had informed him that in his experience he had found that milk usually began to turn whenever its temperature reached 60° or higher. Chief-Engineer Birdsall, of the Department of Public Works, had also informed him, that, whenever the temperature of Croton Lake rose to 60° or above, there was a peculiar taste about the water, which he attributed to the decomposition of certain matters contained within it.

As to the point why there are always so many more cases and deaths in July than in August, the difference usually amounting to at least one-third, it seemed to him that it might perhaps be explained by the fact that it took a few weeks after the onset of warm weather to fully arouse the tenement-house population to the danger to which their children were exposed from this disease, and to the necessity of taking suitable precautions as regards fresh air and diet for its prevention.

In the discussion which followed the reading of the paper, Dr. L. Emmett Holt referred to some statistics of Liverpool which tended to confirm some of Dr. Seibert's conclusions. In one year 347 deaths occurred from cholera-infantum in July, the average temperature being 58.9° F., while in August, when the temperature was 59.2°F., there were 969 deaths. Dr. Holt said that in summer there were different forms of diarrhœal disease in growing children, and that he thought it was advisable that some distinction should be made between them. In the production of what is ordinarily known as 'summer-complaint,' he believed that there were four principal factors concerned, — namely, heat, feeding, sanitary conditions, and constitution, — and that the most important of these features was heat.

Dr. J. Lewis Smith thought that there was perhaps a fallacy in comparing summer diarrhœa with that of winter; the two being, in his opinion, very different diseases. He believed that summer-complaint was due to heat, but just how this acted was not yet known. Heat alone is not sufficient, else the disease would be prevalent in the country as well as in the city. How much gaseous exhalation had to do with its production was not ascertained. The opinion is gaining ground that summer diarrhœa is a microbic disease. It was well known that milk which had begun to decompose had a tendency to give rise to the affection. In Asiatic cholera the causative agency of Koch's bacillus had been pretty generally accepted, and it was believed that this microbe was received into the mouth, and acted as a source of irritation to the intestines by its actual presence, and not by causing decomposition of food. In like manner it did not seem unreasonable to suppose that micro-organisms might act in the same way in some cases of summer diarrhœa.

Dr. A. Caille thought that decomposing milk was the chief exciting cause, while a high temperature paves the way. Two French physiologists had made some experiments by exposing animals to a continual temperature of 104°, and the phenomena which they observed to result from the exposure were: (1) increase of nervous excitability; (2) nervous depression; and (3) convulsions, coma, and death; death resulting more speedily in a moist high temperature than in a dry high temperature. The same results had been noticed to be produced in children when the weather was very hot. It was his opinion, therefore, that while high temperature did not directly produce diarrhœa, it did have a pernicious effect upon the system, and under these circumstances any irritating substance would be likely to give rise to diarrhœa.

As regards the smaller number of cases of summer-complaint, as well as of deaths from the disease, in August than in July, he thought that perhaps one reason for this was that a much larger number of children left the city in August than in July, while those which remained had the advantage of the numerous fresh-air excursions then provided for the poor.

Dr. A. Jacobi said that the cases which occurred were not all alike. In some there was a simple catarrh, in others a tendency to collapse. He thought that great heat would kill by its direct effect on the heart, the myosin of the muscular tissue of that organ being coagulated by the heat. Intense heat would cause a dilatation of