THE JOURNAL
OF THE
Board of Arts and Manufactures
FOR UPPER CANADA.

MARCH, 1866.

KNITTING AND KNITTING MACHINERY.

In writing of almost any process of manufacture in the present advanced stage of improvement which characterizes so many branches of the world's industry, it becomes absolutely necessary to note the principal progressive steps from the beginning. In the absence of this historical guide, the general reader would fail to comprehend the wonderful advances made; thus missing the gratification which such reading yields, as well as those incentives which the earnest reader often feels to emulate those illustrious laborers in the world of progress, to whom a just sense of our obligation can be best manifested by becoming models for emulative imitation to the next generation.

In view of the encouragement due to home manufacture, we propose to call attention to the interesting Machine Knitting Factory recently established in this city by Mr. Simpson, May, 1865, and for the reasons above given, to take as rapid a survey of its history as is compatible with our object and limits.

The word *stocking* does not necessarily imply any article of apparel, as the Roman *tibia* did but designate the manner in which the work of making it was done.

It was *stocken, Saxon* (past participle of stican), because it was made with *sticking* pins, now, with perhaps less propriety, called *knitting needles.*

This kind of work, so far as we are aware, has no antiquity to boast, as those who sometimes confound *netting* with knitting might imagine. We know that ancient nations made nets, which they used in fishing and hunting, and there is no doubt but those were recticular in their structure as they are to-day. Network was also used for ornamentation—ecclesiastical, domestic and personal. Beekman remembered having seen "retiform hangings in old churches, and on old dresses of ceremony, borders or trimmings of the same kind; and in the middle ages, the mantles of the clergy had often coverings of silk, made up of meshes, similar to those of our fishing nets. Knitting is a modern invention. Like netting, it consists of one thread only; but instead of being formed into meshes, secured by knots, it repeats upon itself a series of loops secured only by a fastening at either extremity. This is essentially the case in all true knitting, whether done by hand or machine. Knitted stockings seem to have appeared in England in the reign of Henry VIII. His majesty ordinarily wore cloth hose, 'except there came by great chance a pair of silk hose from Spain.'"

Savary tells us that in 1527 knitting had become a considerable branch of industry in France; that the brethren of the craft formed themselves into a guild, and for their patron saint they chose *St. Fiacre of Scotland,* believing, as they did, that in that country the art was invented; and in the sixteenth century, which could not have been more than 27 years prior to their incorporation, it was the general belief that the first knit stockings seen in France came from Scotland. However this may be, we have no knowledge whatever of such things till we hear of bluff King Hal enjoying the occasional luxury of a pair, which, by great chance, came from Spain. Scotland could not have produced many, nor France many, nor could it have become an extensive branch of industrial occupation in Spain or Italy, or surely the powerful and extravagant monarch of England would not have been compelled to encase his royal limbs in hose of rigid cloth, clumsily made by a tailor. The French guild, if not a myth, had existed 20 years when Edward VI. succeeded his father on the throne, and yet stockings were not so plentiful; but "great notice" was taken of a pair of black Spanish silk ones being presented to that king by Sir Thomas Gresham. Besides, Queen Elizabeth wore stockings of cloth all her life up to the third year of her reign, 1562, when Mrs. Montague, her silk woman, presented her with a pair, and so great a luxury did she find them, that, "she never wore cloth any more."

It is related by Stow, the historian, that the first pair of woollen stockings made in England were the work of a London apprentice, who, seeing a pair, brought from Mantua, in the shop of an Italian merchant, borrowed them, took them home, and imitated them perfectly. This occurred in 1564. Fifteen years later, when Elizabeth visited Norwich several female children appeared before her, some of whom were spinning worsted yarn, and others knitting hose of the same material. Ten years later, in 1589, just 25 years after William Rider, the London apprentice, knitted the first pair of woollen stockings in England, there came a revolution in knitting, such as startled people.

The peaceful avocation of knitting for a livelihood had been pursued in several counties by large numbers of the inhabitants, and it had become an established trade. Some short time prior to the year above mentioned, William Lee, a native of Woodborough, in Nottinghamshire, had been expelled the University of Cambridge for marrying against the statutes. Thus, without other resources, the clerkly young husband found himself depending for his daily bread upon his wife's dexterity at knitting. No doubt he felt this to be very humiliating; at any rate he conceived the idea of making fingers of iron that should be made to form several loops at once, whereas his wife's could form but one. Many weary days and nights he pondered over the crude idea. Had mechanical powers and motions been as well understood then as now; had there been as suggestive models as are everywhere to be found now, William Lee's difficulties would have been comparatively trifling. Though even at this day, inured as we are to the daily phenomena of new inventions, a machine displaying so much original ingenuity as the stocking frame could not fail to attract universal admiration. Since Lee's machine came to light two hundred and seventy-six years have passed away and many thousands of inventive minds have explored the realms of mechanical science and the stocking loom in its fundamental principles has survived all changes. In all parts of the world thousands are this day working almost entirely unaltered, even by the side of the rotary machines to be presently noticed.

Lee was not merely an inventor without worldly wisdom, for he displayed a great deal of energy and business tact in introducing his frame and setting it up, first at Calveston, near Nottingham, and afterwards in London. Yet he was doomed to disappointment and poverty, and a cruel death in a foreign land. According to Mr. Felkin, Lord Hunsdon entered into a kind of partnership with Lee, and thus one of the Tudor family became the first stocking maker's apprentice.

However this may be, it is certain that that nobleman and his son accompanied Queen Elizabeth when she went to see Lee working at his frame, and it is equally certain that his lordship interceded with her Majesty to obtain a patent for the invention.

The answer of good Queen Bess on this occasion shewed great regard for the welfare of her subjects. "My lord," she said, "I have too much love to my poor people who obtain their bread by knitting to give my money to an invention which will tend to their ruin, by depriving them of employment and thus make them beggars. Had Mr. Lee made a machine that would have made silk stockings, I should, I think, have been somewhat justified in granting him a patent for that monopoly which would have affected only a small number of my subjects; but to enjoy the privilege of making stockings for the whole of my subjects is too important to grant to any individual."

Our inventor then applied himself to silk work, and in 1596 succeeded in making plain silk stockings from a twenty guage frame. Of these he erected nine, worked by apprentices. In the meantime the Queen died, and his prospects of obtaining a patent from James were so small that he accepted the munificent offers some time before made by the French ambassador, Sully, to remove with his machinery and workmen to his country. Having established these at Rouen, he repaired to Paris where he was introduced by the Duke of Sully to Henry IV., but just as prosperity was about to reward all his anxious toil the king was murdered, and Lee falling under the ban of proscription against protestants sought refuge in Paris, where he died in poverty.

Lee's brother, however, and all the work people except two returned to England. The two who remained were allowed to retain one frame. Every exertion was now made to recommence operations. Those of the trade resident in London petitioned Cromwell for a charter of incorporation. The petitioners urge that it is nothing different from the common way of knitting "but only in the number of needles at an instant working in this more than in the other by an hundred to one, set in an engine or frame] composed of above 2,000 pieces of smith's, joiners' and turners' work after so atificial and exact a manner, that by the judgment of all beholders it far excels in the ingenuity, curiosity, and subtility of the invention and contexture all other frames or instruments of manufacture in use in any known part of the world."

The "Lord Protector" however, paid no attention to their petition, and the stocking knitters guild owe their charter to Charles II., in 1663.

In 1669 there were in England 660 frames, of which 390 were employed on silk. In 1714 there were about 8,000. In 1753, 1,400; in 1782, 20,000; in 1812, 29,590, including 1,449 in Scotland, and 976 in Ireland. In 1844 there were in the United Kingdom 48,482 frames. Since that time so great has been the improvement in the manufacture of hosiery, that, with a great reduction in the price of goods, stockings have become a common article of apparel in parts where formerly they were little known.

Large numbers of people are employed in the trade in Nottingham, Derby and Leicester, in England, and Hawick and other places in Scotland.

Early in the last century English emigrants introduced frame knitting into the United States, a very active part being taken by an apprentice of Jedediah Strutt, who in England invented a machine for making ribbed work. Some Germans also established the business at Germantown, near Philadelphia, where the trade flourishes to a very great extent. Now, however, the work is literally revolutionised. Instead of the square frame, with its straight row of needles, which the thread traversed from end to end and back, the work is accomplished with almost incredible rapidity by a revolving circular machine. This kind of machine has been in use for a number of years in England, and some ten or twelve years ago we saw one at work at an exhibition of the Franklin Institute. This pattern of the machine is now at work at

SIMPSON'S KNITTING FACTORY,

in this city. The needles, instead of being in a right line, are ranged side by side, accurately equi-distant, in an open circular frame of iron, with their points or hooks pointing inwards. This frame or disc revolves, carrying the needles about fifty revolutions a minute, the number of needles being six hundred, each one making a complete loop at every revolution, so that one of these machines makes 3,000 loops a minute, or 75 yards of continuous circular cloth, for under shirts, daily. This is drawn up on a roller, the tension being nicely regulated by the machine itself, so as to ensure evenness of texture in the fabric throughout. This winds the cloth up over head ; and another, which for its neatness and symmetrical structure we admired still more, winds its cloth around a nether roller, doing about the same quantity of work. These two are kept at work on under-shirting, and four others on stockings, one of which is for ribbed work. These latter are, of course, smaller, as the leg is smaller than the body, and their productive capacity is about twelve dozen pairs of socks daily, that is, without feet, as the shirts are without sleeves ; these have to be added afterwards.

To describe the delicate and complicated machinery used in knitting, without drawings, is impossible. In nearly all cases the needle or hook is still Lee's ; that is, an iron or steel hook, bent back over the stem and possessing so much elasticity that, with the *presser bar* in the old frame, or the *presser wheel* in the rotary machine, it admits of instant pressure down *into* a bed or indentation punched in the shank, immediately under the hook, to receive it, that when thus down it may form a closed eye, over which the loop on its stem may slip and become part of the cloth. Let us suppose a loop to be still in the hook over which the last one passed, and it will be seen, at least imperfectly, how the successive loops form the endless chain which constitutes the fabric, just like hand knitting. But, in order to be understood, the operations must be watched and studied.

The wool used in this establishment, we are happy to learn, is all Canadian, and to prepare it for the knitting machine here are two sets of cards. Only one, however, was running when we visited the factory. We have seen some very good cards in Canada, but we have nowhere any better than these, and certainly none in better working condition. There are two spinning jacks, one of 120 and the other 240 spindles.

All the machinery we saw running was excellent. Of the picker, however, we cannot speak favourably, and we say so because, as on a former occasion, we are anxious to call the attention of woollen manufacturers to the fact that a good picker is a very important article. And we speak advisedly when we say that the truncated conical machine which we spoke of in Vol. IV. page 255, would pay for itself in a very short time in its saving of cards and the time lost in dressing. It would present the wool to the first breaker in almost as favourable a condition as that in which it is now presented to the second, and its superiority on coming from the condenser would be manifest. There is some new machinery in process of erection here, and considerably more will be in operation within three months, included in which there will be a new and ingeniously contrived machine for the more effectual mixing of cotton and wool, several frames for adding feet to socks, and other work for which they are best adapted, and we have a hope that the *picker* which we have spoken of will be included.

The number of hands employed by Mr. Simpson is at present about forty, and the contemplated extension of the business will add perhaps as many more.

At present the consumption of wool is at the rate of 90,000 pounds a year, and Canadian wool is preferred ; but there has been some difficulty in obtaining a full supply, to which fact we would call the attention of our farmers.

The goods produced here find a ready market, on which we congratulate the proprietor and thank him for his courtesy.

THE CHOLERA.

In all human probability, ere a few months elapse, this fearful visitation and scourge will be upon us ; and it therefore behooves not only our Municipal rulers, but every householder and private individual amongst us, to do what we can to avert, by attention to proper sanitary laws, its otherwise fearful consequences.

In almost all our cities, towns and villages, a vast amount of filth is left to accumulate on vacant lots, in lanes, yards, slaughter-houses, and cellars; many houses are undrained, or have drains insufficient or untrapped, and ventilation of premises generally bad; privies and cesspools are in close proximity to wells, from which water is obtained for family use—during each former visitation a most frightful means of propagating the disease.

There is also a vast amount of personal uncleanliness, and uncleanliness in the dwellings of a large portion of every community. The uniform testimony of medical men and sanitary reformers is, that, from these things, combined with improper food and intemperate or irregular habits, the principal danger of cholera, in its worst form, arises.

Much has been written and published in the newspapers and otherwise, as to the treatment and cure of cholera. Some of these directions are no doubt good, but many are unreliable. At a recent meeting of the Academy of Sciences, in Paris, Dr. Velpeau, a most eminent physician, said:—

"I am obliged to avow that it is not always in our power to point out an efficacious remedy. The cholera is no doubt caused by the introduction of a poison into the organism. If the poisonous element is in small quantity, and the organism strong, it makes no ravages; if the contrary be the case, the danger is real. Also when the patient absorbs what is administered to him, his cure is probable. But sometimes the stomach refuses to absorb any thing; and in this case recourse should be had to external means, which are often insufficient. In a word, the malady almost always commences by characteristic symptoms, such as premonitory diarrhea. The preventive treatment is easy, and it is for each person to guard himself. Excess of every kind should be carefully avoided, and the rules of salubrity attentively observed. The means of arresting the malady at its outset are very simple. My advice is this—pour from three to four drops of laudanum on a lump of sugar, and swallow it. Repeat in two hours afterward, and so on, until the colic and vomiting pass away. Take also very small injections of starch, poppy flowers with six, seven, eight or ten drops of laudanum. This treatment will almost always suffice to stop the diarrhea, and will be a guaranty against the malady."

A New York journal remarks that:—"The premonitory diarrhea of the cholera is of a very peculiar character, very easily distinguished from other forms of diarrhea. The discharges are frequent, and are white and watery, generally compared to rice water. Even for these it is best to consult a physician if possible, but if no physician is within reach, then, according to Velpeau, we are to swallow three or four drops of laudanum every two hours till the diarrhea is checked."

The London *Mechanics' Magazine*, referring to another mode of treatment, says:—

"We recently noticed Dr. Burq's visit to Toulon for the purpose of testing his copper theory in cholera cases, and we now state the results obtained with his system by Dr. Lisle, physician to the Asile at Marseilles. The formula employed was:—A solution of 5 per cent. of sulphate of copper in pure water, 1·50 gms.; Sydenham's laudanum, 10 drops; sugar and water, 120 gms; one teaspoonful every quarter of an hour in dangerous cases. The results were, out of 32 patients, 7 deaths and 25 cures. There were besides, in the same establishment, 36 patients treated with other methods; of these, 28 died and 8 recovered."

The same journal says:—"The inhabitants of Rio Tinto, in Spain, celebrated for its copper mines, have hitherto been free from cholera, although surrounded by the pestilence. This is attributed in the country to the sulphurous acid gas which is evolved from the copper ore exposed to the operation of roasting."

The *New York Sun*, in publishing the following recipe, says:—

"This compound is pronounced by medical men to be excellent; but our readers must remember that it is a medicine which should be used moderately, although none can be harmed by it if they follow the directions. A few doses generally relieve the patient. Children require only half the quantity used for grown people:—Mix in a small bottle equal parts of the tincture of opium (laudanum,) tincture of rhubarb, tincture of camphor, and essence of peppermint (treble strength). Add two drachms of spirits of aromatic ammonia. Then shake all the ingredients together, cork the bottle, and it is ready for instant use. It will keep for years. *Dose*—ten drops, twenty drops, or a teaspoonful, mixed with a little sugar and water; to be taken every fifteen minutes, thirty minutes, or an hour, according to the severity of the attack and the age of the sufferer."

We might select numerous other recipes published, but however good any of them may be, there is no doubt but "prevention is much better than cure," and therefore means to that end should be early resorted to.

At a late session of the State Medical Society, held at Albany, resolutions were adopted expressive of the opinion that the cholera may be prevented from becoming epidemic in any city, town or locality by the adoption and right enforcement of proper hygienic measures.

Previous to attention being paid to sanitary matters, to any appreciable extent, the annual mortality was—

In London........................	1 in 20
In Liverpool......................	1 in 28
In Philadelphia..................	1 in 39

Under the present system of government it is now—

In London........................1 in 45
In Liverpool. ....1 in 41
In Philadelphia ....1 in 50

This shows the importance of a good system of drainage and comparative cleanliness; especially when we take into account not only the decrease in the present death rate, but that for every death in a large community there are twenty-eight cases of sickness.

Arguing upon a series of facts related, the N. Y. *Methodist* says the following conclusions may be drawn:—"That cholera has followed the channels of commercial interests, keeping close by water-sides, and establishing itself first in filthy quarters of cities, that were already inviting its appearance."

A *Report on Epidemic Cholera* issued by the *Citizens' Association of New York*, says:—

"That classes of lodging houses in the cities of England that had been brought under sanitary regulations, with a total population of 80,000 was nearly exempt from cholera during the last epidemics, while the lodging and tenement houses not under such regulations continued to be hotbeds of both cholera and fever. In the report of the General Board of Health in 1849, it is stated that in the great tenant houses called the Metropolitan Buildings, in which the regulations were complete, though with a population exceeding five hundred persons, not a case of cholera occurred, yet in the same district the epidemic was very fatal. In the report of the same Board in 1851, it is stated that 'in the metropolis every efficient sanitary improvement has been followed as directly as cause and effect by a corresponding decrease of sickness and mortality. *There is no exception to this rule*—it applies to the courts, alleys and houses occupied by the industrious classes; it applies to the public institutions of every kind; to prisons, to hospitals, to lunatic asylums; and, above all, to establishments specially erected to test the value of sanitary principles—to the model lodging houses of the metropolis. In our report on epidemic cholera, it is shown that only one out of 795 persons, inmates of these model buildings, had been attacked by the disease, whereas, among the population of London generally, one person in 75 was attacked.'"

A remarkable fact is told of the city of Worcester, England. "Having been twice scourged by cholera, the city undertook to avert the later epidemics by means of effectual cleansing and efficient sanitary regulations. The result was, that while the pestilence swept through the neighboring cities and villages, the populous city of Worcester escaped, 'and the Destroyer of uncleanly cities made a *passover* with the people of Worcester, for on every lintle and doorpost was written 'cleanliness, *cleanliness*.' Not a house was entered, and the town was saved in the midst of the most frightful desolation."

A large number of the members of the Medical Faculty, and other gentlemen of this city, recently met the Board of Health, by invitation, at a public meeting, to consider the steps necessary to place Toronto in a proper sanitary condition. The meeting was a large and influential one, and the chief burden of the whole discussion was "the necessity of strict cleanliness, and its effectiveness in preventing or in ameliorating the visitation of cholera."

The following letter was addressed to the Chairman of the Board, by Dr. Uzziel Ogden, who was prevented from being present. It, in our opinion, so completely covers the whole ground, that we have no hesitation in publishing it in full:—

TORONTO, Feb. 14, 1866.

"SIR,—As I cannot be with you to-night, I present my suggestions for the present emergency:—

"1st. I would advise a thorough cleansing of the city, the cesspools, privies, streets, lanes and gutters.

"Removal of slaughter-houses, hog-pens, and cleansing of cowsheds.

"Examination of water supplies, and the closing up of wells in the most crowded localities.

"Pure water to be furnished to the poor.

"House and street drains to be trapped, the former by proprietors, the latter by the Corporation, as far as practicable. Where practicable, drains and gutters to be periodically flushed. The establishment of a regular system of scavenging, and the enforcement of penalties for deposition of refuse, or offal, in the streets, alleys, or gutters.

"The employment of cheap disinfectants, one of the best being pure fresh lime.

"2nd. In the event of cholera appearing, the establishment of dispensaries in different parts of the city, easy of access by the poor, where remedies may be obtained for the treatment, only of cholera, in its premonitory and other stages; each dispensary under the control of one or two medical men, assisted by two or three medical students, one of whom should always be on the spot to dispense medicines in the absence of the medical officer.

"3rd. I think the time has arrived when a 'Medical Officer of Health' should be appointed by the Government for the city.

"Health Officers are now appointed for most of the British towns, and the duty of such officer would be to look after all matters affecting in any way the health of the city, by inspecting the water supplies, the various kinds of food exposed for sale, drainage, ventilation, overcrowding, &c.

"He would advise with, and suggest measures to, the Board of Health, who should be charged with the duty of carrying out his suggestions as far as possible; and under his advice and control alone, would I place the carrying out of the above or any other sanitary measures.

"4th. The establishment of a Cholera Hospital, while it may be necessary for a very few cases, is generally disapproved of by recent British writers, the time lost in conveying the patient to the place, combined with the fatigue, often ensuring a fatal termination, and more than counterbalancing the benefit. If established at all, it should be within easy and prompt access, readily supplied with pure water, and easily kept free of contamination by excretions.

"I would strongly impress upon the people the fact, that proper sanitary measures, honestly carried out, by themselves and the authorities, can render cholera as mild and harmless as any of the other epidemics by which we are usually visited."

Under the head *Sanitary Precautions*, page 215 of this journal, for the past year, are some extracts from a paper read by Mr. Edwin Chadwick, on the sanitary and drainage works of the city of Salisbury, of interest as bearing on this subject; and at page 278, for the same year, is a memorandum issued by the Privy Council of England, on *Processes of Disinfection* during the visitation of cholera, to which we beg to refer our readers.

BOARD OF ARTS AND MANUFACTURES FOR LOWER CANADA.

We regret having received the report of proceedings of the Annual Meeting so late—it is partly in type, but we have been obliged to postpone it for our next issue.

Board of Arts and Manufactures

FOR UPPER CANADA.

ANNUAL EXAMINATIONS.

Members of Mechanics' Institutes are reminded that the Fourth Annual Examination of candidates will be held sometime during the month of May or June next. A list of the subjects of examination was published in the January number of the Journal for the present year, and full particulars can be had on application to the Secretary.

We hope to see a large number of candidates entered, as nothing can be more beneficial to the youth who has recently left school, and is entering upon the sterner duties of life, than to refresh his memory and still further improve his mind, in the pursuit of studies more particularly adapted to the department of industry he may have chosen, or is intending to engage in; and to those who have, unfortunately, not had the advantages of early instruction, these examinations afford admirable opportunities for *testing* the progress they are making in self-education and improvement.

Guardians and employers of youth would also consult their own interests by affording all possible encouragement to those placed under their charge, in the pursuit of their studies and examination, even to the offering of pecuniary rewards to such as may succeed in obtaining first-class certificates. Youths who thus spend their time, and succeed in obtaining distinctions, will generally make better and more intelligent employees than those who neglect the improvement of their mind.

TRADE MARKS.

Trade marks registered in the office of the Board of Registration and Statistics, and open for inspection at the Library of this Board:

(*Continued from page 32.*)

Carleton & Hovey, Lowell, Mass.; registered by S. J. Lyman, Montreal, "Chlorate Troches." Vol. A, folio 95. Dated January 11th, 1866.

Daniel Young, M. D., Conway P. O., "The Great Shoshonees Remedy." Vol. A, folio 94. Dated January 25th, 1866.

George Martin, Montreal, "Martin's Photo-Nitrate of Silver." Vol. A, folio 96. Dated February 12th, 1866.

James Aitkin Harte, Montreal, "Concentrated Lye." Vol. A, folio 97, No. 70. Dated February 15th, 1866.

J. Kenneth Campbell, Montreal, "Campbell's Improved Cocoine." Vol. A, folio 98, No. 71. Dated February 15th, 1866.

Canadian Patents.

BUREAU OF AGRICULTURE AND STATISTICS,
PATENT OFFICE, OTTAWA, Jan. 1, 1866.

LIST OF LETTERS PATENT OF INVENTIONS, *issued for a period of* FOURTEEN YEARS *from the date hereof.*

(*Continued from p. 230, Vol. 5, of this Journal.*)

FRANCIS JUDD HORN, of the Township of East Whitby, in the County of Ontario, Mechanic, "A new and useful Broad-cast Seed Sower and Cultivator."—(Dated Quebec, 10th April, 1865.

THOMAS LALOR, of the City of Toronto, in the County of York, Locksmith, "A new and useful Latch and Side-bolt Lock for Gaol purposes for Cell and Corridor Gates."—(Dated Quebec, 4th August, 1865.)

WILLIAM THOMAS AIKINS, of the City of Toronto, in the County of York, Physician, "A process for the manufacture of Sugar and Syrup from Indian Corn and other Cereals, and from all amylaceous or saccharine Bulbs or Roots, and from Starch, prepared from these or any other sources, the said process to be called 'Simple and direct method of manufacturing Sugar and Syrup from Cereals and Roots and Starch.'"—(Dated Quebec, 4th August, 1865)

HENRY MCSTRAVICK, of the City of Hamilton, in the County of Wentworth, Broommaker, "A new and useful Metallic or Gutta Percha Shoulder Cap, for fastening the Broom Corn without winding the same with wire or twine, to the handle of the Broom." (Dated Quebec, 9th August, 1865.)

THOMAS STERRY HUNT, of the City of Montreal, Chemist and Mineralogist, "A Composition for Furnace Linings and Fire Bricks."—(Dated Quebec, 10th August, 1865.

CHARLES S. PECKHAM, of the Village of Stanstead Plain, in the County of Stanstead, Gentleman, "A new and useful Improved Metallic Threshold and Outside Door Attachment."—(Dated Quebec, 10th August, 1865.)

GEORGE WILLIAM ANDERSON, of the City of Montreal, Civil Engineer, "A new and useful Universal Needle Threader."—(Dated Quebec, 12th August, 1865.)

JOHN WATSON, of the Village of Ayr, in the County of Waterloo, Iron Founder, "Certain new and useful improvements in Reaping and Mowing Machines." (Dated Quebec, 15th August, 1865.)

JAMES CLARK, of the Township of Caledon, in the County of Peel, Carpenter, "A new and useful Machine for working an Ordinary Dash Churn."—(Dated Quebec, 15th August, 1865.)

JOHN EDMONDS, of the Village of Smithville, in the County of Lincoln, Engineer, "A new and useful Improvement on the plan now in use for the Setting, Placing, or Inserting the Tubes in Boilers for the purpose of Generating Steam."—(Dated Quebec, 15th August, 1865.)

EDWARD CAULFIELD, of the Town of Brockville, in the County of Leeds, Plumber and Gasfitter, "Certain new and useful Improvements in that class of apparatus which relates to the Increase of the Illuminating Powers of Gas, such as is used for Lighting Cities and Dwellings."—(Dated Quebec, 16th August, 1865.)

GEORGE FERGUSON, of the City of Toronto, in the County of York, Nurseryman, "A Fire Lighting Attachment."—(Dated Quebec, 16th August, 1865.)

PAUL CEREDO, of the City of Montreal, Sculptor, 'A Machine called the 'Cinderella Sifting Machine,' for sifting and separating coal, ashes, and for other purposes."—(Dated Quebec, 16th August, 1865.)

FREDERICK HENNEBERG, of the Village of Washington, in the Township of Blenheim, in the County of Oxford, Mechanic, and MENNO BECHTEL, of the Township of Wilmot, in the County of Waterloo, Yeoman, "A new and useful Machine which they call 'Henneberg's Rotary Flax Puller.'"—(Dated Quebec, 18th August, 1865.)

JACOB HARRINGTON, of the Township of East Zorra, in the County of Oxford, Yeoman, "A new and useful Flax Puller, called and known as 'The Canadian Flax Puller.'"—(Dated Quebec, 18th August, 1865.)

WILLIAM J. COPP, of the City of Hamilton, in the County of Wentworth, Iron Founder, "An Improved Cooking Stove known as 'The Prince of Wales Cooking Stove.'"—(Dated Quebec, 18th August, 1865.)

SAMUEL HERBERT BARNETT, of the City of Montreal, Watchmaker and Jeweller, "A new and useful Alarm to be called, 'Barnett's Electro Burglar and Fire Detector.'"—(Dated Quebec, 19th August, 1865.)

ROBERT HILL, of the Town of Barrie, in the County of Simcoe, Machinist, "A new and useful Improved Side Gearing for Threshing Machines."—(Dated Quebec, 22nd August, 1865.)

JAMES MILLER, of Upton, in the County of Bagot, District of St. Hyacinthe, Tanner, "A new and useful Improvement in the manufacture and preparation of a Concentrated Extract of Tanbark, to be called, 'Miller's Concentrated Extract of Tanbark.'"—(Dated Quebec, 25th August, 1865.)

WILLIAM LINTON THOMPSON, of the Township of Stanstead, in the County of Stanstead, Clerk in Holy Orders, "A new and useful improved Peat Manufacturer."—(Dated Quebec, 25th August, 1865.)

WILLIAM RITCHIE HIBBARD, of the City of Montreal, Trunkmaker, "An Improved Cachet or Safety Seal for Trunks."—(Dated Quebec, 25th August, 1865.)

WILLIAM SAUNDERS, of the Township of Pickering, in the County of Ontario, Millwright, "Saunder's Improved Washing Machine."—Dated Quebec, 26th August, 1865.)

WILLIAM CURTIS, of the Town of Belleville, in the County of Hastings, Mechanic, and WILLIAM BAMFORD, of the same place, Mechanic, "A new and useful Lifting Pump, known as 'Curtis and Bamford's Lifting Pump.'"—(Dated Quebec, 28th August, 1865.)

JOHN HUTCHINGS COX, and JOHN MURPHY, of the City of Montreal, Opticians and Machinists, "A new and useful Speed Regulator for Fluids."—(Dated Quebec, 29th August, 1865.)

NICHOLAS HILTMAYER, of the Village of Omemee, in the County of Victoria, Watchmaker, and GEORGE MORRISON, of the same pl ce, Merchant, "A new and useful Car Coupling Life Saver."—(Dated Quebec, 1st September, 1865.)

ANSLEY HEATH, of the Township of Townsend, in the County of Norfolk, Yeoman, "A new and useful implement of Husbandry to be known and styled, 'Heath's Plaster Sower.'"—(Dated Quebec, 1st September, 1865.)

CYRUS DANIELS, of the Township of Barnston, in the County of Stanstead, Farmer, "A new and useful Improved Beehive."—(Dated Quebec, 4th September, 1865.)

ALEXANDER CHAMPION, of the Town of Stratford, in the County of Perth, Machinist, "New and useful Improvements in Reaping Machines."—(Dated Quebec, 6th September, 1865.)

THOMAS ROGERS, of the City of Toronto, in the County of York, Laborer, "A new and useful Binder for Sewing Machines."—(Dated Quebec, 6th September, 1865.)

EDWIN WOODBURY, of the City of London, in the County of Middlesex, Merchant, "A new and useful Woodbury's Bag Holder."—(Dated Quebec, 6th September, 1865.)

SAMUEL SMITH, of the Town of Guelph, in the County of Wellington, Cooper, "A new and useful Smith's Improved Combined Stave Machine."—(Dated Quebec, 12th September, 1865.)

HENRY TREFFRY, of the Village of Howick, in the County of Huron, Carpenter and Joiner, "A new and useful Fence called 'Treffry's Portable Angular Board Fence.'"(—Dated Quebec, 12th September, 1865.)

D'ARCY PORTER, of the City of Toronto, in the County of York, Machinist, "Certain new and useful Improvements in Sewing Machines."—(Dated Quebec, 19th September, 1865.)

ALBERT N. HENRY, of the Village of Oshawa, in the County of Ontario, Yeoman, "A new and useful Beehive."—(Dated Quebec, 19th September, 1865.)

HENRY COLLARD, of the Township of Leeds, in the County of Leeds, Yeoman, "A new and useful Pea Harvester."—(Dated Quebec, 22nd September, 1865.)

JOHN CONRAD FOX, of the City of Kingston, in the County of Frontenac, Piano Manufacturer, "An Improved Sounding Board for Pianos."—(Dated Quebec, 23rd September, 1865.)

JAMES KERR, of the Town of Galt, in the County of Waterloo, Millwright, "A new and useful Grain Separator, called 'Kerr's Improved Grain Separator.'"—(Dated Quebec, 23rd September, 1865.)

CHESTER FREDERICK HALL, of the City of Toronto, in the County of York, Coach Builder, "A new and useful Improvement in the Construction of Lumber Waggons, designed especially for use in mill and lumber yards, the object of which is to facilitate the discharge of their loads."—(Dated Quebec, 23rd September, 1865.)

EDWIN WHITEFIELD, of the City of Montreal, Artist, "A new and useful Indelible Printing Fluid."—(Dated Ottawa, 25th October, 1865.)

LANCELOT KIRKUP, of the City of Montreal, Mechanical Engineer, "A new and useful Double Bolt Rivet and Spike Machine."—(Dated Ottawa, 25th October, 1865.)

SAMUEL VARNEY, of the Township of Brompton, in the District of St. Francis, Farmer, "A new and Improved Double Acting Force Pump."—(Dated Ottawa, 25th October, 1865.)

JOHN HOUSTON, of the Township of Stanstead, in the County of Stanstead, Gentleman, "A new and Improved Churn."—(Dated Ottawa, 25th October, 1865.)

LANCELOT KIRKUP, of the City of Montreal Mechanical Engineer, "A new and useful Improved Split Railroad Spike."—(Dated Ottawa, 25th October, 1865.)

JOHN HALL, of the Township of Leeds, in the County of Megantic, Miller and Millwright, "A new and useful Vertical Double Acting Mill Stone and Feeding Gear."—(Dated Ottawa, 25th October, 1865.)

MATHIAS JANNARD, of the City of Montreal, Coffin Manufacturer, "A new and Improved Air Tight Metal Coffin."—(Dated Ottawa, 25th October, 1865.)

EPHRAIM D. CARD, of the Township of Haldimand, in the County of Northumberland, Carpenter, "A new and useful Self-Acting Brake for Carriages."—(Dated Ottawa, 31st October, 1865.)

ALEXANDER FORBES PORTER, of the City of Montreal, Engineer, "A new and useful Electric Steam Battery."—(Dated Ottawa, 14th November, 1865.)

WILLIAM ASPLEY ROBINSON, of the City of Hamilton, in the County of Wentworth, Civil Engineer, "Certain new and useful improvements in Locomotives; the first thereof being in that part called the 'Safety Valve,' and the other is the mode of counter-weighing or balancing that part called the 'Link Motion or Slide-valve Gear.'"—(Dated Ottawa, 23rd November, 1865.)

MILES PETTIT, of the Township of Hallowell, in the County of Prince Edward, Yeoman, "A new and useful Spinning and Quilling Machine, called 'Pettit's Shuttle-head Spinning and Quilling Machine.'"—(Dated Ottawa, 23d November, 1865.)

JOSEPH NELSON PITTS, of the Town of Port Dover, in the County of Norfolk, Machinist, "A Turbine Water Wheel."—(Dated Ottawa, 23rd November, 1865.)

HENRY BOLTON, of the Township of Eramosa, in the County of Wellington, Yeoman, "A new and useful Pig's Nose Cartilage Divider."—(Dated Ottawa, 23rd November, 1865.)

THOMAS DEWITT, of the Village of Morpeth, in the County of Kent, Blacksmith, "A new and useful Spring-jack and Coupling for Wheel Carriages."—(Dated Ottawa, 23rd November, 1865.)

HENRY CARTER, of the Township of Malahide, in the County of Elgin, Blacksmith, "A new and useful machine called, 'Carter's Balance Churn.'"—(Dated Ottawa, 23rd November, 1865.)

GEORGE CORWIN FRASER, of the Township of Pickering, in the County of Ontario, Yeoman, "An Improved apparatus for the Coupling or Joining together of Railroad cars, called 'The Universal Self-Coupler."—(Dated Ottawa, 23rd November, 1865.)

WILLIAM VANHORN, of the Township of Pittsburg, in the County of Frontenac, Yeoman. "A new and useful Portable Foot Warmer."—(Dated Ottawa, 23rd November, 1865.)

CYRUS KINNEY, of the Township of Dereham, in the County of Oxford, Yeoman, "A Portable Combined Sheep Rack and Shed."—(Dated Ottawa, 23rd November, 1865.

ALFRED PILKEY, of the Town of Stratford, in the County of Perth, Tanner and Currier, "A new and useful Compound to be used in connection with the Liquor of Hemlock Bark, for the Tanning of Leather." (Dated Ottawa, 23rd November, 1865.)

GEORGE LACEY DARLING, of the Town of Simcoe, in the County of Norfolk, Jeweller, and SAMUEL GARDINER, of the same place, Sculptor, "A new and useful Machine or Implement for Boring in Rock, called, 'The Combination Rock Drill.'"—(Dated Ottawa, 23rd November, 1865.

JOSEPH NELSON PITTS, of the Town of Port Dover, in the County of Norfolk, Machinist, "A Universal Loom Head."—(Dated Ottawa, 23rd November, 1865.)

JOSEPH NELSON PITTS, of the Town of Port Dover, in the County of Norfolk, Machinist, "A Ventilating Drum."—(Dated Ottawa, 23rd November, 1865.)

ANTHONY NEVILLE, of the Township of Ernesttown, in the County of Lennox & Addington, Gentleman, "An Improvement in Lamps."—(Dated Ottawa, 23rd November, 1865.)

JOSIAH JAMES, of the Township of Whitchurch, in the County of York, Machinist, "A new and useful improvement in the Tire of Carriage Wheels; the Wheel, with the improvement, being called, 'The Eureka Wheel.'"—(Dated Ottawa, 24th November, 1865.)

ISRAEL KINNEY, of the Township of Oakland, in the County of Brant, Coach Builder, "A new and useful appliance for Securing Doors against the weather, called 'Israel Kinney's Weather Leaf.'"—(Dacod Ottawa, 24th November, 1865.)

CHARLES TAYLOR, of Bonaventure, in the District of Gaspé, Millwright, "A new and useful Machine for Deepening and Sharpening the Teeth of Saws." (Dated Ottawa, 25th November, 1865.)

JAMES HODGES, of the Township of Bulstrode, in the District of Arthabaska, Civil Engineer, "A new and useful Improved Machine for Pulping and Manufacturing Peat Fuel."—Dated Ottawa. 27th November, 1865.)

ALEXANDER GORDON, of the City of Hamilton, in the County of Wentworth, Mechanic, "A new and useful Beehive."—(Dated Ottawa, 28th November, 1865.)

ABIEL O'DELL, of the Town of Bowmanville, in the County of Durham, Mechanic, "A new and useful Improved Washing Machine, called 'The Ariston.'" (Dated Ottawa, 28th November, 1865.)

WILLIAM WHITE, of the City of Ottawa, in the County of Carleton, Trader, "A new and useful Art for the Preservation of Eggs, called 'White's Novel Egg Preserving Art.'"—(Dated Ottawa, 30th November, 1865.)

EDWARD PERRY, of the City of Montreal, Trunk Manufacturer, "A new and useful Trunk Hasp."—(Dated Ottawa, 15th December, 1865.)

ALFRED WOODWARD, of the City of Montreal Mechanic, "A new and useful Apparatus for Carburreting Gas."—(Dated Ottawa, 15th December, 1865.)

THOMAS HENRY INCE, of the City of Toronto, in the County of York, Esquire, "Certain new and useful improvements in Shoeing Horses."—(Dated Ottawa, 19th December, 1865.)

MINARD MILLS, of the Township of Yarmouth, in the County of Elgin, Yeoman, "A new and useful Machine, called 'Mills' Beef Steak Mangler.'"—(Dated Ottawa, 19th December, 1865.)

CHARLES DION, of the City of Montreal, Photographic Artist, "A new and useful Improved Domestic Fire Alarm."—(Dated Ottawa, 21st December, 1865.)

Correspondence.

To the Editor of the Board of Arts Journal.

SIR,—That it is desirable and important to have Canada worthily represented at the exhibition to be held at Paris next year, is, I take it for granted, admitted on all hands. By what means we shall secure the best possible representation of the manufacturing products of the country, is, however, a fit subject for discussion.

In the official report of the proceedings of the sub-committee of the Board of Arts and Manufactures for Upper Canada, published in the last number of your valuable *Journal*, it is stated that the members are averse to the holding of a preliminary joint exhibition for both Provinces, from which to make a selection of articles to be sent to Paris. I think this is much to be regretted; and perhaps if the question were fully discussed and looked at from a Provincial stand-point, a different conclusion might even yet be arrived at.

The manufactures of the two sections of the Province have never yet been fairly brought into actual competition at any provincial exhibition, yet it cannot be doubted that if advantage were taken of this opportunity, sufficient inducements would be held out to secure the accomplishment of this, by many, long wished for actual comparison of the industrial products of Upper and Lower Canada. The spirit of emulation would then be rife, and it would arouse a feeling of enquiry which would lead to results that would be mutually beneficial to the manufacturers themselves, as well as to the country, through the improved character of many of its productions.

Articles made to undergo an ordeal of this kind before being purchased for the Paris exhibition, would be much more likely to have that character of excellence about them, without which it would be a waste of money to send them.

A joint Provincial Exhibition held for this purpose would also remove the apparently very just cause of complaint that would be made of partiality and injustice, if the other course indicated in your last number were adopted, viz., that of making a list of the articles required, and the respective Boards authorised to contract with competent parties for their supply. In cases where there are several manufacturers of the same articles, it would be a very invidious task to select a favoured one out of the number, and thus by imputation stamp him as the best manufacturer in his line; whilst his rivals in the trade might, and, if afforded the opportunity, most probably would have excelled his production for this special occasion. Competition is a healthy stimulant, and should be encouraged wherever practicable.

If a list of the kind of articles specially required were published, and it were announced that the best of each sent to a public exhibition would be paid for at its full value—that it would be sent to Paris—and that the maker would be entitled to any credit it would there receive,—we may rest assured there would be a superior collection of the manufactured products of Canada sent; but if the articles required are ordered by private contract, there will be no certainty that the selection will be the best the country can produce, or such as will reflect credit upon it.

Although there is no official information given as yet upon the subject, we may expect the space allotted to Canada will not be very large, and therefore the more reason that the greatest care should be taken that the quality of the articles selected is fully up to the highest standard we can attain.

These few remarks are made in view of the interests of the Province as a whole, and with the hope that you will accept them in the same spirit.

I remain, your obedient servant,

AN EXHIBITOR IN L. C.

Montreal, Feb. 19, 1866.

[We should agree with our esteemed correspondent as to the desirability of a joint exhibition for Upper and Lower Canada, from which to select articles for the Paris Exhibition, if there were a suitable central position for holding such exhibition between this and Montreal; and if it had been so arranged last fall—the Agricultural Associations of Upper and Lower Canada giving up their respective exhibitions for this year, and devoting all their funds to the joint exhibition. As it now is, we know of no funds available for prizes, and the Government say positively that no legislative moneys will be granted for the purpose of such an exhibition. We do not see where funds are to be obtained, and feel certain that in the absence of a *very* liberal prize list there would be but little competition, and the result would be a failure, It is a subject that will bear discussion, but we fear the time is now too short to accomplish what our correspondent suggests.—EDITOR JOURNAL.]

Selected Articles.

ON OZONE IN RELATION TO HEALTH AND DISEASE.

BY B. W. RICHARDSON, M.A., M.D., F.R.C.P.

I have undertaken to write a few pages for the *Popular Science Review* on the subject of Ozone in relation to disease. The subject is all novelty and interest, so that those who have studied it, as I and some few others have studied it, are sure of a hearing when they communicate what they know in intelligible language. But for the very reason that the subject is both novel and interesting, it is necessary to approach it with caution, and certainly without enthusiasm. The cold philosopher whom Bulwer Lytton has so marvellously depicted in "Zanoni," Zanoni's own guide and counsellor, would not himself have been too frigid in his philosophy to deal with this topic. Since the day when the word Ozone first became known in this country, I have made the subject before us a careful study, and eleven years ago a conjoint paper by Dr. Moffatt and myself was read at the Epidemiological Society, the key-note of which paper was "Ozone and disease." But I confess that as yet I know very little about the matter—very little that can be called real and demonstrative. I feel as one of the crew of Columbus might have felt when, nearing the western islands of the Indies, he saw floating towards him remnants of trees and broken paddles and canoes, with flights of birds above head, and other indications that land must be near, but no land in sight. I feel that there are many indications of the near approach of some great truth connected with discoveries on Ozone; but the truth is either not visible as yet, or, being visible, is so dimly seen as to be indefinable.

It is fair, reader, that I should give you this warning, and having made so clear a confession, I will ask you to trust me as a guide without hesitation or fear. I will direct the light I hold boldly on paths that are known, and if at any time it shall fall on paths that are obscure, the *fact* shall be stated, and no artificial path shall be described.

The chemists have held a sharp contest respecting the true nature of Ozone. In general terms the word refers to a gaseous substance possessing a peculiar odour: it is a negative word, conveying no accurate idea of the composition of the substance—and perhaps this is an advantage to science rather than the contrary, at least for the present time; the word, that is to say, is meaningless, and might from its derivation "οζω, to smell," apply to any gas that is odorous; but because it is meaningless as a definition, it pledges itself to no theory or hypothesis as to the elementary constitution of the substance it designates. When that constitution is discovered, and all chemists shake hands over it in cordial agreement, it will be good time to change the name, if that be desirable, and make the designation define the substance as it really is in its essence.

The circumstances under which Ozone may be presented are, to a considerable extent, known. When an electrical machine—a common frictional machine—is set in motion, and sparks or flashes are taken from the positive conductor, Ozone is developed, and its characteristic odour is readily detected. When water is decomposed by electricity, Ozone appears, with oxygen, at the positive pole; in fact, according to one view, the oxygen is simply in an active state, ozonized. If oxygen, nitrous oxide gas, or carbonic acid gas, be placed in a glass jar, and electrical sparks be passed through the gas, Ozone is developed, and the same has been stated in respect to nitrogen, but Dr. Wood and I were unable by experiment to sustain this latter assertion. Ozone may also be obtained by heating one end of a glass rod gently, and then immersing the said end in a jar through which rectified ether is diffused in vapour.

A ready way of making Ozone is to take sticks of common phosphorus, scrape them until they have a metallic lustre, place them, in this condition, in a large bell jar, and half cover them with water. The air in the bell jar is soon charged with Ozone, and a large room can readily be supplied with air in the ozonized state by this process.

To make Ozone on a large scale an apparatus invented by Siemens is the best. A cylinder of glass is covered neatly on its outer surface with tinfoil in the same manner as a Leyden jar. Then within this cylinder a smaller cylinder, also coated with tinfoil, is introduced and fixed with cork. The two free ends of the large cylinder are closed with corks well coated with sealing-wax varnish, and each cork is perforated so that a small wooden or glass tube may be inserted. There is thus formed a chamber of glass, lined with tinfoil, and if a bellows be attached to one of the small tubes, and air be driven from the bellows, it passes through this chamber and can be collected as it escapes at the opposite end. To ozonize the air that may be sent through this chamber, it is now only necessary to discharge electrical sparks through the chamber while the current of air is making its way. To effect this, the coating of tinfoil on the inner and the coating of tinfoil on the outer cylinder are each armed with a fine platinum wire. These wires are connected by their free ends with the poles, one wire to one pole, the other to the opposite pole,—of a large induction coil. The coil being set in action by the power derived from three or four cells of a Grove's battery, electrical discharges are freely made in the chamber of the cylinder, and the air is richly ozonized. In the diagram herewith supplied, the apparatus, as it is set up ready for action, is well depicted by Mr. Orrin Smith.

By means of this apparatus I have produced an air which is irrespirable except for a brief period, and so active in its destructive power that gutta-percha and india-rubber tubings are destroyed by merely conveying it. To obviate the mechanical difficulties arising from this cause Dr. Wood has very ingeniously devised a tube of quills, which answers every purpose: the quills are held together with sealing-wax varnish, the narrow end of one quill being inserted into the wider end of another, and so on in a line.

Such are the various methods by which Ozone is produced, and however produced it appears to have the same properties; it is, therefore, assumed to be the same substance as derived from all these sources, but what it is,—that is still a disputed question.

I shall not trouble the reader with any argument on this great subject. It suffices for the physiologist to know that there is an active agent, which he may call Ozone, and which he can produce at will,—but I may state, in one or two words, that, in respect to composition, one class of theorists hold Ozone to be simply oxygen in an active state, while others maintain that it is a combination of oxygen with hydrogen, a peroxide of hydrogen. According to my light I should say that those who hold for the active oxygen theory have the best of the disputation; but I will not press the point further, as the object of this paper is not to discuss what Ozone is, but what it does in one particular course of action.

By operating with Siemens's apparatus, we may discover with great rapidity and by frequently repeated experiment, the influence of Ozone on both dead and living organic matter. We may follow these lines usefully.

On dead matter that has become putrid Ozone acts with great vehemence as a deodorizer or purifier. This it effects by decomposing the products which emanate from the putrefying body, and the effects are the same in the most offensive compounds. I could illustrate these facts by numerous experiments; but one will be sufficient.

In the year 1854, I placed a pint of blood derived from an ox, in a large, wide-mouthed bottle. The blood had coagulated when it was placed in the bottle, and consisted of two parts clot and serum. It was left in this state, exposed to the air, until it was quite putrid, and the clot was softening: then the clot was gently stirred from time to time, until it had entirely redissolved as a result of alkaline decomposition. At the close of the year, the whole mass was as fluid as port wine, and was most offensive to the sense of smell. The stopper was placed in the bottle, and the bottle itself was put aside. In the year 1862, the bottle was taken from its hiding-place, and an ounce of the blood was withdrawn. The fluid was so offensive as to produce nausea when the gases evolved from it were inhaled. It was subjected by Dr. Wood and myself to a current of Ozone from Siemens's cylinder. For a few minutes the odour of Ozone was destroyed by the odour of the gases from the blood; gradually the offensive smell passed away; then the fluid mass became quite sweet, and at last a faint odour of Ozone was detected, whereupon the current was stopped. The blood was thus entirely deodorized, but another and most singular phenomenon was observed. The dead blood coagulated as the products of decomposition were removed, and this so perfectly, that from the new clot that was formed serum exuded. Before the experiment commenced, I had predicted on theoretical grounds that the phenomenon of secondary coagulation must follow upon purification, and this experiment, as well as several others afterwards performed, verified the truth of the prediction.

We gather from this experiment then, the first fundamental fact I would like to impress, that the substance called Ozone energetically destroys the putrid emanations of decomposing animal substances, and, even after they are long dead, restores to the dead matter certain of its properties which, though in truth they are always physical, are vulgarly called vital. We might turn this fact to some great account in the matter of decomposing animal food. If the butcher were a scientific man, he could at little expense restore to wholesome freshness and purity the greater portion of the decomposing carcases, which now, at bad seasons of the year for preservation, he is obliged to cast away as a nuisance.

I have put forward these effects produced on dead matter by Ozone in its concentrate form that the facts may impress the mind forcibly and sharply, for the light we possess leaves no obscurity here; and now we may venture a step further, and show the same series of effects as progressing on the largest scale, not artificially or by human experiment, but universally, with nature herself as the experimentalist. By some grand process Ozone is produced in the atmospheric sea which surrounds our planet. It is estimated to exist naturally in the proportion of one part of Ozone to ten thousand parts of air. I cannot vouch for the entire accuracy of this computation, because the amount, according to our present mode of estimating it, seems to fluctuate, and no sufficient number of experiments have been made in different portions of the world to allow of a correct average being determined: we must take one part in ten thousand as an approximate, not an actual value.

The natural process leading to the production of Ozone in the atmospheric sea is not as yet understood. At first, electrical storms were conceived to be the means of production; then Professor Dove advanced the idea that the Ozone is generated in the upper equatorial currents of air, and is by these diffused over the planetary surface with the north and south winds; and again Dr. Moffatt, whose labours in this department of science cannot be over-estimated, considers that Ozone is connected with the phenomenon of phosphorescence, and that, in short, it is produced in nature at large as we have seen it produced in the laboratory as a result of phosphorous oxidation. Of all these theories, that of Dr. Moffatt is the most simple, and is best supported by observation.

When we know the two facts that Ozone purifies decomposing organic substances, by breaking up the offensive deleterious products of decomposition, and that it exists naturally in the air we breathe, we might infer that it fulfilled some useful purpose in the universe, without speculating rashly. But we have no occasion to speculate at all, for we find as a positive fact, sustained by the most perfect evidence, that Ozone *is* usefully employed, and that in truth it is the great purifier of the impure air of city and town. It is now proved that the Ozone in air, after it is diffused through town and city, is no longer to be detected there by the most delicate tests for its presence. Hence it is said to be lost in towns; in other words, it is used up in the process of destroying those exhaled substances which pass from the bodies of men and animals, and which escape from the organic *débris* that necessarily accumulate in and about every human habitation.

Were the formation of Ozone to cease in nature, I doubt if life could exist on this globe, according to the present constitution of terrestrial laws.

Turn we now to the effects produced by Ozone on living animals. The light rests steadily here on some facts of great interest. By means of Siemens's apparatus, I have been able to determine with accuracy the action of this remarkable body in its concentrate form on healthy living organisms.

When air containing an excess of Ozone is breathed for some minutes, it produces, first, a sense of irritation of the nose and throat, with sneezing, and soon a dull heavy pain in the head, and headache more or less severe. After a time there is watery discharge from the nostrils, and free secretion from the back of the throat. When the inhalation is over, the symptoms gradually subside, and I have never known any bad effects follow, although the headache will remain for five or six hours. These symptoms are very decided, and have been experienced by Schönbein, Scoutetten, Wood, myself, and many other observers. As a class of symptoms they are without doubt identical with those which characterize nasal catarrh, or common cold. I do not believe that any of my learned *confrères* in physic would hesitate for a moment in pronouncing a person who was suffering from Ozone catarrh as being affected with common cold, premising that the cause was withheld from his knowledge.

The inference, therefore, has been drawn that when common cold is the prevailing disease, there is an excess of Ozone in the air, and that the symptoms are due to such excess of Ozone.

On this particular point the light we have shines doubtfully: the inference is fair and reasonable, but the actual proofs are not as yet afforded. The position is as follows:—

A disease identical with catarrh can be excited by the inhalation of an air containing an excess of Ozone.

It has been shown, specially by Moffatt, that catarrh is common during what are called the Ozone periods.

But catarrh is sometimes present in a general form when, by the ordinary tests, Ozone cannot be shown to be present in excess.

The theory, therefore, is not perfect in all its parts. It may be imperfect because our present tests for Ozone are not sufficiently accurate; it may be, *the* test we always employ is sometimes interfered with in its action by the presence of other bodies foreign to the atmospheric air. The test itself consists of a paper saturated with solution of iodide of potassium and starch. When this paper is exposed to ordinary air it undergoes no change; when it is exposed to ozonized air, the potassium is oxidized, and the iodine being set free combines with the starch, forming iodide of starch. The iodide of starch strikes a dark blue colour, and the depth of the colour struck on the paper gives the theoretical degree of Ozone present in the air. Schönbein and Moffatt each prepare Ozone test papers, with scales, for preparing degrees of intensity.

The test being made more accurate, it is possible, and indeed probable, that in time Ozone will be proved to stand to catarrh in the position of cause to effect. Nay, I have thought that the local currents of Ozone may probably be generated from the friction of air in its passage, with violence, through narrow channels, as when there is produced what is commonly called draught; and certainly an Ozone paper colours more quickly in a draught than it does in a calm air. But, after all, these facts bearing on the connection of Ozone with catarrh may be singular coincidences only; it is hard to think so lightly of them, but it would be unsafe to think more.

Speculation as to the influence of Ozone in the production of disease has been carried much further by some authors. It has been argued that croup, diphtheria, quinsy, bronchitis, inflammation of the lungs, and pneumonia, stand to Ozone in the position of effect to cause. Presuming that common cold is really a product of excess of Ozone in the air, there can be nothing more reasonable, or more fairly inferential, than that these other allied disorders follow upon the same cause; and again, there can be no doubt that the disorders are most common and most fatal during the Ozone periods—*i.e.*, periods when Ozone is most active; but for the same reasons as were given in regard to common cold, the evidence is not decisive. The evidence that has been accumulated ought never to be forgotten by the man of science, and no opportunity for extending it and improving it ought to be let slip; but it cannot be accepted in any positive sense at this moment.

We are assisted to some knowledge in relation to the possible effects of Ozone, as a disease-producing agent, by experiments, with excess of Ozone, on living animals. I have studied this point with some care, and have arrived at certain results exceedingly interesting to the man of science, and to all, indeed, who would know something of disease and its possible causation. In these experiments I charged air with Ozone until it was painful to breathe, and then filling a chamber with this air, and keeping the chamber supplied with it by means of a free current, the effect of a continued inhalation of the air was observed on animals of an inferior order.

Without entering into details, I may state the facts that were thus elicited.

In the first place, all the symptoms of nasal catarrh and of irritation of the mucous membranes of the nose, the mouth, and the throat, are rapidly induced. Then follow free secretion of saliva and profuse action of the skin,—perspiration. The breathing is greatly quickened, and the action of the heart is increased in proportion. Carried to an extreme degree, congestion of the lungs succeeds, and a well-known disease, which we physicians call "congestive bronchitis," is set up. The examination of the chest by the stethescope yields every physical sign of this disease, and the appearances of the lungs, if the induced malady be allowed to run to a fatal termination, leave no particle of evidence wanting to indicate the nature of the malady. The mucous membrane of the bronchial tubes is coated with a tenacious secretion, the lungs are congested in points, and the extreme terminations of the bronchial tubes are filled with a frothy pearl-like mucus.

The blood is changed in physical quality under Ozone. It is not altered materially in colour, but it undergoes rapid coagulation, and its corpuscles run together with unusual force, forming into close masses or groups. I believe also, that the fibrine, or plastic matter of the blood, is increased in quantity, either actually or relatively; but on this point I am not as yet positively informed by experimental investigation. It is worthy of remark that these effects of Ozone, administered by inhalation, are more readily developed in carnivorous than they are in herbivorous animals. It is much easier, for instance, to bring rats under the influence of Ozone than rabbits.

From the series of facts relative to the effects produced by excess of Ozone—and they are facts which any one who chooses to go to a little trouble can learn for himself—it is no difficult task to arrive at the conjecture that congestive bronchitis and inflammation of the lungs in man and animals, are produced by the respiration of Ozone in the air: the difficulty, in fact, is to avoid coming to that conclusion too hastily, the phenomena of the artificial and the phenomena of the natural disease being so closely allied as to admit of no distinction. Why, then, should we hesitate to accept the conjecture? If it be faithfully true, it makes dark places illuminate, and the most crooked paths straight; it reveals a new era in medicine, and in one vast department puts the physician side by side with the pure physicist in the circle of the fixed sciences; if it be true, the physician will only have to wait for a little further advance on the part of the meteorologist to be able to predict the advent of diseases—a sure proof that a degree of fixed science has been actually attained.

At the last meeting of the British Association for the Advancement of Science, my distinguished friend, Dr. Moffatt, did, indeed, somewhat more than anticipate these successes. In a paper read by him, and entitled, "Phosphorescence in connection with Storms and Disease," he exhibited tables to show that the atmospheric conditions under which the luminosity of phosphorus took place were those of the south or equatorial current of air, namely, a minimum of atmospheric pressure, and maximum of temperature and humidity; and that those under which non-luminosity takes place are the conditions of the north or Polar current, namely, maximum of pressure and minimum of temperature and humidity. The atmospheric conditions of Ozone and non-Ozone periods are the same as those of the luminosity and non-luminosity of phosphorus. Phosphorus becomes luminous and Ozone periods commence on the approach of storms, and if a storm sets in during a luminous or Ozone period, the luminosity increases in brilliancy and the Ozone in quantity. He also showed tables on the luminosity of phosphorus, Ozone, and the prevalence of disease in connection with the system of meteorological telegraphy, instituted by the late Admiral Fitzroy. From these it appeared that all the periods of luminosity commenced with the setting in of the atmospheric conditions, of the approach of which cautionary telegrams gave warning. Of diseases, 80 per cent. of apoplexy, epilepsy, and sudden death occurred on the days on which phosphorus became luminous. The atmospheric conditions which lead to those storms, of which the telegram gave warning, are invariably accompanied by diseases of the nervous, vascular, and muscular systems. During the two years in which those telegrams were sent, 143 cases of those diseases came under his notice; of which 54·5 per cent. took place on telegram days, and 45·5 per cent. on other days similar in a meteorological sense to those on which the telegrams were issued, differing only in degree, as the tables shewed. Although storms are accompanied by diseases of some kinds, they are nevertheless, he maintained, of great benefit in a sanitary sense. They carry with them a supply of nature's deodorizing and disinfecting agent—Ozone. As far as he had had opportunities of observing, he had come to the conclusion that cholera disappears with the setting in of the equatorial or ozoniferous current, as was the case at Newcastle in 1863, and in the London epidemic. During a cholera epidemic the barometer readings are high, a calm prevails, and there is no Ozone. In conclusion, Dr. Moffatt asked whether, seeing the intimate connection there is between periods of the luminosity of phosphorus and Ozone periods, and of non-luminosity and non-ozone periods, and knowing that Ozone is formed by the action of phosphorus on moist air, we might not reasonably look to phosphorescence for the chief source of atmospheric Ozone? It was a question whether we might not find phosphorus a useful disinfectant by using it as a producer of artificial Ozone. He had himself used phosphorous as a disinfectant for four years.

Must these suggested and suggestive triumphs of science be checked even by a doubt? Alas! the stern truth stands out, *they must.*

They must stand at the bar and wait for the verdict, not because they are necessarily untrue,—not because they may not be all true,—but because they fall short of perfect demonstration. We must yield that Ozone in excess, as we produce it in the laboratory, induces certain symptoms of disease; but as yet we know of no instance in which an excess sufficient to produce the same symptoms exists in nature. An air so charged with Ozone as to produce these symptoms, would require no chemical test to prove the presence of an injurious agent. It would be an irrespirable air, and it would affect with varying intensity all who breathed it. In order, therefore, to sustain these conjectures in their entirety, we must assume two positions, each of which is yet unproven: firstly, that Ozone may exist in intensity in the air, although not detectable by the present recognized tests or by the senses; and secondly, that there are local currents of Ozone which cross the path of one person and injure him, while others escape. Both these positions are possible, but they are not proven. They will be approached by steady work at oxygen, a body which we once thought the immortal Priestley had divined and defined, but regarding the nature of which we stand as yet like little children, who, thinking they detect form and colour and beauty in a soap-bubble, suddenly are perplexed by seeing it resolve itself into the, to them, invisible and unknown.

Reader, I fear you are weary, and I too tire. I have only one or two things more to say on the text I have taken, and "cito" shall be the motto. Firstly, then, let me add in regard to active oxygen, Ozone, that as it is the great purifier of the dead earth, so perchance it is the physical purificator of the living animal. The light shines doubtfully here, but the direction of it is to show that when oxygen gas is brought into contact with the blood in the living lungs, it is in part transformed into Ozone, and that the subtle, active agent is doing its work more secretly but not less certainly, within the tissues of the organism, than in the world without. Secondly, I would mention that the special physiological effects of Ozone are destroyed by heat, and are obscured or prevented by extreme cold. In experiments to show the effects on animal respiration, a temperature not lower than 65 deg. Fahr., and not higher than 75 deg., should be sustained. Thirdly, I would state that there is a condition of atmospheric oxygen in which that gas exhibits an opposite condition to the ozonised state. Oxygen in this opposite or negative condition is called antozone. There are different methods of producing autozone which I have not space to describe; but I must note that in some experiments on the re-inhalation of air many times over I was able to reduce oxygen to such negative state that it failed to support life. The act of purifying such oxygen from carbonic acid and other tangible impurities had no effect in rendering it better fitted for the support of healthy life; but Ozone at once restored to it active power. In this negative oxygen animals die as if under the influence of a narcotic; in it the destruction of the products of organic decomposition is greatly impeded, and the presence of such products speedily renders it intolerably offensive: dead animal tissue in it rapidly putrifies, and wounds in the bodies of living animals become sanious, dark, and unwholesome.

Lastly, we gather from what has gone before a few facts bearing on hygienic measures, general and special. We may learn that as Ozone is used up in crowded localities, and as its presence is essential for the removal of the products arising from decomposing organic remains, no mere attention to ventilation, however important that may be, can suffice to make the air efficient for supporting healthy life unless the air be rendered active by the presence of Ozone. Hence it is an absurdity of the worst description to build hospitals for the sick in the midst of the crowded localities of the poor, and to ventilate them with air that has swept its way over a sea of ammoniacal compounds derived from the living and the dead. Hence, human dwellings built on the borders of lakes or pools charged with organic *débris*, or built near manure heaps, or over sewers, or on ground saturated with putrefying substances, becomes necessarily the centres of the fever type of disease; not by necessity, as is vulgarly supposed, because the inhabitants are conscious of "smell," but because the air they breathe is reduced in active power, and poisons are being generated around them to which they are constantly exposed, and before which they fall a ready prey.

The lecture is over: I have dealt with a subject that is in some sense a paradox, abstruse yet simple, unpractical and yet of all subjects the most practical when it is well known. In time there will be no paradox, but the hard and most mysterious labours of the scientific investigator will resolve themselves into a few easy propositions which all will understand. Then we shall take care to conserve Ozone where it should be conserved, to supply it like light in places where it cannot be always secured naturally; and to neutralize it if, like the Roman centurion's soldiers, it comes when we do not want it. In Ozone another generation may actually see an article of commerce, and even now an "Ozone Company" might prove itself not merely a useful, but, as a sequence, a paying concern. Such a company could bleach, deodorize, disinfect, preserve meat and vegetables, and give sea air to every family that required it; its supply could be as manageable as gas, and as cheap as water; and with due precaution the lieges might make use of the agent as safely in their households as I and other men of science make use of it in the laboratory.

A REVOLUTION IN WOOD ENGRAVING.

A tide of adversity has set in like a flood, and threatens to whelm the wood engravers. As in engraving so in building, it is difficult to say where art and science shall meet. In this utilitarian age, the claims of the engineer are placed before those of the artist, as lamented at a recent meeting of the Royal Institute of Architects, when the use of iron work in building was under consideration. The beautiful wrought iron work of the Mediæval period has given place to castings or devices cut by machinery, much to the disapproval of all true art worshippers, more especially ecclesiastical architects, who say truly that ironwork is out of character in cathedrals, and quite unfitted for—

> The figures we see in arabesque
> Half hidden in flowers, all painted in fresque,
> In gothic vaulted ciels.

But this has nothing to do with engraving, against which art chemisty and mechanical appliances have within the last few weeks been making desperate onslaughts, in the shape of some very promising new processes showing unusual strength in their infancy. The most serious of them is the graphotype process. Many attempts have been made in past years to reproduce the lines of the artist in relief on a hard surface, from which printed impressions may be taken, and the most successful have been those in which portions of a metal plate are eaten away with acids. What with time, expense, and production of ragged lines, these methods have competed with wood-engraving with difficulty, but the graphotype process reproduces, in an hour or two, the lines of the draughtsman in a very perfect form, so much so, that George Cruickshank said publicly that had the process been known when he was a boy he should now be riding about in a coach and six, instead of in twopenny omnibusses.

Mr. Hitchcock, one of the first engravers in New York, in the summer of 1860, in the course of rubbing a wood block with an ordinary glazed visiting card, noticed that though the card was rubbed away the letters on it stood out in relief. This was the germ of his invention. A mass of powdered chalk is submitted to hydraulic pressure of 120 tons to the inch; by this means a polished white tablet of somewhat fragile character is obtained, and on it the artist draws his design by means of a fine-pointed brush. The ink used is nothing but a mixture of glue and lampblack. When the drawing is finished the plate is rubbed over gently with a very soft brush, which does not affect the lines of the picture but rubs away the surface of the chalk in the intervening white spaces, consequently, the drawing stands out in relief. The tablet is next soaked in silicate of potash—water glass—and on being taken out dries as hard as marble. Any number of stereotype copies can of course be taken from this block and printed from it in the ordinary way. The process is so simple and rapid that the *Spectator* surmised a few days ago, that it must be the forerunner of a daily illustrated paper. The process is patented in England, and already one or two weekly papers have been illustrated by it. Sometimes it is the case that the stereotype copies want finishing-off by an engraver, but it is equally common to print from the untouched blocks. The process in all its details was shown at work at a recent meeting of the Society of Arts.

Another process which looks promising, considering that it has only been a month or two in existence, is that of Mr. Woodbury, who not only dispenses with the engraver, but in the majority of cases with the artist also, as he prints from photographic pictures. A film of gelatine containing any alkaline bichromate salt is rendered insoluble in water by exposure to light, consequently when such a film has been exposed under a negative the portions of it unexposed to light dissolve away, the parts most exposed remain intact, and all the shadows of the picture are represented by varying thicknesses of gelatine. Mica, talc, or glass is used as a support for the film during this part of the operation. As already stated in The Engineer, when this gelatine picture in relief is placed beneath a plate of lead and hydraulic pressure applied, the soft gelatine stamps its image in the metal. This produces a metal block from which to print; it has no lines to make a line engraving, but the deepest shadow is represented by the deepest hollow in the lead, all the other shadows varying proportionately in depth. It would be useless to try to print from such a block with opaque printing-ink, but a semi-transparent gelatine ink is used, and the thicker the deposit of this mixture the deeper the shadow in the finished print. As yet the process has the defect that the blacks of the picture stand out slightly in relief, and in the manipulations there are several elements of uncertainty in the results. Some time must yet elapse before Woodbury's process is so modified as to be suitable for book illustration.

A third process is also of a photographic character, but of such importance that the public should know more about it than the majority do at present. All the present photographs, so carefully treasured and perhaps prized as heir-looms in the albums of our readers, are sure to fade. They are a mockery, a delusion, and a snare, as all good photographers know, but do not publicly avow. That delicate film of silver forming the shadows of the picture is acted upon by every breath of sulphurous impurity in the atmosphere, from gas and other sources, in the same manner that a silver spoon is acted upon by the sulphur of the breakfast egg. Moreover the glossy surface of the picture consists of albumen, white of egg, so that the silver picture is actually formed upon that substance which above all others is the direst enemy to its permanent character. Whatever the care taken by the photographer, albuminate of silver is an unstable salt, the pictures *will* turn yellow and fade, and are not of value for book illustration.

A process has been made public by Mr. Swan, of Newcastle-upon-Tyne, whereby photographs can be taken, not in silver, but in Indian ink, the most imperishable form of carbon, consequently such pictures are likely to possess the permanency of old black letter manuscripts. A plate of glass is coated with a film of collodion and dried. A thick and warm mixture of gelatine, bichromate of ammonia, and Indian ink, is then poured on the dried collodion, and the thick black film allowed to dry on the glass in the dark. When dry the film is lifted with a penknife at one of the corners; it then can be gently peeled off the glass, and resembles a sheet of exquisitely polished patent leather. It is afterwards placed under a negative, the collodion side next the glass, and exposed to light. The light when admitted through the negative penetrates the dark film to a certain depth. The gelatine sheet is next fixed by a solution of india-rubber in benzole to a piece of white paper; and the whole placed in warm water. The black mass dissolves away in the water, except only those portions on which light has acted, which adhere to the paper, forming the shadows of the picture, which is quickly unfolded in all its beauty. It is sharper than a common photograph, because the polished collodion surface lies in closer contact with the negative than the coarser albumenised paper, the superiority of the picture in this respect being visible to the eye. It is a cheap process, but one very little practised by photographers, who will probably take it up when the public raise an outcry for permanent pictures.

All improvement and innovation must be gradual, so wood engravers, who have brought their art to such a creditable state of excellence, will not lose the ground they have gained suddenly. The wisest of them will turn their attention to the most powerful of the new processes, and by adopting and practising it themselves make it a friend rather than a foe. As regards the other two processes, especially the last one, they show signs of promise, and their progress will no doubt be closely watched by engravers. As the reproduction of the design of the artist becomes more and more a mechanical or chemical operation in which skilled labour is not required, profusely illustrated books will be the rule and not the exception, for which reason there is hope that the innovations will not represent loss to engravers, but gain to the public.—*London Engineer.*

HOW PETROLEUM IS FORMED.

Professor Wilber's Theory.

There have been numerous theories proposed to account for the origin of petroleum. Mr. White, of Toronto, who had published a book on the subject, thought it had come from the union of the carbon of the carboniferous limestone with the hydrogen of water. This was what might be called a chemical theory, but he feared that chemists and men of science generally would decline to accept it. Petroleum had been supposed to have been formed from the remains of land animals, and fishes. He had heard of the whole theory, which supposed the petroleum deposits to have been formed from the remains of vast shoals of whales, sunk down and imprisoned long ago in the rock formations while forming. This, as well as some other theories he had heard of, could scarcely be maintained without provoking a smile. Meanwhile he had his own theory, and he thought it as good as any of the rest, perhaps better. His idea was, that oil had been formed from the remains of marine vegetation, just as coal had been formed from that of land. Every coal bed had clay below and slate above. There was a certain uniformity in the conditions under which coal was formed, which pointed to a certain uniformity of process in its formation, and to one great epoch in the geological time when it was formed. Peat was at first formed, and this afterwards became coal. Few persons had any adequate idea of the immense growth of seaweed in the depths of the ocean. It had been shown that seaweeds had in their composition a large amount of oily, carbonaceous matter. After their term of growth was fulfilled they became detached, floated off and finally sunk to the bottom. Now it was a received opinion among geologists that this portion of the North American continent had once been the bed of a salt water ocean. The ocean floor, as they must remember, was not level by any means, but had throughout its whole extent deep hollows and rising ridges. It was of course in these deep hollows that the seaweed deposits would find their last resting place, after long tossing about in the waves and ocean currents. In this way it would come to pass that they would not be evenly distributed over the bottom, but only in those hollows or pockets. Meanwhile the deposit of solid, stratified rock, or what afterwards became such, was going on, and after the lapse of untold ages these masses of seaweed became covered to various depths. He considered it no unreasonable or unscientific supposition, that these masses of oily, carbonaceous matter should, under the circumstances take the form of oil, of a liquid hydrocarbon. They had seen that, oil existed in and was distilled from coal, which was conceded to be the remains of terrestrial vegetation. There was therefore nothing violent in the supposition that petroleum, so exactly like coal oil in its properties, had been formed from the remains of marine vegetation. The vegetable origin of both, he contended, was indubitable. But further, it so happened that the Devonian rocks, which contain these oil deposits, were also the rocks in which salt was found, in immense subterranean reservoirs of brine, now condensed or saturated far beyond the saltness of the ocean. These two deposits, oil and salt were thus brought closely together in point of geological time. The salt was allowed to be an ocean deposit, and if so, the inference was fair that the oil was one also. Although of another nature, and formed in a different way, it had been laid down about the same time, that was, when this section of country was an ocean bed. He considered this to be a very strong proof that petroleum was, as he had said, the product of immense deposits of marine vegetation.—*Lecture delivered in Hamilton.*

VEGETABLE FOOD.

Food yielding fat and oil is supplied by both the vegetable and animal kingdoms. The distinguishing feature of the following articles of food is the oil they contain:

Oleaginous Food.

Under the names of oil, butter, fat, lard, suet, grease, a substance is used largely as an article of food, which differs chemically from starch and sugar in the small quantities of oxygen gas it contains. The composition of these oleaginous substances may be presented generally as follows:—Carbon eleven parts, hydrogen ten parts, oxygen one part.

Oil differs from the other carbonaceous substances in food in not only supplying materials for maintaining animal heat, but in forming a part of the tissues of the body called fat.

Its action as a heat-giver is greater than starch or sugar, as it supplies hydrogen as well as carbon for burning in contact with oxygen. Its power as a heat-giver compared with these is as two-and-a-half to one. It is very generally present in both animal and vegetable food. The action of oil on the system is not, however, confined to its heat-giving powers. It seems essential to the development of the fleshy part of the body. Hence it is found present in the eggs of animals. Fish-oil is given in those diseases where a wasting of the flesh is present as, in consumption.

The animal system has the power of converting starch and sugar into fat. All ruminant and hybernating animals become fat in the summer and autumn. The fat thus accumulated is consumed during the winter in maintaining the heat of the body. Man to some extent obeys the same law, and weighs more during the summer than the winter months.

Oils vary in their chemical composition and physical properties. Many vegetable oils, as cocoa-nut and olive oil, contain two principles, one of which is liquid, and remains so at all ordinary temperatures; the other is solid when the temperature falls below 40 degrees. The former is called *Oleine*, and the latter *Stearine*. Fats, lards, and butters are composed of the latter, or of principles having the same property.

Oleine, stearine, and other fatty principles consist of acids combined with a base. This base is called *Glycerine*, and is separated from oils in the process of soap-making.

The principal source of oil used as food from the vegetable kingdom is the olive (*Olea Europea*). The seeds of most plants contain oil in addition to starch and other matters. The seeds of the palm tribe contain much oil as the cocoa-nut palm (*Cocus* *nucifera*). So also do the seeds of the cocoa or chocolate plant (*Theobroma cacao*).

The following table gives the quantities of oil or fat in one hundred pounds of the more common articles of food:—

Vegetable Food.

Potatoes	0·2
Wheat flour	1·2
Barley Meal	0·3
Oatmeal	5·7
Indian Meal	7·7
Rye	1·0
Peas	2·0
Rice	0·7
Beans	2·0
Cocoa	50·0
Lentils	2·0
Buckwheat	1·0
Tea	4·0
Coffee	12·0

Animal Food.

Milk	3·5
Pork	50·0
Veal	16·0
Beef	30·0
Mutton	40·0
Fish	7·0
Cheese	25·0

The olive (*Olea Europea*) is cultivated in the south of Europe. The part of the plant which contains the oil is the fruit. The berries of the olives are pressed, and yield the oil which is so extensively employed on the continent of Europe, and known in this country under the name of salad oil. In countries where little butter or fat meat is employed as food, this oil is a most important ingredient in diet.

The seeds of most plants contain oil in addition to starch and other principles. Many seeds are used for obtaining oil for various purposes in the arts, as the poppy, rape, mustard, hemp, and flax seeds. The following seeds, eaten as food, contain oil:—

Almonds	(*Amygdalis communis.*)
Chesnuts	(*Castania vesca.*)
Walnuts	(*Juglans regia* et *Juglans nigra.*)
Peccan nuts	(*Juglans olivæ formis.*)
Brazil nuts	(*Bertholletia excelsa.*)
Spanish and hazel nuts	(*Carylus avellana.*)
Hickory nuts	(*Carya alba*)
Beech nuts	(*Fagus sylvatica.*)
Pistacia nuts	(*Pistacia vera.*)
Cashew nuts	(*Anacardium occidentale.*)
Chicha nuts	(*Sterculia Chicha.*)
Pine seeds	(*Pinus Pinea.*)

The seeds of many other species of plants are eaten, and the oil they contain is probably their chief recommendation.

Amongst them may be mentioned the various forms of acorns which are eaten in Portugal, Greece, Asia Minor, and other parts of the world. The sacred bean of Egypt (*Nelumbium speciosum*), and the lotos (*Nymphæ lotos*) of the same region, the water-nuts (*Trapa natans*) of China and Cashmir, and the souari, or butter nuts (*Caryocar butryosum*) of Demerara.

A bread is made at Gaboon, in Africa, from the seeds of the *Mangifera gabonensis*, called dica or odika bread. By simply boiling in water, from 70 to 80 per cent. of fat can be extracted from this bread. In this respect these seeds resemble chocolate, and it is not impossible that they might be used in Europe in the same way. They are exceedingly abundant in Gaboon.

The seeds of many of the palms yield large quantities of oil, especially the oil palm (*Elais guineensis*) of Africa. The seed of the cocoa-nut palm (*Cocos nucifera*) is used as a substantive article of diet in Ceylon and many parts of the East Indies. It is imported into this country for the sake of the oil it contains. The milk in the interior of the seed is a blank fluid, and when the nut is fresh gathered, is a cool and pleasant drink. In the young state the seeds of most palms are filled with a cool fluid consisting mostly of water. This fluid is drunk by the inhabitants of the countries in which they grow. The double cocoa-nut of the Seychelles Islands (*Loidicea Seychellarum*) contains sometimes as much as fourteen pints of water, and is drunk by sailors touching on these islands with great relish. Even the hard ivory-nut (*Phytelephas macrocarpa*) contains when young a fluid which is drunk by the native of the countries in which it grows.

Amongst vegetable food yielding oil the cocoa or chocolate plant (*Theobromo cacao*) is one of the most remarkable. The seeds of this plant contain 50 per cent. of a hard oil or butter.

Food is sometimes preserved in oil which, on account of the small quantity of oxygen it contains, prevents animal or vegetable substances from putrefying. A familiar instance is known in this country in the case of the fish called sardines, which are thus preserved. Oil is used for this purpose in China.

Acids.

Many of the organic acids resemble closely in their composition starch and sugar, and may to a certain extent act on the system in the same way. They are therefore referred to the carbonaceous group, but there is no reason to suppose that in any system of diet they could be substituted for any of the other substances in the group. The following paragraphs explain their action;

Organic acids enter extensively into the composition of various kinds of food. The acids most commonly used in diet are—Acetic acid, citric acid, tartaric acid, malic acid, oxalic acid.

As articles of diet they probably all act in the same manner on the system. They all exert a solvent power over mineral substances, and assist in carrying the alkalies and alkaline earths into the blood. There is also reason to believe that in certain states of the system they favour the development of the gastric juice in the stomach, and assist, by their decomposition, in oxidising the materials of the blood. In all cases they act medicinally, or as auxiliaries, to the first class of foods.

Acetic Acid or *Vinegar*, is obtained either from the oxidation of alcohol in fermented liquors, or from the distillation of wood. Common vinegar is obtained from the oxidation of the fermented wort of malt. Vinegar is added to sauces and food to give them a flavour. It also preserves vegetable substances from decomposition, and is used in the manufacture of what are called "Pickles."

Citric acid is contained in many fruits, but it exists in greatest abundance and purity in the fruits of the Orange tribe (*Aurantiaceæ*). Citric acid is separated from the fruits of these plants in a crystalline form.

Tartaric Acid is found in the juice of the fruits of the vine tribe (*Vitaceæ*), more especially of the common vine (*Vitis vinifera*). This acid gives the acidity to the fruit of the grape, and is the acid present in wines. It forms with potass an insoluble salt, known by the name of cream of tartar.

Malic Acid is contained in the fruits of the rose tribe (*Rosaceæ*). It has the same general properties as the other acids, and is contained alone in apples and pears, whilst in cherries, plums, &c., it is mixed with other acids.

Oxalic Acid is contained in the wood sorrel (*Oxalis acetosella*), also in the common sorrel (*Rumex acetosa*), and various species of rhubarb (*Rheum*). Species of the latter genus are extensively cultivated in the country, and the petioles of their large leaves cut up and made into pies, puddings, &c.

The basis of vinegar consists of acetic acid, which is composed of carbon, hydrogen, and oxygen; the same elements that enter into the composition of alcohol. This compound is also procured from the distillation of wood. The acetic acid thus procured is called pyroligneous acid. The quantity of acetic acid in vinegar is from four to five per cent. Malt vinegar contains, besides acetic acid, water, dextrin, and frequently sulphuric acid. Wine vinegar contains besides acetic acid, the constituents of the wine from which it is made, as tartaric acid, &c. Pure vinegar is transparent, but burnt sugar is added to give it a colour, on account of a popular prejudice in favour of coloured vinegar.

Various kinds of fruits, leaves, and parts of plants are preserved in vinegar and added to food. Some things are used in this way which are not otherwise employed. This is the case with the caper, which is the fruit of the *Capparis spinosa;* and the stertion, the fruit of the Indian cress (*Tropæolum majus*). A collection of fruits and plants preserved in vinegar will be found on the shelves devoted to the exhibition of "acids."

Sugar may be converted into vinegar by the aid of vegetation. The so-called "Vinegar Plant," of which a specimen is exhibited in the Museum, is the *mycelium* of a fungus, which, during its growth in sugar and water, decomposes the sugar, and the result is the formation of the vegetable matter of the plant, and the development of acetic acid.

The natural order Aurantiaceæ embraces the orange, the lemon the citron, the shaddock, the pomelot, the lime, and other fruits. All of them contain citric acid, and varying proportions of sugar.

The flowers of the orange yield a delicious perfume known as oil of Neroli.

The juice of these fruits is employed in the Navy for the purpose of preventing scurvy amongst sailors. This effect has been attributed solely to the citric acid, but it has been found that the acid alone does not act so efficaciously as when contained in the juice of the fruit. Hence some writers have attributed the effect to a chemical compound of the acid with other ingredients of the juice.

Citric acid is also found in many fruits, but mixed with other acids, as in the berberry, strawberry, &c.

Tartaric Acid forms with potass an insoluble salt, known by the name of argol, and, when purified, cream of tartar. This salt is found in the lees of wine. By burning it the tartaric acid is converted into carbonic acid, and the salt of tartar (carbonate of potash) is made from the tartar of wine. Hence also the name tartaric acid. The dried fruits of the grape (*Vitis vinifera*) are known by the name of "raisins" and "currants."

The tomato is the fruit of the *Lycopersicum esculentum*, and on account of its acid flavour is used as a sauce.

The edible products of the natural order Rosaceæ, comprising the fruits of the apple, pear, apricot, nectarine, peach. cherry, plum, raspberry, strawberry, contain malic acid. They are mostly preserved in sugar. Many forms of plums called prunes contain a sufficient quantity of sugar to be dried and preserved without further preparation.—*Guide to the Food Collection in the South Kensington Museum.*

DECAY OF GUTTA-PERCHA AND INDIA-RUBBER.

From a report made some time since to the Chemical Society—England—by Prof. William Allen Miller, M.D., F.R.S., it seems that india-rubber and gutta-percha, when exposed to the atmosphere, gradually absorb oxygen, and combine with it to form resin; acting in this respect like other hydrocarbons. Prof. Miller says:—

"The inquiries to which this investigation has given rise have extended over many months, and have included a large number of analyses, but the results obtained may be stated in a small compass, as they are very definite. I have examined numerous samples of gutta-percha cables, both injured and sound, which have been in use for several years, and I find in all cases that the deteriorated portions have undergone chemical change, and that change consists in a process of oxidation.

"Whatever retards or prevents this oxidation, retards or prevents the decay of the gutta-percha, some of the specimens which I examined being as good as new, though they had been manufactured and used electrically for years; while others in a few months had become brittle, rotten, and unserviceable. As the general result of these inquiries, I find that, whenever the gutta-percha has been completely submerged in water, no injurious change has occurred, sea-water appearing to be eminently adapted to the preservation of the gutta-percha. On the other hand, alternate exposure to moisture and dryness, particularly if at the same time the sun's light has access, is rapidly destructive of the gutta-percha, rendering it brittle, friable, and resinous in aspect, and in chemical properties. A gradual absorbtion of oxygen takes place, and the gutta-percha slowly increases in weight, becoming at the same time proportionately soluble in alcohol, and in dilute solutions of the alkalies. In every instance, however, some portion of the gutta remained unchanged in composition.

"My experiments have also been extended to the prolonged action of air, moisture, and light, upon india-rubber, and here also I find that these agents effect analogous changes, though somewhat less rapidly.

"The caoutchouc, however, instead of becoming brittle, is converted into a glutinous mass, losing its elasticity, increasing in weight to a certain extent, and becoming partially soluble in alcohol and diluted alkaline liquids.

"These deductions are made from the examination of a number of samples supplied to me partly by Capt. Galton and Mr. L. Clark, including specimens of coated telegraph wires suspended in air, specimens of submarine cables, specimens of wires sunk in the soil under various conditions, besides experiments instituted by myself upon the action of various agents upon gutta-percha, and they include the results of an extended and well-contrived series of experiments made at the works of the Electric Telegraph Company, under the direction of Mr. L. Clark."

Among the analyses given by Prof. Miller are the following:—

"Pure gutta-percha differs in some of its properties from the commercial gutta. I found on examining the whitest samples, purified by Dr. Cattell, that it formed a porous, milk-white mass, wholly soluble in benzol, in ether, in bisulphide of carbon, and in the ordinary solvents of gutta-percha. It is a perfectly pure hydro-carbon, probably containing $C_{20}H_{80}$. I found it to consist of:

	Found.		$C_{20}H_{80}$
Carbon	88·96	or	88·88
Hydrogen	11·04	or	11·12
Total	100·00	or	100·00

"When exposed to a temperature of 212° it softens, but does not liquefy; it loses a trace of moisture, and then gradually absorbs oxygen; becoming brown, brittle, and resinous in appearance. In one specimen the increase in weight amounted to 4·45 per cent. The oxidized portion is insoluble in benzol, which, when digested on the brown mass, dissolves out a quantity of unaltered gutta, which had been protected from oxidation by the coating of resin.

"This resinous mass when thus purified was found to have been produced from the gutta-percha by simple absorbtion of oxygen, the gutta having in one experiment absorbed more than a fourth of its weight of oxygen from the atmosphere.

"The caoutchouc of commerce is, like gutta, not a pure vegetable principle, and consists of a hydrocarbon of definite composition, mixed with a small quantity of resin, the amount of which varies in different specimens.

"The following are the results of my analysis of a sample of pure unmanufactured Para rubber, compared with a sample of good sheet masticated or manufactured rubber:—

	Virgin.	Masticated.
Pure caoutchouc	96·6	96·64
Moisture	1·3	0·82
Resin	1·8	2·06
Ash	0·3	0·48
Total	100·0	100·0

Or, deducting moisture and ash, its elementary composition gave:—

	Virgin.	Masticated.
Carbon	85·82	85·53
Hydrogen	11·11	12·06
Oxygen	3.07	2·41
Total	100·0	100·0

"Caoutchouc, like gutta-percha, is, as already stated, liable to deterioration, by exposure to the action of oxygen in the presence of solar light, but the gum is less rapidly injured if exposed to their influence in the native state, than if it had been previously masticated. When subjected to the action of air excluded from light, it does not experience any marked change, even during very long periods. It is, however, important to observe that the masticated rubber is much more porous than the unmanufactured caoutchouc. When immersed in water, caoutchouc absorbs a much larger quantity of this liquid than gutta-percha, and the masticated much more than the unmanufactured or virgin rubber."

CONFECTIONARY: COLORS AND ADULTERATION.

We take the following important extract from *Weatherley's Treatise on the Art of Boiling Sugar, &c.*:—It is to be hoped that every manufacturing confectioner, who went to the International Exhibition, 1862, saw Dr. Hassall's large case of adulterated articles, used as food, and henceforth determined to discard all mineral colors and adulterated compounds from his workshop. Those that missed this interesting collection, may be told that it consisted of every conceivable article, used or consumed as food, bought indiscriminately at shops, in various parts of London, and nearly every trader who saw it, found articles he dealt in represented there. But in respect to this trade, adulterated lozenges of all kinds abounded, mixtures colored with chrome, and sugar goods with vermilion, red lead, etc. Names of parties were not revealed, but it was a wholesome lesson to all interested; and it ought to be known in the trade generally, that the "Adulteration of Foods Act," passed not long since, contains very stringent clauses as regards using any deleterious matter or compound in coloring or mixing, etc. Ignorance cannot be urged on the part of those in the trade who now use poisonous mineral colors in sweets or other goods, when every color that can possibly be required can be obtained, in which no pernicious qualities exist.

[Vegetable colors ready for the confectioner's use are to be obtained of Messrs. Bush & Co., Liverpool street, City.]

In the regulations, established by the Minister of Commerce for the guidance of the French confectioners, the following are the only colors allowed, and are all that are necessary to the English confectioner: (Blues), indigo, Prussian blue, ultramarine. (Reds), cochineal, carmine, carmine lake. (Yellows), saffron, French berries, and turmeric or fustic. (Greens), by mixing the yellows and blues. In allowing ultramarine to be used, it must not be thought or understood to be the description of blue sold under that name, "of German manufacture," which is very unwholesome. The best color from cochineal we have made is as follows: ¼ lb. powdered cochineal, 2 ounces washing soda, "bruised," 2 ounces rock alum, "bruised," ½ lb. cream of tartar, put 3 pints of water in a copper pan, add the soda and the cochineal; when it has boiled, add the alum, gradually, or it will flow over; keep stirring till it is dissolved, and boil up again; then add the cream of tartar, boil two or three minutes longer, and strain through a small hair seive for use; these quantities can be reduced in the same ratio, if required. No utensil of tin or iron must be used with this receipt, or it will give a purple cast to the color. If desired, some of this liquor can be dried down by evaporation to a paste, and used on the slab; the only advantage in this, is for stripes or casings, and saving the pans. Saffron, as a yellow, for best goods, cannot be equalled, and is best kept with spirits, but water, for small quantities, answers the same purpose. A remarkable substitute for this article is a solution of logwood chips, made the same as strong tea, but it will only act when fresh, and the sugar is reduced either by cream of tartar or any of the acids used to cut the grain, and which is a great recommendation, as it instantly detects the omission, by turning the boil to a dirty color, which, when discovered, the lowering can be added in solution, and it instantly changes bright. The very high price of saffron has made this a valuable discovery for cheap goods, while it is equally as wholesome to use. Indigo, dissolved with sulphuric acid, makes a fine blue, one ounce in powder to a quarter of a pound of vitriol; it must be mixed in a jar or pot holding about a pint, and must not be put into syrups while on the fire. Carmine, though highly prized as a color by a trade, is now generally bought. The process of making is simple, but troublesome, and not suited to the present work. If for any purpose a variety of colors is desired, use the following: Purple (cochineal and weak liquid blue); orange (yellow with red); green (blue and yellow). It will greatly accelerate the work, and be much more convenient, to keep colors for stripes and castings ready for use; they ought (with the exception of cochineal, saffron, etc.) to be worked with a palate knife, with some sweet salad oil, on a piece of stone, into a paste, and kept in use for jelly pots. Where clear castings are required of a different color from the original boil, keep some in the pan for the purpose of mixing in cochineal, etc. Mind it is strong, and does not require boiling in more than a minute or so, or the sugar will become very weak. Some prefer doing this on the slab, but for many goods it does not look so well. Keep a roller handy, to make your casing even and regular. Should you find it does not adhere properly to your pulled sugar, wipe it over with a damp cloth, or you can even wet it with your hand slightly, the heat in the body of the pulled sugar drying it.

A LETTER from India to a London paper, states that the monkeys of that country seem to be firmly persuaded that the telegraph lines and poles were erected for their special use and behoof, in performing gymnastic exercises.

Machinery and Manufactures.

Boiler Incrustation.

The Polytechnic Association of the American Institute held its regular weekly meeting on Thursday evening, Jan. 11, the President, S. D. Tilman, Esq., being chairman.

The subject being "Boiler Incrustations," part of the report of Prof. Chandler, which we published Dec. 27. was read.* It was stated that Prof. Chandler, after consultation with the Central Railway officials, estimated that $700,000 yearly would be saved by purifying the water on that road and its branches; and, as all the railways in the country amount to 100 times as much, $70,000,000 would be saved if they all used pure water. To this it was replied that the water on the Central, between Syracuse and Rochester, was of the worst quality; and that some lines, such as the Harlem, had nearly pure water; consequently a general conclusion from this particular instance was of little account. The recommendation to blow off frequently, a few gallons at a time, was criticised as an imperfect remedy, and in some cases an aggravation rather than a remedy. Napier's experiment was referred to, showing that excessive blowing off increased the incrustation, because the sulphate and carbonate of lime were thrown down by heat; and the more water was pumped in, the more of these impurities were precipitated; and the water blown off was purer than the water pumped in. The trial in Austria, four years ago, of spraying the feed into a separating vessel in the steam room, was cited, showing that the heat in a locomotive was sufficient to precipitate all the lime; and that, if time were allowed, it would fall to the bottom of the separator; and, not having heat to bake it, it could be blown out as mud. Mr. Weissenhorn's process of separating the lime by the exhaust steam was adduced to show that the outlandishers were not ahead of us in this method of avoiding lime incrustations; but to this it was replied that the heat of 212 deg. was insufficient to precipitate *all* the lime; 280 to 300 deg. were required; therefore Mr. Weissehorn's process was partial and incomplete, though good as far as it went. Mr. Zerah Colburn's proposal to supply water at steam temperature, 350 deg. or more, to locomotives was cited; and it was argued that if that plan were feasible, the lime could be separated by heat in the close tanks at the stations; and the water evaporized in the boilers might be so pure that no incrustations could be made from it; and there would be the further advantage of saving a quarter of the work done by fire on the line. Martin's invention to supersede surface condensation, by separating the lime in a heater, was cited, as perhaps applicable to the stationary heating tanks of railways.

Thursday evening, Jan. 18, the President, S. D. Tilman, Esq., being chairman.

At last the subject of boilers is "exhausted." A few points are worth mentioning. A Texan gentleman suggested that if the boilers were placed aft, and the cabins forward, it would be

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* See February No. of this Journal.

safer. He was once standing over a boiler on a Mississippi boat when it burst. The deck was raised, but not entirely destroyed, and the steam came up and scalded many. He saved himself by running into his stateroom and holding a blanket over the door, to exclude the steam. His hands were scalded, but he was not otherwise hurt; but many were killed by inhaling the steam. Mr. Miller, an engineer on another boat, escaped from the steam by throwing himself down and holding his cloak over his face. In both these cases, had the boilers been aft and the passengers forward, the steam would have been carried astern by the current of air due to the speed of the boat. Except when the wind is abaft, this proposed arrangement would promote safety. In these cases all the damage to persons was by steam scalding, which would not have happened had the boilers been as far aft as practicable.

It was suggested by Mr. Selleck that if the boilers were corrugated, as proposed by Mr. Montgomery, there would be less danger of rupture by strains from inequality of temperature: the corrugations would yield by flexure.

Mr. Fisher repeated his opinion, several times stated before, that the boilers made up of water tubes, with small connections, which long ago had been found safer than all others, ought to be fairly tried on a large scale, whatever may be their probable cost; the costs of their use thirty-five years ago were not so excessive as to deserve a moment's consideration in cases where hundreds of lives are concerned. This view appeared to be generally applauded.

There was no general agreement among the speakers in this long discussion; each had his remedy; some were for punishing engineers and captains, others lor compelling proprietors to pay a large sum for every person killed or injured; others were for contrivances to keep the water high; others had theories of electricity, decomposition of water, and gaseous explosions; others suspected that deäerated water caused explosions; and each seemed to hold his own opinions at the end of the discussion.

Mr. Wiard, who has done much of the talking, is the only one who has made experiments. He invited the members to call at Mr. Plass's shop, 110 East Ninth street, New York, to witness the performance of apparatus which he had fitted to a boiler to prevent undue heating of the steam, and consequent excessive and dangerous heating of the plates.—*American Artisan.*

Hydraulic Forging Press.

We translate the following article from *Le Moniteur Industriel.*

Mr. Haswell, superintendent of the Austrian Railway Company's machine shop at Vienna, has constructed a hydraulic press to serve instead of a steam hammer in forging crank axles, connecting-rods and other heavy forgings for locomotives. The steam hammer, although a great improvement on previous means to forge heavy masses, has certain inconveniences: it does not work uniformly on the mass; the exterior parts directly struck absorb the useful effect to the detriment of the interior parts, which are not compressed by the blow. The welding of the interior parts is consequently incomplete, and the effect of the hammer is sometimes to shut in the scoriæ instead of expelling them.

When the welding is effected and the shaping is to be done, the steam hammer does not work with accuracy, and sometimes strains on the welds. The iron, unequally worked in different parts, has different degrees of strength, which may be the cause of accidents. Finally, the violent blows of the steam hammer produce vibrations which, many times repeated, cause pernicious alterations in the molecular structure of the iron.

Now, in the welding, as in the shaping of a forging, a gradual pressure is more effective to unite and weld the parts, and to force them into shape. For this reason Mr. Haswell uses the hydraulic press, which, with sufficient power, has a great facility of manouvering and rapidity of action. The machine of Mr. Haswell is used successfully in the shops of the company in forging connecting-rods, cross-heads, pistons and rods in one piece, crank-axles, etc.—*American Artisan.*

Effects of Heating, Rolling, Hammering and Annealing Metals.

Elaborate experiments and careful observations have developed many interesting and important facts with regard to the variations of destiny, etc., which different metals undergo in different degrees in the operations of heating, drawing, rolling, hammering and annealing.

At a temperature rather above a cherry-red, iron wire will remain three months, surrounded with charcoal, without cementation taking place, while a white heat will, in five minutes, render brittle a square bar of malleable iron, eight-tenths of an inch in diameter.

Wires of copper, and of alloys of copper and zinc, are increased in diameter, and diminished in density, by annealing. The operation of rolling condenses metals more than that of wire drawing. The density of iron and copper will be greater if the metals are heated before being passed through the rollers. The reverse in the case with alloys of copper and zinc. The density of metals is greatest when drawn into very fine wires. Hence, two small wires are stronger than one large one of the same transverse area with the united areas of the small ones. This result grows out of the fact that the particles of the smaller wires are compacted throughout their entire cross section, while those of the latter are thus compacted for a certain depth only.

Wires may be increased in length in two ways, first, by diminution in the case of its cross section; and, second, but only in a slight degree, by increasing the distances between the component particles. When wire is lengthened by the latter process, it returns to its former length by annealing.

Again, wires of certain different metals, after passing through the same hole in the wire-drawing plate, have different diameters, but all such subsequently acquire equal diameters during the process of annealing. The diameter of a wire is said to increase very slowly by time after passing through a wire-drawn plate. Wires which have been bent, and subsequently straightened have a tendency to re-acquire the same curvature by time.

Wires exposed to a high heat lose part of their tenacity. They require to be annealed in wire drawing, not to render them more tenacious, but to allow the particles to resume the position from which they may again be displaced.

The loss of tenacity is common to copper, iron, platinum, and the alloys of copper and zinc.

Hydrogen has an action on copper and silver, at high temperatures, which permanently separates their particles. On alloys of copper and zinc, and even silver and copper, it has no such action.

Brass wire approaches to iron in strength, while copper wire is much inferior to it; hence brass is much used instead of iron where the latter would oxydize too rapidly.

Iron wire is made of different qualities, to stand a strain from 75,000 up to 130,000 pounds to the square inch. The tenacity of brass wire varies from 78,000 to 87,000 pounds to the square inch, while copper wire will part at from 38,000 to 44,000 pounds.

These facts, with many others of a like character, have been carefully arrived at by many and most elaborate experiments, and a knowledge of them is valuable to every mechanic.—*Chemical Gazette.*

Oil of Poppy-seed.

Dr. Smith, in his editorial correspondence to the *Boston Medical Journal*, in a recent letter from Switzerland, speaking of the agricultural products of that and the adjoining country, says:—"Immense crops are raised here of articles wholly unknown to the American farmers, and perhaps the kinds best fitted to particular localities, where grain and potatoes yield poorly under the best efforts. One of these is poppies, from the seed of which a beautiful transparent oil is made, that is extensively used for house painting. It is almost as colorless as water, and possesses so many advantages over flax-seed oil that it may ultimately supersede that article. Where flax cannot be grown, poppies often can be, even in poor sandy soil. Linseed is annually becoming dearer, and the demand for paint oil is increasing. With white lead, poppy oil leaves a beautiful surface, which does not change afterwards by the action of light into a dirty yellow. In short, this oil is destined to bring about a revolution in domestic economy. Another season, some one should make a beginning at home in this important branch of industry. The oil may be used for other purposes, and even put up in the cruet for salads." [This oil is always used with the white and other light colors by artists.—Eds. *American Artisan.*

Myatt Wine.

Mr. Edward Panton, of London, C. W., has placed upon our table a bottle of this new wine for inspection. It is manufactured from the Myatt Wine Plant, from the Mountains of Thibet Mr. Panton, who is agent for the plant in Canada, assures us that it grows most luxuriantly in this country, one acre being capable of producing four thousand gallons. The wine has an excellent flavor, and Mr. P. produces certificates from numerous medical gentlemen, that it is to be preferred to most wines in cases of sickness. Its strength is that of Sherry. Several parties here have given orders for both plants and samples of the wine. If what is said of it is true it will not only entirely revolutionize the drinking customs of Canadian society, where the want of a cheap and pure beverage has been much felt, but it will save millions of dollars, and become an important branch of our national industry.—*Woodstock Times.*

Coal, its Use and Abuse.

A series of interesting experiments, "On the use and abuse of coal in our manufactories," has been made by Mr. Lewis Thompson, M.R.C.S. and from the communication to *Newton's London Journal*, he seems to have discovered that practically at this moment in our manufactories, with a kind of coal capable of converting 15 times its weight of water into steam, only 6 pounds of steam are raised per pound of coal consumed; in other words, more than one-half of the coal burnt under our steam boilers is thrown into the air and lost. This assertion is based upon the daily working of several different steam boilers in London, Manchester, Newcastle-on-Tyne, and Glasgow. Mr. Thompson has come to the general conclusion, that, except immediately after a charge of coal, the air from a well-fed furnace contains no appreciable amount of hydrogen, or hydrocarbon, or sulphurous acid; that the quantity of carbonic acid gas is about 6 per cent, the quantity of oxygen gas about 9 per cent, and the quantity of carbonic oxide gas about 8 per cent—thus leaving us to infer that about 9 per cent. of the oxygen in atmospheric air is consumed by the hydrogen of the coal. Hence it appears that, in respect to the production of heat in furnaces, 9 parts of the oxygen of the air escape unacted on; and of the remaining 12 parts, 6 are converted into carbonic acid, 2 combine with the hydrogen to form water, and 4 are carried off in the shape of carbonic oxide gas. Upon these data he states that the heat given out by coal is thus distributed —usefully employed in raising steam, 46$\frac{2}{3}$ per cent.; loss from carbonic oxide gas, 41$\frac{2}{3}$ per cent., and loss from radiation and imperfect conduction; 11$\frac{2}{3}$ per cent. We have employed percentages as more generally intelligible than the fractions of a semicircle expressed in degrees, according to which Mr. Thompson calculates. An improved steam-boiler furnace has been invented by Mr. Thompson for preventing the loss.—*Amer. Artizan.*

Useful Receipts.

A Varnish for Coating Metals.

Digest one part of bruised copal in two parts of absolute alcohol; but as this varnish dries too quickly it is preferable to take one part of copal, one part of oil of rosemary, and two or three parts of absolute alcohol. This gives a clear varnish as limpid as water. It should be applied hot, and when dry it will be found hard and durable.

A Liquid Glue that keeps for Years.

Dissolve 2 pounds good glue in 2·19 pints of hot water; add gradually 7 oz. nitric acid, and mix well.

The Way to Zinc Cast Iron.

MESSRS. EDITORS:—For the information of E. D., and others, I place at your disposal some experiments made by myself in galvanizing small cast-iron articles such as gears and other small parts of machinery. I heated the castings to be galvanized to a red heat; I then plunged them into a bath of clear muriatic acid, to detach the scales and to thoroughly clean them; they are then immersed in a bath of melted zinc. As soon as the iron has attained the melting heat of the zinc they are removed. In this way I have made some beautiful galvanized castings. Great care should be taken, or in plunging the articles into the zinc, while wet, the zinc will be thrown in the face of the operator. The zinc should be covered with sand, and the casting must be immersed very slowly. E. H. HILL.

Worcester, Mass., Oct. 14, 1865.

Scientific American.

Japan Black.

1. Asphaltum, 3 oz.; boiled oil, 4 quarts; burnt umber, 8 oz. Mix by heat, and when cooling thin with turpentine.

2. Amber, 12 oz.; asphaltum, 2 oz.; fuse by heat, add boiled oil, half a pint; rosin, 2 oz.; when cooling add 16 oz. oil of turpentine. Both are used to varnish metals.

To Varnish Articles of Iron and Steel.

Dissolve 10 parts of clear grains of mastic, 5 parts of camphor, 15 parts of sandarach, and 5 of elemi, in a sufficient quantity of alcohol, and apply this varnish without heat. The articles will not only be preserved from rust, but the varnish will retain its transparency and the metallic brilliancy of the articles will not be obscured.

Bronze Paint for Iron or Brass.

Chrome green, 2 lbs; ivory black, 1 oz.; chrome yellow, 1 oz.; good japan, 1 gill; grind all together and mix with linseed oil.

A Metal that Expands in Cooling.

Lead, 9; antimony, 2; bismuth, 1 part. This metal is very useful in filling small defects in iron castings, &c.

Cast Iron Cement.

Clean borings, or turnings, of cast iron, 16; sal ammoniac, 2; flour of sulphur, 1 part; mix them well together in a mortar and keep them dry. When required for use, take of the mixture, 1; clean borings, 20 parts, mix thoroughly, and add a sufficient quantity of water. A little grindstone dust added improves the cement.

Paint for Coating Wire Work.

Boil good linseed oil with as much litharge as will make it of the consistency to be laid on with the brush; add lampblack at the rate of one part to every ten, by weight, of the litharge; boil three hours over a gentle fire. The first coat should be thinner than the following coats.

A New Hydraulic Cement.

At the sitting of the Academy of Sciences on the 4th instant, M. Henri Sainte Claire Deville announced that a very valuable hydraulic cement may be obtained by heating dolomite,—the abundant native double carbonate of magnesium and calcium, commonly known as "magnesian limestone,"—to between 300 and 400 deg. Centigrade, and then making it into a paste with water. The heat to which the dolomite is subjected should be above 300 deg., but should not exceed 400 deg.—*Mechanics' Magazine.*

Practical Memoranda.

Solubility of the Gases.

The following table shows the solubility of the gases named in one volume of water at 32° and at 59°:—

Gases.	At 32° F.	At 59° F.
Ammonia	1049 60	727·2
Hydrochloric acid	505·9	458 0
Sulphurous acid	68·861	43·564
Sulphuretted hyd'n.	4·3706	3·2326
Chlorine	Solid.	2·368
Carbonic acid	1·7967	1·0020
Protoxide of nitrogen	1·3052	0·07780
Olefiant gas	0 2563	0·16150
Marsh gas	0·05449	0·03909
Carbonic oxide	0·03287	0·02432
Oxygen	0·04114	0·02989
Nitrogen	0·02035	0·01478
Air	0 02471	0·01795
Hydrogen	0·01930	0·01930

The gases thus taken up by water may all, with the exception of hydrochloric acid, be expelled by boiling. Other liquids besides water dissolve the gases with greater or less avidity, thus alcohol at 32° dissolves of sulphurous acid 328·62 times its own volume.—*Tomlinson.*

Composition of Atmospheric Air.

The average composition of atmospheric air may be thus stated:—

	Oxygen	20 61	100·00;
	Nitrogen	77·95	
	Carbonic acid	·04	
	Aqueous vapour	1·40	
	Nitric acid,		Traces.
	Ammonia,		
	Carburetted hydrogen,		
And in Towns.	Sulphuretted hydrogen,		Traces.
	Sulphurous acid,		

The respiration of animals and the combustion of gas, lamps, and candles have a similar effect on the oxygen of the air; while the hydrogen of combustible bodies, uniting with another portion of the oxygen, forms vapour of water in considerable quantities—a pound of oil during its combustion giving off more than a pound of water, in addition to the carbonic acid. Animals also give off a considerable portion of vapour of water, combined with animal effluvia of a putrescent character.—*Ibid.*

Velocity of Sound.

The velocity of sound in common river water, at a temperature of 15° centigrade, is 4,700 feet a second, while at a temperature of 30° centigrade it is 5,000 feet a second. In solids the velocity is generally much greater than in liquids. In fir-wood, for example, it is 15,000 feet a second; in iron it is 17,000; in lead, however, it is only 4,000 feet a second.

Conducting Power of Certain Substances.

The power of conducting heat of a piece of dried chalk was equal to ·19, but became equal to ·30 when the substance was very moist. That of a well-dried piece of new red sandstone was equal to ·25, but became as much as ·60 when saturated. For a block of dry clay the conductive power was ·23, and became ·37 when well moistened.

Iron in Brass.

Dr. Crace Calvert, in a recent lecture, said:—Without occupying your time with further instances, let us call your attention to an important fact that Dr. Matthiessen, Mr. Johnson, and myself have observed, viz., that the addition of a small quantity of metal, which may be considered as an impurity, completely modifies, in many instances, its properties; and the most important example that I am acquainted with is the influence which the addition of one or two per cent. of iron exercises on the properties of brass. If a brass be composed of sixty per cent. copper and forty per cent. zinc, it will be susceptible of being drawn or bent when cold, but cannot be forged or worked when heated; while if 1·75 or 2 per cent. of iron be substituted for the same quantity of zinc, then a most valuable brass is obtained, for not only is this brass capable of being forged at a red heat, like iron, but its tenacity is increased in an enormous proportion, for each square inch of surface is able to support a "breaking weight" of from twenty-seven to twenty-eight tons—a tenacity nearly equal to that of iron.

Messrs. Beyer & Peacock, of Manchester, who experimented with bolts made of this alloy, in the hope of substituting them for iron ones in the fire-boxes of locomotives, found that these bolts would support a strain equal to those of iron, and that the threads of the screw were not stripped with more facility than those of iron when exposed to the same strain.

Tenacity of Copper.

The tenacity of cast copper is sufficient to support a weight of 12,000 lbs. to the square inch, or rather more than half as much as good cast iron.

Statistical Information.

American Railroads.

The number of railways in the United States and the number of miles in actual operation, have become immense. The States are now encircled with almost as numerous chains of iron as Great Britain, and the amount of capital invested therein has become enormous. Up to September last there were no less than five hundred and ninety-three companies, owning one or more lines. Pennsylvania leads all her sister States in the length of her railways, which cover three thousand three hundred and fifty-nine miles. The following figures have been compiled to show the length and cost of the railways in the principal States:—

	Miles. 1860.	Miles. 1864.	Total cost.
Pennsylvannia.......	2,593	3,359	$176,080,000
Ohio....................	2,045	3,010	117,583,000
Illinois..................	2,799	3,157	120,417,000
New York.............	2,682	2,820	135,877,000
Indiana	2,163	2,195	71,198,000
Georgia	1,419	1,419	39,389,000
Virginia.................	1,378	1,378	42,905,000
Massachusetts.	1,264	1,285	59,051,000
North Carolina......	938	938	19,180,000
South Carolina......	673	913	22,000,580

Canada appears very favourably in the matter of railways, She would come next to Indiana in the above list. Statistics for 1860 set down the length of our railways at one thousand nine hundred and seventy-four miles; since that time there has been a moderate increase. In 1850 we had only twelve miles in operation. Our railway progress has been rapid and gratifying.—*Trade Review.*

The British Navy during 1865.

In 1865, the Royal Navy of Great Britain was composed of 765 ships of all classes, of which 193 were in actual commission (carrying 3,936 guns,) exclusive of royal yachts, tenders, gunboats cruisers, tug boats, etc., engaged in harbor duty. This list comprised 16 ships of from 70 to 104 guns, mounting 1,276 guns. 27 of from 30 to 67 guns, carrying 1,119 guns; 29 of from 20 to 29 guns, carrying 638 guns; 38 of from 10 to 19 guns, carrying 556 guns; and 83 of from 1 to 9 guns, carrying 347 guns. Of the above 11 were either all or partly iron-cased, and their joint armament represented 216 guns. In addition to this number there were then building 28 ships of all classes, viz.: four iron screw ships, one iron screw corvette, one hydraulic iron-cased vessel, two double-screw iron and wood gunboats, and 20 wooden screw ships, frigates, corvettes, etc. The ships paid out of commission since the commencement of the year 1865 are 36 in number, representing an armament of 670 guns. The ships commissioned since the 1st of January, 1865, are 32 in number, representing an armament of 509 guns.—*Army and Navy Gazette.*

British Steam Packet Companies.

There are now twenty-three steam packet companies in Great Britain, who own about 370 steamers, the tonnage of which is 560,000, the horse-power 110,000, and the value between £30,000,000 and £40,000,000 sterling.

Life-boats.

During the last twelve months the life-boats of the National Life-boat Institution have providentially been the means of rescuing 444 lives from shipwreck on the coasts of the United Kingdom. The institution has also granted rewards and several silver medals and other honorary acknowledgments, to the crews of fishing-boats and others for rescuing 182 persons from various wrecks on our coasts; giving altogether a grand total of 626 lives saved from death during the past year—mainly through the instrumentality and encouragement of the National Life-boat Institution. For these joint services, and exercising the life-boats every quarter, the society has paid £4,871. The institution has already paid this year £21,374 on various life-boat stations. Since its formation it has expended altogether £128,859 on its 153 life-boat establishments. The demands on the society continue to be very heavy for payments on life-boat establishments. It is, therefore, earnestly hoped that the public at large will continue to strengthen the hands of its committee in carrying out the great and national objects of the Life-boat Institution. We may add that contributions are received by all the bankers in the United Kingdom to the credit of the society, and by its secretary Richard Lewis, Esq., at his office, John street, Adelphi, London.—*Engineer.*

Smithsonian Institute.

The restoration of the Smithsonian Institute will cost $100,000. The whole amount of Smithson's bequest, $515,109, is in the U. S. Treasury at six per cent. semi-annually interest. Total annual income, $30,910, but this cannot be used for building purposes. The edifice cost $300,000.

Population of Paris.

At the commencement of the sixteenth century the population of the French capital amounted to only 100,000. In about 200 years later—that is, in the year 1708—Paris contained 500,000 souls, the population having more than quadrupled within two centuries. Since that period a vast increase has taken place, Paris in 1865 containing 1,667,841 inhabitants.

Miscellaneous.

Wonders of Animated Nature.

There are few things more wonderful, more interesting, or more instructive to the observing and reflecting mind, than the changes which take place in animated nature, with the regular changes of the seasons. We have sometimes referred to a journal which we have regularly kept each day for nearly twenty years. In looking this over, we find that the time of departure for the common barn or purple back swallow, for the South, has varied but slightly in all these years, as there is scarcely three days difference in their time of leaving, during the long period in which we have observed them. A large proportion of the barn swallows leave on the 27th of July, or within two days afterwards, and the purple martins on the 7th and 8th of August. It is true that swallows may be seen even in September, who have late broods to rear and teach, or for some other cause did not join the general company in the regular migration. The bobolinks stay later, and do not congregate here in such numbers as the swallows, but go singly, in pairs, or rarely more than a dozen or two in a flock. They may be seen and heard every day, flying high, uttering a sharp and rather plaintive note, as they pass with an irregular, but energetic motion. They do not go long distances at one effort, as do the swallows, but stop and feed on the seeds of wild grasses that abound on the banks of large rivers like the Delaware, Potomac, and others that lie in their paths.

If we could observe the habits of more minute creatures, we should undoubtedly find the same unerring instincts guiding them to places where their proper food abounds, or, if food is not needed, where they can pass through the necessary changes which are essential in order to perpetuate their kind.

In reflecting upon the wonderful habits of animals on the land, we have been led to enquire whether similar instints guide those that live in rivers or in the seas, and we find the same paternal care of the Creator has been extended to all his creatures, and that wisdom for self-preservation and reproduction has been given to them all.

In Pennant's British Zoology, we find that early in September the herrings pay their annual visits to the shores of the British Isles. The account of them is exceedingly interesting. He says, "the great winter rendezvous of the herring is within the Arctic Circle; there they continue for many months in order to recruit themselves after the fatigue of spawning, the seas within that space swarming with insect food in a far greater degree than in our warmer latitudes."

This mighty army begins to put itself in motion in the spring; we distinguish this vast body by that name, for the word Herring is derived from the German, Heer, an army, to express their numbers. They begin to appear off the Shetland Island in April or May; these are forerunners of the great shoal which comes in June, and their appearance is marked by certain signs, by the numbers of birds, such as Gannets and others which follow to prey upon them; but when the main body approaches, its breadth and depth is such as to alter the very appearance of the ocean.

It is divided into distinct columns of five or six miles in length and three or four in breadth, and they drive the water before them with a kind of rippling; sometimes they sink for the space of ten or fifteen minutes, then rise again to the surface, and in bright weather, reflect a variety of splendid colours, like a field of most precious gems.

The first check this army meets in its march southward is from the Shetland Isles, which divide it into two parts; one wing takes to the east, the other to the western shores of Great Britain, and fill every bay and creek with their numbers; others pass on towards Yarmouth, the great and ancient mart of herrings; they then pass through the British Channel, and after that, in a manner disappear. Those who take to the west, after offering themselves to the Hebrides where the great stationary fishery is, proceed toward the north of Ireland, where they meet with a second interruption, and are obliged to make a second division; the one takes to the western, and is scarce perceived, being soon lost in the immensity of the Atlantic; but the other, which passes into the Irish Sea, rejoices and feeds the inhabitants of the coasts that border on it.

Among the principal enemies of this fish may be numbered various species of whales, some of which are observed to pursue large shoals, and to swallow them in such quantities, that, in the stomach of a single whale, no less than six hundred herrings are said to have been found.—*New England Farmer.*

Is the Cattle Plague Small-pox?

The London *Lancet* contains the following:—

"The report of Dr. Murchison's dissections of the diseased cattle, which appeared in the *Lancet* as long ago as August 26th, showed clearly that the rinderpest was not the pathological equivalent of human typhoid fever, and we believe we are correct in stating that this opinion has been confirmed by every subsequent observer. From Dr. Murchison's present communication, however, it is obvious that there exists a very strong analogy, if not absolute identity, between the rinderpest and small-pox. The arguments by which this view is supported, deserve serious consideration. It appears that in all cases of cattle plague there is an eruption on the skin, sometimes popular and postular, like that of variola; at other times consisting of flattened vesicles like those of cowpox. The two diseases also resemble one another in their general systems and anatomical lesions, in their period of incubation and duration, and in their extreme contagiousness and capability of propagation by inoculation. There are even some grounds for believing that rinderpest may communicate cow-pox to the human subject, and the reason why this accident has not happened oftener may be due, as Dr. Murchison suggests, to the fact that most of the inhabitants of this country are protected by vaccination.

"It also appears that the physicians who so carefully described the cattle plague in the last century constantly alluded to the eruption, and compared it to that of small-pox. If the view now referred to be correct, it is impossible to overestimate its importance. A remedy is at once placed in our hands for arresting the spread of the cattle plague, which has already come to be regarded as a great national calamity. We prevent the fatal form of small-pox in the human subject by inducing a mild form of the disease through vaccination. If rinderpest be a severe form of small-pox in cattle, why may it not also be prevented by inducing in cattle the mild form of the disease, or ordinary cow-pox? This we know can be done by inoculating them with vaccine lymph, or with the matter of human small-pox.

"No time ought to be lost in adopting Dr. Murchison's suggestions, to ascertain whether cattle, after such inoculations, be proof against the rinderpest. In the meantime valuable information might be obtained from members of our profession practising in those parts of the country where ordinary cow-pox is known to prevail. Many remarkable instances have been recorded where individual cattle or entire herds have escaped in the midst of surrounding pestilence. Can it be shown, this exemption has been due to their having suffered previously from the cow-pox? It seems, however, that the ordinary cow-pox has for some years been dying out in this country, so that it has been difficult to obtain fresh lymph direct from the cow, and thus the cattle of this country are probably less protected than formerly against the variola in a severe form. If this be so, there is no reason why vaccination should not be practised as commonly among cattle as among men. The above investigations have been carried out in connection with the experimental inquiries instituted at the instance of the medical committee of the Cattle Plague Commission. Their former recommendation as to the arrest of traffic in cattle, is now being urgently pressed on the Goverment by the farmers at large; and if the views enunciated by Dr. Murchison should prove correct, the value of the service of the Royal Commission will be of the highest national importance."

It appears by the *Mark Lane Express*, that Dr. Parsons, after devoting much time to the study of this disease, has arrived at similar conclusions to Dr. Murchison. It must be said, however, that the correctness of these conclusions are disputed by many others; and that although vaccination has apparently succeeded in some cases, it has in others entirely failed. The true character of the disease has yet to be discovered.

Concentrated Beef.

After many years of persevering effort, and the expenditure of many thousand dollars, Mr. Gail Borden has at last succeeded in producing an extract of beef that is not only nourishing but palatable. We have before us a specimen of this extract; it closely resembles a piece of erasing india-rubber. This specimen is about 2½ inches in length, 1½ inches in width, and ⅜ths of an inch in thickness, and it weighs 4 oz.; the price of it at retail is 75 cents—equal to $3 per pound. At the present cost of production the article is expected to come into use only for making beef tea for invalids; but after a market is opened, establishments for its preparation will be erected in Texas and other cattle-grazing localities, where beef is cheap, and it will probably be brought into general use for making soups, etc.

At the present time there is only one establishment in operation, that is at Elgin, Illinois, 42 miles N. W. from Chicago. Beeves, fresh from the pastures and stalls, are killed, the meat is macerated in boiling water, care being taken to avoid ebullition which would carry off some of the most savory and nutritient elements; the extract is then concentrated in a vacuum pan to a very thick jelly; and the drying is completed by a process that, for the present is kept secret.

The perfect extract is rolled and cut into the form described, and wrapped in paper that has been saturated with paraffine. Paraffine being tasteless and inodorous, exerting no chemical action, and being impervious to air and moisture, is an admirable substance for this purpose, and may be profitably employed for a great variety of manufactures, where it is desirable to keep the product from the atmosphere.

The establishment at Elgin is capable of reducing the carcasses of eight beeves per day; from 100 lbs. of meat 4½ lbs. of extract are obtained. Mr. Borden claims to get all the albumen, and everything but the fiber. He says that farmers who have given the substance remaining to their hogs, affirm that the swine refuse to eat it, and that it is worthless for purposes of food for any animals. The gelatine is not included in the extract; it is well known that substance is all eliminated by the kidneys without imparting nutriment to the system.

We have tried Mr. Borden's extract, and find that it makes a palatable and nutritious beef tea. It is recommended by the Boston *Medical and Surgical Journal*, and other medical authorities of the highest respectability, for the use of invalids.—*Scientific American.*

The French System of Weights & Measures.

The last monthly report of the Agricultural Department has an exceedingly able article on the French system of weights and measures, in which the opinion is expressed that a law will be passed, by the present Congress, making this the only legal system of the country, but allowing eighteen months or two years preparation for the change.

It takes a man or child from five to fifteen minutes, to learn this system thoroughly, and we have no doubt if every Member of Congress would devote the very little effort that is required to master the system, it would be immediately adopted by an almost unanimous vote, and that a much shorter delay than eighteen months would be allowed before it should go into operation. It could be taught in all the public schools in a single day, and the adults among our people—nearly all the graduates of public schools or of higher seminaries—could learn it as easily in a week as they could in eighteen months, or in eighteen years.

What is there of it to learn? Simply four units—the unit of length, the unit of weight, the unit of capacity, and the unit of area. The unit of length is the meter, a little more than a yard, about 39½ inches; the unit of weight is the gram, about 15½ grains; the unit of capacity is the litre, about 1¾ pints, and the unit of surface is the are, equal to 100 square meters. Besides a knowledge of these units, it is only necessary to know that the system is decimal, like that of our money. The other quantities are obtained by multiplying or dividing these units by 10, 100, 1,000 or 10,000. A length of 10 units is called a decameter; a length of 100, a hectometer; a length of 1,000, a kilometer; and a length of 10,000, a myriameter. The multiples of the other units are expressed by the same prefixes; for instance, a weight of 10 grams is called a decagram; of 100, a hectogram; of 1,000, a kilogram; and of 10,000 a myriagram. It will be seen that these prefixes for the multiples are taken from the Greek numerals; those for the fractions of the units are derived from the Latin numerals; for instance, a tenth of a meter is called a decimeter; of a hundredth a centimeter; a thousandth a millimeter.

A child will master the whole system in very little more time than is required to commit to memory the table of avoirdupois weights. Let Congress pass an act declaring that, after the first of January, 1867, the French system of weights and measures shall be the legal system of the country, in one month it will be thoroughly taught to all the children in our public schools—every newspaper in the country will publish it—long before the year expires our people will be thoroughly prepared for it—and before the expiration of another year, there will be a general expression of wonder that we endured the enormous labor and inconvenience of our old complicated and incongruous system as long as we did.—*Scientific American.*

London "Pneumatic Dispatch" Railway.

"The formal opening of the first portion of the tube which is to connect the General Post-office with the terminus of the London and North-western Railway took place yesterday. Four waggons with goods passed from Euston Square to Holborn, and its arrival at the company's premises at the latter place was watched by the gentlemen present. Afterward a number of them were conveyed in the waggons to the Euston terminus, thus testing the capabilities of the service, although the journey was a little uncomfortable, the wagons not being fitted for passenger traffic. Tarpaulin coverings were obtained for one or two of the carriages, but the greater number of the excursionists had to fit themselves in as best they could among the bags of shingle, taking care to keep their heads well below the edge of the carriages, lest, as an American gentleman present was credited with saying, 'they might get their hair brushed by machinery.' The first sensation at starting, and still more upon arriving, was certainly not agreeable. For about a quarter of a minute in each case there was a pressure as on the ears, suggestive of diving-bell experience; suction like that with which one is drawn under a wave, and a cold draught of wind upon the eyes, having almost the effect of falling water; but once fairly within the tube, these sensations were got rid of, or left behind, and the motion had little more positive discomfort about it than would be attendant on riding on a 'lorry' over the worst ballasted line in England. It was a curious sensation to be *flying horizontally* through the earth—feet foremost, in utter darkness, for the best part of ten minutes, which in that place seemed half an hour, knowing that to the right and left of you there were gas-pipes, water-pipes, drains, cellars, roots of trees, and all the intricate fibres of the London sub-soilway; that nearer again to you was an arch which you might touch at your peril, and that of all these you could could absolutely see nothing. The conventional horrors of rats and catacombs troubled one little, seeming out of place beside this latest effort of human invention or audacity."—*London Engineer.*

Thermo-Electric Battery.

A thermo-electric battery, of much greater power than it has hitherto been thought possible to obtain by heating dissimilar metals at the point of junction, is now in daily use in one of the lectures of Mr. King, at the Polytechnic Institution. It is the invention of an Austrian engineer, who has had several honors conferred upon him for having brought his researches to such a successful result. The bars of metal in the battery consist of two alloys, one containing a large proportion of antimony with a little bismuth and zinc, and the other the same proportions of bismuth and zinc, with a very large admixture of copper. The pairs of bars are mounted on a frame, and the metals heated at the point of junction by a row of jets, burning a mixture of gas and common air. Instead of the feeble—almost inappreciable—effects of all earlier thermo-electric batteries, this one will not only give a long spark with a good induction coil, but will enable an electro magnet to hold a bar of iron with such power that a strong man can scarcely release it. This fact indicates that a current of considerable quantity as well as intensity is produced; yet this effect, according to Mr. King, is not accompanied by a corresponding waste of the most oxidizable of the alloys employed in the battery. The electricity, in such case, would seem to come from the heat alone—a very inexpensive source; and, in the commercial interests of telegraphy, it is to be regretted that the power of the apparatus has not been measured by a galvanometer and set of resistance coils, whence data could be obtained from which to judge of the practical utility of the new battery. The current from it will certainly work a short line of telegraph efficiently, and judging by appearances, a long one also.—*London Engineer.*

Filtering Water.

Le Génie Industriel reports a new application of the law of capillary attraction, by Mons. Aman Vigié, to the filteration of water on a large scale. His system is based on the ascensional power of water through porous bodies. By the law of capillarity water will penetrate a porous body to a certain height. If, when arrived at that point, it finds a siphon curve, it will follow that curve, and run off; and thus a regular and constant current may be obtained. The water, elevated solely by capillary attraction, is freed from all impurities held in suspension, and in the same condition as if it had passed through a filter. Mons. Vigié had caused to be made for his first experiments filters of terra cotta, very porous. This substance has the advantage of great durability; and it is inert, and cannot alter the water. The filters placed in mud worked for a long time without their pores being choked; the part immersed in the mud working as effectively as the other parts.

Oxygen in the Blood.

In some experiments instituted by Dr. Harley "into the condition of the oxygen absorbed into the blood during respiration," a certain quantity of fresh ox blood was first shaken with renewed portions of air until it had become thoroughly saturated with oxygen, then introduced into a graduated glass vessel with 100 per cent. of ordinary air, carefully corked, and kept during twenty-four hours in a room of moderate temperature. At the expiration of this time the gas was analyzed, and it was found that 10·54 per cent. of oxygen had disappeared, while 5·05 per cent. of carbonic acid existed where only a trace of its presence could previously be detected.

Rendering Wood Plastic.

The *Chemical News* says wood may be rendered plastic, by "injecting diluted hydro-chloric acid into the wood under a pressure of about two atmospheres. The duration of the operation must be regulated by the nature of the wood, the bark is not removed, and by a very simple arrangement the liquid injected at one extremity may be partially collected at the other. If the green wood is submitted to pressure, the cellules having been previously washed with water, it may be reduced to a tenth of its original size; the fibres may be excessively compressed without breaking or tearing, and when dry have no tendency to resume their natural condition. Woods treated in this way will serve for many purposes. If, after the treatment with hydro-chloric acid, the wood is washed and dried, it may be cut and chiseled with great facility, and serves admirably for sculptural purposes. The wood is dried by passing air under pressure through the cellules at about 37°; the moisture is rapidly expelled, and as the mass contracts evenly throughout, there are no cracks. Colors or the various substances which prevent wood from rotting may be injected in a similar manner; soluble glass or freshly precipitated silica renders it very durable, and at the same time incombustible."

Snow on Street Railways.

On the *removal* of snow from the track of the New York Street Railways, the *American Artisan* says—"To relieve themselves from this great expense, the street railway companies, years ago, salted their tracks to melt the snow; and the mayor has within a few days notified them not to do so. The practice is murderous to horses and men. Some hundreds of horses had their hoofs come off, in consequence of being frozen by the brine, a few winters since; and many people had their feet badly chilled; and Dr. Sayre reported that Capt. Reed, of the navy, had his feet frozen in consequence of stepping into a pool of brine as he was entering a car at night, and that he died in consequence. The brine remains liquid at 14° below the freezing point of water; and when a foot is dipped into it, it is cooled as quick as thin iron is cooled in water; horses hold up their feet alternately when they are left standing in puddles of brine; and the practice is now known to be an outrage on public health, and a very costly remedy to those who practice it; yet still some railways wish to persevere in it, to save the greater cost of power to overcome the resistance of snow on their tracks."

Titanium.

Iron improved with titanium has been tested for tensile strength, and has stood a strain equal to 47 tons per square inch; and, in puddling furnaces fettled with the ore, the fettling has in some instances lasted a month without renewal, the iron produced being of uniform good quality. These are extreme cases, but indicate the value of the use of the ore.—*Mechanics Magazine.*

The Artisan and the Actress.

ONCE at a social party, Madame K.
(A foreign actress of especial note
For reading well what other people wrote,
And writing ill what few can truly say
They ever read at all) said, with a sneer,
When C. was called a genteel *artisan*,
"What! a *mechanic* and a GENTLEMAN!
Pray, tell me sir, are such things common here?"
"Why, no," replied the wittiest of men—
Looking, the while, serenely in her face—
"Perhaps 'tis not a very common case,
And yet such things do happen now and then,
Just as in your trade one may chance to be
An *actress* and a LADY—don't you see?"