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FOR UPPER CANADA.

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PATENT LAWS.

The justice and propriety of granting exclusive rights to inventors in their discoveries, for a limited time, has been viewed differently by various writers upon the subject, according as their several personal interests appear to have influenced them.

At the annual meetings of the Social Science Congress, and also of the British Association, in England, a party led by Sir Wm. Armstrong, who has profited perhaps more than almost any other man by patent rights, proposes to abolish such rights altogether; and urges the adoption of their suggestions through a professed regard for the interests of inventors, manufacturers, and the public, who, it is said, are "allured by a false hope of reward by means of the monopoly obtained;" that "by the operation of the patent laws many useful inventions are kept from general employment, and a temptation is held out to persons to take out patents for merely speculative purposes;" and maintaining that "the tendency of these laws, as a whole, is to discourage inventions." A writer in the *Exchange* well remarks in regard to Sir Wm. Armstrong, that "such a proposition comes with a bad grace from one who is himself the owner of many patents, and who is chiefly known to the world as the inventor of a new machine, not patentable as an ordinary invention, but for which he has received a large sum of money, a lucrative appointment, a title, and last, but not least, a very extensive and profitable contract." Mr. Hawes, Vice-President of the Society of Arts, in a paper upon the subject read before the Social Science Congress, and Mr. Bright, M.P., through the columns of the *Times*, have recently been enunciating similar views, maintaining that the granting of patents is "inimical to universal free trade," and "injurious to industry;" but, with all due deference to the opinion of such celebrated authorities, we cannot see the honesty of appropriating to our own use or profit an invention or discovery originating in the brain of another individual, and which has cost him much time and labour, and probably much expense also, to bring to perfection. As well may we dispute the right of an author to the copyright of his book, as the inventor of a useful machine to a monopoly of its use or profit for a certain limited time. John Stuart Mill, the eminent political economist, has designated this species of "free trade" as nothing else than "free stealing." A writer in the *Builder* says, "as to the right of a man requiring remuneration for a new invention, we consider that it is out of the pale of discussion, and we hold that a man has as much right to his own idea as to the shirt on his back, very often more."

It is often argued that patent rights are granted for trifling improvements. Michel Angelo was accustomed to say that "perfection consisted in trifles." Numberless cases of apparently trifling improvements in the mechanical arts and sciences are recorded, that have been the means of bringing about great changes in trade and manufactures; almost revolutionising some departments of a nation's commerce. Abolish patent rights, and what will be the inevitable results? Every one who has made a discovery or invention likely to be of profit to himself, will conceal the fact as long as possible. The effect of such a course would be that important discoveries, which under our patent laws are given to the public, and are of so much commercial value to the country, would remain entirely unknown, unless the inventor should be—which is rarely the case—a man of means sufficient to enable him at once to put his discovery into practice, and profit thereby before other parties have time or opportunities for doing so; but even under such circumstances success would seldom be attainable, as the most valuable mechanical discoveries generally require from two to seven years ere they are appreciated by the public, so as to be remunerative to the inventor.

An English cotemporary instances the first important working patent power loom, invented or perfected by a gentleman who spent many years time and all his means in doing so, and reduced himself and family to the verge of starvation. He held on, however, through years of the greatest discouragement from the leading manufacturers, until, in the end, first one, and then another, took out a license under him, and he became wealthy, and finally represented his native town in Parliament. The advantages on the side of the public were, that the goods manufactured were not only improved in quality but reduced in price, and a great impetus was given to trade.

The London *Times*, now in favour of free trade in inventions, in the year 1852, while the English Patent Law Amendment Bill was under discussion, truthfully wrote as follows:—

"The law, however, regards those who wish to derive a pecuniary benefit from the result of their labour, inquiry, and ingenuity; and we ask what such men would do, supposing no law existed by which they could secure a property in that which they had discovered? The answer is obvious; they would endeavour to keep their process a secret, and in those cases in which secrecy is impossible, they would have no motive to go through the trouble and expense of discovery. Where secrecy might be possible, we should find the new process fenced round by every mystery and mystification which the ingenuity of the discoverer could devise. Secrecy would be enforced on workmen, as far as possible, by keeping them in ignorance; and when this became no longer feasible, the sanction of oaths would be employed to that end. A state of most painful suspicion and restraint would be the condition of every one who was in possession of an invention, and of all whom he employed. A more mischievous, as well as a more disagreeable condition, can hardly be conceived. The necessary uncertainty of success, after every precaution taken, the suffering and expense attendant upon all such endeavours, would prove a heavy counterpoise to all expected benefit from the invention. Thus, under this system of no privilege, a large class of discoveries would be wholly without protection, and the remainder would be most imperfectly, and with great labour and expense, guarded against unfair appropriation. On the other hand, putting aside for the moment any consideration of the difficulty attending the means of attaining such an end, let us ask what would be the effect of a promise made by society to every *bona fide* inventor, that he should enjoy an exclusive property in his discovery for a limited period? If such exclusive property could be insured, if the right itself could be accurately defined and easily acquired, society would, in so far as depended upon the law, have done its utmost to foster a spirit of discovery, because it thereby would render certain such reward as the invention itself really deserved; and to itself society would not by this means do injury, for although there would be some delay in the full and universal enjoyment of the benefit, whatever it might be, resulting from the invention, yet, upon the whole, ultimately there would be a greater harvest of discovery than would accrue from a system by which no reward was provided for him from whom the benefit came. With common men the common motives to exertion must be relied on, and society, by thus judiciously protecting private interests, would promote the general welfare."

It is questionable whether Sir Wm. Armstrong ever would have perfected his hydraulic machinery and ordnance, or Mr. Bessemer his steel, labouring so long and incessantly to that object, had they not had the assurance that if successful their labours would be rewarded by means of the exclusive rights secured to them by the patent laws of the land; and of a host of other inventors both on this continent and in Great Britain the remark would be equally true.

We are not aware that any considerable number of persons in Canada are in favour of abolishing our patent laws, but an urgent demand for their amendment is put forth by all who are interested in patents; and hopes are entertained that, as the subject has been referred to in His Excellency's speech at the opening of the present session of our Canadian Legislature, a really good measure may be introduced and receive the sanction of the assembled wisdom of the Province.

The principal objections to the present law are, 1st, That a patent right cannot be obtained by any but a British subject, nor by a British subject unless an actual resident of Canada. 2nd, That no efficient examination is made as to the novelty or utility of the inventions, thus allowing so many useless articles to be patented. 3rd, That the specifications and drawings of patented articles are not published by the Department, so as to be available to the public for reference. 4th, That the law being prohibitory as to Americans obtaining patent rights in Canada, Canadians can only obtain patent rights in the United States by payment of the sum of $500, which in many cases is tantamount to a prohibition.

As to the first of these objections, it must certainly appear very ungenerous to our fellow-subjects coming from other portions of the Queen's dominions with a valuable invention or discovery, to find that by our provincial law he is excluded from obtaining any protection; and to the American most inconsistent for us who are continually declaiming against American publishers for pirating the works of English authors, to refuse him a patent right on payment of suitable fees—the avowed purpose being to use and benefit by his invention, without affording him any remuneration therefor.

The 2nd objection we do not esteem as of much weight, the loss accruing from patenting useless articles falling principally upon the inventors themselves. Could an efficient examination, however, be established, it would prevent the re-patenting of any invention or discovery, and thus prevent an injustice being done to the original patentee.

As to the 3rd objection, it would greatly increase the value both to the inventor and the public if the specifications and drawings were freely published, and placed in the libraries of the Boards of Arts and Manufactures, and of all Mechanics' and similar institutions, for reference. It would also afford information to inventors of what had already been patented, and save them time and expense in perfecting machines already discovered and patented by others.

A gentleman of this city devoted some years study to what he considered a new mode of propelling steamers, an improvement on the ordinary side paddle-wheels now in use, and went to the expense of having models prepared preparatory to applying for a patent. When his models were nearly completed he consulted the British Patent Office publications in the Free Library of this Board, and at once discovered that an invention exactly similar had been patented in England some years previously. Another gentlemen from the city of Hamilton, who had for a long time been studying an improvement on the screw propeller, and was about to apply for a British patent, found, on reference to the same library, a description of an exactly similar invention. By these means they were saved further trouble and expense, and had they only consulted these works sooner, they would no doubt have been saved much disappointment also.

The provisions of the present law referred to in the 4th objection is undoubtedly the most detrimental of any to the interests of Canadian inventors, and also to the public, whose interests are identical with theirs, A number of inventions are now waiting the alteration of our law, so as to secure reciprocity with the United States. The reasons given by the inventors for withholding their discoveries from the public are, that a patent for Canada only secures the monopoly of a very limited market, and they cannot afford to pay the sum of five hundred dollars required from every Canadian citizen for a patent in the United States, consequent upon our prohibitory law; and therefore prefer to wait, hoping that our legislature will make such amendments thereto as will enable us to take advantage of the law passed by the United States Congress, March 2nd, 1861, section 10, "That all laws now in force fixing the rates of the Patent Office to be paid, and discriminating between the inhabitants of the United States and those of other countries, which shall not discriminate against the inhabitants of the United States, are hereby repealed," and establishing uniform rates of fees of $35 for all, on the conditions recited in the foregoing extract.

It will thus be seen that so soon as our law ceases to discriminate against the inhabitants of the United States, a reciprocity in patents will take place; and surely no one can for a moment doubt but the advantage of securing the American market to our inventors, will be a boon far more valuable than we can confer on American citizens by throwing our market open to them.

A fear is sometimes expressed that by granting patent rights to Americans, they will neither manufacture their inventions here or sell rights to others to do so; but this may be guarded against by providing that unless the manufacture of the article patented is commenced in the province within say twelve months after the issue of the patent, all exclusive rights therein shall be forfeited by the patentee or his assignee.

The immorality which the present law leads to is also another important consideration. A large number of patents taken out in Canada are the inventions of American citizens, who, on finding that patent rights cannot be obtained in their own name, on account of their being aliens, secure the service of some weak or immoral minded Canadian, who for a *consideration* makes the affirmation that the invention or discovery is his, and thus secures the patent, which, most probably, is then assigned over to the American.

The countries that do not now discriminate between their own subjects and foreigners in the issue of patents are Austria, Australia, Bavaria, Belgium, France, Great Britain, Hanover, India, The Netherlands, Poland, Portugal, Prussia, Russia, Sardinia, Saxony, Spain, Sweden and Norway, the United States of America, and several minor states and governments; so that Canada now stands alone in sustaining prohibitory patent laws.

The duration of patent rights in the foregoing States vary from three to fifteen years, and the fees from an average of from $5 in some to $60 in others, per annum, for the whole term. In some two dozen of German and other States there exists no special patent legislation, but the respective governments grant privileges to inventors for the exclusive use or working of their inventions.

A draft of an amended Bill was prepared by the provincial government during the past year, which will most probably be submitted to the Legislature during its present session. The leading features of the Bill are that it provides for the establishment at the seat of government of a Patent Office, to be attached to the Bureau of Agriculture, and the appointment of a Commissioner of Patents; for the granting of patents to "any person of any country whatever," on the same conditions as to inhabitants of Canada; the establishment of a gallery for models of inventions, to be open at all suitable times for public inspection; the preparation of indices, &c., to specifications, to be open to the inspection of the public at such times as the Commissioner may appoint; the registration of "trade marks," and of copyrights of original designs, and the forwarding of copies of index of titles of designs to the Boards of Arts and Manufactures for public inspection. A large portion of the Bill is taken up with the necessary forms of law proceedings in cases of infringements of patents, assignments, &c., which we do not propose to discuss; there appears to us, however, to be one very important omission in the draft of Bill, in not providing for a six months "provisional protection," so as to allow inventors to experiment on their machines with a view to perfecting them before depositing a complete specification. The absence of this provision in the present law causes the greatest dissatisfaction, and accounts to a great extent for the many crude machines patented in the Province, as the inventors dare not put their utility and completeness to a practical test for fear of others witnessing and pirating their ideas, and, as has been done in too many cases, taking out patents before the real inventors are fully prepared.

In the United States the inventor is allowed to file a caveat which protects him for twelve months, unless another person applies for a protection for a similar invention, when notice thereof is given the person filing the caveat, and he is required within three months of the date of such notice to file his complete specification, model, &c., and make his final application for the patent. In Great Britain the inventor is allowed to file a "provisional specification" which protects him for six months, on payment of a small fee; and if he proposes to proceed with his application for a patent, having satisfied himself of the novelty and utility of his invention or discovery, notice thereof must be given to the Commissioner not less than eight weeks before the expiration of the term of provisional protection; and at least eight days before the expiration of such provisional protection, he is required to file his complete specification, and make application for the issue of the letters patent. We strongly urge the introduction of somewhat similar provisions in any amended Act that may be passed in this Province.

A clause should also be introduced into the Bill requiring inventors to furnish four copies of specifications and drawings with their applications, on sheets of uniform sizes for binding in books, so that on the issue of the patent one copy might immediately be forwarded to each of the Boards of Arts and Manufactures for the Province, where they would be free for reference by all parties desirous of examining them. The advantage to patentees in thus giving publicity to their inventions and discoveries would far more than recompense them for the extra trouble and expense in furnishing the two additional copies, and intending applicants for patents would have increased facilities for ascertaining the nature of previously patented inventions, with which theirs might possibly clash, and thus be saved the expense and annoyance of making fruitless applications for patents. The public would also be promptly informed through the columns of this Journal of the nature of all inventions and discoveries patented, and would have an opportunity of examining and judging for themselves as to their utility.

It would also tend to prevent the setting up of false "claims" by patentees, and be of great assistance to inventors, if the issue of letters patent were announced weekly, or at any rate monthly, in the *Canada Gazette*, with the short "claim" registered by each patentee, in the same manner as these are published in the United States, and of which we give two examples for illustration:—

41,141.—Machine for making Horse-shoe Nails.—Daniel Dodge, Keeseville, N. Y.:

I claim, first, the employment in a machine for making forged nails, of cutters so constructed, arranged and operating as to serve the purpose of cutting metal from the side to reduce the thickness and produce the desired form of the point of a nail, substantially as herein specified.

Second, the finger, f, or its equivalent operating in combination with the upper cutter, b, and with a fixed guide or gage, substantially as and for the purpose herein set forth.

41,142.—Washing Machine.—Samuel Davis, Providence, R. I.:

I claim the combination and arrangement of the dasher, B, and upright, C, with the deflector, D, lever, E, standard, I, rest, e, and shelf, f, substantially as described.

The Board of Arts and Manufactures for Upper Canada have again petitioned the Government and Legislature for amendments to the law, in accordance with these views.

IMPROVEMENTS IN STEAM ENGINES.

Of the many reputed improvements in Steam Engines made during the last 30 years, that one of two cylinders, a high pressure and a low pressure cylinder combined, has made the least headway. This construction of engine has been before the public during the period named, giving ample opportunity to those using steam engines for its adoption; yet it has not found favor with the manufacturing community—those most deeply interested in it. Had there been any material advantage, such, for instance, as to compensate for the large additional first cost and subsequent maintenance, there would probably have been more of them in use at the present time. The alleged saving in fuel is in most cases looked upon as a canard, and is always received with more or less of distrust. Some engine builders can get as much useful effect from one cylinder as other builders can get from two, the construction being so widely different. We have heard of a case where a second entire engine of low pressure has been put down beside one of high pressure, the exhaust pipe of the latter joining directly to the steam chest of the former, and the crank shafts of each connected with gears; and with the usual flourish of trumpets the saving in fuel is heralded as 40 per cent.—40 only. "The collins turbine was said to give 80 more than the over shot and did not come into general use.

The high and low pressure cylinders combined remind us forcibly of the fable of the mountain and the mouse; it being about a parrallel case to the additional useful effect obtained from the unwieldy No 2.

Connecting the crank shafts by gears however, in the case of two engines—a high and a low pressure engine—affords a better opportunity for the proper application of the steam than that adopted at the Hamilton Water Works, where two cylinders are applied to one end of a Walking Beam. The arrangement in this latter case is such as to prevent so favorable a distribution of the steam.

We would recommend all Engine Builders who value their good name, that in publishing the economy of their engines to give the particulars in every case of the "actual" amount of fuel consumed, and of the work performed. The useful effect can easily be obtained by a very simple contrivance, called Proney's friction brake.

If all the engines in our own immediate neighbourhood were so tested, the manufacturing community might then see where the most economical engines are built; and good Builders would not shrink from the application of such a test. We would then see the proportion of foot lbs. to the cord of wood or the ton of coal.

METRIC SYSTEM OF WEIGHTS AND MEASURES.

Samuel Brown, Esq., recently read before the Society of Arts a paper on this subject, in which he showed the great social, commercial and political advantages that would attend the adoption of a uniform system of weights and measures throughout the civilised world. The author gave a history of the metric system, and stated that the great Exhibition of 1851 had been the means of forcing the consideration of the question upon the public mind, owing to the impossibility of comparing together the produce of the world's industry, with such diverse systems of weights, measures, and values, as at present exist.

Long previous to the French revolution the confused state of the ancient weights and measures in France had attracted attention, but it was not till 1790 that the question began to be vigorously taken up. It was at first proposed that an equal number of commissioners from the Academy of Sciences and Royal Society of England should meet and ascertain, at some suitable parallel of latitude, the length of the seconds pendulum; but this proposition was not agreed to, and the French Academy proceeded by themselves. They resolved that all the multiples and subdivisions should be decimal; and that the units of surface, capacity, and weight should all depend on the unit of length, which they decided to take from the dimensions of the earth, as being of universal application. They fixed that the unit of the whole system should be the ten-millionth part of the arc of the meridian between the Equator and the North Pole; and a new measurement was completed, delegates were invited from all the nations of Europe, to assist in the reduction of the calculations and decide on the several units of capacity and weight. England was prevented by war from joining in this work, but representatives from various other States attended.

"The result of these deliberations was the fixing definitely the exact length of the metre. The square of ten metres, or 100 square metres, was made the standard of surface measurement, and called the "arc." The cube of a tenth part of the metre, or cubic decimetre, was the standard measure for liquids, called the "litre." The weight of a cubic centimetre of distilled water at its maximum density was the standard for weight, and called a "gramme." We may leave out the "stere," used as the unit for solidity, which was a cubic metre, as not being required for international purposes. It was used in France for measuring the solid contents of stacks of firewood. Such being the units, all derived from the "metre," the next step was to simplify the nomenclature of the multiples and subdivisions. This was done by prefixes, which are not French, but derived from the dead languages, taught in the schools of all countries, all the multiples being denoted by Greek and the subdivisions by Latin prefixed.

	GREEK.			
Thus,	Deca...	...	was used for 10	times.
	Hecto	...	" 100	"
	Kilo...	...	" 1000	"
	Myrio	...	" 10000	"

For the subdivisions the prefixes were:—

LATIN.	
Deci	for $\frac{1}{10}$th part.
Centi	$\frac{1}{100}$th part.
Milli	$\frac{1}{1000}$th part.

These being prefixed to the respective names for each unit of length, surface, capacity and weight, the whole system was complete. In acquiring it the memory is taxed in the smallest possible degree, and it is, as a system of weights and measures, in all respects a marvel of simplicity and perfection. If this could be brought into universal use, all the complicated and numerous tables taught in the schools of different countries might be swept away, and the following brief table, common to all nations be substituted in their place:—

	Length.	Surface.	Capacity.	Weight.
Myria ...	10000	...	...	10000
Kilo	1000	...	1000	1000
Hecto ...	100	100	100	100
Deca	10	...	10	10
UNITS.	Metre.	Are.	Litre.	Gramme.
Deci	·1	...	·1	·1
Centi	·01	·01	·01	·01
Milli	·001	...	...	·001

Whatever objections may be made to the use of the learned languages for names which are to be learnt and most extensively used by the poor and the ignorant, there can be no doubt that they give the greatest facility in acquiring the system. In any country in which this system is introduced, even if the old names of the nearest corresponding weights and measures should in popular use be applied to the new, it is very desirable that, in public and private schools, the original nomenclature should be taught, as the means of firmly fixing in the memory, with the least expenditure of time and labour, the entire system."

It was shown from an inquiry that for a boy to learn our present system of weights and measures, with all the branches of Arithmetic thereon depending, would occupy nearly three years, whereas the probable time for a decimal system would be less than ten months. It has already been adopted in France, Belgium, Holland, Spain, Portugal, Greece, Italy and other countries, whose total population amounts to 150,000,000; and through the efforts of the International Decimal Association and other bodies, a Parliamentary Committee has investigated the subject and recommended its gradual adoption in England. In conclusion the author stated that "If the metric system be once legalised in this country we can hardly form an estimate of the immense benefits that would follow to the commerce of the world. Our colonies would naturally and for their own sakes, adopt the system of the mother country, with whom their trade principally lies. India, which has no common system of weights and measures, but under the varieties of native governments, is full of incongruous and absurd systems, by which it cannot be doubted the labouring classes especially are exposed to false weights and trade frauds, might by our influence gradually find one simple system prevailing throughout the whole of those vast dominions. The Americans, who have long agitated this question, would not, we are assured by the American delegates who have been sent to our European congresses, hesitate to make the change. They are only deterred now by the disturbance that would arise in their large trade with this country as long as our present system continues. An impetus would be given to Russia and Germany to complete the work to which they are already half committed.

The expression in the old English statute "that there should be but one measure and one weight throughout the land," might be expanded into the grander idea, which would then be almost realised, that there should be but "one measure and one weight throughout the earth." Commerce, the real harmonizer of nations, uniting them in the bonds of mutual interest and growing esteem, would then receive a still greater development than has occurred even in the last few years, diffusing everywhere the blessings of peace, and causing all nations to pause ere they precipitated each other into the calamities of war.

A NEW OPHTHALMOSCOPE,

FOR PHOTOGRAPHING THE POSTERIOR INTERNAL SURFACE OF THE LIVING EYE:

The invention of Dr. A. M. Rosebrugh, Oculist, Toronto.

At a late meeting of the Canadian Institute, the President, the Rev. Dr. McCaul, in the chair, Dr. Rosebrugh read a paper on the theory of the Ophthalmoscope, and gave a description of and mode of using a new instrument of his invention for viewing and photographing the deep structures of the living eye. He also exhibited a number of photographs taken with this instrument, showing portions of the retina, vessels, optic nerve, &c., of the eye of a cat.

After reading the paper, he illustrated the mode of using the instrument as an ophthalmoscope, by demonstrating in a very satisfactory manner the retina of the eye of a live cat introduced for the purpose. As the instrument is undoubtedly a most valuable scientific invention, we take great pleasure in bringing before our readers in this number of the Journal the essential part of Dr. Rosebrugh's communication as read before the Canadian Institute.

In giving an outline of the optics of the eye, the doctor states that the blackness of the pupil under ordinary circumstances, and the invisibilty of the parts behind it, do not depend (as was formerly supposed) upon the total absorption of all the rays of light that enter the eye, but solely upon the refraction the rays of light undergo in passing through the transparent media of the eye, and that part of these rays are reflected from the eye, which can be seen by an observer having his eye in the line of the light illuminating the eye that is being experimented upon; but this position is an impossible one, without some special contrivance for the purpose, as, if the experimenter places his eye beyond the light his eye is dazzled, and if it is placed between the light and the eye under examination the illuminating rays are intercepted.

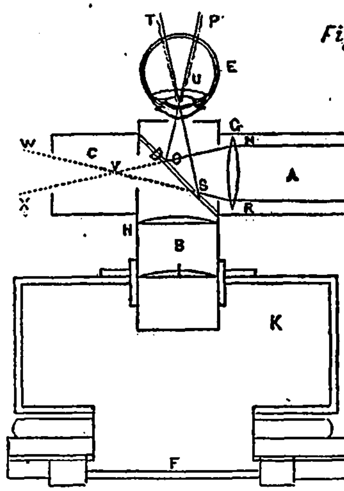
This difficulty is overcome by using reflected instead of direct light; the observer placing his eye behind and looking through an aperture in the mirror—the reflected rays from which illuminate the eye under examination.

This is the principle upon which the ordinary ophthalmoscope is constructed. We regret that our space will not admit of a further notice of this portion of Dr. Rosebrugh's interesting paper. We reproduce however, entire, the part of the doctor's paper referring to this new instrument.

Construction.

The Tubes.—The instrument consists of two brass tubes (A & B fig. 1) 1½ inches in diameter, being respectively 4 and 2½ inches in length. The longer tube B moves freely in a brass collar fitted to the aperture of a small camera K, and the shorter tube A is turned toward the source of light.

Fig. 1



A tube C of the same width, 1½ inches in length, is joined to the side of the outer extremity of the tube B opposite to and in a line with tube A. The outer extremity of the tube B extends ¼ of an inch beyond its juncture with the tubes A and C, and is terminated by a thin brass diaphragm having a central circular aperture of ⅜ of an inch in diameter.

At the juncture of the tube A with B there is a circular aperture of one inch diameter, and between C and B an aperture of ½ inch diameter, affording a communication between A and C through B.

The Plate Glass.—At the juncture of the tubes, there is placed an elliptical piece of highly polished thin plate glass with parallel surfaces, which is inclined at such an angle to the tubes that a ray of light falling upon it through the centre of the tube A from the direction M Q will be reflected at right angles to its original direction and in the same plane with the centre of the tube B, which will be through the centre of the aperture in the diaphragm. A portion of the ray will be refracted by the plate glass, and pass through the tube C parallel to its original direction.

The Lenses.—At the inner extremity of the illuminating tube A, and as close as possible to its juncture with the camera tube B, a double convex lens G is placed 1¼ inches in diameter, and having a focal distance of 2½ inches. In the corresponding position of the tube B, or close to the plate glass reflector, the lens H is placed, convexo-plane of 5 inch focal distance; 1¾ inches from this is another lens, 1, also convexo-plane, and of 5 inch principal focal distance, and having the same diameter, viz, 1¼ inch.

The Camera.–The camera consists of a mahogany box three inches square and seven inches high, having (to secure steadiness) a base six inches square At the aperture in the centre of the anterior side there is a brass collar fitted, through which slides the tube B containing the lenses. At the opposite side of the camera is a central aperture 2½ inches square, behind which is a slide with a piece of ground glass 2½ inches square. This slide moves in grooves for the purpose, and can be removed to make way for a slide containing a sensitized plate also about 2½ inches square. The whole is contained in a case about 8 inches in height, which serves the double purpose of supporting the instrument when in use, and holding it afterwards.

Photographing.

As yet I have not attempted a photograph of the retina of the human eye, but have confined my experiments to the lower animals, and have employed solar light only in order to shorten the time as much as possible; but I do not doubt that diffused light, particularly that reflected from a bright cloud, would with a longer "exposure" answer very well. In using the instrument for this purpose, a tripod, or what answers quite as well, a table of the ordinary height is placed near a window where the light of the sun will fall upon it.

It is well to have the shutters closed, and a beam of solar light admitted of the size of the illuminating tube; but this is not absolutely essential if precautions be taken to prevent diffused light entering the camera, and the ground glass be shaded while examining the image on its surface.

Position of the instrument.—The camera must be turned at right angles to the source of light, and the tube A, or, illuminating tube, turned so that the light will fall full into the tube, and be incident upon the whole of the lens G.

If the camera and tube be now in proper position, a cone of light will issue from the end of the camera tube through the centre of the aperture in the diaphragm, which is the condensed light from the lens G reflected from the plate glass D. This cone forms a focus about ½ inch outside the diaphragm, which can be seen by holding a thin piece of white paper near the diaphragm. If it be a cat or rabbit, that is to be experimented upon, it is well to have it secured in a box of the right size, with the head projecting through an aperture for the purpose.

In photographing the eye of a cat I found it necessary to put it under the influence of chloroform, but the image of the optic nerve, vessels, &c., upon the ground glass is so very bright and clear that I do not doubt, if the most sensitive process be adopted, the impression could be taken instantaneously, thus rendering anæsthesia unnecessary.

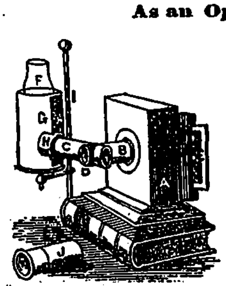
Position of Eye.—In either case the eye must be brought to the proper position, and the eyelids held apart by an assistant, If it be the eye of a patient to be photographed, the instrument must be mounted upon its case, which will for most persons, give it the right height. The patient being seated upon a chair as close as possible to the table, should lean forward toward the camera, and bring his eye as near as possible to the aperture in the diaphragm, the brow can rest lightly against the end of the tube, and by bringing the elbows upon the table he can, with the palms of his hands, extemporize a very good rest for his chin.

The pupil of the eye to be photographed must have been previously dilated with atropine.

Process.—If the instrument be now in its proper position, and the light from the plate glass enter the dilated pupil, the fundus of the eye will be brilliantly illuminated, and its reflection will pass out of the eye and through the plate glass and lenses, and form an inverted image upon the ground glass at the back of the camera where the observer in the rear will see the optic nerve entrance, distribution of the arteries and veins, &c., beautifully depicted, but magnified about four diameters.

If the details of the image be not perfectly defined the camera tube must be moved backwards or forwards until the proper focus be obtained. This image can be seen by the observer again very much magnified by placing to his eye a lens of say six inch focal length, and bringing his eye with the lens to within six inches of the ground glass; but the image will be seen even better by moving the ground glass to one side; the observer will then see the *aerial* image of the reflection from the eye, which will occupy the same position as the ground glass previously occupied. The slide containing the ground glass can now be removed, and a slide substituted containing a glass plate "prepared" by the ordinary collodion process. An "exposure" of about five seconds is sufficient. If the "developing" prove that a good "negative" has been obtained, it must be "fixed" and used for printing the photographs; if not, other plates should be employed until a more satisfactory result be obtained.

As an Ophthalmoscope.



The position of the instrument when the light is supplied by a lamp.—A the camera, B camera tube, C illuminating tube, D diaphragm with central aperture, E slide with ground glass, F glass chimney of lamp, G brass tube which acts as a shade, and from which projects H, a brass collar opposite the flame of the lamp, and to which is adapted the illuminating tube C of the instrument; I upright of the lamp-stand, J eye-piece to be adapted to the inner extremity of the camera tube B; when this is used the camera can be dispensed with.

In using this instrument as an ophthalmoscope, that is for examining the interior of the eye, artificial light should be employed. That from a kerosene oil lamp answers very well, but the best light for ophthalmoscopic purposes is from the gas argand-burner, and the most convenient is the movable table lamp suplied with gas through a flexible tube. The evening is the best time for making these examinations; if in the day time, the room must be darkened, and the instrument be placed in the same position in regard to the light as when solar light is used, but the flame of the lamp should be brought within two or three inches of the entrance of the illuminating tube, and the two must be on the same horizontal line. A screen, to shade the ground glass and the observer's eye, should be placed between the light and the back of the camera, or, what I have found to be much better, a metallic shade can be placed around the lamp, from an aperture in which, projects a tube or collar somewhat resembling that of a magic lantern, of the right size to allow the illuminating tube of the instrument to fit closely. Indeed with this apparatus the camera can be dispensed with altogether, that is in making examinations of the eye simply: when the object is to demonstrate the fundus of the eye to a number of persons, the camera should be used both with and without the ground glass.

Optics.

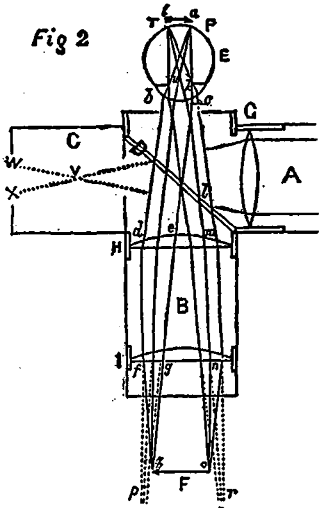
In the accompanying diagrams I have made the mean position of the optical centre of the eye at the centre of curvature of the cornea, or at a distance one-third of the diameter from the cornea, making the posterior focal distance of the eye about ⅞ of an inch. I have also represented the eyes as "homogenous bodies, possessed of a single condensing refracting surface, which is regarded as the optical equivalent of the various surfaces in a real eye.

"By giving such hypothetical eyes a higher index of refraction than that of the media of any real eye, we may preserve the proportion between the distance of the cornea and the retina from the optical centre almost unchanged, while substituting an equivalent for a real eye, which may be assumed to be quite accurate in so far as concerns any optical conclusions with which we have to do." —*Dr. George Rainy on the Theory of the Ophthalmoscope.*

Illumination.—Let M Q (fig. 1) represent parallel rays of solar light incident upon the double convex lens G, at the points N R they are refracted and emerge from the lens convergingly towards a focus V in the tube C, but at O and S they are intercepted by the plate glass D, a portion of the rays are reflected by its polished surface in the direction E, and rays not reflected or absorbed are transmitted and pass to form a focus at V, the principal focal distance of the lens G, and again diverge in the direction W X.

The rays reflected from the surface of the plate glass form a focus at U (which is also the focal centre of the eye E) at the same distance in front of the plate glass D, as V is behind it, these rays at U again diverge and illuminate a portion of the fundus at T P.

Fig 2



Reflection. — Let E (fig. 2) represent the same eye illuminated as just described, D the plate glass, and H I the lenses in the camera tube. Rays from any portion of the illuminated fundus as *a*, are reflected from the fundus and emerge from the cornea at *b c*, the width of the dilated pupil, and proceed to the plate glass D (parrallel rays of light emerging from an eye having its accommodation paralyzed are parrallel or very nearly so) where some of its rays will be reflected through the lens G in the direction of the source of illumination, but other rays proceed to *d*, *e*, where they are incident on the lens H by which they are refracted, and they would proceed to a focus at the principal focal distance of the lens H—viz., at 5 inches, but they are again intercepted at *f*, *g*, by the lens I, which refracts them to an earlier focus at *h*. In the same way rays from *i*, on E's retina, proceed from the cornea parrallel to the axis *i*, *k*, *m*, and are also refracted by the lens H and I, and are brought to a focus at *o*. In like manner all points intermediate between *i* and *a*, on E's retina, are reflected from the fundus and refracted by the lenses forming an inverted image of *i*, *a*, at *o*, *h*, which is received upon the ground glass placed at F.

Application—Advantages.

The advantages I claim for this instrument are:

1st. The simplicity of its construction, taking into consideration its two-fold purpose, viz , as an ophthalmoscope, and as a photographing instrument. My friend Dr. Noyes, of the N. Y. Eye Infirmary, constructed an instrument for photographing the fundus oculi, and which was I believe to a considerable extent successful, but its construction was too complicated and the instrument too expensive to be generally adopted. Dr. Noyes' instrument is constructed somewhat upon the principle of the binocular microscope. Any good optician can construct this instrument. The one I exhibited to the Institute was made by Charles Potter, of King street, Toronto.

2nd. The limited experience necessary in order to use it successfully; the ordinary ophthalmoscope requiring months of practice before it can be used satisfactorily.

3rd. Being able to see the aerial image free from reflections from the object lens, which reflections are serious obstacles to beginners.

4th. Being able to receive the image, either of a healthy or diseased fundus, upon a screen of ground glass which can be seen by a number of persons at the same time, and could be taken advantage of by gentlemen lecturing upon the physiology of the eye or upon the pathology of its deep structures.

5th. With it, artists will be enabled to make coloured representations of the fundus, which, with the instrument now in use, has never yet been effected; thus, Mr. Hulke in his Treatise on the Ophthalmoscope, and Jabez Hogg in the preface to his "Manual of Ophthalmoscopic Surgery" (June, 1863), apologizing for defects in their coloured representations, state that it is impossible to procure the services of artists having the requisite knowledge of the use of the ophthalmoscope.

6th. Rendering it comparatively easy to photograph the reflection from the posterior internal surface of the eye.

I cannot conclude without expressing the hope that this instrument will contribute something towards awakening more of an interest in ophthalmoscopic science, as the ophthalmoscope is undoubtedly as essential in investigating diseases of the eye, as the stethescope in diagnosing affections of the heart and lungs; and I trust its use will aid in banishing from ophthalmic nomenclature the indefinite term of amaurosis, where, as Walther observed, "the patient and physician are both blind."

Board of Arts and Manufactures

FOR UPPER CANADA.

The following is a copy of petition just presented to the three branches of the Legislature of this province, for amendments to the laws relating to patents for inventions:—

The Petition of the Board of Arts and Manufactures for Upper Canada, humbly sheweth:—

That in the present state of the Patent Laws of this Province, none but *British subjects who are actual residents* in Canada, can obtain protection for any invention or discovery they may produce:

That your petitioners consider this unjust towards British subjects non-resident of Canada; and more especially towards such as are subject to the Patent Laws of the Imperial Government, which makes no distinction as to the country to which the applicant or inventor may belong, in the granting of Patent Rights:

That in respect to the Inventions of Foreigners, the Patent Laws of this Province are not based on those principles on which the Patent Laws of almost all other countries are established, that is, the absence of prohibitions and discriminating fees in the granting of Letters Patent:

That the Patent Laws of the United States have recently been so modified as to do away with all discriminating fees, on the condition set forth in section 10 of an enactment of the American Congress, of the 2nd of March, 1861, as follows:—'That all laws now in force fixing the rates of the Patent Office fees to be paid, and discriminating between the inhabitants of the United States and those of other countries, which shall not discriminate against the inhabitants of the United States, are hereby repealed :"

That under said enactment of the American Congress, citizens of Canada are, in consequence of the prohibitory laws of this province, altogether excluded from the benefit of taking out Patents in the United States, unless by payment of a fee of $500: inhabitants of other countries being subject to a fee of only $35 for a similar privilege.

That the absence of "Provisional protection to parties for a limited period, while perfecting their inventions, is frequently a cause of injustice to them, and of imperfections or incompleteness in the articles patented:

That a provision for furnishing copies of the Drawings and Specifications of Patents issued, of a uniform size for binding, to the free Libraries of reference of the two Boards of Arts and Manufactures of the Province, would conduce to the interests of both the inventors and the public.

Wherefore your petitioners humbly pray, that your Honourable House will be pleased to pass such an act as to your Honourable House may seem best adapted to carry out the views of your petitioners, in doing away with all prohibitory or discriminating laws for the granting of Letters Patent in this Province; for granting "Provisional Protection" to Inventors; and providing for the transmission of copies of Drawings and Specifications to the respective Boards of Arts and Manufactures, for reference.

And your Petitioners will ever pray, &c., &c.,"

BRITISH PUBLICATIONS FOR JANUARY.

	£	s.	d.	Publisher
Agricultural Education, fcap. 8vo.	0	2	6	*Longman.*
Barry (Rev. Prof.) Handbook of Rhetoric for Schools and Private Students, 12 mo.	0	1	6	*Simpkin.*
Bell (Major Evans) Empire in India: Letters from Madras, &c., post 8vo.	0	8	6	*Trübner.*
Brown (J. H.) Spectropia: Surprising Spectral Illusions, 1st series, 2nd edit., 4to.	0	2	6	*Griffith & Far.*
Bryce (James) and Johnston (Alex. K.) Gazetteer and Atlas, 8vo.	0	18	0	*Griffin.*
Cayzer (Thos. S.) One Thousand Algebraical Tests, 8vo.	0	3	6	*Griffith & Far.*
Davies (Thomas) Preparation and Mounting of Microscopic Objects, fcap. 8vo.	0	2	6	*Hardwicke.*
Denman (James L.) Vine and its Fruit in relation to Wine Production, post 8vo.	0	8	6	*Longman.*
Graham (William) Principles of Elocution, new and revised edit., fcap. 3vo.	0	3	0	*Chambers.*
Guernsey (E.) Homœpathic Domestic Practice, abr'd, &c., by H. Thomas, fcp. 3vo.	0	5	0	*Turner.*
Handbook (The) of the Court, Peerage, and House of Commons, 1864, 16mo.	0	5	0	*P. S. King.*
Humber (Wm.) Record of the Progress of Modern Engineering, 4to.	3	3	0	*Spon.*
Laxton's Builder's Price Book for 1864, fcap. 8vo.	0	4	0	*Simpkin.*
London Catalogue (The) of Periodicals, Newspapers, &c., 1864, roy. 8vo.	0	1	0	*Longman.*
Lyell (Sir Chas.) Geological Evidences of the Antiquity of Man, 3rd ed. rev'd, 8vo.	0	14	0	*Murray.*
Mayhew (Edward) Illustrated Horse Management, 8vo.	0	18	6	*W. H. Allen.*
Phillips (John) Guide to Geology, 5th edit., fcap. 8vo.	0	4	0	*Longman.*
Tabor (J.) Land Surveying and Levelling for Farmers, &c., 8vo.	0	3	6	*Longman.*
War Office List (The) January, 1864, 8vo.	0	6	0	*Harrison.*

Canadian Patents.

BUREAU OF AGRICULTURE AND STATISTICS, Patent Office, Quebec, 19th February, 1864.

William Chapman, of the township of Nottawasaga, in the county of Simcoe, Carpenter, "A new and useful improvement in Furniture Castors."—(Dated 1st July, 1863.)

John Soper, of the village of Vienna, in the county of Elgin, Carpenter, "A new and improved Bee-Hive."—(Dated 1st July, 1863.)

William Inglis, of the city of Montreal, Mechanical Engineer, "A new and useful improved vertical Steam Boiler."—(Dated 2nd July, 1863.)

Ives Wallingsford McGaffey, of the city of Hamilton, in the county of Wentworth, Machinist, "A Regulating Damper."—(Dated 2nd July, 1863.)

James Elijah Anderson, of the town of Port-Dover, in the county of Norfolk, Blacksmith "Anderson's Gig."—(Dated 2nd July, 1863.)

Gelston Sanford, of the city of Quebec, Machinist, additional new and useful improvements in the machine for breaking and cleaning flax, hemp, and other like fibre yielding plants."—Dated 3rd July, 1863.)

George Waters Bell, of Stanstead, in the county of Stanstead, Farmer, "An improved self-closing Gate to be called Bell's improved self closing Gate fixtures."—(Dated 3rd July, 1863.)

Edward Trenholm, of Trenholmville, in the township of Kingsey, in the county of Drummond, Farmer and Miller, "New and improved machinery for the purpose of loading and unloading ships with flour in barrels, or any article contained in barrels, cases, bundles, or loose pieces to be called Trenholm's Barrel loading machine."—(Dated 3rd July, 1863.)

Alexander Dunn, of the city of Montreal, Tinsmith, "A new and improved apparatus for the better ventilation of Public Buildings, Houses and the like."—(Dated 3rd July, 1863.)

Robert James Alison, of the city of Montreal Tanner and Currier, "An improved machine for rossing Tan-bark."—(Dated 3rd July, 1863.)

Oren Kendall, of the village of Coaticook, in the county of Stanstead, Millwright, "An improvement in Water Wheels, to be called O. Kendall's Improved Turbine."—(Dated 3rd July, 1863.)

Alexander McDonald, of the city of Montreal, Carpenter and Joiner, "A new and improved apparatus for hoisting and lowering Barrels into and out of ships."—(Dated 3rd July, 1863.)

Richard Benjamin Ragg, of the city of Montreal, Gentleman, and Thomas William Emery, of the same place, Tinsmith, "A new and improved Ventilator to be called "Ragg and Emery's Ventilator."—(Dated 7th July, 1863.)

Samuel Morse, of the town of Milton, in the county of Halton, Founder, "A means of giving motion to certain parts of a threshing machine and separator."—(Dated 8th July, 1863.)

Dalrymple Crawford, of the city of Toronto, Merchant, "Improvements in oils and fats."—(Dated 8th July, 1863.)

Joseph Wray, of the city of Montreal, Undertaker, "A refrigerator for the preservation of dead bodies."—(Dated 13th July, 1863.)

William Berry, of the city of Montreal, Engineer and Sewing Machine Manufacturer, "An anti-fractional loop stopper for sewing machines."—(Dated 14th July, 1863.)

William Duncan Stephenson, of the city of Montreal, Gentleman, "A new and useful Tube and Valve atmospheric Churn Dasher."—(Dated 17th July, 1863.)

Edward William Colley, of Ste. Mary's, in the county of Perth, Tinsmith, "An Eave-trough and metallic moulding machine."—(Dated 28th July, 1863.)

George F. Beebe, of Sophiasburg, in the county of Prince Edward, Mechanic, "A Stump Extractor."—(Dated 28th July, 1863.)

Francis Milo, of Kingston, in the county of Frontenac, Painter, "A transplanter."—(Dated 28th July, 1863.)

James Chase, of Brooklin, in the county of Ontario, Melodeon Maker, "A machine for sinking field drains."—(Dated 31st July 1863.)

Levi V. Bowerman, of Hallowell, in the county of Prince Edward, Farmer, "A Waggon Box."—(Dated 31st July, 1863.)

Marshall McKay, of the city of London, Joiner, "A slat Splitting Machine."—(Dated 31st July, 1863.)

George Byron Brice, of Ingersoll, in the county of Oxford, Blacksmith, "A sulkey and seat spring called, Brice's Sulkey and Seat Spring."—(Dated 3rd August, 1863.)

Walter James Handscombe Rodd, Artist, and James Lovell, Printer and Publisher, both of the city of Toronto, "A process for the manufacture of paper and textile fabrics from the Helianthus or Sun-flower."—(Dated 3rd August, 1863.)

William Driscoll, of Merrickville, in the county of Grenville, Carpenter, "A double crank churning and Horizontal Boring Machine."—(Dated 6th August, 1863.)

James Hurlbut, of the township of Reach, in the county of Ontario, Yeoman, "A water meter."—(Dated 7th August, 1863.)

George Henry Meakins, of Belleville, in the county of Hastings, Machinist, "An improved Sewing Machine."—(Dated 12th August, 1863.)

David Lister, of the city of Toronto, in the country of York, Engineer "A new and useful hopper shaped Fire Grate for Locomotive Engines."—(Dated 18th August, 1863.)

William Henry Rodden, of the city of Toronto, in the county of York, Gentleman, "A sled Snow Shovel."—(Dated 22nd August, 1863.)

William Renslow Bowen, of the township of Haldimand, in the county of Northumberland, Machinist "A machine for the shrinking of waggon tires."—(Dated 22nd August, 1863.)

James Good, of the city of Toronto, in the county of York, Iron Founder, "An ash box for the description of stove known as the Albanian radiating stove."—(Dated 25th August, 1863.)

James Chase, of Brooklin, in the county of Ontario, Melodeon Maker, "A window curtain roller fixture called, Chase's magic curtain fixture."—(Dated 25th August 1863.)

George Slater, of Mount Forest, in the county of Grey, Carpenter, "An article called a weather strip to be attached to outside doors."—(Dated 26th August, 1863.)

Warren Fairman, of the township of Pittsburgh, in the county of Frontenac, Yeoman, "An improved Fence called Fairman's Fence."—(Dated 31st August, 1863.)

Edwin Roblin, of the township of Sophiasburgh, in the county of Prince Edward, Machinist, "An improved Snath,"—(Dated 26th August, 1863.)

William Wagner, of the city of Montreal, Provincial Land Surveyor and Architect, "A new and improved Kiln or Oven for burning bricks, tiles, &c."—(Dated 11th September, 1863.)

Kivas Tully, of the city of Toronto, Architect and Civil Engineer, "A valve Propeller."—(Dated 12th September,, 1863.)

Jehiel Churchill, Yeoman, and Thomas Churchill Teacher, both of the township of Pickering, in the county of Ontario, "A machine for the fabrication of baskets."—(Dated 22nd September, 1863.)

Charles McDonald, of the village of Embro, in the township of West Zora, in the county of Oxford Wool Carder and Clothier, "An improvement to the double or wool custom carding machine."—(Dated 28th September, 1863.)

Cyrus Dean, of the town of St Catharines, in the county of Lincoln, Engineer, "A machine for effecting more perfect combustion of fuel in the furnaces of Locomotives."—Dated 28th September, 1863.)

Daniel Shepard, of the village of Waterdown, in the county of Wentworth, Stave Cutter, "The Stave Cross Cutter."—(Dated 2nd October, 1863.)

Arthur Shaw, Esq., assignee of Jonathan H. Havens, Clergyman, both of the village of Queenston in the county of Lincoln, "A new and useful Window Lock."—(Dated 5th October, 1863.)

Charles Newton Crandell, of the township of Onondaga, in the county of Brant, Yeoman, "An improved Bee-hive, called "Crandell's Patent movable Comb and miller catcher Bee-hive."—(Dated 7th October, 1863.)

John Fear, of the village of Washington, in the township of Blenheim, in the county of Oxford, Wheel Wright, "An improved Pump, called "The Balance Pump."—(Dated 8th October, 1863.)

Alpha Soper, of the village of Orono, in the township of Clarke, in the county of Durham, Mariner, "An apparatus for the raising of sunken vessels called "Soper's portable sub-marine air tanks,"—(Dated 15th October, 1863.)

William Chambers, of the city of London, in the county of Middlesex, Engineer, "A combined cultivator and grain and seed depositor."—(Dated 15th October, 1863.)

Thomas Milner, of the city of Montreal, Sewing Machine Operator, "A new and useful Corder."—(Dated 26th October, 1863.)

Sylvester B. Jenks, of the town of Sherbrooke, Machinist, "A new and improved Egg-beater."—(Dated 26th October, 1863.)

Adolphe Leveque, of the city of Montreal, "A submarine elevating Bag."—(Dated 27th October, 1863.)

William Inglis, of the city of Montreal, Mechanical Engineer, "Improvements in the boiler and valve gear of the Steam Engine, to be called Inglis' improved Water tube Boiler."—(Dated 27th October, 1863.)

Charles François Painchaud, of the parish of Ste. Anne de Varennes, Physician, "An improved Horse rake."—(Dated 27th October, 1863.)

Marcel E. Lymburner, of the city of Montreal, Silver-plater, "A new and improved Skirtlifter."—(Dated 27th October, 1863.)

Frederick H. Kurczyn, of the city of Montreal, Gentleman, "A new water proof cement for paths, roofings, floorings, cisterns and water tanks."—(Dated 27th October, 1863.)

Henry Wood, of Montreal, Mechanical Engineer, Dame Margaret Lighton Kinmond, of the same place, widow and executrix of the late Richard Haselden, in his lifetime of the same place, Civil Engineer, and George Henry Fourdrinier, of the village of Lyn, in Upper Canada, Gentleman "A new and useful Excelsior Desiccator, and other apparatus for curing damaged grain, and for the manufacture of malt."—(Dated 27th October, 1863.)

Robert Highet, of the town of Cobourg, in the county of Northumberland, Ironmonger, "An improved iron axle tree, to be called Highet's patent iron axle tree."—(Dated 2nd November, 1863.)

John Vivan Jepson, of the city of Montreal, Gentleman, "A new and improved Steam pressure Guage."—(Dated 5th November, 1863.)

William W. Kitchen, of the township of Grimsby in the county of Lincoln, Yeoman, "A double single-tree."—(Dated 5th November, 1863.)

Samuel Smith, of the village of Acton, in the county of Halton, Cooper, "An improved machine for the jointing of staves for Barrels called "Smith's Stave-jointer."—(Dated 23rd November, 1863.)

Walter M. Lee, of Oshawa, in the county of Ontario, Carpenter, "An improved Bee-Hive called "Lee's dividing Bee-Hive."—Dated 23rd November, 1863.)

Thomas Bryan, the younger, and Mark Ashman both of the township of London, in the county of Middlesex, Chair and Agricultural Implement makers, "An improved Cradle for the cutting of Grain called "The Economic Muley Cradle."—(Dated 23rd November, 1863.)

Cyrenius Chapin Roe, of the town of Brantford, in the county of Brant, Machinist, "A Horse Power, called 'The Canadian Horse Power'."—(Dated 24th November, 1863.)

Christopher Lockman, of the city of Hamilton, in the county of Wentworth, Machinist, "An attachment for sewing machines for ruffling."—(Dated 24th November, 1863.)

Walter Jex Sutton, of the village of Oshawa, in the county of Ontario, Merchant, "An improved Rat-trap called "Sutton's Canadian Rat-trap."—(Dated 24th November, 1863.)

Thomas Bletcher, of the town of Peterborough, in the county of Peterborough, "A wood sawing machine."—(Dated 24th November, 1863.)

John Bell and David Bell, of the parish of St. Nicholas, in the county of Levis, Road Masters of Grand Trunk Railway Company of Canada, "A Reversible wing for Railway Crossings."—(Dated 26th November, 1863.)

Robert Edwin Walker, of the town of Stratford, in the county of Perth, Coach Builder, "An improved Straw-Carrier, called "The folding Straw-Carrier."—(Dated 18th November, 1863.)

John Coleman, of the village of Oshawa, in the county of Ontario, Wood Turner, "A machine called "A Nulling Gage."—(Dated 29th November, 1863.)

Richard Dover Chatterton, of the town of Cobourg, in the county of Northumberland, Esquire, "A safety coupling apparatus called "Chatterton's Safety Coupling for Carriages, Railway Cars, &c."—(Dated 29th November, 1863.)

James Ward, of the township of Bury, in the county of Compton, Yeoman, "A new and improved Flax puller."—(Dated 1st December, 1863.)

Henry Carrier, of Roxton Falls, in the county of Shefford, Cabinet-Maker, "A new and improved Bee-Hive."—(Dated 3rd December, 1863.)

Thomas Pringle, of the city of Montreal, Mill-Wright and Machinist, "A tidal grain Elevator."—(Dated 3rd December, 1863.)

John McAuley Gallacher, of the city of Montreal, Chemist, "A new and useful fertilizing compound to be called Gallacher's fertilizing compound."—(Dated 3rd December, 1863.)

Hyatt Summers, of the township of Thorold, in the county of Welland, Yeoman, "An improved Horse Rake called Summer's duplicate Horse Rake."—(Dated 9th December, 1863.)

Daniel Snider, of the township of Vaughan, in the county of York, Churn-Maker. "An improved Churn called Snider's Lever handle and flap dash Churn."—(Dated 10th December, 1863.)

James Henry Sampson, of the village of Belmont, in the county of Middlesex, Boot-tree Maker, "An improved Boot-Tree, called Sampson's Boot-Tree."—(Dated 14th December, 1863.)

Aime Nicholas Napoleon Aubin, of Belœil, in the county of Vercheres, Esquire, "A new and improved safety runner for winter vehicles."—(Dated 16th December, 1863.)

George Roger Prouse, of the city of Montreal, Merchant, "A new and improved Steam Radiator."—(Dated 19th December, 1863.)

Jonathan Hilton Havens, of the town of Guelph, in the county of Wellington, Clerk, "An improved Coupling for Railroad Cars."—(Dated 22nd December, 1863.)

Correspondence.

CANADIAN TIMBER AND THE GREAT EXHIBITION.

To the Editor of the Journal of the Board of Arts and Manufactures.

SIR,—Allow me to correct an error which occurs in an article under the above heading, copied from a recent number of the *London Canadian News* into the January number of your Journal. The error I allude to is the statement that, "Dr. "Hurlburt, the Commissioner who had charge "of the woods exhibited in the Canadian department of the last Exhibition, has nobly exerted "himself in bringing under the notice of the proper "authorities the valuable advantages possessed by "these woods, and to his labours we may, we "believe, attribute the high opinion the committee "of Lloyd's now entertain of them for shipbuilding "purposes. Dr. Hurlburt has well earned the "thanks of all Canadians for his perseverance in "attaching public attention in this country to one "of the most valuable products of the Province." It affords me pleasure to know that Lloyd's have placed the standard of Canadian Timbers over that of other countries for ship-building purposes; but I do not wish you or the people of Canada to suppose that the Province owes Dr. Hurlbert a debt of gratitude, or thanks even, for any services he may have performed in bringing before Lloyd's commissioners the superiority of Canadian Woods. On his first interview with them, in endeavouring to describe the various kinds, the Doctor found it rather a difficult task; for on showing them a Tamarack board he tried to impress upon them that it was White Cedar. This would not do for men of their practical knowledge, and they soon found out that all the Doctor knew of these woods—their proper names and qualities—might be put in a snuff-box and the lid shut down.

Finding they could not get the information they required, the Commissioners went home in disgust, leaving the Doctor alone (not in his glory) by the side of his Cedar-tamarack to mourn over his inability to discharge the duties of the honourable office our Government had placed him in.

All then went on quietly for a time, nothing occurring to disturb the quiet of our Wooden Commissioner, who went off on a pleasure excursion.

I think between one and two weeks elapsed when these same gentlemen paid another visit to the Canadian Court, and inquired of the courteous Secretary-Commissioner, Mr. Chamberlain, of Montreal, if there was no other person besides Dr. Hurlburt from whom they could obtain a description of the Canadian timber. Mr. Chamberlain introduced them to me as being well acquainted with their names and qualities. They remarked I had better get the Catalogue of the timber; I said No, there is no wood amongst them that I do not know the names of. The catalogue is of no use, as it does not correspond with the numbers on the timber—duplicate numbers being placed on totally different kinds.

I described to them a number of specimens that I considered most suitable for ship-building purposes. They said they would leave it to my judgment to choose some specimens for them, as, to use the language of one of them, "I had my head screwed on the right side." I selected for them five specimens, viz.—Black Walnut, Hickory, Black Birch, and Red and White Cedars—these kinds they have added to their list for ship-building purposes, as I recommended.

Now Sir, if there is credit due to any one, I claim the honour, as the above statement cannot be contradicted.

I attended the Exhibition with my World Renowned *Invalid Bedstead*—which by the way was pronounced by the principal surgeons and doctors of London, to be the best bedstead for patients suffering with asthma, consumption, spinal disease, heart disease and fractures of limbs, that have ever come before the British public. It was to show and explain this that I remained nearly eight months at the Great Exhibition, where I labored early and late for Canadian interests; and I now feel gratified if I have in any degree been the means of placing before the British public the woods selected by me.

I do not wish to extend this letter to an unreasonable length, or I might mention some other things for which we have no reason to thank the worthy Commissioner, but I forbear, hoping you will insert this in your next, and confer a favour on.

Yours truly,

THOMAS MCILROY,

Brampton, Feb. 10th, 1864.

[We do not hold ourselves responsible for the statements of our Correspondent, and felt some hesitation in publishing his communication; but as Mr. McIlroy has given it over his proper name we have thought it advisable to insert it, and will cheerfully give space in our next for a reply.—ED.]

Proceedings of Societies.

HAMILTON AND GORE MECHANICS' INSTITUTE.

The Annual Meeting of the members was held in the Reading Room of the Institute, at Hamilton, on Friday, the 26th February, 1864. In the absence of the President, F. J. Rastrick, Esq., A. Macallum, Esq., the Vice-President, occupied the chair; and the Secretary, Mr. Simons, read the Annual Report of the Directors, and the Report of Auditors, from which we make the following extracts:

Number of Members.

The number of members on the 1st of February, 1864, was	512		
Members have been elected during the year, numbering	122		
		634	
Deduct number of those who have retired during the same period		81	
			553
From which deduct also those over six months in arrear			69
And there remain in good standing on the books			484

Finance.

The receipts and expenditures for the past year are as follows:

Receipts.

	$	cts.
To Balance from last year	144	65
" Subscriptions to 1st February, 1863	1123	18
" Hall Rent	1011	62
" Donations	404	00
" Sundries	9	73
" Paper Sales	80	94
" Concert Fund	32	31
" Show Cards	30	00
" Rent	50	00
	$2886	43

Expenditure.

	$	cts.
By Cash paid for Magazines	46	55
" " Newspapers	323	78
" " Building Account	476	74
" " Insurance	48	40
" " Gas Account	356	65
" " Outstanding Debts	120	89
" " Salaries	713	00
" " Incidental Expenses	63	36
" " Interest Account	409	27
" " Wood Account	79	39
" " Postage Account	80	99
" " Printing Account	29	62
" " Book Account	27	61
" In hand	110	16
	$2886	43

(Signed) Jno. Murray, James Robb, } *Auditors.*

Library.

The number of Volumes added to the Library during the year has been	70
Of which 10 were purchased and 60 were donations.	
The total number of Volumes at the date of the last Report was	2739
To which add Volumes unbound	35
The number of Volumes in the Library on the 1st inst. was therefore	2844

The number of Volumes issued during the year has been 6,765, or an average daily issue of over 21 Volumes.

The following gentlemen presented books to the Institute during the year:—

John Brown, Esq.	in boards, 35	
	bound 57	
		92
F. J. Rastrick, Esq		2
Dr. Hamilton		1
		95

It is almost needless to add that a large number of Volumes require binding.

News Room.

For the gratuitous supply of the following Newspapers, the Board recommend that thanks to the gentlemen supplying them be recorded:—

[Here follows a list of 42 papers supplied gratuitously to the Reading Room by the publishers and others; and a list of 57 newspapers and periodicals purchased by the Institute.]

Among the gentlemen who have been liberal contributors to the Institute are John Brown and Isaac Buchanan, M.P.P., Esqs. The books which have been presented to the Library by the former form no inconsiderable portion of it; while to the latter the Institute is not only indebted for its handsome fountain, but for a large and valuable safe. Besides an expression of thanks, the only return for such generosity which the Institute has in its power to bestow is that of Honorary Membership, and the Board recommend that this be accorded to them.

To the Great Western Railway, who have regularly contributed in a manner worthy of the great interests committed to their charge, the thanks of the Institute are also due for their extremely liberal donation of $400.

The Board regret that the funds of the Institute did not admit of payment of the Instalments upon the Mortgage to the Canada Life Assurance Company being made as they became due, $400 being unpaid; and they think that some immediate steps should be taken to meet this and the balance of the outstanding debts, which now amount to $1077 93, for several of them have been incurred years ago, and a feeling of good will to the Institute has alone prevented a recourse to law to collect them. The Board hope that the members of the Institute will express an opinion as to whether it be advisable to make an appeal to the citizens generally for pecuniary aid, or to increase the fee for membership; for the fact cannot be concealed that the financial position of the Institute is critical, its income being insufficient to meet demands against it.

The Directors cannot omit mention of the death of their lamented co-director, Dr. Craigie. To say that they have missed his valuable counsel would but inadequately express the loss they have sustained. A good man, a sincere friend, and a valuable member of society has been taken away, and, although months have elapsed since he died, few of those who knew him can say that they do not miss him now.

In conclusion, the Directors have again to acknowledge the efficient services of Mr. Rutherford, the Superintendent. Notwithstanding the many duties which devolve upon him, they have been performed in a most satisfactory manner and highly creditable to himself.

It was then resolved that the report of the Directors be adopted; and also resolved unanimously, that in accordance with the recommendation of the Directors, as contained in their report, Isaac Buchanan, Esq., M.P.P., and John Brown, Esq., be declared Honorary Members of the Institute.

The Chairman then invited Members to express their views as to the best means to be adopted for relieving the Institute from the more pressing demands against it. Several gentlemen addressed the meeting, but the prevailing feeling seemed to be in favor of a suggestion of Mr. Masterton, that an energetic canvass of members and others should be made for extra subscriptions. Mr. Masterton felt assured that the call would be responded to by the merchants and all who were interested in the prosperity of the city. An active canvass of the city was also recommended for new members; it was also resolved, that the incoming Board of Directors be recommended to make early arrangements for a Festival, it being the opinion of the members present that a re-union of that description would be conducive to the welfare of the Institute.

The Meeting then proceeded to the election of Office-bearers and Directors, when the following gentlemen were appointed:—

President—Thomas McIlwraith, Esq.

Vice President—Thomas M. Simons, Esq.

Directors — Edward Hilton, John Ferrie, George Murison, W. H. Glassco, Alexander Harvey, H. M. Melville, Arch Macallum, K. Fitzpatrick, Thos. B. Townsend.

A vote of thanks was then unanimously passed to the retiring Office-bearers and Directors, when the meeting adjourned.

At a meeting of the Board, which was held on the 1st March, Alex. Stuart, Esq., was appointed Secretary; and Thos. B. Townsend having sent in his resignation as Director, J. A. Bruce was elected in his stead.

Useful Receipts.

American Whitewash.

Slake half a bushel of lime with boiling water, and cover the vessel to retain the steam. Strain the liquor, and add one peck of salt previously dissolved in warm water, 3 lbs. of rice boiled and ground to a paste, Spanish whiting, 8 oz., glue, 1 lb. Mix and add hot water, 5 gallons. Let stand a few days, and apply hot. It makes a brilliant wash for inside or outside work.

Paint for Out-buildings.

A cheap and durable paint, which is a better preserver of wood than oil paint, and has this advantage: it can be best used upon unplaned boards. This is the formula: Take one bushel of good whitewash lime, and slake it, and mix it into a fine, smooth whitewash. It will take at least forty gallons of water. Then add the following ingredients: 20 lbs. of Spanish whiting; 17 lbs. of rock salt; 12 lbs. of sugar. This mixture should be well stirred, and if mixed a day or two before using it is better. Indeed, it may be kept as long as desirable, and when needed for use, after thoroughly stirring, it is ready. It should be put on like any other whitewash, in a thin condition, and rough boards will require three coats to make a durable white color, which will stand the weather three or four years. It is one of the very best applications for shingles. Its color can be modified to a drab, by Rosendale cement, or to a yellowish shade by yellow ochre, and reddish by Venetian red; or any other tint, by some cheap color.

Balls for Scouring Clothes.

1st. Fuller's earth, 2 lbs., soap, 1 lb., turpentine, 2 oz., ox gall enough to make a paste.

2nd. Fuller's earth, whiting, and pipe clay, equal parts, ox gall enough to make a paste. These are used to remove grease from cloth, or stains from clothes.

Balls Used to Polish Furniture.

Melt 1 lb. of bees-wax, and 2 oz. resin, with ½ oz. of Alkanet root, add linseed oil and spirit of turpentine, of each 5 fluid ounces. Strain, and when setting, make balls.

Betton's British Oils.

Oil of rosemary, 1 part; tar, 8 parts: oil of turpentine, 16 parts; mix. Used as a liniment for cattle.

Black Brunswick.

Melt by heat 2 lbs. asphaltum, add 1 pint hot boiled oil, cool, and add 2 quarts of oil of turpentine. Used to black grates and iron work.

Prepared Glue.

A good glue is prepared by dissolving common glue in vinegar to the consistency desirable for use. It will keep for a long time.

To Sharpen Old Files and Rasps.

First boil them in soap, ley or a mixture of slaked lime and soda in water. This done, wash them in water and directly throw them into a vessel full of diluted sulphuric acid, formed of one part acid and six parts water; let them remain here for some time, the exact period being easily found by taking out a file, observing whether the nicks appear sharp or not; as soon as the sharpening is effected, the files must be taken out and washed in another vessel containing a solution of soda, about an ounce of soda to a pail of water.

How to Select Flour.

1st. Look at the color; if it is white, with a slightly yellowish, or straw-colored tint, buy it. If it is very white, with a bluish cast, or with white specks in it, refuse it.

2nd. Examine its adhesiveness; wet and knead a little of it between your fingers; if it works soft and sticky, it is poor.

3rd. Throw a little lump of dry flour against a dry, smooth, perpendicular surface; if it falls like powder, it is bad.

How to Cure Meat.

To one gallon of water take one and a half pounds of salt, one-half pound of sugar, one-half ounce of saltpetre, one-half ounce of potash. In this ratio the pickle to be increased to any desired quantity. Let these be boiled together, until all the dirt from the sugar rises to the top and is skimmed off. Then throw it into a tub to cool, and when *cold* pour it over your beef or pork to remain the usual time, say four or five weeks. The meat must be well covered with pickle, and should not be put down for at least two days after killing, during which time it should be slightly sprinkled with powdered saltpetre, which removes all the surface blood, &c., leaving the meat fresh and clean. Some omit boiling the pickle, and find it to answer well; though the operation of boiling purifies the pickle by throwing off the dirt always to be found in salt and sugar. If this receipt is properly tried, it will never be abandoned.

To Prepare Bladders.

Cut off the loose fat, wash in a weak solution of chloride of lime, and rinse in clear water. When drying blow them tight and keep them expanded. Used to tie over jars, pots, &c., and to contain powdered pigments.

Blacking for Harness.

1st. Melt together 8 oz. bees-wax and one oz. oil of turpentine, add 2 oz. ivory black, 1 oz. Prussian blue, and ¼ oz. copal varnish. Apply with a brush and polish with a duster.

2nd. Isinglass or gelatine, and indigo, of each ¼ oz; logwood, 4 oz.; soft soap, 2 oz.; glue, 4 oz.; vinegar, 1 pint; mix by heat, and strain.

For Dress Shoes.

Gum 1 oz., lump sugar ½ oz., ivory black ½ oz., water a sufficient quantity. Dissolve the gum and sugar, grind the black finely with the solution, and apply to the leather with a sponge. No polishing is required.

Boot Powder.

French chalk or Venetian talc, powdered. Applied to the heels of new boots, to facilitate the trying them on.

Boot and Shoe Blacking-paste.

1st. Ivory black 1 lb., treacle 12 oz., sulphuric acid 1 oz., sweet oil 2 oz. Mix the black and treacle well, add the oil, then, by degrees, the acid, and as much water as may be required.

2nd. Ivory black 20 oz., treacle 16 oz., linseed oil 5 oz., sulphuric acid 3 oz., indigo 2 drachms, mucilage ½ oz. Mix as before.

Liquid.

Prepared as paste-blacking, afterwards adding vinegar or sour beer sufficient to render it ready for use.

For liquid blacking the ingredients are required to be finely divided, and are best mixed by passing through a paint mill. On the large scale these particulars are minutely attended to, and hence the superiority of the products. A small portion of blue improves the appearance of all blackings, and should be added where effect is desired.

To Waterproof Boots.

Boiled oil 1 pint, bees-wax, rosin, turpentine, each 3 oz.; melt the solids, add the oil, and when cool, the turpentine. Used to prevent damp feet, by soaking new boot soles, and allowing them to become thoroughly dry.

Booth's Axle Grease.

1st. Water 1 gallon, soda ½ lb., palm oil 10 lbs.; mix by heat, and stir till nearly cold.

2nd. Water and rape oil, of each 1 gallon, soda ½ lb., palm oil ¼ lb.

Brass Alloy.

1st. 6 oz. zinc to 16 oz. copper, makes a good brass, that bears soldering well.

2nd. 8 oz. zinc to 16 oz. copper, is ordinary brass, softer than the former.

The ordinary range of good yellow brass, that files and turns well, contains 4½ to 9 oz. of zinc for every pound of copper. With additional zinc, it is harder and more crystalline; with less, more tenacious, and hangs to the file like copper.

To Clean Brass.

1st. Rub over it tripoli, or rotten stone, with sweet oil, and a small proportion of spirits of turpentine added, and polish with leather.

2nd. Use a solution of oxalic acid, or of roche-alum boiled in water.

3rd. Sulphuric or hydrochloric acids will clean brass; but it speedily tarnishes again.

Brazil Paper.

Dip paper in a strong decoction of brazil-wood, and dry it. Used as a test paper; turns yellow by acids, and purple or violet by alkalies.

Selected Articles.

RELATION OF SCIENCE TO ELECTRO-PLATE MANUFACTURES.

By George Gore, from *Popular Science Review.*

* * * * *

In the present period of scientific progress, when the attention of men of business is so frequently attracted to some new invention or discovery which appears likely, if not to supersede their particular occupation, at least to have some influence upon it, it is the interest of every such person to watch the progress of science and to seize it for his own advantage, instead of allowing others to do so, and thereby divert his trade into other channels.

No art nor manufacture is so perfect as to be exempt from the influence of discoveries and inventions, and no man can produce so perfect an article, but that by the aid of science a better may be produced.

In what consists the great success of applying science to trade?—simply the influence of demonstrable truth. We know that if we have once discovered all the laws or conditions of some improved process or result in a manufacture, the reproduction of exactly the same conditions will hereafter enable us to invariably produce the same result. In this respect science differs from empiricism, for empirically working a process we are ignorant of the condition or laws which are operating, whilst with a scientific knowledge we understand those laws, and can direct them to our particular purposes. In the process of electro-plating, we understand the laws of the phenomena, and can direct them so as to obtain silver of a hard or soft quality, brittle or tough, crystaline silver, &c., according to our pleasure; but if we had only an empirical knowledge of the subject, we could not thus vary the process.

The great success of coating articles with silver by the electro process depends in a very large measure upon the demonstrable fact that alkaline cyanides have a strong affinity for noble metals, and but little affinity for base metals; no other substance possesses this quality, or at least in so eminent a degree. In proof of this fact, I have twisted together two similar-sized and clean pieces of very thin wire, the one piece being gold and the other iron, and immersed the double wire in a solution of cyanide of potassium; in about six weeks the so-called "indestructible" metal, gold, was all corroded and dissolved, whilst the base and "destructible" metal, iron, was as bright and perfect as ever. Further if two pieces of wire, the one being of gold and the other of iron, are connected with the end of a galvanometer, and their extremities immersed in a solution of cyanide of potassium, or other alkaline cyanide, the noble metal will be found to be electro-positive to the iron; and a galvanic battery of weak power might even be constructed of those three elements, which would present the singular anomaly of generating an electric current *in an opposite direction* to that in all other cases obtained.

So great a resistance has iron, and so strong an affinity has silver to be dissolved by a solution of cyanide of potassium, that if a current of electricity is simultaneously sent through both into that liquid, the electricity will pass freely as long as there is a portion of the silver remaining, and the silver will dissolve rapidly; but as soon as all the silver has dissolved the current will be nearly stopped, and the iron; instead of dissolving, will liberate bubbles of gas.

This is precisely the condition that was required for the success of electro-plating, viz., a liquid which should not corrode (as *acid* liquids do) the articles of base metal immersed in it, and should easily dissolve and retain in solution the noble metals with which the articles were to be coated, and at the same time conduct electricity readily, and not lose those qualities by exposure to atmospheric air; alkaline cyanides are the only known liquids that fulfil all these conditions.

The success of an important enterprise has frequently depended upon an apparently trivial circumstance, and it was even so with the important process of silver electro-plating in the early period of its development. In the year 1838, Messrs. G. R. & H. Elkington were engaged, commercially, in coating military and other metal ornaments with gold and silver, by immersing them in various solutions of those metals, some of which were composed of ferrocyanide of potassium, and also carbonate of potash, with the oxides of gold and silver dissolved in them.

By this process of simple immersion, although the action was electrical, the articles received only an extremely thin film or coating of the precious metals, and it was highly desirable that the thickness should be considerably increased, on account of the greater degree of durability required.

About this period, professor Jacobi, of St. Petersburg (October, 1838), and Mr. Spencer, of Liverpool (May, 1839), published their processes of electrotype for copying engraved plates in copper by separate currents of electricity, by means of which a firm coating of copper, of considerable thickness, could be readily obtained. From the moment that this method of obtaining *thick* deposits of firm copper by means of a *separate* electric current was made known, Mr. John Wright, a surgeon of Birmingham, and Mr. Alexander Parkes, a modeller and experimentalist, in the employ of Messrs. Elkington, were constantly engaged in experiments, to obtain thick deposits of silver and gold by similar means. A great variety of liquids were tried for the purpose, but all the solutions of gold and silver operated upon gave only a thin deposit of firm metal, which, as it increased in thickness, became loose in aggregation, and assumed the character of a dark-coloured or black metallic powder, completely useless for the purpose required.

At this particular juncture, Mr. Wright met with the following passage in Scheele's "Chemical Essay" (pages 405 and 406). Speaking of the solubility of the oxides and cyanides of gold, silver, and copper, it says, that "if after these calces" (*i. e.*, the cyanides or ferrocyanides of gold and silver) "have been precipitated, a sufficient quantity of precipitating liquor be added, in order to redissolve them, the solution remains clear in the open air, and in this state the aerial acid" (*i. e.*, the carbonic acid of the atmosphere) "does not precipitate the metallic calx."

This liquid, "the precipitating liquor," is obtained by burning dried blood with potash in an iron vessel, cooling the melted product, and dissolving out its soluble portion by water; the resulting solution contains cyanide and ferrocyanide of potassium, the latter of which is commonly known as "yellow prussiate of potash."

Mr. Wright had been working during several months, expressly to obtain a thick deposit of silver, with the aid of a separate current, before he met with the above passage. He then took a solution composed of chloride of silver, dissolved in an aqueous solution of ferrocyanide of potassium, and succeeded in obtaining what had never been obtained before,—a *thick* deposit or coating of *firm* silver by electrolytic action.

The first article that received the successful coating was a small vase, which was coated at Mr. Wright's residence, and the next was a figure of a small kid. The mode of proceeding adopted by him in these cases, was to place the article in the silver solution contained in a porous vessel (a common garden-pot) immerse the porous cell in an outer vessel containing dilute sulphuric acid, place a cylinder of sheet-zinc around the porous vessel in the dilute acid, and connect it by means of a copper wire with the article to be coated; the electrical action then commenced, and the article gradually acquired a thick coating of silver: this method is commonly known as the "single cell" process. It was about a month after this when a solution of actual cyanide of silver and potassium, the substance now universally used for electro-plating, was first employed by Mr. Wright for the purpose, although cyanides, in several forms, had been used both for coppering and silvering by simple immersion, without the aid of a battery or zinc, about sixteen months previously.

The above-mentioned successful results were immediately submitted to Messrs. Elkington, who made arrangements with Mr. Wright for the security of the discovery and invention, and patented it on March 25th, 1840; this patent was the basis of all successful electro-silver-plating and gilding. A handsome remuneration was made to Mr. Wright by this firm for his invention, and an annuity paid to his widow (afterwards the wife of Mr. Cammell, of Sheffield) after his death. A separate battery, to generate the electric current, was not employed until January, 1841, nearly a year after the date of the patent; and, in the early stages of the process, the silver solution was employed hot; now it is always used cold. Nickel silver was always the substance employed as a base for receiving the deposit from the earliest period of electro-silver-plating, or at least soon after the date of Mr. Wright's patent. The edges of articles are made of the best quality of nickel silver, which is very white and very hard, suitable for resisting friction, whilst the body part, or mass of the article, is made of a commoner quality, not only because it is less expensive, but also because it is worked more easily.

Electro-deposition of the precious metals was *theoretically* accomplished long before cyanide of potassium was known; as early as the year 1805, Brugnatelli "gilt, in a complete manner, two large silver medals, by bringing them into communication, by means of a steel wire, with the negative pole of a voltaic pile, and keeping them, one after the other, immersed in ammoniuret of gold, newly made and well saturated." We should therefore not condemn theoretical science, because we are not able, even with fair and persevering trial, to apply it to any useful purpose, but *wait patiently* until circumstances ripen for its application. Many discoveries and inventions which are inapplicable in one state of knowledge, become applicable by the progress of science and art; the idea of electro-gilding, first attempted in 1805, by means of a solution of ammoniuret of gold, had to await the discovery of cyanide of potassium, in 1812, before it could be practically applied; and the idea of an electric telegraph, first attempted by the aid of frictional electricity, had to abide the development of the voltaic battery, and the discovery of electro-magnetism, before it could be successfully carried out.

A great number of experiments had to be made, and many serious difficulties to be surmounted, before practical and remunerative electro-plating was an accomplished fact. One of the chief difficulties consisted in making the silver adhere firmly to all parts of the underlying metal; this want of adhesion arose partly from the employment of too many cells in the battery, and partly from the use of too strong mercurial solution in preparing the surface, and was eventually overcome by lessening the number of cells, and dipping the previously cleaned articles in a *very weak* solution of mercury immediately before placing them in the plating liquid. If the deposit of silver is not firmly attached to the whole of the surface of the article, it is apt to rise in blisters and peel off when the articles are subjected to the after-process of burnishing. This non-adhesion of the silver was particularly apt to occur with articles made of Britannia metal, and with this particular alloy it was not overcome for several years; it was then effected by first coating the articles with copper, by electro process, in a solution composed of sesquicyanide of copper dissolved in an aqueous solution of cyanide of potassium, a liquid invented by Mr. Wright for the purpose of coppering articles of iron previous to silvering them, and patented in September, 1841. The method now in use for coating Britannia metal is different; it consists in first forming a thin deposit of silver upon the article, by a powerful battery, in a solution containing but little cyanide of silver and much cyanide of potassium, thus transferring the article to the ordinary silver-plating liquid, and completing the deposit therein in the ordinary manner: this process was first employed by Mr. Thomas Fearn, from whom it was purchased by Messrs. Elkington for a considerable sum of money.

Another difficulty arose in a tendency of the deposited silver to assume a granular or semi-crystalline state upon the surface of the articles, especially at their edges, during the process of deposition; this was overcome by employing proper proportions of the ingredients in the plating solution, and carefully adapting the power of the battery to the size of the articles. In addition to these difficulties another was experienced; the article after being plated and finished, in a few months became much discoloured: this was a consequence of too rapid deposition. And a still more serious difficulty, which required several years to surmount, arose from the opposition of the manufacturers of plated wares of Sheffield to the new method of plating; they objected to take licenses for the new process; but now the electric method is the only one they employ. A dispute also arose between Messrs. Elkington, of Birmingham, and Ruolz, of Paris, the latter having obtained a knowledge of the process and taken out a patent for France a short time before Messrs. Elkington, and a trial at law resulted, in which it was established that Messrs. Elkington were the original patentees of the cyanide of potassium solution, and it was finally settled by a compromise between Messrs. Ruolz and the patentees for the use of the process. In consequence of these and other difficulties, it was at least seven years before it became both practical and remunerative.

In electro-plating the deposited metal spreads as readily over the most elaborately engraved or figured surfaces as over the plainest forms, and in consequence of this property the new process caused a new and great extension of trade in plated articles to spring up, because articles of complicated forms, or with elaborate designs upon them, could not be made by the old method without very great expense. By the new method they were first cast of the requisite shape in German silver, and then coated with the precious metals, whereas by the old plan they required to be made from flat sheets of copper previously plated with silver by fusion; the different parts of a complex figure were first stamped into the requisite forms separately, and then the various pieces soldered together to make the entire figure; and thus a figure which could be made entire in a single piece by the new mode, required to be formed of several or many pieces by the old one, and after a moderate amount of wear the lines where tho parts were soldered together became visible, and greatly disfigured the object, and those lines could not again be covered with silver. By the old plan, every portion of a figure which was "undercut," *i.e.* in which the external parts overhung the internal ones, as the mouth or ear of an animal, for example, required to be made of several pieces, whilst by the new method such parts could be made entirely in one piece with the whole figure, and be coated with the precious metals all over, without any seam or joining. A great scope for the extension of beauty and taste in designs of metallic figures and vessels thus commenced, which has gradually extended itself to electro-plated articles of a very moderate price, such as tea-pots, coffee-pots, cream-jugs, sugar-basins, &c., the base of which consists of Britannia metal; and the electro process has thus enabled persons of limited incomes to enjoy the use of articles of elegant design previously inaccessible even to the wealthy.

The next event of importance in the history of electro-plating consisted in the applicatiion of magneto-electricity instead of electricity from a voltaic battery to depositing purposes. In August, 1842, J. S. Woolrich took out a patent for the use of a magnetic-electric machine instead of a voltaic battery for electro-plating. This machine, which is in use at Mr. Fearn's electro-gilding works, Birmingham, and various other places, consists of a revolving wheel containing at its outer edge a number of short bars of soft iron, upon which are wound coils of insulated copper wires, giving to the bars the appearance of a series of reels; the wheel is surrounded by a set of powerful steel magnets, which are immovable, and fixed in a case, and have their ends, or poles, all pointing towards the wheel, so that as the wheel revolves, each of the reels of wire with its iron core, passes in succession between and very close to the poles of each magnet. As each of these coils approaches a magnet, a current of electricity is developed in one direction, and as it leaves the magnet a current is produced in the opposite direction, and similarly with the whole of the coils. All the corresponding ends of the coils are connected with the axle of the wheel, from which the positive electricity of all the spirals is collected by a metal spring which presses upon the axle and conveys the current onwards to the depositing solution; and all the opposite ends of wire are connected with an apparatus on the axle called a communicator or break, and this apparatus collects all the negative electricity of those ends and transmits it to another spring which conveys it to the plating vat. And thus, by quick rotation of the wheel, a rapid succession of electric impulses are generated, which are employed for plating purposes in the same manner as the ordinary voltaic current. The above machine is a very convenient source of electricity where a cheap motive power is at command, and where the quantity of electricity required is not very great.

The surface of silver deposited from the ordinary cyanide of silver and potassium plating solution has a frosted or snow-white appearance, which in many cases has to be burnished and made bright by mechanical means. This, with articles of highly figured design, and also with the interior of certain articles that required to be made bright, was a great disadvantage, as the process of burnishing is tedious, and with the interiors of vessels also very awkward to perform. As with the difficulty in the early period of the electro-process in obtaining thick deposits of firm silver, a little circumstance was the cause of that difficulty being overcome, so was it with this obstacle, and it happened as follows:—In the process of copying figures for electro-typing by a mixture of wax and resin, the surface of the wax is covered with a film of phosphorus by means of a solution of phosphorus in bisulphide of carbon. It was observed by Mr. Millward, at Messrs. Elkington's establishment, that when these prepared wax moulds were put into the cyanide of silver-plating solution for the purpose of receiving a coating of silver, other articles, such as spoons, forks, &c., which were being plated in the same vat, and especially those nearest to the wax moulds, acquired a coating, more or less perfect, of *bright* silver, which occurred sometimes in patches, and sometimes extended all over the articles, instead of the ordinary snow-white deposit. This circumstance attracted attention, and induced Mr. Millward to try the effect of adding bisulphide of carbon alone to the plating liquid. Considerable success soon resulted; but at this juncture the secret escaped, and in consequence thereof a patent was taken out, March, 1847, by Mr. Millward and a person of the name of Lyons, who had acquired a knowledge of the secret, for producing bright deposited silver by means of bisulphide of carbon. This process has been constantly employed ever since, and is now in extensive use, and with its aid the silver is rendered very bright and the amount of burnishing required very considerably reduced, but it has the disadvantage of making the deposited silver much harder. Bright copper had been observed about two years before bright silver, and occurred whenever a large number of phosphorized wax moulds were put into a solution of sulphate of copper to receive an electro-deposit of copper. Other substances possess the quality of imparting brightness to deposited silver, but none in so satisfactory or eminent a degree as bisulphide of carbon: among these may be mentioned bicarbonates of the alkalies and many organic compounds, and it is probable that the brightness depends upon a *gaseous* body being dissolved in the plating liquid.

No important improvement in the electro-deposition of silver has since been made; and the process at present in use may be briefly described as follows:—A certain quantity of pure or virgin silver in a granulated state is taken, allowing about one ounce for each gallon of plating solution required (the actual proportions, however, in use by manufacturers vary from a quarter of an ounce to two or three ounces of silver per gallon), a warm mixture of four parts of pure and strong nitric acid and one part of water, contained in a capacious vessel of glass or stoneware, is placed in a warm situation, where the air-fumes may readily escape without injuring persons or furniture; and small quantities of the silver are added, from time to time, as fast as it dissolves, care being taken not to add it in too large quantities at a time—otherwise waste will ensue—until nearly all the silver is dissolved. It is advisable to employ a deficiency of the acid mixture in the first place, and to add more of it towards the end of the process, taking care not to add more than will dissolve all the silver, but rather to leave a little silver undissolved, even with the liquid quite hot; by this means, the presence of much free acid is avoided, and an after-loss of cyanide of potassium and escape of poisonous fumes of prussic acid prevented. Each ounce of silver requires nearly one and three-quarter ounces of strong nitric acid to dissolve it.

The solution of nitrate of silver obtained is now considerably diluted with *distilled* water in a capacious vessel of stoneware, and there is added to it, in portions at a time, with stirring, a solution of cyanide of potassium of moderate strength as long as a white precipitate or cloud, which is cyanide of silver, is produced; this precipitate is allowed to subside between each addition, and it is very particular that as the precipitate produced becomes less copious the cyanide of potassium solution should be added more sparingly and at longer intervals of time, and that on no account should that liquid be added after it fails to produce a precipitate. This point requires some care and experience, but may be known by the cyanide of potassium solution producing a *transparent* but slightly brown appearance where it passes into the white and cloudy liquid: this transparency is caused by its dissolving the suspended fine particles of cyanide of silver; if by accident too much cyanide of potassium has been added, a cautious addition of nitrate of silver solution (for which purpose a little should be reserved) in a similar manner, will bring it back to the neutral or proper point: the whole is then well stirred and allowed to subside until the supernatant liquid is quite clear. Each ounce of silver dissolved requires nearly half an ounce of cyanide of potassium of ordinary quality to precipitate it.

The supernatant liquid is then filtered through a calico bag, the sediment put into the bag, and the bag filled five or six times successively with spring water. A small quantity of hydrochloric acid is added to the filtered liquid to precipitate any dissolved silver (of which there is always more or less) in the form of chloride of silver: this is allowed to subside, the clear liquid is thrown away, and the sediment retained on account of its silver.

Now, the wet contents of the filter are transferred to a capacious vessel, and to it is added, with constant stirring, a strong solution of cyanide of potassium until it is all dissolved, a memorandum of how much cyanide of potassium is used being made, because the amount varies greatly in different cases and is dependent upon the quality of that substance. If the cyanide of potassium is of ordinary quality, each ounce of silver employed will require about two or two and a half ounces of cyanide of potassium to re-dissolve it; whatever the quantity required to re-dissolve the cyanide of silver may be, an equal additional amount should now be added to the mixture to constitute *free* cyanide, and sufficient water then added to dilute the solution to the proportion of one ounce of silver per gallon, or any other strength that may be desired: the solution now only requires to be filtered and it is ready for use.

In coating articles with silver by means of this liquid a voltaic battery is employed: the battery varies in its arrangement in different establishments and in different cases, but always contains dilute sulphuric acid and plates or bars of zinc. The battery most commonly used consists of a sheet of copper and a plate of amalgamated zinc immersed in a mixture of oil of vitriol and water contained in a large stoneware jar; the zinc plate is connected by a copper wire with the articles to be coated, and the sheet of copper is connected by another copper wire with a sheet of pure silver, which is hung in the plating solution near the articles. In this arrangement the electricity is generated by the action of the acid and water upon the surface of the zinc, and passes from the zinc through that liquid to the sheet of copper, then along the copper wire to the sheet of silver, then through the plating-liquid to the articles to be coated, and back to the zinc plate by the other copper wire.

The electricity in passing from the surface of the sheet of silver into the plating-liquid causes the cyanide of potassium to act upon that metal and dissolve it, and at the same time the electricity passing into the surface of the articles decomposes the solution in contact with them and causes it to yield up its silver to those surfaces; and these two simultaneous actions are perfectly equal in amount, *i. e.*, for every ounce of silver dissolved on one side an ounce of silver is deposited on the other, and thus the amount of silver in solution remains unaltered for an indefinitely long period. The only alteration that takes place in the liquid is that it becomes unequal in composition in different parts—that portion of it about the dissolving-plate becomes richer in silver and specifically heavier, and therefore sinks to the bottom of the vat, whilst that about the articles becomes poorer in silver, specifically lighter, and rises to the surface; and this inequality renders it necessary to stir the liquid occasionally, otherwise the quality of the metal deposited upon the articles would be different at the upper ends to what it is at the lower ones.

In most electro-plating establishments two or three such battery-cells as those described are used for depositing silver, and in the early period of plating a much larger number was used. When several cells are employed, the zinc plate of the first one is connected by a wire with the copper of the next, and so on throughout the series, leaving the extreme copper at one end and the extreme zinc of the other to be connected with the vat in the manner described: by this means there is a course opened throughout for the electricity to circulate, and each additional cell or pair of plates imparts an additional impulse to the electric current.

Several other kinds of voltaic batteries besides the one described are also extensively used in electro-deposition; there is Smee's battery, which contains a sheet of platinized silver instead of the sheet of copper; Grove's, which consists of amalgamated zinc in dilute sulphuric acid and a sheet of platinum in strong nitric acid, the two liquids being kept from mixing freely, but allowed to touch each other by means of a separating diaphragm or cell of unglazed (*i. e.* porous) earthenware; and Bunsen's battery, which is similar to Grove's; graphite (obtained from gas retorts) being, however, employed instead of the sheet of platinum. Daniell's battery, which consists of amalgamated zinc in dilute sulphuric acid, and copper in a solution of sulphate of copper, the two liquids being separated by a porous partition, is not much used for electro-plating; and the preference of one battery over another for electro-deposition depends partly upon the bias of the plater in favour of that particular battery, but chiefly upon the special purpose for which the battery is intended; in cases where great resistance is offered to the passage of the electric current, as in solutions for coating articles of iron, &c., with brass, the more powerful batteries of Grove and Bunsen are used. Whichever of these batteries is employed, and whatever may be the metal intended to be deposited, the article to receive the coating is always connected with the *zinc* plate of the battery, and the metal to be dissolved is connected with the copper, silver, carbon, or platinum, as the case may be.

All metallic articles that are to be coated with silver or other metals by electro-process require to be perfectly cleaned and prepared before being placed in the plating-liquid, otherwise the metal deposited upon them will not adhere properly. To clean them they are at first immersed in a boiling solution of caustic potash to remove greasy and tarry matters; then, if they are formed of German silver, brass, or copper, they are washed in water, dipped momentarily into aquafortis, again washed in water, then dipped into a very dilute solution either of nitrate of mercury or of cyanide of mercury and potassium, and immersed in the silver-plating vat. In cases where it is desired to know the quantity of silver deposited upon them, they are weighed after cleansing, and also at intervals during the process of deposition. Articles formed of Britannia metal, lead, tin, and similar metals or alloys, are not dipped into aquafortis, but immersed in a weak silver solution immediately from the caustic potash liquid, to receive a thin preparatory electro-coating, and then transferred to the ordinary silver vat. The thickness of silver deposited upon articles is frequently very minute, as may be judged from the fact that full-sized iron snuffers are sometimes wholly coated with silver for two-pence each pair, and other common articles at proportionate prices.

After receiving the coating of silver, much remains to be done to the articles before they assume a saleable condition, they have to be "scratched" by a bundle of revolving fine brass wires to remove asperities; burnished to make them bright; in some cases they have to be "oxidized" in particular parts. This consists in wetting those parts with a solution of bichloride of platinum, which blackens those portions; and, in other cases, different parts, as, for instance, the interior of cream-jugs, sugar-basins, &c., have to be electro-gilded. And in cases where portions of the exterior have to be gilded, the remaining surface is coated with copal varnish, to prevent the gilding from taking place on those parts. And, finally, the articles are washed in clean water, and at once immersed in hot, dry sawdust, which absorbs the moisture and dries them quickly, before they have time to tarnish. The processes of preparing and finishing articles are, in nearly all cases, much more troublesome than that of plating itself.

These various points of information are only the *outlines* of the process of electro-plating, and for the details the reader is referred to the various published works on the subject.

The scientific perfection of electro-deposition consists in its definite mathematical character. Under carefully prepared conditions, all the chemical actions that occur in the battery and plating-vat stand in certain precise mathematical relations to each other; for every 32½ parts of zinc dissolved in each cell of the battery, there are 108 parts of silver dissolved and 108 parts deposited in the vat; or if it be a copper solution, 31¾ parts of copper, or an antimony solution, 40 parts of antimony; for every 32½ parts of zinc dissolved in the battery, there are 9 parts of water decomposed, and if it be a Smee's, or a common zinc and copper cell, there is 1 part of hydrogen set free at the negative silver or copper plate; and similarly with all the chemical actions taking place in the various battery-cells and depositing liquids. Each action in a given circuit stands in a certain mathematical relation to each and all the others, and this is known as the law of "definite electro-chemical action."

The artistic advantage of electro-deposition consists in the great facilities it affords for the exercise of taste and design, and for more accurately imitating the forms of nature, as in rocks, animals, fruits, trees, &c. And its domestic utility and household economy consist in the greater degree of cleanliness and beauty obtained at so moderate a cost.

As long as arts and manufactures are left to be directed and improved by simple experience, their progress is extremely slow; but directly scientific knowledge is successfully applied to them, they advance with astonishing speed. For years the manufacture of plated metal wares existed without making any material progress; but, on the application of science, its progress became surprising, and called the attention of all persons to the new process.

Thirty years ago electro-plating for commercial purposes was unknown; but as soon as Jacobi and Spencer made known the results of their electrical experiments upon metallic solutions, the manufacture of plated wares began to advance; and so rapid has been its progress, that, at the present time, thousands of persons are employed in it, and electro-plate productions are used in all parts of the world.

Thus it is that man, to some extent the servant, but hoping to become more the master of nature, is daily striving to acquire a greater knowledge of the workings of natural forces, and to apply those forces to human benefit; he first becomes the obedient disciple of nature, in order that he may ultimately become its director; and so great a degree of success has already resulted from this course, that we are justified in expecting that, at some future time, science will extend its helping hand to all trades and manufactures, and that ultimately scientific principles will be universally recognized as the great "regulators of productive industry."

THE MANUFACTURE OF VEGETABLE OILS.

Whether considered as a medium for the application of colour in works of art, or of utility as the principal source of illuminating power where gas is unattainable, or as the lubricator without which all machinery, from the simple clock of the cottager to the most complicated and powerful engine, would be all but useless, the value of oil is incalculable; and a few words on its manufacture and the process of refining it cannot be uninteresting. To furnish these we were favoured with a visit to the extensive works of Messrs. Pinchin and Johnson, who have two sets of premises, one for the manufacture of oil, called Albert Works, on the Middlesex bank of the Thames, near Hammersmith, the other for refining purposes, in Cable street, St. George's-in-the-East. The oils they manufacture are rape and linseed only, but their refining operations extend to the animal as well as the vegetable oils. The Albert Works have a river frontage of about 200 feet, and recede from the bank about the same distance, thus covering an area of more than three-quarters of an acre. The building consists of four storeys; the manufacture is carried on in the lowest, the upper ones being used as storage for the grain, which is hoisted from the barges by means of cranes worked by steam power. The first object which arrests the visitor's attention is the engine, which is a small but beautiful piece of machinery of forty-five horse-power. With the exception of the workmen's meal-times and Sundays, it is always at work night and day. From the engine-room the visitor is conducted to the manufactory, where, as soon as he can recover from the irritation in the eyes produced by the volatile oil escaping from the heated and bruised seed, the whole process presents itself before him.

The grain is received from the upper floor into a *hopper*, in which is a screen, the agitating of which removes all foreign substances and suffers the seed alone to pass through its meshes. This falls between two faced, hollow, iron cylindrical rollers, which are heated by steam, which as they revolve crush, or, as it is termed, *open the grain*. Thus opened it is thrown on to a *steel plate calf* fixed on a bed of solid masonry, which is constantly traversed by a pair of edge-runners weighing from eight to nine tons and travelling at the rate of sixteen revolutions per minute. They revolve in a strong framework attached to a vertical axis, which also, by means of a large cog wheel at the top, which engages a wheel upon the main shaft, revolves slowly. A double motion is thus given to the grinders or edge runners, one on their own axis and one on the iron plate, which we may consider the nether millstone. A raised border or rim prevents the seed from escaping from the plate, and the paste is brought regularly under the stones by means of rakes or sweeps attached to the vertical framework and revolving with the runners on the surface of the plate. When the grain has been sufficiently ground, the paste is brought to an open portion of the rim, and falls over into perforated troughs placed to receive it. Through the perforations a considerable quantity of oil oozes, and this, being considered purer than that which is obtained by expression, is conveyed to a cistern set apart for the purpose. The paste is next put into a jacketed kettle, that is, one surrounded by a hollow chamber into which steam is injected for the purpose of heating it. Within this kettle is an agitator or stirrer, so that all the paste is in turn brought to the heated surface and raised to an even temperature. Having remained in the kettle six minutes, it is collected in woollen bags about eighteen inches long and six inches wide, each bag is placed between four layers of press hairs (a kind of horse-hair mat), and eight of them being thus prepared, they are ranged in two perpendicular rows between four grooved shelves of a hydraulic press. The pumps worked by the steam-engine are set in motion and a pressure of four hundred tons is speedily realized. The oil being expressed, runs into an underground tank, the bags are then withdrawn, and on being removed the residue presents itself in the form of what is known as linseed cake. These cakes are placed in a rack to cool, when they become so hard as not to be easily broken; they are then orderly stacked, and from time to time sent away in waggons or barges to supply the cattle-food market, for which purpose the cake is in great request.

A quarter of linseed which only undergoes one pressure yields an average of one hundred and twenty pounds of oil and thirty-five cakes of nutritious food, each weighing eight pounds, or an aggregate of two hundred-weight and a half. Rape seed which is twice ground and pressed yields per quarter from eighty to ninety pounds of oil at the first, and from sixty to seventy at the second pressure. Of these two kinds of oil-producing seeds upwards of six hundred thousand quarters are annually imported, and this mill alone works up thirty-five thousand quarters per annum. Calcutta, Bombay, and Kurrachee are the great emporia for these seeds, and it is a remarkable fact that, whereas the last-named place, when it fell into the hands of the British in 1839, consisted of only about fifty wretched huts inhabited by fishermen, it is now a thriving port and one of the principal outlets for the oil-producing seeds of India.

After the oil has remained a few days in the receiving cistern the parenchymous matter subsides; it is then pumped into vats for a second settling, after which it is barrelled and conveyed to the Refinery. This is situated about a quarter of a mile down the Blackwall line, of which property it occupies nine arches in its rear. The premises are very large, and are used not only for refining vegetable but also animal oils. The casks of unrefined oil are hoisted to the upper floor by means of a crane worked by steam. Along this floor a large vat, capable of holding ten tons, is extended. It is lined with copper; is fitted with a horizontal agitator or fan; and is called the reception vat. Into this receptacle five tons of rape oil are decanted, an equal quantity of water is added, and the whole treated by chemical process. The agitator is set in motion, and after four or five hours the oil becomes thoroughly washed, its impurities having been removed. The agitation is then stopped and the water and bleaching ingredients are allowed to subside. The oil is next drawn off into the boiling vat on the next storey. This vat also is lined with copper, fitted with fans or agitators and a coiled perforated tube; steam is admitted into the tube until a uniform temperature of 212 deg. is obtained. It is kept in this condition and continually agitated for about four hours, when all impurities having been thrown off it is allowed to cool, assisted by the fans, which bring every portion in turn into contact with the air. At the end of eight or ten hours, it is sufficiently cool to be drawn off into the filters, which are in the lower storey. Each filter contains five tons. Having passed through the filter, the oil fully refined; is pumped into appropriate tanks to be ready for barrelling; and receives the name of Colza oil, on account of its illuminating properties, the true Colza being an oil expressed from the *Brassica oleracea*, a variety of the cabbage plant, from whose seeds an oil much used on the Continent is expressed.

Some idea may be formed of the vast quantity of purified rape oil consumed for lubricating and illuminating purposes, when this refinery alone sends out upwards of two thousand tons per annum. A single railway company consumes three hundred tons a year, and the Great Eastern requires one thousand gallons for the single voyage to New York. Whale, seal, and sperm oils are refined by a more simple process. They are simply filtered through flannel bags; the residue of the common kinds is called foots, and is one of the ingredients used in the manufacture of soap. The deposit produced in the filtration of sperm oil is called spermaceti, and is very valuable commanding a ready sale at £90 per ton. These oils are used for the purpose of illumination only, with the exception of sperm, which is employed in the cotton districts for the lubrication of spindles. Large quantities of olive oil are imported from Spain for lubricating machinery, and immense quantities of American lard are imported, pressed and filtered for obtaining the oil known as lard oil, which is considered a good lubricator, and certainly has the quality of cheapness to recommend it.

THE HISTORY OF COAL OIL AND ITS DISCOVERY.

When we speak of the discovery of coal oil, in reference to late events, it must not be mistaken for a modern invention. The extraordinary attention drawn upon it by the discovery of a more abundant supply, by artificial wells, since the August of 1859, has made its previous history of comparatively little interest to one class of minds, but, on the other hand, has invested that previous history, to philosophic eyes, with all the charm of an archæological investigation. Did not the builders of Babel use clay for bricks and slime for mortar? (Gen. xi. 2.) It is evident from an examination of any of the ruins of Mesopotamia, that asphaltic mortar was the bed into which their alabastar wainscot pieces were set, and with which their vast terraces were compacted, and probably their roofs protected; the use of which so abundantly, only facilitated their destruction when the torch was at last applied. The pitch used was made by evaporating Petroleum. That of Babylon we know was obtained from the sulphur, brine, and oil springs of Is; the products of which are still sold in the village of Hits. The story of the catastrophe of Sodom and Gomorrah, if not originated, was perpetuated by the vast accumulations of rock oil in the centre of the Dead Sea, as on the surface of a heated, simmering brine vat, where it is hardened by oxydation and drifted to the surrounding shores. A similar phenomenon—a lake of pure Petroleum—elicited the amazement of the Spaniards who discovered Trinidad.

Oil springs, in fact, have been known and esteemed, and even worshipped, in every age and many countries. Herodotus describes a bitumen spring in Zacynthus, Zante, one of the Ionian Islands; and probably this spring sufficed the Egyptian nation for their incessant religious use of Petroleum for mummies, the embalming of which is amusingly described in Hunt's Merchants' Magazine for 1862. The "Greek fire" of more modern times was probably compounded of Petroleum from the Zantean springs. Discorides tells us that rock oil was collected in Sicily and burned in the lamps of Agrigentum. The classic home of naphtha is Baku, a high peninsula on the western shore of the Caspian Sea, containing thirty-five villages and twenty thousand souls, rocky and sterile, without an attractive spot, without a stream, without one drop of sweet water except what falls directly from the clouds, and without a tree. But coal gas rises every where from a soil saturated with naphtha, and numerous volcanoes in action discharge volumes of mud. From the time of Zoroaster, the naphtha of Baku has been sent all over Asia for the service of the sacred fire of the Parsees. The liquid streams spontaneously through the surface, and rises wherever a hole is bored. But especially at Balegan, six miles from the capital village, the sides of the mountain stream with black oils, which collect in reservoirs constructed in an unknown ancient time; while not far off a spring of white oil gushes from the foot.

Upon their festival occasions, the people pour tuns of this oil over the surface of the water in a bay of the Caspian, and then set, as it were, earth, sea, and sky in a blaze of light. Sometimes far grander exhibitions take place naturally. In 1817, a column of flame, six hundred yards in diameter, broke out near Balegan, and roared with boiling brine and ejaculated rocks for eighteen days together, until it raised a mound nine hundred feet in height. Of course, the population use the oil for light and fuel, and coat their roofs with it. A clay pipe or hollow reed steeped in lime water, set upright in the floor of a dwelling, serves as a natural and sufficient gas-pipe. The Ghebers bottle it for foreign use; the Atecshjahns fire with it their lime kilns and burn their dead. No wonder the religious sentiment of oriental mystics was entranced by such a land of fire as Baku, where, in the fissures of the white and sulphurous soil, the naphtha vapors flicker into flame: where a boiling lake is covered with a flame devoid of sensible heat; where after the warm showers of autumn, the surrounding country seems on fire; flames in enormous volumes rolling along the mountains with incredible velocity, or standing still expectant; where the October and November moons light up with an azure tint the entire West, and the Soghda-ku, Mount Paradise, the eastern buttress of the Caucasus, covers its upper half with a glowing robe; while, if the night be moonless, innumerable jets of flame, isolated or in crowds, cover all the plains, leaving all the mountains in obscurity. The Gheber and the chemist here may worship side by side. All the phenomena of distillation and combustion, under varying barometric and thermometric conditions of the atmosphere, may be studied; for none of this general fire burns unless when captured and applied to human uses in the lamp or stove or kiln. In the midst of this devouring element—

through this world in flames—men live and love unharmed, tend sheep, plant onions, sleep, are born and die, as in more prosaic regions. The reeds and grass are in nowise affected by the flowing oil or by the burning gas. In fact, Rottiers, the traveller, thought the whole phenomenon electric, when he noticed that the vacuum in his thermometer tube seemed to be especially full of flame, and that the east wind put to quiet the whole exhibition; with which fact we may compare the curious discoveries of Moffat with his phosphorous thermometer, published in Silliman's Journal, December, 1862, p. 437, as bearing on his theory of two normal opposite air currents. From an equally remote era the Burman empire and northern Hisdostan have received annual supplies of rock oil from the wells of the Himalaya valley of the Irrawaddy, through Rangoon; and it has always been a favourite drug in the Indian pharmacopœia.

In Italy, the oil wells of Parma and Modena date back nearly two centuries, the year 1640 being that assigned to their discovery. The springs of Ammiano have long lighted the streets of Genoa.

In France, oil springs have been known from time immemorial at Clermont and Gabian; and in Canton Neufchatel; and in Bavaria, Germany.

In the English coal mines, of course, the coal oil gas—the dreadful fire-damp—was always a well known demon to the mining population; but in 1659 Shirley, perhaps first, describes it to the reading public as an illuminating gas. In 1733, Sir James Lowther laid pipes along the mines and burned the gases at the surface of the earth. Dr. Clayton's retort experiments, to which we referred above, were six years later still. His "incondensible spirit" he burned in bladders tor the amusement of his friends, as did Dundonald again in 1786, and Murdock in 1792. But the lighting of London streets and houses with gas came not till 1842. Twenty years have elapsed, and there are in Great Britain and Ireland, 1,015 gas works, with a capital of $90,000,000, charging an average of $1.80 per thousand cubic feet to small consumers, and deducting from twenty-five to thirty per cent. for heavy consumption. Some of these companies pay twelve per cent. dividends, and many of them ten per cent. The average capital of British gas works is said to be nearly twenty per cent. less than that of American works.

In America, the history of coal oil commences with the use which the white settlers found the Indians made of it for medicine, for paint, and for certain religious ceremonies. The settlers adopted its medicinal use alone, and retained for more than one affluent of the Alleghany river the Indian name of Oil Creek. The one which has become so celebrated lately, enters the river a few miles above the town of Franklin. The oil was collected by the natives and the whites by spreading blankets on the marshy pools which line the edges of the bottoms at the foot of steep hill-sides, or even mountain walls, such as hem in those valleys and support a table land of coal measures above. The remains of ancient pits, with notched logs for ladders, show how long the product has been valued by the Aborigines. But although in all the valleys of western New York and Pennsylvania, eastern Ohio and Kentucky, and northwestern Virginia, the evidences of the almost universal existence of the Seneca Oil was known to the early settlers, its actual abundance underground was not dreamed of. Even long after the era of salt-well boring had begun, the isolated cases of spouting wells did not teach the truth as it is now known. Some of the oldest salt wells of the Pittsburg region, it is true, and of the Kanawha valley, yielded not only brine, but also oil and gas in great abundance; and in more than one place, and with a partial and temporary success, the gas was tubed off and led beneath the boiling vats for fuel. But it was too fitful in its escape to be relied upon; the oil which accompanied it was of no use, and when abundant a great nuisance. Hildreth describes the quantities of Petroleum spouted from the salt well bored in 1819, in the valley of the Little Muskingum, in Ohio, and the tremendous explosions of gas which interrupted, sometimes for days together, the flow of brine. It was this fitful and ungovernable vis a tergo, having its unknown seat of power in the deep, which made every effort futile to employ the gas as fuel.

Travellers report, however, that this has been successfully done by the Chinese salt-makers for many centuries. As for the oil, continues Hildreth, it made for itself a local commerce, beginning to be in demand for lamps in workshops and manufactories, and the suggestion was already made that it would serve to light the streets of the cities Ohio. It is not a little singular, says Mr. Hodge, that with the sources of supply thus pointed out, and the useful application of the Petroleum ununderstood, its value should have remained unapciated, and at the expiration of more than thirty-five years, be at last perceived through the progress of experiment made upon the distillation of bituminous shales and coal. But the fact seems to stand thus: the natural coal oil was a disgusting and imperfect thing, and there was neither the pressure of necessity nor the favor of science applicable, in Ohio, in the beginning of the century, to its purification. The destruction of the whale fishery, the increase of the railroad system, with its rolling gear and workshop machinery, and the coming in of lard oil as a substitute for whale oil, all had to intervene between the inception and the performance of the coal oil drama.

It was in 1847, that Mr. Young, in Glasgow, (the most intimate friend, by the way, of the African traveller, Livingstone,) had established his purification of Petroleum from the Kidding's mines in Derbyshire, boghead cannel, common coal shales, peat and solid bitumen, and introduced the use of these mineral oils to such an extent, that a search for the native article long known to exist, was set on foot in earnest. The oils of the coal region of America at once commanded principal attention. The first practical movement in this direction was not made, until, in 1854, Messrs. Eveleth & Bissell, of New York, secured the right to the upper spring on Oil Creek, and organized a company. Still, three years passed before Mr. Bowditch and Col. Drake, of New Haven, began the first Titusville boring, striking the oil stratum at seventy-one feet depth in August, 1858. The drill sank suddenly into a cavity, and the oil rose within five inches of the surface, and was pumped off at the rate of, at first, 400 and afterwards 1000 gallons per day.

The news spread. The wildest speculation soon aged. Every acre of land in the valley, and part way up the steep hill-sides, for ten miles south of the boring, as far as to the junction of Oil Creek with the Alleghany river, was bought up by eager contestants for a fortune sure to be realized in a few months. Hundreds of wells sunk speedily to various depths. The once quiet, beautiful valley became a noisy den, a hideous desert. Derricks, scaffolds, and pumping gear took the places occupied by the tall forest trees or blooming orchards. Groups of warehouses, barrel factories, board ing-houses, and whole villages replaced each solitary farm-house. The stream was dammed and sluced for artificial floods, harbors were excavated in the lowest places and the rest of the intervale became a stinking bog of mud and salt mingled with oil. Not a blade of grass was to be seen, and nothing to be heard but the clanking of the pumps, the blowing of some new well in its first energy, the shouting of drivers urging miserable mules and horses through the nauseous mud, dragging empty barrels to the wells, or full ones down to the stream, where the boatmen fasten them together for the next flood. Long barges, filled with casks or with the oil itself in bulk, lie waiting for the moving of the waters, when the upper dam is opened. Among them are to be seen strange crafts, composed of barrels lashed together like a raft, or barrels sawed in two and lashed together thus, to carry the oil in bulk, and filled to the brim.

Occasionally the pond freshets, as they are called, become scenes of ludicrous disaster. The latest were those of December 2d and December 5th, 1862, in which fifty thousand barrels of oil were lost. "The loss on the Alleghany river," writes a correspondent, "is estimated at 400,000 or 500,000 gallons." The scene is graphically described in the columns of the *Philadelphia Coal Oil Circular* of December 13: "The boats grounding in great numbers; the larger overriding, crushing, and swamping the smaller craft, and breaking each other up. In the Friday's freshet, twenty ill-secured boats at the upper wells broke loose when the water was first let off, and came down broadside, making a clean sweep of the creek, tearing away from the shores all the boats that lay successively below them, in spite of the frantic efforts of their owners. Oily ropes in oily hands were of no avail for snubbing round oily posts; everything went with a run, or rather with a slide, and for once, at least, the creek deserved its name. Boatmen, standing on oily thwarts and gunwales, and handling oily poles, were capsized into the water, and came out dripping with oil. One reporter counted fifty-six considerable wrecks between the Tarr farm and Oil creek bridge. Boats were forced up to their full lengths out of the water upon the M'Clintock bridge pier, like floes of ice; three hundred barrels, staved and whole, floated from one of them alone. The new railroad will prevent such tragicocomic scenes from happening in future."

But far more fearful scenes than these by water have occurred on shore. More than once, in spite of all precaution, a spouting well has taken fire, and roared and burned like a volcano. Then pump works, engine-houses, stores and boats, the soil, the stream, and the river into which it pours its flame, spread their common conflagration over day and night. In the autumn of 1861, a well about three miles up Oil Creek was lit by a cigar, while thirty or forty people were standing around it, of whom fifteen were killed instantly by the explosion, and thirteen severely injured. A column of fire, with its head rising and falling from thirty to fifty feet, continued to burn.

The Little & Merrick well was one hundred and fifty feet deep at first, but in the spring of 1861 was deepened, without considerable increase of oil, until half past six o'clock in the afternoon of April 17th, when, from a depth of three hundred and thirty feet, a stream of oil and gas, mixed with very little water, four inches in diameter, rushed up with such violence that its spray reached far beyond the top of the derrick. The air became an atmosphere of gas. The sickened hands forsook their boring tools and fled, leaving the oil to waste itself, like a cataract, into the creek. The engine firemen put their fires out. Soon a great crowd collected from the older works, and closely surrounded the new jet, when, suddenly, two simultaneous flashes, and a report like the rolling fire of a platoon of musketry, as it seemed to those at hand, but like two separate cannon shots to those who felt the concussions three miles distant, and to those that heard them seven and eight miles off, inaugurated a general conflagration. A scene of indescribable terror and confusion ensued. Yet all escaped but half a dozen, who were burned to charcoal where they stood; many others died, however, of their wounds, and numbers more were scarred for life. Four wells lost everything, including 500 barrels of oil on hand, and other property was destroyed elsewhere. In the dead of night there stood the fountain of flame, a jet of pure oil, not subsiding and returning to its work, but a ceaseless unintermittent rush, like the steady blowing off of a steam boiler, and more than a hundred feet in height, rolling clouds of black and massive smoke up over the tops of the surrounding hills with a ceaseless surf-like roar.

In the autumn of 1862, the tanks of the Filkins well caught fire, and the space burned over soon embraced from eighteen to twenty acres, on which one hundred and fifty oil tanks, full of a three months' supply, were standing close together, intermingled with engine-houses, offices, &c. Seven flowing and three pumping wells, with thirty thousand barrels of oil took fire in quick succession. The flames ran up the trees of the maple grove, and the valley was black with smoke that stifled the heroic men who fought the flames. Men stood bravely on tanks of oil as dangerous as so many powder magazines. Oil Creek, of course, took fire, and increased the grandeur of the scene. There were no explosions during the whole conflagration; crude oil is not explosive.

Returning to the general history of the oil regions, which we left, for a moment, to describe their biographical details, the mania for oil well boring was not long confined to Oil Creek valley, but soon took possession of the main valley of the Alleghany from Franklin nearly up to Warren, and the lateral valleys of its tributaries, Two Mile Run and French Creek. It then spread southward, and began a similar history on Slippery Rock Creek and Beaver and Mahoning rivers. Up the latter valley it spread into Ohio, and established wells in Trumbull county on some of the highest ground along the north-west edge of the coal measures in that State. The first borings, in the spring of 1860, were those of Mecca, twenty-one miles south-west of Erie. By the next November, between six and seven hundred wells had been already sunk in one small district, and twenty-five steam pumping engines were at work.

INFLUENCE OF FOOD UPON THE INTELLECT.

Very few well-informed persons dispute the fact that the nature of the food taken by man has an influence upon his brain or mental power. It is unquestionable that certain kinds of food are injurious to beasts, and produce or tend to induce disease; and this peculiarity has a proportionate evil effect upon the animal part of man. Other matter taken into the system for refreshment or luxury, such as drink or narcotics, has also some influence upon the character of those who partake of it. National traits and characteristics are thus developed, and we see Germans and Hollanders heavy, slow thinkers, solid rather than brilliant, and given to sluggishness rather than bodily activity. Cannot the cause of this be found in the quantity of beer, tobacco and highly seasoned cookery which is consumed by the people; and may we not trace some of the prominent traits of the French character to the quality of diet and drink they subsist on? Whatever conclusion we may arrive at (for the question is an open one and susceptible of much discussion), we may not venture to dispute the results of actual experiments on this subject, made by learned physicians; some account of their researches we append herewith:—

In the excellent work of Prof. Moleschott, of Zurich, *Lehre der Nahrungsmiittel, fur das Volk*, the influence of diet on the intellect is dwelt upon at great length. "It is a well-known fact," says this philosopher, "that change of food has transformed the wild cat in to the domestic fireside-compani on from a carnivorous animal, with short intestines,, it has, by gradually becoming accustomed to other food, become transformed into another being enabled by a long intestinal canal to digest vegetable food, which in its natural state it never touches. Food, therefore, makes the most rapacious and perfidious animal in the world an inmate with man, agreeing with children, and rarely, except to a close observer, revealing its former guiltful character. Are we, then, to wonder that tribes of men become ardent, phlegmatic, strong or feeble, courageous or cowardly, thoughtful or unintelligent, according to the different kinds of aliments they take? If food is transformed into blood, blood into nerve and muscle, bone and brain, must not the ardor of the heart, the strength of the muscles, the firmness of the brain, the activity of the brain, be dependant upon the constituents of food?" Again, in treating of the diet of the artist and literary man, the author states that "a well-baked bread and lean meat, combined with young vegetables and such roots as are easy of digestion and contain a considerable proportion of sugar, form a wholesome diet for thinkers and poets; a large quantity of leguminous seeds, heavy bread, rich gravy, and greasy meat, create those irritable, morose, and almost always slender statesmen, who have permitted gloomy thoughts and gloomy imaginations to eclipse all happier views of life in them, or that they have come to consider rods and fetters as the most important promoters and protectors of civilization."

To the Reverend Professor Haughton of Trinity College, Dublin—a philosopher who has enlarged the boundaries of many departments of science—we are indebted for an admirable physiological investigation (published in the Dublin *Quarterly Journal of Medical Science*), the results of which have established the curious fact that the greatest or perhaps we should say the hardest thinker is the greatest eater.

Professor Haughton states that men employed in mere manual routine labor, require only a vegetable diet, whilst those who are engaged in pursuits requiring the constant use of the intellectual faculties must be supplied with food of a better kind—*i. e.*, mixed animal and vegetable aliments.

These interesting experiments of Professor Haughton open up a wide field of curious and interesting inquiry. Is vital activity a mere modification of chemical force, and is the explanation of all the phenomena of living beings to be found in the domains of chemistry and the various physical sciences? No doubt many of the changes which take place during the different stages in the life of an animal can be clearly traced to the unmodified action of the various physical agencies, but there are others which are not so easily explained, and which some physiologists refer to the operation of a force which they regard as distinct from all others, namely the vital. It should however, be remembered that this force, as it is called, never evidences its independent nature by any unaided manifestations of a material character. It has never been proved that any portion of matter, however small, has been caused to change its position in space by the sole agency of the vital power.

Mr. Grove suggests that the inorganic forces and animal force will yet be shown to be convertible into each other; but let this acute student of nature speak for himself:—

"Some difficulty in studying the correlations of vital with inorganic forces arising from the effects of sensation and consciousness, presenting a similar confusion to that alluded to when, in treating of heat, I ventured to suggest that observers are too apt to confound the sensations with the phenomena. Thus, to apply some of the considerations on force, given in the introductory portion of this essay, to cases where vitality or consciousness intervenes, where a weight is raised by the hand, there should, according to the doctrine of the non-creation of force, have been somewhere an expenditure equivalent to the amount of gravitation overcome in raising the weight. That there is expenditure we can prove, though in the present state of science we cannot measure it. Thus, prolong the effort, raise weights for an hour or two, the vital powers sink, food, *i. e.*, fresh chemical force, is required to supply the exhaustion. If this supply is withheld and the exertion is continued, we see the consumption of force in the supervening weakness and emaciation of the body."

The question next arises, how does the food, in the process of its decomposition, develop motive power? This is a question more easily asked than answered. We know that the grouping of atoms of matter into the organized forms, to which the terms starch, sugar, caseine, &c., have been given, was effected by plants, under the influence of sunlight. Substances, there is reason to believe, should not be regarded merely as "consolidated masses of the atmosphere and water," but also as accumulations of force. When these substances are disorganized in the mechanisms of animals, the force which was previously pent up in them is set free; part of it takes the form of heat, a portion of it, occasionally (perhaps always) is resolved into electricity, and part is recognized as muscular power (animal motive power). The heat set free by the disorganization of food in the animal economy differs in no respect from that developed by the combustion of fuel in our furnaces; and by means of the electricity procurable from the torpedo every phenomenon peculiar to that variety of force can be exhibited. Now the enquiry presents itself here, are we to infer from these well-ascertained facts that vital action is the result of the conjoint influence of the ordinary physical (including chemical) agencies, modified by the peculiar state of aggregation of the atoms of matter on which they act; or that, in addition to the physical forces set free by the destruction of the animal mechanism and by the decomposition of the food, there is developed a peculiar force correlated to the physical forces, but differing in its manifestations from each of them in the same way that electricity differs from magnetism, or light from heat? To the latter view we are disposed to incline. We believe that all the forces of nature are but modified manifestations of the one all-pervading ætherial fluid (in a state of motion), and that the modifications arise, in most instances, from the differences in the nature of the ponderable matter on which this universal force acts.

It is generally to be regretted that a staple food of a large portion of the people of this country (England) is deficient in flavor and too bulky to be nutritious. We have long been of opinion that, in this country, at least, the best agricultural laborer is he who is best fed. Let us see what facts we can call upon in support of this opinion.

Oatmeal is the staple article of the food of the Scotch laborers, and of those of the northern parts of England, and its great superiority of the potato is strikingly manifest, when we compare the physical development of the consumers of the two alimental substances.

In the counties of York, Lancaster, Northumberland and Cumberland, the *physique* of the laborer is superior to that of the worker of any other part of England. But the northern laborer is not merely more powerful than his southern *confrere*, for he excels him in the exercise of his intellectual faculties. This is so well known to the farmers from the north of England, who have settled in other parts of that country, that they offer higher wages to the laborers from their own part of the kingdom; knowing well, from further experience of their habits, that they will not only do more but better work than the laborers of the south.

The cause of the superior intelligence, and greater physical powers of the common people of the north of England, as compared with those elsewhere, may in part be found in ethnological differences. But granting this, their maintenance would be impossible, were the food of the people of this district similar to that of the laborers of the English midland counties.

In the north of England and in Scotland, although potatoes are extensively consumed, yet buttermilk, which the people by no means despise is also largely made use of; and oatcake is far from being a stranger on the poor man's board. In the south of England, oatmeal, whether served up in the semi-fluid form of porridge, or in the solid condition of cake, is almost unknown.

It requires no argument to prove that the people of the north of England are better agricultural laborers than those of the south, and are themselves excelled by their neighbors north of the Tweed. Although there is but little ethnological difference between the agricultural laborers of the south of Scotland and those of the north of England, it appears to me that the former possess more brains and muscles than the latter; they are stronger and more skillful workmen. We think, however, that no such difference is observable between the artizans of Glasgow and those of Newcastle or Carlisle. In the case of the rural workmen this may appear anomalous, but it is not really so. The artizans of both countries are well paid, and can, therefore, afford to use a generous diet, composed chiefly of animal food; but the Scotch agricultural laborer subsists principally upon oatmeal and peas, whilst the English laborer uses a diet which is to a far less extent made up of these articles. Were the English and Scotch laborers supplied with precisely the same kind and quality of food, we think there would be little, if any, difference in the amount and quality of their work. The highly nutritious nature of the pea and oat, as compared with the potato, will be evident from the analyses made of them.

These analyses prove that one pound of peas is capable of putting more muscle on the human machine than fifteen pounds of potatoes could do; and that, taking the amount of flesh-formers in a substance as a measure of its nutritive value, oats are more valuable than potatoes as food—that is, a pound of oatmeal will form as much lean flesh as half a stone of potatoes! The value of a food substance is not, however, altogether in proportion to its amount of nitrogenous or flesh-forming matters, but also, to a great degree, upon the proportion of starch it yields. In this respect the potato is by no means an inferior aliment; indeed, were it as deficient in heat-giving and fat-forming matters as it is in flesh-forming substances, it would be utterly impossible for working men to subsist, as they do, almost exclusively upon this so called "national esculent."

From what has been stated, it is clear that potatoes contain a quantity of starch altogether disproportionate to their amount of nitrogenous or flesh-forming substances; and we have no hesitation in asserting that, as a general rule, a man fed exclusively on potatoes cannot be as hard-working and intelligent a laborer as if he were supplied with other food of a more concentrated kind—one in which the muscle-forming constituents bore a higher proportion to the fat-forming elements. The addition of buttermilk (which is very rich in nitrogenous matters) to potatoes, serves in some measure to remedy the evils of a potato diet; but all requires a capacious middle region to accommodate the large quantity of potatoes and buttermilk which a hard-working man would require, to enable him to develop an amount of motive power equal to that expended, say, by a navvy in his day's toil. A mixed diet of potatoes and oatmeal is incomparably better than pure potato diet, and if the oatmeal be the staple, and the potato the adjunctive article of food, so much the better.—*Scientific American.*

ON THE PHOTOMICROSCOPE.

By Sir David Brewster, K.H., F.R.S.

(*Paper read at the January Meeting of the Photographic Society of Scotland.*)

Under the name of *bijoux photomicroscopiques*, M. Dagron, of Paris, sent to the Exhibition of 1861 a series of these beautiful little optical instruments, which consisted of a plano-convex lens of such a thickness that its anterior focus coincided with the plane side of the lens. By placing the eye behind the convex side, these photographs, invisible almost to the eye, were seen so distinctly, and so highly magnified, that they excited general admiration. M. Dagron had presented some of them to the Queen, who admired them greatly; and as he was the only exhibitor, he naturally expected that the ingenuity with which he had produced a new article of manufacture would have received a higher reward than "Honourable Mention."

In 1860 M. Dagron had taken out a patent in France for this combination of an elongated or cylinder lens with a photograph, under the name of *Bijoux Photomicroscopiques.* He placed the lens in brooches and other female ornaments; and the combination became so popular, and the sale so great, that fifteen opticians in Paris invaded the patent, and succeeded in reducing it. The photomicroscopes have therefore been made by various opticians in Paris, in England, and also in Scotland, containing photographs of the finest productions of ancient and modern art, both in painting and sculpture—of single persons—of family groups and social groups of public characters and other eminent individuals. One of these, made by M. Dagron, was so small that it could be placed in a ring, and contained no fewer than *eighteen* excellent portraits of the "Defenders of Italy." In like manner the members even of a very large family may have their portraits grouped in one of these photomicroscopic bijoux, and the mother or the sister, or the father and the brother, may carry about their persons, in a locket, a ring, a bracelet, a gold sphere, or a watch-key, this interesting family group, and smile or weep even in the social circle over these cherished representations of the living or the dead.

Although the picture is small, and the aperture through which we see it exceedingly minute, yet it is so much magnified that, when there is only one portrait, it appears as large as an oil-painting of the kit-cat size when seen on a wall at the distance of ten or twelve feet.

The following history of the invention, of its application to jewellery, and of the trial for reducing M. Dagron's patent, may be interesting to the Society:—

In 1856 Mr. Dancer, an eminent optician in Manchester, presented to me a number of beautiful microscopic photographs, consisting of a single portrait, groups of portraits, and monumental inscriptions. In order to show these to strangers not accustomed to the use of small single microscopes, I employed a lens of such thickness, that the photograph was seen distinctly by placing it in contact with the anterior surface of the lens—a form of the single microscope which I had described and used upwards of forty years ago. When I was in Italy in the winter of 1857, Mr. Dancer's photographs were exhibited in this way to the Pope and Cardinal Antonelli at Rome, and at Florence to the young Grand Duke and Grand Duchess of Tuscany, the Marquis of Normanby, Prof. Amici, and others. The interest excited by these photographs was so great that I showed them to the distinguished Roman jeweller, Signor Fortunato Castellani, and suggested to him the idea of constructing brooches containing precious stones, so that the photographs might be placed within them, and magnified by one of the precious stones, or by colourless topaz or quartz formed into a lens. Signor Castellani was pleased with the suggestion, and I gave him the address of Mr. Dancer as qualified to furnish him with microscopic photographs from originals sent to him. I never learnt the result of this suggestion; but on my return to England in the summer of 1857, I inserted the following notice of the photomicroscope and its applications, in the article "Microscope," in the *Encyclopædia Britannica,* published in October, 1857:—

"Among the wonders of microscopic photography, not the least interesting and useful are the fine microscopic portraits taken by Mr. Dancer, of Manchester, and copies of monumental inscriptions, so minute that the figures in the one and the letters in the other are invisible to the eye. A family group of seven complete portraits occupies a space the size of the head of a pin; so that ten thousand single portraits could be included in a square inch. They are executed upon films of collodion as transparent as glass; so that a family group could be placed in the centre of a brooch, a locket, or a ring, and magnified by the central jewel, cut into a lens sufficient to exhibit the group distinctly when looked into or held up to the light.

"Microscopic copies of despatches and valuable papers and plans might be transmitted by post, and secrets might be placed in spaces not larger than a full stop or a small blot of ink."

Towards the end of 1858 microscopic photographs excited much interest in Paris, where I had shown them in 1857; and various methods of exhibiting them in connexion with a lense or lenses were adopted in the following year. In December 1858, M. Marion took out a patent in which the photograph was fixed at the end of a tube and magnified by *four* achromatic lenses placed within the tube. M. Dagron, in June 1859, took out a patent for a different method, in which the photograph was placed at the end of a brass tube, and the lens at the end of a second tube, distinct vision being obtained by moving the lens tube within the other.

On the 8th of May, 1860, M. Dagron obtained a "certificate of addition" to this patent for the method now in use of placing the photographs at the end of a cylinder-lens; and he proposed to put this little microscope, with its photograph fixed to it, in brooches, lockets, rings, &c., as I had suggested to Signor Castellani in 1857. On the 4th of April 1861, M. Martinache took out a patent for another construction, in which the photograph was placed in the middle of a brass tube having a lens at each end, the lens furthest from the eye having no other purpose than to throw light on the photograph. M. Martinache obtained a "certificate of addition" to his patent on the 7th of June, 1861. This patent was supposed to be an invasion of that of M. Dagron; but after some law proceedings had taken place, M. Dagron purchased the patent right of M. Martinache for £1250.

Although M. Dagron's method of applying the photomicroscope to jewellery exhibited much ingenuity, and was doubtless his own independent idea, it was not deemed of sufficient originality to entitle him to the exclusive privilege of manufacturing and selling the instrument. The Parisian opticians were therefore induced to try the validity of his patent; and having learnt that I had exhibited the photographs in the same way, and suggested the application of the instrument to jewellery, they succeeded in reducing the patent. M. Dagron appealed against this decision, on the ground that the passage which we have quoted from the article "Microscope," in the *Encyclopædia Britannica*, was not sufficient publication; but the court, the Correctional Tribunal of Paris, rejected the appeal, and found him liable in the expenses of the process. On the ground that M. Dagron had acted in good faith, the court refused to give damages to the fifteen Parisian opticians whom he had interdicted from manufacturing the photomicroscope.*

In the course of this process the cylinder lens which I had described and used nearly forty years ago is called a *Stanhope;* but I have learned on inquiry that Lord Stanhope never proposed a plano-convex lens of such thickness that its anterior focus coincided with its plane side.†

Since the manufacture of the *bijoux photomicroscopiques* has been open to all opticians of all countries, we have not seen or heard of any remarkable improvement upon them. We expect, however, to see the central, or any other precious stone in female ornaments, so constructed as a photomicroscope that the observer looks into its *central facet* in order to see the photograph on its inner side. If the ornament should consist of coloured precious stones, or of stones not sufficiently thick to form a cylinder lens, the lens might be made of diamond or New Holland topaz or quartz, or glass, and inserted in a cylindrical aperture formed in the central facet of any of the precious stones.

We have now before us one of Mr. Dagron's photomicroscopes, containing a photograph of Sir Walter Scott, and sold at Messrs. Knox, Samuel, and Dickson's for one shilling. The cylinder lens is only *one third* of an inch long, and its diameter *one tenth* of an inch. It is placed within the eye-end of an ivory tube which screws into a larger piece, so as to resemble a minute opera-glass. The larger or object-end has an aperture of *one-twelfth* of an inch, and the smaller or eye-end an aperture of *one-twenty-fifth* of an inch, through which we see the portrait as large and distinct as if it were an oil picture on the wall!

In the pamphlet of M. Dagron, to which we have referred, he has described the very ingenious apparatus by which he executes his microscopic photographs, and the whole process of making the cylinder lens, and placing the photograph on its plane surface. The price of a complete apparatus is only £4 10s.; and as he supplies cylinder lenses for the small sum of 6s. 8d. per gross, any of our photographers may add to their profession this new and lucrative branch of it, as practised so generally in Paris. Considering the ingenuity and skill which M. Dagron has displayed in the construction and application of the photomicroscope, and in giving the benefit of it to photographers, and to the public, at such small expense, we cannot but regret that the jury of the Great Exhibition did not honour him with their medal.

Edinburgh College, Dec. 1863.

A number of photomicroscopes, in various styles of gold mounting, were exhibited by Mr. Bryson, Optician; they were very much admired for their distinctness and delicacy. Messrs. Knox, Samuel, and Dickson exhibited a collection by M. Dagron, in the usual ivory mounting.

* An account of this trial will be found in the "*Moniteur de la Photographie,*" April, 1862.

† M. Dagron calls the cylinder lens a *Stanhope* in his very interesting tract, just published, entitled *Photographie Microscopique* p. 36: Paris, 1864.

PROCESS FOR MANUFACTURING KEROSENE.

The specification describes the process for obtaining oils, denominated Kerosene, from "bitumen wherever found." The kerosene consists of three distinct hydrocarbons, namely A Kerosene, B Kerosene, and C Kerosene. The C Kerosene, or that which is employed in lamps, may be formed by an admixture of the light with the heavier oils, until the specific gravity is raised up to about 0·800, water being 1000. The first part of the process consists in submitting the raw material to dry, or decomposing distillation, in large cast iron retorts at a temperature not exceeding 800°. The condensation of the vapors is effected in iron pipes, or chambers, surrounded by water.

"The liquid products of this distillation are heavy tar and water, or ammoniacal liquor, which lie at the bottom of the receiver, and a lighter fluid which floats above them." The heavy fluids and the light are separated by drawing off one from the other. "The heavy liquids may be utilized or disposed of advantageously; but they have no further connection with this process." The light liquid is submitted to re-distillation at the lowest possible heat, in a common still and a condenser. The products of this distillation are a light, volatile liquid, which accumulates in the receiver, and a heavy residuum left in the still, and which may be added to the heavy liquid impurities of the first distillation.

The light liquid is transferred from the receiver to a suitable vessel or vat, and mixed thoroughly with from five to ten per cent. of strong sulphuric, nitric, or muriatic acid, according to the quantity of tar present. Seven per cent. is about the average quantity of acid required. The preference is given to sulphuric acid. With the acid and oil, from one to three per cent. of the peroxide of manganese is added, and the whole thoroughly agitated together. The mixture is allowed to stand undisturbed from twelve to twenty-four hours, in order that the impurities may subside. The light supernatant fluid is now drawn into another vessel. The distillate is then mixed with two per cent. or more of freshly calcined lime, which takes up any water that may be present, and neutralizes the acid. The oil is then distilled, and finally rectified, if necessary. The product is kerosene, the lightest part of which is called A kerosene, and the two succeeding parts B and C kerosene.

The above mode has been much improved by the use of steam, introduced into or above the oils during their distillation, by diminishing the quantity of acid and washing with water. The latter removes much of the soluble impurities. The A kerosene is perfectly colorless, and has a close analogy to eupion. The remaining hydrocarbon oils are of a light straw color. They burn freely in lamps, without incrustation of the wick.

There are a number of oil manufactories in Germany. In some of these lignite is used, in others cannel coal. The coal is usually broken into small pieces, and when it contains sulphur it is moistened with lime water. The coal is then thoroughly dried in a furnace constructed for the purpose. The dried coals are distilled in common gas retorts, the eduction pipes of which open at the ends opposite their heads. In some instances the flame of the furnace is not permitted to strike the sides or upper surface of the retort.

Miscellaneous.

Labour and Contentment.

We commend the following sensible letter, taken from a Boston paper, to the consideration of all whom it may concern:—

"I am a mechanic—I work the raw to the fabric, from coarse to fine. My wages are two dollars per day by the year. Sick days and legal holidays are the only ones I lose. I live well and manage to have something to show at the end of the year—say one hundred and fifty dollars. It is insignificant compared with the large sums your columns make mention of as the yearly gain of the trading classes. I am aware of it, and, what is fortunate, it fails to disturb me in the least, for I remember that healthy thrift is like a tree—at first only the twig, then the trunk, followed by branches, and not too hurriedly neither lest the toughened process be overleaped; the firm, solid, capacious tree is matured. The lesson is, that real growth comes from below and works up. Gold in the beginning and fine gold later in the day. Industry and day wages have laws—I know it. To my next year's earnings I unite my last year's savings—and with the same expenditure of effort my gains enlarge.

"So saith the law of thrift. I don't live meanly, I assure you. Good food is my victuals, and liquor isn't my drink. The tobacco market I never seek. I go to church all day Sundays and am none the worse for it; and pay my pew-rent. I have time, there, among other privileges, to see who goes, and think of those who stay away, and calculate a little about them, too. Conclusion—that those who attend pay the smallest pew tax and get the least harm into the bargain. Another item is worth knowing in these fast days, namely, not to indulge in likings for all the 'dazzles' which art and cunning invent and fling temptingly before every dollar that is earned. To go without this, and go without that, may cross a little, but it has in it a virtue, force, to sweeten later periods; it isn't neither a self-acting one, it comes like its sister virtues, by acquirement only—it is an accomplishment. Thus reasoning, I am content to work well at day wages —not disturbed to repeat that A or B makes yearly fifty or a hundred thousand dollars, for besides the luxury of toil, there is luxury of thought, that growth comes from labor, while waste wears away at the top. Primarily, day wages and growth; secondarily, ease and *decay*."

Improvements in Photography.

Dr. Van Monkhoven has just published a method for obtaining positive impressions by means of the oxalate of peroxide of iron. This substance is obtained by taking sulphate of iron in small crystals, and pouring in a little nitric acid. The sulphate is dissolved and red fumes are evolved. A mild heat will hasten the operation. The acid should be added in a sufficient quantity to transform the crystals into a yellow liquid, but without being in excess. The liquid is then diluted with water, filtered, and a hot solution of the hydrate of baryta is added, but not sufficient for saturation. We thus get a precipitate which is a mixture of peroxide of iron and sulphate of baryta. This is well washed by letting it deposit at the bottom of a vessel and stirring it up at intervals, and each time with fresh water. The precipitate is then put into a porcelain evaporating-dish and heated with a gradual addition of bi-oxalate of ammonia, until the precipitate has become white. It is now dissolved; the insoluable part is sulphate of baryta, which may be thrown away; the remaining solution is evaporated, and then left to crystallize; this is the required oxalate of peroxide of iron. All these operations must be performed by night or in the dark. To prepare the paper, dissolve 300 grammes of the oxalate of iron and ammonia, and keep this solution in a dark place till wanted. The paper must be coated with gelatine on the best side, and the wrong side marked with pencil. Pour the solution into a porcelain basin, lay the paper on the liquid surface, wrong side upwards, let it float for four minutes, then hang the leaves up, and let them dry in the dark. Both the solution and the paper may be kept indefinitely, provided they be protected from daylight. In order to receive an impression, the paper is exposed for eight minutes at the utmost, according to the luminous intensity and the nature of the impression. In order to develop the image, which is but weak and negative on leaving the frame, the sheet is stretched on blotting paper, and brushed lengthwise with a ball of cotton steeped into a solution of one part of nitrate of silver in twenty parts of distilled water. By the action of light the peroxalate of iron has been changed into a proto-oxalate which has the property of taking possession of the silver contained in the nitrate. Hence the image at once appears of a fine purple colour. The impression is now washed several times, and the operation is successfully ended. Instead of nitrate of silver, chloride of gold may be used to develop the image, which is then violet, and need only be washed once.—*Galignani.*

The Great West.

The four States of Indiana, Illinois, Iowa, and Wisconsin, have a computed area of 124,000,000 acres, or a surface of about one half greater than the whole British Isles. From 1850 to 1860 the area under cultivation rose from 11,956,269 acres to 25,949,886 acres—an increase of 142 per cent. At the same time the value of the farms advanced from $278,704,593 to $1,027,292,333 ; and the value of the farming implements rose from $15,924,442 to $39,645,875.

The population of these four states was 2,337,491 in 1850, and 4,513,208 in 1860.

The aggregate live stock of the four states was:

	1850.	1860.
Cattle of all classes......	1,946,756	3,724,726
Sheep	2,291,392	3,523,827
Swine	4,660,196	6,033,368
Horses and Mules........	668,739	1,340,054

In other words swine increased in numbers 29 per cent., sheep 54, cattle, 90, and horses 100 per cent.

The immense grain crops of these four states increased as follows:—

	Crop of 1849.	Crop of 1859.	Est. for 1862.
Wheat, bushels	21,445,745	63,624,450	83,812,946
Rye, do.	263,325	2,446,137	2,603,524
Barley, do.	391,063	2,605,133	2,971,680
Indian corn do.	119,257,125	233,620,654	290,639,035
Oats, do.	20,681,272	37,303,750	43,247,662

Such are the kind of products which constitute the foundation of the nation's material power.

The Value of Dead Horses.

Some people will no doubt be astonished to learn that large fortunes have been made every year since the commencement of the war, out of the dead horses of the Army of the Potomac. The popular idea is that when Rosinante yields up the ghost, she is buried in some field, or left to molder into mother earth in the woods somewhere. Not so. She has made her last charge and gnawed her last fence rail, but there is from $20 to $40 in the old animal yet. A contract for the purchase of the dead horses in the Army of the Potomac for the ensuing year, was let a few days ago, to the highest bidder, at $1 76 per head, delivered at the factory of the contractor. Last year $60,000 were cleared on the contract, and this year it is thought $100,000 can be made on it. The animals die at the rate of about fifty per day, at the lowest calculation.

At the contractor's establishment they are thoroughly dissected. First the shoes are pulled off; they are usually worth fifty cents a set. Then the hoofs are out off; they bring about two dollars a set. Then comes the caudal appendage, worth half a dollar. Then the hide—I dont know what that sells for. Then the tallow if it be possible to extract tallow, from the army horses, which I think extremely doubtful, unless they die immediately after entering the service. And last but not least, the shin bones are valuable, being convertible into a variety of articles that many believe to be composed of pure ivory, such as cane heads, knife-handles, &c.

Caustic Alkalies.

Very great quantities of the solution of caustic alkalies are employed in purifying coal and Petroleum oils. At present those washes, as they are called, are permitted to run to waste. Frequently they are partially neutralized by the acid that preceded them in the purifying process.—When these solutions are strongly alkaline, they may be submitted to evaporation and crystallization for further use, the impurities which float upon them being removed. If they have been neutralized by the acid taken up from the oil, the neutralization should be completed by the addition of more acid, when they will form sulphate of soda, or sulphate of potash, as one or the other alkali has been employed.

These alkalies are excellent fertilizers, when they are combined in compost with peat or other organic substances.

An Italian Recipe for Making Wine.

A gentleman having written to a friend in Italy for instructions as to making wine, received the following broken English reply—" The way to make wine with grapes is to stomp well them in a tob with a hol and a spicket in the bottum, and put that juse in a barel, where has been wine or whisky or liquors of some kind, otherwise the wine will stink of wood. Let them boil for forty days, meanwhile making the barel full every day, for in the boiling diminish. Shot up it after the forty days, and longer you let him stay older it comes, and better it will be." The word "boil" means, in this case, "ferment." The rest is intelligible, and those who follow the recipe faithfully will find it a good one.

Aluminum Bronze Pens.

Aluminum bronze, which is an alloy of aluminum with copper, has for some time been in use in Birmingham, and it has been worked into a variety of useful and ornamental articles—for instance, watch cases, watch chains, brooches, and many little trinkets—and the metal looks so gold-like that when nicely polished it cannot by the eye alone be distinguished from gold. Now we have it applied to another purpose. Messrs. C. T. Lutwyche and Son have patented the application of it to the manufacture of writing pens. They profess that pens made of this metal are, in appearance, equal to those made of gold, and are quite as incorrodible; that they write as smoothly as quills, whilst the price is so reasonable that any one may purchase them.

Heating Values of Different Woods.

The following is set down as the relative heating values of different kinds of American wood: Shellbark hickory, being taking as the highest standard, 100 ; pignut hickory, 95 ; white hazel, 72 ; apple tree, 70 ; red oak, 69 ; black walnut, 66; white beech, 65; black birch, 62; yellow oak, 60; hard maple, 59; white elm, 58; red cedar, 50; wild cherry, 55; yellow poplar, 52; butternut, 52; white birch, 49; white pine, 42.

The Camphor Storm-Glass.

Dealers in philosophical and optical instruments sell simple storm-glasses which are used for the purpose of indicating approaching storms. One of these consists of a glass tube, about ten inches in length and three-fourths of an inch in diameter, filled with a liquid containing camphor, and having its mouth covered with a piece of bladder perforated with a needle. A tall phial will answer the purpose as well as the ten-inch tube. The composition placed within the tube consists of two drachms of camphor, half a drachm of pure saltpetre and half a drachm of muriate of ammonia. pulverized and mixed with about two ounces of proof spirits. The tube is usually suspended by a thread near a window, and the functions of its contents are as follows:—If the atmosphere is dry and the weather promises to be settled, the solid parts of the camphor in the liquid contained in the tube will remain at the bottom, and the liquid above will be quite clear; but on the approach of a change to rain, the solid matter will gradually rise, and small crystalline stars will float about in the liquid. On the approach of high winds, the solid parts of the camphor will rise in the form of leaves and appear near the surface in a state resembling fermentation. These indications are sometimes manifested *twenty-four hours* before a storm breaks out! After some experience in observing the motions of the camphor matter in the tube, the magnitude of a coming storm may be estimated; also its direction, inasmuch as the particles lie closer together on that side of the tube that is *opposite* to that from which the coming storm will approach. The cause of some of these indications is as yet unknown; but the leading principle is the solubility of camphor in alcohol, and its insolubility in water, combined with the fact that the drier the atmosphere the more aqueous vapor does it take up, and *vice versa.*

Steam Engine Improvement.

In a late number of the *Scientific American*, under the head of "Recent American Patents," we find the following notice of an improvement relating to the *steam-engine:*—

"In all reciprocating steam engines heretofore constructed the movement of the piston has produced a concussion or shaking of the bed or foundation upon which the engine has been supported, and a tendency to tear the engine away from said bed or foundation, in many cases to the great detriment of the structure in which the engine is contained. This action has been especially injurious in the case of horizontal engines arranged transversely to the keels of vessels for driving screw propellers, and has been the great obstacle to the running of such engines at sufficiently high speeds to drive the propeller without the intervention of gearing or its equivalent between the crank shaft and propeller shaft. In such engines the weight of the piston and its attached piston rods and cross-head is frequently many thousand pounds, and the inertia of this mass, in the starting of the piston, re-acts against one end of the cylinder and tends to move the cylinder and bed of the engine toward one side of the vessel, and the force required to arrest the piston as it completes its stroke, after having acquired a great momentum, re-acts upon the framing and bed of the engine in the opposite direction to the re-action first mentioned, and tends to move the bed of the engine toward the other side of the vessel. In this way two distinct concussions are produced upon the vessel in a lateral direction during every stroke of the engine or in every stroke of each piston when more than one engine or an engine with more than one cylinder is used. The object of this invention is to counteract the above-mentioned effect or tendency of the movements of the piston of an engine; and to this end it consists in the connection with such piston, of a weight which has a corresponding reciprocating motion, but always moves in an opposite direction to the piston, such weight being equal or nearly equal to the weight of the piston and its rod or rods and their connections with the crank. and moving the same distance or being heavier and moving a correspondingly less distance, or lighter and moving a correspondingly greater distance. John Ericsson, of New York city, is the inventor of this improvement."

Ventilating Ships.

An important part of Dr. Edmonds' ventilating apparatus has been fitted to the "Royal Sovereign" cupola-ship, in which, by a simple arrangement, from 300 to 350 channels actually existing in every ship have been made available for the ventilation of the bilges and timber spaces. This is done by converting the latter into branch channels of one long air-shaft, constructed along each side of the ship. Through this air-trap a draught is created by communicating it into the funnel or ash-pit in steam-ships, or into ordinary ventilators in sailing-ships,—in either case revolving fans, worked by hand or machinery, may be used in connection with this system if an extraordinary amount of ventilation is required, and from its diffused action injurious draughts, which are inseparable from all other plans in use, are entirely avoided. Ship-owners are interested in the success of this system, as it promises to prevent dry rot by the free circulation of air which it creates through the whole framework of the ship. But it serves another equally important object,—that of the removal of all the foul smells usually prevailing between decks, which are engendered by dampness in the timber spaces, and decaying matter lodged in them. This is a very important result to obtain, particularly in troop and emigrant ships, as these are often causes of disease in hot climates. To perfect the ventilation deep air channels are provided, which form part of the deck itself, and act immediately below it, but even without these a very efficient ventilation can be obtained. In the "Royal Sovereign" the efficacy of the plan has been already tested, so far as her present state of equipment admits of it, a very slight increase of temperature in the funnel being sufficient to draw a current of air through the air shafts, and necessarily through the whole framework of the ship, which passing into the funnel is carried high into the open air.