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FOR UPPER CANADA.

JULY, 1861.

THE INTERNATIONAL EXHIBITION OF 1862.

When the proposition to hold an International Exhibition in London, in 1851, was first put forward, the greatest obstacles to its successful accomplishment were found to consist in the prejudices of the great mass of the British people. The manufacturers and machinists dreaded the exposure of all the best specimens of their skill to the inspection and imitation of foreigners; others loudly condemned the folly of permitting their own countrymen to see and examine the finest productions of other lands, and thus inflicting a grievous injury upon the home trade. Every argument, in fact, that could be suggested by ignorance or jealousy was urged in opposition to this project. But at last the few who gave themselves up to the task, succeeded by their untiring energy and zeal, after appealing to the common sense of the community, in removing such obstacles, and had at length the satisfaction of finding their efforts crowned with preëminent success. At this time, however, such prejudices no longer exist; all agree in acknowledging that so far from an exhibition of this kind proving an injury to the country, it is calculated to confer upon it an almost inestimable benefit. Already has this feeling been substantially manifested; a guarantee deed to the amount of £414,600, has been signed by nearly 1000 persons connected with or interested in Arts, Manufactures, and Commerce, a sum amply sufficient to carry out the enterprise without risk of loss or failure. Such an array of names indicates most clearly the general conviction that great good resulted from the exhibition of 1851, and that a suitable time has again arrived for testing and comparing the progress of all nations in Arts, Manufactures and all other departments of industry. It will be well then to consider briefly the grounds upon which the expectation is founded, that the exhibition to be held in 1862, will prove worthy of the age, and show that such an advance has been made in industrial processes as to warrant the promoters in deciding upon ten years as the proper period for the recurrence of such undertakings. First then let us refer to the progress of the nation since 1851.*

The population of Great Britain has largely increased. In 1851 it was 25,180,555, and in 1862 it will probably be 29,000,000. In London there will be next year half a million more inhabitants than in 1851. The people are better employed, and their social and intellectual condition is improved.

Railways have been extended from above 6000 to above 10,000 miles.

The electric telegraph has become universal, and in every direction facilities for communication have been increased. The duties on soap and paper, the only manufactures the prosperity of which was then thwarted by excise restrictions, have been repealed. All taxes on the dissemination of knowledge have been abolished, and increased facilities have been afforded for the circulation of knowledge by post. The import duties have been repealed, or very nearly so, on raw materials, the produce of foreign countries. The manufactures also of foreign lands have been admitted, free of duty, to compete with those of the country; old industries have been stimulated and improved. New industries have arisen.

In fine arts, painting and sculpture, it is hardly possible, except in very extraordinary periods, that a marked change can be observed in a single ten years; but this country certainly holds it own, as compared with the productions of other countries.

Photography, hardly known in 1851, has developed itself, and has become an important branch of art and industry, used alike by the artist, the engineer, the architect, the manufacturer, the merchant and the magistrate.

In the preparation of colours for printing and dyeing, most important discoveries have been made. The recently discovered and most beautiful and brilliant colours, called the "Aniline" series, are produced from coal and its products, and the facility of their application is so great that a complete revolution is taking place in the processes of dyeing and printing.

In the manufacture of glass great economy has been introduced; and the process, just perfected, of transferring photographs to glass, and permanently fixing them by the action of fire, will add a new and beautiful style of ornamentation to buildings of every description. The manufacture of agricultural implements, and especially the application of steam power to them, has been so improved and extended that it is now a highly important branch of trade; and the exhibition of the improvements which have been made in spinning, weaving, and winding machinery, will afford interesting evidence of the mechanical progress in these branches of industry. In the manufacture of iron, improvements are also made; its production is continually being economized, and a metal between iron and steel is now produced, at one process, which heretofore required two or more processes, alike expensive and difficult.

In artificial light, the sphere of production is en-

* Condensed from an article in a recent number of the *Journal of the Society of Arts*, London.

larged and light is cheaper, whereby hours are now available for industrial pursuits, and for the acquisition of knowledge by large numbers, which were formerly either unemployed or wasted. In steam-power, especially that applied to railroads and to ocean steam navigation, economical appliances have advanced rapidly. In ship building, the past ten years have produced vast changes. The navy and mercantile marine have advanced in scientific construction and in mechanical arrangement. The ocean steamers which were then employed in the postal service included but one of 2,000 tons; now there are many of nearly double that tonnage, with corresponding power and speed. In printing, great advances have been made; in the perfection of chromatic printing, and in the application of most expensive and most beautiful machinery to the printing of the daily journals. Invention and mechanical contrivances have thus kept pace with the requirements of intellect and the daily increasing love of knowledge.

The effect of the progress that has been made since 1851 is also shown by the rapid increase of colonial and foreign trade, and the much greater interest that foreigners take in England and English manufactures.

On such topics one might enlarge at any length, but enough has been said to show that, if the Exhibition of 1851 was "to form a new starting point from which all nations were to direct their further exertions," that of 1862 will surely still more efficiently perform that office, inasmuch as the basis upon which it rests is broader, the nations interested in the progress of civilization and commercial freedom more numerous, and the population to be stimulated to exertion enormously larger.

Since then so much may be expected from the mother country, in addition to what was done in 1851, surely expectations, in at least an equal proportion, may be formed respecting the position which Canada ought to take in the approaching Exhibition. Our country has since that time made enormous strides in everything that tends to its advancement and material progress. Then it had but recently emerged from a period of discontent and difficulty; now it is—as is acknowledged on all hands—the most flourishing and rapidly increasing in wealth and population of all the Colonies of the British Empire. It now has a system of railway and water communication unsurpassed any where; the Victoria Bridge over the St. Lawrence being one of the greatest engineering triumphs in the world.

While it is a matter of extreme regret that the Government do not intend to appropriate any sum of money, during the present year, towards the representation of Canada at the International Exhibition of 1862, still we trust that our manufacturers and artizans will not be discouraged, but will set about the preparation of the products of their skill with the energy that is their great characteristic, and thus render the exhibition of our progress, resting as it must upon individual resources, the more satisfactory and encouraging than if it were mainly dependent upon pecuniary aid bestowed by our Government.

THE DUNDAS COTTON MANUFACTORY.

The subjoined notice of the Dundas Cotton Works is taken from a late number of the "*True Banner*," published in that town. We rejoice to find that such an establishment has been set in active operation, and we heartily concur in the wishes of our contemporary for the success of the undertaking.

About a year ago, Joseph Wright, Esq., a gentleman whose experience in the Cotton Manufacturing business in England extends over a lengthy period of years, purchased the large brick and stone building erected in this town by Holt & Co., for the purpose of converting the same into a Cotton Factory, since which time he has been actively engaged fitting up machinery for the prosecution of the enterprize; and we are happy to be able to announce that he has now got his works so far advanced as to be able to turn out a very large quantity of cotton-batting and yarn daily. We visited the establishment on Friday last, when we were very courteously shown through the various departments thereof, and had an opportunity of watching the process of manufacture from the raw cotton to the packing of the batting and yarn in bales ready for the market; and as it may prove interesting to some of our readers to know something of the operations that are necessary for the conversion of the raw material into such marketable products as are daily sold and bought in large quantities in every section of the country, we give a brief outline thereof. In the manufacture of Batting, the raw cotton is first thrown into a machine called a "whipper," where it is beaten out and cleaned; it is then passed to a machine called a "scutcher," where all the seeds and dust that may still be in the cotton are removed, and where it is brought out into what is called a "lap," when it is ready for the carding machines, through which it passes and receives the final dressing, and is wound on large drums and cut into six feet lengths, whence it is removed and put up into "batts" ready for baling.

The process of manufacturing yarn is of a much more complicated nature. The raw cotton is first placed in a very large scutching machine, which occupies of itself one entire room; the scutcher is composed of a large number of rollers, beaters, fans, &c., and the cotton, in passing through it, is thoroughly cleansed, and pressed, the fans carrying all the dust and refuse beneath the floor and out of the building. This machine coils the cotton into "laps" on large drums, which are carried to another room, where ten large carding machines are in operation, and where the "laps" are run through—the fibres of the cotton being all laid straight and drawn out into what is called a "sliver," which coils of itself directly from each machine into a can. The can is then removed containing the "sliver," and placed at another machine called a draw frame having three "heads" and five "deliverers" to each "head," where the sliver passes through three distinct processes for the purpose of straightening and strengthening it, when it is again coiled into another can. The draw frame is a singularly constructed and self-acting machine—one peculiarity being that if any one of the numerous slivers passing through it breaks, the frame, or that section of it through which it is passing, immediately stops and the operative remedies the defect. From the draw frame the cans containing the slivers are removed to the "slubbing frame," which wisps the "sliver" and puts the first twist into it, and where it is run off into large bobbins, and transferred to the "roving frame," which machine twists the cotton into finer threads and transfers it to other bobbins. These bobbins are then carried to another room where the "throstle" frames are in operation and where the sliver receives a still finer twist and is drawn out into the perfect yarn, wound on small bobbins. These bobbins are then conveyed to the reeling machines where the yarn is put into hanks, and afterwards pressed and packed ready for market.

The description we have given above of the process of manufacturing the batting and yarn from the raw cotton as imported from the place of growth, can convey but a slight idea of the complicated nature of the operations through which it requires to pass before completed, but the outline we have given will afford the reader who may never have seen the process an inkling thereof.

The machinery in the works has been imported from the best manufacturers in England, and is certainly beautiful to look at—everything being perfect and very highly finished. Mr. Wright can now turn out ready for market every week with the machinery he has now in operation, 120 bales of batting, weighing from three to four thousand pounds, and 6000 lbs of yarn; and it is his intention, we understand, to add other branches of cotton manufacture to his already extensive establishment in the course of a few months. We wish him every success in his new undertaking, and hope he may realize his most sanguine expectations as to the success of his enterprize. His perseverance and untiring assiduity as a man of business entitle him to much praise, and we doubt not but his Works will earn for their proprietor a first place amongst the manufacturers of Canada.

In speaking of the quality of goods manufactured by Mr. Wright the *Globe* says:

Canadian Cotton Yarn.—We had the opportunity yesterday of inspecting samples of the first lot of cotton yarn manufactured in this Province, the product of the factory of Mr. Jos. Wright, Dundas. The sample, compared with the American yarn, was even, uniform in texture, and in strength superior.—Good judges of the article speak of it in the highest manner. The rate at which it can be manufactured and sold is as low, if not lower, than the imported article, which is much inferior in quality. We are glad to notice that the patient enterprize which Mr. Wright has displayed, during the past year-and-a-half, at length promises a profitable return; and we are sure every Canadian dealer and consumer will give his wares the preference over the imported article.

ON THE CHEMICAL HISTORY OF A CANDLE.

BY M. FARADAY, D.C.L., F.R.S.

From the Chemical News, Feb. 2nd, 1861.

Lecture V.—Oxygen present in the Air—Nature of the Atmosphere—Its Properties—Other Products from the Candle—Carbonic Acid—Its Properties.

We have now seen that we can produce hydrogen and oxygen from the water that we obtained from the candle. Hydrogen, you know, comes from the candle, and oxygen, you believe, comes from the air. But then you have a right to ask me, "How is it that the air and the oxygen do not equally well burn the candle?" If you remember what happened when I put a jar of oxygen over a piece of candle, you recollect there was a very different kind of combustion to that which took place in the air. Now, why is this?—it is a very important question, and one I shall endeavour to make you understand; it relates most intimately to the nature of the atmosphere, and is most important to us.

We have several tests of oxygen besides the mere burning of bodies; you have seen a candle burnt in oxygen, or in the air; you have seen phosphorous burnt in the air, or in oxygen, and you have seen iron filings burnt in oxygen. But we have other tests besides these, and I am about to refer to one or two of them for the purpose of carrying your conviction and experience further. Here you have a vessel of oxygen. I will show its presence to you: if I take a little spark and put it into that oxygen you know by the experience you gained the last time we met, what will happen,—if I put that spark into the jar it will tell you whether we have oxygen here or not. Yes! We have proved it by combustion; and now here is another test for oxygen, which is a very curious and useful one. I have here two jars full of gas, with a plate between them to prevent their mixing; I take the plate away, and the gases are creeping one into the other. "What happens," say you, "they together produce no such combustion as was seen in the case of the candle." But see how the presence of oxygen is told by its association with this other substance. What a beautiful, curious gas I have obtained in this way, showing me the presence of the oxygen. In the same way we can try this experiment by mixing common air with this test-gas. Here is a jar containing air—such air as the candle would burn in, and here is a jar or bottle containing the test-gas. I let them come together over water, and you see the result: the contents of the test-bottle are flowing into the jar of air, and you see I obtain exactly the same kind of action as before, and that shows me that there is oxygen in the air,—the very same substance that has been already obtained by us from the water produced by the candle. But then, beyond that, how is it that air does not burn the candle as well as oxygen will? We will come to that now. I have here two jars; they are filled to the same height with gas, and the appearance to the eye is alike in both, and I really do not know at present which of these jars contains oxygen and which contains air, although I know they have previously been filled with these gases. But here is our test-gas, and I am going to work with the two jars, in order to examine whether there is any difference between them in the quality of reddening this gas. I am now going to turn this test-gas out into one of the jars, and observe what happens:—There is reddening you see; there is then oxygen present. We will now test the other jar, but you see this is not so bright, not so red, not so distinct, as the first; and, further, this curious thing happens, if I take these two gases and shake them together well with water, we shall absorb the red gas; and then if I put in more of this test-gas and shake again we shall absorb more, and I can go on as long as there be any oxygen present to produce that effect. If I let in air it will not matter, but the moment I introduce water, the red gas disappears, and I may go on in this way, putting in more and more of the test-gas, until I come to something left behind which will not redden any longer by the use of that particular body that rendered the air and the oxygen red. Why is that? You see in a moment it is because there is, besides oxygen, something else present which is left behind.

I will let a little more air into the jar, and if it turns red you will know that some of that reddening gas is still present, and that, consequently, it was not for the want of this producing body that that air was left behind.

Now, you will begin to understand what I have got to say. You saw that when I burnt phosphorous in a jar, as the smoke produced by the phosphorous and the oxygen of the air condensed, it left a good deal of gas unburnt, just as this red gas left something untouched,—there was, in fact, this gas left behind which the phosphorous cannot touch, which the reddening gas cannot touch, and this is something which is not oxygen, and yet is part of the atmosphere.

So that is one way of opening out air into the two things of which it is composed,—oxygen, which burns our candles, our phosphorous, or anything else, and this other substance which will not burn them. This other part of the air is by far the largest part. Now, this substance is a very curious thing when we come to examine it; it is remarkably curious, and yet you say, perhaps, that it is very uninteresting. It is uninteresting in some respects because of this,—that it shows no bright appearance of combustion. If I test it with a taper as I do oxygen and hydrogen, it does not burn like hydrogen, nor does it make the taper burn like oxygen. Try it in any way I will, it does neither the one thing or the other; it will not take fire: it will not let the taper burn; it puts out the combustion of anything. There is nothing that will burn in it in common circumstances. It does not smell; it is not sour; it does not dissolve in water; it is neither an acid or alkali; it is as indifferent to all our organs as it is possible for a thing to be. And you might say, "It is nothing; it is not worth chemical attention; what does it do in the air?" Ah! then come our beautiful and fine results shown us by an observant philosophy. Suppose, in place of having nitrogen, or nitrogen and oxygen, we had pure oxygen as our atmosphere. What would become of us? You know very well that a piece of iron lit in a jar of oxygen goes on burning to the end. When you see a fire in an iron grate, imagine where the grate would go to if the whole of the atmosphere were oxygen. The grate would burn up more powerfully than the coals; for the iron of the grate itself is even more combustible than the coals which we burn in it. A fire put into the middle of a locomotive would be a fire in a magazine of fuel, if the atmosphere were oxygen. The nitrogen lowers it down and makes it moderate and useful for us, and then with all that it takes away with it the fumes that you have seen produced from the candle, disperses them throughout the whole of the atmosphere, and carries them away to places where they are wanted to perform a great and glorious purpose of good to man, for the sustenance of vegetation; and thus does a most wonderful work, although you say, on examining it, "why it is a perfectly indifferent thing." This nitrogen in its ordinary state, is an inactive element; no action short of the most intense electric force, and then in the most infinitely small degree, can cause the nitrogen to combine directly with the other element of the atmosphere, or with other things round about it; it is a perfectly indifferent, and therefore to say, a safe substance.

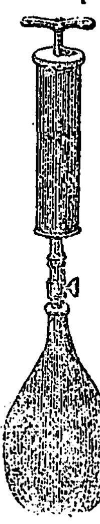
But before I take you to that result, I must tell you about the atmosphere itself; I have written on this diagram, the composition of one hundred parts of atmospheric air:—

	Bulk.	Weight.
Oyxgen	20	22·3
Nitrogen............	80	77·7
	100	100·0

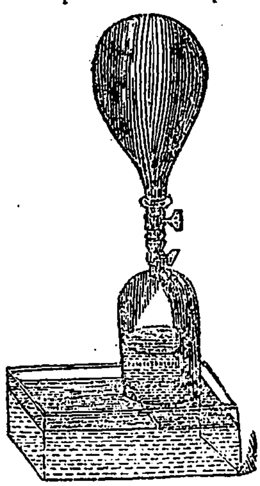
it is a true analysis of the atmosphere, so far as regards the quantity of oxygen and the quantity of nitrogen present. By our analysis, we find that five pints of the atmosphere contains only one pint of oxygen, and 4 pints or 4 parts of nitrogen by bulk. That is our analysis of the atmsphere. It requires all that quantity of nitrogen to reduce the oxygen down, so as to be able to supply the candle properly with fuel, so as to supply us with an atmosphere which our lungs can healthily and safely breathe; for it is just as important to make the oxygen right for us to breathe, as it is to make the atmosphere right for the burning of the fire and the candle.

But now for this atmosphere. First of all let me tell you the weight of these gases. A pint of nitrogen weighs 10 grains and $\frac{4}{10}$ths, or a cubic foot weighs $1\frac{1}{6}$ oz. That is the weight of the nitrogen. The oxygen is heavier; a pint of it weighs $11\frac{9}{10}$grs., and a cubic foot weighs $1\frac{3}{4}$ oz. A pint of air weighs about $10\frac{7}{10}$grs., and a cubic foot $1\frac{1}{5}$ oz.

You have asked me several times, and I am very glad you have, "How do you weigh gases?" I will show you; it is very simple, and easily done. Here is a balance, and here is a copper bottle made as light as we can consistent with due strength, turned very nicely in the lathe, and made perfectly air-tight, with a stop-cock, which we can open and shut, which at present is open, and, therefore, allows the bottle to be full of air. I have here a nicely-adjusted balance in which I think the bottle, in its present condition, will be balanced by the weight on the other side. And here is a pump by which we can

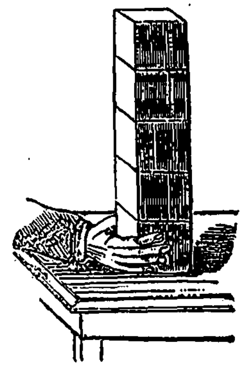


force the air into this bottle, and with it we will force in a certain number of volumes of air as measured by the pump [Twenty measures were pumped in]. We will shut that in and put it in the balance. See how it sinks; it is much heavier than it was. By what? By the air that we have forced into it by the pump. There is not a greater *bulk* of air, but there is the same bulk of *heavier* air, because we have forced in air upon it. And that you may have a fair notion in your mind as to how much this air is, here is a jar full of water. We will open that copper vessel into this jar, and let the air return to its former state. All I have to do now is to screw them tightly together, and to turn the taps, when there, you see, is the bulk of the twenty pumps of air which I forced into the bottle; and to make sure that we have been quite correct in what we have been doing, we will take the bottle again to the balance, and if it is now counterposed by the original weight, we shall be quite sure we have made our experiment correctly. It is balanced; so, you see, we can find out the weight of the extra volumes of air forced in in that way, and by that means we are able to ascertain that a cubic foot of air weighs 1¼ oz. But that small experiment will by no means convey to your mind the whole literal truth of this matter. It is wonderful how it accumulates when you come to larger volumes. This bulk of air [a cubic foot] weight $1\frac{1}{10}$ oz. What do you think of the contents of that box above there which I have had made for the purpose? The air which is within that box weighs one pound—a full pound, and I have



calculated the weight of the air in this room,—you would hardly imagine it, but it is above a ton. So rapidly do the weights rise up, and so important is the presence of the atmosphere, and of the oxygen, and the nitrogen in it, and the use it performs in conveying things to and fro from place to place, and carrying bad vapours to places where they will do good instead of harm.

Having given you that little illustration with respect to the weight of the air, let me show you certain consequences of it. You have a right to them because you would not understand so much without it. Do you remember this kind of experiment: have you ever seen it? Suppose I take a pump somewhat similar to the one I had a little while ago to force air into the bottle, and suppose I place it in such a manner that by certain arrangements I can apply my hand to it. My hand moves about in the air so easily that it seems to feel nothing, and I can hardly get velocity enough by any motion of my own in the atmosphere to make sure that there is much resistance to it. But, when I put my hand here [on the air-pump receiver, which was afterwards exhausted] you see what happens. Why is my hand fastened to this place, and why am I able to pull this pump about? And see! how is it that I can hardly get my hand away? Why is this? It is the weight of the air—the weight of the air that is above. I have another experiment here which I think will explain to you more about it.



When the air is pumped from underneath the bladder which is stretched over this glass, you will see the effect in another shape; the top is quite flat at present, but I will make a very little motion with the pump, and now look at it,—see how it has gone down, see how it is bent in; you will see the bladder go in more and more, until, at last, I expect it will be driven in and broken by the force of the atmosphere pressing upon it [the bladder, at last, broke with a loud report]. Now, that was done entirely by the weight of the air pressing on it, and you can easily understand how that is. The particles that are piled up in the atmosphere stand upon each other, as these five cubes do; you can easily conceive that these five cubes are resting upon the bottom one, and if I take that away the others will all sink down. So it is with the atmosphere; the air that is above is sustained by the air that is beneath, and when the air is pumped away from beneath them, the change occurs which you saw when I placed my hand on the air-pump, and which you saw in the case of the bladder, and which you shall see better here. I have tied over this jar a piece of sheet india-rubber, and I am now about to take away the air from the inside of the jar, and if you will watch the india-rubber—which acts as a partition between the air below and the air above, you will see when I pump how the pressure shows itself. See where it is going to, I can actually put my hand into the jar: and yet this result is only caused by the great and powerful action of the air above. How beautifully it shows this curious circumstance.

Here is something that you can have a pull at when I have finished to-day. It is a little apparatus of two hollow brass hemispheres, closely fitted together, and having connected with it a pipe and a cock, through which we can exhaust the air from the inside; and although the two halves are so easily taken apart while the air is left within, yet, you will see when we exhaust it by-and-by, no power of any two of you will be able to pull them apart. Every square-inch of surface that is contained in the area of that vessel sustains fifteen pounds by weight, or nearly so, when the air is taken out; and you may try your strength presently in seeing whether you can overcome that pressure of the atmosphere.

Here is another very pretty thing,—the boy's sucker, only refined by the philosopher. We young ones have a perfect right to take toys, and make them into philosophy, inasmuch as now-a-days we are turning philosophy into toys. Here is a sucker, only it is made of india-rubber; if I clap it upon the table, you see at once it holds. Why does it hold? I can slip it about, and yet if I try to pull it up, it seems as if it would pull the table with it. I can easily make it slip about from place to place; but only when I bring it to the edge of the table can I get it off. It is only kept down by the pressure of the atmosphere above. Here are a couple of them; if you take these two and press them together, you will see how strong they stick. And, indeed, we may use them as they are proposed to be used, to stick against windows or against walls, where they will adhere for an evening, and serve to hang anything on that you want. I think, however, that you boys ought to have experiments that you can make at home; and so here is a very pretty experiment in illustration of the pressure of the atmosphere. Here is a tumbler of water; suppose I were to propose to you to turn that tumbler upside down so that the water should not fall out, and yet not keep it in by my hand, but merely by using the pressure of the atmosphere: could you do that? Take a wine-glass either quite full or half full of water, and put a flat card on the top; turn it upside-down, and then see what becomes of the card and of the water. The air cannot get in because the water by its capillary attraction round the edges keeps it out.

I think this will give you a strong notion of what you may call the materiality of the air, when I tell you that that box holds a pound of it, and this room more than a ton, and you will begin to think that air is something very serious. I will make another experiment to convince you of this positive resistance. There is that beautiful experiment of the pop-gun, made so well and so easily you know out of a quill, or a tube, or anything of that kind; where we take a slice of potato for instance, or an apple, and take the tube and cut out a pellet, as I have now done, and push it to one end. I have made that end tight; and now I take another piece and put it in: it will confine the air that is within the tube perfectly and completely for our purpose; and now I shall find it absolutely impossible by any force of mine to drive that little pellet close up to the other. It cannot be done; I may press the air to a certain amount, but if I go on pressing, long before it come to the second the confined air will drive the front one out with a force something like that of gunpowder; for gunpowder is in part dependent upon the same action that you see in this case.

Here is an experiment which I saw the other day and was very pleased with, as I thought it would serve our purpose here. (I ought to have held my tongue for four or five minutes before I began this experiment, because I depend upon my lungs for the success of it. By the proper application of air I expect I can drive this egg out of one cup into the other by the force of my breath, but if I fail it is in a good cause, and I do not promise success, because I have been talking more than I ought to do to make the experiment succeed.

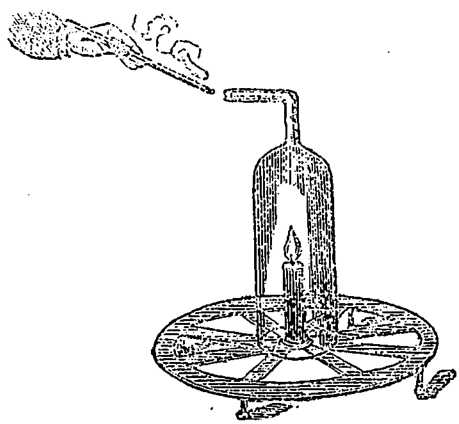
[The Lecturer here tried the experiment, and succeeded in blowing the egg fron one egg-cup to the other.]

You see that the air which I blow goes downwards between the egg and the cup, and makes a blast under the egg, and is thus able to lift a heavy thing for a full egg is a very heavy thing for air to lift. If you want to make the experiment you had better boil the egg quite hard at first, and then you may very safely try to blow it from one cup to the other with a little care.

I think I have now kept you long enough upon this property of the weight of the air, but there is another thing I should like to mention. You saw the way in which, in this pop-gun, I was able to drive the second piece of potato half or two-thirds of an inch before the first piece started, by virtue of the elasticity of the air; just as I pressed in the copper bottle the particles of air by means of the pump. Now this depends upon a wonderful property in the air, namely, its elasticity, and I should like to give you a good illustration of this. It is this: if I take anything that confines the air properly, as this membrane, it is able to contract and expand so as to give us a measure of the elasticity of the air, and to confine in it a certain given portion of air: and then, if we take the atmosphere off from the outside of it, just as in these cases we put the pressure on—if we take the pressure off you will see how it will then go on expanding and expanding, larger and larger, until it will fill the whole of this bell-jar, showing you that wonderful property of the air, its elasticity, its compressibility, and expansibility, to an exceedingly large extent; and this is very essential for the purposes and services it performs in the economy of creation.

We will now turn to another most important part of our subject, remembering that we have examined the candle in its burning, and have found that it gives rise to various products. We have the products, you know, of soot, of water, and of something else, which you have not yet examined. We have collected the water, but have allowed the other things to go into the air. Let us now examine some of these other products.

Here is an experiment which I think will help you in part in this way. We will put our candle there, and place over it a chimney, thus. I think my



candle will go on burning, because the air-passage is open at the bottom and the top. In the first place, you see the moisture coming—that you know about. It is water produced from the candle by the action of the air upon its hydrogen. But besides that, something is going out at the top: it is not moisture,—it is not water,—it is not condensible; and yet, after all, it has very singular properties. You will find that the air coming out of the top of our chimney is nearly sufficient to blow the light out I am holding to it, and if I put the light fairly opposed to the current, it will blow it quite out. You will say, that is as it should be, and I am supposing that you think it ought to do so, because the nitrogen does not support combustion, and ought to put the candle out, since the candle will not burn in nitrogen. But is there nothing else there than nitrogen? I must now anticipate,—that is to say, I must use my own knowledge, to supply you with the means that we adopt for the purpose of ascertaining these things, and examining such gases as these. I will take an empty bottle,—here is one,—and if I hold it over this chimney, I shall get the combustion of the candle below sending its results into the bottle above; and we shall soon find that this bottle contains, not merely an air that is bad as regards the combustion of a taper put into it, but having other properties.

Let me take a little quick lime and pour some common water on to it,—the commonest water will do. I will stir it a moment, then pour it upon a piece of filtering paper in a funnel, and we shall very quickly have a clear water proceeding to the bottle below, as I have here. I have plenty of this water in another bottle, but nevertheless I should like to use the lime water that was prepared before you so that you may see what its uses are. If I take some of this beautiful clear lime-water and put that into this jar which has collected the air from the candle, you will see a change coming about. Do you see that that water has got quite milky? Observe, that will not happen with air merely. Here is a bottle filled with air, and if I put a little lime-water into it neither the oxygen nor the nitrogen, nor anything else that is in that quantity of air will make any change in the lime-water, it remains clear and perfect, and no shaking of that quantity of lime-water with that quantity of air in its common state will cause any change; but if I take this bottle with the lime-water and hold it so as to get the general products of the candle in contact with it, in a very short time you see we shall have it milky—there is the chalk, consisting of the lime which we used in making the lime-water, combined with something that came up from the candle,—that other product which we are in search of and which I want to tell you about to-day. This is a substance made visible to us by its action, which is not the action of the lime-water either upon the oxygen or upon the nitrogen, nor upon the water itself, but is something new to us from the candle. And then we find this white powder produced by the lime-water and the vapour from the candle appears to us very much like whitening or chalk, and when examined it does prove to be exactly the same substance as whitening or chalk. So we are led, or have been led, to observe upon the various circumstances of this experiment, and to trace this production of chalk to its various causes to give us the true knowledge of the nature of this combustion of the candle,—to find that this substance issuing from the candle is exactly the same as that substance which would issue from a retort if I were to put some chalk into it and make it red hot with a little moisture: you would then find that exactly the same substance would issue from it as from the candle.

But we have a better means of getting this substance, and in greater quantity, so as to ascertain what its general characters are. We find this substance in very great abundance in a multitude of cases where you would least expect it. All limestones contain a great deal of this gas which issues from the candle, and which we call *carbonic acid.* All chalks, all shells, all corals, contain a great quantity of this curious air. We find it fixed in these stones, for which reason Dr. Black called it "fixed air,"—finding in these fixed things like marble and chalk,—he called it fixed air because it lost its quality of air, and assumed the condition of a solid body. We can easily get this air from marble. Here is a jar containing a little muriatic acid, and here is a taper which, if I put it to that jar, will show only the presence of common air. There is, you see, pure air down to the bottom; the jar is full of it. Here is a substance—marble, a very beautiful and superior marble, and if I put these pieces of marble into the jar, a great boiling apparently goes on. That, however, is not steam; it is a gas that is rising up, and if I now search the jar by a candle I shall have exactly the same effect produced upon the taper as I had from the air which issued from the end of the chimney over the burning candle. It is exactly the same action, and caused by the very same substance that issued from the candle; and in this way we can get carbonic acid in great abundance,—we have already nearly filled the jar. We also find that this gas is not merely contained in marble. Here is a vessel in which I have put some common whitening-chalk which has been washed in water and deprived of its coarser particles, and so supplied to the plasterer as whitening. Here is a large jar containing this whitening and water, and I have here some strong sulphuric acid, which is the acid you might have to use if you were to make these experiments (only in using this acid with limestone, the body that is produced is an insoluble substance, whereas, the muriatic acid produces a soluble substance that does not so much thicken the water). And you will seek out a reason why I take this kind of apparatus for the purpose of showing this experiment. I do it because you may repeat in a small way what I am about to do in a large one. You will have here just the same kind of action, and I am evolving in this large jar carbonic acid exactly the same in its nature and properties as the gas which we obtained from the combustion of the candle in the atmosphere. And no matter how different the two methods by which we prepare this carbonic acid, you will see, when we get to the end of our subject, that it is all exactly the same, whether prepared in the one way or the other.

We will now proceed to the next of our experiments with respect to this gas. What is its nature? Here is one of the vessels full, and we will try it as we have done so many other gases—by combustion. You see it is not combustible, nor does it support combustion. Neither, as we know, does it dissolve much in water, because we collect it over water very easily. Then you know that it has an effect and becomes white in contact with lime-water, and when it does become white in that way, it becomes one of the constituents to make carbonate of lime or limestone.

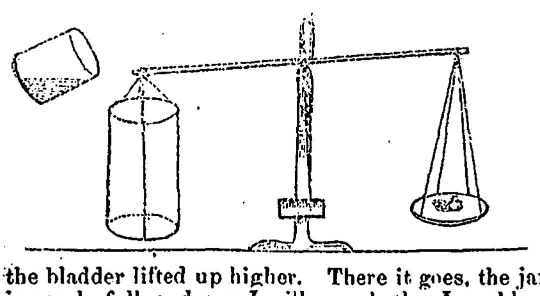
Now, the next thing is to show you that it does dissolve a little in water, and therefore that it is unlike oxygen and hydrogen in that respect. I have here an apparatus by which we can produce this solution. In the lower part of this apparatus is marble and acid, and in the upper part cold water. The valves are so arranged that the gas can get from one to the other; I will set it in action now, and you can see the gas bubbling up through the water, as it has been doing all night long, and by this time we shall find that we have this substance dissolved in the water. If I take a glass and draw off some of the water, I find that it tastes a little acid to the mouth ; it is impregnated with carbonic acid ; and if I now apply a little lime water to it, that will give us a test of its presence. This water will make the lime-water turbid and white, which is the carbonic acid test.

Then it is a very weighty gas ; it is heavier than the atmosphere. I have put their respective weights at the lower part of this table, along with, for comparison, the weights of the other gases we have been examining:—

	Pint.	Cubic foot.
Hydrogen . . .	$\frac{3}{4}$ grs	$\frac{1}{12}$ oz.
Oxygen . . .	$11\frac{9}{10}$	$1\frac{1}{3}$
Nitrogen . . .	$10\frac{4}{10}$	$1\frac{1}{6}$
Air	$10\frac{7}{10}$	$1\frac{1}{5}$
Carbonic acid . .	$16\frac{1}{3}$	$1\frac{9}{10}$

A pint of it weighs $16\frac{1}{3}$ grs., and a cubic foot weighs $1\frac{9}{10}$ oz., almost two ounces. ' You can see by many experiments that this is a heavy gas. Suppose I take a glass containing nothing else but air, and this vessel containing the carbonic acid ; and suppose I pour a little of this gas into that glass, I wonder whether any has gone in or not ; I cannot tell by the appearance, but I can in this way [introduces the taper]. Yes, there it is, you see ; and if I were to examine it by lime-water, I should find it in the same way. I will take this little bucket, and put it down into the well of carbonic acid,—indeed we too often have real wells of carbonic acid,—and now, if there is any carbonic acid, I must have got to it by this time, and it will be in this bucket, which we will examine with a taper. There it is, you see ; it is full of carbonic acid.

I have another experiment here by which I will show you its weight. I have here a jar suspended at one end of a balance—it is now equiposed, but when I pour this carbonic acid into the jar on the one side which now contains air, you will see it sink down at once because of the carbonic acid that I pour into it. And now I examine this jar with the lighted taper. I shall find that the carbonic acid has fallen into it, and it no longer has any power of supporting the combustion. If I blow a soap bubble which of course will be filled with air, and let it fall into this jar of carbonic acid, it will float. But I shall first of all take one of these little balloons filled with air I am not exactly sure where the carbonic acid is, we will just try the depth, and see where abouts is its level. There you see we have this bladder floating on the carbonic acid, and if I evolve some more of the carbonic acid, you will see



the bladder lifted up higher. There it goes, the jar is nearly full, and now I will see whether I can blow a soap bubble on that and float it in the same way. [The Lecturer here blew a soap bubble and allowed it to fall into the jar of carbonic acid, when it floated in it midway.] It is floating as the balloon floated by virtue of the greater weight of the carbonic acid than of the air. And now, having so far given you the history of the carbonic acid, as to its sources in the candle, as to its physical properties and weight, when we next meet I shall show you of what it is composed, and where it gets its elements from.

VEGETABLE FOOD.

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

OLEAGINOUS FOOD.

Under the names of oil, butter, fat, lard, suet, grease, a substance is used largely as an article of food, which differs chemically from starch and sugar in the small quantities of oxygen gas it contains. The composition of these oleaginous substances may be represented generally as follows: Carbon 11 parts, Hydrogen 10 parts, Oxygen 1 part.

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

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

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

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

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

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

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

VEGETABLE FOOD.	
Potatoes	0·2
Wheat Flour	1.2
Barley Meal	0.3
Oatmeal	5.7
Indian Meal	7.7
Rye	1.0
Peas	2.0
Rice	0.7
Beans	2.0
Cocoa	50.0
Lentils	2.0
Buckwheat	1.0
Tea	4.0
Coffee	12.0
ANIMAL FOOD.	
Milk	3.5
Pork	50.0
Veal	16·0
Beef	30·0
Mutton	40·0
Fish	7·0
Cheese	25·0

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

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

Almonds	(*Amygdalus communis*).
Chesnuts	(*Castan a vesca*).
Walnuts	(*Juglans regia* et *Juglans nigra*).
Peccan Nuts	(*Juglans olivœformis*).
Brazil Nuts	(*Bertholletia excelsa.*)
Spanish & Hazel Nuts	(*Corylus avellana*).
Hickory Nuts	(*Carya alba*).
Beech Nuts	(*Fagus sylvatica*).
Pistacio Nuts	(*Pistacia vera*).
Cashew Nuts	(*Anacardium occidentale*).
Chicha Nuts	(*Sterculia Chicha*).
Pine Seeds	(*Pinus Pinea*).

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

Amongst them may be mentioned the various forms of acorns which are eaten in Portugal, Greece, Asia Minor, and other parts of the world. The Sacred Bean of Egypt (*Nelumbium speciosum*), and the Lotos (*Nymphœa Lotos*) of the same region, the Water-nuts (*Trapa natans*) of China and Cashmir, and the Souari or Butter-nuts (*Caryocar butyrosum*) of Demerara.

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

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

Amongst vegetable foods yielding oil the Cocoa or Chocolate plant (*Theobroma Cacao*) is one of the most remarkable. The seeds of this plant contain 50 per cent. of a hard oil or butter.

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

ACIDS.

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

Organic Acids enter extensively into the composition of various kinds of food. The acids most commonly used in diet are—Acetic acid, Citric acid, Tartaric acid, Malic acid, Oxalic acid.

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

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

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

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

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

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

The basis of vinegar consists of acetic acid, which is composed of carbon, hydrogen, and oxygen; the same elements that enter into the composition of alcohol. This compound is also procured from the distillation of wood. The acetic acid thus procured is called pyroligneous acid. The quantity of acetic acid in vinegar is from 4 to 5 per cent. Malt vinegar contains, besides acetic acid, water, dextrin, and frequently sulphuric acid. Wine vinegar contains, besides acetic acid, the constituents of the wine from which it is made, as tartaric acid, &c. Pure vinegar is transparent, but burnt sugar is added to give it a colour, on account of a popular prejudice in favour of coloured vinegar.

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

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

The natural order Aurantiaceæ embraces the Orange, the Lemon, the Citron, the Shaddock, the Pomelot, the Lime, and other fruits. All of them contain citric acid, and varying proportions of sugar.

The flowers of the Orange yield a delicious perfume known as Oil of Neroli.

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

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

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

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

The edible products of the natural order Rosaceæ, comprising the fruits of the Apple, Pear, Apricot, Nectarine, Peach, Cherry, Plum, Raspberry, Strawberry, contain malic acid. They are mostly preserved in sugar. Many forms of plums called Prunes contain a sufficient quantity of sugar to be dried and preserved without further preparation.—*A Guide to the Food Collection in the South Kensington Museum.*

The Board of Arts & Manufactures

FOR UPPER CANADA.

The regular quarterly Meeting of the Board will be held on Tuesday, the 2nd day of July, at half past one o'clock, P.M., at the Board Rooms, in the New Hall of the Mechanics' Institute, corner of Church and Adelaide Streets, Toronto.

The Sub-committee will meet at half past eleven o'clock, A. M., on the same day.

W. Edwards,
Secretary.

THE TORONTO MECHANICS' INSTITUTE.

ABSTRACT OF ANNUAL REPORT AND PROCEEDINGS.

The Annual Meeting of this Institution was held on Monday, May 13th; Joseph D. Ridout, Esq., President, in the chair.

The Secretary read the report of the Board of Directors, which was adopted; and the President having appointed scrutineers of the ballot, the election was proceeded with, and resulted in the selection of the following named gentlemen as Office-bearers and Directors for the ensuing year, viz:

Rice Lewis, *President.*
R. A. Harrison, *1st Vice-President.*
W. Edwards, *2nd Vice-President.*
John Paterson, *Treasurer.*

Directors: Messrs. W. Hay, J. E. Pell, Jos. D. Ridout, Patrick Freeland, John Cowan, C.W. Bunting, James Litster, W. S. Lee, John Withrow, H. Piper R. J. Griffith and R. McPhail.

The first topic taken up in the report is the membership.

"The Board had hoped to be in a position to report an increase of members during their term of office. Although their hopes in this respect have not been fully realized, the decrease has been so trifling, compared with the two former years, as to justify them in concluding that the Institute has again entered upon a career of prosperity similar to that which it previously enjoyed."

The number of members and subscribers at last annual report, was 626, the total number at present is 620, showing a decrease of six during the year, compared with a decrease of 165 reported last year.

"The Board confidently anticipate a large accession to the membership during the ensuing year, induced by more extensive accommodations, the prospect of large additions both to the library and reading room, and improvement in every other department."

The treasurer's statement shows total receipts from all sources $17,480 13 ; expenditure, $8,428 13 ; balance in hand $9,052,00. The assets and liabilities of the Institute are estimated as follows :

Assets:		
Balance cash in hand.	$9,052 00	
Members' Subscriptions due ...	128 00	
Rents due	26 37	
Value of Building	32.000 00	
Value of ground (cost)	6,525 00	
Value of Library, Furniture, &c.	4,200 00	
		$51,931 37
Liabilities:		
Loan on Building and Ground		18,400 00
Clear Assets		$33,531 37

In compliance with the new by-laws of the Institute, the principal portion of the books held by the members were sent in during the week preceding the annual meeting, and a thorough examination of the library was made by the Board. Its condition is thus given :

"The total number of Books in the Library, according to the last Annual Report, was		4,121
Added by purchase during the year		292
Bound up from Reading Room		56
Donations		1
Total		4,470
Worn out, or rendered unfit for circulation during the year	153	
Missing, or worn out during former years, but of which no account had been previously taken, for want of annual examination; and works lost by members, for which payment has been received by the Institute	282	435
Now in Library		4,035

The report recommends that a Conversazione should be held at the opening of the Music Hall, the profits to be devoted exclusively to the purchase of books for the Library.

The Board acknowledges the obligation the Institute is under to those gentlemen who have furnished their respective periodicals to the Reading Room free of charge ; and states that

"This department of the Institute has been well attended during the year, and undoubtedly would have been better appreciated, but for want of room and consequent classification of the periodicals supplied ; the interest, however, taken in the Reading Room augurs well for the future, when the large room with ample accommodation shall be thrown open."

The Reading Room has been supplied during the year with 41 Canadian, 22 British, and 15 American Newspapers and Magazines ; several other British Periodicals have been ordered.

For want of proper accommodation in the present building, and having to devote so much time and attention to the new Hall, but one lecture was delivered in connection with the Institute during the past session.

"An English class established in 1859, under the direction of Mr. Richard Lewis, was re-organized last fall and met for a term of five months. The exercises consisted of lessons in English Grammar, on the analysis of sentences, on composition and rhetoric, and on logic, elocution and public speaking. Mr. Lewis labored zealously for the improvement of his class, which was well attended, and a manifest improvement was the result in all who attended industriously to the studies. It was closed only a week or two since, when the thanks of the class were heartily accorded to Mr. Lewis for the interest he had manifested in the welfare and improvement of its members.

"The class has agreed to meet at intervals through the summer months, so as to continue its organization ready for next session.

"A class for the study of vocal music has recently been established in connection with the Institute, conduced by Mr. C. Pearson, which your Board have reason to believe is making satisfactory progress in its studies.

The Board recommend to their successors, that a large share of attention be given to the formation and conducting of classes in the Institute, especially as ample rooms have been provided in the new Hall for their accommodation.

The report states that a settlement was obtained with the government in August last, "when the sum of $16,000 was accepted for the purpose of covering the cost of alterations and repairs to the new Hall, and for Rent, Insurance, and Interest on the debt, for such time as the building might be expected to be undergoing the necessary repairs and alterations. After various delays from causes which have already been under discussion, the principal works for the completion of the building were given out to contract, and are now, with the exception of the Music Hall, nearly ready for occupation.

The services of the late President, Patrick Freeland, Esq., and of the Hon. G. W. Allan, in obtaining the settlement with the government, are acknowledged with the warmest expression of thanks.

"The Board have leased the set of offices in the south-west corner of the ground floor of the building, for a term of five years, at an annual rent of $300 ; and have also leased three rooms, on the south-west corner of the second story, to the Board of Arts and Manufactures, for its model rooms, and Free Library of reference, for a term of three years, at an annual rent of $240.

"Other rooms, both for permanent and casual rentals, are yet at the disposal of the Institute, from the whole of which a sufficient revenue to meet the annual interest, and insurance on the building, may be anticipated."

An arrangement has been entered into with the "Toronto Electoral Division Society," to hold a joint Exhibition of Arts, Manufactures, and Horticultural and Agricultural products, in the New Hall of the Institute. The Exhibition will open on Monday the 7th of October, and remain open from 10 a. m., to 10 p. m., each day, for two weeks. Nearly one thousand dollars will be offered in prizes, open to all the Province.

The Institute proposes to hold a Bazaar in connection with the Exhibition, the proceeds to be applied to the purchase of a suitable Organ for the Music Hall, where it will be at all times available for Concerts, Musical Societies, &c.

"Under authority of the Act passed during the last session of the Provincial Legislature, your Board surrendered the original Charter of the Institute, and filed declarations incorporating it under the general Act for the Incorporation of Mechanics' Institutes, chap. 72 Consolidated Statutes of Canada. The new constitution and by-laws adopted under said act have been in force since the first day of September last."

The report strongly urges upon the members the claims the Journal of the Board of Art and Manufactures has on their support; and also recommends that during next year, with the extensive accommodations for classes already referred to, a large number of the members will prepare themselves to compete for diplomas at the Annual Examination proposed to be held by the Board, in May, 1862.

Under the new Constitution and by-laws of the Institute, the office of Secretary and Librarian is made a joint office, filled by the appointment of the Board of Directors, instead of by annual election by the members as heretofore. Mr. George Longman has been appointed to the joint office.

(Signed) Jos. D. Ridout,
President.

PROVINCIAL EXHIBITION.

Rules and Regulations,

Sixteenth Exhibition of the Provincial Agricultural Association, to be held at London, on Tuesday, Wednesday, Thursday and Friday, September 24th, 25th, 26th, and 27th.

"The members of the Agricultural Societies of the several Townships within the County, or Electoral Division or United Counties, wherein the Annual Exhibition may be held, and the members of the said County or Electoral Division Society, shall be also members of the Association for that year, and have member's tickets accordingly; provided the Agricultural Societies of the said Townships, or the Society of the said County or Electoral Division or United Counties, shall devote their whole funds for the year, including the Government Grant, in aid of the Association. The Office-bearers of all County Societies shall have tickets of free entrance during the show.—*By-Law.*"

1. The payment of $1 and upwards constitutes a person a member of the Agricultural Association of Upper Canada for one year; and $10 for life, when given for that specific object, and not as a contribution to the local funds.

2. No one but a member shall be allowed to compete for prizes except in classes, 29, 39, 47, 48, and 59.

3. All entries must be made on printed forms, which may be obtained of the Secretaries of Agricultural Societies, or of Mechanics' Institutes, free of charge. These forms are to be filled up and signed by the exhibitor, enclosing a dollar for membership, and sent to the Secretary of the Association, Board of Agriculture, Toronto, on or before Saturday, August 31st, after which no entries can be taken except in the Horticultural and Ladies' Departments and Foreign Classes.

Exhibitors in these Departments may enter articles up to Monday Evening of the show week, when the Books will be finally closed.

4. *Blood Horses, and thorough-bred Cattle* must be entered, and have their full pedigree properly attested and sent to the Secretary in Toronto, *not later than Saturday, August 24th.* No animal will be allowed to compete as pure bred, unless they possess regular Stud and Herd Book pedigrees, or satisfactory evidence be produced that they are directly descended from such stock. In the class of Durham cattle, particularly, no animal will be entered for competition, unless the pedigree of the same be first inserted in the English or American Herd Book, or in the Upper Canada Stock Register, kept at the office of the Board of Agriculture.

5. Tickets from the Treasurer's office will be furnished each exhibiting member, till Monday evening, Sep. 23rd, which will admit himself only, free to every department of the Exhibition during the Show. Life members admitted free throughout the Exhibition.

No members' tickets will be issued after Monday evening, but those issued up to that time will be good till the close of the show.

Necessary attendants upon stock and articles, belonging to exhibitors, will be furnished with admission tickets with their names written upon them, which ticket will be good at the *Exhibitor's Gate only.*

6. The admission fees to non-members, on Tuesday and Wednesday, will be half-a-dollar, and on Thursday and Friday, a quarter dollar, each time of entering through the gates.

Tickets of admission to those who are not members, will be issued on and after Tuesday morning, at 25 cents each,—two such tickets to be given up at the gates each time of admission, on Tuesday, and Wednesday, and one such ticket on Thursday and Friday, in accordance with the above rates. Children under fourteen years of age, half-price. Carriages to pay one dollar each admission; each occupant, except the driver, to be also provided with the usual admission ticket. Horsemen half a dollar.

7. Every article, other than live stock, exhibited for competition, must be the growth, product, or manufacture of Canada, except in classes 39 and 59. Live stock, except in class 29, must be the *bona fide* property of persons residing in Canada, and must be exhibited in the name of the owner only.

☞ *All Premiums for articles, except Stock, are to be awarded to the manufacturers or producers only.*

8. Articles for exhibition must be on the grounds on Monday, Sep 23, except live stock, which must be there not later than Tuesday at noon.

9. Discretionary premiums will be awarded for such articles as may be considered worthy by the Judges, although not enumerated in the list, and the Directors will determine the amount of premium.

In the Fine Arts and Mechanical department, Diplomas will be awarded—in addition to the money prizes—to any specimen evincing great skill in its production, or deemed otherwise worthy of such a distinction, on its being recommended by the Judges and approved of by the Committee to whom all such matters shall be referred.

10. In the absence of competition in any of the Classes, or if the stock or articles exhibited be of inferior quality, the judges will exercise their discretion as to the value of the premiums they recommend.

No person will be allowed to interfere with the judges while in the discharge of their duties. Any person so interfering will forfeit any premium which may be awarded them.

11. A General Superintendent will be appointed, who will have the general supervision of the grounds, and the arrangements of the exhibition. He will have an office upon the ground; where all persons having enquiries to make in relation to the arrangements will apply.

No articles or stock exhibited will be allowed to be removed from the grounds, till the close of the exhibition, under the penalty of losing the premiums. The exhibition will close immediately upon the delivery of the President's address on Friday afternoon. An Auctioneer will be on the ground after the premiums are announced, and every facility afforded for the transaction of business.

12. Delegates, Judges and Members of the Press are requested and expected to report themselves at the Secretary's Office, immediately on their arrival.

13. The Judges are to meet at the Secretary's Office on the grounds, on Tuesday, 24th, at noon, to make arrangements for entering upon their duties.

14. The annual meeting of the Directors of the Association will take place on the grounds on Friday morning, 27th, at 10 o'clock.

15. While the directors will take every possible precaution, under the circumstances, to insure the safety of articles sent to the exhibition, yet they wish it to be distinctly understood that the owners must themselves take the risk of exhibiting them; and that should any article be accidentally injured, lost, or stolen, the Directors will give all the assistance in their power towards the recovery of the same, but will not make any payment for the value thereof.

Exhibitors must provide for the delivery of their articles upon the show ground. The Association cannot in any case make provision for the transportation, or be subjected to any expense therefor, either in their delivery at or return from the grounds; all the expenses connected therewith must be provided for by the Exhibitors themselves.

16. The Treasurer will be prepared to commence paying the premiums on Saturday, 28th, at 9 a. m., and parties who shall have prizes awarded them are particularly requested to apply for them before leaving London, or leave a written order with some person to receive them, stating the articles for which prizes are claimed.

N.B.—In case the Directors shall require any particular information in reference to animals or articles taking first prizes, the owners will be expected to transmit it, when requested to do so.

☞The Local Committee will make arrangements with Steamboat and Railroad proprietors for carrying articles and passengers at reduced rates.

Provender will be provided by the Association for live stock at cost price.

Arrangements will be made with the Customs department for the free entry of articles for competition.

Music.—The following prizes, in addition to the list published in the last number of the *Journal*, are offered in competition to instrumental Bands of Music:—

For the Best Canadian Amateur Band consisting of not less than eight performers, of whom there shall not be more than two professional artists		$100 00
2nd.	do	75 00
3rd.	do	50 00

Each Band will be required to execute the following pieces of Music, viz: —The National Anthem; Rule Britannia; a quick step; Waltz; Song; Polka; Set of Quadrilles, and a Medley or Operatic Piece; and to be on the grounds under the direction of the Committee during the continuance of the Exhibition. Bands intending to compete will communicate their intention to the Secretary of the Association at Toronto, or to the Secretary of the Local Committee, at London, at least a week before the Exhibition commences.

The Board of Arts & Manufactures

FOR LOWER CANADA.

Board Rooms, Mechanics' Hall,
Montreal, 28th May, 1861.

The Board met this day at 3 o'clock, p.m.

Present: J. Redpath, President, in the chair; W. Rodden, Vice President; Dr. Dawson, Messrs. Browne, Bulmer, Chamberlin, Forsyth, Murray, Munro, and McQuestin.

The Minutes of the last meeting were read and approved.

The following Report, from the Sub-Committee, was then read:

The Sub-Committee have the honor to report—That the Secretary has reported, as the result of his labours at Quebec during the past session of Parliament, that the Provincial Government having declared their intention to oppose all legislation for the amendment of the laws relating to Patents of Invention, the bill prepared for that purpose and introduced by Mr. Abbott, M.P.P., for Argenteuil, and printed, was not passed into law. Those portions of it, however, relating to Trade Marks and the Registration of Designs were introduced as a separate bill, into the Legislative Council, by the Hon. Mr. Ferrier. It was taken charge of in the Assembly by the Hon. John Rose, and, with some slight modifications, became law.

No action was taken by the government upon the petition for some measure of sanitary reform, a matter, the urgency and importance of which seems to be little appreciated by the public men of the country.

The bill prepared to amend the act constituting this Board was, after several interviews with members of the government, by Professor Hind on behalf of the Upper Canada Board, and your Vice President and Secretary on behalf of this Board, also confided to the Hon. Mr. Ferrier, and by him introduced in the Legislative Council. At the beginning of the session the Board of Agriculture, through Major Campbell, introduced the bill of last session to amend the act constituting that Board, but without the portions relating to the Boards of Arts and Manufactures. In committee, however, the bill relating to this Board was incorporated with it, and further proceedings upon Mr. Ferrier's bill stayed in the Council. The two bills thus amalgamated passed the Lower House without opposition, and received a 2nd reading in the Council. Having been referred to a committee, however, it was never reported, the committee deeming that the amendments in the constitution of the Board of Agriculture and the abolition of the Provincial Agricultural Association would not be acceptable to the farmers of Upper Canada. The other bill, relating solely to the Boards of Arts and Manufactures, was then moved to a second reading with the assent of the Government, and referred to a committee, where all but the more important clauses were cut out. In its reduced form it received a third reading, and was sent to the Lower House, where, however, the Agricultural influence revenged itself upon the Upper Canada members of the Council representing the Agricultural interest, who had defeated their bill, by refusing to suspend the rules and allow the bill of the Boards of Arts to become law. They declared that both bills should go through, or neither. Your committee refrain from all comment on this proceeding, contenting themselves with simply recording it.

Notwithstanding the urgent representations made of the absolute necessity of an increased grant to enable this Board to perform the functions assigned to it with advantage to the government and public, or with credit to themselves, her Majesty's Provincial advisers did not think that in the present condition of the finances of the country, any increase could be made in the grants. Thus, while the Agricultural Boards have upwards of $100,000 placed at their disposal, to foster that which scarcely needs fostering in Canada, the boards representing the Mechanics and Manufacturers of the country, an interest struggling upwards amid many difficulties, must remain content with $4000 as a mark of the appreciation in which they are held by the government and parliament of the country.

The government also declined to submit any grant in the estimates, for the purpose of having Canada represented in the Great Exhibition of 1862. Your committee cannot express too strongly their sense of the evil done to the country by this, in their opinion, unwise economy. There can be no doubt that nothing has ever given Canada so high a position in the eyes of Europe, as the Exhibition she made of her various products in 1851 and 1855. Till then regarded by the mass of Europeans as a distant semi-barbarous dependency of Britain, with a rigorous climate and barren soil, where nought but savages and outcasts could live, and nought but furs and timber could be procured. She showed on these occasions how great her resources were, and, to the astonishment of those who knew her best, took a position which vied with that of old, wealthy and mighty nations. Just at a time when our railway system is in a great measure completed, when our seaports are crowded beyond all previous example with ships seeking cargoes of our products; when the mines of Lower Canada are just being opened up, and there is especial need that the attention of capitalists should be directed towards the splendid opening here for investment in mining adventures, when the *eclat* of the visit of the heir apparent is still fresh in the minds of the people of Britain, to put in an apparent admission that we have already culminated and are beginning to decay, that we can not do as well now as we did ten years ago, is to submit to humiliation, to lose ground, and accept defeat in the contest for industrial rank.

The neglect to appoint a Commission will have this further evil effect, that according to the sixth rule or decision of the Royal Commission, no private parties in any foreign country or colony will be allowed to exhibit, nor will the Commissioners hold communications with any such persons except through Commissioners appointed by their governments. It will therefore be impossible, it is feared, for individual enterprise in any way to remedy this neglect of the government. It is hoped, therefore, that a Commission may yet be appointed to act on behalf of individual contributors who may be desirous of exhibiting specimens of the mineral and other riches of the country. Even if this obstacle did not exist, the Board could not, owing to the scanty funds placed at its disposal, undertake the work.

The report was unanimously adopted.

It was then resolved, that the President (J. Redpath), the Vice President (W. Rodden), Dr. Dawson, and the Secretary (B. Chamberlin), be a committee to wait on Messrs. Galt and Rose, in reference to the interest on the debt of the building, and in regard to an Exhibition. Said committee to report to the Sub-committee. And in the event of the government giving encouragement with reference to the Exhibition of 1862, the Sub-committee is empowered to make the preliminary arrangements, and report at the quarterly meeting.

It was also resolved, that a memorial embodying the views of the Board in reference to the Exhibition in 1862, as expressed in the report just adopted, be prepared and forwarded to the Governor in Council, and that the same be given all possible publicity.

The meeting then adjourned.

B. CHAMBERLIN, *Secretary.*

Correspondence.

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

Sir,—In the January number of your journal there appeared a programme of a system of Examinations, in various departments of study, of members of Mechanics' Institutes in Upper Canada, proposed to be held annually by the Board of Arts and Manufactures; the first of which was announced to take place in May of the present year.

Not having heard that such an examination has been held, and feeling somewhat curious to know whether any candidates have presented themselves from the fifty or sixty Mechanics' Institutes in this section of the Province, I take the liberty of asking you for information on the subject.

I notice in the number of the *Society of Arts Journal* for May 31st, that the examination by that Society for the present year had been concluded, and that there were thirty-six successful candidates for money prizes, and 653 for first, second and third class certificates.

The subjects for examination were nearly the same as contained in the programme of your Board, and embrace almost every branch of study of value to practical men.

In analysing the occupations of the various candidates to whom the money prizes and certificates were awarded, I find that there were 239 clerks and book-keepers, 60 teachers, 137 mechanics and manufacturers in sixty-four different branches of trade, 35 warehousemen, 28 pupils of Institutes, 8 draughtsmen, 14 chemists, 26 pupils of architects, engineers and surveyors, 24 grocers, drapers and salesmen, 7 revenue, excise and civil service officers, 7 booksellers and stationers, and 4 reporters; and the remainder were gardeners, letter-carriers, artists, dress-makers, miners, housekeepers, farmers, dentists, governesses, agents, messengers, engine drivers, timekeepers, auctioneers, merchants, police constables, and persons engaged in various other industrial pursuits.

I have no doubt but the good effected in England by the establishment of these examinations has been very extensive, as it has brought into active operation a well digested system of class education, in connection with the various mechanics' and other institutes in union with the Society; and has been the means of affording instruction annually to some thousands of the adults and youths of the industrial classes, who, being actively engaged in business, would otherwise have had no favorable opportunities of improving their minds, and fitting themselves for their several occupations.

We cannot hope to see, in our time, as complete organizations of classes by the Institutes here as in England; but still, much may be done if the efforts are only made and persisted in; and when the proposed examinations of the Board shall be successfully carried out, there is no doubt but the holders of its certificates of competency, proficiency, &c., in any particular department of study, will possess very great advantages over their fellows, in the ready obtaining of employment at liberal rates of remuneration.

Yours, &c.,

A Member T. M. I.

Toronto, June 18, 1861.

[No candidates offered themselves at the time appointed, owing, no doubt, to the comparatively short notice given by the Board of the intended examination. We are informed, however, that classes have been organized in some of the Institutes, with a view to preparing themselves for the next session.—Ed. Jour.]

Toronto, 17th May, 1861.

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

Sir,—I was very much pleased upon the receipt of the May number of your valuable journal, to notice a letter signed "A member T. M. I." I am right glad to see the gauntlet thus thrown down by your correspondent, for I am sure that many will unite with him in saying, "I have been anxiously looking for correspondence on the subject as each issue of the Journal has appeared, but have so far had to look in vain."

I exceedingly regret Mr. Editor that so much apathy should be found to exist among those who interest themselves in the Mechanics' Institutes of Upper Canada; evidently something needs to be done to clothe the "Dry Bones" with life, health and vigour. There is the material Sir, or I should rather say (to continue the figure) there is the body,—the question is, who shall be the first to suggest the means of imparting a healthy tone to it? There are, I doubt not, many Institutes in the Upper Province in good and successful working order, and the question naturally suggests itself how and why they are so? This question is a pertinent one, of considerable importance, inasmuch as they are the exception, instead of being, as they might and should be, the rule. I feel convinced that if we could get together the managers or leading men from the successful and from the unsuccessful Institutes, that in addition to the knowledge the one might be able to impart to the other, they would infuse such a spirit of industry and enterprise into the indolent and lethargic, as would enable them to prosecute with vigour, that with which they are connected.

My plan is then, to form for Upper Canada an union of Mechanics' Institutes, one of the objects of which should be to meet annually or oftener at some central place, in a kind of conference such as is suggested by, "Appendix E, Hand Book of Mechanics' Institutions, by W. H. J. Traice," a copy of which you have in your free Library of Reference, and should be in the possession of every Institute.

I will close by proposing two things. First. That for the benefit of all, you publish in your next number the above mentioned appendix, and Second, that if there are any institutions ready and willing to adopt the proposition as above, (that of union), that they forward to your Secretary a statement to that effect, the names of which you might publish in the succeeding number of your Journal, and I have no doubt but that in the course of a few months a sufficient number of Institutes would have reponded, to justify the calling of delegates to form the association.

I do hope, Mr. Editor, that the active working officers and members of the Mechanics' Institutes of this Province, will renew their endeavours to teach the hard working and industrious sons of toil, that *knowledge is power*, and learn themselves that *union is strength.*

Another Member,

T. M. I.

[We are pleased to see commenced in the Journal a correspondence relating to the position and objects of the Mechanics' Institutes of the Province, and hope to see the subject well discussed in these pages, so that the views and experiences of those who have taken an active part in the management of these institutions may be imparted to others.

For the information of the writer of the above communication, we would mention that one of the purposes for which the Boards of Arts and Manufactures have been established is the promotion of the interests of the several Mechanics' Institutes in Canada; and that being composed principally of Delegates from these Institutions, with the Presidents of all Incorporated Institutes as *ex-officio* members of the Board, furnishes at once just such an organization as our correspondent suggests.

In August 1858, the executive committee of this Board, in a circular addressed to the Presidents and Delegates of the several Institutes, communicated the following resolution:—

Resolved:—"That the Secretary do request the delegates from the several Mechanics' Institutes to be prepared, at the next Quarterly Meeting of the Board, to discuss the question,—'*What can be done by the Board to promote the efficiency of the Mechanics' Institutes in Upper Canada?*' and also to suggest that meetings of the respective Institutes be held to discuss the question, some time prior to the attending of their Delegates at the meeting of the Board to be held on the 5th of October next."

We regret to say that, notwithstanding the above invitation, no representatives from the Institutes came to the meeting prepared to discuss the question suggested, or to give any information relating thereto. We trust however that it will again be taken up at an early meeting of the Board, and that members will then be prepared to discuss any matters bearing on the interests of these institutions.—Ed. Journal.]

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

Sir,—I have read with much interest the Reports of Mechanics' Institutes published in your Journal. They bear evidence of progress and effort in the right direction. The establishment of reading rooms and libraries within the reach of the laboring classes, forms an important step in adult education; and the delivery of popular lectures, however general and unsystematic in their order, must give a beneficial impulse to these efforts. The great purpose, however, of these Institutes still remains neglected—the establishment of classes for adult education. This is the most important, as it is no doubt the most difficult work to be accomplished. The news room and library are not used for educational purposes. The library is used for amusement, and works of solid information are very rarely demanded; whilst the patrons of the news room seek its resources for political or general information, or the pastime of a leisure hour. No doubt these branches of a Mechanics' Institute have an important influence on the character of its members; but no Mechanics' Institute is worthy of its name, or the patronage of the friends of progress, which does not offer the advantage of *class instruction* to the working classes. The countless opportunities for making discoveries, inventions and improvements, which lie around them in their daily avocations, are lost, because, notwithstanding all our educational efforts, the great body of the people in every department of labour are ignorant of the principles of physical science. Were our farmers familiar with the elements of agricultural chemistry, our artizans with those of mechanical philosophy, our miners with those of geology, and were these educated to that degree of intelligence which would enable them to communicate to others the suggestions inspired by their avocations, it is impossible to over-estimate the advantages that would follow. Instead of inventions and discoveries being isolated and confined to the theorist and the philosopher, they would spring from their natural sources, the field of labour, and be as extensive as the number of experimenters.

Now, the Mechanics' Institute is the college of the people. What an efficient common school system commences, they would continue; and no national system of instruction is complete without this adult college of the people. The common school, under the best conditions, can only supply a general elementary education. The special instruction needed by adults in their different pursuits is acquired best as it is needed, and in the evening classes of a Mechanics' Institute that instruction could be best obtained. Much may be done in this regard by the members forming themselves into mutual instruction classes. But the best amateur teaching is limited and of little value. It is too often unmethodical, uncertain, spasmodical and defective. Thorough instruction must come from the qualified and professional teacher, and we have no right to expect such instruction unless we pay the just value for it. Hence it should be the chief object of the directors of these institutes to encourage and aid the formation of classes, under efficient teachers. The fees should be such as would enable the poorest member to become students; and as it is not probable that these fees would remunerate the teacher, a portion of the funds of the institute, and of all other available resources, whether of benevolent subscriptions or Government aids, should be devoted to this all-important object

The Periodical Examination which the Board of Arts proposes to hold, and the certificates it offers to successful candidates, is of such importance that it ought to receive every encouragement, while the programme of examination at once suggests the proper subjects of study for the classes of a mechanics' institute. In the present depressed circumstances of these institutes, it would be impossible to take up all the subjects; and in making a selection, whilst the tendency would probably be to take up the most practical and necessary—such as arithmetic, mathematics, chemistry, mechanics, drawing and agriculture—the claims of those branches which have relation to the communication and the discipline of thought should not be neglected. The study of English, in all its forms of grammar, composition, and the examination of high-class literature, and the practice of discussion, under judicious management, have the highest claims in the education of the common people, where the common people hold such civic and political power as in this country.

But as the kind of instruction and the management of classes must form a subject of large consideration, I forbear to trespass any further on your columns for the present.

I am, Sir, respectfully yours,

R. L.

Toronto, June 19, 1861.

NOTICES OF BOOKS.

The Metals in Canada. A Manual for Explorers, containing Practical Instructions in Searching for and testing the value of Metallic Ores, with special reference to Canada: By James L. Willson, and Charles Robb, Mining Engineers. Montreal: B. Dawson, & Son. 1 Vol. paper, pp. 80.

This little work is, as its authors profess it to be, a compilation from various learned treatises on the subject of mining, and more particularly from the Reports of the Provincial Geological Survey. It sets forth in a very clear and concise manner the forms and modes of deposit, and other circumstances under which ores of the more useful metals, with the exception of iron, have been or are likely to be found in Canada, together with notices of the most important mines throughout the world that bear analogy to those in this country. It also gives short practical directions for making surface explorations, and for testing and examining many of the metals and minerals.

A work of this kind, small though it be, is likely to prove of great utility not merely to those who are practically engaged in investigations of this nature, but also to all whose attention is directed to the mineral wealth existing in the country. There is no doubt that as long as coal and the precious metals are supposed to be hidden beneath the surface of the earth, requiring only skill and knowledge to bring them forth, the minds of the community are continually harrassed and perplexed by reports of coal mines, veins of silver, and similar discoveries. Under such circumstances, when the public are excited, and individuals are ready upon the slighest grounds to plunge into mining speculations the negative knowledge afforded by works of this description is surely of no slight value. The ability to set at rest such vain expectations, and unfounded opinions on subjects of so great moment to the welfare of the community is undoubtedly by no means unimportant. "At the present time," as our authors state in their introduction, "a variety of circumstances combine to give an impetus to mining enterprise in this country. The recent discoveries of valuable deposits of copper and lead in the eastern part of the Province, the continued and greatly increased yield of the former metal in the Lake Superior region, and its proportionably diminished production in Cornwall, taken in conjunction with the increasing demand for this article, the removal of the government restrictions on explorations, and greater liberality in regard to grants of land for mining purposes, the recovery from recent great commercial depression, and the universal attention which has lately been directed in England to the development of the resources of this Province." We cannot, in fine, refrain from expressing the gratification we feel at being able to recommend a work of this description, emanating as it does from Canadian pens. It is a pleasing proof that our country is advancing in scientific attainments, and that its great natural resources stand in a fair way of being properly developed.

The Canadian Agriculturist, or Journal and Transactions of the Board of Agriculture for Upper Canada.—Toronto.

We have received the semi-monthly numbers of this excellent publication from the 1st January to the present time, and have invariably found their contents not only instructive and interesting, but well adapted to diffuse a great variety of much needed practical information among the farmers of Canada. Written comment on a Journal which has reached its thirteenth volume is wholly unnecessary, but we may be permitted to express our conviction that the Canadian Agriculturist under its present management will rapidly increase in public favour and estimation; and become a means of diffusing a knowledge of the science and practice of Husbandry, throughout a people at present eminently agricultural in their pursuits, and to a very large extent dependent upon their soil for its support.

Selected Articles.

ON SOME POINTS IN AMERICAN GEOLOGY.

BY T. STERRY HUNT, M.A., F.R.S., OF THE GEOLOGICAL SURVEY OF CANADA.

Concluded from page 166.

Such was the state of the question when Mr. Hall came forward bringing his great knowledge of the sedimentary formations of North America to bear upon the theory of continents and mountains. These were first advanced in his address delivered before the American Association for the Advancement of Science, as its President, at Montreal in August, 1857. This address was never published, but the author's views were brought forward in the first volume of his *Report on the Geology of Iowa*, p. 41, and with more detail in the introduction to the third volume of his *Palæontology of New York*, from which we have taken the abstract already given. He has shown that the difference between the geographical features of the eastern and central parts of North America is directly connected with the greater accumulation of sediment along the Appalachians. He has further shewn that so far from local elevation being concerned in the formation of these mountains, the strata which form their base are to be found beneath their foundations at a much lower horizon than in the undisturbed hills of the Mississippi valley, and that to this depression chiefly is due the fact that the mountains of the Appalachian range do not, like those hills, exhibit in their vertical height above the sea the whole accumulated thickness of the palæozoic strata which lie buried beneath their summits.

Mr. Hall has made a beautiful application of these views to explain the fact of the height of the Green Mountains over the Laurentides, and of the White Mountains over the former, by remarking that we have successively the Lower and the Upper Silurian strata superimposed on those of the Laurentian system. The same thing is strikingly shown in the fact that the higher mountain chains of the globe are composed of newer formations, and that the summits of the Alps are probably altered sediments of tertiary age. (*Am. Jour. Sci.* xxix. 118.)

The lines of mountain elevation of De Beaumont are, according to Hall, simply those of original accumulations, which took place along current or shore lines, and have subsequently, by continental elevations, produced mountain chains. "They were not then due to a later action upon the earth's crust, but the course of the chain and the source of the materials were predetermined by forces in operation long anterior to the existence of the mountains or of the continent of which they form a part." (P. 86.)

It will be seen from what we have said of Buffon, De Montlosier and Lesley that many of the views of Mr. Hall are not new but old; it was, however, reserved to him to complete the theory and give to the world a rational system of orographic geology. He modestly says, "I believe I have controverted no established fact or principle beyond that of denying the influence of local elevating forces, and the intrusion of ancient or plutonic formations beneath the lines of mountains, as ordinarly understood and advocated. In this I believe I am only going back to the views which were long since entertained by geologists relative to continental elevations." (P 82.)

The nature of the palæozoic sediments of North America clearly shows that they were accumulated during a slow progressive subsidence of the ocean's bed, lasting through the palæozoic period, and this subsidence which would be greatest along the line of greatest accumulation, was doubtless, as Mr. Hall considers, connected with the transfer of sediment and the variations of local pressure acting upon the yielding crust of the earth, agreeably to the views of Sir John Herschel. This subsidence of the ocean's bottom would, according to Mr. Hall, cause plications in the soft and yielding strata. Lyell had already in speculating upon the results of a cooling and contracting sea of molten matter, such as he imagined might have once underlaid the Appalachians, suggested that the incumbent flexible strata, collapsing in obedience to gravity would be forced, if this contraction took place along narrow and parallel zones of country. to fold into a smaller space as they conformed to the circumference of a smaller arc, "enabling the force of gravity, though originally exerted vertically, to bend and squeeze the rocks as if they had been subjected to lateral pressure.*

Admitting thus Herschel's theory of subsidence and Lyell's of plication, Mr. Hall proceeds to inquire into the great system of foldings presented by the Appalchians. The sinking along the line of greatest accumulation, produces a vast synclinal, which is that of the mountain ranges, and the result of a sinking of flexible beds will be the production within the greater synclinal and anticlinal axes, which must gradually decline toward the margin of the great synclinal axis. This process the author observes appears to furnish a satisfactory explanation of the difference of slope on the two sides of the Appalachian anticlinals, where the dips on one side are uniformly steeper than on the other. (P. 71.)

* Travels in North America, 1st visit, vol. i. p. 78.

An important question here arises, which is this:—while admitting with Lyell and Hall that parallel foldings may be the result of the subsidence which accompanied the deposition of the Appalachian sediments, we inquire whether the cause is adequate to produce the vast and repeated flexures presented by the Alleghanies. Mr. Billings in a recent paper in the *Canadian Naturalist* (Jan. 1860), has endeavored to show that the foldings thus produced must be insignificant when compared with the great undulations of strata, whose origin Prof. Rogers has endeavored to explain by his theory of earthquake waves propagated through the igneous fluid mass of the globe, and rolling up the flexible crust. We shall not stop to discuss this theory, but call attention to another agency hitherto overlooked, which must also cause contraction and folding of the strata, and to which we have already alluded. (*Am. Jour. Sci.* (2) xxx. 138.) It is the condensation which must take place when porous sediments are converted into crystalline rocks like gnesis and mica slate, and still more when the elements of these sediments are changed into minerals of high specific gravity, such as pyroxene, garnet, epidote, staurotide, chiastolite and chloritoid. This contraction can only take place when the sediments have become deeply buried and are undergoing metamorphism, and is, as many attendant phenomena indicate, connected with a softened and yielding condition of the lower strata.

We have now in this connection to consider the hypothesis which ascribes the corrugation of portions of the earth's crust to the gradual contraction of the interior. An able discussion of this view will be found in the *American Journal of Science* (2) iii. 176, from the pen of Mr. J. D. Dana, who, in common with all others who have hitherto written on the subject, adopts the notion of the igneous fluidity of the earth's interior.

We have however elsewhere given our reasons for accepting the conclusion of Hopkins and Hennessy that the earth, instead of being a liquid mass covered with a thin crust, is essentially solid to a great depth, if not indeed to the centre, so that the volcanic and igneous phenomena generally ascribed to a fluid nucleus have their seat, as Keferstein and after him Sir John Herschel long since suggested, not in the anhydrous solid unstratified nucleus, but in the deeply buried layers of aqueous sediments which, permeated with water, and raised to a high temperature, become reduced to a state of more or less complete igneo-aqueous fusion. So that beneath the outer crust of sediments, and surrounding the solid nucleus, we may suppose a zone of plastic sedimentary material adequate to explain all the phenomena hitherto ascribed to a fluid nucleous. (*Quar. Jour. Geol. Society,* Nov. 1859. *Canadian Naturalist,* Dec. 1859 and *Am. Jour. Sci.* (2) xxx. 136.)

This hypothesis, as we have endeavoured to show, is not only completely conformable with what we know of the behaviour of aqueous sediments impregnated with water and exposed to a high temperature, but offers a ready explanation of all the phenomena of volcanos and igneous rocks, while avoiding the many difficulties which beset the hypothesis of a nucleus in a state of igneous fluidity. At the same time any changes in volume resulting from the contraction of the nucleus would affect the outer crust through the medium of the more or less plastic zone of sediments, precisely as if the whole interior of the globe were in a liquid state.

The accumulation of a great thickness of sediment along a given line would, by destroying the equilibrium of pressure, cause the somewhat flexible crust to subside; the lower strata becoming altered by the ascending heat of the nucleus would crystallize and contract, and plications would thus be determined parparallel to the line of deposition. These foldings, no less than the softening of the bottom strata, establishes of weakness or of least resistence in the earth's crust, and thus determine the contraction which results from the cooling of the globe to exhibit itself in those regions and along those lines where the ocean's bed is subsiding beneath the accumulating sediments. Hence we conceive that the subsidence invoked by Mr. Hall, although not the sole nor even the principal cause of the corrugations of the strata, is the one which determines their position and direction, by making the effects produced by the contraction not only of sediments, but of the earth's nucleus, itself, to be exerted along the lines of greatest accumulation.

It will readily be seen that the lateral pressure which is brought to bear upon the strata of an elongated basin by the contraction of the globe, would cause the folds on either side to incline to the margin of the basin, and hence we find along the Appalachians, which occupy the western side of such a great synclinal, the steeper slopes, the overturn dips or folded flexures, and the overlaps from dislocation are to the westward, so that the general dip of the strata is to the centre of the basin, on the other side of which we might expect to find the reverse order of dips prevailing, The apparent exceptions to this order of upthrows to the south-east in the Appalachians appear to be due to small down throws to the south-east, which are parallel to and immediately to the north-west of great upheavals in the same direction.

Mr. Hall adopts the theory of metamorphism which we have expounded in the paper just quoted above, *Canadian Naturalist*, Dec. 1859, (see also *Am. Jour. Sci.* (2) xxv. 287, 435, xxx. 135,) which has received a strong confirmation from the late researches of Daubrée. According to this view, which is essentially that put forward by Herschel and Babbage, these changes have been effected in deeply buried sediments by chemical reactions, which we have endeavoured to explain, so that metamorphism, like folding, takes place along the lines of great accumulation. The appearance at the surface of the altered strata is the evidence of a considerable denudation. It is probable that the gneissic rocks of Lower Silurian age in North America were at the time of their crystallization overlaid by the whole of the palæozoic strata, while the metamorphism of carboniferous strata in Eastern New England points to the former existence of great deposits of newer and overlying deposits, which were subsequently swept away.

On the subject of igneous rocks and volcanic phenomena, Mr. Hall insists upon the principles which we were, as far as we know the first to point out, namely their connection with great accumulations of sediment, and of active volcanos with the newer deposits. We have elsewhere said: "the volcanic phenomena of the present day appear, so far as we are aware, to be confined to regions of newer secondary and tertiary deposits, which we may suppose the central heat to be still penetrating, (as shewn by Mr. Babbage,) a process which has long since ceased in the palæozoic regions." To the accumulation of sediments then we referred both modern volcanos and ancient plutonic rocks; these latter, like lavas, we regard in all cases as but altered and displaced sediments, for which reason we have called them exotic rocks. (*Am. Jour. Sci.* (2) xxx. 133). Mr. Hall reiterates these views, and calls attention moreover to the fact that the greatest outbursts of igneous rock in the various formations appear to be in all cases connected with rapid accumulation over limited areas, causing perhaps disruptions of the crust, through which the semi-fluid stratum may have risen to the surface. He cites in this connection the traps with the palæozoic sandstones of Lake Superior, and with the mesozoic sandstones of Nova Scotia and the Connecticut and Hudson valleys.

It may sometimes happen that the displaced and liquified sub-stratum will find vent, not along the line of greatest accumulation, but along the outskirts of the basin. Thus in eastern Canada it is not along the chain of the Notre Dame mountains, but on the north-west side of it that we meet with the great outbursts of trachyte and dolerite, whose composition and distribution we have elsewhere described. (Report of Geological Survey for 1858, and *Am. Jour. Sci.* (2) xxix. 285.)

The North American continent, from the grand simplicity of its geological structure and from the absence, over great areas, of the more recent formations, offers peculiar facilities for the solution of some of the great problems of geology; and we cannot finish this article without congratulating ourselves upon the great progress in this direction which has been made within the last few years by the labors of American geologists.

Montreal, March 1, 1861.

VARNISHES.

(*Concluded from page* 167.)

Brown Varnish.—Rectified spirit 2 gallons; sandarach 3 pounds; shell-lac 2 pounds; pale turpentine varnish 1 quart. Put them into a tin bottle, cork securely and agitate frequently, placing the tin occasionally in hot water till the gum is dissolved, then add a quart of pale turpentine varnish.

Brilliant Amber Spirit Varnish.—Fused amber 4 oz.; sandarach 4 oz.; mastic 4 oz.; highly rectified spirit 1 quart. Expose to the heat of a sand bath, with occasional agitation, till dissolved. The amber is fused in a close copper vessel, having a funnel-shaped projection, which passes through the bottom of the furnace by which the vessel is heated.

Crystal Varnish.—Picked mastic 4 oz.; rectified spirit 1 pint; animal charcoal 1 oz. Digest, and filter.

Picture Varnish.—Chio turpentine 2 oz.; mastic 12 oz.; camphor ½ drachm; pounded glass 4 oz; rectified oil of turpentine 3 pints. This is for oil paintings.

Tingry's Essence Varnish.—Powdered mastic 12 oz.; pure turpentine 1½ oz.; camphor ½ oz.; powdered glass 5 oz.; rectified oil of turpentine 1 quart.

Chinese Varnish.—Mastic 2 oz.; sandarch 2 oz.; rectified spirit 1 pint. Close the mattrass with bladder, with a pin hole for the escape of vapor; heat to boiling in a sand or water bath, and when dissolved strain through linen.

Canada Varnish.—Clear balsam of Canada 4 oz.; camphene 8 oz. Warm gently, and shake together till dissolved. This varnish is for maps, drawings, &c., which must be first sized over with a solution of isinglass, taking care that every part is covered. When dry, the varnish is brushed over it.

Common Turpentine Varnish.—This is merely clear pale resin, dissolved in oil of turpentine; usually 5 pounds of resin to 7 pounds of turpentine.

Amber Varnish.—Amber 16 oz.; melt in an iron pot, and add ½ pint of drying linseed oil, boiling hot, and add 3 oz resin, and 3 oz. asphalte, each in fine powder. Stir till they are thoroughly incorporated; remove from the fire, and add a pint of warm oil of turpentine.

Balloon Varnish.—Melt india-rubber in small pieces with its weight of boiled linseed oil, and thin it with oil of turpentine.

Varnish for Engraving on Copper.—Yellow wax 1 oz.; mastic 1 oz.; asphaltum ½ oz. Melt, pour into water, and form into balls for use. A softer varnish for engravers is made thus: Tallow 1 part, and 2 of yellow wax; or, with 2 oz. wax, 1 drachm common turpentine, and 1 drachm olive oil.

Etching Varnishes.—White wax 2 oz. asphaltum 2 oz. Melt the wax in a clean pipkin, add the asphaltum in powder and boil to a proper consistence. Pour it into warm water, and form into balls, which must be kneaded, and put into taffeta for use.

Another.—White wax 2 oz.; Burgundy pitch ½ oz.; black pitch ½ oz.; melt together, and add by degrees 2 oz. powdered asphaltum, and boil it till a drop cooled on a plate becomes brittle.

Another.—Equal quantities of linseed oil and mastic melted together.

Engraving Mixture for Writing on Steel.—Sulphate of copper 1 oz.; sal ammoniac ½ oz. Pulverise separately, adding a little vermilion to color it, and mix with 1½ oz. vinegar. Rub the steel with soft soap, and write with a hard, clean pen, without a slit, dipped in the mixture.

Etching Fluids.—For Copper.—1. Aquafortis 2 oz.; water 5 oz. Mix.

2. *Callot's Eau Forte for Fine Touches*.—Dissolve 4 parts each of verdigris, alum, sea salt, and sal ammoniac, in 8 parts vinegar; add 16 parts water, boil for a minute, and let it cool.

For Steel.—1. Iodine 1 oz.; iron filings ½ drachm; water 4 oz. Digest till the iron is dissolved.

2. Pyroligneous acid 4 parts by measure; alcohol 1 part. Mix, and add 1 part double aquafortis (sp. gr. 1·28). Apply it from 1½ to 15 minutes.

Varnish for Engraving on Glass.—Wax 1 oz.; mastic ½ oz.; asphaltum ½ oz.; turpentine ½ drachm.

Another.—Mastic 15 parts; turpentine 7; oil of spike 4.

Le Blond's Varnish.—Keep 4 pounds balsam of copaiva warm in a sand or warm bath, and add 16 oz. of copal, previously fused and coarsely powdered, by single ounces, daily and stir it frequently. When dissolved add a little Chio turpentine.

Sealing Wax Varnish.—Black or colored sealing wax, broken small, and sufficient rectified spirit to cover it; digest till dissolved.

Black Japan.—Boil together a gallon of boiled linseed oil, 8 oz. umber, and 3 oz. asphaltum. When sufficiently cool thin it with oil of turpentine.

Brunswick Black.—Melt 4 pounds asphaltum, add 2 pounds hot linseed oil, and when sufficiently cool add 1 gallon oil of turpentine.

Varnish for Gun Barrels, after browning them.—Shell-lac 1 oz.; dragon's blood ¼ oz.; rectified spirit 1 quart. Dissolve and filter.

Transfer Varnish.—Alcohol 5 oz.; pure Venice turpentine 4 oz.; mastic 1 oz.

Hair Varnish.—Dissolve 1 part of clippings of pig's bristles, or horsehair, in 10 parts of drying linseed oil, by heat. Fibrous materials (cotton, flax, silk, &c.,) imbued with the varnish and dried, are used as a substitute for hair cloth.

Glass Varnish.—This is a solution of soluble glass, and is thus made: Fuse together 15 parts powdered quartz (or fine sand), 10 parts potash, and 1 charcoal. Pulverize the mass, and expose it for some days to the air; treat the whole with cold water, which removes the foreign salts, &c.; boil the residue in 5 parts of water until it dissolves. It is permanent in the air, and not dissolved by water. This varnish is used to protect wood, &c., from fire.

Varnish for Gilded Articles.—Gum-lac 4 parts; dragons's blood 4; annatto; gamboge 4; saffron 1. Dissolve each resin separately in 8 parts alcohol, and make a separate tincture with the dragon's blood and annatto, also in 8 parts alcohol each; then mix the former together, and add a sufficient quantity of the tinctures to give the required shade and color to the varnish.

Gold Varnishes.—Turmeric 1 drachm; gamboge 1 drachm; oil of turpentine 2 pints; shell lac 5 ounces; sandarach 5 oz.; dragon's blood 7 drachms; thin mastic varnish 8 oz. Digest, with occasional agitation, for fourteen days, in a warm place; then set it aside to fine, and pour off the clear.

Another.—Dutch leaf 1 part; gamboge 4; gum dragon 4; proof spirit 18. Macerate for twelve hours, then grind on a stone slab.

Earthenware Varnish.—Flint glass 1 part; soda 1. Mix.

Magilp.—Mastic varnish 1 part; drying oil 2. Mix.

Another.—Mastic varnish 1 part; drying oil 1. Mix.

Another.—Equal parts of mastic varnish, drying oil, and turpentine. Mix.

Metallic Varnish for Coach Work, &c.—Ashphaltum 56 pounds. Melt, then add litharge 9 pounds; red lead 7 pounds; boil, then add boiled oil 12 gallons; yellow resin 12 pounds. Again boil, until in cooling the mixture may be rolled into pills; then add spirit of turpentine 30 gallons; lampblack 7 pounds. Mix well.

Impermeable Varnish.—Boiled oil 100 parts; finely powdered litharge 6 parts; genuine beeswax 5 parts. Boil until sufficiently thick and stringy, then pour off the clear.

Engravers' Stopping-out Varnish.—Take lampblack and turpentine to make a paste.

Varnish for Water Color Drawings.—Canada balsam 1 pint; oil of turpentine 2 warts, mixed. Size the drawing before applying the varnish.

CEMENTS.

Shell-lac Cement, or Liquid Glue.—Fine orange shell-lac, bruised, 4 oz.; highly rectified spirit, 3 oz. Digest in a warm place, frequently shaking, till the shell-lac is dissolved. Rectified wood naphtha may be substituted for spirit of wine, where the smell is not objectionable. This is a most useful cement for joining almost any material.

Shell-lac Cement, without Spirit.—Boil 1 oz. of borax in 16 oz. water; add 2 oz. powdered shell-lac. and boil in a covered vessel till the lac is dissolved. This is cheaper than the above, and for many purposes answers very well. Both are useful in fixing paper labels to tin, and to glass when exposed to damp.

Keller's Armenian Cement, for Glass, China, &c.—Soak 2 dr. of cut isinglass in two oz. of water for 24 hours; boil to 1 oz.; add 1 oz. spirit of wine and strain through linen. Mix this, while hot, with a solution of 1 dr. of mastic in 1 oz. of rectified spirit, and triturate with ½ dr. powdered gum ammoniac, till perfectly homogenous.

Dr. Ure's Diamond Cement,—Isinglass, 1 oz; distilled water, 6 oz; boil to 3 oz., and add 1½ oz. of rectified spirit, Boil for a minute or two, strain, and add, while hot, first, ½ oz. of a milky emulsion of ammoniac, and then 5 dr. of tincture of mastic.

Hoenle's Cement for Glass and Earthenware.—Shell-lac, 2 parts; Venice turpentine, 1 part. Fuse together, and form into sticks.

Cheese Cement, for Earthenware, &c.—Mix together white of egg, beaten to a froth, quick-lime, and grated cheese. Beat them to a paste, which forms an excellent cement.

Curd Cement.—Add ½ pint of vinegar to ½ pint of skimmed milk. Mix the curd with the whites of 5 eggs well beaten, and sufficient powdered quicklime to form a paste. It resists water, and a moderate degree of heat.

Cement for joining Spar and Marble Ornaments &c.—Melt together 8 parts of resin, 1 of wax, and stir in 4 parts, or as much as may be required, of Paris Plaster. The pieces to be made hot.

Hensler's Cement.—Grind 3 parts of litharge, 2 of recently burnt lime, and 1 of white bole, with linseed oil varnish. This is a very tenacious cement, but it takes a considerable time to dry.

Singer's Cement for Electrical Machines and Galvanic Troughs.—Melt together 5 lbs. of resin, and 1 lb. of beeswax, and stir in 1 lb. of red ochre (highly dried, and still warm), and 4 oz. of Paris plaster, continuing the heat a little above 212°, and stirring constantly till all frothing ceases. Or (for troughs,) resin, 6 lbs; dried red ochre, 1 lb.; calcined plaster of Paris, ½ lb.; linseed oil, ¼ lb.

Composition for welding Cast Steel.—Take of borax 10 parts, sal-ammoniac, 1 part; grind or pound them roughly together; then fuse them in a metal pot over a clear fire, taking care to continue the heat until all spume has disappeared from the surface. When the liquid appears clear, the composition is ready to be poured out to cool and concrete; afterwards, being ground to a fine powder, it is ready for use. * * * To use this composition. The steel to be welded is first raised to a "bright yellow" heat, it is then dipped among the welding powder, and again placed in the fire, until it attains the same degree of heat as before; it is then ready to be placed under the hammer.

Cast-Iron Cement.—Take of clean Iron borings, or turnings, 1 cwt.; of sal-ammoniac 8 oz.: and 1 oz. of flour of sulphur. Mix them thoroughly, and add sufficient water. If the cement is not to be immediately used, care should be taken to keep the mixture soaked in water; if left dry, the cement will heat, and be spoiled.

Cement for Steam Pipe Joints, &c., with Faced Flanges.—To 2 parts of white lead mixed, add 1 part of red lead dry; grind, or otherwise mix them, to a consistence of thin putty; apply interposed layers, with one or two thicknesses of canvass or gauze wire, as the necessity of the case may require.

Glues.—1. A very strong glue is formed by throwing a small quantity of powdered chalk into melted common glue.

2. To make a glue which will resist the action of water—boil one pound of glue in two quarts of skimmed milk.

Botany Bay Cement.—Take one part of Botany Bay gum, and melt and mix it with 1 part of brick-dust.

Cap Cement.—As Singer's; but 1 pound of dried Venetian red may be substituted for the red ochre and Paris plaster.

Bottle Cement.—Resin 15 parts; tallow 4 (or wax 3) parts; highly dried red ochre 5 parts. The common kinds of sealing wax are also used.

Turner's Cement,—Beeswax 1 oz.; resin ½ oz; pitch ½ oz. Melt, and stir in fine brickdust.

Coppersmith's Cement.—Powdered quick-lime, mixed with Bullock's blood, and applied immediately.

PHOTOGRAPHIC SOCIETY OF SCOTLAND.*

The question of printing is one so all important to photographers that too much can hardly be said about it; and I therefore propose addressing to your society a short sketch of my experience on the subject, hoping that, even if it should not contain any important new modification of the processes already known, it may at least assist in unravelling the tissue of confusion in which the beginner finds himself entangled when in search of a process to adopt.

I propose to treat specially of printing on albuminized paper, and that in a purely practical point of view, dividing my subject into several heads, and treating each as curtly as may be consistent with a clear description.

It is hardly necessary to describe at length the operation of albuminizing paper, as few photographers now do this for themselves, the very finest quality of albuminized paper being easily obtained at a rate far below that at which an amateur could make it; besides which the process has been given very fully in almost every manual of photography. It is a great mistake to add acetic acid to the albu-

* On Photographic Printing, by F. Maxwell Lyte, F. C. S.

men, which being in itself alkaline, the addition of the acetic acid gives rise to the development of an acetate, with subsequent formation of acetate of silver on the nitrate bath. This being a very unstable salt, paper which contains it becomes rapidly embrowned in keeping. The dose of salt added to the albumun need not exceed two per cent.

The albuminizing of the paper should be carried on in a dry place, and during dry weather, and the paper itself should be dry before being albuminized: the *eclat* of the proof much depends on this. The paper should not be left on the bath for more than two minutes; if it remains longer, the albumen is liable to run into streaks on drying, and will never have the fine gloss it ought to have; in fact if the albumen does not dry rapidly, and has time to sink into the paper, the proofs will always look dull and faded. The best paper that can be used is that called "papier de Saxe," of which the genuine is imported from Germany; but several of the French manufacturers make a capital imitation of it, which seems nearly, if not quite, to equal the original, and is far cheaper, the real Saxe costing 80fs. the ream, while the imitation may be had for half the money.

It is advisable to keep the paper some time before albuminizing it, as thus many of the little metallic spots disappear by oxidation; but after it is albuminized it cannot be employed too soon, and should be kept in a very dry place; but I have never seen albuminized paper which, even with every precaution did not slightly deteriorate before it had been kept six months. This arises from the fact of the salt disappearing from the surface, where it was at first and becoming imbibed into the web of the paper; so that the sensitive compound of silver forms down in the tissue of the nitrated paper, and the image when printed, being no longer on the surface, does not possess its proper brightness of effect. To sensitize the paper, a solution of nitrate of silver must be made by dissolving that salt in water, in the proportion of 80 or 90 grs. of the former to each ounce of the latter. This solution is to be placed in a convenient dish, and the paper laid face downwards on it, with the usual precautions in order to avoid air-bubbles. The paper should remain on this bath for not less than four minutes, and be then lifted off, drawing it at the same time over a glass rod, which should be held in such a way as to scrape the superfluous liquid from the face of the paper, and cause it to drip back into the dish. Each sheet of paper so sensitized withdraws a portion of silver from the bath; and were more nitrate of silver not added, the bath would soon become too weak. I find in practice that papier de Saxe, prepared with albumen containing two per cent. of salt, requires an addition of one dram of nitrate to the bath for each whole sheet, or parts of a sheet equal to a whole, which has been sensitized on it; and the bath must be filled up with water, so as to bring the bulk of the liquid always up to the same point. Paper when thus sensitized may be hung on a string, by a crooked pin, to dry, or what is better still, suspended in one of the little wooden clips sold for that purpose. After a time it will be found that the bath begins to turn brown and become discoloured; and with a view to correct this, many methods have been proposed, such as the coagulation of the albumen by heat, which in my experience I have found to have no effect, or filtering through animal black, or the addition of kaoline, both of which answer well, but are wasteful and tedious, or the addition of citric acid, which is likewise objectionable, as it soon renders the bath intensely acid, and paper sensitized on it is slow in printing, and has a tendency to turn red, and lastly, the method of Messrs. Girard and Davanne of adding a small portion of solution of common salt, and subsequent filtration, which is the best.

This process I have modified, and I think advantageously so, in the following manner: make a mixture of 3 ounces 5 drachms 2 scruples and 15 grains of crystallized phosphate of soda, with 1 ounce 3 drachms 2 scruples and 15 grains of crystallized carbonate of soda, and pound them together, and keep them in a bottle for use. Of this mixture take two ounces 2 drachms 2 scruples and 5 grains, and dissolve in 35 ounces of distilled water. When it is requisite to decolour a bath which has become coloured by use, all that is necessary is to add some of this solution, in the proportion of one fluidrachm to every pint of the bath. Shake them well up together, and filter, when the liquid will be found to run through quite clear and free from colour. The precipitate and the filter, both of which contain silver, may be added to the other residues, and subsequently worked up again. This treatment slightly impoverishes the nitrate bath; and in order to restore it to its normal state, it becomes necessary to add to it 58 grains of nitrate for every drachm of the solution which has been used. Not only is the bath by this means completely and rapidly decoloured and retained in a neutral condition, but it afterwards never becomes so easily discoloured by albumen.

If prepared paper is meant to be kept some time, it should be placed in a Marion's preservative case; but should the albumen employed have been fresh and the paper of good quality, it will keep perfectly in a dry place for four or five days.

Be careful never to evolve fumes of ammonia or sulphuretted hydrogen in the room where prepared paper is hanging, or it will become discoloured; and for like reason avoid the emanations from stables, &c. &c.

Printing pictures must be regulated by the taste of the operator, only let it be remembered that the strength of the print is always rather diminished during the fixing and toning processes. There have been many and various theories formed on the rationale of the process of printing; the one, however, to which I give the preference is that of Messrs. Girard and Davanne. These gentlemen suppose that when sensitive paper is exposed to the light, and the compound of nitrate and chloride of silver at its surface undergoes decomposition, the cloride of silver becomes reduced to the metallic state with liberation of chlorine, and that this chlorine immediately attacks the free nitrate of silver with which it comes in contract, converting it into fresh chloride of silver, and setting free nitric acid and oxygen. The former is in its turn again decomposed, and more chlorine set free to react as before, while the nitric acid is decomposed in its nascent state by the organic matter of the paper. There is therefore continual decomposition and recomposition going on, till all the free nitrate of silver becomes used up, while successive layers of reduced silver are formed, and super-imposed in the dark parts of the print. In case the sky of a negative has become solarized, which is sometimes unavoidable, it will be necessary to paint around the outline of the horizon with some opake colour, such as chrome yellow, or vermilion mixed with a little Indian ink, and having printed a proof, to cut out the sky along the line of the horizon. This, being darkened by a few minutes' exposure to the sun, is to be pasted over the sky of the negative with a little varnish, which for this purpose is preferable to gum or paste. This treatment is however often inadmissible, and can never be applied where there are trees in the sky-line. Care must also be taken not to make the paper used in stopping out approach too near to the sky-line, as the thickness of this paper would be liable to prevent the contact of the negative with the positive during printing, and would thus render the proof indistinct in those parts. To avoid this is the object of the painting-line. The same object may be met by carefully paring the edge of the cut-out sky before pasting it down. A pure white sky is often unsightly on a finished proof, and this defect it may be desired to correct: there are three ways of doing so. The first, and best, is by printing in clouds photographed from nature; the next by imitating clouds by means of cotton-wool laid between two glasses; and the third, by making a plain shaded sky. The general principle involved is the same in all three, viz., the application of a negative with natural or artificial clouds, or (in the case of a plain sky) of a clean glass over the proof. The whole is then to be covered with an opake card, and this moved gently up and down over the face of the proof thus exposing that portion of the sky which it is desirable to darken, and shading it gradually down from the top of the proof to the horizon, which should be left white. The card must be kept in constant motion, otherwise a line will be formed across the sky.

Those who are observant of nature may have remarked that the sky, while deep blue over head, seems to fade gradually to a much paler tint towards the horizon. This fact may be profited by to avoid shading the sky too low on the horizon; and thus while the effect is more natural, the danger of destroying the details by darkening the horizon of the picture itself may be avoided. As soon as the print is finished, it must be soaked for at least half an hour in some clean spring water. The object of this is to withdraw most of the free nitrate contained in the proof. From this bath it is to be transferred to another, composed of about a tablespoonful of saturated solution of salt to each pint of water. In this it must remain for not less than a quarter of an hour, and will then be ready for the colouring bath, which is made as follows. Dissolve 200 grains of crystallized phosphate of soda in one pint of water, add to this one ounce of a solution of chloride of gold composed by adding a quarter of an ounce of terchloride of gold to 12 ounces of water;* almost as soon as the proof is placed in this bath, it will be seen to change colour, and pass from the red tone it had assumed in the saline bath to a reddish violet, and then through various shades of violet till it becomes of a bluish-grey tint. The toning may be stopped at any of these shades of colour, according to the taste of the operator, each of them giving a special tone to the fixed and finished proof. For instance, if only left a short time in the toning bath, the proof when finished will incline more or less to red; a longer toning will give it a sepia tint, while, if toned till it becomes grey, a cold grey-black will be the result. From the toning bath the proof should be removed to one of plain water, in which it must from time to time be moved and turned, especially if several proofs are being treated at the same time. I must here recommend the following precautions. While the proof is in the toning bath, let it be frequently turned and kept in constant motion. Let the toning be done by preference in a warm room, as a given quantity of gold will then go further. The same object is hardly attained by warming the solution itself, which seems, it is true, to obtain an increase of activity by this treatment, but becomes, on cooling, proportionately more inactive than ever. Solutions of phosphate of soda and chloride of gold may be kept separately for any length of time without change, but when mixed they should be used as soon as possible; indeed, after a few hours the mixture becomes very slow in its action. Old colouring baths may be mixed with the old hypo, to be treated with other residues.

As the precipitation of gold only takes place on the darkened portions of the proof, it will be found an economical plan to cut round the edges of each picture before toning it, if there should be any dark margin; and these clippings should likewise be kept as residues. The proof after colouring, should be left in the washing water for from half an hour to an hour. This soaking in water is necessary; for otherwise the colour passes off in the hypo, and the proof turns red; the bath of water seems then to have the effect of fixing the colour on the proof. If not frequently turned and moved about in the water, the picture gets stained, and patchy in colour; and again, there may be stains, produced by inequalities or streaks in the albumen itself, which were not apparent before this part of the process. Highly albuminized paper is more slowly toned than the less albuminized variety, but the tones produced are far more rich. The process is quite inapplicable to plain salted paper, which is best coloured by Sutton's sel d'or or the old gold and hypo process.

After this bath of water, the toned proof is to be placed in the hypo bath, composed by dissolving 40 ounces of hyposulphite of soda in a pint of water, and adding a bit of pounded common whiting equal to about the size of a pea. This addition of whiting is made with a view to preventing the hypo from turning acid and decomposing with formation of other compounds, liable to sulphurize the proofs and cause them to fade. The pictures should be left in the hypo for at least two hours, and then taken out and washed in water. Many methods have been proposed for the washing of positives, such as sponging, and all sorts of mechanical contrivances to squeeze out the hypo from the web of the paper; but although they may be efficient where only a few pictures are concerned, I know of no plan equal to the old one of simply changing the pictures from

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* It will be found convenient to keep the nitrate of silver, as well as the chloride of gold, in solution. The former may be made of such a strength that every ounce of solution is equal to half an ounce of solid nitrate, by merely putting ten ounces of nitrate of silver into a bottle which holds just a pint, and adding first three-quarters of a pint of water, shaking till the salt is dissolved, and then filling up with water. A still shorter method is to put into a glass any quantity of nitrate of silver, and add to it a *little* more than its own weight of water; then place in the liquid one of the little hydrometers sold in the shops, and called "pese sirops," and add slowly more water stirring all the time. As the water is added the "pese-sirops" will sink lower and lower; and when the liquid stands at 40° on the stem of the instrument, the solution is exactly at 50 per cent., and one ounce is equal to half an ounce of solid nitrate.

one dish to another, renewing the water at each change. All my pictures are treated in this way, and washed for at least twelve hours without intermission; and the process, although laborious, is successful, as I never have a fading picture. After twelve hours' washing, a lot (150 pictures) were soaked in the same water, and frequently agitated and turned in it for four or five hours. This water was then poured off and acidulated with some sulphuric acid, and then carefully evaporated, nearly to dryness; had any trace of hypo been left, free sulphur would have been found in the residue; the latter, however, after being washed on a filter with distilled water, was calcined in a platinum crucible without giving off the least odour of sulphur. I concluded then that no trace of hypo could have remained in these proofs after the washing above mentioned.

The same experiment, tried after washing a like number of proofs for six hours, gave me perceptible traces of sulphur in the residue.

After the picture is washed, there only remains the mounting. For this purpose, take a sheet of thin cardboard, rather larger than the proof, paste it on this, using common paste freshly made, or, what is better, paste made with potato-flour. When dry, the proof must be passed through a satining press, or hot-pressed if possible, and, lastly, fixed in a small wooden frame, made and sold for the purpose, and called a stirator, and rubbed over with the following encaustic:—white wax, 2 ounces; essence of turpentine, 2 ounces; fine copal varnish, ½ to 1 drachm. The wax being melted in a small earthen pot, must be withdrawn from the fire, and the turpentine then added, and last of all the varnish. The proportion of turpentine in this receipt may be varied at pleasure, so as to make the encaustic thicker or thinner at the will of the operator. It should be rubbed well into the face of the proof with a bit of flannel, and then the superfluous portion rubbed off with another flannel, till a fine surface is obtained. By this means, not only is the print much protected from being injured by moisture or deleterious gases, but even the finest albuminized proofs are much improved in appearance, and all the deep shades gain in detail.—*Photographic Journal.*

MISCELLANEOUS.

The Coal Trade of Great Britain.

STATISTICS.—The annual return of coals, cinders, culm, and patent fuel shipped coastwise at the several ports of England, Scotland, and Ireland, to other ports of the United Kingdom; and also of the quantities exported to foreign countries and British settlements abroad during 1860, as compared with the preceding year, has just been issued, and shows a slight improvement (about 5 per cent.) in the quantities shipped, whilst the average price per ton has somewhat receded. The subjoined tabulated statement shows the shipments coastwise and the exports during the last two years:

COASTWISE.

	Coals. Tons.	Cinders. Tons.	Culm. Tons.	Total. Tons.	Pat. fuel. Tons.
1859........	9,913,595	45,091	148,247	10,107,833	29,190
1860........	10,522,126	40.203	158.387	10.720.716	26.197
Inc.	608,531	....	10,140	612.883	....
Dec.	....	5,788	....	....	2,993

EXPORTS.

	1859. Tons.		1860. Tons.		Increase. Tons.	
Coals......	6,784.337	£3,113,487	7,060.388	£3,141,507	276,051	£28,020
Cinders....	213,579	154,419	247,761	171.827	34,182	17.408
Culm......	9,033	2,107	13,683	2,947	4,650	840
Total......	7,006,949	£3,270,013	7,321.832	£3,316.281	314,883	£46.268
Pat. fuel.	75,080	45,266	90,743	55,350	15,663	10,084

For Coals France is still our best customer; but, notwithstanding the existence of the Commercial Treaty of 1860, which was not in force in the preceding year, there has actually been a decrease in the quantity taken by that country from 1,376,890 tons to 1,335,053 tons; whereas a very considerable increase was contemplated. To the United States the shipments have increased from 204,516 tons in 1859 to 309,869 tons in 1860. To Hamburg the exports were 477,587 in 1860 against 473,130 tons in the preceding year. To Denmark there has been a diminution from 450,556 tons in 1859 to 409,196 tons in 1860. To Italy the increase has been from 347,326 tons to 442,798 tons. To British India the increase has been from 164,630 tons in 1859 to 289,096 tons in 1860; and to China (including Hong Kong) the increase has been from 93,000 tons to 139,000 tons. Taking a general view of the return, the variations can only be regarded as trifling—a circumstance which may, perhaps, be accounted for by the universal depression which has prevailed having prevented the ordinary increase, and through Australia becoming each year better able to supply herself with mineral fuel.

From an analysis of the statements of quantities exported, and the declared value thereof, it appears that the average price per ton of coal exported has been upwards of 3d. per ton less in 1860 than in the preceding year; the average price per ton in 1859 was rather more than 9s. 2d., whilst that for 1860 was about 8s. 10¾d. The superiority of the Welsh coal as compared with the North Country coal, appears to be gradually becoming more universally admitted; for although both the Welsh ports and the North Country ports show an improvement, the proportional increase for the Welsh ports is somewhat greater than that for the Northern ports.

The consumption of patent fuel has decreased in this country, but, owing to an augmentation in the export trade, the total shows an increase, amounting to rather more than 10 per cent.—With regard to price, about 2d. per ton more was obtained in 1860 than in the preceding year. The quantity of coals brought into London was, in 1860, coastwise, 3,573,377 tons, against 299,170 tons in 1859; and inland navigation and land carriage, 1,499,899 tons in 1860, against 1,210.776 tons in 1859. The import of patent fuel into London was 18,951 tons in 1860, against 20,642 tons in the preceding year.—*London Mining Journal.*

The Lime Light in London.

The London Journals contain very favourable notices of the new lime light, produced according to an improved principle and arrangement of apparatus. The light is said to be of a pure white color and of dazzling brilliancy, making all the old gas burners in the proximity appear as dull as though they were burning in the bright sunlight of noonday, in comparison. This description of light is so intense that it can be distinctly seen at a distance of ninety five miles. A single jet of the light of medium size, is equivalent to forty argand, or eighty fish-tail gas burners, or to four hundred wax candles; and its intensity and brilliancy may be increased by augmenting the quantity of gas supplied. As compared with the illuminating power of common gas, a single jet, consuming four cubic feet of the mixed gases of hydrogen and oxygen, is said to be equal, in illuminating power, to that obtained from four hundred feet of ordinary gas. The mode in which the light is produced is by the combustion of lime under the great heat caused by the flame of the mixed gases. A stream of common gas, which is used instead of pure hydrogen, is conducted through one pipe, and a supply of oxygen is sent through a second one, each being attached to separate gas-holders. The pipes terminate near the lamp in one single tube, where the gases are allowed to mix in their way through a curved jet to what is called the wick of the lamp, which is simply a lump of lime, held in close proximity to the mouth of the curved tube by a piece of metal. In lighting the lamp, the first step is to direct the stream of hydrogen upon the lime; it is lighted, and gives forth a small flame of yellow color, soon succeeded by a flame of deep red. When the lime is in this state the oxygen is turned on, and instantly the bright white light is produced.—*Railway Review.*

Danger of Tinned Lead Pipes.

Dr. Frankland, F.R.S., (London) states that he has made several experiments with lead pipes tinned inside, in order to discover if the tin was a preventive of lead corrosion by the water. It was found to be a complete protective, when all the surface was perfectly coated, but the least flaw in the tin coating, if it exposed the lead to the water, was more dangerous than the use of pure lead pipe. The reason given for this is, that a galvanic action is engendered between the two metals, by which the lead is rapidly decomposed, and made to poison the water.—*Scientific American.*

Sheet Zinc for Roofing.

A report of a committee appointed by the Central Society of Architects, in Paris, recommends "that zinc, which was at first rejected, but is now so generally used should be applied with great care, as certain precautions, very simple, but never to be overlooked, are indispensable. Thus: contact with plaster, which contains a destructive salt, is to be avoided; also, contact with iron, which is very injurious, and liable to cause a rapid oxydation. Eave gutters should always be supported by galvanized brackets, and no gutter or sheet zinc should be laid on oak boards.—*Ibid.*

On the Structure of the Luminous Envelope of the Sun.

Mr. Joseph Sidebotham read a paper, being a communication to him from James Nasmyth, Esq., of Penshurst. Mr. Nasmyth has made the discovery, that the entire surface of the sun is composed of objects of the shape of a willow leaf. These objects average about 1000 miles in length and 100 in breadth, and cross each other in all directions, forming a network. The thickness of this does not appear to be very great, as through the interstices the dark or penumbral stratum is seen, and it is this which gives to the sun that peculiar mottled appearance so familiar to observers. These willow leaf-shaped objects are best seen at the edges of a solar spot, where they appear luminous, on a dark ground, and also compose the bridges which are formed across a spot when it is mending up; the only approach to symmetrical arrangement is in the filaments bordering the spot, and those composing the penumbra, which appears to be a true secondary stratum of the sun's luminous atmosphere. Here these bodies show a tendency to a radial arrangement. Although carefully watched for, no trace of a spiral or vertical arrangement has been observed in these filaments, thus setting aside the likelihood of any whirlwind-like action being an agent in the formation of the spots, as has been conjectured to be the case. The writer does not feel warranted at present in hazarding any conjectures as to the nature and functions of these remarkable willow leaf-shaped objects, but intends pursuing the investigation of the subject this summer, and hopes to lay the results before the British Association during their meeting in this city. The paper was illustrated by three beautiful drawings. No. 1 represented one of the willow leaf-shaped objects; No 2 the luminous surface of the sun as being entirely composed of these objects; and No. 3 a large drawing of a solar spot as seen on the 20th July, 1860, exhibiting the surface of the sun composed of these objects, as also the penumbra and the bridges across the dark portion of the spot in which the exact shapes of these objects were to be seen most clearly. Mr. Sidebotham stated that the image of the sun was examined by Mr. Nasmyth with a mirror of plane glass, set at an angle of 45 degrees; nearly the whole of the light and heat of the sun passed through the glass, and the rays used were those only reflected from its surface. *Manchester Literary and Philosophical Society March 5th,* 1861.

Carbonic Acid in the Soil.

Van den Broek says (*Annalen der Chem. und Pharm.* Bd. cxv. s. 87) that a solution of carbonic acid percolating through the soil, is, up to a certain limit, robbed of its carbonic acid, so that the filtrate no longer causes any turbidity with lime-water; and, if a stream of hydrogen gas be passed through a layer of earth, the carbonic acid can be displaced. The author lays stress on this property of the soil holding carbonic acid, as supporting Liebig's views on the subject of the nutrition of plants.

Test for the Sulphide of Carbon in Coal Gas.

Dr C Herzog communicates the following to *Chem. Centralblatt*, No 1, 1861, p. 1:—Prepare a saturated solution of ammonia in absolute alcohol and a perfectly saturated solution of sugar of lead. Place in a test-tube five drops of the lead solution and about a drachm of the alcoholic ammonia, and allow the gas to bubble through the solution from a narrow glass tube just dipping under the surface. If sulphide of carbon be present in the gas the solution immediately takes an orange colour, and, after a time, a deep brown precipitate falls. If carbonic acid be present as well a white precipitate also is produced, which gives a brighter tinge to the orange colour. For a controlling experiment, the gas may be passed for a short time through the alcoholic ammonia alone, and a couple of drops of the lead solution added afterwards, whereupon, if sulphide of carbon be present, the orange precipitate is produced as before. To free the gas from sulphurretted hydrogen, it may be first passed through a lead solution, which does not affect the sulphide of carbon. The author remarks that the orange precipitate obtained as above, if allowed to remain in the liquid, turns white in twenty-four hours, but if collected on a filter immediately, washed a little, and then dried, it remains of a dark brown colour. The chemical changes which take place when sulphide of carbon is passed into the alcoholic ammonia are, according to the author, rather complex and somewhat variable, but he recommends the test as very simple and practical.

Emeraldine and Azurine.

A Patent for the improvements in the Manufacture of Colouring Matters. By Frederick Crace Calvert, Charles Lowe, and Samuel Clift, Manchester.

This curious patent may be divided into two principal parts, one being the production of a green colouring matter from aniline and its homologues, and the other being the conversion of the green colour into a blue.

The green they call Emeraldine, and the blue Azurine. The chemists who devote themselves to colouring matters are said to be at their wits end for names.

The Patentees do not appear to have succeeded in isolating their new colouring matters, for it is specially stated that they are obtained by oxidation in direct contact with the yarn, &c.

In preparing the green colour, they first impregnate the goods with an oxidising agent. They recommend a solution of chlorate of Potash (4 oz. to the gallon), the goods, after steeping, are to be dried and then padded or printed with an acid salt of the base. They prefer a solution of tartrate or hydrochlorate of aniline containing one per cent. of the alkaloid. After the padding or printing, the goods are aged for twelve hours, that time being sufficient for the complete development of the colour.

They also prepare the green by the following modification of the first process:—They mix the oxidising agent with the salt of aniline, and print on both together of course thickening with starch or flour in the usual manner. They recommend the following mixture:—

"Solution of an acid salt of aniline (containing 1 lb. of aniline.)	
Tartrate or chloride of aniline	3 lbs.
Starch or flour paste	60 lbs.
Chlorate of Potash	1 lb.

The chlorate of potash must be dissolved in the starch paste whilst hot, and the solution of the acid salt of aniline we add to it after cooling."

We quote the above literally because it appears to us rather vague. If we understand the directions, they mean that three pounds of a solution of tartrate or "chloride" of aniline are to be taken, which three pounds of solution are to contain one pound of aniline.

The green colour, as produced by the above method, is to be converted into a blue or purple by boiling in a weak solution of soap or alkali, the goods are then to be dried. The soap solution should contain four ounces of printer's soap to the gallon; and the alkaline bath one ounce of caustic soda to the gallon.

The patentees say that instead of the alkaline or soap bath, the goods may be passed through a solution containing one ounce of chromate or bichromate of potash to the gallon of water.

The above colours do not require any mordant.

This patent appears to us to be of great interest. We know that efforts have, for a long time past, been made to apply aniline directly to fabrics, and convert it into colouring matter in the fibre. Some of these efforts have led to dissappointment. If yarn, impregnated with a salt of aniline, be passed into a solution of a chromate or bichromate, it immediately assumes a dirty green colour, which acquires a certain amount of purple tone by treatment with soap. If the aniline solution be strong the goods become nearly black in the chromate bath.—*Chemical News.*

Photography.

Photography is an affair of the present century. Its annals covers scarcely sixty years, and may be divided into three distinct periods:—the first extending from the time when science partially revealed the fascinating secret of light-printing, till the independent and valuable discoveries of Mr. Fox Talbot gave the world an art of sterling utility, where it had before possessed only a few curious experiments; the second comprising the years when, protected by Mr. Talbot's care, and in a great degree popularized by the restrictive powers of his patent, the art made slow advances to maturity; the third reaching down to the present time, from the date when the art somewhat ungraciously burst away from the control of its practical originator. As early as 1802, Sir Humphry Davy and Mr. Wedgwood hit upon a process by which they were able to render paper so sensitive of light that they could produce upon it negative images of objects brought directly in contact with it. They even directed attention to the probable results to be obtained through this sensitive paper and the co-operation of a camera obscura. The pictures, however, produced by Sir Humphry and his coadjutor were transient, and they expressly avowed their ignorance of any means by which the semblances could be rendered permanent. From 1802 till 1834 Sir Humphry's experiments remained, at least as far as the public knew, without being in any way developed or improved upon. In the latter year however Mr. Fox Talbot, by independent investigation and perfectly original experiments, went far beyond the distinguished philosopher. He achieved, like Sir Humphry, pictures, but he also contrived to render them permanent. Mr. Talbot's next step was to discover a process by which he obtained "positives" *from* his "negaitves." On the 8th of February, 1841, William Henry Fox Talbot, of Lacock Abbey in the County of Wilts, Esquire, obtained letters patent for his famous Calotype process. A gentleman of position and wealth, Mr. Talbot made no ungenerous use of his patent. Reserving to himself, as he was well entitled to do, the commercial advantages that might accrue to the parent of so remarkable an invention, he gracefully waived his patent rights in favour of amateur photogaphers, permitting them without let or hindrance to derive all possible enjoyment from the practice of his discovery, so long as they did not employ it for pecuniary gain. At this date it would be nothing short of repulsive injustice to detract from Mr. Talbot's services. He was indeed the father of the photographic profession, as well as the inventor of the photographic art. From his own funds, as well as by his influence with men of science, he created a new field of industry. At a considerable expense he erected workshops and employed assistants. Before, however, he could reap a reward from his outlay, or even reimburse to himself the large sums absorbed by his operations, the invention of the Collodion process by Mr. Archer in 1850, gave the death-blow to his undertakings. In the memorable trial of *Talbot* v. *Laroche* in the Common Pleas, December 1854, it was attempted to establish that the unlicensed practitioners of the Collodion process were guilty of infringing Mr. Talbot's rights. The jury, however, declined to adopt that view of the case; and passing over the Rev. Mr. Reade's discoveries prior to 1841, they gave Mr. Talbot the merit of being, within the meaning of the patent laws, the first and true inventor of the Calotype process; but at the same time they found that in producing pictures by the Collodion process M. Laroche had in no way been guilty of violating Mr. Talbot's patent. The decision was most important to photographers. It was given just as the term of Mr. Talbot's patent was at the point of expiration, and was the cause why that gentleman failed to obtain a renewal of his rights. From that time photography has been free from the fetters of letters patent. If that freedom has been beneficial to the artists, it is no less certain that it has been injurious to the originator of their art. The public can, however, console themselves for this unhappy consequence of a useful decision, by reflecting that to a man in Mr. Talbot's circumstances, the position of a victim for the public good is a comparatively easy lot, and Mr. Talbot has reason at the same time to congratulate himself that he has not like some inventors, lost the credit of his invention, although, like most inventors, he has acquired but little substantial gain from his ingenuity.—*Photographic Journal.*

On the Chemical Analysis of the Solar Atmosphere.

Kirchhoff has communicated some further results of his remarkable investigations on the constitution of the solar atmosphere. The author maintains that the sun has an ignited gaseous atmosphere, which encloses a core of still higher temperature. If we could see the spectrum of this atmosphere, we should detect the bright lines which are characteristic of the metals existing in it, and should recognise the metals themselves from these. The more strongly luminous body of the sun does not, however, permit the spectrum of his atmosphere to appear. It inverts this spectrum ; so that instead of the bright lines which the spectrum of the atmosphere alone would exhibit, dark ones make their appearance. We see, therefore, only the negative image of the spectrum of the sun's atmosphere.

In order to study the solar spectrum with the requisite degree of accuracy, Kirchoff procured from the workshop of Steinheil an apparatus consisting essentially of four large flint-glass prisms and two telescopes.

With this apparatus the spectra are seen in a hitherto unattainable degree of distinctness and purity. It exhibits in the solar spectrum thousands of lines, with such clearness that they are easily distinguished from each other. It is the author's intention to draw the whole spectrum, as seen with his apparatus, and he has already done this for the portion which lies between Fraunhofer's lines D and F.

This apparatus exhibits the spectrum of an artificial source of light with the same distinctness as the solar spectrum, provided only that the intensity of the light is sufficient. A common gas-flame, in which a metalic compound evaporates, is usually not sufficiently luminous, but an electric spark gives with the greatest distinctness the spectrum of the metal of which the electrodes consist. A large Ruhmkorff's induction-coil yields electric sparks in such rapid succession that the spectrum can be observed as easily as that of the sun.

A very simple arrangement permits the comparison of the spectra of two sources of light. The rays of one of the sources may pass through the upper half of the vertical slit, while those of another pass through the lower half. When this is the case, one of the two spectra is seen immediately beneath the other, and it is easy to determine whether coincident lines occur in both.

In this manner the author satisfied himself that all the bright lines peculiar to iron correspond to dark lines in the solar spectrum. In the portion of spectrum between D and F, about seventy particularly well-marked lines occur, resulting from the iron in the sun's atmosphere.

Iron is remarkable on account of the great number of distinct lines which it produces in the solar spectrum. Magnesium is interesting because it produces the group of Fraunhofer's lines lying in the green denoted by Fraunhofer by *b*, and consisting of three very strong lines. Very distinct dark lines in the solar spectrum correspond to the bright lines produced by chromium and nickel, and we may, therefore regard the presence of these substances in the sun's atmosphere as proved. Many other metals appear, however, to be wanting in the sun's atmosphere. Silver, copper, zinc, lead, aluminum, cobalt, and antimony have extremely brilliant lines in the spectra ; but no distinct dark lines in the solar spectrum correspond to these.

Many metalic compounds do not give in a gas-flame the spectrum of their metal, because they are not sufficiently volatile. In these cases the spectrum may be made to appear by means of the electric spark. It is true that in this case the spectrum of the metal of which the electrodes consist and that of the air in which the spark passes is also seen. To avoid the difficulty arising from the very great number of bright lines of which the spectrum of every electric spark consists, it is necessary to have recourse to a particular arrangement. The electric spark is allowed to pass at the same time between two similar pairs of electrodes, the light of one spark being allowed to pass through the upper, that of the other through the lower half of the slit, so that one spectrum is seen above the other. When the two pairs of electrodes are clean, the two spectra are perfectly similar ; when, however, a metalic compound is placed upon one pair, the corresponding spectrum immediately shows the lines belonging to the metal introduced. The author has satisfied himself that in this manner even the metals of the rare earths, yttrium, erbium, terbium, &c., may be recognised most quickly and certainly. It is, therefore to be expected that, by the help of Ruhmkorff's apparatus, the spectral method of analysis may be extended to the detection of all metals. The researches which the author has undertaken, in connexion with Bunsen, will, it is hoped, determine this point. —*Journ. für Prakt. Chemie.*

The United Kingdom, in 1860.

The annual Statistical Abstract for the United Kingdom, prepared by the Board of Trade, and published by the Queen's printers, appears this year in the convenient form of a thin octavo volume. These annual summaries extend from 1841 to the present time, but 1860 is the most remarkable year in the series. We bought and manufactured to an extent unknown before. But then there was a larger population to do it. The population of England and Wales in 1860 was estimated at 20,000,000, and that of Scotland above 3,000,000. The births in the year exceeding the deaths by 298,579, and our prospects are good for the unprecedented number of 381,436 persons married. There are no means of completing this statement by including Ireland, but even if its population should prove to be only 6,000,000 it is probable that the births in the United Kingdom altogether exceeded the deaths by 1,000 a day Emigration took from our shores 128,469 persons in the year, but a large deduction must be made from this for the immigration of the year, of which, however, there is no record. The number of paupers in receipt of relief cannot be given for any one date ; in England it was 890,423 at the close of the year, and in Ireland 50,683 ; in Scotland, on the 14th of May, 78,306—altogether rather more than 1,000,000, out of our population of 29,000,000 or 30,000,000.. We were not a pauperised people, or we should not have raised as we did a net revenue of £67,458,093, the largest sum that ever found its way from the pockets of the taxpayers into the exchequer since the close of the great European war, with the single exception of the year 1858 (the Crimean war.)

Comparing 1860 with seven years ago, we have added £30,000,000 to the National Debt, and raised our expenditure for the forces from £16 000,000 to £30, 000,000, and our civil expenditure from £7,000,000 to above £10,000,000. As for the mode in which the taxation was raised at the two periods we levied nearly £4,000,000 more by Customs and Excise duties last year, but £8,000,000 more from income tax and stamps and taxes; making a considerable difference in the incidence of taxation, because, though the working classes and humbler classes generally pay about two-fifths of the Custom and Excise duties, the upper and middle classes pay the bulk of the direct taxation. But all classes were able to pay more in 1860 than in 1853, though that was a year of extraordinary prosperity. The declared value of the British and Irish produce and manufactures exported was £98,933,781 in 1853; in 1860 it was £135,842,817. The exports to foreign countries rose from £65,601,057 in the former year, to £92, 170,560 in the latter; to British possessions from £33, 332,724 to £43,672,257. The progress in the cotton trade has far exceeded all others. In 1853 we sent out to clothe the world, 1,584,727,106lbs. of cotton manufactures; in 1860. 2,765,337,118lbs; the declared value of these exports increased from £25,817,248 to £42,141,505.

The tonnage of vessels entered and cleared, with cargoes and in ballast, at the ports of the United Kingdom, was, in 1853 British, 10,268.423; foreign, 8,121,887; in 1860, British, 13,914,923; foreign, 10,774,369. 1016 vessels, of 241,968 tons, were built and registered in the United Kingdom in 1860, and the total number of vessels of the United Kingdom employed in the home and foreign trade (exclusive of river steamers) rose from 18,206, of 3,730,087 tons in 1853, to 20,019, of 4,251, 739, in 1860. These vessels employ 171,592 men. Ships brought us from abroad in 1860, no less than 5,880,958 quarters of wheat and 5,086,220 cwt. of wheaten flour; the quantity of British wheat sold in the principal market towns in England was smaller than for years—4,628,257 quarters; but, owing to the price having been low in the early part of the year, the average *Gazette* price of wheat in 1860 was only 53s. 3d. The computed real value of our imports of corn and flour of all kinds was £21,671,918, in 1859 only £18. 042,063. The computed real value of our imports was not ascertained until 1854; in that year it was £152, 389,053; in 1860 it was £210,648,643.

Orange, Red and Yellow Colors from Coal Tar.

The following is the substance of a patent lately taken out in England by C. Cowper, of London. It relates to a new method of extracting colors from coal tar. The patentee takes a quantity of the solid pitch obtained from coal tar, which is placed in a clay retort and heated until the retort is red. In conducting this operation, a quantity of red-orange and resinous matter distills over toward the end of the operation. This resinous matter is then treated for 24 hours with cold fuming sulphuric acid, which dissolves it. It is now diluted with water, the excess of acid neutralized with chalk and the clear liquor filtered. This solution slightly acidulated and heated colors silk and wool a red-brown.

A beautiful yellow color is also obtained from the coal tar as follows:—Sulphuric acid, as free as possible from nitrous vapors and sulphate of iron, is heated in a water bath, or in a glass or earthenware vessel, to about 190° Fah. The orange-red matter is then added gradually to the extent of about one-ninth the weight of the acid—*i. e.*. nine parts of sulphuric acid to one of the orange-red matter. When it is found that, by throwing a small quantity of this mixture into water, it is dissolved, the heat must be removed. To promote the action of the acid on the coloring matter, the mixture should be continually stirred during the operation by means of a glass spatula. If neutralized by means of carbonate of soda, a yellow dye is obtained principally for dyeing silks, which is purified in the following manner:—The mixture of the coloring matter with sulphuric acid is diluted with water: it is then neutralized by means of carbonate of lime. After having removed the sulphate of lime again by washing and filtering, the yellow solution is heated to boiling point, and small quantities of hydrate of lime are gradually added, until it is found that, by pouring a small quantity of the yellow solution into a solution of protochloride of tin, a brown powder becomes precipitated. The yellow solution is allowed to cool completely. After separating from it the brown precipitate, by filtering and washing, the yellow solution is again heated to boiling point, and is acidulated with pure hydrochloric acid (muriatic acid). A solution of albumen or gelatine is then added, in small quantities, until it is found that the yellow solution when filtered and heated to boiling point, colors silks a pure yellow.—*Scientific American.*

TO INVENTORS AND PATENTEES IN CANADA.

Inventors and Patentees are requested to transmit to the Secretary of the Board short descriptive accounts of their respective inventions, with illustrative wood cuts, for insertion in this Journal. It is essential that the description should be concise and exact. Attention is invited to the continually increasing value which a descriptive public record of all Canadian inventions can scarcely fail to secure: but it must also be borne in mind, that the Editor will exercise his judgment in curtailing descriptions, if too long or not strictly appropriate; and such notices only will be inserted as are likely to be of value to the public.

TO CORRESPONDENTS.

Correspondents sending communications for insertion are particularly requested to write on one side only of half sheets or slips of paper. All communications relating to Industry and Manufactures will receive careful attention and reply, and it is confidently hoped that this department will become one of the most valuable in the Journal.

TO MANUFACTURERS & MECHANICS IN CANADA.

Statistics, hints, facts, and even theories are respectfully solicited. Manufacturers and Mechanics can afford useful coöperation by transmitting descriptive accounts of LOCAL INDUSTRY, and suggestions as to the introduction of new branches, or the improvement and extension of old, in the localities where they reside.

TO PUBLISHERS AND AUTHORS.

Short reviews and notices of books suitable to Mechanics' Institutes will always have a place in the Journal, and the attention of publishers and authors is called to the excellent advertising medium it presents for works suitable to Public Libraries. A copy of a work it is desired should be noticed can be sent to the Secretary of the Board.